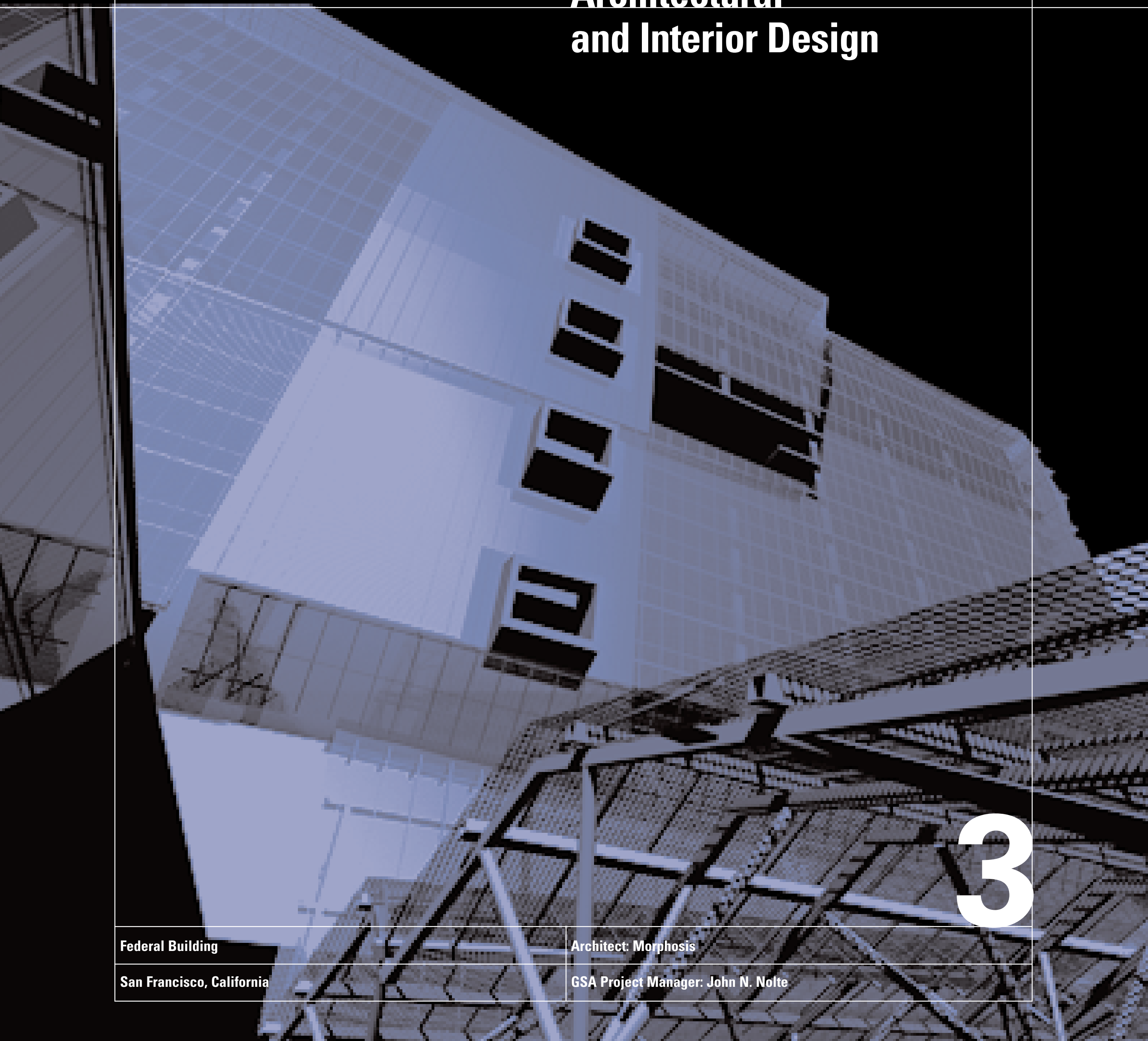
Architectural and Interior Design



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3.1 Basic Building Planning Principles

Integrated Design. To achieve the Guiding Principles of Federal Architecture, noted in Chapter 1, use a collaborative, integrated design process that:

- Sets specific goals for siting, energy, water, materials, and indoor environmental performance.
- Involves all relevant parties working together from the beginning of a project.
- Establishes and documents comprehensive design and performance goals at the beginning of a project and incorporates them throughout the building process including program documents, construction documents, and material provided to the building owner and operator.
- Considers all stages of the building's life-cycle, including deconstruction.

Performance Measures and Functional Objectives. The A/E shall ensure the design supports quality based performance measures for customer satisfaction, energy consumption, and reduced operations and maintenance. The A/E shall also identify all functional expectations and establish alternative features that support attainment. To the maximum extent possible, the A/E shall apply those architectural elements that optimize building performance and functional capabilities. Performance and functional issues raised in the project's design program and/or as addressed in Appendix A.2 shall be specifically addressed in concept presentations.

Environmental Sensitivity. The natural setting of the site, its contours and vegetation shall be viewed as assets to be preserved and woven into the design as much as possible. In settings including historic buildings, adjoining historic properties, or located near historic properties that will be affected by GSA construction, external design review, including public participation, is required under the Section 106 of the National Historic Preservation Act and may also be required under the National Environmental Policy Act. Compliance reviews should be coordinated, through the Regional Historic Preservation Officer, early and as frequently as the project complexity warrants, so that comments can be effectively addressed during the course of design.

Urban Context. Facility design and orientation should be consistent with existing and planned development patterns and nearby uses. The building's exterior should be consistent with existing local design guidelines. Where appropriate, the project team should help to develop design guidelines for the project and neighboring undeveloped sites.

Basic Configurations and Core Placement. Planning for cores must consider the depth of the occupiable space established by the core and exterior walls. The optimum depth of the occupiable space (the space between core and window wall) in an office building is approximately 12,000 mm (40 feet) for providing access to daylight.

Placement of Core Elements and Distances. In buildings with large floor plates, not all core elements need to be placed at each core location. How often each element needs to be repeated is governed by occupant needs and the following maximum radii and distances:

- **Passenger Elevators** should be grouped in banks of at least two for efficiency. Elevator groups of four or more should be separated into two banks opposite each other for maximum efficiency in passenger loading and minimum hall call notification for accessibility under requirements of UFAS/ADA. Travel distances from a given office or workstation to an elevator should not exceed 61000 mm (200 feet).
- See Chapter 7: *Fire Protection & Life Safety* for additional egress requirements.

U.S. Courthouse, Seattle, Washington

- The location of stairs within buildings should encourage their use, in lieu of elevators, to the fullest extent feasible. This will reinforce the recognition of sustainable energy conservation.
- **Electrical Closets** must be stacked vertically and should be located so that they are no more than 45m (150 feet) from any occupied space. Shallow, secondary closets off permanent corridors may be used for receptacle panelboards where the distance between the riser and the farthest workstation exceeds 45m (150 feet) and a separate riser is not warranted. See section *Space Planning, Building Support Spaces, Mechanical and Electrical Rooms* of this chapter for minimum size requirements.
- **Communications Closets** shall meet the requirements of EIA/TIA Standard 569: *Commercial Building Standard For Telecommunications Pathways And Spaces (*and related bulletins). Communications closets must be provided on each floor, with additional closet for each 930 m2 (10,000 square feet). Closets must be stacked vertically and must be placed so that wiring runs do not exceed 90 m (300 feet). Closets must tie into vertical telecommunications backbones. See section *Space Planning, Building Support Spaces, Mechanical and Electrical Rooms* of this chapter for minimum size requirements.

Building Circulation

Federal buildings must have clear circulation systems. Utility system backbone pathways should be routed in circulation spines providing service access to utilities without disrupting other tenant agencies.

Planning Grid

Planning grids shall be used to integrate building interiors to allow more future serviceability, particularly for buildings that will experience extensive reconfiguration through their life span. A building design shall follow the prescribed planning grid dimension unless the designer can show long term efficiencies using another dimension. Following a standard dimension will allow GSA to maintain standard replacement parts to service the building.

Some structural bay sizes can adversely affect interior parking layout. The 6100 mm by 6100 mm (20-foot by 20-foot) bay is too narrow for a two-way driveway aisle. Some of the larger bays cannot be efficiently adapted to parking layouts. Transfer beams or inclined columns would have to be used to adjust the column spacing. If a major parking facility must be integrated with the office structure, the 9100 mm by 9100 mm (30-foot by 30-foot) bay is recommended.

Technology Infrastructure

A total integration of all building systems will provide for current operations as well as for future changes. A technology infrastructure should be planned in each building to accommodate power systems including normal, emergency and uninterrupted power, mechanical systems and controls, fire detection and suppression systems, security systems, video and television systems, communications systems, including voice and data, lighting controls, plumbing services, and special utility services, such as gas or exhaust systems. It is not intended to provide infinite amounts of space for these systems, but to recognize their dimensional characteristics and the ability to service system components. The infrastructure must provide adequate spare capacity and integrate the utility entrance facilities, equipment rooms, backbone pathways, horizontal distribution pathways and workstation outlets for each system. In part, floor-to-floor heights are determined by the depth of space required for the technology infrastructure, including structural, mechanical, electrical and communications systems.

Five key concepts must be followed in providing technology infrastructure in Federal buildings.

- Equipment rooms and closets should be located together on each floor.
- All walls of equipment rooms and closets should be stacked vertically using the same plan configuration from floor to floor to accommodate vertical risers for backbone systems. When more than one closet is required on each floor, they shall be interconnected by a minimum of two 100 mm (8 inch) conduit passageways.
- Accessible flexible horizontal pathways must be provided from the closets on each floor to the workstation outlets. These pathways may be through underfloor ducts, cellular floor systems, access floor systems, or overhead cable trays and wire ways. Horizontal pathways must provide at least three separate channels for separation of power and different communications systems.
- Excess capacity must be provided in each system for future expansion of services.
- The data/telecommunications closet must be adequately sized to accommodate multiple vendor equipment and for the ease of maintenance of the equipment.

EIA/TIA Standard 569: *Commercial Building Standard For Telecommunications Pathways And Spaces* (and related bulletins) provides specific criteria for infrastructure for communication systems. The criteria covers the communication service entrance pathway, entry point, entrance room, equipment room, vertical backbone pathway, communication closets, and horizontal pathways. Horizontal pathways covered by this standard include underfloor duct, access floor, conduit, cable trays and wire ways, ceiling pathways and perimeter pathways.

Raised Floor Systems. Access floors shall be incorporated into all new construction where office functions will take place. Permanent corridors can be exempted from this requirement. See the GSA PBS *Guidelines for Raised Floor Systems, with and without Underfloor Air Distribution* (RF/UFAD Guidelines) for more information.

The vertical zoning of the floor-to-floor space for horizontal utility distribution must be analyzed. In typical office areas, this can be standardized. In special purpose spaces such as courtrooms, meeting rooms, library stacks, or laboratory spaces, the infrastructure must be given detailed consideration before establishing the final floor-to-floor heights. See the *RF/UFAD Guidelines* for more information.

If floor air plenum distribution is to be considered in offices with raised floors, refer to the *RF/UFAD Guidelines* for more information.

All underfloor and ceiling areas used for horizontal system distribution must be accessible without requiring repair to interior finishes. To the extent possible, avoid routing pathways over areas where it is difficult to bring in hoist or set up scaffolding, such as fixed seating areas and sloped or terraced floors for stairways.

Space Allocations and Classifications

This section describes the methodology and policies for tabulating space requirements for GSA facilities. It also describes application of GSA policies for providing and charging tenant agencies for space in GSA owned or controlled space.

The GSA provides space for Federal agencies and charges the agencies a rental rate for the space they utilize. Therefore, GSA tabulates space for both planning purposes and for charging rent. These two purposes require slightly different application of the same space measurement information. For planning purposes, GSA converts agency space requirements, expressed as usable area, to gross building area through the application of building efficiency factors. For rental charges, GSA converts the agency space requirements, expressed as usable area, to rentable area through the application of ratios that are unique to each building. Agencies identify the amount of usable area they require within a building for the GSA and request this space on a Standard Form 81 (SF81).

GSA provides a tenant improvement allowance for finishes and features within its rental charge. The A/E must design within that allowance. The agency may fund any costs over the tenant improvement allowance directly through a Reimbursable Work Authorization (RWA).

The GSA uses formalized standards for establishing the area to be allocated to each tenant agency for the rent charge. GSA has adopted the Standard Method for Measuring Floor Area in Office Buildings ANSI/BOMA Z65.1, current edition, issued by the Building Owners and Managers Association (BOMA). This standard is a national standard approved by the American National Standards Institute. The full standard is available from BOMA International.

Certain systems related to security monitoring and building control may be provided as part of the project by GSA, or, if specially requested, by the tenant agencies, with GSA providing the infrastructure support.

Space Measurement for Rental Purposes

A Summary. The following are terms and calculation formulas extracted from the ANSI/BOMA Z65.1. They are provided to assist the user in understanding GSA's space accounting. Individuals responsible for performing space measures must utilize the entire Standard Method for Measuring Floor Area published by BOMA.

The ANSI/BOMA Z65.1 standard uses a two-step process to determine rentable area assessed a tenant. The first step allocates common shared space on each floor to the tenants of that floor. The second step allocates common spaces that support the entire building to all tenants within the building. This explains the use of different ratios for each floor.

Basic Rentable Area. Basic rentable area is the usable area occupied by a tenant plus their proportion of the floor common areas. It is calculated by:

Usable Area X Floor R/U Ratio = Basic Rentable Area

Building Common Area. Building common area is usable area allocated to provide services to building tenants but is not included inside a tenant space. Building common areas include lobbies, atrium floor space, concierge areas, security desks located in public areas, conference rooms, lounges or vending areas, food service facilities, health or fitness centers, daycare facilities, locker or shower facilities, mail rooms, fire control rooms, fully enclosed courtyards, and building core and service areas such as mechanical or equipment rooms. Excluded from building common areas are floor common areas, parking spaces and loading dock areas outside the building line.

Building R/U Ratio. Building R/U ratio is the factor used to distribute building common areas to all tenants on a prorated basis. Note that this figure will be constant for the entire building, but could change over time if portions of the ground floor are converted from common areas to store areas.

Building Rentable Area. Building rentable area is the sum of the floor rentable areas. It is also equal to the gross measured area of the building minus vertical penetrations.

Floor Common Area. Floor common area includes toilets/washrooms, janitorial closets, electrical rooms, telephone rooms, mechanical rooms, elevator lobbies, and public corridors that are available primarily for the joint use on that floor. Note that this will vary floor to floor based on public corridor configurations. For single-tenant floors, corridor and lobby spaces may be included in the office or store usable area because they will be for the exclusive use of that floor's only. On main ground floors, floor common areas would only include corridors created because of store area configuration and telephone, janitor closet and electrical closets added because of the addition of store area on the ground floor.

Floor R/U Ratio. Floor R/U ratio gives the basic rentable area. It is calculated by the following formula:

Floor Rentable Area/Floor Usable Area = Floor R/U Ratio

Note that this ratio will vary from floor to floor based on public corridor configurations.

Floor Rentable Area. Floor rentable area is the gross measured area minus the exterior wall and major vertical penetrations. Floor rentable area is calculated by:

(sum of Office and Store Usable Areas on the floor) X Floor R/U Ratio = Floor Rentable Area

It is also equal to the sum of the basic rentable areas for that floor. Full floor tenants will be assessed the gross measured area of a floor *minus building common spaces* as their floor rentable area. Note that because it includes building common area, floor rentable area is not necessarily indicative of space demised for a single tenant's use.

Oakland Federal Building, Oakland, CA

Floor Usable Area. Floor usable area is the sum of all office, store and building common usable areas. Floor usable area is the floor rentable area minus floor common areas which are available primarily for the joint use of tenants on that floor.

Gross Building Area or Constructed Area. Gross building area or constructed area is the total constructed area of a building. It is measured to the outside finished surface of permanent outer building walls, without any deductions. This is the area GSA budgets for construction purposes.

Gross Measured Area. Gross measured area is the total area within the building, minus the exterior wall.

Office Area. Office area is the usable area within the tenant space including internal partitions and half of the demising wall separating the space from other tenants. It is measured to the tenant side finished face of all building common areas.

R/U Ratio. R/U ratio is the factor used to convert usable area to rentable area. It is the product of the Floor R/U ratio and the Building R/U ratio. It is derived by the following formula:

Floor R/U Ratio X Building R/U Ratio = R/U Ratio

It accounts for the allocation of floor common areas and building common areas. Note that it will be different for each floor.

Rentable Area. This is the figure that will be assessed each tenant for their space charges. Rentable area includes the usable area, the prorated share of the floor common area, and the prorated share of the building common areas. It is calculated by the following formula:

Usable Area X R/U Ratio = Rentable Area

It may also be calculated by the following two-step formula:

Step 1)

Usable Area X Floor R/U Ratio = Basic Rentable Area

then **Step 2**)

Basic Rentable Area X Building R/U Ratio = Rentable Area

Store Area. Store area is the usable area of a structure that is directly served by permanent public lobbies or has direct access from outside. BOMA describes these spaces as suitable for retail occupancies. The term store area was developed for main ground levels to allow the public lobby and other building common areas to be prorated to all tenant spaces in the building measured in m^2. Most common space on main ground levels normally falls within building common areas rather than floor common areas, so rentable figures for store areas will not normally be significantly impacted by floor common areas.

Usable Area. Usable area is the actual area the agency occupies in a tenant suite measured in square meters. It is the office area, store area or building common area. It is calculated by measuring from the dominant portion of the exterior wall to the outside face of major vertical penetrations. It includes all structural elements, openings for vertical cables, and vertical penetrations built for the private use of the tenant.

Space Measurement for Planning Purposes

Tenant agencies communicate their space requirements to GSA on the Standard Form 81 (SF81). This form identifies the total area of each space classification required by the agency within an individual building.

Tabulation of space requirements for planning purposes involves four steps:

Step 1 – Tenant agencies must identify the individual room areas they require within a facility or tenant suite.

Step 2 – To calculate the total usable area within an agency's suite, additional area must be added to the individual room areas to account for internal corridors, partitions, structural members, and planning inefficiencies. Traditionally, GSA has instructed the tenants to include 50 percent of an aisle space directly fronting the individual room area and the partitions enclosing the room area as part of the room area request. GSA then has added to this a factor of 20 percent to convert individual room areas to agency usable area. GSA must report the utilization of space by tenant agencies to the Office of Management and Budget. Target utilization ratios include 3.25 m2 (135 square feet) for primary office space with 20 percent additional space for office support areas. The agency may also calculate the usable area from the individual room areas by directly multiplying the area enclosed in the room by a factor. The following minimum planning factors are recommended. For spaces requiring wider aisles or more than one or two cross-aisles, or in buildings with irregular column grids, curved or stepped external walls or odd-shaped floor plans, higher planning factors are recommended.

Rooms size	Factor
Less than 10 m^2 (100 sf)	1.4
Less than 15 m^2 (150 sf)	1.3
Less than 50 m^2 (500 sf)	1.2
Less than 100 m^2 (1000 sf)	1.1

Step 3 – Classify space according to the GSA space classification standards, and request space from GSA on the SF81. GSA must have a signed SF81 from the tenant agency to process a space request.

Step 4 – GSA divides the sum of the tenant usable space areas to be housed in the building by a building efficiency factor to convert the usable area tabulations to a gross building area. The gross building area is the size of building Congress will fund. Efficiency factors used by GSA for planning purposes include the following:

Facility Type	Planning Factor
Warehouse	85%
Libraries	77%
Office	75%
Courthouse	67%

The space classification system is divided into general broad categories with subcategories for specialized spaces. The following are classifications currently used by GSA for planning purposes.

Conveying Systems

All elevators must comply with ASME A17.1, the Architectural Barriers Act Accessibility Standard (ABAAS), and Chapter 7: *Fire Protection & Life Safety, Elevator Systems.*

All occupied areas of a GSA multi-story building or facility must be served by at least one passenger elevator. Areas of future expansion must be anticipated as well as future configuration of existing spaces, to ensure all areas are provided elevator service in the future.

The ASME A17.1 current edition applies to the design of all elevators, lifts and escalators. Additionally, the Architectural Barriers Act Accessibility Standard (ABAAS) must be complied with for accessibility.

The selection of type and quantity of conveying systems, such as elevators, escalators and wheelchair lifts, must be made in conjunction with a thorough vertical transportation traffic analysis of the facility.

Elevators. If no separate freight or service elevator is provided, one passenger elevator must be designated as a service elevator with pads to protect the interior wall surfaces of the cab. A minimum ceiling height of 2700 mm (9 feet) is required in service elevator cabs. Freight elevators shall have a ceiling height of not less than 3700 mm (12 feet).

Table 3-1
Space Classification

1. Office	Total Office
2. Other General Purpose	ADP, auditorium, light industrial, structurally changed, lab, conference/training, food service, cafeteria, snack bar, health unit, fitness center, judges chambers, childcare
3. General Storage	general storage
4. Tenant floor cut	TFC
5. Residence & Quarters	quarters and residence
6. Outlease Retail	
7. Courtroom	judicial hearing rooms, courtrooms
8. Non-Building Charges*	railroad crossing, antennas, boat dock, land

*(square footages associated with this category, if they exist, fall outside the ANSI/BOMA total, and the "Assigned" total)

In large or high-rise buildings, the number of freight elevators provided for GSA buildings should be determined by the elevator traffic analysis. The use of more than one freight elevator will provide better freight service for the tenants as well as provide redundancy for normal maintenance and during times when repair work is conducted.

Where equipment penthouses are provided, service elevators should provide access to that level.

There may be *Security or specific purpose* elevators to transport designated groups of people such as judges, cabinet members or prisoners. An elevator shall service all maintenance floors.

Lockout should be provided for all floors served by passenger and freight elevators. Key locks, card readers or coded key pads, integral with the elevator control panel, must be provided to override lockout. A non-proprietary control system for elevator security systems should be used. The extent of control should be defined by the Project Team. See Chapter 8, *Security Design.*

Trap doors and hoist beams shall be provided at the elevator machine rooms for traction elevators where the machine room is not served by a freight or service elevator for removal of equipment for service and repair.

Elevator Traffic Analysis. The A/E must hire an independent consultant to perform objective studies on the number and type of elevators needed at the facility. The traffic analysis shall determine the quantity, capacity and speed requirements of elevators. The capacity and speed are the limiting factors used in determining the minimum number of cars that will meet both the average interval and handling capacity criteria.

Separate calculations must be made for passenger and for freight or service (combination of passenger and freight) traffic. If there are parking levels in the building, a separate analysis should be prepared for the shuttle elevators connecting parking levels with the lobby.

The type of building occupancy will determine the probable number of stops used in the traffic analysis calculations. A single-tenant building will require a greater probable number of stops than a multi-tenant building. This is especially true when balanced two-way traffic is considered because the incidence of inter-floor traffic is much greater in a single-tenant building.

The anticipated elevator population shall be calculated based on the occupiable floor area of the building and a factor of 14 m^2 (150 ft^2) per person. It shall be assumed that 8 to 10 percent of the resulting population would not require elevator service during the peak periods. If the building design requires two or more elevator banks, the population calculation results shall be apportioned by functional layout of the building. These divisions shall then be assigned to the appropriate elevator banks. For this purpose an "elevator bank" is defined as a group of adjacent or opposite elevators that function under a common operational system.

The criteria by which the traffic analysis calculations should be judged are "average interval" and "handling capacity."

Average interval is defined as the calculated time between departures of elevators from the main lobby during the a.m. up-peak period. Calculated intervals during the up-peak period should not exceed 30 seconds for a typical elevator bank.

Handling capacity is defined as the number of persons the elevator system must move in any given 5-minute period of up-peak traffic used to measure average interval. GSA buildings shall always be designed for a 16 percent handling capacity, even if the building is designed as a multi-tenant facility.

Elevator Capacities. Capacities of 1590 kg to 1810 kg (3,500 to 4,000 pounds) shall be used for passenger elevators. Elevator cab sizes shall be in accordance with the standards established by the National Elevator Industries, Inc. (NEII). Elevator cabs shall be designed to reflect the architectural character of the building design.

Escalators. Escalators may be installed as supplements to elevators when vertical transportation is required for a large *unpredictable* volume of public traffic. GSA prefers to use escalators only where absolutely necessary because of high maintenance costs. They should be used where the first floor is not large enough to contain the high public traffic so that the interval for elevators can be calculated with accuracy.

Escalators should be located to be visible from the building entry and convenient to the areas they serve.

Fire Protection

See Chapter 2: *Site Planning and Landscape Design* and Chapter 7: *Fire Protection & Life Safety* for additional requirements.

Seismic Design

Seismic design is discussed in detail in Chapter 4: *Structural Engineering.*

Design Issues Affecting Security

Specific criteria for site and building security are described in detail in Chapter 8. Some of the planning concepts are stated here because of their importance to building planning, but architects should familiarize themselves with Chapter 8 before developing schematic design concepts.

Table 3-2
Criteria for Design of Escalators

Nominal Escalator Width	Capacity in Persons Per Hour	Capacity in Persons Per 5 Mins.
820 mm (32 in.)	3,000	250

General Layout. Many future security problems can be prevented by planning a clear, simple circulation system that is easy for staff and visitors to understand. Avoid mazes of hallways and hidden corners. Exterior doors should be readily visible.

Planning for Future Security Provisions. All Federal buildings shall be planned to allow for future controlled access, both to the entire building and to individual floors.

Site Design. Building entrances shall be designed to make it impossible for cars to drive up and into the lobby. Planters can be provided as barriers; bollards are also acceptable if well integrated with the design of the building entrance. Barriers to vehicle access should be visually punctuated and as unobtrusive as possible to pedestrians. Consideration should be given to incorporating security features that allow for flexible use of the site. If addressed skillfully, planters, trees, or sculpted bollards can be employed to provide amenities while meeting vehicle barrier requirements. High blank wall should be avoided; lower walls with sitting edges are preferable.

Building Entrances. GSA buildings should have *one* main entrance for staff, visitors and the public. In large buildings a second entrance may be designated for employees only. Buildings may have additional doors used for egress or access to service areas. These doors should not be used as entrances. Original primary entrances at historic buildings should be retained as such. Closure of ceremonial entrances and redirecting public access to below grade and other secondary entrances for security or accessibility purposes is discouraged. Wherever possible, access for the disabled to historic buildings should be provided at, or nearby original ceremonial entrances. For building entrances and unsecured areas of building lobbies, raised floor systems shall not be used. See Chapter 8 for access controls and intrusion detection systems.

Building Lobby. The building lobby shall always be designed to permit subdivision into a secure and a non-secure area. The two areas could potentially be divided by turnstiles, metal detectors or other devices used to control access to secure areas. There shall be space on the secure side for a control desk and an area where bags can be checked. Mechanical ductwork, piping and main electrical conduit runs should not extend from one area to the other. In building entrance lobbies, vending machines, automatic tellers, bulletin boards, and other tenant support services should be located in ancillary space outside of entrance lobbies or consolidated in a retail tenant service core. Equipment that must be installed in lobbies should be of a low profile variety and consolidated with other equipment to minimize bulk. For building entrances and unsecured areas of building lobbies, raised floor systems shall not be used. See the section *Space Planning, Public Spaces, Entrance Lobby and Atria* of this chapter.

Lobby Security Equipment. The A/E shall incorporate non-prescription screening devices into the lobby entrance design. In historic building entrance lobbies, where feasible, security processing equipment should be located in an ancillary space. Equipment that must be installed in historic lobbies should be of a low profile variety, consolidated with other equipment to minimize bulk, and placed carefully to avoid altering the original spatial configuration of the lobby. See First Impressions Program.

Courts and Plazas. The most important consideration in designing exterior plazas and public spaces is the future potential use of those spaces. Potential uses should include shared and alternate uses. The team should discuss with potential users how they would like to use the space, in order to incorporate appropriate amenities, relate outdoor areas to inside uses (e.g., like dining facilities), accommodate traffic to and from the building, and provide for regular programmed use of the spaces and special events, as appropriate. Consideration should be given to different areas of a public plaza which would be appropriate for different types and intensities of public activity. Potential users of the space would include not only the building tenants, but also persons in neighboring properties as well as organizations, such as performing arts or vending organizations, that might assist GSA in bringing activities into the space. The treatment of seating, shade, water, art, bollards, and the space's flexibility are important to supporting appropriate uses.

Plazas should be designed with electrical outlets, and other simple infrastructure, to support future flexibility and a wide range of uses.

U.S. Courthouse, Boston, MA

Retail Shops. Generally, retail shops should be located on the non-secure side of the lobby. Exceptions could exist where commercial establishments serve the building population only. Some buildings may have multiple levels of retail around an atrium. In that case, the security checkpoint should be located at the elevator lobby. Designers should coordinate opportunities for retail with the Retail Tenant Services Center of Expertise as well as the Center for Urban Development.

Elevators. See *Building Planning, Conveying Systems* section of this chapter and Chapter 8. Elevator control panels must have lockout provisions for all floors (passenger and freight).

Mechanical and Electrical Spaces. Access to mechanical and electrical spaces should be from the inside of the building, located on the secure side of the (potential) security point in the building lobby.

3.2 Space Planning

Ceiling Height. The general office space should have a ceiling height that provides long-term flexibility for future floor plan changes. In historic buildings, however, original ceilings in significant spaces should remain exposed to view. New suspended ceilings in standard office space within historic buildings should maintain the original ceiling height to the greatest extent possible, maintaining full clearance at windows and grouping systems, as necessary, to minimize the reduction of ceiling height. In office space containing vaulted ceilings, oversized windows, or similar features, consideration should be given to thoughtfully designed, exposed system solutions that maintain full ceiling clearance and allow ornamental surfaces to remain exposed to view.

The clear ceiling height for office spaces is a minimum of 2700 mm (9 feet) for spaces that are larger than 14 m^2 (150 square feet). The clear ceiling height of individual office rooms not exceeding an occupiable 14 m^2 (150 square feet) is a minimum of 2700 mm (9 feet). The clear ceiling height of private toilets and small closets, which are ancillary to other office spaces is a minimum of 2300 mm (8 feet).

Enclosed offices should have the same ceiling height as adjacent open office spaces to allow future reconfiguration flexibility.

Automated Data Processing (ADP) Areas. ADP spaces require access flooring over a plenum space, even if access floors are not used elsewhere in the building. ADP areas are almost exclusively associated with main frame computer equipment. See Chapter 7, *Fire Protection & Life Safety,* for additional essential electronic facilities requirements.

The access flooring of ADP areas shall be level with adjacent related spaces and must always be level with the landings of elevators that serve the ADP facility. Ramps shall only be used where it is impossible to adjust the level of the structural floor. Where ADP areas occupy 33 percent or more of a floor, the entire floor, including internal corridors, shall be designed with raised access flooring to accommodate ADP facility expansion. The floor levels of access flooring should be constant throughout the floor. Designers shall consider the need for access floor systems in ADP areas to carry larger loads due to special equipment like UPS systems.

Training and Major Conference Rooms. Individual training and conference rooms may be located within the building to best suit the tenant. If such spaces are grouped to form a large training or conference facility, they should be located near the ground floor to avoid excessive loading of vertical transportation and to provide immediate egress for large groups of people.

Rooms designed for video teleconferencing or training should have a minimum clear ceiling height of 3000 mm (10 feet).

Public Spaces

Public spaces are those accessible to the general public. They include entrances, lobbies, stairways, public elevator and escalator lobbies, and the permanent corridors at each floor level. In historic buildings, new materials should be commensurate in quality with original finishes and compatible in form, detail, and scale with original design.

Entrances and Vestibules. The main entrance to a Federal building must be conveniently located for vehicular and pedestrian traffic. All public entrances shall be accessible to physically challenged individuals. Vestibules must be provided at each main lobby entrance and must include

Reagan Building, Washington, D.C.

an air lock. The distance between inside and outside doors must comply with accessibility criteria.

A canopy, portico, or arcade should be used for weather protection, and to emphasize the main entrance or enhance the building design.

Approaches must be well-lighted and designed to direct the visitor to the entrance. Grade level approaches are preferred over elevated approaches that require steps, but need to be coordinated with overall approach to provide building security. Clear and attractive graphics should be provided to assist visitors with directions.

Entrance Lobbies and Atria. The lobby should be clearly visible from the outside, both day and night.

The main lobby should accommodate visitors by providing information facilities, waiting areas and access to vertical transportation. Since the lobby also serves as the collection point for all employees entering the building, it shall be designed to accommodate the high volume of pedestrian traffic. Areas such as cafeterias, auditoria and exhibition halls should be located near the lobby. Where appropriate, designers should strategize security design to make monumental interiors, atria, and other grand spaces suitable for after hours public use.

Even in non-secure buildings, lobby space shall be planned to be divisible into a non-secure and secure area, with space on the secure side to accommodate a future security station that may include an identity check, bag check, metal detector and turnstiles. Also allow for adequate queuing space on the future non-secure side of the lobby. Refer to Chapter 8 and the section on *Design Issues Affecting Security, Building Lobby* of this chapter for further details.

Access, maintenance and cleaning of the interior and exterior wall and ceiling surfaces (glazing and cladding) of multi-level lobbies or atria must be addressed during design, as well as maintenance and cleaning of light fixtures and servicing smoke detectors (if provided). Portable lifts or other appropriate equipment can be used to access these elements where approved by the Facility Manager; scaffolding should be avoided. The flooring materials within this space must be able to accommodate the loads and use of this equipment. Maintenance professionals should be included in Schematic and Design Development reviews to address these issues.

Mechanical, electrical and communication systems must be integrated into the lobby design. Fixture and outlet locations, and forms, sizes, finishes, colors and textures of exposed mechanical and electrical elements, must be coordinated with all other interior elements. It is desirable to conceal HVAC supplies and returns.

Elevator and Escalator Lobbies. Like entrance lobbies, elevator and escalator lobbies shall be designed to efficiently accommodate the movement of pedestrian traffic to other parts of the building. Adequate space should be provided to perform this function.

The elevator and escalator lobbies should be close to the main lobby and be visible from the main entrance. Visual supervision and physical control of the lobbies for elevators and escalators shall be a prime consideration for building security.

If unusually large pieces of equipment or furniture such as mechanical equipment or conference tables must be transported to a specific floor via an elevator, verify that the item can be moved into and through the lobby space.

Public Corridors. A complementary palette of materials should be used to establish a hierarchy in the treatment of spaces and corridors as they lead visitors from the entrance lobby to the main corridors and finally to departmental corridors. It is desirable to introduce as much natural light as possible into corridors, through windows, transoms or borrowed light.

Building Support Spaces

Placement of Core Elements and Distances. In buildings with large floor plates not all core elements need to be placed at each core location. How often each element needs to be repeated is governed by occupant needs and the following maximum radii and distances:

- *Elevators* should always be grouped in banks of at least two for efficiency. Travel distances from a given office or work station to an elevator shall not exceed 200 feet. Travel distances to stairs are governed by code.
- *Toilets* should also be placed within 200 feet of every office or work station.
- *Electrical rooms* must be stacked vertically and should be located so that the area of coverage does not exceed 12,000 square feet and the length of the branch circuits do not exceed 150 feet. Shallow, secondary closets off permanent corridors may be used for receptacle panelboards where the distance between the riser and the farthest work station exceeds 150 feet and a separate riser is not warranted.
- *Communication Closets* must be stacked vertically and shall be placed so that wiring runs do not exceed 150 feet.

Toilet Spaces. Toilet space includes general use toilets and associated vestibules, anteroom and contiguous lounge areas.

Toilet rooms for both sexes should also be located adjacent to the cafeteria.

Toilet rooms shall be screened from public view without the use of double door vestibules at entrances. All public and common use toilets must have facilities for the disabled and comply with ABAAS. All other toilets must have provision for future adaptation to accessible requirements.

Table 3-3
Number of Toilet Fixtures

Number of Persons Per Toilet Room	Men WC	Men Ur	Men Lav	Women WC	Women Lav
1 to 8	1	1	1	2	1
9 to 24	2	1	1	3	2
25 to 36	2	1	2	3	2
37 to 56	3	2	2	5	3
57 to 75	4	2	2	5	4
97 to 119	5	2	3	7	5
120 to 134	6	3	4	8	5
Above 135	1/20	1/40	1/30	1/15	1/24

To the extent possible, toilets shall be grouped to reduce plumbing runs. The layout of toilets should minimize circulation space. However, toilet rooms for assembly areas, such as training or conference facilities, must accommodate short-term, high-volume traffic. In those areas, there shall be three women's toilets for every two toilets and/or urinals for men. Circulation should be adequate to handle peak traffic. In areas where assembly occupancies exist, provide fixtures consistent with code requirements for this occupancy.

- A fold-down changing table for infants should be available in toilets for public use.
- Feminine product dispensers shall be in each women's restroom.
- Toilet seat covers shall be provided in each restroom.
- Toilets for public usage shall be equipped with the large commercial toilet paper dispensers.
- Verify and get approval from the building management for the selection and placement of the following:
  - Commercial toilet paper dispensers
  - Soap dispensers.
  - Paper towel dispensers.
  - Paper towel trash receptacles.
  - Feminine hygiene products dispenser.
  - Feminine products disposal.
  - Toilet seat cover dispenser.

Toilet Partitions. All toilet partitions must be ceiling hung. They should be metal or similarly durable construction.

Toilet Accessories. Stainless steel is preferred for toilet accessories. Accessories should be integrated into the design of toilet rooms. Recessed and multi-function accessories that do not clutter the room are preferred.

Locker Rooms. Locker rooms shall be finished spaces. The shower area should be separated from the locker area. Regular gypsum wallboard is not to be used as a substrate for any shower room surface.

Custodial Spaces. Custodial spaces are devoted to the operation and maintenance of the building and include building maintenance storage rooms, stockrooms and janitor's closets. Custodial spaces shall be coordinated and approved by building management.

Storage Rooms. Storage rooms are utilitarian spaces. Rooms may be any configuration that will efficiently accommodate the materials to be stored. Access doors and aisles need to be large enough to move the stored materials. The configuration of storage rooms should be coordinated with the Facility Manager.

Janitor's Closets. Janitor's closets should be centrally located on each floor near the toilet facilities and be directly accessed from the corridor, not by going through the restrooms. They should accommodate all the equipment and supplies needed to service the area worked from the closet. All available space within the closet can be put to use to store gear and supplies. As a minimum, the service closet shall have a 600 mm (24-inch) square mop basin, a wall-mounted mop rack, and 900 mm (3 feet) of 250 mm (10-inch) wide wall shelving; the floor area should be a minimum of 1.7 m^2 (18 square feet).

Mechanical and Electrical Rooms. These spaces include, but are not limited to, mechanical and electrical equipment rooms, enclosed cooling towers, fuel rooms, elevator machine rooms and penthouses, wire closets, telephone frame rooms, transformer vaults, incinerator rooms, and shafts and stacks.

Equipment Spaces. Mechanical and electrical equipment rooms must be designed with adequate aisle space and clearances around equipment to accommodate maintenance and replacement. Hoists, rails and fasteners for chains should be provided to facilitate removal of heavy equipment. The working environment in equipment rooms should be reasonably comfortable. Doors and corridors to the building exterior must be of adequate size to permit replacement of equipment. This path (may include knock-out panels, hoists and provisions for cranes) is necessary and must be demonstrated for equipment replacement. A minimum of 4 percent of the typical floor's gross floor area shall be provided on each floor for air-handling equipment. A minimum of 1 percent of the building's gross area shall be provided for the central heating and cooling plant (location to be agreed upon during preparation of concept submission.) Mechanical equipment room shall not be less than 3700 mm (12 feet) clear in height. All mechanical equipment room must be accessible via a freight elevator at that level for the purpose of operations and maintenance, and replacement of equipment. The freight elevator must be of a size to accommodate the largest component of the equipment. Ship's ladders are not permitted as a means of access to mechanical equipment. Mechanical equipment rooms should not be less than 3700 mm (12 feet) clear in height. In some buildings special fire protection measures may be required. See Chapter 7: *Fire Protection & Life Safety,* for additional requirements.

All equipment spaces must be designed to control noise transmission to adjacent spaces. Floating isolation floors are recommended for all major mechanical rooms. See the section *Special Design Considerations, Acoustics, Design Criteria for Building Spaces, Class X Spaces* of this chapter for noise isolation criteria.

Main electrical switchgear shall not be below toilets or janitor closets or at an elevation that requires sump pumps for drainage. If electrical switchgear is housed in the basement, provisions shall be made to prevent water from flooding the electrical room in the event of a pipe breaking. Automatic sprinkler piping shall not be installed directly over switchgear equipment.

Mechanical rooms as a rule shall open from non-occupied spaces such as corridors. If mechanical rooms must open from occupied spaces because of configuration constraints consider incorporating a vestibule with partitions that extend to structure and sound-gasketed doors at each side for acoustic and vibration separation.

Equipment Placement. The architect shall coordinate with the mechanical engineer to place mechanical equipment in order to optimize access for maintenance and replacement. Design of equipment placement shall allow maintenance of motors and replacement of filters from the ground. When there is no practicable alternative and equipment must be placed overhead, replacement of filters shall require a standard step ladder requiring one person to safely operate.

Communications Equipment Rooms. In addition to the criteria stated for general mechanical and electrical equipment rooms, equipment rooms for communications equipment must comply with EIA/TIA Standard 569: *Commercial Building Standard For Telecommunications Pathways And Spaces* (and related bulletins).

Equipment rooms shall be sized to accommodate the equipment planned for the room. At a minimum, the room should have 69 660 mm^2 (0.75 square feet) of equipment room space for every 9.3 m^2 (100 square feet) of occupiable space. The equipment room should be no smaller than 14 m^2 (150 square feet). Federal Technology Service (FTS) should determine if tenants will share equipment rooms or if separate equipment rooms are required for specific tenants.

Equipment rooms shall be connected to the communications entrance facilities and the backbone pathway.

The equipment room will have 24-hour HVAC service and be protected from contaminants.

Spaces for Uninterruptible Power Systems (UPS) and Batteries. The UPS modules and associated batteries must be installed in separate, adjacent rooms.

See the UPS and battery manufacturers' installation instructions for weights, dimensions, efficiency, and required clearances in the design. Allow space for storage of safety equipment, such as goggles and gloves. Special attention shall be given to floor loading for the battery room, entrance door dimensions for installation of the UPS and ceiling height for clearance of the appropriate HVAC systems and exhaust systems.

Electrical Closets. Electrical closets must be stacked vertically within the building. Closets shall be designed to contain adequate wall space and clearances for current and future requirements, and should have a minimum size of 1800 mm by 3000 mm (6 feet by 10 feet). Shallow closets must be at least 600 mm (24 inches) deep by 2600 mm (8 feet 6 inches) wide. These are satellite closets for electrical panelboards. They should not contain extraneous floor area, which may be an invitation to store items that do not belong in electrical closets.

Communications Rooms. Communications rooms must be stacked vertically within the building. Rooms shall be sized to contain adequate floor space for frames, racks and working clearances for current need and future expansion. Communications closets shall meet the requirements of EIA/TIA Standard 569: *Commercial Building Standard For Telecommunications Pathways And Spaces* (and related bulletins). Agency requirements for separate, dedicated communication closets shall be verified.

Vertical Shafts. Vertical shafts for running pipes, ducts and flues shall be located adjacent to other core elements to the maximum extent possible. Be aware of the requirement to locate fire alarm vertical risers remotely. Shafts shall be straight vertical runs. Shafts shall be sized to accommodate planned expansion of the systems. Shafts shall be closed at top and bottom, as well as at the entrance to the mechanical room, for sound isolation.

Loading Docks. Loading docks must be located for easy access by service vehicles and must be separate from the main public entrances to the building. Loading docks must be convenient to freight elevators so that service traffic is segregated from the main passenger elevator lobbies and public corridors. Service route from dock from elevator shall plan for the transport of large items such as rolled carpet goods. Loading docks must accommodate the vehicles used to deliver or pick up materials from the building. If the bed height of vans and trucks varies more than 450 mm (18 inches), at least one loading berth must be equipped with a dock leveler. The dock shall be protected with edge guards and dock bumpers. Open loading docks should be covered at least 1200 mm (4 feet) beyond the edge of the platform over the loading berth. In cold climates dock seals should be used at each loading bay. Alternatively, consideration could be given to enclosing the entire loading bay.

Separate or dedicated loading docks should be considered for food service areas.

A ramp should be provided from the loading dock down to the truck parking area to facilitate deliveries from small trucks and vans. This ramp should have a maximum slope of 1:12 and comply with ABAAS, ensuring that it may be easily maneuverable for deliveries on carts and dollies.

If the building size warrants, a dock manager's room or booth should be located so the manager can keep the entire dock area in view and control the entrance and exit from the building.

Loading docks must not be used as emergency egress paths from the building.

Loading Berths. Provide at least one off-street berth for loading and unloading. The berth should be 4600 mm (15 feet) wide and at least as long as the longest vehicle to be accommodated. Local zoning regulations or the architectural program may require a longer length. The space should be located adjacent to the enclosed or open loading dock. If additional loading berths are required they need not be wider than 3600 mm (12 feet), as long as they are contiguous to the 4600 mm (15-foot) wide berth.

An apron space shall be provided in front of the loading berth for vehicle maneuvering equal to the length of the berth plus 600 mm (2 feet). This area should be flat, with a minimum slope of 1:50 for drainage. The minimum headroom in the loading berth and apron space is 4600 mm (15 feet). When a steeper slope is required in the apron area, the headroom should increase with a gradient allowance to allow trucks to traverse the grade change.

If the approach to the loading dock is ramped, the design should permit easy snow removal.

Staging Area. A staging area inside the building shall be provided adjacent to the loading dock. It must be protected from the weather. The staging area shall not interfere with emergency egress from the building.

Trash Rooms. Trash rooms shall be adjacent to loading docks or service entrances. Trash rooms must be sized to accommodate the trash handling equipment required and provide storage for packaged trash generated during a three day occupancy of the building. Space shall be allowed for sorting recycling of paper, glass and metals. Facilities that use trash containers that are picked up by vendors must have at least one loading berth for the trash container.

Building Engineer's Space. Even if not included in the building program, an office space for the building engineer should be evaluated. Most GSA buildings require such a space, which houses the consoles for the Building Automation System. This space is normally located near the loading dock or main mechanical spaces.

Security Control Center. All GSA buildings with a local security force should have a control center. In the event that the building will not be served by a local security force, this room could be combined with the building engineer's office or the fire control center.

The security control center should be located adjacent to the main lobby. Approximately 21 m^2 (225 square feet) should be allocated for this room which is intended to house the command station for the security guards and their equipment for current as well as future building needs. There should be an expectation in the planning of the building that a security command center and inspection station may be needed in the future, if it is not required at time of building design.

Robert A. Young Federal Building Child Care Center, St. Louis, MO

Fire Command Center. See Chapter 7: *Fire Protection & Life Safety,* for additional requirements.

Food Service Areas. The entrances to the dining area should be visible from the main circulation paths, but should not impede lobby traffic.

Space allocations for food service facilities are established in GSA handbook, *Concession Management Desk Guide (PMFC-93).*

Dining Areas. Dining areas should be located to take advantage of natural light and outdoor eating areas in climates where this is feasible.

Serveries should be laid out to minimize waiting times for customers. Scramble service is recommended.

In most cases, food service areas perform better when not isolated within a facility. Designers shall consider making food service directly accessible to the public and integrated with the site design. GSA has had success mitigating security concerns by a variety of means including placing food service within freestanding structures, and hardened partitions.

Child Care Centers. See GSA *Child Care Center Design Guide (PBS-P140).* Child care centers will usually be operated by organizations outside the Federal Government. The GSA Office of Child Care Development Programs shall be consulted before design concepts are finalized.

Laboratories. The construction of new laboratories in existing office buildings is strongly discouraged. See Chapter 7: *Fire Protection & Life Safety,* for additional requirements.

Outleased Space. This term defines building space leased to businesses as commercial stores.

Outleased spaces and the connection between them and the remainder of the building should be designed so they can function as Government office space in the future. Consideration should also be given to those building without programmed outleased space to allow for this flexibility in the future.

Outdoor Eating Areas. To the extent possible, outdoor eating areas should be encouraged. When incorporating outdoor eating areas, the security of the building or facility shall be considered. Special consideration should be given to capture those opportunities to engage the building's exterior/landscaping with the community in which it is placed. See Chapter 2, *Site Planning and Landscape Design, Landscape Elements* and Chapter 8.

Structured Parking

The building program will stipulate the numbers and types of vehicle parking spaces. The program will also state whether parking is to be exterior on-grade parking or interior, structured parking. The following criteria apply to structured parking facilities and are minimum requirements. Dimensions apply to passenger cars and need to be modified for other types of vehicles.

Parking Layout. To the extent possible, parking spaces should be arranged around the perimeter of the parking deck for maximum efficiency. Two-way drive aisles should be used with 90-degree vehicle parking stalls on each side. When locating entrances and ramps, consider internal and

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external traffic flow, queuing during peak periods of ingress and egress, and required security features.

Drive Aisles. Two-way aisles must have a minimum width of 7000 mm (23 feet). One-way aisles and aisles with stalls on only one side are less efficient and should be avoided if possible.

Vehicle Stalls. Stalls to accommodate regular passenger cars should have be sized to comply with local zoning requirements. When there are no zoning requirements then parking spaces should be a minimum size of 2600 mm (8 feet 6 inches) wide and 5500 mm (18 feet) long. No special consideration should be given to compact vehicles. No structural element may intrude upon the required stall dimension, and columns must not be located within 610 mm (2 feet) of the required aisle except where the aisle has no stalls perpendicular to it. Each stall must have access to an aisle.

Accessible parking spaces must be provided; these must comply with ABAAS for quantity, location and size.

Accessible parking spaces shall be adjacent to access aisles that are part of an accessible route to the building or facility entrance. Accessible routes shall not be located behind parking spaces.

Ramps. The incline on parking area ramps shall not exceed 12 percent. The break-over angle at changes of plane in ramps shall not exceed 6 percent. The incline on ramp floor garages shall not exceed 5 percent. The entire length of the entrance and exit ramps must be protected so that snow and ice do not accumulate on the ramps if inclement weather is excessive. Snow melting systems should also be considered. Careful consideration needs to be given to providing proper drainage of the parking deck.

Garage Openings. Overhead doors or grilles at vehicular entries to structured parking garages may be provided for security purposes. The operation of overhead doors or grilles must utilizes advanced technology (use of sensors or incorporating sallyports) to prevent entry by unauthorized persons. These overhead grilles or doors shall be electric and operated by card-readers or other means of remote control. The control devices and doors or grilles shall be suited for high frequency operation, and should open and close quickly to avoid impact damage to vehicles; they must also have a sensor edge to detect a vehicle or other object below it and reverse operation. These openings should be monitored by camera.

These openings shall be a minimum of 3600 mm (12 feet) wide with minimum height of 2400 mm (8 feet). A headache bar shall be provided in front of each opening; this shall be mounted 100 mm (4 inches) lower than the height of the clear opening.

Walkways. Pedestrian walkways shall link the parking area with the building entrance. Provide curbs, bollards, other barriers or low walls to prevent vehicles from encroaching upon pedestrian walkways. Identify pedestrian crossings of vehicular traffic lanes by painted crosswalks and signage.

3.3 Commissioning

The design architect shall identify and coordinate commissioning practices with the Construction Manager, Project Manager, and (if contracted separately) the Commissioning Authority, for the project's programmed performance goals. As appropriate, coordinate with other disciplines to fully enable required testing and certifications. Incorporate into construction specifications those testing and certification requirements that involve construction contractors. Examples of possible programmed performance goals include:

- Assigned Annual Energy Consumption Goal
- Attainment of Programmed LEED rating
- Assured Envelope Thermal Integrity, Certified by Hot-Box and/or Infra-red (thermographic) Imaging
- Water Penetration and/or Moisture Control
- Blast Resistance Glazing Performance
- Seismic Response
- Acoustic Performance
- High-wind Impact Resistance
- Accessibility Requirements
- Functionality of Applied Innovative Technologies

3.4 Special Design Considerations

Incorporation of Recycled-Content Materials

The GSA is committed to maximizing the use of recycled-content materials specified in the construction of Federal building projects. Many commonly used products are now available with recycled content, including steel, aluminum, concrete, masonry, acoustic tile, paint, carpet, ceramic tile, and insulation.

To support markets for the materials collected in recycling programs, the Resource Conservation and Recovery Act requires agencies to buy recycled-content products designated by EPA. Through the Comprehensive Procurement Guidelines (CPG), EPA designates items that must contain recycled materials when purchased by Federal agencies, or government contractors, using appropriated Federal funds. Refer to Chapter 1, *Recycled-Content Products.*

Information on specifying and purchasing recycled-content products can be found on the Internet at www.epa.gov/cpg.

The CPG items listed in Table 3-4 are frequently found in buildings. Product specifications and standards that might exclude the use of recovered materials should be revised to allow the use of these items.

U.S. Courthouse, Seattle, Washington

Daylight and View

All buildings receive daylight. A daylit building, however, is specifically designed to efficiently use daylight through adapted components and control strategies. The goal of daylighting design is to minimize energy use and maximize human comfort. The benefits of daylighting are far reaching and include the physiological and psychological benefits of daylight, e.g. circadian rhythms; but also the little thought of benefits of view of the natural environment.

Although daylight and access to an outdoor view have typically been considered as part of the standard for windows and skylights, GSA had determine that these should be given additional consideration as a special design consideration upon both the structural design of the building. All building orientations have daylighting potential. It is a matter of using the appropriate techniques and technologies to take advantage of daylight.

Contrary to what is commonly believed, North America has year-round access to sufficient daylight for lighting

Table 3-4
Examples from the CPG List of Designated Products

Building Insulation Thermal insulation made from recovered materials is available in several forms including rolls, loose-fill, and spray foam. Insulation can include a range of recovered materials such as glass, slag, paper fiber, and plastics.

Carpet Recycled-content polyester carpet is available for light- and moderate-wear applications. Recycled fiber polyester carpet is manufactured from PET recovered soda bottles.

Carpet Cushion Carpet cushion, also known as carpet underlay, is padding placed beneath carpet. Carpet cushions made from bonded urethane, jute, synthetic fiber, and rubber can be made from recovered materials.

Cement and Concrete Coal fly ash and ground granulated blast furnace (GGBF) slag are recovered materials that can be used as ingredients in cement or concrete. Coal fly ash is a byproduct of coal burning at electric utility plants. Slag is a byproduct of iron blast furnaces. The slag is ground into granules finer than Portland cement and can be used as an ingredient in concrete. The level of coal fly ash in concrete typically ranges from 15 to 35 percent of total cementitious material, but can reach 70 percent for use in massive walls and girders. The level of GGBF slag usually ranges from 25 to 50 percent.

Reprocessed and Consolidated Latex Paints For Specified Uses Reprocessed paint is postconsumer latex paint that has been sorted by a variety of characteristics including type (i.e., interior or exterior), light and dark colors, and finish (e.g., high-gloss versus flat). Reprocessed paint is available in various colors and is suitable for both interior and exterior applications. Consolidated paint consists of postconsumer latex paint with similar characteristics (e.g., type, color family, and finish) that is consolidated at the point of collection. Consolidated paint is typically used for exterior applications or as an undercoat.

Structural Fiberboard and Laminated Paperboard Structural fiberboard is a panel made from wood, cane, or paper fibers matted together which is used for sheathing, structural, and insulating purposes. Laminated paperboard is made from one or more plies of kraft paper bonded together and is used for decorative, structural, or insulating purposes. Examples of these products include building board, insulating formboard, sheathing, and acoustical and non-acoustical ceiling tile.

Floor Tiles and Patio Blocks Floor tiles for heavy duty or commercial specialty applications can contain up to 100 percent postconsumer rubber. Floor tiles containing 90 to 100 percent recovered plastic are also readily available. Patio blocks made from 90 to 100 percent recovered plastic and 90 to 100 percent postconsumer rubber are used for walkways and trails.

Shower and Restroom Dividers / Partitions Shower and restroom dividers/partitions are made of 20 to 100 percent recovered plastic or steel. They are used to separate individual shower, toilet, and urinal compartments in commercial and institutional facilities.

Signage Signs made from recovered materials are used inside and outside of office buildings and other public places. EPA's designation pertains to plastic signs used for nonroad applications and covers any associated plastic or steel supports.

commercial buildings. Only in the extreme north of Alaska or Canada, due to the dark winter months, is there a lack of sufficient sunlight for daylighting purposes. The average illumination level under overcast skies at latitude of 50° is 7500 lux. This is about 15 times more illumination than that required to perform average indoor tasks.

Daylight in building design is recognized as a valuable means of improving energy effectiveness in commercial buildings. Refer to IESNA RP-5-99: *Daylighting Conference Proceedings*, May 1998. The research and design communities recognize it as a valuable way of providing tenants access to outside views. It has been identified in case studies and research that humans value their ability to maintain a visual link to the outside. This linkage reenforces individuals with the sense of connectedness and comfort that the temporal and physical natural environment provides.

Daylight Design Criteria. Daylighting is essentially a systems integration challenge for a multi-disciplinary design team. It is important that daylighting considerations involve the participation and cooperation of the owner/tenant, architect, electrical lighting designer, mechanical systems engineer, interior designer, operation and maintenance staff and the construction team. Daylighting is unique in that it requires designers to address multi-disciplinary qualitative issues, in addition to the usual technical issues. For lighting to be truly effective, it must provide a comfortable and healthy visual environment that will support the activities of the occupants.

Even when excellent daylighting components or technologies are selected, poor integration can lead to unreliable building performance and uncomfortable work environments. Critical design elements include building orientation, fenestration size, lighting and control systems optimization and commissioning.

Daylight Design Concept and Integration Process. The daylight design process shall include the following steps;

- Concept, Design Basis
- Building Orientation and Form
- Daylighting the Perimeter
- Daylighting the Core
- Windows and Glazing identification and selection
- Shading, daylight controls and visual comfort
- Utilization of a Daylight Design Software, e.g. BDA
- Mechanical Coordination
- Auxiliary Lighting Integration
- Commissioning

Acoustics

The standards in this section have been established to ensure adequate acoustic qualities in Federal buildings.

Design Criteria for Building Spaces. Every element of a built space, including its shape, surfaces, furniture, light fixtures and mechanical systems contribute to its acoustical characteristics. Four key concepts govern the perceived quality of office acoustics:

- **Appropriate levels of speech privacy.** Speech privacy refers to the degree to which a conversation cannot be overheard in an adjacent space. Lawyers, doctors, human resources officers, executives and others whose position requires them to discuss sensitive information require confidential speech privacy, that is, a setting where, when a door is closed, the content of a conversation cannot be overheard. Professional staff members whose position requires extended periods of concentration require normal speech privacy, where the content of conversation in adjacent spaces cannot be overheard without making an effort, providing freedom from distraction. Little or no speech privacy is needed for receptionists, clerical staff, and team-oriented workgroups where overheard conversation can actually be beneficial.

- **Appropriate levels of background sound.** Continuous background sound in offices is mostly generated by heating, ventilation, and air conditioning (HVAC) equipment. In conference spaces, courtrooms and auditoria, it is important that this background sound not interfere with the intelligibility of speech. In enclosed offices, HVAC background sound is an important component in achieving the required level of privacy because it helps to cover up or “mask” speech transmitted between adjacent spaces. In open plan areas, the background sound provided by contemporary HVAC equipment is often not uniform and/or does not have the tonal balance and loudness needed to mask speech transmitted between adjacent cubicles. For this reason, additional electronic background noise or sound masking is often deployed in these areas.
- **Control of intrusive noise, vibration, and reverberation.** Office equipment generating noise levels above the background should be located away from primary work areas or should be surrounded by acoustically isolating panels. Noise induced by mechanical equipment should be controlled through vibration isolation devices, appropriate placement of equipment and noise attenuators in ducts. Reverberation and echoes must be controlled in courtrooms, auditoria, conference, team, and training room spaces. Sound absorbing materials are used to help control reflected sound energy and echoes. Particular attention must be paid to rooms with parallel walls (causes "flutter" echoes) and rooms with curved or concave ceilings (leads to acoustical focusing effects).

Isolation from exterior noise sources. Buildings located near airports, highways, rail corridors or other sources of significant environmental noise levels must have exterior wall and window assemblies controlling noise intrusions.

Closed Offices Versus Open Plan. Required levels of acoustic privacy should be included as a design criterion. For work that does not require acoustic and/or visual privacy, an open plan environment with low or no partitions between workstations is appropriate. For work that requires a balance between ongoing, active collaboration, easy workgroup reconfiguration, flexible settings, and minimized unwanted acoustic distraction, an open plan setting with a well-engineered acoustical design is recommended. Key components of such engineered open plan designs are highly absorptive ceilings, suitable height partition panels that both absorb and block sound, suitable levels of background sound (typically provided by electronic sound masking systems), and ready access to acoustically private (closed office) meeting spaces. A protocol that encourages lowered voice levels is also recommended. Closed offices are encouraged for workers who routinely require extended periods of concentration, in-office meetings, and/or confidential conversation. Meeting spaces and closed offices that require speech security must be designed in conjunction with a qualified acoustical consultant.

Parameters Used in Acoustical Design. The following parameters are used to specify acoustical standards for GSA buildings:

Background Noise— the continuous noise within a space. The loudness of noise is quantified by several assessment schemes, including noise criteria (NC), balanced noise criteria (NC-B) and room criteria (RC) contours. These contours are published in the *ASHRAE Handbook of Fundamentals.* Lower values are quieter.

Environmental Noise— the continuous noise outside a building. The Day-Night Average Noise Level (DNL) is a descriptor established by the U.S. Environmental Protection Agency to describe the average day-night sound level. Lower values are quieter.

Noise Isolation— the amount of noise transmitted through the perimeter boundary elements of a space. *Sound transmission class* (STC) quantifies the sound insulating performance of building elements such as walls, windows, and doors when tested in a laboratory in accordance with ASTM E90. *Noise Isolation Class* (NIC) quantifies the field-tested sound isolation between two enclosed spaces separated by a partition when tested in accordance with ASTM E336. NIC accounts for both the sound insulating performance of the partition, and unintentional paths ("flanking paths") between the spaces (e.g. wall/ceiling connections, partition penetrations, etc.). The numerical value of NIC is usually less than that of the STC for the separating partition. NIC should only tested in fully furnished spaces. *Ceiling attenuation class* (CAC) quantifies the sound insulating performance of a ceiling assembly spanning across rooms that share a common plenum when tested in accordance with ASTM E1414. *Field Impact Insulation Class* (FIIC) quantifies the field-tested impact sound insulating properties of a floor/ceiling assembly when tested in accordance with ASTM E1007. Greater STC, NIC, CAC or FIIC values represent better performance.

Reverberation Time— the time required for sound to decay 60 decibels in the 500 Hz band in an enclosed space. Reverberation time becomes longer as the sound absorption is reduced and/or the room volume increases.

Sound Absorption— the amount of sound absorbed by a surface finish. *Sound absorption average* (SAA) quantifies the efficiency of a material in absorbing sound energy when tested in accordance with ASTM C423 (SAA replaces the earlier noise reduction coefficient or NRC). SAA/NRC is a single number rating between 0 and 1. Greater SAA/NRC values represent a more effective sound absorber. An excessive amount of reflected sound (reverberation) tends to degrade speech communication.

Speech Privacy— the amount of speech that can be understood in a space adjacent to the location where a conversation is occurring. Articulation Index (AI) is a measure of the intelligibility of speech, which is related to the level of the speech relative to the level of the background noise at a particular location. When tested in open plan offices in accordance with ASTM E1130, AI takes into account the noise reduction of partitions between spaces, the absorption in spaces, the distance between source (talker) and receiver (listener), the level of the background noise, and typical voice levels. AI is a single number rating between 0 and 1; lower AI values mean fewer words can be understood, indicating increased privacy. An AI value of .05 indicates less than 8% of speech in an adjacent space can be understood and is considered the upper threshold of "confidential" speech privacy. An AI of .15 means indicates that, with concentrated effort, nearly two-thirds of speech in an adjacent space can be understood. Recent research indicates that above this level, intruding conversation may become distracting. An AI of .20 is considered the upper threshold for "normal" speech privacy.

Design Criteria for Building Spaces. Acceptable acoustics are determined by the use of a space and the requirements of its occupants. It is the responsibility of the design team to meet the following minimum standards governing the acoustical performance of various space usage categories.

Environmental Noise. The impact of site noise on a building's interior spaces shall be mitigated under any of the following conditions:

- Building is located within an airport noise contour of DNL 60 or greater
- Building is located within 500 feet of a freeway or railroad right-of-way
- DNL at the building's property line exceeds 70 dB

Table 3-5

	1	2	3	4	5
Space	**Maximum Mechanical Noise (RC/NC)**	**Minimum Absorption: Ceiling (SAA/NRC)**	**Minimum Absorption: Walls (SAA/NRC)[1]**	**Minimum Noise Isolation (NIC)**	**Optimum Reverberation (RT60)**
Teleconference Facility	20	0.8/ 50%	0.8/ 25%	53	0.5
Meeting rooms, training facilities	25	0.8/ 50%	0.8/ 25%	48[2]	0.6
Private offices, confidential speech privacy	30	n/a	0.8/ 25%	45	n/a
Private offices, normal speech privacy	35	n/a	0.8/ 25%	40	n/a
Private offices, normal speech privacy, sound masking	35[3]	n/a	0.8/ 25%	35	n/a
Private offices, normal speech privacy, low voice level	35	n/a	0.8/ 25%	31	n/a
Open Plan offices, normal speech privacy, sound masking	40[4]	0.9/ 100%	0.8/ 25%	n/a	n/a
Open Plan offices, no speech privacy	40	0.8/ 100%	n/a	n/a	n/a
Child care center	35	0.8/ 80%	0.8/ 25%	31	0.5

1 Absorption should be placed on two adjacent walls.

2 Operable walls and partitions shall achieve the required NIC rating for the spaces that they are separating.

3 Steady state background noise provided by electronic sound masking system: 40-42 dBA.

4 Steady state background noise provided by electronic sound masking system: 45-8 dBA.

In such locations, an acoustical report shall be submitted showing that the building's acoustical design mitigates the intrusion of exterior noise to no more than 5 dBA over the maximum mechanical noise levels (Table 3-5, Column 1).

For locations where a railroad runs beneath or abuts the site, a newly constructed building shall contain provisions that minimize vibration transmitted to office spaces within the building, including feelable vibrations and vibrations in the form of audible noise.

Mechanical and Plumbing Noise. All mechanical equipment shall be vibration isolated per ASHRAE standards and guidelines, including spring isolators, inertia bases as well as ancillary items such as flexible piping and electrical connections. In seismic areas, acoustical vibration isolation must not compromise seismic code requirements and vice-versa. As such, housed springs should be avoided; instead, un-housed springs with separate seismic snubbers should be used.

Ambient noise from mechanical equipment shall not exceed noise criteria (NC) values shown in Table 3-5, Column 1, "*Mechanical Noise*". Diffusers with an NC rating 5 points less than the noise criterion for the space being served are required.

Where occupied space occurs adjacent to, above or below mechanical, electrical equipment, or machine rooms, or adjacent to HVAC or elevator shafts, the intervening structure (partitions, shaft walls, doors, floor and ceiling assemblies, etc.) shall be sufficient to control noise intrusion to no greater than the maximum noise criteria (NC) or room criteria (RC) values shown in Table 3-5, Column 1, "Mechanical Noise". Where an elevator shaft or equipment room occurs adjacent to noise sensitive spaces (NC/RC 35 or lower), the maximum intrusion level of elevator noise shall be limited to 5 dB below the maximum NC/RC for the space in all octave bands.

All hot-water heating, supply, waste, and drain piping shall be vibration isolated from the structure, as well as from other piping, ductwork, gypsum board, etc. in the walls, ceilings and floors enclosing noise sensitive spaces (Table 3-5, Column 2, NC/RC 35 or less). All stud and joist spaces where such piping is located shall have R-11 (3-½-inch thick) batt insulation installed, and piping shall not be closer than one-inch to gypsum board.

Noise isolation, room acoustics and speech privacy. Absorptive materials are required in speech sensitive spaces to control reverberation and echoes. Table 3-5, Columns 2 and 3 lists spaces that require absorptive finishes. The first number in each column refers to the minimum level of the material's performance; the second refers to the minimum percentage of the ceiling or wall that must have finishes achieving this performance.

Floor/Ceiling assemblies separating office spaces shall achieve an NIC of not less than 50 (when furnished) and Field Impact Isolation Class (FIIC) of not less than 50. Table 3-5, Column 4 lists the minimum noise isolation (NIC) for spaces requiring acoustically rated walls.

For constructions on suitable slab floors, when properly detailed and constructed, and with all connections caulked airtight with acoustical sealant, the following wall assemblies will satisfy the minimum specified NIC requirements, with the offices furnished typically. Doors and other holes in the walls will degrade the overall performance. These wall examples are not the only constructions that will satisfy the performance criteria, but are intended solely to provide guidance on projects that do not require a qualified acoustical consultant during the design phase.

U.S. Courthouse at Foley Square, New York, NY

NIC 53 (teleconference room): double stud wall, two layers of gypsum board each side, batt insulation in the stud cavities. Full height (slab to slab).

NIC 48 (meeting rooms, training facilities): staggered stud wall, two layers of gypsum board each side, batt insulation in the stud cavity. Full height (slab to slab).

NIC 45 (private offices, confidential speech privacy): single stud wall, two layers of gypsum board each side, batt insulation in the stud cavity. Full height (slab to slab) or six-inches above a hung gypsum board ceiling.

NIC 40 (private offices, normal speech privacy): single stud wall, two layers of gypsum board one side, one layer of gypsum board the other side, batt insulation in stud cavity. Slab to slab (preferred); minimum six-inches above acoustical tile ceiling (minimum CAC 44).

NIC 35 (private offices, normal speech privacy, sound masking): single stud wall, single layer gypsum board each side, batt insulation in stud cavity. Minimum six-inches above acoustical tile ceiling (minimum CAC 44).

NIC 31 (private offices, normal speech privacy, low voice level; misc. other spaces): single stud wall, single layer of gypsum board each side, batt insulation in the stud cavity. Terminates at underside of acoustical tile ceiling (minimum CAC 35).

Commissioning. Verification that the above acoustical requirements have been met is required as part of contract documents. Acceptable documentation includes either a report by an acoustical engineer, stating that the intent of these requirements has been met, or other documentation showing that these acoustical requirements have been incorporated as contractual requirements. Contracting Officer may require, at no cost to the Government, test reports by a qualified acoustical consultant showing that acoustical requirements have been met by as-built construction.

3.5 Building Elements

This section establishes design guidelines for the various building elements, which are defined as the physical parts of building construction. These may be individual materials, assemblies of materials, equipment, or assemblies of materials and equipment.

It is the architect's responsibility to specify construction materials and systems appropriate to the final design. For additional requirements on fire protection and building construction (e.g., types of construction, panel and curtain walls, fire stopping, and spray-applied fire resistive materials), see Chapter 7: *Fire Protection & Life Safety.*

Substructure

Ground Water Control. The drainage mat and soil filter should relieve hydrostatic pressure on substructure walls and allow water drainage to the level of the drain. Drainage system piping may be clay tile or rigid PVC. Pipes should not slope less than 1:200. Subsurface drainage should discharge into the storm drain, by gravity if possible. Cleanouts shall be provided at grade to facilitate washing out the system.

Waterproofing. Membrane waterproofing should follow the recommendations of the National Roofing Contractors Association (NRCA) as contained in *The NRCA Waterproofing Manual.*

Underslab Insulation. Provide insulation under concrete slabs on grade where a perma-frost condition exists, where slabs are heated, and where they support refrigerated structures.

Exterior Closure

Products constructed of carbon steel are not permitted in exterior construction, which includes exterior walls, soffits or roofs, except where protected by a galvanic zinc coating of at least 460 grams per m^2 (1.5 ounces per square foot) of surface or other equivalent protection.

Exterior Wall Construction. Brick masonry design shall follow the recommendations of the Brick Institute of America (BIA) contained in the publications, *Technical Notes on Brick Construction.*

Concrete masonry design shall follow the recommendations of the National Concrete Masonry Association (NCMA) contained in the publication, *TEK Notes.*

Architectural precast concrete design shall follow the recommendations of the Precast Concrete Institute (PCI) contained in PCI publication, *Architectural Precast Concrete,* Second Edition.

Exterior limestone veneer design shall follow the guidelines of the *Handbook on Indiana Limestone* published by the Indiana Limestone Institute of America.

Marble veneer design shall follow the recommendations in *Exterior Marble Used in Curtain or Panel Walls* published by the Marble Institute of America.

Vapor retarder must be provided in a building envelope where heat loss calculations identify a dewpoint within the wall construction and in any building or part of any building that is mechanically humidified.

Exterior Cladding and Articulation. The use of different exterior materials, window designs, sun control devices and other design elements contribute to the design articulation of a building. Each of these components, their use and how they are combined on a building must be reviewed for opportunities provided for birds to roost ("bird roosts") on the exterior of the building. "Bird

Sam Gibbons U.S. Courthouse, Tampa, FL

roosts" can create both maintenance and visual problems, particularly in high-rise buildings.

Such opportunities for 'bird roosts' must be identified in the design phase and alternatives ways to address this be pursued. Consider the use of steeply sloped surfaces, limited use of horizontal surfaces at window sills, sun control devices or other design features or design approaches to address this issue. See the *Sun Control Devices* section of this chapter.

Sun Control Devices. Projecting exterior sunscreens may be used in addition to interior daylight control devices where they are beneficial for building operation and energy conservation. Design elements such as steeply angled fins or large scale gratings, instead of horizontal fins and flat planes, should be considered for sun screen components to provide shading and heat control for a building.

Consideration shall be given to operable and fixed sun control devices for maintenance, repair and replacement. Window washing systems used for the facility must also be compatible with any sunscreens or sun control devices.

Glazing, shading devices, and sources of illumination should be analyzed in detail to minimize heat gain and maximize direct day light into all spaces to produce the best microclimate for tenants in building perimeter spaces.

Daylight shading controls should be programmable and calibrated with a daylight sensor to maximize daylight and minimize energy consumption where possible.

Exterior Soffits. Design exterior soffits to resist displacement and rupture by wind uplift. Design soffits for access to void space where operating equipment is located or maintenance must be performed. Soffits can be considered totally exposed to weather and should therefore be designed to be moisture resistant. Provide expansion and contraction control joints at the edges and within the soffit. Spacing and configuration of control joints should be in accordance with the recommendations of the manufacturer of the soffit material.

Operating equipment or distribution systems that may be affected by weather should not be located inside soffits. Where it is necessary to insulate the floors over soffits, the insulation should be attached to the underside of the floor construction so that the soffit void may be ventilated to prevent condensation.

Exterior Windows. Although fixed windows are customary in large, environmentally controlled GSA buildings, in certain circumstances operable windows may be appropriate. Sometimes operable windows can also be used as a means of smoke control. In addition, operable windows may be used where they provide for window washing operations. In such cases, the operable windows should be able to be washed from the interior side.

Replacement of windows in historic structures should exactly match original frame and munton profiles. First consideration should be given to rehabilitating the existing windows.

Consideration of glare control plus heating and cooling loads must be factored into decisions on amount and placement of windows.

Aluminum windows shall meet the requirements of ANSI/AAMA Standard 101-85. Only Optional Performance Classes may be used. Metal windows other than aluminum shall meet the requirements of the National Association of Architectural Metal Manufacturers Standard SW-1 for the performance class required. Wood windows should meet the requirements of ANSI/NWMA Standard I.S. 2-87, Grade 60.

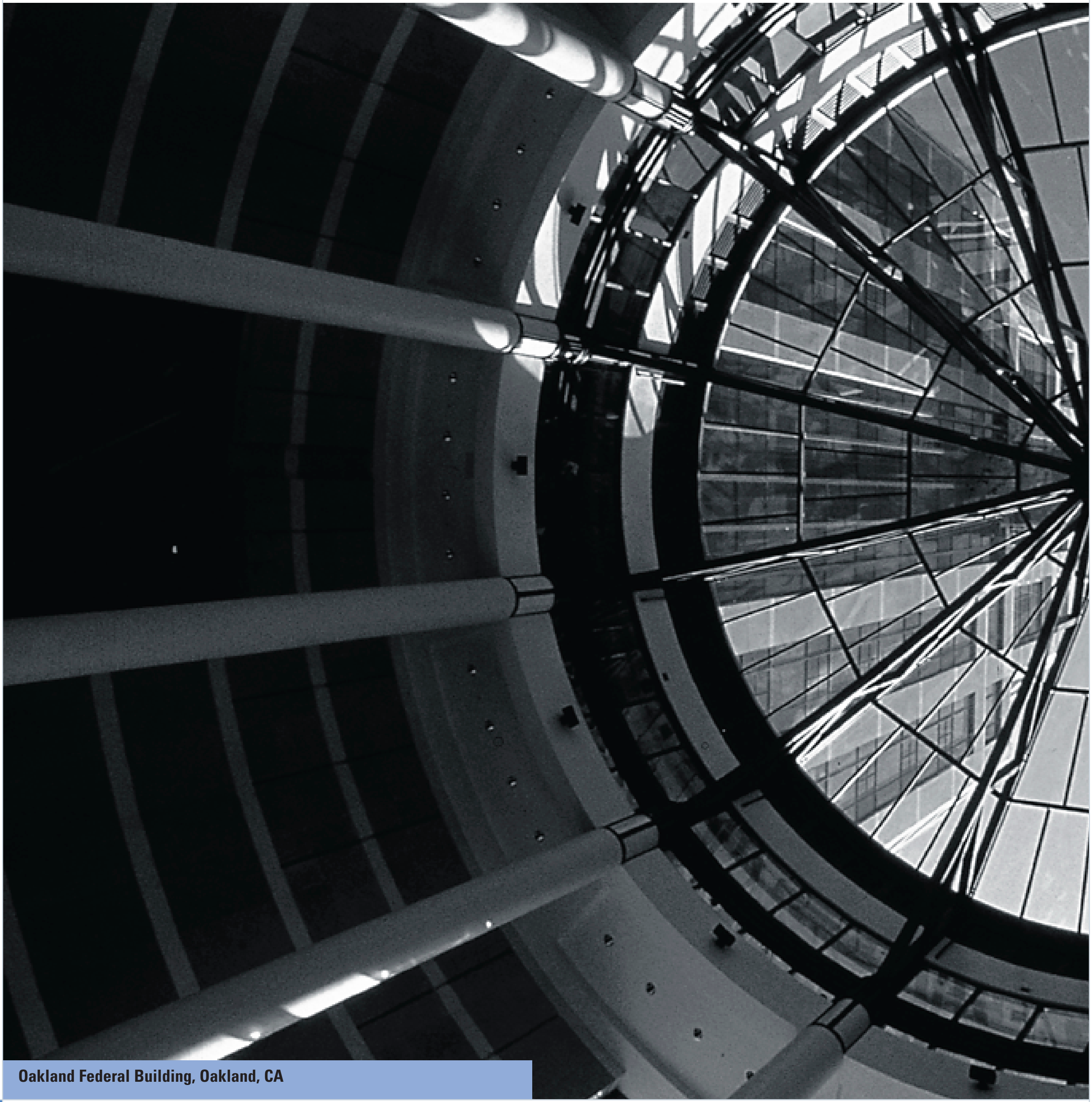
Aluminum frames must have thermal barriers where there are more than 1670 heating degree days °C (3,000 heating degree days °F). Window mullions, as much as possible, should be located on the floor planning grid to permit the abutment of interior partitions.

Glazing. The choice of single, double or triple glazed windows should be based on climate and energy conservation and security requirements. Use thermally broken frames when double and triple glazing units are specified. Highly reflective glass that produces mirror images should be used with care to avoid creating glare in surrounding streets and buildings.

Condensation Resistance. Windows should have a condensation resistance factor (CRF) adequate to prevent condensation from forming on the interior surfaces of the windows. The CRF can be determined by testing in accordance with AAMA 1502.7, *Voluntary Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Sections.* Where a CRF in excess of 60 is required, do not use windows unless some condensation can be tolerated or other methods are used to prevent or remove condensation.

Window cleaning. The design of the building must include provisions for cleaning the interior and exterior surfaces of all windows. Window washing systems used in the region must be considered and a preferred system and equipment identified during design. In large and/or high-rise buildings, such glass surfaces as atrium walls and skylight, sloped glazing, pavilion structures, and windows at intermediate design surfaces must be addressed. See also the *Building Specialties, Window Washing Equipment* section of this chapter.

Robert C. Byrd Courthouse, Charleston, WV



Oakland Federal Building, Oakland, CA

Exterior Doors. Entrance doors may be aluminum and/or glass of heavy duty construction. Glazed exterior doors and frames shall be steel and meet the requirements of SDI Grade III with a G-90 galvanic zinc coating. Vestibules are desired to control air infiltration. Sliding automatic doors are preferred over swinging type. Motion detectors and push plates are preferred over mats as actuating devices.

Overhead coiling doors are preferred for loading docks. At least one personnel door should be provided in addition to the overhead doors.

Hardware for Exterior Doors. Hinges, hingepins and hasps must be secured against unauthorized removal by using spot welds or peened mounting bolts. All exterior doors must have automatic closers. The exterior side of the door shall have a lock guard or astragal to prevent jimmying of the latch hardware. Doors used for egress only should not have any operable exterior hardware. See Chapters 7 and 8 for additional information.

All public entrances provided in accordance with Paragraph F206.4.1 (Public Entrances) of the ABAAS shall have at least one entrance door complying with Section 404.3 (Automatic and Power-Assisted Doors and Gates) of the ABAAS. Where a public entrance has a vestibule with exterior and interior entrance doors, at least one exterior door and at least one interior door shall comply with Section 404.3.

Roofing. Roofing design shall follow the recommendations of the National Roofing Contractors Association as contained in NRCA publication, *NRCA Roofing and Waterproofing Manual.* The design of metal flashing, trim, and roofing shall follow the recommendations of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) publication, *Architectural Sheet Metal Manual.*

Roof Drainage. Dead level roofs are not permitted. Roof drains or scuppers are the only low points permitted. Provide a minimum slope to drains of 1:50 on roofing surfaces. When providing roof slope, consider sloping the structural roof deck. Over the life of the building this may be less expensive than providing tappered insulation each time the roof is replaced. Roofs shall not be used to retain water.

Insulation. Roof insulation should be installed in a minimum of two layers to minimize thermal breaks in the roof system.

Access to Roof. An interior permanent stair should be provided to permit access to roof-mounted equipment. Permanent access to all roof levels should be provided to facilitate reoccurring inspection and maintenance.

Roof-Mounted Equipment. Roof-mounted equipment shall be kept to a minimum and must be housed in penthouses or screened by walls. Penthouses and screen walls should be integrated into the building design and constructed of materials used elsewhere in the building exterior. Some roof-mounted equipment, such as antennae, lightning rods, flagpoles, etc., do not have to be screened, but these elements must be integrated into the building design. Roof-mounted equipment should be elevated as recommended in the *NRCA Roofing and Waterproofing Manual* and set back from the roof edge to minimize visibility. Critical roof-mounted equipment should be installed in such a way to permit roof system replacement or maintenance without disruption of equipment performance.

Penetrations through the roof to support equipment are extremely vulnerable to leaks. Flashing details must be studied for appropriate continuation of the waterproof barrier. Pitch pocket details should not be used.

No building element may be supported by the roofing system except walkways. Provide walkways on the roof along routes to and around equipment for maintenance.

Skylights and Sloped Glazing. Skylights are defined as pre-fabricated assemblies shipped ready for installation, while sloped glazing is defined as field-assembled. Skylights design shall follow the guidelines of the AAMA Standard 1600. For the design of sloped glazing, two AAMA publications are available: *Glass Design for Sloped Glazing and Structural Design Guidelines for Aluminum Framed Skylights.*

Skylights and sloped glazing should use low emissivity glass. Placement should be calculated to prevent glare or overheating in the building interior. Condensation gutters and a path for the condensation away from the framing should be designed.

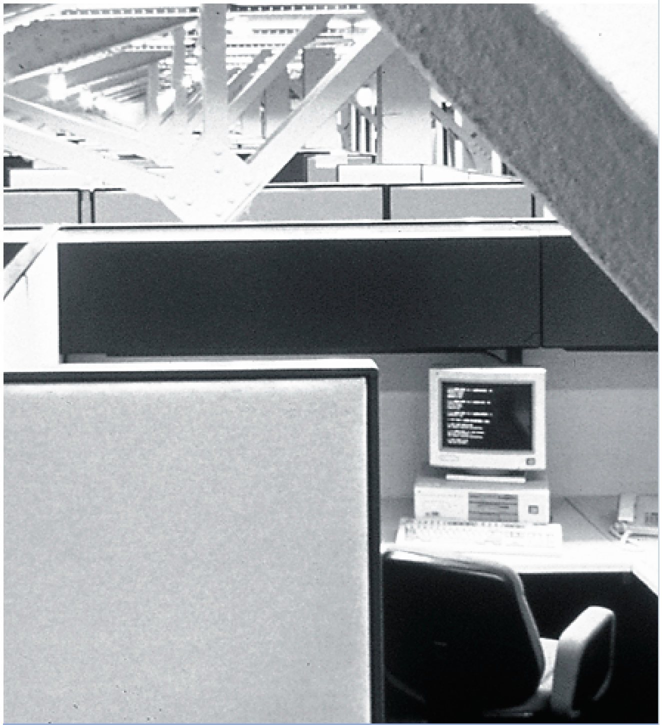
Consideration shall be given to cleaning of all sloped glazing and skylights, including access and equipment required for both exterior and interior faces. See also *Building Elements, Cladding and Articulation* and *The Buildings Specialties, Window Washing Equipment* sections of this chapter.

Thermographic Testing. In order to verify performance related to the design intent of the exterior building envelope, regarding thermal resistivity, thermographic testing shall be performed at various conditions on the finished construction and before occupancy. This testing will verify that the actual construction meets the requirements as specified.

Cornerstone

A cornerstone is required for all new buildings as a part of the exterior wall. The cornerstone should be a cut stone block having a smooth face of size adequate to present the following incised letters: UNITED STATES OF AMERICA, (PRESIDENT'S NAME), PRESIDENT, GENERAL SERVICES ADMINISTRATION, (ADMINISTRATOR'S NAME), ADMINISTRATOR, (YEAR OF PROJECT COMPLETION). The words, UNITED STATES OF AMERICA, should be in letters 50 mm (2 inches) high and other letters should be proportionally sized by rank.

All names should be of those individuals in office at the time construction funds were appropriated, if construction is completed during a subsequent President's term of office.



Postal Square, AOC Workstation

Interior Construction

Partitions. Partitions should be selected for use based on the type of space and the anticipated activity within that space. For subdividing within tenant areas, preference should be given to the use of pre-finished, demountable partitions that can be easily relocated with a minimum of time and waste. The following should be evaluated: the volume of people; their activities; the type, size, weight and function of equipment (mail carts, forklifts, etc.) that will be used in the space; and any free-standing, moveable or wall-mounted equipment that will impose lateral loads (built-ins, wall-mounted televisions, etc.).

Each potential wall system must be evaluated for structure, backing, finish and protection factors. GSA prefers partition systems that are simple to construct, made from readily available materials, economical and easily moved and reassembled by common laborers.

Metal stud systems must meet the requirements ASTM C754. The application and finishing of gypsum board should follow standard ASTM C840. Adequate tolerances should be designed where the top of a partition abuts the underside of the building structure; allow for deflection and long term creep.

Partitions used at the perimeter of a humidified space must include a vapor barrier. In computer rooms the need for air plenum dividers below the floors must be checked.

Interior Finishes. Refer to the section on *Interior Finishes* in this chapter.

Interior Doors. Interior doors in tenant spaces should be flush, solid-core wood doors. Steel door frames should meet the requirements of SDI *Recommended Erection Instructions for Steel Frames.* Provide matching-edge veneers for transparent-finished wood doors. Avoid the use of wood door frames except to match wood doors in specially designed areas.

Ceiling Suspension Systems. The design of suspension systems for acoustical ceilings must meet the requirements of ASTM C.635 for heavy-duty systems and ASTM C.636. When designing a suspended ceiling system with drop-in components, such as lighting fixtures, specifications may not be incorporated that can only be satisfied by hard metric versions of recessed lighting fixtures unless market research of cost and availability has been done as outlined in Chapter One; *General Requirements, Metric Standards, Metric Policy Guidelines.*

Building Specialties

Window Washing Equipment. Generally, window washing and exterior maintenance are performed by maintenance contracting firms that provide their own powered platforms, scaffolding, or chair lifts to perform these functions. To accommodate the use of maintenance equipment, suitable engineered systems shall be designed and incorporated into the building design. The design will be for buildings three stories or 12,200 mm (40 feet) and higher, and shall conform to OSHA Standard 29 CFR 1910.66, Subpart F - *Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms,* ANSI Standard A120.1, *Safety Requirements for Powered Platforms for Building Maintenance,* and ANSI Standard A39.1, *Safety Requirements for Window Cleaning.*

Waste Removal Equipment. Waste is normally removed from GSA buildings by contract maintenance firms. The firm will usually collect the waste from receptacles in the occupied spaces into carts, which will be taken to larger containers at the waste pick-up station. The firm will usually provide the containers as part of its contract.

The minimum architectural requirements for waste removal are: access for waste handling equipment from the occupied areas of the building to the pick-up station; housing for the on-site containers; and maneuvering space for the collection vehicles. In calculating numbers of containers, assume separate containers for recyclable materials (paper, glass and metals). Waste handling stations must be completely screened by walls and doors or gates constructed of materials complementary to that of the building.

Certain buildings may require additional waste handling equipment such as incinerators or compactors. All incinerator designs must be approved by the Environmental Protection Agency. GSA will coordinate this review.

Flagpoles. See Chapter 2: *Site Planning and Landscape Design, Landscape Design, Landscape Elements.*

Telephone Enclosures. Enclosures for public telephones should be provided in the main lobby, near the cafeteria, near the auditorium and in other building areas serving the public. Accessible public phones must be provided; they must comply with the UFAS/ADA *Accessibility Guidelines* for number, location type and design.

Shelves shall be provided at phone locations, and shall be designed and constructed to accommodate the weight of persons sitting or leaning on them. Assume a 113 kg (250 pound) load per 300 mm (1 foot) of shelf length. In historic buildings where original telephone enclosures exist, reuse original enclosures to the extent possible and design alterations to be visually compatible with original finishes.

Drinking Fountains. At least one water fountain should be provided on every floor near toilet rooms and near auditoria. One drinking fountain per location, and 50 percent of all fountains in the facility, shall be accessible to disabled persons per ADAAG Guidelines. Retain original fountains in historic buildings, retrofitting hardware and remounting, when possible, to provide access for the disabled. Where modifying historic fountains is not practical (e.g., fountain mounted in stone or other ornamental wall), supplement with new fountains of similar materials and detailing to original fountains.

Window Coverings. All GSA buildings should be equipped with adjustable window coverings. Describe the controls for coverings on clerestory and atria windows, and how they will be serviced for cleaning, maintenance, repair and replacement. In some instances it may be possible to consider automated blinds that respond to sun angle and internal temperatures. This may be particularly beneficial in the southern and southwestern areas of the country.

Artwork, Signage, and Registry of Designers

Artwork. The process of commissioning art for Federal buildings and courthouses is a collaboration between GSA, the architect of the building, art professionals and community advisors. The Art-in-Architecture Program strives for a holistic integration of art and architecture. Through collaboration – from the initial concept through construction – the artist, architect, landscape architect, engineer, lighting specialist, and practitioners of other disciplines can work as a team to create new expressions of the relationships between contemporary art and Federal architecture. The focus on integrating art with the design of new Federal buildings and courthouses is predicated upon substantial involvement and responsibility of the A/E team. Provisions for cleaning, maintenance and security of the artwork should be coordinated with the Facility Manager.

Ronald Reagan Federal Courthouse, Santa Ana, CA

The Art-in-Architecture project shall begin concurrently with the selection of the A/E and be timed so that the artist(s) have sufficient time to collaborate with the A/E firm on design concepts and that the artist be prepared to discuss their art concept at the Concept Presentation.

Please consult the *Art-in-Architecture Program Guidelines* for additional information.

Fine Arts Program Mission. To manage the portfolio of fine arts assets under GSA's stewardship to insure their accountability, accessibility, preservation and appropriate use to enhance and promote superior workplaces for federal agencies and the public they serve.

Scope of Collection Statement. The Fine Arts Collection includes commissioned public works of art that enhance the architecture of federal buildings; portable works of art commissioned under the federal patronage of the New Deal; works of art purchased with Art in Architecture (AiA) funds; and maquettes. The collection includes over 17,000 installed or associated paintings, sculpture, architectural or environmental works of art, and graphics dating from the 1850's. The collection does not include:

- decorative arts, such as furniture and light fixtures (unless commissioned through the AiA program)
- architectural ornamentation or details, such as historic mosaic flooring, stenciled borders, ceiling medallions, coffered ceilings, cast eagles, and ornamental molding (unless commissioned through the AiA program)
- commemorative works of art, such as busts and portraits
- artwork purchased for office space, such as reproduction prints and posters

Please consult the *Fine Arts Program Desk Guide* for additional information.

Graphics and Signage. Graphics and signs must be clear and simple, and shall be standardized to ensure easy identification of the building entrance, parking, and all the tenant agencies and services located in the building. Signs combining pictograms and printed messages are recommended for a more universal understanding. Sign design shall comply with all the UFAS/ADA Guidelines; Underwriters Laboratory (UL)— Illuminated Signs Standard; Occupational Safety and Health Administration (OSHA) Standards for safety signs; and Federal Standard 795 for accessibility.

Signage in historic buildings should be compatible with original designs, using historic finishes, colors, and typefaces. Typefaces must be acceptable within ADA requirements where adequate contrast, scale, and other design factors ensure signage legibility.

Signage must be designed to be adjustable for tenant moves and changes. These techniques should be specified to ensure easy maintenance and compatible expansion.

Integrating electronic monitors and other available new technology is an important design consideration. Employing electronic means to display building amenities, missing persons, federal job postings, building-related messages and other public notices makes updating easier and reduces clutter. While using new technology is useful and conveys progress, it is important that these installations be successfully integrated into the building's architecture, most particularly in historic buildings.

See sections 2.14 *Site Signage* and 9.3 *Signage and Graphics* for additional requirements.

Additional information about GSA graphic standards can be found at **www.gsa.gov/logo**.

Emergency Evacuation Route Signage

- Emergency evacuation route signage shall be posted in a tamper resistant frame or engraved on a placard that is mounted on the walls in each passenger elevator lobby, freight elevator lobby, and any mechanical spaces that may be occupied by contractors or other personnel not familiar with floor layouts and exit locations. The minimum size of the signage shall be 8 1/2 inches by 11 inches. This signage shall be depicted in either landscape or portrait form depending on the architectural layout and orientation of the elevator lobbies at each floor. {Also provide labeling as required in PBS ORDER 3490.1, Paragraph 7.d.(1), dated March 8, 2002.}
- The signage shall consist of a CADD generated floor plan for each floor with the evacuation routes identified (show routes to two different exits with directional arrows). Provide a "YOU ARE HERE" designation pointing directly to the signs final installed orientation. Also provide a main heading titled "EVACUATION PLAN". This signage may contain a zoomed in core area of the building (for a larger view of routes) if all evacuation routes and evacuation stairways are legibly shown. The signage shall contain a LEGEND for clarification purposes of any additional items shown on these evacuation plans. Also, include the following statement on plans "IN CASE OF FIRE DO NOT USE ELEVATORS - USE STAIRS".

Registry of Builders and Designers. A plaque shall be placed inside the building with the names of the individuals on the GSA project design team; the consultant architects and engineers; the onsite construction managers; and the construction workers will be inscribed on the plaque. The GSA Project Manager will provide the specifications for the design and construction of the plaque.

3.6 Interior Finishes

Recommended Minimum Standards for Finishes in Tenant Spaces. GSA has set minimum standards for the quality of finishes. GSA provides a tenant improvement allowance for finishes and features within its rental charge. Within this allowance, the choices for interior finishes are the responsibility of the tenant. GSA recommends the following as minimum standards. Where tenants choose finishes below these minimum standards, the tenant is responsible for above standard maintenance costs. Codes may have a bearing on the type of finishes in an area and shall be consulted. For fire safety requirements, see Chapter 7, *Fire Protection & Life Safety, Interior Finishes.* An example is the need to provide carpet tile rather than continuous carpet over access flooring. Architects shall specify, where practicable, finishes that contain recycled, renewable, and/or reusable materials and that eliminate or minimize the release of harmful substances during installation and use. Finishes shall be specified based on the value they provide over their useful life; considerations include maintenance and disposal costs in addition to first costs.

Carpets. Carpets should be used in all areas where acoustics are a concern, most notably in office working areas. Carpet tile should be used whenever there is access flooring, a cellular floor, or a ducted floor system, so that maintenance of systems under the floor can be done without destroying the carpet. Carpet tile is available in hard back or cushion back, which maintains its overall appearance longer and is more comfortable to stand and walk on than hard back.

Six-foot-wide (1800mm) cushion back broadloom carpet can be used in many installations. Twelve-foot-wide (3700mm) broadloom carpet without a cushion back or separate pad is appropriate for use in low traffic areas. In high traffic areas, a cushion back or carpet pad should be specified.

Off-gassing of harmful chemicals from carpet installations into the interior is a serious health concern. To minimize off-gassing that adversely affects indoor air quality, all carpet materials, including carpet fibers, backing, cushion, and adhesives, shall meet or exceed the Carpet and Rug Institute's "Green Label" criteria and contain recycled, renewable, and/or reusable materials as much as practicable. Preferred materials for carpet backing and cushioning are those containing natural fibers, polyolefin, polyvinyl butryal (PVB), polypropylene, polyurethane, or urethane.

Carpets that use recovered materials shall be specified (see section 3.2, *Special Design Considerations)* and care should be taken to specify carpet that can be recycled in the future. However, when specifying a carpet that complies with RCRA Section 6002 and Executive Order 13101, care must be taken to verify it also meets all the criteria for its intended use and level of foot traffic.

The amount of foot traffic and soiling should be considered when selecting carpet. The CRI has developed test criteria for rating carpet in each of three classifications: severe traffic, heavy traffic, and moderate traffic. A selection of carpet for a lower foot traffic level than anticipated is discouraged.

Severe traffic level – Extreme foot traffic and soiling. Examples are corridors, entrance areas, lobbies, office circulation, food service areas, etc.

Heavy traffic level – Heavy to medium heavy foot traffic and soiling. Examples are private offices, living quarters, open plan office cubicles and workstations.

Moderate traffic level – Moderate foot traffic. Examples are sleeping areas, conference rooms and consultation areas. Commercial grade carpet should be specified for these areas.

A complete list of usage areas and their minimum use classification is available from the Carpet and Rug Institute, PO Box 2048, Dalton, GA 30722

Carpet pattern can mask or camouflage traffic patterns, spots, and soil, so that its appearance will be maintained for a longer period of time. Pattern performance is:

Random pattern design = excellent

Geometric Pattern = good

Tweed = marginal

Solid Color = Poor

Stains will be the most noticeable when using colors that contrast with soil, dust and spills. Therefore, light and dark colors at the extreme ends of the color spectrum do not perform as well as colors that are in the medium range.

Cushioning carpet adds a shock absorber to the carpet and reduces the crushing of the yarn. This prevents a loss of appearance from creating contrast in the traffic areas, thereby allowing the carpet to provide longer service. It also provides ergonomic benefits by absorbing impact resulting in less stress on the lower legs and feet of the occupants.

Since 80 percent of the soil in the building comes in the entrance areas of the building, it is important to catch the soil at the entry. There are different systems available, including special carpet tiles and entry mats available on GSA Federal Supply Contracts.

Wall Covering. Use wall coverings that will maintain acceptable appearance in the location used for a minimum of 10 years. Preferred wall coverings include those that use natural fibers, polyester, polyethylene, and low-VOC spray-applied polychromatic finishes.

Martin Luther King Courthouse, Newark, NJ

Architectural Woodwork. Work under this section should be certified as meeting the referenced standard under the terms and conditions of the AWI Quality Certification Program.

Resilient Flooring. Resilient flooring materials should be selected based on durability, ease of maintenance, and the effects of their materials, installation and maintenance on indoor environmental quality. Surfaces that require extensive use of volatile cleaning and waxing compounds should be avoided. Suitable resilient flooring materials include, but are not limited to, linoleum, cork, rubber, or polyolefin.

Base. Where specified, floor perimeters shall use a wall base made of materials that provide long-term durability for the use intended. Preferred base materials include wood, rubber, ceramic tile, marble, and terrazzo.

U.S. Courthouse, White Plains, NY

General Office Space (Open and Enclosed Offices)

This category of space comprises a large proportion of area in Federal buildings. Materials, surfaces, and systems must be chosen with quality and flexibility as primary concerns. Office spaces characteristically change with their occupants, occupancy configurations and utility requirements. Interior finishes should allow these transformations to occur with minimal disturbance and cost.

Resilient flooring should only be used in offices adjacent to utilitarian spaces such as loading docks.

Carpet for Raised Access Floor. Carpet tiles should be used on raised access floor. Both carpet adhered to floor panels and loose-laid carpet tile are permitted.

Ceilings. The majority of the ceiling system for general office space shall be suspended acoustical materials to allow for accessibility. Grid size and spacing should be based on the building-planning module. Limited use of drywall soffits shall be used to delineate space and provide relief from open expanses of acoustical tile materials. Drywall ceilings shall be located where is maintenance access is not required.

Doors. The finish for solid core wood doors in general office spaces should be limited to a paint grade finish or wood veneer. Glass doors may be used at entrances to tenant suites.

Training and Conference Rooms

These areas should be finished at levels of quality equivalent to but differentiated from the adjacent office areas. The material choices and spatial configurations need to be appropriate for the use of the space. In addition, the application of tackable acoustic wall panels, whiteboard wallcoverings and rails for the display of presentation materials within these spaces is appropriate. Coordinate all lighting, audiovisual, communication and technology requirements with the building systems.

Internal Corridors

Corridors within general office areas should receive the same finishes as the office areas themselves. Color and material changes compatible with the overall palette may be useful in these areas for orientation.

Entrances and Vestibules

Entrance lobbies and atria are the focal point of the Federal building. They are the landmark to which all other spaces in the facility relate. They should be an extension of the exterior of the building and the point of transition to interior spaces. These spaces have high levels of visibility and public use and warrant the highest degree of visual detail and finish.

It is desirable to integrate the exterior and interior building design in these areas. Materials shall relate and be of high quality. Choose durable, moisture-resistant materials since these areas are typically exposed to weather. The depth of vestibules should be no less than 2100 mm (7 feet) to minimize air infiltration.

Floors. All entrance areas require a means to prevent dirt and moisture from accumulating on the entrance lobby floor. It is desirable to have permanent entry way systems (grilles, grates, etc.) to catch dirt and particulates from entering the building at high volume entry ways. Buildings located in areas with severe weather conditions will require more elaborate entry mat and drainage systems to prevent the tracking of melting snow and rain. Buildings located in more moderate climates may require only a natural or synthetic fiber floor mat. The entrance vestibule may also have a hard surface flooring surrounding the matted area that would be part of the adjoining main entrance area.

Doors. Doors at building entrances and vestibules should be glazed to facilitate orientation and safe movement in these high traffic areas.

Elevator and Escalator Lobbies

These elements are functionally related to the public entrance and lobby areas and, therefore, should be treated with the same level of finish and compatible materials as those spaces. It is appropriate to introduce special floor, wall and ceiling treatments, and distinctive lighting that should be repeated on the upper floors for continuity.

Floors. Elevator and escalator lobbies should harmonize with the finishes used in the entrance lobby or atrium. Because of their importance in orientation and movement, floor treatments in these areas should be similar throughout the building.

Walls. Use durable, high quality surfaces, and coordinate wall finishes with elevator door and frame finishes.

Ceilings. Special treatments are appropriate to visually distinguish elevator lobbies. Provide either high-end accessible ceiling systems or integral access panels to ease access to elements above the ceiling.

Elevators

Passenger elevators usually receive the highest amount of traffic in the facility. Their finishes should relate to the entrance and lobby areas and should be focal points for the interior design of the building. Although finishes need to be durable, high quality architectural design of cabs and entrances is a priority.

Floors. Elevator floors receive a great amount of wear in a very concentrated area. The flooring surface shall be either extremely durable or easily replaceable. Hard surface floors, such as stone, brick or tile, are usually poor choices because cab floors tend to be unstable. Over time, grouted materials often loosen or crack. Carpet, wood or high quality resilient materials are better choices and perform well acoustically. Carpet materials should be selected for low pile height and high density.

Walls. Wall materials shall present a high quality image and should be sufficiently durable to take some abuse. Materials shall be installed on removable panels or other replaceable devices to facilitate maintenance and renewal of finishes.

Ceilings. Ceilings shall be replaceable. In passenger elevators recessed downlights or indirect fixtures should be used.

Doors. Surfaces should be scratch resistant and easily replaced or refinished. Inside and outside finishes should be coordinated with adjacent wall surfaces.

Freight Elevators. Finishes for freight elevators shall be very durable and easy to clean. Stainless steel walls and doors are preferred. Flooring shall be sheet vinyl or resilient vinyl tile. Ceiling light fixtures must be recessed and protected from possible damage.

National Archives, College Park, MD

Stairways (closed)

General Requirements. Where internal stairways are used for both general vertical circulation and emergency egress, finishes should be consistent with the floors being served by the stair. In stairways used for utility purposes or only for emergency egress, unfinished or minimally finished surfaces are appropriate.

Floors. In general circulation stairs, flooring for stairways, treads, and landings should provide acoustic control. Resilient materials are most appropriate and shall be combined with a non-slip nosing on the treads; these must be non-combustible. These surfaces should be coordinated with materials of the floors, which the stair serves. Utility and egress-only stairs should be of unfinished, sealed concrete or steel. Always provide non-slip nosings.

Walls. Wall surfaces in these areas should be drywall substrate with a simple, straightforward finish such as paint or wall covering. In utility and egress stairs, provide a painted or unfinished surface.

Ceilings. Absorptive materials are desirable in stairways for their acoustic effect. Stair runs should have painted gypsum board soffits where appropriate.

Doors. Doors between adjacent building areas and stairways should match other doors in the building areas. The doors should have the same finish on the interior and the exterior. Utility and egress stair doors should be painted metal.

Stairways (open)

Open stairways that connect lobby and atrium spaces should be appropriately finished in materials that match or relate to the adjacent surfaces in quality and appearance.

Floors. Floor finishes for open stairs should match or coordinate with the adjoining lobby and atrium spaces served by these stairs.

Public Corridors

Floors. Public corridors adjacent to building entrances, atria, etc., which carry significant foot traffic and provide major circulation pathways throughout the building shall have materials selected that shall be extremely durable and require low maintenance. To improve acoustic control in corridors adjacent to work spaces, hard, reflective surfaces should be avoided.

Walls. Walls in public corridors should receive a wall covering over a drywall substrate.

Ceilings. Accessible acoustical ceilings should be selected for corridors. Use a high quality system in public areas. Avoid inaccessible (sealed) ceiling systems. Submit alternative proposals to design team.

Doors. Doors along public corridors should be of a quality equivalent to that of other elements in these spaces and higher quality than those in the interior spaces. Finish may be wood veneer. The finish on both sides of the door should match. At interior spaces with high levels of public use provide glazed entry door systems along public corridors.

3.7 Building Support Spaces

General Use Toilets

Toilets are part of the permanent building core and should be designed with good quality, long-lived finishes. They are an extension of the public spaces of the building. The most appropriate finish for floors and walls in toilet rooms is ceramic or porcelain tile. In light-use areas, less costly moisture-resistant materials may be substituted. In all cases, carefully chosen patterns and colors will enhance the design image.

Continuous vanities of stone, artificial stone, or solid surface material shall be designed for lavatories. Sinks shall be under mounted. A large, continuous mirror should be provided on at least one wall of each toilet room. See section 3.2, *Space Planning Requirements.*

Equipment Spaces and Maintenance Shops

Walls and ceilings of all equipment and maintenance shops should be gypsum board, concrete masonry surfaces or other durable surfaces; exposed batt or other forms of insulation should not be used at wall surfaces. Walls in these areas should be painted.

Floors in mechanical rooms and maintenance shops should be waterproofed. Floors in electrical and communications rooms should be painted or sealed. Communications equipment rooms may also have resilient flooring.

Rooms containing major electrical or environmental equipment must be designed to provide clearance for service including replacement of components or the entire piece of equipment.

Staff Locker Rooms and Custodial Spaces

Storage rooms should receive minimal finishes. As in other support areas, these finishes should be coordinated with adjacent spaces. Janitors' closets should be similarly finished, except those containing sinks, which should be provided with a ceramic tile floor and base. Staff locker rooms should be provided with resilient flooring and vinyl wallcovering (or equivalent), except in "wet" areas, which should be finished similar to general use toilets (ceramic tile floor and walls).

Building Engineer's Office and Security Control Center

If theses spaces are included in the building program space requirements, they should be finished like an office. Flooring in the building engineer's office should be vinyl tile if it is located near the central plant or other utilitarian support spaces.

Food Service Areas

Cafeteria Kitchens and Serveries. These areas are operated under concession agreements. Finishes are governed by health regulations and the requirements of the concessionaire. Designers should coordinate their work with the GSA handbook *Concession Management Desk Guide PMFC-93.*

Kitchens Other Than Cafeteria Kitchens. This section describes smaller kitchens typically used by employees. Flooring in these kitchens should be resilient. Walls should have durable, washable finishes such as vinyl wall-covering or ceramic tile, depending on intensity of use. Ceilings should be acoustic material with consideration given to the use of moisture resistant ceiling materials in kitchens with higher humidity.

Other Specialty Areas

Court buildings, border stations, and child care centers have special requirements for finishes. See the *U.S. Courts Design Guide* and Chapter 9: *Design Standards for U.S. Court Facilities* for Court spaces. See the *U.S. Border Station Design Guide* (PBS-P130), and *GSA Child Care Center Design Guide* (PBS-P140) for finishes for these facilities.

Historic stair, Ariel Rios, Washington, D.C.

3.8 Alterations in Existing Buildings and Historic Structures

The general goal of alteration projects is to meet these facilities standards for new projects. Renovation designs must satisfy the immediate occupancy needs and anticipate additional future changes. As they are remodeled, building systems should become more flexible and adaptable to changing occupancy needs.

Alteration projects are defined at three basic scales: refurbishment of an area within a building, such as a floor or a suite; major renovation of an entire structure; and upgrade/restoration of historic structures.

In the first instance, the aim should be to satisfy the program requirements within the parameters and constraints of the existing systems. The smaller the area in comparison to the overall building, the fewer changes to existing systems should be attempted. Components, equipment and construction should match the existing as much as possible to facilitate building maintenance.

In the second case, the opportunity exists to approximate the standards and flexibility of a new building, within the limits of the existing space and structural capacity.

Where a historic structure is to be altered, special documents will be provided by GSA to help guide the design of the alterations. The most important of these is the Building Preservation Plan (BPP) which identifies zones of architectural importance, specific character-defining elements that should be preserved, and standards to be employed. Refer to pages 1-14 for The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Historic Preservation. For some buildings a Historic

Structures Report is also available. Early and frequent coordination between the architect, State Historic Preservation Officer, Regional Historic Preservation Officer, preservation specialists, external review groups, and other appropriate GSA specialists is imperative to timely resolution of conflicts between renovation and preservation goals.

To the extent feasible, GSA seeks to achieve the *rehabilitation* of historic structures. Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

In general, alterations in historically significant spaces should be designed contextually to blend with original materials, finishes, and detailing, and to ensure a uniform and inviting first impression. When substantial repairs or alterations are undertaken in significant and highly visible locations, opportunities should be sought to restore original features that have been removed or insensitively altered, to reestablish the original design integrity of the space. Alterations affecting the configuration of significant spaces should be as transparent as possible, using glass and contemporary materials, as appropriate, to minimize the visibility of the alteration(s) while subtly distinguishing new construction from original construction.

The architectural, mechanical and electrical systems in historic buildings often differ greatly from today's design and construction standards, and frequently many of these building systems need to be upgraded substantially or completely rebuilt or replaced. The end result should be a building whose architectural, mechanical and electrical systems support its modern use while retaining its historic and architectural character.

Understanding the exact requirements of the user is essential to effectively implement the program for remodel projects. Close interaction between designers and users, to communicate and incorporate program information *during the concept design phase,* will enable the designers to meet the users' needs without incurring excessive construction cost. Practical solutions often develop in a dialogue with the users that would not have been relayed by an administrator.

Alteration design requires ingenuity and imagination. It is inherently unsuited to rigid sets of rules. Each case is unique. The paragraphs that follow should be viewed as guidelines and helpful hints to be used when appropriate and disregarded when not.

Evaluation of Existing Systems

Every alteration project includes an evaluation which describes the physical condition of building systems, identifies variances from present codes, and notes available capacity for structural, mechanical, electrical and communications systems.

Code Requirements for Alterations

For most major renovations an evaluation of code deficiencies is appropriate. See Chapter 1.3: *National Codes and Standards, Code Requirements for Alterations.* Code deficiencies that related to life safety, particularly egress, should be remedied. Strict adherence to the letter of the code is often impossible. An equivalent method of protection will have to be developed to achieve an equal or greater level of safety. See Chapter 1.1, *Purpose of Facilities Standards for the Public Buildings Service.* Architects will be expected to work closely with the GSA regional fire protection engineer who will have final authority on life safety code compliance issues. Alternative approaches outlined in state historic building codes, rehabilitation codes, and performance based codes to resolve conflicts between prescriptive code requirements and preservation goals should be explored.

New work in alterations generally should meet current codes, unless a special hazard is created by combining new and old systems. Such conflicts should be resolved with GSA.

See Chapter 7: *Fire Protection & Life Safety,* for additional information.

Placing Mechanical and Electrical Systems in Renovated and Rehabilitated Buildings

Finding space for air conditioning, power and communications cabling is one of the biggest design challenges in remodeling work. Existing systems are usually totally inadequate, shafts are too small and ceiling space is too shallow. See Chapter 5: *Mechanical Engineering, Major Alterations in Existing Buildings and Historic Structures* and Chapter 6: *Electrical Engineering, Major Alterations in Existing Buildings and Historic Structures.*

Vertical Distribution. Space for new shafts can sometimes be found in stairwells, if the stairs are larger than required by code. Any element incorporated must have the appropriate fire-resistive construction and not impose on the accessible pathway. If elevator systems need to be replaced, elevator shafts can become duct shafts or electrical closets. The building exterior also offers possibilities if new vertical elements can be integrated with the façade design.

Original elevator doors should be retained. Design for new hoistway and cab doors should be based upon original door detailing, matching original materials and adapting ornamentation as necessary to comply with code.

Original hardware should be maintained in place and upgraded to remain functional wherever possible. Lobby and corridor floor landing indicators should be scaled to avoid destruction of original ornamental finishes, such as borders in stonework designed to frame original indicators.

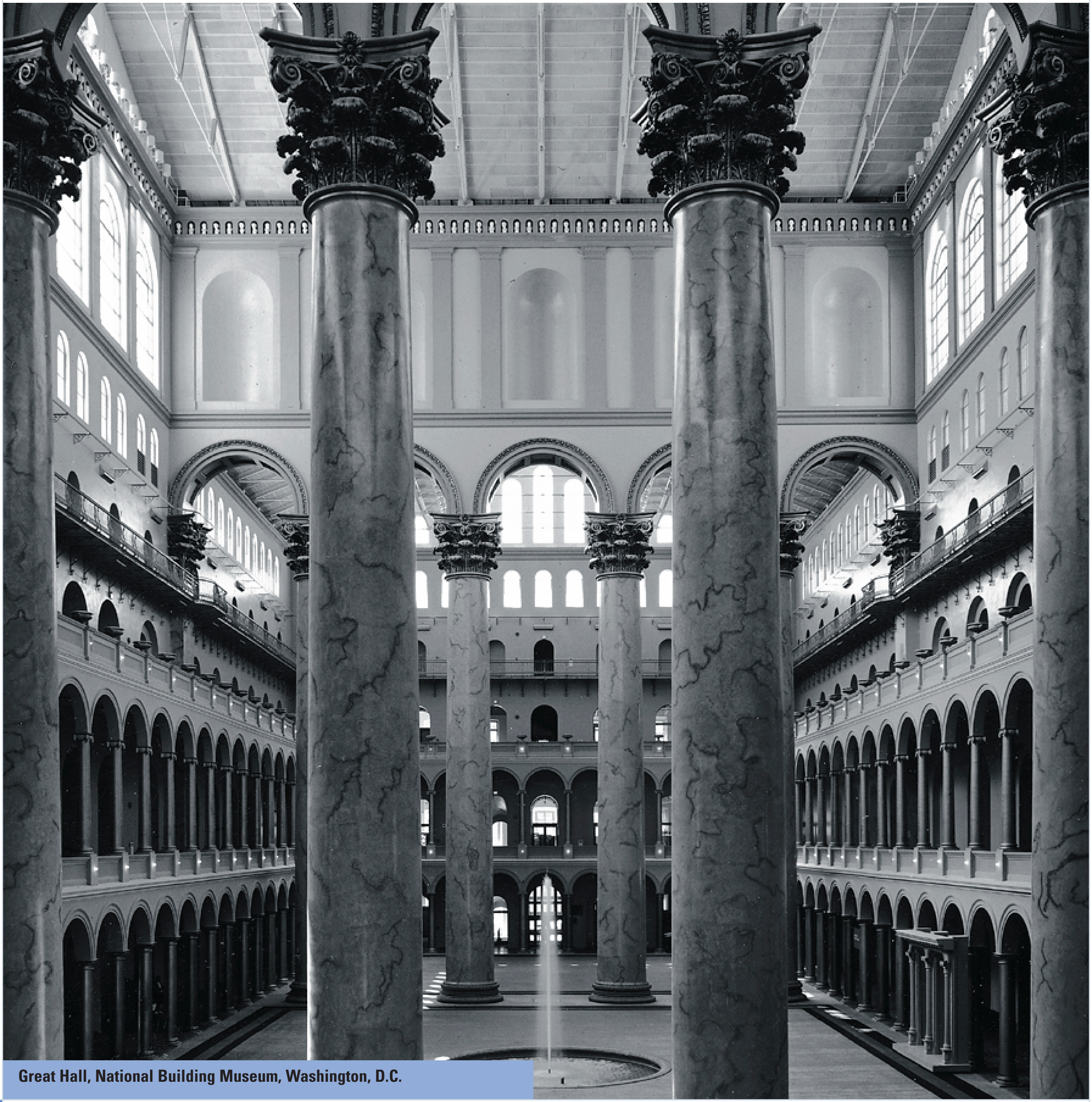
Horizontal Distribution.

Fortunately, many older buildings have tall floor to floor heights, which give the architect two options: a raised access floor or a very deep ceiling space.

If raised access flooring is to be considered, refer to *GSA RF/UFAD Guidelines.*

The other option is to create a deep ceiling space and zone it carefully for the most efficient fit of all engineering systems. Ceilings should never be dropped below the level of the window head. In historic buildings, care should be taken not to allow the installation of dropped ceilings to damage character-defining architectural details and, if possible, to maintain visual access to such details. Carefully designed exposed system installations are encouraged in workspace where exposing systems will a) enable original ornamental ceilings and finishes to remain exposed, b) maintain original high ceiling volume and daylight in new open space offices, or c) avoid disturbing hazardous materials such as asbestos. Exposed systems in historic spaces should be designed to minimize interference with historic details.

In narrow buildings, it may be possible to create a furred horizontal space adjacent to the exterior and core walls, which can be used as a raceway for utilities. Vertical furring on columns and walls for receptacles is another possibility and can be integrated as an architectural feature. If space is tight, all-water or water-and-air systems should be considered for air conditioning, instead of all-air systems.



Great Hall, National Building Museum, Washington, D.C.

Utility distribution in historic buildings is the most difficult because ceilings *and* floors often have to be preserved or restored. In these cases, decentralized air conditioning units with little or no ductwork become feasible. Pre-wired systems furniture, which is available in wood, is also a very good solution.

Placement of Main Mechanical and Electrical Equipment. If new equipment is to be placed on the roof, the structural capacity of the framing system must be investigated.

Elevators. For complete building renovations a transportation study should be done, as described earlier in this chapter. If elevators need to be replaced, service can often be improved significantly by selecting higher speed elevators to fit into the existing shafts. New shafts are expensive to build and should be avoided.

Space Planning Strategies

Office Space. It may be necessary to design a slightly larger space allocation - about 12 m^2 (135 square feet) per person - for office layouts in older buildings. This compensates for less than ideal bay sizes and existing walls configurations. The planning standards described earlier in the section *Space Planning*, should be used as much as possible.

Pre-wired systems furniture may be an appropriate solution for distribution of power and communications wiring in renovated buildings. Open plans have been used successfully in historic buildings. Furniture systems must be selected with great care to minimize any adverse impact on the historic features of the building. Modular furniture system dimensional planning restrictions, best adapted to large open office areas, may have limited feasibility in older structures with short or irregular structural spans.

Food Service. In many older Federal buildings, dining areas are located below grade in cramped, poorly ventilated, poorly lit, and publicly inaccessible spaces. Major renovations are a good opportunity to correct this situation.

Acoustics

Office Space. Where existing office space is altered to an open plan, noise isolation of the ceiling system should be a minimum of NIC 20. Noise isolation class between rooms should be NIC 40 in Class B spaces and NIC 35 in Class C space. See the section *Special Design Considerations, Acoustics, Design Criteria for Building Spaces* of this chapter.

Historic Buildings. Hard surfaces often predominate in old buildings and create resonance and echoes. While it may be possible to upgrade the acoustical environment, this should not be done at the expense of the historically significant features of the building.

Alteration of Building Elements

Exterior Closure. See Chapter 4: *Structural Engineering, Alterations in Existing Buildings*. Most older buildings lack adequate insulation and vapor barriers, but these can be added from the inside at the time of alteration. Design alterations to avoid damaging original finishes in preservation zones (as defined in the BPP or HSR).

Refer to *Building Elements* Section of this chapter for references regarding treatment of existing windows.

Exterior masonry should be cleaned if necessary and repointed. Joints should be resealed.

Re-roofing. Where existing roofing is to be replaced, it should be completely removed and the substrate prepared for new roofing. The new roofing system should not be of greater weight than the old, unless a structural analysis shows that the framing system can carry the additional weight. Do not overlay new roofing membrane systems over existing roof membranes. Installing new roofing systems over an existing roof will place additional load on the building structural system and may trap moisture remaining in the original roof. This trapped moisture can facilitate the premature deterioration of the building materials.

Uncommon Products Used In Rehabilitations

In historic preservation it may be necessary to specify uncommon materials that may be hard to find. These products may be described with the supplier's name and address in the specifications. If more than one supplier exists, multiple manufacturers must be stated. The specifications should also contain a note stating: "The use of a trade name in the specifications is to indicate a possible source of the product. The same type of product from other sources shall not be excluded provided it possesses like physical characteristics, color and texture."

New equipment should not be installed on existing materials that are very difficult to adapt for proper connections. These may include: structural glass, marble, and ceramic tile.

3.9 Life Cycle Cost Analysis

All life cycle cost analysis work focusing on particular items should consider the impact on other related systems. In other words, it should be a comprehensive effort balancing the impacts on all aspects of the building design.

Methods for performing life cycle cost analysis are discussed in Chapter 1: *General Requirements, Life Cycle Costing.* This section describes: which architectural and interior systems require life cycle cost analysis: the method to be used for analysis: the number of alternatives to be considered: and the factors to be considered. These requirements vary according to the size and type of building. For individual projects, the Scope of Work may define a different level of analysis than recommended in the *Facilities Standards.*

The following systems are to be analyzed depending on the size of the facility. For each system, the factors relate to scale and complexity, and the number of alternatives to be considered.

Tunnels and Bridges. The analysis should consider the costs of the connection versus staff travel time on alternative circulation routes. Travel time can be based on actual contact information between agencies or on assumptions by the planning team. Other factors that cannot be calculated but should be considered in making the selection include climate conditions; security; and construction challenges. The analysis should be performed when connections are considered for small buildings. It is not necessary to perform analysis on any building with a high security classification or on large buildings.

Exterior Wall Construction and Finishes. The analysis shall consider construction costs, known upkeep, maintenance and replacement costs and schedules, thermal resistance effects on heat loss/gain and first cost impacts to HVAC system designs. Other factors that cannot be calculated but should be considered in making the selection include appearance, the ability to match the finish of expansion areas or replacement panels, resistance to moisture, freezing and ultraviolet light damage, seismic and wind resistance, source and manufacture availability and construction requirements.

Sun Control Devices. The analysis should consider: construction costs; solar gain reduction, HVAC system first costs, operating costs; maintenance and replacement costs; and utility costs compared with not providing sun control devices. As previously stated, sun control also relates to maximizing efficient use of natural daylight in the building.

Exterior Windows. The analysis should consider the construction costs, HVAC system first costs, solar transmission and heat gain and insulation characteristics. Other factors that cannot be calculated but should be considered in making the selection include the affect of color tones on the interior environment, exterior views into the building and security. Analysis should be performed on moderately sized and large buildings considering at least one alternative and at up to three alternatives for very large buildings.

Alternative Roof Systems. In typical projects, a life cycle cost analysis is not required. If a new technology is proposed that has a higher initial costs and probable long term cost savings, then an analysis should be used as part of the decision to utilize the new technology.

Sam Gibbons U.S. Courthouse, Tampa, FL

Vincent E. McKelvey Federal Building laboratory wing, Menlo Park, CA

Conveyance Systems. The selection and sizing of elevator and escalator systems must be performed as prescribed in the preceding section *Selecting Conveyance Systems* in this Chapter. No other life cycle cost analysis will be required for conveyance systems.

Interior Wall Systems. The analysis must consider the installation costs including any associated special ceiling, floor, power or communication cabling systems, cost of repairs or refinishing and the percent of the material that can be reused during remodels. The churn factor, or percent of the space disrupted by change within a given year, for space renovation should be established by the GSA region. Other factors that cannot be calculated but should be considered in making the selection include appearance, safety, disruption during moves, manufacturing availability for custom systems, acoustical separation, and security. Analysis should be performed on very large buildings considering at least one alternative.

Interior Protective Finishes. The analysis must consider the installation costs, known cleaning and upkeep costs, known replacement and refinishing costs, any increases in illumination levels because of reflectivity characteristics and remedial acoustical work. Other factors that cannot be calculated but should be considered in making the selection include appearance, safety, disruption during remodeling, ability for the material to be patched, and the release of vapors. The analysis should be performed on finishes covering large areas or high traffic areas.