Structural

Reference Materials
NIH Design Policy and Guidelines

C.1 General

During the design and planning phase, the most cost-effective structural design shall be developed considering functional as well as aesthetic issues.

All NIH campus buildings will be designed to meet all current building codes and ordinances applicable to construction in Montgomery County, MD. These include, but are not limited to, the latest editions of the following:

The BOCA National Building Code, Building Officials and Code Administrators (BOCA) International, Inc., Country Club Hills, IL

Building Code Requirements for Reinforced Concrete, ACI 318, American Concrete Institute, Detroit, MI

Manual of Steel Construction ASD, American Institute of Steel Construction, Chicago, IL

Building Code Requirements for Masonry Structures, ACI 530; and *Specifications for Masonry Structures*, ACI 530.1, American Concrete Institute, Detroit, MI

Minimum Design Loads for Buildings and Other Structures, ASCE 7, American Society of Civil Engineers, New York, NY

National Design Specification for Wood Construction; and *National Design Specification Supplement*, National Forest Products Association, Washington, DC

C.2 Load Requirements

C.2.1 Live-Loads

Floor live-loads will meet or exceed BOCA requirements and may exceed only for special projects. Actual design floor loads should be simplified to accommodate future load occupancy changes. Generalized live-load categories should be applied to large areas, preferably one category to any one floor. Design live-loads shall be noted on all structural plans.

For renovation projects, the live-loads of adjacent existing areas shall be noted on the structural plans. This is to aid the contractor in determining construction live-loads in staging areas or areas to be accessed during construction or demolition.

Specialized equipment loads and requirements shall be verified with the equipment manufacturer.

The following minimum live-loads shall be used except where the NIH dictates higher loads for specific projects.

Laboratories	5 kPa
Vivarium	5 kPa
Vivarium With Primates	6 kPa
Offices	5 kPa
Mechanical Areas	7.5 kPa
or weight of actual equipment if greater	
Catwalks	5 kPa
Patient Rooms	5 kPa
Operating Rooms	5 kPa
Nursing Areas	5 kPa
Libraries	7.5 - 15 kPa
Storage Rooms	7.5 kPa
Standard File Rooms	7.5 kPa
High-Density File Rooms	15 kPa
Stationary X-Ray Film Files	12 kPa
Rolling X-Ray Film Files	20 kPa
Fitness Center, Recreation	7.5 kPa
Conference Rooms	6 kPa
Reception and Lobby Areas	6 kPa
Kitchen, Cafeteria	5 kPa
Frozen Storage, Refrigeration Areas	10 kPa
Mail Room	10 kPa
Central Computer Areas	10 kPa
Visitor Information and Exhibit Areas	10 kPa
Interstitial Platform	2 kPa
Loading Docks and Receiving Areas	12 kPa
Roofs (Not Designed for Future Expansion)	2 kPa
Parking Garage Floors	4 kPa
Laundry (Centralized)	10 kPa
Repair and Maintenance Shops	7.5 kPa
Stairs, Corridors	5 kPa
Toilet Rooms	5 kPa

Bank Vault Area	15 kPa
or weight of actual equipment if greater	
Agent Cashier Vault Area	7.5 kPa

Provision shall be made for a concentrated load of 1200 kg upon any area 800 mm^2, if this would provide stresses greater than the uniform loads above.

C.2.2 Live-Load Reduction

Columns supporting a building roof level shall not be subjected to live-load reduction. Elsewhere the designer may apply the BOCA National Building Code for live-load reduction, except no member shall be designed to carry less than 75% of the unreduced design live-load on the tributary area carried by the member.

C.2.3 Wind Loads

The building shall be designed for the geographic basic wind speed of 130 kmph and Exposure B as stated in the BOCA Code. The importance factor shall be 1.15.

C.2.4 Seismic Loads

The building shall be designed to resist the BOCA Code seismic forces. Seismic Hazard Exposure Group I shall be used. Presently, Montgomery County, MD is located on BOCA seismic maps in an area with both peak velocity-related acceleration (Av) and effective peak acceleration (Aa) less than 0.05. However, the building shall be designed with values of Av and Aa <0.05 and Seismic Performance Category A. The greater seismic loading may be provided for flexibility for future building modifications on demand recognizing that BOCA seismic provisions change frequently and generally become more stringent.

C.2.5 Snow Loads

The building shall be designed for the geographic ground snow load of 1 kPa per the BOCA Code. An importance factor of 1.2 shall be used. The effects of sliding and drifting snow shall be considered. Design roof load shall be the greater of this analysis or 2 kPa as listed in the table above.

C.2.6 Dead Loads

The building shall be designed to support the actual weights of all materials. These include structural materials, finishes, ceilings, partitions, shielding, piping, and ductwork. Assumed weights other than the actual building structure shall be enumerated on the design documents.

C.2.7 Hanging Loads

Loads exceeding 20 kg shall not be hung from any metal decking. All ductwork, piping, etc. shall be hung directly from the structural steel framing or supplementary steel members.

For new concrete construction, cast-in inserts should be considered for hanging items in mechanical rooms, attaching overhead lights and equipment in operating rooms, or hanging any heavy loads. For existing construction, expansion anchors shall not be used in tension.

The Structural Engineer shall design the support for thrust blocks needed by the piping systems inside the building. Close coordination with the Plumbing Engineer is required.

For plaster ceiling panels, an area of 16 m^2 shall not be exceeded.

C.3 General Requirements

C.3.1 Future Expansion

Any specific plans for future vertical or horizontal expansion must be accommodated. Provisions shall be made for the addition of future floors and additions as determined by the NIH on a project-by-project basis. Future expansion plans, including assumed type of construction and live-loads, shall be shown on the drawings.

C.3.2 Geotechnical

A comprehensive geotechnical investigation will be required. This will include test borings in soil, and rock coring, if rock is encountered. The investigation will provide information as to the types of soil encountered, allowable bearing pressures, differential and absolute settlements, lateral soil pressures, suggested types of foundations, water table, drainage requirements, and special foundation problems.

The geotechnical report is to be included in the construction documents.

A geotechnical consultant shall also be retained to verify materials encountered during construction and monitor earthwork operations. Use of a registered geotechnical consultant in the State of Maryland, or where the project is located, will be required.

C.3.4 Alternative Systems

A minimum of three feasible alternative structural systems must be thoroughly evaluated. A narrative describing the advantages and disadvantages of each system shall be submitted and a recommended system identified. Comparative cost estimates will be included. The structural system selected will be the one that best combines overall economy with suitability of design. It must be compatible with the architectural, mechanical, electrical, and fire protection systems.

At least one of the alternatives to be evaluated shall be an interstitial building system.

C.3.5 Peer Review

A review of all final calculations, specifications, and drawings by the Structural Engineer of record shall be performed by an independent, licensed structural engineer if requested by the NIH.

C.3.6 Parking Garages

Parking garage design loads shall be reviewed on a project-by-project basis to accommodate future flexibility of space.

In addition to the submittal of at least three feasible alternative structural systems required in the Alternative Systems section, a minimum of three parking garage maintenance designs shall be submitted. These designs shall incorporate the specification of parking garage wearing-surface systems, reinforcing materials, and concrete additives for the prevention of deterioration of the structure from deicing salts. Life cycle cost estimates comparing high first costs for a long-lived wearing surface to low first costs for a frequently replaced wearing surface shall be included.

The use of a consultant who specializes in the design of parking garages is required.

C.3.7 Loading Docks

The NIH standard loading dock height is 750 mm. A continuous galvanized steel angle shall be embedded into the edge of the loading dock to protect the corner. A concrete apron shall be constructed when paving the area adjacent to the loading dock. Epoxy-coated reinforcing shall be used in the loading dock and apron concrete for protection against deterioration due to deicing salts.

C.3.8 Vibration

Areas sensitive to vibration shall be designed considering the effects of adjacent equipment or operations. The use of a consultant specializing in vibration analysis and control is required for all hospital, laboratory, and vivarium construction for both new construction and renovations. The consultant shall address issues relative to vibration-sensitive equipment and specialized functions such as nuclear magnetic resonance, neurosurgery, eye surgery, mass spectrometry, and fitness centers. Specialized equipment requirements shall be verified with the equipment manufacturer.