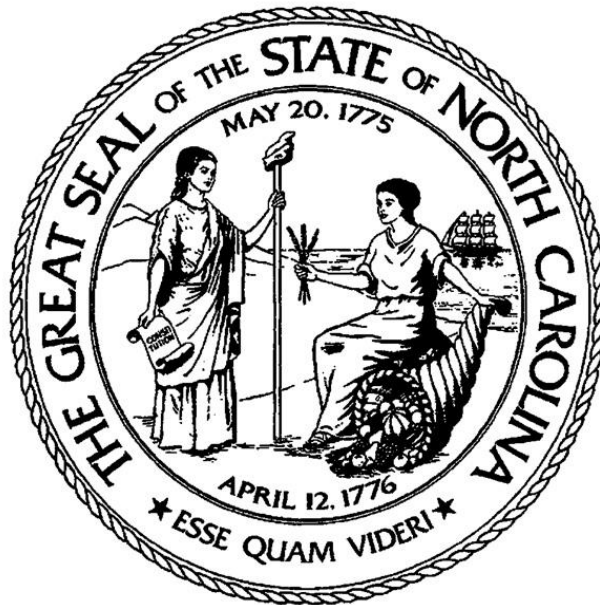


# North Carolina State Building Code

## Volume I – General Construction (Standard Building Code with North Carolina Amendments)



1978 Edition

North Carolina Building Code Council

and

North Carolina Department of Insurance

Post Office Box 26387

Raleigh, North Carolina 27611

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# North Carolina State Building Code



**Volume I – General Construction  
(Revisions Adopted Through December 11, 1984  
Effective January 1, 1985)**

*(Reprinted by permission of the International Code Council)*

North Carolina Building Code Council  
and  
North Carolina Department of Insurance  
1202 Mail Service Center  
Raleigh, North Carolina 27699

## FOREWORD

North Carolina has been a pioneer in the field of Statewide Building Regulations which have been enacted for the protection of the public. The Building Laws passed in 1903 and 1905 created a Building Code for materials and methods of construction in use at that time in this State.

The General Assembly of 1933 created a Building Code Council and authorized it to, in cooperation with the Commissioner of Insurance, prepare and adopt a State Building Code. The first State Code was adopted in 1935 and ratified by the 1941 General Assembly.

The 1957 Legislature rewrote the 1938 Act, ratified the 1953 edition and reorganized and expanded the membership and responsibility of the Council.

The 1953 edition of the State Building Code was revised in accordance with the 1957 Act and printed as the 1958 edition.

The 1933 Act of the General Assembly provided that any city or county could adopt any building regulation so long as it was more stringent than the State Building Code regulations. However, after a General Assembly Study Commission Report, the 1957 Legislature provided that any local building regulation which was different from the State regulation would have to be approved by the Building Code Council. The Council adopted a policy to only approve local amendments to the State Code which were absolutely necessary. The policy includes that when cities and counties see the need for local amendments, they would be incorporated as a part of the State Building Code in lieu of approving the regulations applying to a specific city or county unless local conditions warranted such specific regulations.

The 1967 edition of the State Building Code was prepared utilizing the framework of the Standard Building Code, with several chapters taken from the American Insurance Association's National Building Code and the egress chapter was taken from the Life Safety Code of NFPA.

The present 1978 edition has been prepared by the Building Code Council with assistance of specially appointed Advisory Committees representing the architectural and engineering professions and local inspection departments plus others affected by the regulations. The latest edition and amendments to the Standard Building Code were utilized as a basis for the State Building Code so therefore the North Carolina State Building Code is the "Standard Building Code with North Carolina amendments". Special acknowledgements to the Southern Building Code Congress and other organizations where other material came from is made on a subsequent page.

The Code is presented with the hope that its use will protect the public from dangerous and unsanitary buildings and will provide architects and engineers a set of minimum standards to follow in designing buildings. The Building Code Council has authority to make changes in the Code when the wider use of materials and methods comply with safety standards set forth in the laws. From time to time, there will be modifications and changes in the code and users of the Code should contact the Department for copies of changes.

**PREVIOUS EDITIONS OF THE  
NORTH CAROLINA STATE BUILDING CODE**

1936 Edition  
1953 Edition  
1958 Edition  
1967 Edition

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Volume I-C – MAKING BUILDINGS ACCESSIBLE TO AND USABLE BY THE  
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Volume I-E – STATE OF NORTH CAROLINA REGULATIONS FOR MODULAR  
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Volume III – HEATING, AIR CONDITIONING, REGRIGERATION AND VENTILATION

Volume IV – ELECTRICAL



# **NORTH CAROLINA STATE BUILDING CODE**

**1978 EDITION**

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## **Volume I GENERAL CONSTRUCTION**

*(Reprinted by permission of the International Code Council)*

Adopted by the North Carolina Building Code Council  
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SOUTHERN STANDARD BUILDING CODE, 1976 Edition, (Basic framework of all chapters except as listed below), Published by Southern Building Code Congress, 3617 8th Avenue, South, Birmingham, Ala. 35322.

NATIONAL BUILDING CODE, 1976 Edition, (Chapter VIII, X, XXVII and parts of several others). Published by American Insurance Association, 85 John Street. New York, N.Y. 10038.

LIFE SAFETY CODE. 1976 Edition, (Most of Chapter XI), Published by National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

BASIC BUILDING CODE, 1975 Edition, (Appendices A-G), Published by Building Officials Conference of America. 1313 East 60th Street. Chicago, Ill. 60637.

NATIONAL FIRE CODES. Volumes I-X, 1977 Editions, (Many Standards adopted or referred to in various chapters, especially Chapters V, XXIX, XXX and Appendix H), Published by National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

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# CHAPTER 1

## ADMINISTRATION

### SECTION 101 TITLE, PURPOSE, DEFINITION AND SCOPE

#### 101.1 – TITLE

These Rules and Regulations shall be known as the North Carolina State Building Code, may be cited as such, and will be referred to hereinafter as "the Code" or "this Code". [Authority: G.S. 143-138(a).]

#### 101.2 – PURPOSE

The purpose of the Code is to provide certain minimum standards, provisions and requirements for safe and stable design, methods of construction and uses of materials in buildings and/or structures hereafter erected, constructed, enlarged, altered, repaired, moved, converted to other uses or demolished and to regulate the equipment, maintenance, use and occupancy of all buildings and/or structures. All regulations contained in the North Carolina State Building Code shall have a reasonable and substantial connection with the public health, safety, morals, or general welfare, and their provisions shall be construed liberally to those ends. (Authority: G.S. 143-138 (b), (c).)

#### 101.3 – DEFINITION

Unless the context clearly indicates otherwise, whenever the word "building" is used in this Chapter, it shall be deemed to include the word "structure" and all installations such as plumbing systems, heating systems, cooling systems, electrical systems, elevators, and other installations which are parts of, or permanently affixed to, the building or structure. [G.S. 143-138(b).]

#### 101.4 – TYPES OF BUILDINGS REGULATED

- (a) Except as specifically provided in subsection (b) below, the provisions of this Code shall apply to every type of building (including any appurtenances attached thereto), wherever it might be situated in the State.
- (b) This Code shall not apply to:
  - (1) Farm buildings located outside the building-regulation jurisdiction of any municipality; [See Section 504 for definition of "farm buildings".]
  - (2) The design, construction, location, installation, or operation of equipment for storing, handling, transporting, and utilizing liquefied petroleum gases for fuel purposes or anhydrous ammonia or other liquid fertilizers:
  - (3) The design, construction, location, installation, or operation of equipment or facilities, other than buildings, of a public utility, as defined in (G.S. 62-3, or an electric or telephone membership corporation, including without limitation poles, towers, and other structures supporting electric or communication lines. [Authority: G.S. 143-138(b), (c).]

#### 101.5 – APPLICATION OF CODE TO NEW BUILDINGS

This code shall apply to the design, construction, location, and installation of all new buildings, as defined in [Section 101.3](#) and not exempted by [Subsection 101.4\(b\)](#).

### 101.6 – APPLICATION OF CODE TO EXISTING BUILDINGS

- (a) *In General:* Existing buildings and parts thereof, including those Installations listed in [Section 101.3](#), which complied with the minimum safety standards of the Code in effect at the time of construction or installation, which have been properly maintained, and which meet any applicable requirements of [Chapter 10](#) of Volume I of this Code, shall be deemed in compliance with the Code. Such buildings shall be required to comply with the current Code only as indicated in the subsections below.
- (b) *Additions:* All additions to existing buildings shall comply with the current provisions of the Code when they are constructed.
- (c) *Alterations:* When alterations are made to an existing building which affect its structural strength, exits, fire hazards, electrical systems, or sanitary conditions, such alteration shall comply with current requirements of the Code. Unaltered portions of the building or its installations shall be required to come into compliance with the current Code only in the circumstances specified in other subsections of this section.
- (d) *Extensive Annual Alterations or Repairs, Reconstruction after Damage:*
  - (1) If, within any twelve month period, alterations or repairs costing in excess of fifty per cent of the then physical value of the building are made to an existing building, such building shall be made to conform to the requirements of this Code for new buildings.
  - (2) If an existing building is damaged by fire or otherwise in excess of fifty per cent of its physical value at the time of damage, it shall be made to conform to the requirements of this Code for new buildings.
  - (3) For the purposes of this subsection, the "physical value" of the building shall be determined by the local inspection department.
- (e) *Maintenance:* All buildings or structures, both existing and new, and all parts thereof, shall be maintained in a safe and sanitary condition. All devices or safeguards which are required by this code in a building when erected, altered, or repaired, shall be maintained in good working order. The owner, or his designated agent, shall be responsible for the maintenance of buildings and structures.
- (f) *Change of Use:* This Code shall apply to all buildings which are to be devoted to a new use and which the requirements of this code are in any way more stringent than the requirement covering the previous use of the building. (G.S. 143-138(b), 143-139, 153A-357, 160A-417.)

### SECTION 102 CONTENT

This Code includes the following volumes:

- Volume I – General Construction
  - " I-B – One and Two Family Dwelling Code
  - " I-C – Making Buildings Accessible to and Usable by the Physically Handicapped
  - " I-E – State of North Carolina Regulations for Modular Construction
  - " II – Plumbing
  - " III – Heating and Air Conditioning
  - " IV – Electrical Systems

(See G.S. 143-138 (b))

**SECTION 103 ADMINISTRATION BY COMMISSIONER OF INSURANCE**

**103.1 – GENERAL**

- (a) The Commissioner of Insurance shall have general supervision, through the Division of Engineering and Building Codes of the Department of Insurance, of the administration and enforcement of all sections of the North Carolina State Building Code other than those specified in the subsections below, in cooperation with local inspectors appointed by cities and counties. [Authority: G.S. 143-139(b), 153A-350 to 153A-375, 160A-411 to 160A-438.]
- (b) The Bureau of Boiler Inspection of the Department of Labor shall have general supervision of the administration and enforcement of those sections of the Code which pertain to boilers of the types enumerated in Article 7 of Chapter 95 of the General Statutes.
- (c) The Department of Labor shall have general supervision of the administration and enforcement of those sections of the Code which pertain to elevators, moving stairways, and amusement devices such as merry-go-rounds, roller coaster, and ferris wheels. [Authority: G.S. 143-139.]

**103.2 – PLAN APPROVALS**

The plans and specifications of the following types of buildings are required to be submitted to the Division of Engineering and Building Codes of the Department of Insurance and approval obtained before work is begun on such buildings:

Occupancy Group	Building Plans to be Approved
Group R – Residential	Over 4 stories or over 100 rooms
Group B – Business	Over 4 stories or Over 50,000 sq. ft.
Group F – Industrial	Over 4 stories or Over 50,000 sq. ft.
Group M – Mercantile	Over 4 stories or Over 50,000 sq. ft.
Group E – Educational	All Buildings (over 200 people for Non-Public owned)
Group I – Institutional	All Buildings
Group A – Assembly	Over 200 People
Group H – Hazardous	Over 200 People
Buildings Owned by State, Cities or Counties	All Buildings

When a local building inspection department receives plans for a building or other structure, or components thereof, which its inspectors are not certified to approve under the rules of the North Carolina Code Officials Qualification Board, that department may require that the plans be submitted to and approved by the Commissioner of Insurance.

**103.3 – STAFF FOR BUILDING CODE COUNCIL**

The Division of Engineering and Building Codes of the Department of Insurance serves as Staff for the Building Code Council. (Authority: (G.S. 143-137(c).)

### **103.4 – RIGHT OF ENTRY**

The Commissioner of Insurance and his authorized deputies in the Division of Engineering and Building Codes have the right at all reasonable hours to enter into or upon all buildings in their jurisdiction for the purpose of examination and inspection. (Authority: G.S. 69-4, 153A-360, 153A-364, 160A-420, 160A-424, 143-139(b).)

### **103.5 – INSPECTIONS**

The Commissioner of Insurance and his authorized deputies in the Division of Engineering and Building Codes may inspect any building wherever it may be situated in the State to assist local officials in the enforcement of the Building Code. (Authority: G.S. 143-139(b).)

### **103.6 – APPEALS**

The Commissioner of Insurance and his authorized deputies (and local inspection officials) and the Department of Labor with respect to provisions set forth in [Section 103.1\(b\)](#) and [\(c\)](#) shall hear any appeals raising questions under the Code before officials attempting to enforce the same.

## **SECTION 104 ADMINISTRATION BY BUILDING CODE COUNCIL**

### **104.1 – COMPOSITION OF BUILDING CODE COUNCIL**

The Building Code Council consists of 12 members appointed by the Governor, including one registered [architect](#), one licensed general contractor, one registered [architect](#) or licensed general contractor specializing in residential design or construction, one registered engineer practicing structural engineering, one registered engineer practicing mechanical engineering, one registered engineer practicing electrical engineering, one licensed plumbing and heating contractor, one municipal or county building inspector, one representative of the public who is not a member of the building construction industry, one licensed electrical contractor, and one registered engineer on the engineering staff of a State agency charged with approval of plans of state-owned buildings and 1 representative of the fire service. [Authority: G.S. 143-136.]

### **104.2 – OFFICERS**

The Council shall elect from its appointed members a Chairman and Vice-Chairman. Officers shall serve for a period of two years from the date of election or until their successors are elected. [Authority: G.S. 143-137(a).]

### **104.3 – MEETINGS**

The Building Code Council shall meet regularly the *second Tuesday in March, June, September, and December*. Special meetings may be called by the Chairman. Any five members of the Council shall constitute a quorum. Information concerning the exact time and place of each meeting shall be available from the Division of Engineering and Building Codes of the Department of Insurance during the 15 days prior to each such meeting. [Authority: G.S. 143-137(b).]



## 104.4 – DUTIES

The Building Code Council has the duties of adopting and from time to time amending the North Carolina State Building Code, of approving local building regulations which deviate from the State Building Code, of hearing and deciding appeals from decisions of any enforcement agency with reference to provisions of the Code and of recommending appropriate statutory changes and improvements in administrative practices other than administrative.

## 104.5 – STAFF AND PERSONNEL

The Division of Engineering and Building Codes of the Department of Insurance serves as the staff for the Council. [Authority G.S 143-137(c).]

# SECTION 105 ADMINISTRATION BY LOCAL BUILDING OFFICIALS

## 105.1 – ORGANIZATION & JURISDICTION OF LOCAL INSPECTORS

- (a) Initial responsibility for administration and enforcement of the Code has been allocated by the General Statutes to local inspection officials, under the general supervision of the State officials designated in [Section 103.1](#). Local inspection officials may be organized and have jurisdiction as specified in the subsections below:
- (b) A City Inspection Department, with jurisdiction over areas within the city limits, over any extraterritorial area as to which the city has jurisdiction pursuant to Section 160A-360 of the General Statutes or any special act of the General Assembly, and over any areas as to which the city has contracted with another unit to enforce the Code;
- (c) A County Inspection Department, with jurisdiction over unincorporated areas outside any city's jurisdiction, over any portion of a city's jurisdiction wherein the City Council has requested the county to enforce the Code, and over any areas as to which the county has contracted with another unit to enforce the Code;
- (d) A Joint Inspection Department created by two or more units of local government, with authority over the legal jurisdiction of all units supporting the joint department. [Authority: G.S. 143-139, 153A-351, 153A-353, 160A-360, 160A-411, 160A-413, 160A-461, 160A-462.]

## 105.2 – DUTIES OF LOCAL INSPECTORS, GENERAL

Local Inspection Departments shall receive applications for permits, issue or deny permits, make necessary inspections, issue or deny certificates of compliance, issue orders to correct violations, revoke permits, bring judicial actions against actual or threatened violations, keep adequate records, and take any other actions that may be required in order adequately to enforce the Code. [Authority: G.S. 153A-352, 160A-412.]

## 105.3 – PERMITS REQUIRED

- (a) *New Building*: No person shall commence or proceed with construction of any new building or structure covered by this Code without first applying for and receiving one or more permits covering all work to be done.

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- (b) *Existing Buildings*: No person shall commence or proceed with reconstruction, alteration, repair, moving or demolition of any existing building or structure without first applying for and receiving one or more permits covering all such work. (Reference: [Chapter 10, Section 2604.](#))
- (c) *Buildings within Fire Limits*: A special permit is required for any alteration, repair, or movement of a wood frame building inside fire limits. (References: Section 302; G.S. 153A-375, 160A-436, 160A-437, 160A-438.)
- (d) *Signs*: A permit is required to install signs. (Reference: [Section 2301.](#))
- (e) *Marquees, etc.*: A permit is required to install marquees, awnings, etc. (Reference: Section 2601.)
- (f) *A permit is required whenever the use of an existing building is changed*. This permit shall not be used until the inspector has made an inspection of the building to determine whether it must be altered or repaired in order to meet the requirements of the Code with respect to the new use. (G.S. 143-138(b), 143-139, 153A-357, 160A-417.)

### 105.4 – APPLICATION FOR PERMIT

- (a) Each application for a permit shall be filed with the appropriate local Inspection Department, in writing, on a form furnished for that purpose, and shall contain a general description of the proposed work and its location. The application shall be signed by the owner or his authorized agent.
- (b) Each application shall indicate the proposed use or occupancy of all parts of the building and of that portion of the site or lot, if any, not covered by the building, and shall contain such other information as may be required by the Inspection Department.
- (c) When required by the Inspection Department, two or more copies of specifications and of drawings drawn to scale with sufficient clarity and detail to indicate the nature and character of the work shall accompany each application. Such drawings and specifications shall contain information, in the form of notes or otherwise, as to the quality of materials, where quality is essential to conformity with this Code. The Inspection Department may require details, computations, stress diagrams, and other data necessary to describe the construction and basis of calculations, and they shall bear the signature of the person responsible for the design. Plans for all buildings shall indicate how required structural and fire-resistive integrity will be maintained where a penetration of a required fire-resistive wall, floor, or partition will be made for electrical, mechanical, plumbing, and communication conduits, pipes, and systems and also indicate in sufficient detail how the fire integrity will be maintained where required fire-resistive floors intersect the exterior walls.
- (d) No permit shall be issued unless the plans and specifications are identified by the name and address of the author thereof.
- (e) Where the General Statutes require that plans for certain types of construction be prepared only by a registered [architect](#) or a registered engineer, no permit shall be issued unless the plans and specifications bear the North Carolina seal of a registered [architect](#) or registered engineer.

- (f) Where the General Statutes require a licensed contractor for certain types of construction, no permit shall be issued for such construction except in compliance with these statutes.
- (g) The Inspection Department may require drawings showing the location of the proposed building and of every existing building on the site or lot. He may also require a boundary line survey, prepared by a qualified surveyor. [Authority: G.S. 143-139, 153A-357, 160A-417, 83-12, Ch. 87, Ch. 89C, 133-1.1.]
- (h) Where necessary to determine compliance with Code standards, the Inspection Department may require tests or test reports. Such tests must be made by an **approved** testing laboratory or other **approved** agency, at the expense of the applicant. Copies of test reports or the results of tests shall be kept on file in the Inspection Department. [Authority: same as (g) above.]

### **105.5 – PERMITS**

- (a) If the Inspection Department is satisfied that the work described in an application for permit and the drawings and specifications filed therewith conforms to the requirements of this Code and all other applicable State and local laws, it shall issue a permit therefor to the applicant.
- (b) The permit shall be in writing and shall contain a provision that the work done shall comply with the State Building Code and all other applicable State and local laws.
- (c) A permit issued for work under this Code shall expire by limitation six months (or such lesser period fixed by local ordinance) after the date of issuance if the work authorized has not been commenced. If after commencement the work is discontinued for a period of 12 months, the permit therefor shall immediately expire. No work authorized by any permit that has expired shall thereafter be performed until a new permit has been secured.
- (d) After a permit has been issued, no changes or deviations from the terms of the application, plans and specifications, or the permit (except changes or deviations clearly permissible under this Code) shall be made until specific written approval of proposed changes or deviations has been obtained from the Inspection Department. (Authority: G.S. 143-139, 153A-357, 153A-358, 153A-359, 160A-417, 160A-418, 160A-419.)
- (e) When the Inspection Department issues a permit, it shall endorse in writing or by stamping "APPROVED" all sets of plans which have been submitted. One set of plans so approved shall be retained by the Inspection Department, and the other set or sets shall be returned to the applicant; one set of which shall be kept at the site of the work and shall be open to inspection by any authorized member of the Inspection Department.

### **105.6 – INSPECTION REQUIRED**

- (a) As the work covered by permit progresses, local inspectors shall make as many inspections thereof as necessary to satisfy them that the work is being done in accordance with this Code, any other applicable State and local laws, and the terms of the permit.

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- (b) When required, the Inspection Department shall make at least the following inspections of all work being performed under the permit and shall either approve that portion of the construction as completed or shall notify the permit holder or his agent wherein the same fails to comply with the law. The permit holder or his agent shall give timely notice to the Inspection Department when the work for these inspections are ready:

Foundation Inspection: To be made after excavation and forms, if any are erected and reinforcing steel, if any, is placed and prior to placement of concrete.

Frame Inspection: To be made after the roof, all framing, fire-blocking and bracing is in place and all pipes, chimneys, and vents are complete.

Insulation Inspection: To be made after framing is complete with insulation being installed and prior to finish being applied.

Final Inspection: To be made after the building or structure is completed and ready for occupancy.

- (c) Work shall not proceed on any part of a building or structure beyond the point indicated for each inspection described in subsection (b) above until written approval has been received from the inspection department.
- (d) Reinforcing steel or structural framework of any part of any building shall not be covered or concealed in any manner whatsoever without first obtaining the approval of the Inspection Department and, where appropriate, the designing [architect](#) or engineer.
- (e) In all buildings where plaster is used for fire protection purposes, the permit holder or his agent shall notify the Inspection Department after all lathing and backing is in place. Plaster shall not be applied until the approval of the Inspection Department has been received.
- (f) Where necessary to determine compliance of any work with Code standards, the Inspection Department may require tests or test reports. Such tests must be made by an [approved](#) testing laboratory or other [approved](#) agency, at the expense of the owner. Copies of test reports or the results of tests shall be submitted to and kept on file in the Inspection Department.
- (g) *Periodic Inspections:* Local Inspection Department shall make periodic inspections (subject to direction of the local governing board) of existing buildings to determine their compliance with this Code and to determine whether they meet minimum requirements for safety to life. In addition, they shall make inspections when they have reason to believe that unsafe, unsanitary, hazardous, or unlawful conditions may exist in a particular structure. (Reference: [Chapter 10](#), Volume 1.)
- (h) Change of Use: When an existing building is to be converted to another use or occupancy, it shall be the responsibility of the owner or his agent to notify the Inspection Department to make an inspection of such building to assure that it will be in compliance with the safety requirements of this Code as they would apply to the new use or occupancy. [Authority: G.S. 153A-360, 153A-364, 160A-420, 160A-424, 143-139.]

### **105.7 – RIGHT OF ENTRY**

Authorized personnel of a local Inspection Department shall have a right to the extent provided by the N.C. General Statutes to enter on any premises within the Department's jurisdiction, including entry into or upon all buildings or structures, for the purpose of inspection or other enforcement action, upon presentation of proper credentials. [Authority: G.S. 69-4, 69-13, 143-139, 153A-360, 153A-364, 160A-420, 160A-424.]

### **105.8 – STOP ORDERS**

- (a) Whenever any building or structure or part thereof is being constructed, reconstructed, altered, repaired, or demolished in a hazardous manner, or in substantial violation of this Code or any other applicable State or local building law, or in a manner that endangers life or property, the appropriate inspector may order the specific part of the work that is in violation or presents such a hazard to be immediately stopped.
- (b) The stop order shall be in writing, directed to the person doing the work, and shall state the specific work to be stopped, the specific reasons therefor, and the conditions under which the work may be resumed.
- (c) The owner or builder may appeal from a stop order to the North Carolina Commissioner of Insurance within a period of five days after the order is issued. Notice of the appeal shall be given in writing to the Commissioner of Insurance, with a copy to the local Inspection Department. The Commissioner shall promptly conduct a hearing at which the appellant and the inspector issuing the order shall be permitted to submit relevant evidence, and shall rule on the appeal as expeditiously as possible. Pending the ruling by the Commissioner of Insurance on an appeal, no further work shall take place in violation of the stop order.
- (d) Violation of a stop order shall constitute a misdemeanor. [Authority: G.S. 143-139, 153A-361, 160A-421.]

### **105.9 – REVOCATION OF PERMITS**

The inspection department may revoke and require the return of any permit by notifying the permit holder in writing stating the reason for the revocation. Permits may be revoked for any substantial departure from the approved application, plans, or specifications; for refusal or failure to comply with the requirements of this Code or any other applicable State or local laws; or for false statements or misrepresentations made in securing the permit. Any permit mistakenly issued in violation of this Code or any other applicable State or local law may also be revoked. [Authority: G.S. 143-137, 153A-362, 160A-422.]

### **105.10 – CERTIFICATE OF COMPLIANCE**

- (a) At the conclusion of all work done under a permit, the appropriate inspector or inspectors shall make a final inspection, and if they find the completed work complies with this Code and all other applicable State and local laws and with the terms of the permits, the Inspection Department shall issue a certificate of compliance.
- (b) No new building or structure or part thereof may be occupied, and no addition or enlargement of an existing building or structure may be occupied, and no existing building or structure that has been altered or moved may be occupied, and no existing building or structure whose use has been changed may be occupied, until the Inspection Department has issued a certificate of compliance.
- (c) A temporary certificate of compliance may be issued permitting occupancy for a stated period of specified portions of the building or structure that the Inspection Department finds may safely be occupied prior to final completion of the entire building or structure.
- (d) Occupying a building or structure in violation of this section shall constitute a misdemeanor. [Authority: G.S. 143-139, 153A-363, 160A-423.]

### **105.11 – RECORDS AND REPORTS**

- (a) Local Inspection Departments shall keep complete, permanent, and accurate records in convenient form of all applications received, permits issued, inspections and reinspections made, defects found, certificates of compliance granted, and all other actions of the Department.
- (b) Periodic reports shall be submitted to the local governing board and to the Commissioner of Insurance as they shall by ordinance, rule, or regulation require. [Authority: G.S. 143-139. 153A-373. 160A-433.]

### **105.12 – CONDEMNATION OF UNSAFE BUILDINGS**

- (a) Whenever a local inspector finds any defects in a building, or finds that the building or structure has not been constructed in compliance with this Code or other applicable State and local laws, or that a building because of its condition is dangerous or contains fire hazardous conditions, it is his duty to notify the owner or occupant of the building of its defects, hazardous conditions, or failure to comply with law. The owner or occupant shall each immediately remedy the defects, hazardous conditions, or violations of law in the property he owns.
- (b) Whenever a local inspector finds conditions in a building which are especially dangerous to life, or unfit for human habitation, or constitute a nuisance, or have otherwise been defined as hazardous and contrary to the public interest by a local ordinance, he shall immediately initiate actions in accordance with appropriate statutory authority to vacate, demolish, close, repair, or otherwise correct such conditions.

- (c) Removal of a notice condemning a building as unsafe or failure to comply with a valid order to correct such conditions shall constitute a misdemeanor; in addition, the Inspection Department may bring appropriate actions to prevent violations, require corrective action, or prevent occupancy of the building or structure. [Authority: G.S. 69-13, 143-138(h), 143-139, 153A-121, 153A-122, 153A-123, 153A-365 to 153A-372, 160A-174, 160A-175, 160A-193, 160A-425 to 160A-432, 160A-441 to 160A-450.]

## **SECTION 106 APPEALS**

### **106.1 – APPEALS – GENERAL**

All appeal proceedings heard pursuant to this Section shall comply with the provisions, insofar as applicable, of G.S. 143-140, 143-141, 153A-374, 160A-434, and Article 3 and 4 of G.S. Chapter 150A (the Administrative Procedure Act).

### **106.2 – APPEALS TO THE COMMISSIONER OF INSURANCE OR DEPARTMENT OR LABOR**

- (a) Any person desiring to raise any questions under the State Building Code arising out of a decision of a local inspector shall be entitled to a full hearing before the Commissioner of Insurance or Department of Labor as to the provisions which they are charged with administering.
- (b) Anyone desiring to appeal from any order, decision, or determination by a member of a local Inspection Department pertaining to this Code shall file a written notice with the Commissioner of Insurance or Department of Labor (whichever has Jurisdiction) and with the local Inspection Department within a period of 10 days after the order, decision, or determination.
- (c) The Commissioner of Insurance (or Department of Labor) shall appoint a time for the hearing of the appeal, giving the appellant and the local Inspection Department reasonable notice thereof. The Commissioner (or Department of Labor), through an appropriate official, shall conduct a full and complete hearing of the matters in controversy and make a determination thereof within a reasonable time thereafter. The person requesting the hearing and the local Inspection Department shall, upon request, be furnished a written statement of the decision, setting forth the facts found, the decision reached, and the reasons therefor. [Authority: G.S. 143-139, 143-140, 153A-374, 160A-434.]
- (d) Appeals from the Commissioner of Insurance may be taken to the Building Code Council or to the Courts as provided by law. [Authority: G.S. 153A-43.]

### **106.3 – APPEALS TO BUILDING CODE COUNCIL FROM DECISIONS OF STATE ENFORCEMENT AGENCIES**

- (a) Any person desiring to take an appeal to the Building Code Council from the decision of the State enforcement agency must file such an appeal within 30 days after such decision giving written notice to the Council.

(b) *Procedural Rules for Appeals from Decisions of Enforcement Agencies:*

*Rule 1 – Time of Notice* – Any person wishing to appeal from the decision of an enforcement agency to the Building Code Council shall give a written Notice of Appeal as follows:

- (a) The *original and twelve copies* of said notice shall be filed not later than 30 days from the date of the decision of the enforcement agency with the Building Code Council, c/o Division of Engineering, Department of Insurance, Box 26387, Raleigh, North Carolina.
- (b) The staff of the Building Code Council shall immediately forward one copy of said notice to the enforcement agency from which the appeal is taken.
- (c) The time within which notice is to be filed, shall be computed by excluding the first and including the last day. If the last day is Saturday, Sunday or a legal holiday, it must be excluded.

*Rule 2 – Form of Notice* – Whenever Notices of Appeal is given as provided by these rules, said notice shall be legibly printed, typewritten or mimeographed and shall contain the following information:

- (a) The name of the party or parties taking the appeal;
- (b) The name of the enforcement agency and the date of the decision from which the appeal is taken;
- (c) The decision from which the appeal is taken must be set forth in full in the Notice of Appeal, or a copy of said decision must be attached to all copies of the Notice of Appeal;
- (d) The contentions and allegations of fact of the party or parties taking the appeal must be set forth in full in a clear and concise manner with particular reference to the section or sections of the North Carolina State Building Code in controversy;
- (e) The original notice shall be signed by the party or parties filing same. No notarization or verification is required;
- (f) In order for the filing to be placed on the agenda for the Building Code Council and to be heard at any regular or called meeting, such filing shall be complete with information required by these rules, together with all substantiating data required and must be filed in accordance with these rules at least 30 days prior to such scheduled hearings.

*Rule 3 – Time for Hearing* – Upon the proper filing of an appeal in accordance with these rules, the Chairman of the Building Code Council shall cause the appeal to be heard by the Council within a reasonable time, at least *ten day notice* to Council members.

*Rule 4 – Notice to Appellant* – The Chairman of the Building Code Council shall cause all appeals to be docketed for hearing and shall fix the time and place for said hearing and shall cause not less than ten day notice in writing, of the time and place of the hearing on the appeal to be given to the appellant, the enforcement agency from which the appeal is taken and all members of the Council.



*Rule 5 – Dismissal* – The Council shall, upon motion of the enforcement agency or on its own motion, dismiss all appeals for the following reasons:

- (a) Not prosecuted by the appellant.
- (b) All appeals wherein the Notice of Appeals has not been filed in accordance with these Rules.
- (c) For lack of jurisdiction. [Authority: G.S. 143-139, 143-140, 143-141, 153A-374, 160A-434.]

#### **106.4 – APPEALS TO COURT**

By Statute a person may appeal directly to the Superior Court in Wake County or the county in which the building is to be situated with or without an appeal to the Building Code Council.

[Authority: G.S. 143-140, 143-141(d), 153A-374, 160A-434.]

### **SECTION 107 AMENDMENTS TO STATE BUILDING CODE**

#### **107.1 – AMENDMENTS – GENERAL**

In considering and acting upon proposed amendments to this Code, the Building Code Council shall comply with the requirements of G.S. 143-138 and of Articles 2 and 5 of G.S. Chapter 150A (Administrative Procedure Act).

#### **107.2 – PROCEDURAL RULES FOR HEARINGS BEFORE THE BUILDING CODE COUNCIL ON PROPOSED AMENDMENTS TO THE NORTH CAROLINA STATE BUILDING CODE**

The following procedural rules shall apply when any citizen, State agency, or political subdivision of the State makes application to the Building Code Council requesting that the North Carolina State Building Code be revised or amended pursuant to G.S. 143-138(d):

*Rule 1 – Request for Hearing* – Any citizen, State agency, or political subdivision of the state requesting a hearing before the Building Code Council for the above purposes shall submit a written request as follows:

- (a) An *original and 12 copies* of said request for hearing shall be filed with the Building Code Council. *c/o* Division of Engineering, Department of Insurance, Box 26387, Raleigh, North Carolina. In order for the filing to be placed on the agenda for the Building Code Council and to be heard at any regular or called meeting, such filing shall be complete with information required by these rules, together with all substantiating data required and must be filed in accordance with these rules at least 30 days prior to such scheduled hearings.
- (b) The staff of the Building Code Council shall immediately forward one copy of said request to each member of the Building Code Council.

*Rule 2 – Form of Request for Hearing* – Each request shall be legibly printed, typewritten, or mimeographed and shall contain the following information:

- (a) Name, address and basis of interest of party or parties requesting hearing.

- (b) The proposed amendment to the North Carolina State Building Code must be set forth in full, and the request shall contain explicit reference to the affected section or sections of the Building Code.
- (c) The request shall state, in support of the proposed amendment or amendments, the reasons for proposing the amendment or amendments.
- (d) The proposed amendment or amendments shall comply with the *standards set forth in G.S. 143-138(c)* and reference to the particular standards and sections involved shall be set forth in the request for hearing.
- (e) The original request for a hearing shall be signed by the party or parties or their duly authorized agent submitting same and be received at least 30 days before date of hearing to be considered.

*Rule 3 – Time of Hearing* – Upon the proper filing of a request for hearing in accordance with these rules, the Chairman of the Building Code Council shall cause a hearing to be held within a reasonable time not to exceed six months; said hearing shall be open to the public.

*Rule 4 – Notice of Hearing* – The Chairman of the Building Code Council shall fix the time and place for said public hearing and shall cause notice of the hearing to be given as follows:

- (a) Notice in writing to the party or parties or their duly authorized agents requesting the hearing not less than fifteen days prior to the hearing;
- (b) Notice of public hearing by publication as required by G.S. 143-138(a);
- (c) Not less than *ten day notice* in writing to all members of the Building Code Council.

*Rule 5 – Improper Filing of Request for Hearing* – When a request for hearing is filed under this Section other than in accordance with these Rules, the staff of the Building Code Council shall notify the applicant of proper procedure to follow.

### **107.3 – PRINTING AMENDMENTS**

Amendments to the State Building Code will be printed once each year as an accumulative supplement. [Authority: G.S. 143-138(g).]

## **SECTION 108 APPROVAL OF LOCAL ORDINANCES**

### **108.1 – LOCAL CODES AND ORDINANCES TO BE APPROVED**

Section 143-138(e) of the General Statutes requires that any city or county building code or building rules and regulations governing construction must be approved by the Building Code Council in order to be legally effective. In the interest of standardization of local codes and ordinances throughout the State, to facilitate understanding of requirements by inspectors, [architects](#), engineers, builders, and the general public, and to encourage free competition among members of the construction industry throughout the State, the Council announces a policy of approving only those local deviations from the State Building Code for which a local government presents compelling evidence of necessity.

## 108.2 – PROCEDURAL RULES

The following procedural rules shall apply when any city or county makes application to the Building Code Council requesting approval of a local ordinance:

### *Rule 1*

- (a) An *original and 12 copies* of the request for the hearing and proposed local ordinance shall be filed with the Building Code Council in care of the Division of Engineering, Department of Insurance, Box 26387, Raleigh, North Carolina.
- (b) Request for the hearing must be signed by a *responsible official* of the city or county.
- (c) Request for hearing and copies of ordinance must be sent in at least 30 days before date of hearing to be acted on, (Regular meetings of Council are held the *second Tuesday in March, June, September, and December.*)

### *Rule 2*

All Local ordinances (including those relating to *Building construction, plumbing, heating and electrical*) must be divided into three major sections:

1. Local *administrative regulations, fees, etc.* dealing with administration of the Code. These regulations should not conflict with State Laws.
2. Reference to an *adoption of the State Building Code* (including general construction, plumbing, heating and electrical). Reference also should be made to adoption of the recommended Uniform Residential Code for dwellings if it is desired to have regulations applicable to dwellings.
3. The *proposed amendments to the State Building Code* (including general construction, plumbing, heating and electrical) must be set forth in full, designating page and paragraph reference to that section of the State Building Code proposed to be modified or supplemented.

### *Rule 3*

The reason for requesting the change to the State Code must be shown. Reference to sections of nationally recognized standards set forth in G.S. 143-138(c) should be made to support this request.

### *Rule 4*

After approval of the Council and local administrative body, two copies of all amendments must be sent to the Secretary of the Council in the form they are to be distributed, one for the *Council's file* and the other to be stamped approved by the Building Code Council and returned for *local file*.

### **SECTION 109 ALTERNATE MATERIALS AND ALTERNATE METHODS OF CONSTRUCTION**

Although a certain material, or a particular method of construction, is specifically prescribed by the Code, this Code is not Intended to prevent the use of a material, or method of construction, different from the material, or method of construction specifically prescribed by the Code, provided any such alternate material or method of construction has been approved and its use authorized by the building official. The building official shall approve any such alternate material, or method of construction, provided the building official, in his sole discretion, finds that the proposed alternate material, or method of construction, is for the purpose intended, at least the equivalent of that specifically prescribed by the Code in quality, strength, effectiveness, fire-resistance, durability, performance and safety. The building official may require that sufficient evidence or proof be submitted to substantiate any claim that may be made regarding its use, and, in the opinion of the building official, the evidence and proof are not sufficient to justify his approval, the aggrieved party may appeal the decision of the local building official to the Building Code Council under the provisions of [Section 106.3](#).

### **SECTION 110 VIOLATIONS AND PENALTIES**

Any person who shall be adjudged to have violated the North Carolina State Building Code shall be guilty of a misdemeanor and shall upon conviction be liable to a fine not to exceed \$50.00 for each offense. Each thirty days that such violation continues shall constitute a separate and distinct offense. [Authority: G.S. 143-138(h).]

### **SECTION 111 VALIDITY**

If any section, subsection, sentence, clause or phrase of this Code is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this Code.

## CHAPTER 2 DEFINITIONS AND STANDARDS

### SECTION 201 DEFINITIONS

#### **201.1 – GENERAL**

For the purpose of this Code, certain abbreviations, terms, phrases, words, and their derivatives, shall be construed as set forth in this Section.

#### **201.2 – TENSE, GENDER AND NUMBER**

Words used in the present tense include the future. Words in the masculine gender include the feminine and neuter. Words in the feminine and neuter gender include the masculine. The singular number includes the plural and the plural number includes the singular.

**ADDITION** – is an extension or increase in floor area or height of a building or structure.

**ALLEY** – means any public space or thoroughfare twenty (20) feet or less in width which has been dedicated or deeded for public use.

**ALTER OR ALTERATION** – means any change or modification in construction or occupancy.

**AMUSEMENT DEVICE** – means a mechanically operated device which is used to convey persons in any direction as a form of amusement.

**APARTMENT** – shall mean a dwelling unit as defined in this code.

**APARTMENT HOUSE** – is any building or portion thereof used as a multiple dwelling for the purpose of providing three (3) or more separate dwelling units which may share means of egress and other essential facilities.

**APPLICABLE GOVERNING BODY** – a city, county, state, state agency or other political government subdivision or entity authorized to administer and enforce the provisions of this code, as adopted or amended.

**APPROVED** – means approved by the building official or other authority having jurisdiction.

**APPROVED PLASTIC** – (Defined in [Section 2201.2\(a\)](#))

**ARCHITECT** – within the meaning of this Code, shall be deemed to be a duly registered and licensed architect.

**AREA (building)** – is the maximum horizontally projected area of the building at or above grade, exclusive of court and vent shafts.

**AREA (Gross Floor)** – is the area within the inside perimeter of the exterior walls with no deduction for corridors, stairs, closets, thickness of walls, columns or other features, exclusive of court and vent shafts.

**AREA (Net Floor)** – is the area actually occupied not including accessory unoccupied areas such as corridors, stairs, closets, thickness of walls, columns, toilet room, mechanical area or other features.

## DEFINITIONS AND STANDARDS

**AREAWAY** – means an unroofed subsurface space adjacent to a building.

**A.S.T.M.** – means American Society for Testing and Materials.

**ASSEMBLY OCCUPANCY** – (Defined in [Section 404](#)).

**ATRIUM** – An open patio or court, with or without a roof or ceiling around which a building is built.

**ATTIC** – means the space between the ceiling beams of the top habitable story and the roof rafters.

**ATTIC STORY** – means any story situated wholly or partly in the roof, so designated, arranged or built as to be used for business, storage or habitation.

**AUTOMATIC** – as applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of rise of temperature, or combustion products, such as incorporated in an automatic sprinkler system, automatic fire door, automatic fire shutter, or automatic fire vent.

**AUTOMOBILE PARKING STRUCTURE** – means a structure used for the parking or storage of automobiles.

**AUTOMOTIVE SERVICE STATION** – (Defined in [Section 405.4](#)).

**AWNING** – (Defined in [Chapter 26](#))

**BALCONY** – means that portion of the seating space of an assembly room, the lowest part of which is raised four (4) feet or more above level of the main floor.

**BALCONY** – (Exterior) A platform that projects from the wall of a building or structure and is enclosed by a parapet or railing no less than 42" in height ([See 1108.4](#)).

**BASEMENT** – means a story of a building or structure having one-half or more of its clear height below grade. Also see “[Story](#)”. A basement used as habitable space shall be considered a story.

**BEAM** – a primary structural member supporting secondary structural members, floor, roof, joists, and the like.

**BLEACHERS** – (Defined in [Section 503.2](#))

**BOILER** – is a heating appliance intended to supply hot water or steam.

**BRICK** – means a solid masonry unit having a shape approximately a rectangular prism, usually not larger than 12 by 4 by 4 inches. A brick may be made of burned clay or shale, of fire clay or mixtures thereof, of lime and sand, of cement and suitable aggregates, or of other approved materials.

**BUILDING** – means any structure built for the support, shelter or enclosure of persons, animals, chattels, or property of any kind which has enclosing walls for fifty (50) percent of its perimeter. The term “building” shall be construed as if followed by the words “or part thereof”. (For the purpose of this Code each portion of a building separated from other portions by a fire wall shall be considered as a separate building.) For the purpose of area and height limitations this definition shall be applicable to sheds and open sheds.

**SHED** – means any structure built for the support, shelter or enclosure of persons, animals, chattels, or property of any kind which has enclosing walls for less than fifty (50) percent of its perimeter.

**OPEN SHED** – means any structure that has no enclosing walls.

**BUILDING AND STRUCTURE** (existing) – is any structure erected prior to the adoption of this Code, or one for which a legal building permit has been issued.

**BUILDING COMPONENT** – (Defined in [Section 2101.2 \(1\)](#))

**BUILDING, FARM** – (Defined in [Section 504](#))

**BUILDING LINE** – means the line, established by law, beyond which a building shall not extend, except as specifically provided by law.

**BUILDING OFFICIAL** – is the officer or other designated authority charged with the administration and enforcement of this code, or his duly authorized representative.

**BUILDING SYSTEM** – (Defined in [Section 2101.2 \(2\)](#))

**BUILDING OCCUPANCY** – (Defined in [Section 405](#)).

**CANOPY** – (See [Chapter 26](#))

**CAST STONE** – is a building stone manufactured from cement concrete precast and used as a trim, veneer or facing on or in buildings or structures.

**CELLAR** – means that portion of a building, the ceiling of which is entirely below grade or less than four (4) feet six (6) inches above grade (See [STORY](#).)

**CHIMNEY CONNECTOR** – is the pipe which connects a fuel burning appliance to a chimney.

**CITY** – (See definition [APPLICABLE GOVERNING BODY](#).)

**CLOSED CONSTRUCTION** – (Defined in [Section 2101.2 \(3\)](#))

**COMBUSTIBLE MATERIAL** – A material which cannot be classified as noncombustible or limited-combustible in accordance with that definition.

**COMMON-PROPERTY LINE** – means a line dividing one lot from another when said lots are not of one ownership.

**COMPLIANCE ASSURANCE PROGRAM** – (Defined in [Section 2101.2 \(4\)](#))

**CONCRETE** – (See [Chapter 16](#).)

**CONDOMINIUM DWELLING UNIT** – for the purpose of this code is an [apartment](#) as defined in this code.

**CONSTRUCTION** – (See [Chapter 6](#))

**CONSTRUCTION TYPES** – (See [Chapter 6](#))

**COVERED MALL** – is a covered or roofed interior area used as a pedestrian public way and connecting tenant spaces and/or groups of tenant spaces housing individual or multiple tenants.

**CURB LEVEL** – referring to a building, means the elevation at that point of the street grade that is opposite the center of the wall nearest to and facing the street line.

**DEAD LOAD** – (See [Section 1202.](#))

**DISPLAY SIGN** – means a structure that is arranged, intended, designed or used as an advertisement announcement or direction, and includes a sign, sign screen, billboard and advertising devices of every kind.

**DORMITORY** – is a space in a unit where group sleeping accommodations are provided with or without meals for persons not members of the same family group, in one room, or in a series of closely associated rooms under joint occupancy and single management, as lodges in college dormitories, fraternity houses, military barracks, and ski lodges.

**DWELLING** – (Defined in [Section 2101.2 \(5\)](#))

**DWELLING UNIT** – is a single unit providing complete, independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking and sanitation.

**ENGINEER** – within the meaning of this Code, shall be deemed to be a duly registered and licensed engineer.

**ESCALATOR ENCLOSURES** – (Defined in [Sections 1106.2 & 1106.4](#))

**EVALUATION AND INSPECTION AGENCY** – (Defined in [Section 2101.2 \(6\)](#))

**EXHIBITION FACILITY** – is a building or part thereof for which the use is the displaying of manufactured products, furniture, home furnishing accessories, and like items, primarily for the purpose of obtaining sales to wholesalers, retailers, or other dealers.

**EXISTING BUILDING** – (See [BUILDING-EXISTING](#)).

**EXIT** – (Defined in [Section 1102\(a\)\(2\)](#))

**EXIT ACCESS** – (Defined in [Section 1102\(a\)\(1\)](#))

**EXIT DISCHARGE, EXIT OUTLET** – (Defined in [Section 1102\(a\)\(3\)](#))

**EXTRA HAZARD OCCUPANCIES** – Extra hazard-occupancies or portions of other occupancies where quantity and combustibility of contents is very high, flammable liquids, dust, lint or other materials are present introducing the probability of rapidly developing fires with high rates of heat release.

Extra Hazard Occupancies include occupancies such as:

- Aircraft Hangars
- Chemical Works (Extra Hazard)
- Cotton Pickers and Opening Operations
- Explosives and Pyrotechnics
- Woodworking with Flammable Finishing

Under favorable conditions and subject to the approval of the authority having jurisdiction, a reduction of requirements to the next less restrictive occupancy classification may be applied to the following occupancies:

- |                                    |                    |
|------------------------------------|--------------------|
| Cold Storage Warehouses            | Machine Shops      |
| Cotton Picker & Opening Operations | Mercantiles        |
| Feed Mills                         | Metal Working      |
| Leather Goods Manufacturing        | Paper & Pulp Mills |



**FALLOUT SHELTER** – (Defined in Section 511.2)

**FALLOUT SHELTER, DUAL-USE** – (Defined in Section 511.2)

**FALLOUT SHELTER, SINGLE-USE** – (Defined in Section 511.2)

**FAMILY** – means one or more persons living together, whether related to each other by birth or not, and having common housekeeping facilities.

**FIRE DISTRICT** – (See Section 301.)

**FIRE DOOR** – means a door and its assembly, so constructed and assembled in place as to give the specified protection against the passage of fire.

**FIRE PARTITION** – means a partition of construction which subdivides a building to restrict the spread of fire or to provide areas of refuge, but is not necessarily continuous through all stories nor extended through the roof, and which has a fire-resistance rating as required by the Code.

**FIRE-RESISTANCE RATING** – means the time in hours that the material or construction will withstand the standard fire exposure as determined by a fire test made in conformity with the “Methods of Fire Tests of Building Construction and Materials, ASTM E119.”

**FIRE RETARDANT (PRESSURE TREATED) WOOD** – means wood chemically impregnated in accordance with AWWA Standard C1-82 or by other approved means during manufacture and shall have a flame spread rating not exceeding 25, with no evidence of significant progressive combustion when tested for 30 minutes in accordance with “Methods of Test for Surface Burning Characteristics of Building Materials”, ASTM E-84. All materials shall bear identification showing the fire performance rating thereof issued by an approved agency having a re-examination service and, when exposed to the weather shall be identified as “Exterior”. Exterior grade shall comply with requirements of the “Method of Test for Durability of Fire Retardant Treated Wood” ASTM 2898. *Where experience has demonstrated a specific need for use of material of low hygroscopicity, fire retardant treated wood to be subjected to high humidity conditions shall be identified to indicated the treated wood has a moisture content of not over 28 percent when tested in accordance with ASTM D 3201 procedures at 92% humidity.* Subsequent to treatment, fire retardant treated lumber and plywood shall be dried to a moisture content of 19% or less for lumber and 15% or less for plywood.

**FIRE WALL** – is a fire resistive wall, having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof.

**FLAME SPREAD** – is the propagation of flame over a surface.

**FLAME SPREAD RATING** – is that numerical value assigned to a material tested in accordance with “Method of Test for Surface Burning Characteristics of Building Materials, ASTM E84.”

**FLOOR AREA** – See AREA (floor).

**FOOTBOARDS** – (Defined in Section 503.2)

**FRONT OF LOT** – means the front boundary line of a lot bordering on the street, and in the case of a corner lot, may be either frontage.

## DEFINITIONS AND STANDARDS

**GALLERY** – means that portion of the seating space of an assembly room having a seating capacity of more than ten (10) located above a [balcony](#).

**GARAGE** – means a building or structure or a portion thereof, in which a motor vehicle containing a flammable fluid in its fuel storage tank, is stored, housed, kept, repaired or serviced;

**AUTOMOTIVE SERVICE GARAGE** – means a garage where no repair work is done except exchange of parts and maintenance requiring no open flame, cutting, welding or the use of highly flammable liquids;

**BASEMENT PARKING GARAGE** – means an enclosed parking garage located in a basement, and includes an underground parking garage;

**CARPORT** – means a garage attached to a dwelling and having one or more open sides;

**ENCLOSED PARKING GARAGE** – means a garage having exterior enclosure walls and used for the parking of motor vehicles;

**MOTOR VEHICLE SERVICE GARAGE** – means a garage in which a flammable fluid for retail supply to motor vehicles is stored, housed or sold;

**OPEN AIR PARKING GARAGE** – means a garage having not less than 50 per cent of two sides of the garage open to the air at each story and used for the parking of motor vehicles;

**REPAIR GARAGE** – means a garage wherein major repairs may be made to more than two motor vehicles at a time.

**GARAGE-PRIVATE GARAGE** – (Defined in [Section 412.6](#)).

**GARAGE-PUBLIC GARAGE** – means any garage other than a private garage.

**GLASS & GLAZING** – (See [Chapter 20](#))

**GLASS FIBER REINFORCED PLASTIC** – (Defined in [Section 2201.2\(f\)](#))

**GRADE** – is a reference plane representing the average of finished ground level adjoining the building at all exterior walls.

**GRADE** – with reference to lumber, means the division of sawn lumber into quality classes with respect to its physical and mechanical properties as defined in published lumber manufacturers' standard grading rules.

**GRANDSTANDS** – (Defined in [Section 503.2](#))

**GRANDSTANDS, OPEN AIR** – (Defined in [Section 503.2](#))

**GROUND SIGN** – (Defined in [Section 2301.2\(b\)](#))

**HABITABLE SPACE** – is a space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space, and similar areas are not considered habitable space.

**HEATING** – (All definitions in [Chapter 29](#) and Mechanical Code.)

**HEIGHT** – as applied to a building, means the vertical distance from average grade to the highest finished roof surface in the case of flat roofs or to a point at the average height of pitched roofs; **HEIGHT** of a building in stories does not include [basements](#) and cellars, except as specifically provided otherwise.

**HISTORIC BUILDINGS** – (Defined in [Section 1009.1](#))

**HORIZONTAL SEPARATION** – means a permanent open space between the building wall under consideration and the lot line or the center line of a facing street, [alley](#) or public way. Where two or more buildings are on a lot, the horizontal separation of the wall under consideration shall be measured from an imaginary line drawn at a distance from the facing wall equal to the horizontal separation required for that wall.

**HOTEL** – is any building containing six (6) or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied or which are occupied for sleeping purposes by guests.

**INCOMBUSTIBLE MATERIAL** – is synonymous with [NONCOMBUSTIBLE MATERIAL](#).

**INDEPENDENCE OF JUDGEMENT** – (Defined in [Section 2101.2\(7\)](#))

**INDUSTRIAL OCCUPANCY** – (Defined in [Section 408](#)).

**INNER COURT** – an open unoccupied space bounded by the walls of the building, but located within the exterior walls of the building.

**INSTALLATION** – (Defined in [Section 2101.2 \(8\)](#))

**INSTITUTIONAL OCCUPANCY** – (Defined in [Section 409](#)).

**INTERIOR LOT LINE** – is synonymous with [COMMON-PROPERTY LINE](#).

**INSPECTION DEPARTMENT** – refer to [BUILDING OFFICIAL](#).

**INSPECTOR** – refer to [BUILDING OFFICIAL](#).

**KIOSK** – A small light structure with one or more open sides.

**LABEL** – (Defined in [Section 2102.2 \(9\)](#))

**LIGHT DIFFUSING SYSTEM** – (Defined in [Section 2201.2 \(b\)](#))

**LIGHT HAZARD OCCUPANCIES** – Light Hazard-Occupancies or portions of other occupancies where the quantity and/or combustibility of contents flow and fires with relatively low rates of heat release are expected. Light Hazard Occupancies include occupancies such as:

- |  |  |
|--|--|
| Churches                               | Museums  |
| Clubs                                  | Nursing or Convalescent Homes                                |
| Educational                            | Office, including Data Processing                            |
| Hospitals                              | Residential  |
| Institutional                          | Restaurant seating areas                                     |
| Libraries, except large<br>stack rooms | Theaters and Auditoriums excluding<br>stages and prosceniums |

**LINTEL** – means the beam or girder placed over an opening in a wall which supports the wall construction above.

## DEFINITIONS AND STANDARDS

**LISTED** – Equipment or materials included in a list published by a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner. The means for identifying listed equipment may vary for each testing laboratory, inspection agency, or other organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product. (Note: Refer to North Carolina General Statutes 66-23 through 66-27 entitled "Electrical Materials, Devices, Appliances and Equipment.")

**LOAD, DEAD** – means the weight of all permanent construction including walls, floors, roofs, partitions, stairways and of fixed service equipment. (See [Section 1202](#))

**LOAD, LIVE** – is the weight superimposed by the use and occupancy of the building, not including the wind load, earthquake load, or dead load. (See [Section 1203](#))

**LOCAL ENFORCEMENT AGENCY** – (Defined in [Section 2101.2\(10\)](#))

**LOCAL GOVERNMENT** – (Defined in [Section 2101.2\(11\)](#))

**LOT** – a parcel of land considered as a unit.

**LOT LINE** – means a line dividing one lot from another, or from a street or other public space.

**MCSC** – Model Codes Standardization Council.

**MALL (enclosed)** – is a covered or roofed interior area used as a pedestrian promenade and connecting tenant spaces and/or groups of tenant spaces housing individual or multiple tenants.

**MALL (open)** – means an area composed of sidewalks and landscaping which serves as a pedestrian thoroughfare between buildings but is not dedicated to public use.

**MANUFACTURED BUILDING** – (Defined in [Section 2101.2\(12\)](#))

**MARQUEE SIGN** – (Defined in [Section 2301.2\(f\)](#))

**MASONRY** – means that form of construction, composed of stone, brick, concrete, gypsum, hollow clay tile, concrete block or tile, or other similar building units or materials or a combination of these materials laid up unit by unit and set in mortar. For the purpose of this Code, plain monolithic concrete shall be considered as masonry. (See [Section 1402.6](#)).

**HOLLOW MASONRY UNIT** – means a masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than 75 per cent of its gross cross-sectional area measured in the same plane;

**MASONRY OF HOLLOW UNITS** – means masonry consisting wholly or in part of hollow masonry units laid contiguously in mortar;

**REINFORCED MASONRY** – means unit masonry in which reinforcement is imbedded in such a manner that the two materials act together in resisting forces.

**SOLID MASONRY** – means masonry consisting of solid masonry units laid contiguously in mortar, or consisting of plain concrete;

**SOLID MASONRY UNIT** – means a masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

**MEANS OF EGRESS** – (Defined in [Section 1102\(a\)](#))

**MEZZANINE** – is an intermediate level between the floor and ceiling of any story, and covering less than thirty-three and one-third (33 1/3) percent of the floor area immediately beneath.

**MIXED TYPES OF CONSTRUCTION** – has the meaning as set forth in [Section 609](#) of this Code.

**MOBILE HOME** – (Defined in [Section 2101.2\(13\)](#))

**MOTEL** – shall mean hotel as defined in this Code.

**MULTIPLE DWELLING** – has the same meaning as [APARTMENT HOUSE](#).

**MULTIFAMILY HOUSE** – means a building or portion thereof containing three or more dwelling units; including tenement house, [apartment house](#), flat.

**NONCOMBUSTIBLE BUILDING MATERIAL** – is one which, in the form and thickness in which it is used, meets any of the following requirements:

1. Materials which pass the test procedure for defining noncombustibility of elementary materials set forth in ASTM E 136 when exposed to a furnace temperature of thirteen hundred eighty-two (1382) degrees F. for a period of five (5) minutes, and do not cause a temperature rise of the surface or interior thermocouples in excess of fifty-four (54) degrees F. above the furnace air temperature at the beginning of the test and which do not flame after an exposure of thirty (30) seconds.
2. Materials having a structural base of noncombustible materials as defined in paragraph one, with a surfacing not more than one-eighth (1/8) inch thick which has a flamespread rating not greater than fifty (50) when tested in accordance with the method of test for surface burning characteristics of building materials set forth in ASTM E 84.

The term noncombustible does not apply to the flamespread characteristics of interior finish or trim materials. A material shall not be classed as noncombustible building construction material which is subject to increase in combustibility or flamespread rating beyond the limits herein established through the effects of age, moisture or other atmospheric conditions.

**OCCUPIED** – as applied to a building, shall be construed as though followed by the words “or intended, arranged or designed to be occupied.”

**OCCUPANCY** – is the purpose for which a building, or part thereof, is used or intended to be used.

**MIXED OCCUPANCY** – means mixed occupancy as set forth in [Section 403](#) of this Code.

**SPECIAL OCCUPANCY** – means Group H Occupancy, as set forth in [Section 411](#) of this Code.

**OPEN CONSTRUCTION** – (Defined in [Section 2101.2\(14\)](#))

**ORDINARY CONSTRUCTION** – (Defined in [Section 606](#)).

**ORDINARY HAZARD OCCUPANCIES** – Ordinary Hazard (Group 1) – Occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stock piles of combustibles do not exceed eight feet and fires with moderate rates of heat release are expected.

Ordinary Hazard Occupancies (Group 1) include occupancies such as:

Automobile Parking Garages	Electronic Plants
Bakeries	Glass and Glass Products Manufacturing
Beverage Manufacturing	Laundries
Canneries	Dairy Products Mfg. and Processing

Ordinary Hazard (Group 2) – Occupancies or portions of other occupancies where quantity and/or combustibility of contents is moderate, stock piles do not exceed 12 feet and fires with moderate rate of heat release are expected.

Ordinary Hazard Occupancies (Group 2) include occupancies such as:

Cereal Mills	Mercantile
Chemical Plants – Ordinary	Machine Shops
Cold Storage	Metal Working
Confectionery Products	Printing and Publishing
Distilleries	Textile Mfg.
Leather Goods Mfg.	Tobacco Products Mfg.
Libraries-Large Stack Room Areas	Wood Product Assembly

Ordinary Hazard (Group 3) – Occupancies or portions of other occupancies where quantity and/or combustibility of contents is high, and fires of high rate of heat release are expected.

Ordinary Hazard Occupancies (Group 3) include occupancies such as:

- Exhibition Halls
- Feed Mills
- Paper and Pulp Mills
- Paper Process Plants
- Piers and Wharves
- Repair Garages
- Tire Manufacturing
- Warehouses (having moderate to higher combustibility of content such as paper, household furniture, paint, general storage, whiskey, etc.)
- Wood Machining

**OWNER** – is any person, agent, firm or corporation having a legal or equitable interest in the property.

**PARTITION** – means an interior wall, other than folding or portable, that subdivides spaces within any story, [attic](#) or [basement](#) of a building.

**PENTHOUSE** – is an enclosed structure above the roof of a building, other than a roof structure or bulkhead, occupying not more than one-third (1/3) of the roof area.

**PERMANENT AWNING** – means a roof sheltering a sidewalk, platform or paved area.

**PERMIT** – is an official document or certificate issued by the authority having jurisdiction authorizing performance of a specified activity.

**PERSON** – means a natural person, his heirs, executors, administrators, or assigns, and also includes a firm, partnership, or corporation, it's or their successors or assigns, or the agent of any of the aforesaid.

**PLACE OF ASSEMBLY** – means a room or space used for assembly or educational occupancy for 100 or more occupants.

**PLASTIC** – means a material that contains as an essential ingredient an organic substance of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or in its processing into finished articles, can be shaped by flow.

**PLASTIC GLAZING** – (Defined in [Section 2201.2\(c\)](#))

**PLASTIC ROOF PANELS** – (Defined in [Section 2201.2 \(d\)](#))

**PLASTIC WALL PANELS** – (Defined in [Section 2201.2 \(e\)](#))

**PLENUM** – is an air compartment or chamber to which one or more ducts are connected and which forms part of an air distribution system.

**PREFABRICATED CONSTRUCTION** – (Defined in [Section 2101.2\(15\)](#))

**PREFABRICATED SUBASSEMBLY** – (Defined in [Section 2101.2\(16\)](#))

**PREFABRICATED UNIT** – (Defined in [Section 2101.2\(17\)](#))

**PROJECTION SIGN** – (Defined in [Section 2301.2\(e\)](#))

**PROTECTION FACTOR** – (Defined in [Section 511.2](#))

**PUBLIC SPACE** – is a legal open space twenty-one (21) feet or more in width on the premises, accessible to a public way or street, such as yards, courts or open spaces permanently devoted to public use which abuts the premises, and that is permanently maintained accessible to the Fire Department and free of all encumbrances that might interfere with its use by the Fire Department.

**RAIL (guard)** – a bar extending from one post or support to another and serving as a guard or barrier.

**RAIL (hand)** – a narrow rail for grasping with the hand as a support.

**REPAIR** – is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

**REQUIRED** – means required by some provision of this Code.

**RESIDENTIAL CARE FACILITIES** – (Defined in [Section 510](#)).

**RESIDENTIAL OCCUPANCY** – (Defined in [Section 411](#)).

**REVIEWING STANDS** – (Defined in [Section 503.2](#))

**ROOF SIGN** – (Defined in [Section 2301.2\(c\)](#))

**ROOF STRUCTURE** – is an enclosed structure on or above the roof of any part of a building.

**ROOM CAPACITY** – (See [Chapter 11](#)).

**SAFE DISPERSAL AREA** – (Defined in [Section 503.2](#))

**SCHOOL OCCUPANCY** – (Defined in [Section 406](#)).

**SEATING CAPACITY** – (See [Chapter 11](#)).

**SELF-CLOSING** – as applied to a fire door or other opening, means normally closed and equipped with an approved device which will insure closing after having been opened for use.

**SERVICE STATION** – (Defined in [Section 405.4](#)).

**SHAFT** – means a vertical opening extending through one or more stories of a building, for elevators, dumbwaiter, light, ventilation, or similar purpose.

**SHALL** – as used in this Code, is mandatory.

**SHINGLE SIGN** – (Defined in [Section 2301.2\(g\)](#))

**SIGNS** – (See [Chapter 23](#)).

**SMOKE DETECTOR** – A smoke detector is an approved listed detector sensing either visible or invisible particles of combustion.

**SMOKEPROOF TOWER** – (See [Section 1104.2](#))

**SPECIAL OCCUPANCY** – means Group H Hazardous occupancy, as set forth in [Section 107](#) of this Code.

**SPECTACULAR SIGNS** – (Defined in [Section 2301.2\(a\)](#))

**SPRINKLERED** – means equipped with an approved automatic sprinkler system properly maintained. See [Chapter 9](#).

**STAGE** – is a partially enclosed portion of an assembly building which is designed or used for the presentation of plays, demonstrations or other entertainment wherein scenery, drops, or other effects may be installed or used, and where the distance between the top of the proscenium opening and the ceiling above the stage is more than five (5) feet.

**STAGE–WORKING** – (Also Theatrical Stage – See [Section 404.9](#) and [404.10](#)) – a working stage is a partially enclosed portion of an Assembly Building, cut off from the audience section by a proscenium wall of masonry of not less than four (4) hour fire-resistive construction, and which is equipped with scenery, loft, gridiron, fly gallery, and lighting equipment, and the proscenium opening shall be equipped with a fire-proof and smoke-proof curtain, and the depth from the proscenium curtain to the back wall shall be not less than fifteen (15) feet.

**STAGE–NON-WORKING** – a non-working stage is a partially enclosed portion of an Assembly Building, cut off from the audience section by a proscenium wall of not less than one (1) hour fire-resistive construction, without the equipment common to the Working Stage (such as fly gallery and grid iron) and of such dimensions that such equipment cannot be installed (but flat scenery may be used on such stage).

A fireproof curtain is not required for a non-working stage, but if there is a fabric or other curtain it shall be of noncombustible materials or treated with an approved fire retardant. The depth of the stage may be more or less than fifteen (15) feet.



**STAGE, PLATFORM** – a platform is a raised section of floor within the assembly hall or auditorium area, and setting on the floor thereof, not enclosed above the platform floor level, and usually or relatively small area as compared to the auditorium seating area. A platform may be of permanent, temporary, or portable construction; it may have "flat" movable scenery and draw curtains.

**STAGE, ROSTRUM** – (See [STAGE, PLATFORM](#)) usually used for single or small group of persons such as lecturers, no scenery or curtains. May be permanent, temporary, or portable.

**STAGE, DIAS** – a small and low "platform" or "rostrum" may be placed on a stage". May be permanent, temporary, or portable.

**STAGE, PODIUM** – a small "dais" of size sufficient to accommodate one or two persons, such as a band or orchestra conductor or a soloist. A "podium" may be located on a Stage, Platform, Rostrum, or Dais, or the floor of the audience section of a place of assembly. A podium is almost always a portable construction.

**STAIRWAY** – means one (1) or more flights of stairs and the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one (1) story to another in a building or structure.

**STANDARD FIRE TEST** – means the fire test formulated under the procedure of the American National Standards Institute as the "Methods of Fire Tests of Building Construction and Materials, ASTM E119, ANSI A2.1.

**STORY** – is that portion of a building included between the upper surface of a floor and upper surface of the floor or roof next above. The [basement](#) of a building shall be considered a story if it is used for purposes other than storage or heating.

**STREET** – means any public thoroughfare (street, avenue, boulevard, park) or space more than twenty (20) feet in width which has been dedicated or deeded to the public for public use.

**STREET LINE** – means a lot line dividing a lot from a street.

**STRUCTURE** – is that which is built or constructed.

**STRUCTURAL-USE PANELS** – (See [Section 1700.3\(j\)](#)).

**SURVEYOR** – within the meaning of this Code, shall be deemed to be a duly registered and licensed surveyor or Civil Engineer.

**THEATER** – means a building or part thereof, which contains an assembly hall with or without stage which may be equipped with curtains and permanent stage scenery or mechanical equipment adaptable to the showing of plays, operas, motion picture, performances, spectacles and similar forms of entertainment. (See [Section 404](#)).

**THERMOPLASTIC MATERIAL** – (Defined in [Section 2201.2\(h\)](#))

**THERMOSETTING MATERIALS** – (Defined in [Section 2201.2\(g\)](#))

**TOWNHOUSE** – is a single-family dwelling unit constructed in a series or group of attached units with property lines separating such units.

**UNIT OF EGRESS WIDTH** – (Defined in [Section 511.2](#) & [1105.2](#))

**VALUATION OR VALUE** – as applied to a building, means the estimated cost to replace the building in kind.

**VENEER** – means a facing attached to a wall for the purpose of providing ornamentation, protection, or insulation, but not counted as adding strength to the wall.

**VERTICAL OPENING** – is an opening through a floor or roof.

**WALKWAY, COVERED** – (Defined in [Section 505.2](#))

**WALKWAY, ENCLOSED** – (Defined in [Section 505.2](#))

**WALKWAY, TUNNELED** – (Defined in [Section 505.2](#))

**WALL (bearing)** – is a wall supporting any vertical load in addition to its own weight.

**WALL (nonbearing)** – is a wall which supports no vertical load other than its own weight.

**WALL (retaining)** – is a wall designed to prevent the lateral displacement of soil or other material.

**WALL, CAVITY** – means a wall built of masonry units or of plain concrete, or a combination of these materials, so arranged as to provide an air space within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

**WALL, CURTAIN** – means a non-bearing wall between columns or piers and which is not supported by girders or beams, but is support on the ground.

**WALL, FACED** – means a wall in which the masonry facing and backing are so bonded as to exert common action under load.

**WALL, EXTERIOR** – means a wall, bearing or non-bearing, which is used as an enclosing wall for a building, but which is not necessarily suitable for use as a Party Wall or Fire Wall.

**WALL, FOUNDATION** – means a wall below the first floor extending below the adjacent ground level and serving as support for a wall, pier, column or other structural part of a building.

**WALL OF MASONRY, HOLLOW** – means a wall built of masonry units so arranged as to provide an air space within the wall, and in which the inner and outer parts of the walls are bonded together with masonry units or steel.

**WALL, PANEL** – means a non-bearing wall in skeleton or framed construction, built between columns or piers and wholly supported at each story.

**WALL, PARAPET** – means that part of any wall entirely above the roof line.

**WALL, PARTY** – a wall on an interior lot line, used or adapted for joint service between two (2) buildings.

**WALL SIGN** – (Defined in [Section 2301.2\(d\)](#))

**WOOD FRAME CONSTRUCTION** – (Defined in [Section 607](#)).

**WRITING** – includes printing and typewriting.

**WRITTEN NOTICE** – is a notification in writing delivered in person to the individual or parties intended, or delivered at, or sent by certified or registered mail to the last residential or business address of legal record.

**YARD** – is an unoccupied open space other than a court.

**LIMITED-COMBUSTIBLE MATERIAL** – as applied to a building construction material, means a material, not complying with the definition of noncombustible material, which has a potential heat value not exceeding 3,500 Btu per pound, and falls into the following paragraph. Materials which are subject to an increase in combustibility or flame spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be classed as combustible materials.

Materials, in the form and thickness used, having a flame spread rating not greater than 25 without evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would not have a flame spread rating greater than 25 without evidence of continued progressive combustion.

**SECTION 202 LISTING OF REFERENCED STANDARDS**

The following standards are referenced in various sections of this Code. The dates listed herein are the applicable dates unless otherwise noted in the Code text.

<b>Section References</b>	<b>Standard Designation</b>
201.2 .....	<b>ANSI A2.1-1972</b> – Fire Tests of Building Construction and Materials, Methods of
201.2 .....	<b>ASTM D 2898-77</b> – Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
201.2 .....	<b>ASTM D 3201-79</b> – Hygroscopic Properties of Fire Retardant Wood and Wood Base Products
201.2, 506.8, 704.3, 719, 2201.2 .....	<b>ASTM E84-76A</b> – Surface Burning Characteristics of Building Materials, Test for
201.2, 506.1, 703.2(b), 601.3 ....	<b>ASTM E119-76</b> – Fire Tests of Building Construction and Materials
201.2 .....	<b>ASTM E136-73</b> – Noncombustibility of Elementary Materials, Test for
201.2 .....	<b>AWPA C-1-82</b> – All Timber Products – Preservative Treatment by Pressure Process
402.4 .....	<b>NFiPA 30-1981</b> – Flammable and Combustible Liquids Code
402.4, 407.4 .....	<b>NFiPA 58-1983</b> – Liquefied Petroleum Gases, Storage and Handling
404.6 .....	<b>ASTM D626</b> –
404.11(a), 407.9(a)(3) .....	<b>NFiPA 40-1982</b> – Cellulose Nitrate Motion Picture Film.
404.14(a) .....	<b>NFiPA 701-1977</b> – Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.
407.4 .....	<b>NFiPA 33-1982</b> – Spray Finishing

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
407.4 .....	<b>NFiPA 34-1982</b> – Dip Tanks Containing Flammable or Combustible Liquids
407.4 .....	<b>NFiPA 51-1983</b> – Oxygen-Fuel Gas Systems for Welding and Cutting
407.4 .....	<b>NFiPA 37-1979</b> – Stationary Combustion Engines and Gas Turbines

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407.4	.....	<b>NFPA 40E-1980</b>	– Code for the Storage of Pyroxylin Plastic
407.4	.....	<b>NFiPA 63-1975</b>	– Prevention of Dust Explosions in Industrial Plants
407.4	.....	<b>NFiPA 651-1980</b>	– Standard for the Manufacture of Aluminum or Magnesium Powder
407.6(1)	.....	<b>NFiPA 32-1979</b>	– Dry Cleaning Plants
409.3, 901.11(b), 1008.2	.....	<b>NFiPA 71-1982</b>	– Central Station Protective Signaling Systems, for Guard, Fire Alarm, and Supervisory Service, Standard for the Installation, Maintenance and Use of
409.3, 901.11(b), 1008.2	.....	<b>NFiPA 72D-1979</b>	– Proprietary Protective-for Watchman, Fire Alarm and Supervisory Service
409.3	.....	<b>NFPA 74-1980</b>	– Design and Installation of Fire Warning Systems
505.5, 507.2(d), 1103.3(e), 1104.8(a)(2), 1104.9(a) (c)	...	<b>NFiPA 204M-1982</b>	– Smoke and Heat Venting, Guide for
506.4, 901.3, 901.4, 901 9, 1008.2(e)(3)	.....	<b>NFiPA 13-1983</b>	– Automatic Sprinkler Systems
506.7, 1121(a), 1122, 3101, 1203.4(a)	.....	<b>ANSI A17.1-1971</b>	– Elevators, Dumbwaiters, Escalators and Moving Walks, Safety Code for
703.2(b)	.....	<b>ASTM E152-76</b>	– Fire Tests of Door Assemblies
704.3	.....	<b>UL 992</b>	– Chamber Test
706.4	.....	<b>UL 55B</b>	– Class C Asphalt Organic-Felt Sheet Roofing and Shingles
720.2	.....	<b>UL 217</b>	– Single and Multiple Station Smoke Detectors
720.2	.....	<b>ANSI/UL 268</b>	– Smoke Detectors
901.11(b)	.....	<b>NFPA 73</b>	– Electric-Motor-Operated Appliances
1008.2	.....	<b>NFiPA 72A-1979</b>	– Local Protective Signal Systems
1008.2	.....	<b>NFPA 72B-1979</b>	– Auxiliary Protective Signaling Systems
1008.2	.....	<b>NFPA 72C-1982</b>	– Remote Station Protective Signaling Systems
1008.2	.....	<b>ANSI/UL 268</b>	– Smoke Detectors for Fire Protective Signaling Systems
1008.2	.....	<b>NFPA-72D-1979</b>	– Proprietary Protective Signaling Systems
1008.2	.....	<b>NFPA-72E-1982</b>	– Automatic Fire Detectors
1116.9(b)	.....	<b>NFiPA 80-1982</b>	– Fire Doors and Fire Windows
3003	.....	<b>NFiPA 70-1981</b>	– National Electrical Code
1201.4, 1302.3, 1303.1(b), 1304.1(c), 1602.3(f), 1605, 1605(b), 1605(i)	.....	<b>ACI 318-1977</b>	– Reinforced Concrete, Building Code Requirements for

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
Table 12A	..... <b>AASHTO</b> – Standard Specification for Highway Bridges–1977
1203.1, Table 12A, 503.6(c)	.... <b>NFPA 102-72-1978</b> – Tents, Grandstands and Air-Supported Structures Used for Places of Assembly

1203.4(a)	ANSI A17.2-1973 – Elevators, Dumbwaiters, Escalators & Moving Walks-Inspector's Manual
1205.4(c)	NAVFAC DM -2 10/70 – Naval Design Manual-Structural Engineering
1301.3	NFoPA-1982 – Technical Report No.7, The All-Weather Wood Foundation System
1301.3	AWPB FDN-80 – Quality Control Program for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Ground Contact Use in Residential and Light Commercial Foundations.
1302.1(c)(1)&(2)	ASTM D-1586 – Standard Penetration Resistance
1303.2(d)	ASTM D-1143-74 – Pile Load Test
1303.4(b)(2)	AWPA C-3-1981 – Piles–Preservative Treatment by Pressure Processes
1303.4(b)(1)	ASTM D25-1979 – Round Timber Piles, Spec. for
1303.4(b)(3), Table 1304	ASTM D2899-1974 – Establishing Design Stresses for Round Timber Piles
1303.4(c)(2)	ASTM A252-74 – Standard for Welded and Seamless Steel Pipe Piles, Spec. for
1303.4(d)(1)	ACI 543-74 – Recommendations for Design, Manufacture and Installation of Concrete Piles
1303.4(c)(3)	ASTM A36-1975 – Structural Steel, Spec. for
1303.4(c)(3)	ASTM A572-1976 – High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality, Spec for
2501.3	ASTM C62-1975a – Building Brick (Solid Masonry Units Made from Clay or Shale), Spec. for
1402.1	ASTM C55-1975 – Concrete Building Brick, Spec. for
1402.1	ASTM C73-1975 – Calcium Silicate Face Brick (Sand-Lime Brick), Spec. for
1402.1, 1402.2	ASTM C34-1975 – Structural Clay Load-Bearing Wall Tile, Spec. for
1402.2	ASTM C56-1976 – Structural Clay Non-Load Bearing Tile, Spec. for
1402.2	ASTM C57-1957 – Structural Clay Floor Tile, Spec. for
1402.4(a)	ASTM C90-1975 – Hollow Load-Bearing Concrete Masonry Units, Spec. for
1402.4(a)	ASTM C129-1975 – Hollow Non-Load Bearing Concrete Masonry Units, Spec. for
1402.4(a)	ASTM C145-1975 – Solid Load- Bearing Concrete Masonry Units, Spec. for
1402.5	ACI 704-1973 – Cast Stone, Spec. for
1402.5, 1402.9	ASTM C52-1972 – Gypsum Partition Tile or Block, Spec. for
1402.11(a)	ASTM C270-1973 – Mortar for Unit Masonry, Spec. for
1402.11(b)	ASTM C91-1975 – Masonry Cement, Spec. for

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
1402.11(d)	ASTM C476-1976 – Mortar and Grout for Reinforced Masonry, Spec. for
1402.13(a)	ASTM C242-60 – Ceramic Tile, Recommended Standard Spec. for

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1402.13(b)	ANSI A 108.1-1976	– Installation of Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile, and Paver Tile with Portland Cement Mortar
1402.13(b)	ANSI A108.2-1967	– Ceramic Mosaic Tile Installed with Portland Cement Mortar, Spec. for
1402.13(b)	ANSI A108.3-1967	– Quarry Tile and Paver Tile Installed with Portland Cement Mortar, Spec. for
1402.13(c)	ANSI A 136.1-1972	– Organic Adhesives for Installation of Ceramic Tile, Type I and Type II
1402.13(d)	ANSI A108.5-1976	– Ceramic Tile Installed with Dry-Set Portland Cement Mortar
1402.13(d)	ANSI A118.1-1976	– Dry-Set Portland Cement Mortar, Spec. for
1402.14(a)	ASTM A153-71	– Zinc Coatings on Iron or Steel, Spec. for
1402.14(b)	ASTM A116-71	– Zinc Coating on Wire, Spec. for
1402.14(c)	ASTM B277-65	– Copper Coating on Wire, Spec. for
1402.14(c)	ASTM A 82-70	– Cold Drawn Steel Wire for Concrete Reinforcement, Spec. for
1402.14(c)	ASTM A 615-68	– Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec. for
1402.16(b)(1)	ASTM C 109-73	– Compressive Strength of Hydraulic Cement Mortars, Test for
1402.16(b)(1)	ASTM C 349-72	– Compressive Strength of Hydraulic Cement Mortars, Test for
1402.16(b)(2)	ASTM C 348-72	– Flexural Strength of Hydraulic Cement Mortars, Test for
1403.7, 1411.1(b)	SCPI	– Recommended Building Code Requirements for Engineering Brick Masonry
Table 4, 1403.7, 1411.1(a)	NCMA-1970	– Design & Construction of Load-Bearing Concrete Masonry, Spec. for
Table 4, 1403.7, 1411.1(a)	ACI 531-1979-Revised 1981	– Concrete Masonry Structures-Design & Construction
1412.1(a)	ASTM C317-1976	– Gypsum Concrete, Spec. for
1412.1(b)	ANSI A59.1-1973	– Reinforced Gypsum Concrete, Spec. for
1502	AISC	– "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," November 1, 1978
1503	AISI	– "Design of Cold-Formed Steel Structural Members" 1968 edition and addendum #1, Feb. 4, 1977
1504	AISI	– "Specification for the Design of Cold-Formed Stainless Steel Structural Member, 1974 edition"
1505	AISC-SJI	– February 15, 1978 – "Standard Specifications for Open Web Steel Joists H Series"

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
1505	AISC-SJI – February 15, 1978 – "Standard Specifications for Longspan Steel Joists, LH Series, and Deep Longspan Steel Joists, DLH Series"
1505	SJI – May 15, 1978 – "Standard Specifications for Joist Girders"

1506 .....	<b>AISI</b> – 1973 edition “Criteria for Structural Application of Steel Cables for Buildings”
1507 .....	<b>AWS D1.1-1979</b> – "Structural Welding Code"
1507 .....	<b>AWS D1.3-1978</b> – "Specifications for Welding Sheet Steel in Structures"
1508 .....	<b>ASTM A325 or A490 Bolts, August 14, 1980</b> – Specifications for structural joints using
1509 .....	<b>ANSI/ASTM A6-77b</b> – "Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use". (Approved November, 1977)
1601 .....	<b>ACI 322-1972</b> – Structural Plain Concrete, Building Code Requirements for
1602.2(d), Table 1602.2A .....	<b>ASTM C150-1976</b> – Portland Cement, Spec. for
1602.2(b)2 .....	<b>ACI 214-1965</b> – Evaluation of Compression Test Results of Field Concrete, Recommended Practice for
1602.2(c), 1602.3(a) .....	<b>ASTM C39-1972</b> – Compressive Strength of Cylindrical Concrete Specimens, Test for
1602.2(c) .....	<b>ASTM C192-1976</b> – Making and Curing Concrete Test Specimens in the Laboratory
1602.3(a) .....	<b>ASTM C172-1971</b> – Fresh Concrete, Sampling
1602.3(a): 1602.3(d) .....	<b>ASTM C31-1975</b> – Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the field
1602.3(e) .....	<b>ASTM C42-1974</b> – Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
1604 .....	<b>ANSI A122.1-1965</b> – Vermiculite Concrete Roofs and Slabs on Grade, Spec. for
1607 .....	<b>ACI 306-66</b> – Cold Weather Concreting, Recommended Practice
1700.1(f) .....	<b>NFoPA</b> – "National Design Specification and Supplement 1982"
1700.1(f) .....	<b>NFoPA</b> – Wood Construction Data No. 5-1971
1700.1(f) .....	<b>AITC 100-1972</b> – Timber Construction Standards
1700.1(f) .....	<b>AITC 200-1973</b> – Inspection Manual
1700.1(f) .....	<b>AITC</b> – Timber Construction Manual Section Edition-1974, Part II only-1974 including Supplements 2 and 3
1700.1(f) .....	<b>AITC 102-78</b> – Design of Structural Timber Framing, Standards for the
1700.1(f) .....	<b>AITC 104-79</b> – Construction Details, Typical
1700.1(f) .....	<b>AITC 108-80</b> – Heavy Timber Construction, Standard for
1700.1(f) .....	<b>AITC 109-81</b> – Structural Glued Laminated Timber, Testing Standard for

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
1700.1(f) .....	<b>AITC 110-81</b> – Structural Glued Laminated Timber, Standard Appearance Grades for
1700.1(f) .....	<b>AITC 111-79</b> – Structural Glued Laminated Timber During Transit, Storage and Erection, Recommended Practice for Protection of

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1700.1(f) .....	<b>AITC 112-81</b> – Tongue and Groove Heavy Timber Roof Decking, Standards for,
1700.1(f) .....	<b>AITC 113-80</b> – Glued Laminated Structural Members, Standard for Dimensions of
1700.1(f) .....	<b>AITC 117-1974</b> – Change designation to 117-79
1700.1(f) .....	<b>AITC 119-1971</b> – Change designation to 119-81
1700.1(f) .....	<b>AITC 120-71</b> – Delete
1700.1(f) .....	<b>AITC 117-1974</b> – Structural Glued Laminated Timber of Douglas Fir, Western Larch, Southern Pine and California Redwood
1700.1(f) .....	<b>AITC 119-1971</b> – Hardwood Glued Laminated Timber, Standard Spec. for
1700.1(f) .....	<b>AITC 120-71</b> – Structural Glued Laminated Timber Using "E" Rated and Visually Graded Lumber of Douglas Fir, Southern Pine, Hem-Fir, and Lodgepole Pine, Standard Spec. for
1700.1(f) .....	<b>APA 1980</b> – Plywood Design Specification
1700.1(f) .....	<b>APA 1975</b> – Design and Fabrication Specifications for Plywood –Lumber Components
1700.1(f), 1705.3(a), Table 1705.6A .....	<b>APA 1981</b> – Design/Construction Guide – Residential & Commercial
1700.1(f), 1700.3(j) .....	<b>APA</b> – Performance Standards and Policies for Structural-Use Panels
1700.1(f) .....	<b>APA 1975</b> – Cantilevered In-Line Joist System
1700.1(f), 1707.2(c), 1707.3(a)..	<b>TPI 1978</b> – Design Specification for Metal Plate Connected Wood Trusses
1700.1(f) .....	<b>AWPI-1969</b> – "Pole Building Design"
1700.1(f), 1700.3(g) .....	<b>NPA-1969</b> – "How to Install Particleboard Underlayment"
1700.3(a), 1700.3(b) .....	<b>PS 56-1973</b> – Structural Glued Laminated Timbers, Product Standard for
1700.3(c), Table 3 .....	<b>PS 1-1974</b> – Construction and Industrial Plywood, Product Standard for
1700.3(e) .....	<b>PS 57-1973</b> – Cellulosic Fiber Insulating Board, Product Standard for
1700.3(e) .....	Standards of IB Specification No. 1-1970, No. 2-1972 or No. 3-1972
1700.3(f) .....	<b>PS 58-1973</b> – Basic Hardboard, Product Standard for
1700.3(f) .....	<b>PS 59-1973</b> – Prefinished Hardboard Paneling Product, Standard for
1700.3(f) .....	<b>PS 60-1973</b> – Hardboard Siding, Product, Standard for
1700.3(g), 1706.2(d)(5), 1706.7(f) .....	<b>ANSI A208.1-1979</b> – Mat-Formed Wood Particleboard, American National Standard
1700.3(i) .....	<b>PS 51-1971</b> – Hardwood and Decorative Plywood, Product Standard for
1700.4(a), 1707.1(a) .....	<b>NFoPA-1977</b> – "Design Values for Joists and Rafters"

**SECTION 202 LISTING OF REFERENCED STANDARDS (continued)**

<b>Section References</b>	<b>Standard Designation</b>
1700.5, <a href="#">Appendix C</a> .....	<b>AWPB LP2-1980</b> – Softwood Lumber, Timber and Plywood Pressure Treated with Water-borne Preservatives for Above Ground Use, Standard for



1702.11	.....	National Pest Control Association Standards
1702.14	.....	<b>AWPA M4-80</b> – Standard for Care of Preservative Wood Products
1705.3(a)	.....	<b>APA AFG-01</b> – Sept. 1974 “Adhesives for Field Gluing Plywood to Wood Framing”
1705.3(a)	.....	<b>APA</b> – Glued Floor Systems
1705.3(a), 1707.1(a), 1707.3(a)	.....	<b>NFoPA-1977</b> – "Span Tables for Joists and Rafters"
1902(a)	.....	<b>AA</b> – "Specifications for Aluminum Structures, third edition, April, 1976
2002	.....	<b>FS DDG-451c-(4)</b> –
2006	.....	<b>ANSI Z97.1-1972</b> – Performance Spec. and Methods of test for Safety Glazing Material Used in Buildings
2201.2(a), 2206.1(b)	.....	<b>ASTM D1929-1975</b> – Ignition Properties of Plastics, Test for
2201.2(a)	.....	<b>ASTM D2843-1976</b> – Measuring the Density of Smoke from the Burning or Decomposition of Plastics
2201.2(a)	.....	<b>ASTM D635-1976</b> – Test for Flammability of Self-Supporting Plastics
2501(a)	.....	<b>U.L.</b> – Building Material Directory, January, 1978 and Fire Resistance Directory, January, 1978
3001	.....	<b>NFiPA 70-1978</b> – "National Electrical Code"
3101	.....	<b>ANSI-A17.1-1971</b> – "American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks."
3201	.....	<b>ASTM C 687</b> – Recommended Practice for Determination of Thermal Resistance of low Density Fibrous Loose Fill Type Building Insulation
3201	.....	<b>ASTM C 236</b> – Test for Thermal Conductance and Transmittance of Built-Up Sections by Means of the Guarded Hot Box

**SECTION 203 STANDARDS ORGANIZATIONS**

<b>AA</b>	–	Aluminum Association, 750 Third Avenue, New York, New York
<b>ACI</b>	–	American Concrete Institute, P. O. Box 4754, Redford Station, 22400 West Seven Mile Road, Detroit, Michigan 48219
<b>AASHTO</b>	–	American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, D.C. 20004
<b>AISC</b>	–	American Institute of Steel Construction Inc, 1221 Avenue of the Americas, New York, New York 10020
<b>AISI</b>	–	American Iron and Steel Institute, 1000 16 <sup>th</sup> St., N.W. Washington, D.C. 20036
<b>AITC</b>	–	American Institute of Timber Construction, 333 W. Hampden Ave., Englewood, Colorado
<b>ANSI</b>	–	American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018
<b>APA</b>	–	American Plywood Association, P.O. Box 11700, Tacoma, Washington 98411

## DEFINITIONS AND STANDARDS

- ASTM – American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa 19103
- AWPA – American Wood Preservers Association, 1625 Eye St., N.W., Suite 625, Washington, DC
- AWPB – American Wood Preservers Bureau, P.O. Box 6085, Arlington, VA 22206
- AWPI – American Wood Preservers Institute, 1611 Old Meadow Road, McLean, Virginia 22111
- AWS – American Welding Society, Inc., 2501 N.W. Seventh St., Miami, Florida 33125
- CS – Commercial Standard (U.S. Department of Commerce, Bureau of Standards c/o U.S. Government Printing Office, Superintendent of Document, Washington, DC 20402)
- FS – Federal Specifications (Government Printing Office, Superintendent of Document, Washington, DC 20402)
- GA – Gypsum Association, 1603 Orrington Ave., Evanston, Illinois 60201
- NAVFAC – Naval Facilities Command, Commanding Officer, Naval Publications, 5801 Tabor Ave., Philadelphia, Pa
- NCMA – National Concrete and Masonry Association, 6845 Elm St., McLean, Virginia 22101
- NFPA – National Fire Protection Association, 470 Atlantic Ave., Boston, Massachusetts 02110
- NFoPA – National Forest Products Association, 1619 Massachusetts Ave., NW, Washington, DC 20036
- NPA – National Particleboard Association, 2306 Perkins Place, Silver Springs, Maryland 20910
- PS – Product Standard (U.S. Department of Commerce, Bureau of Standards c/o U.S. Government Printing Office, Superintendent of Document, Washington, DC 20402)
- SCPI – Structural Clay Products Institute, 1750 Old Meadow Road, McLean, Virginia 22101
- SJI – Steel Joist Institute, 1230 Keith Bldg., Cleveland, Ohio 44115
- TPI – Truss Plate Institute, 100 West Church St., Frederick, Maryland 21701
- UL – Underwriters' Laboratories, 207 East Ohio Street, Chicago, Illinois 60611

## CHAPTER 3 FIRE DISTRICT (FIRE LIMITS)

### SECTION 301 GENERAL BUILDING RESTRICTIONS – WITHIN FIRE DISTRICTS

#### 301.1 – GENERAL

For the purpose of this Code there shall be established a fire district or zone, which shall be known as the first Fire District. A second Fire District may be established by ordinance. (Reference - General Statutes 160A-435 through 160A-438, 153A-375)

#### 301.2 – TYPE OF CONSTRUCTION PERMITTED

Within the first and second fire districts every building or structure hereafter erected shall be one of the following types except those excluded by Section 304:

- Type I Construction
- Type II Construction
- Type III Construction
- Type IV Construction
  - One-Hour Protected
  - Unprotected
- Type V Construction
  - One-Hour Protected
  - Unprotected

#### 301.3 – OTHER SPECIFIC REQUIREMENTS

- (a) *Exterior Walls:* Exterior walls of buildings located in Fire Districts shall comply with the requirements specified in Chapter VI and Notes a, b, c, d and e of [Table 600](#).
- (b) *Group “H” Special Hazardous Not Permitted:* Every Group “H” occupancy shall be prohibited from location within the First Fire District.
- (c) *Fire Protection:* Every building shall be fire protected throughout as specified for the various types of construction, Chapter VI.
- (d) *Roof Coverings:* Roof coverings in the fire districts shall conform to the requirements for Class A or B roof coverings, as defined in [Section 706](#), except that Class C roof covering may be permitted on existing one and two family wood frame dwellings in Secondary Fire District.
- (e) *Interior Fire Protection - First Fire District:* In buildings over one story in height (unless of Type III Heavy Timber construction or sprinklered or an automobile parking structure; or surrounded on all sides by a permanently open space of not less than thirty (30) feet) all interior walls, partitions, floors, roofs and their supporting structural members shall provide not less than one (1) hour fire-resistance.

### **301.4 – SCOPE**

The Fire District or Fire Limits shall be as delineated by ordinance of the local governing body. References made in such ordinance to Fire District or Fire Limits shall be held to mean the Fire District that is the subject of this Chapter; and unless specifically stated otherwise, such references shall include both the primary and the secondary (if any) Fire Limits. (Refer: G.S. 160A-435 through 438 and G.S. 153A-375.)

## **SECTION 302 CHANGES TO BUILDINGS**

### **302.1 – EXISTING BUILDINGS WITHIN THE FIRE DISTRICT**

An existing building shall not be hereafter increased in height unless it is of a type of construction permitted for new buildings within the Fire District or is altered to comply with the requirements for such type of construction. Nor, shall any existing building be hereafter extended on any side unless such extensions are of a type of construction permitted for new buildings within the Fire District and unless such extension will create no violations of [Section 301.3\(e\)](#).

### **302.2 – ALTERATIONS – GENERAL**

Nothing in this Section, however, shall prohibit other alterations within the Fire District provided that the building or structure is not Type VI and there is no change of occupancy that is otherwise prohibited and provided the fire hazard is not increased by such alteration, in the opinion of the building official.

### **302.3 – MOVING BUILDINGS**

Buildings shall not hereafter be moved into or within the Fire District unless it is of a type of construction permitted in the Fire District. (See [Section 2604](#)) See Section 1009 and 1010 for moving historic buildings.

### **302.4 – RESTRICTIONS WITHIN PRIMARY FIRE LIMITS**

Within the primary fire limits, no Type VI building or structure or addition thereto shall hereafter be erected, altered, repaired, or moved (either into the limits or from one place to another within the limits), except upon the permit of the local inspection department approved by the Commissioner of Insurance. (Reference G.S. 160A-436, G.S. 153A-375).

### **302.5 – RESTRICTION WITHIN SECONDARY FIRE LIMITS**

Within any secondary fire limits, no Type VI building or structure or addition thereto shall be erected, altered, repaired, or moved except in accordance with any rules and regulations established by ordinance. (Reference G.S. 160A-437).

## **SECTION 303 BUILDINGS LOCATED IN AND OUT OF THE FIRE DISTRICT**

The requirements of this Chapter shall apply to any building located partially in the Fire District unless the major portion of such building lies outside of the Fire District and no part is more than ten (10) feet inside the boundaries of the Fire District.

**SECTION 304 EXCEPTIONS TO RESTRICTIONS IN FIRE DISTRICT**

- (a) The preceding provisions of this Chapter shall not apply in the following instances:
- (1) Temporary Buildings used in connection with duly authorized construction.
  - (2) A private garage used exclusively as such, not more than one (1) story in height, nor more than six hundred and fifty (650) square feet in area, located on the same lot with a dwelling.
  - (3) Fences not over eight (8) feet in height.
  - (4) Coal Tipples, Material Bins, Trestles conforming to [Section 412.5](#).
  - (5) Water Tanks and Cooling Towers conforming to Section 713 and Section 714.
  - (6) Greenhouses less than fifteen (15) feet high.
  - (7) Porches on dwellings not over one (1) story in height, and not over ten (10) feet wide from the face of the building, provided such porch does not come within five (5) feet of any property line.
  - (8) Display signs as provided in Chapter XXIII.
  - (9) Sheds open on a long side not over fifteen (15) feet high and five hundred (500) square feet in area.
  - (10) See Section 1009 and 1010 applicable to historic buildings.

**CHAPTER 4**  
**CLASSIFICATION OF BUILDING BY OCCUPANCY**  
**SECTION 401 - CLASSIFICATION BY OCCUPANCY OR USE**

**401.1 – GENERAL**

- (a) Every new and existing building, structure or part thereof shall, for the purpose of this Code, be classified according to its use, or occupancy as a building or structure of one of the following occupancy groups:

ASSEMBLY	(A)	(Section 404)
BUSINESS	(B)	(Section 405)
EDUCATIONAL	(E)	(Section 406)
HAZARDOUS	(H)	(Section 407)
FACTORY-INDUSTRIAL	(F)	(Section 408)
INSTITUTIONAL	(I)	(Section 409)
MERCANTILE	(M)	(Section 410)
RESIDENTIAL	(R)	(Section 411)
STORAGE	(S)	(Section 412)

- (b) Each occupancy group is intended to embrace buildings as hereinafter defined and those of similar character or use. Wherever there is any uncertainty as to the classification of a building, the Building Official shall determine the classification within which it falls, according to the life safety and relative fire hazard involved.

**SECTION 402 HEIGHT AND AREA**

**402.1 – APPLICATION**

- (a) Definition – For the purpose of this Code, “height” and “area”, as applied to a building, has the meaning designated in Chapter II, Definitions.
- (b) Allowable Heights and Floor Areas – The height and area for buildings or structures of the different types of construction, shall be governed by the intended occupancy or use of the building, as provided for in this Chapter and shall not exceed the limits set forth in [Table 400](#) except as modified in [Section 402.2](#) and [402.3](#) and the specific use provisions of this chapter. For the purpose of this Code, each part of a building or structure included within fire walls shall be considered a separate building.
- (c) Area of Existing Building – A building heretofore erected shall not be extended to exceed the allowable floor area set forth in this chapter, governed by the occupancy and type of construction.

A building heretofore lawfully erected, which exceeds such area, may be extended horizontally, provided such extension does not exceed the area prescribed and provided such extension is separated from the existing building by a fire wall as set forth in paragraph (b) of this section.

- (d) Height of Existing Buildings – An existing building shall not be increased in height unless the entire building is altered to meet the requirements of this Code for a new building of such increased height and floor areas.

#### 402.2 – HEIGHT MODIFICATIONS

- (a) Roof Structures – Church spires, chimneys, tanks and supports, aerial supports, parapet walls not over four (4) feet high, bulkheads and penthouses used solely to enclose stairways, tanks, elevator machinery or shafts, or ventilation or air-conditioning apparatus, need not be considered in determining the highest point of the building; provided that the highest point shall be taken to be the highest point of the roof of the highest penthouse when the aggregate area of all penthouses and other roof structures exceeds  $(33 \frac{1}{3})$  percent of the area of the roof upon which they stand. (See Section 712, 713 and 714).
- (b) Grade Entrance Parking – Where a one-story automobile parking structure, enclosed or open, of Type I or II Construction, with grade entrance, is provided under a building of Residential (R) Occupancy, the number of stories to be used in determining the minimum type of construction may be measured from the floor above such parking area. The floor assembly shall provide the occupancy separation required in Section 403.1(d).
- (c) Mezzanines – Mezzanine floors or galleries shall not be regarded as a story. (See definition of “mezzanine,” Chapter II).
- (d) Basements – The basement of a building shall not count as a story if such basements has one-half or more of its clear height below grade, unless used as a habitable space. (See definition of “story”).
- (e) Educational and Assembly Basement Rooms – Basements used as classrooms or assembly rooms shall be counted as a story.
- (f) Business (B) and Mercantile (M) Occupancies of Type II Construction – The height of Business (B) and Mercantile (M) Occupancies of Type II construction shall not be limited provided the fire-resistance of all columns shall be not less than three (3) hours and the other structural members including floors shall be not less than that shown in Chapter VI, but in no case less than two (2) hours except that roofs shall be of not less than one and one-half (1 ½) hours fire-resistive construction.
- (g) Cotton Warehouses Section 407.10
- (h) Dry Cleaning Section 407.6
- (i) Automobile Parking Structures Section 407.7
- (j) Stadiums and Grandstands Section 503
- (k) Special Provisions for High Rise Buildings Section 506

#### 402.3 – AREA MODIFICATIONS

- (a) Application – The exceptions and requirements of this Section shall modify the area limits set forth in Table 400 and the specific use provisions of this Chapter.
- (b) Exceptions to Area Increases – The increase of floor areas permitted by this Section & Table 400 may be additive when applicable.

## CLASSIFICATION OF BUILDING BY OCCUPANCY

### (c) Area Increase for Fire Division Walls

1. For the purpose of this Code, each part of a building included within fire walls shall be deemed to be a separate building. “Exception: Group H Occupancies. See [Sec. 407.4\(c\)](#).”
2. No building shall be limited in area when divided into sections by fire walls, provided no section exceeds the maximum allowable floor area in this Chapter.

### (d) Area Increase for Separation

1. Where streets or public spaces not less than 21 feet in width, or horizontal separation from property lines of total width of not less than thirty (30) feet (or 30 feet between buildings on commonly owned property) extend along more than twenty-five (25) percent of the building perimeter, except for hazardous occupancies, the unsprinklered areas permitted by [Table 400](#) may be increased by the following formula:

$$\text{Where } I = 4/3 \left( \frac{F}{P} - 25\% \right)$$

I = Percent increase of unsprinklered areas

F = Building perimeter in feet which fronts on streets or public spaces not less than 21 feet in width, or horizontal separation not less than thirty (30) feet wide.

P = Total perimeter of building in feet.

2. Where a building of rectangular shape is erected on a corner lot so that the full length of 2 of its sides front on a street or on a public space 21 feet or more in width, or a horizontal separation of 30 feet, the unsprinklered areas in [Table 400](#) may be increased by 50 percent.
3. Where a building is erected on a lot so that the full length of all of its sides front on a street or on a public space 21 feet or more in width, or a horizontal separation of 30 feet, the unsprinklered areas in [Table 400](#) may be increased by 100 percent.
4. [Section 402.3\(d\)](#) does not apply to Group R buildings of Type IV unprotected, Type V unprotected or Type VI construction and Group I occupancy or to Group E and A occupancy over one story in height.

### (e) Unlimited Areas for Business (B), Factory-Industrial (F), Mercantile (M), or Storage (S) Occupancies Outside the First Fire District – Buildings of Type III and Type IV construction in which all wood members are of approved fire retardant treated lumber, may be unlimited in area when complying with all the following provisions:

1. Buildings of Type IV - Protected construction shall not exceed 2 stories in height without [basement](#), and buildings of Type IV - Unprotected construction and of Type III construction in which all wood members are of approved fire retardant treated lumber shall not exceed one story in height without [basement](#).



2. The entire building shall be equipped with an approved automatic sprinkler system except where water may cause or increase a fire, other fire extinguishing systems shall be required in rooms or buildings used for the manufacture or storage of hazardous materials including but not limited to, aluminum powder, calcium carbide, calcium phosphate, metallic sodium and potassium, quicklime, magnesium powder and sodium peroxide. Buildings occupied exclusively by stocks of noncombustible material not packed or crated in combustible material need not be sprinklered.
3. A permanent accessible horizontal separation of 60 feet shall be provided between the building wall under consideration and another building on the same lot or the nearest line to which a building is or may be legally built on another lot. The required 60 feet open space may be reduced to not less than 30 feet on one side provided the building wall facing the reduced open space is built as a fire wall, is not more than 25 percent of the total perimeter in length and there are fire department access openings required by Section 717 protected by approved fire doors.
4. Means of egress shall be provided in accordance with [Chapter 11](#).
5. Proper safeguards must be taken in connection with the handling of materials and processing equipment in compliance with the appropriate N.F.P.A. standard.  
*Note: See Section 407.1(b) for Storage and Handling of Hazardous Materials and Processes.*

(f) Area Increase for Fire Retardant Lumber

1. One story buildings of Type V construction in which all wood members are of approved fire retardant lumber and roof assemblies have been tested and listed by a nationally recognized testing laboratory as not permitting any greater propagation of flame on the underside of the roof assembly than a metal deck roof with combustible insulation board mechanically fastened to the top of the metal deck may be of 100,000 square feet in area when complying with all of the conditions in [Section 402.3\(e\)](#).
2. The limiting areas of one-story buildings of Type III and Type V construction may be increased by 33 1/3 percent provided all wood members are of approved fire retardant treated lumber and roof assemblies have been tested and listed by a nationally recognized testing laboratory as not permitting any greater propagation of flame on the underside of the roof assembly than a metal deck roof with combustible insulation board mechanically fastened to the top of the metal deck.
3. The limiting areas of one-story buildings of Type VI construction may be increased 25 percent provided all wood members are of approved fire retardant treated lumber.

(g) Assembly Occupancy Area Modification

1. Assembly Buildings (non-working stage) of Type III, IV, or V construction which are surrounded on all sides by a permanent open space of not less than sixty (60) feet, and are provided with an approved automatic sprinkler system shall not be limited in area.

## CLASSIFICATION OF BUILDING BY OCCUPANCY

2. Where there are no balconies or galleries in Small Assembly Places, with or without a working stage, and the assembly floor is located at, or within twenty-one (21) inches of street or grade level and all exits meet the street or grade level by ramps having a slope not exceeding one (1) foot in 10 (10) feet, the maximum allowable areas of Type III, IV, and V construction may be increased fifty (50) percent over those specified for Assembly occupancies in [Table 400](#).
  3. One (1) story buildings used for participation sport activities such as swimming, tennis, skating and similar activities, limited in occupant content to those participating in the sports activity, and with no spectator seating permitted, may be unlimited in area when of Types III, IV or V construction and are surrounded on all sides by not less than thirty (30) feet of permanent open space.
  4. For sprinkler requirements see [Section 901](#).
- (h) Educational Occupancy Area Modifications – The area of a one-story Type III, IV or V building may be increased one hundred (100) percent if the building is surrounded on all sides by a permanent open space of not less than sixty (60) feet, and there are not less than two exits provided from each classroom, one of which opens directly to the exterior of the building. If this sub-section is used, [402.3\(d\)](#) is not applicable.
- (i) Hazardous Occupancy Area Modifications – See [Section 407](#).
1. For sprinkler requirements – [Section 901](#).
  2. Dry Cleaning Establishments using flammable solvents – [Section 407.5](#)
  3. Tire Recapping – [Section 407.8](#).
  4. Storage of Combustible Fibers – [Section 407.10](#).
  5. Storage of Hay – [Section 407.11](#).
- (j) Mercantile Area Modifications
1. Malls – [Section 507](#).
  2. Sprinkler Requirements – [Section 901](#).
- (k) Storage Occupancy Area Modifications – [Section 412](#).
1. Aircraft Hangars – [Section 412.4](#)
  2. Automobile Parking Structures – [Section 412.7](#).
  3. Commercial Garages – Sprinkler Requirements – [Section 901](#).

### **402.4 – GENERAL PROTECTIVE REFERENCES**

The following references to other protective requirements as set forth in this Code apply to all occupancies or use groups as set forth in this chapter. See Individual Occupancies for Special Protective References.

Subject	Section
1. Allowable Height and Area .....	Table 400
Heights and Areas are based upon type of construction used	
2. Types of Construction .....	Chapter 6
3. Exit Requirements .....	Chapter 11
4. Protection of Vertical Openings .....	701
5. Protection of Wall Openings .....	703
6. Sprinklers and Standpipes .....	901 to 902, inclusive
7. Mixed Occupancy and Separation Requirements .....	403
8. Light & Ventilation .....	Chapter 8
9. Heating Requirements .....	Mechanical Code Vol. III, N.C. State Building Code
10. Interior Partitions .....	403 & 702.1(b), Chapter 11
11. Exterior Wall Requirements .....	Chapter 5
12. Fire Wall Requirements .....	Definitions 402.1(b), 716
13. Storage and Handling of Flammable Liquids and Gases shall be in accordance with NFPA No. 30 and NFPA No. 56.	

**402.5 – SPECIAL PROTECTIVE REFERENCES**

Special protective references applying to individual occupancies are listed in the appropriate occupancy requirements of this chapter.

1. Requirements for High-Rise Buildings – Section 506.
2. Requirements for Malls – Section 507.
3. Requirements for the Handicapped – Section 508.
4. Reviewing Stands, Grandstands and Bleachers – Section 503.
5. Temporary Structures – 501.
6. Farm Buildings – Section 504.

**SECTION 403 OCCUPANCY SEPARATION REQUIREMENTS**

**403.1 – GENERAL**

- (a) Definition – A building that is used for two or more occupancies, classified within different occupancy groups, shall be considered a mixed occupancy building.
- (b) Limitations – A mixed occupancy building shall be governed by the Height and Area limitations applying to the principal intended use. Accessory occupancies shall not exceed the area limitations nor be located at a story height greater than that permitted for such occupancy group and type of construction being used.

CLASSIFICATION OF BUILDING BY OCCUPANCY

- (c) For each occupancy, the type of construction may be as prescribed for such occupancy in a building of the height and area of the building as a whole, provided each occupancy is wholly separated, horizontally and vertically, by constructions having fire-resistive ratings equivalent to the higher rating prescribed for the two occupancies being separated, as noted in [Section 403.1\(e\)](#).
- (d) Minimum Separation – Unless otherwise specifically prescribed in this Section, the separation of mixed occupancies shall provide not less than one (1) hour fire resistance, except that portions of buildings used as accessory offices or for customary non-hazardous uses necessary for transacting the principal business in Storage (S) and Factory-Industrial (F) occupancies may be separated by partitions of non-combustible construction without fire resistance or by partitions constructed of materials as permitted in the type of construction used.
- (e) Fire Resistance Rating of Separation – The minimum fire resistance of construction separating any two occupancies in a building of mixed occupancy, shall be the higher rating required for the occupancies being separated, as specified below:

**Minimum Requirements\***

Assembly	
Large	4 hour
Small	2 hour
Business	1 hour
Educational	2 hour
Hazardous	4 hour
Factory-Industrial	2 hour
Institutional	2 hour
Mercantile	1 hour
Residential	1 hour
Storage	4 hour
Automobile Parking Structures	2 hour

\*For materials and assemblies to provide the required fire resistance, see Chapter XXV

1. A separation between a private garage and any occupancy shall be the minimum fire resistance specified above for the occupancy. Fire resistance separation shall not be required between Sunday School rooms and a Church Auditorium of Small Assembly Occupancy.
2. A separation between an automobile parking buildings used exclusively for the storage of passenger vehicles that will accommodate not more than nine (9) passengers and any other occupancy shall be four (4) hours.
3. Protection of Horizontal Openings – For requirements governing the protection of door openings in walls and partitions separating mixed occupancies, see Section 703.
4. Protection of Vertical Openings – For requirements governing the protection of vertical openings, see Section 701.

**403.2 – TENANT SEPARATION**

In a building, or portion of a building of a single occupancy classification, when enclosed spaces are provided for separate tenants, such spaces shall be separated by not less than one (1) hour fire resistance – except that in Group S – Storage Buildings, non-combustible, non-fire rated partitions may be used to separate tenants provided no area between partitions rated one (1) hour or more exceeds three thousand (3,000) square feet. See [Section 702.3](#).

**403.3 – SEPARATION BETWEEN TOWNHOUSES**

Each townhouse (See definition for townhouse, Section 201) shall be considered a separate building and shall be separated from adjoining townhouses by the use of separate exterior walls meeting the requirements for zero clearance from property lines as required by the type of construction and fire protection requirements, or by a party wall, or when not more than three (3) stories in height, may be separated by a single wall meeting the following requirements:

1. Such wall shall provide not less than two (2) hours fire resistance. Plumbing, piping, ducts, electrical or other building services shall not be installed within or through the two (2) hour wall.
2. Such wall shall extend from the foundation to the underside of the roof sheathing.
3. Each dwelling unit sharing such wall shall be designed and constructed to maintain its structural integrity independent of the unit on the opposite side of the wall.

**SECTION 404 ASSEMBLY OCCUPANCY – (A)****404.1 – SCOPE**

(a) Assembly (A) occupancy is the use of a building or structure, or any portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions or for recreation, or for food or drink consumption or awaiting transportation.

(b) Assembly (A) occupancy shall include, among others, the following:

Amusement Park Buildings	Motion Picture Theaters
Auditoriums	Museums
Churches	Passenger Depots
Dance Halls	Public Assembly Halls
Gymnasiums	Recreation Halls
Restaurants(large) (restaurants that accommodate 100 or more people, or that have a stage or that provide dancing; otherwise see Section 410)	Stadiums and Grandstands
	Tents (Assembly)
	Theaters for Stage Productions

(c) All buildings of Assembly occupancy shall front directly upon at least one public street or public place not less than thirty (30) feet wide, in which front shall be located the main entrance and exit of such building.

**404.2 – SUB-CLASSIFICATIONS**

Assembly occupancies shall be divided into two sub-classifications as set forth in this section, both of which shall comply with the requirements for Assembly Occupancy unless otherwise specified:

- (a) Large Assembly – shall include theaters and places of assembly having a working stage (see definition) and having a capacity of seven hundred (700) or more persons; also, Large Assembly shall include theaters or places of assembly having a non-working stage but having a capacity of one thousand (1,000) or more persons.
- (b) Small Assembly – shall include theaters and places of public assembly with or without a working stage having a capacity of one hundred (100) or more persons but having a capacity less than designated for Large Assembly.

**404.3 – OCCUPANT CAPACITY**

- (a) The capacity of occupant content assembly occupancies shall be as set forth in [Chapter 11](#).
- (b) It shall be unlawful to allow a number in excess of that posted in any place of assembly.

**404.4 – SPECIAL PROTECTIVE REFERENCES**

The following reference to other protective requirements, as set forth in this Code, shall apply to all areas classified as assembly occupancies. Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

Subject	Section
1. Special Exit Doorway Requirements .....	<a href="#">Chapter 11</a>
2. Non-Combustible Stairway Requirements .....	<a href="#">Chapter 11</a>
3. Storage and handling of flammable liquids and gases shall be prohibited.	
4. Special Construction Requirements .....	404.5
5. Interior Finish .....	404.6 & 704
6. Sprinklers and Standpipes .....	404.7 & <a href="#">Chapter 9</a>
7. Supplementary Lighting .....	1124
8. Non-Working Stage .....	404.8
9. Working Stage .....	404.9
10. Proscenium Curtain .....	404.10
11. Motion Picture Projection Rooms .....	404.11
12. Foyers and Lobbies .....	1113
13. Aisles and Seating .....	1111.1
14. Continental Seating Systems .....	1111.2
15. Boxes, Balconies and Galleries .....	1111.3
16. Tents for Public Assembly .....	404.14
17. Amusement Park Buildings .....	404.15
18. Churches .....	404.16
19. Posting of Occupant Capacity .....	<a href="#">1105.1</a> & <a href="#">1111.4</a>

**404.5 – SPECIAL CONSTRUCTION REQUIREMENTS**

- (a) Buildings of Large Assembly with a working stage shall be of Type I or II Construction.
- (b) Buildings of Large Assembly without a working stage shall conform to the limitations of use prescribed in [Table 400](#).
- (c) Buildings of Small Assembly shall conform to the limitations of use prescribed in [Table 400](#) as modified.
- (d) Gymnasiums and similar occupancies may have running tracks constructed of wood or unprotected metal.
- (e) All walls and partitions for enclosing stairs, passageways or corridors (except foyers or waiting spaces) which are used for exits, or enclosing rooms used for exit purposes in Assembly occupancies, shall be of not less than two (2) hour fire resistance construction. Refer to Section 702 for other requirements.

**404.6 – INTERIOR FINISH AND DECORATIONS**

- (a) Use of materials which develop toxic or noxious gases for interior wall finishes shall not be permitted. See Section 704.
- (b) In no event shall imitation leather or other material, consisting of, or coated with, a pyroxylin or similarly hazardous base, be used in Assembly occupancies. The use of combustible materials for decorative purposes in Assembly occupancies, including among others, curtains, cloth, paper, streamers, draperies, vines, leaves, trees, moss, or other interior decorations, shall be prohibited unless it is flame treated according to ASTM 0626 and tested periodically.

**404.7 – SPRINKLERS AND STANDPIPES FOR WORKING STAGES**

- (a) Every building classified as a Large Assembly shall have an approved system of automatic sprinklers conforming with [Section 901](#) over the stage, in toilet rooms, lounges, smoking rooms, and all other parts including [basements](#), cellars, property rooms, dressing rooms, storerooms, workshops, and all portions of stage and rooms under the stage floor level except as noted below. (Check [Section 404.10\(a\)](#).)
- (b) Sprinklers may be omitted in auditoriums, foyers and lobbies; and over generators and other electrical equipment or switch boards.
- (c) In Large Assembly occupancies, a standpipe outlet with hose attachment shall be provided on each side of the rear of the place of assembly, on each side of the rear of each [balcony](#) and gallery, on each side of the stage, on each tier of dressing rooms, and within 50 feet of all property rooms, storerooms and workrooms. Such outlets shall connect with a standpipe which shall conform to the requirements of [Section 902.1](#), but which shall have a diameter of not less than 4 inches except that standpipes on each side of the stage shall be of diameter not less than 2 ½ inches.

**404.8 – NON-WORKING STAGE**

- (a) A non-working stage shall not provide greater risk to life safety or increase the fire hazard or other emergencies than does the assembly hall served.
- (b) Such stage areas may be an unenclosed area or raised platform within the assembly room.

- (c) A theater stage having a permanent non-movable projection screen shall be considered a non-working stage if otherwise complying with the provisions of this sub-section.

#### **404.9 – WORKING STAGE**

- (a) All working stages shall be enclosed on all sides with walls having a fire-resistance rating of not less than four (4) hours and extending from foundation to a height of four (4) feet above roof.
- (b) There shall not be openings in the wall separating a working stage from the auditorium except the stage or proscenium opening, one doorway at each side of the proscenium opening at the stage floor level or the auditorium floor level, at the level of the musicians pit, and where necessary to the organ. Each such doorway shall be not more than twenty-one (21) square feet in area and shall be protected by a self-closing fire door having a three (3) hour fire-resistive rating. Door openings leading from the stage to the outer air shall be equipped with approved self-closing fire doors.
- (c) There shall not be windows in such enclosure walls of a working stage within five (5) feet of property line other than a street line, and all windows shall be of approved fire-resistive type.
- (d) All moldings and decorations around proscenium opening shall be constructed entirely of non-combustible or fire-resistant materials.
- (e) Above the proscenium opening of a working stage shall be a girder or other structural member of adequate strength to support all loads, constructed of non-combustible material and protected to provide not less than four (4) hour fire-resistance.
- (f) All that portion of the working stage except that used for the working of scenery, traps and other mechanical apparatus for the presentation of a scene, approximately equal to the width of the proscenium opening, shall be of Type I Construction, and appurtenant rooms and compartments shall be of Type I or Type II Construction.
- (g) The rigging loft, fly galleries, including pin-rails, shall be of non-combustible materials.
- (h) The roof over the working stage shall be of Type I Construction.
- (i) Dressing rooms, scene docks, property rooms, workshops, store-rooms, and other rooms or compartments appurtenant to the stage shall be of Type I or Type II Construction and shall be separated from the working stage and other parts of the building by walls having a fire-resistance rating of not less than three (3) hours. Such rooms and spaces shall be separated from each other by non-combustible partitions providing not less than two (2) hours fire-resistance, except that partitions separating dressing rooms from each other shall have at least one (1) hour fire-resistance. Openings other than the necessary doorways at stage level, protected with self-closing fire doors, shall not connect such rooms with the stage.
- (j) Openings through stage floors shall be equipped with tight-fitting trap doors of wood not less than two (2) inches thick.
- (k) The troughs or frames for footlights and border lights shall be of metal or other non-combustible materials. The suspension lines of border lights shall be of wire for at least ten (10) feet from the frames.
- (l) All electrical equipment shall be protected from falling objects and from contact with stage equipment, and shall conform with the electrical requirements of Vol. IV, N.E.C.



- (m) All woodwork and all scenery, drapes, and sets used upon the stage shall be coated or treated by approved method to make them non-flammable or fire-resistive.
- (n) All shelving, closets, etc., property rooms, or storage rooms, shall be constructed of metal or other non-combustible material.
- (o) Space over the working stage shall be provided with one or more ventilators of metal or other non-combustible material, equipped with movable shutters or sash, having an aggregate clear area of not less than one-eighth the area of the stage, constructed to open automatically and instantly by approved heat-actuated devices. Suitable means for manual operation shall be provided in addition. If glass is used in the construction, only wired glass shall be used in such parts where the breaking of glass would cause it to fall on the stage.

#### **404.10 – PROSCENIUM CURTAIN**

- (a) Every proscenium opening of a working stage shall be provided with a curtain of metal or other non-combustible material, so designed and constructed that for at least thirty minutes it will prevent all passage of flame.
- (b) Every proscenium curtain shall overlap the proscenium opening by at least two (2) feet at the top and eighteen (18) inches at each side and shall slide vertically at each side within iron or steel grooves which shall have a minimum depth of twelve (12) inches. Every curtain shall be so arranged and maintained that, in case of fire, it would be released automatically and instantly by an approved heat-actuated device, and will descend slowly and safely by its own weight to completely close the proscenium opening within thirty (30) seconds, taking not over five (5) seconds for the bottom five (5) feet. It shall also be equipped with effective devices to permit prompt and immediate closing of the proscenium opening by manual means.
- (c) Any part of any proscenium curtain shall not be supported by or fastened to combustible material.

#### **404.11 – MOTION PICTURE PROJECTION ROOMS**

- (a) The provisions of this Section shall apply where ribbon-type cellulose acetate or other safety film is used in conjunction with electric arc, Xenon or other light source projection equipment which develops hazardous gases, dust or radiation. Where cellulose nitrate film is used, projection rooms shall be in compliance with the provisions of N.F.P.A. Standard No. 40, Article 29.
- (b) Every motion picture machine projecting film as mentioned within the scope of this Section shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, may be within the projection room or in an adjacent room of equivalent construction.
- (c) There shall be posted on the outside of each projection room door and within the projection room itself a conspicuous sign with one-inch block letters stating: "SAFETY FILM ONLY PERMITTED IN THIS ROOM."
- (d) Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings need not be protected.

## CLASSIFICATION OF BUILDING BY OCCUPANCY

- (e) The room shall have a floor area of not less than eighty (80) square feet for a single machine, and at least forty (40) square feet for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space not less than thirty (30) inches by thirty (30) inches on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors.
- (f) The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than seven (7) feet six (6) inches.
- (g) The projection room shall be provided with not less than one exit having a minimum opening of not less than thirty (30) inches wide and eighty (80) inches high.
- (h) The aggregate of openings for projection equipment shall not exceed twenty-five (25) percent of the area of the wall between the projection room and the auditorium or assemblage area. All such openings shall be provided with glass or other approved material so as to completely close the opening.
- (i) The projection room itself shall be provided with two or more separate fresh air inlet ducts with screened opening terminating within twelve (12) inches of the floor and they shall be located at opposite ends of the room. Such air inlets shall be of sufficient size to permit an air change every three (3) minutes. Fresh air may be supplied from the general building air conditioning system – but when this is done, it shall be so arranged that the projection room will continue to receive one (1) change of air every three (3) minutes, regardless of the status of the general air conditioning system. Each projection room shall be provided with one or more exhaust air outlets which may be manifolded into a single duct outside the room. Such outlets shall be so located as to insure circulation throughout the room. Projection room exhaust air systems shall be independent of any other air systems in the building. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into the supply air system. The exhaust system shall be mechanically operated and be of such capacity as to provide a minimum of one (1) change of air every three (3) minutes. The blower motor shall be outside the duct system. The projection room ventilation system may also serve appurtenant rooms such as the generator room and the rewinding room.
- (j) Each projection machine shall be provided with an exhaust duct which will draw air from each lamp and exhaust it directly to the outside of the building in such a fashion that it will not be picked up by supply inlets. Such a duct shall be of rigid materials, except for a continuous flexible connector approved for that purpose. The lamp exhaust system shall not be interconnected with any other system. For electric arc projection equipment the exhaust capacity shall be two-hundred (200) cfm for each lamp connected to the lamp exhaust system, or as recommended by the equipment manufacturer. Auxiliary air may be introduced into the system through a screened opening to stabilize the arc. When Xenon projection equipment is used the lamp exhaust system shall exhaust not less than three-hundred (300) cfm per lamp nor less than that exhaust volume required or recommended by the equipment manufacturer, whichever is greater. The external temperature of the lamp housing shall not exceed one-hundred thirty (130) degrees F when operating.
- (k) Each projection room shall be provided with rewind and film storage facilities.

- (I) A maximum of four (4) containers for flammable liquids not greater than sixteen (16) ounce capacity and of a non-breakable type may be permitted in each projection room.

#### **404.12 – OUTDOOR MOTION PICTURE PROJECTION BOOTHS**

Every motion picture projector, films or equipment shall be enclosed in a booth of not less than non-combustible construction throughout. Flammable films shall be kept in separate metal containers, stored in metal cabinets tightly closed. Every such booth shall have two exits or exitways located as remotely from each other as possible.

#### **404.13 – REWINDING OF FILM**

All rewinding of flammable film shall be done either in a projection booth, or in a room enclosure constructed to meet the fire-resistance requirements prescribed for film projection booths. If done in projection room, approved enclosed type rewind machines shall be used and an approved can with self-enclosing hinged cover shall be provided for scrap film.

#### **404.14 – TENTS FOR PUBLIC ASSEMBLY**

- (a) Before a temporary permit is granted, the owner or agent shall file with the Building Official a certificate executed by an acceptable testing laboratory, certifying that the tent, decorative materials and tarpaulins meet the requirements for fire resistance prescribed in the National Fire Protection Association “Standard Methods of Fire Tests for Flame-Resistance Textiles and Films, NFPA No.701,” and that such fire-resistance is effective for the period specified by the permit.
- (b) Tent exits, aisles, seating, etc., shall conform with the requirements for places of assembly. All exits shall be kept free and clear of obstructions while the tent is occupied by the public.
- (c) Ground within and adjacent to tents shall be cleared of all grass, underbrush or similar fire hazards.

#### **404.15 – AMUSEMENT PARK BUILDINGS**

- (a) Amusement park buildings used as dining rooms, theaters, or for other purposes shall conform to the requirements of this Code governing the particular use or occupancy.
- (b) Amusement park buildings over one (1) story in height, or one thousand two hundred (1200) square feet in floor area, shall have exterior walls, floors and their supports of not less than one (1) hour fire-resistive construction.
- (c) Where amusement park buildings are located within thirty (30) feet of adjacent property lines, buildings or other structures, the exterior walls shall be constructed of non-combustible materials, or shall be protected to provide not less than one (1) hour.
- (d) Structures of open skeleton frame type shall not be limited in height or area, except that grandstands shall comply with the requirements of Section 503.
- (e) Amusement structures shall provide adequate safety for all loads to which they may be subjected and shall be equipped with approved safety devices and safeguards.

#### **404.16 – CHURCHES**

- (a) This section shall apply to churches or places of worship.

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- (b) All interior finishes and decorations shall conform with [Section 404.6](#) except that nothing in this Section shall prevent the use of wood for ornamental purposes, trusses, paneling or chancel furnishing.
- (c) Every aisle shall lead to an exit door or to a cross aisle running parallel to the seats and leading directly to an exit. Aisles shall not be less in width than thirty-six (36) inches plus an increase of one and one-half (1 ½) inches for each five (5) feet of such aisle from its beginning to an exit, except that aisles with seats on one side may be six (6) inches less in width; where egress is provided at both ends of an aisle, the aisle may have a uniform width of not less than specified herein. Cross aisles shall not be less than three (3) feet six (6) inches. An aisle bordering on a means of entrance shall be not less than four (4) feet wide.
- (d) There shall not be obstructions of any kind in an aisle. Aisles shall not exceed a gradient of more than one (1) in eight (8). Steps shall not be used in any aisle where differences of level can be overcome by gradients. Where it is necessary in balconies to use steps, they shall extend the full width of aisles and risers shall not exceed six and one-half (6 ½) inches.
- (e) Rows of seats between aisles shall have not more than twenty (20) seats. Rows of seats opening into an aisle at one end shall have not more than seven (7) seats. Seats without dividing arms shall have their capacity determined by allowing eighteen (18) inches per person.
- (f) The spacing of rows of seats from back to back shall be not less than thirty (30) inches. In every case there shall be a clear space of not less than twelve (12) inches between the back of one seat and the front of one seat immediately behind it, measured at the seat line.

### SECTION 405 BUSINESS OCCUPANCY – (B)

#### 405.1 – SCOPE

- (a) Business (B) Occupancy is the use of a building or structure, or any portion thereof, for office, professional, or service type transactions including normal accessory storage and the keeping of records and accounts.
- (b) Business (B) occupancy shall include, among others, the following:
  - Office Buildings, greenhouses, service stations, banks, bowling alleys, libraries (other than school).
- (c) Restaurants or places supplying food or drink that accommodate one-hundred (100) or more people, or that have a stage, or that provide dancing or entertainment features, shall be classified in Assembly and not in Business Occupancy (See [Section 404](#)).
- (d) See [Section 506](#) for High Rise Provisions.

#### 405.2 – OCCUPANT CAPACITY

The capacity or occupant content of business occupancies shall be as set forth in [Section 1105](#).

#### 405.3 – SPECIAL PROTECTIVE REFERENCES

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as business occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

1. Special Exit Doorway Requirements ..... Chapter 11

2. Storage and handling of flammable liquids and gases shall be in accordance with the appropriate NFPA standards

3. Posting of floor loads in business storage areas ..... 1002

4. High Rise Provisions ..... 506

5. Automotive Service Stations ..... 405.4

6. Bowling Alleys ..... 405.5

**405.4 – AUTOMOTIVE SERVICE STATIONS**

- (a) An automotive service station of Business (B) Occupancy is a place of retail business at which outdoor automotive refueling is carried on using fixed dispensing equipment connected to underground storage tanks by a closed system of piping, and at which goods and services generally required in the operation and maintenance of motor vehicles and fulfilling of motorist needs may also be available. The building consists of a sales office where automotive accessories and packaged automotive supplies may be kept or displayed. It may also include one or more service bays in which vehicle washing, lubrication and minor replacement, adjustment and repair services are rendered. An automotive service station building shall not have a cellar or **basement**, but may have open pits if such pits are continually ventilated. An automotive service station building shall be of Type I, Type II, Type III, Type IV, Type V or Type VI.
- (b) Canopies and their supports over pumps shall be of non-combustible materials. wood of Type III sizes, or of construction providing one (1) hour fire resistance.
- (c) All equipment likely to cause an explosion, or to be capable of igniting gasoline vapor from heat, sparks, or open flames, shall be located at least four (4) feet above the floor, or be completely and tightly enclosed by non-combustible construction, or construction of not less than one (1) hour fire resistance. Any openings to such enclosures shall be from the outside with the sill raised at least one (1) foot above the adjoining outside level, and shall be located at least five (5) feet from any property line or adjacent building.
- (d) Approved dispensing devices such as, but not limited to coin-operated, card-operated and remote control types are permitted at self-service stations.

**405.5 – BOWLING ALLEYS**

- (a) Bowling Alleys shall comply with the provisions of this section.
- (b) Where bowling pin finishing or refinishing operations are carried on, such a separate building, or a separate room, constructed as specified herein, shall be provided:
  - (1) Such a room shall be located at or above street level and shall have one or more windows opening to the outside of the building.
  - (2) Walls and ceiling of such rooms shall have not less than one (1) hour fire resistance. Floors shall be of concrete at least two (2) inches thick or equivalent non-combustible protective material.
  - (3) Door openings shall be provided with non-combustible sills raised six (6) inches above floor level and protected with approved fire doors.

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- (4) Shelving, containers, and all furnishings shall be of non-combustible material. Machinery shall be effectively grounded.
- (5) Ventilation sufficient to effect complete change of air at least once every three (3) minutes shall be provided.

**SECTION 406 EDUCATIONAL OCCUPANCY – (E)**

**406.1 – SCOPE**

- (a) Educational (E) Occupancy is the use of a building or structure, or any portion thereof, for the gathering together of persons for the purpose of instruction.
- (b) Educational (E) Occupancy shall include, among others, the following:
 

Schools	Nursery Schools
Colleges	Academies
Universities	Kindergartens
Educational Buildings for Churches	Day Care Centers (with children over 3 years old)
- (c) Parts of buildings used for the congregating or gathering of 100 or more persons in one room shall be classified as Assembly Occupancy – (see section 404), regardless of whether such gathering is of an educational or instructional nature or not.
- (d) Schools for business or vocational training shall be classified in the same occupancies and conform to the same requirements as the trade, vocation or business taught.

**406.2 – OCCUPANT CAPACITY**

The capacity of occupant content of educational occupancy shall be as set forth in Section 1105.

**406.3 – SPECIAL PROTECTIVE REFERENCES**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as educational occupancies.

Refer to [Section 402.4](#) for General Protective References Applicable to all Occupancies.

- 1. Non-combustible Stairways Required ..... [Chapter 11](#)
- 2. Corridors ..... [Chapter 11](#)
- 3. Unilateral Light ..... [Chapter 8](#)
- 4. A classroom shall not occupy a [basement](#) area which is fifty (50) percent or more below ground level unless the entire building is sprinklered or the classroom has exit direct to the outside.
- 5. Every heating appliance which produces an unprotected open flame shall be prohibited.
- 6. Where permanent motion picture projectors using cellulose nitrate film are installed, booths shall be provided, as set forth in [Section 404.11](#).
- 7. Rooms used for day care nurseries, kindergarten or first grade pupils shall not be located above or below the floor of exit discharge. Rooms used for second grade pupils shall not be located more than one (1) story above the floor of exit discharge.

8. Storage and handling of flammable liquids shall be prohibited.
9. Furnace and fuel rooms shall be separated by 2 hour rated walls and ceilings with no openings except to the outside of the building. (Section 2902).
10. See Section 510 for requirements for Day Care Facilities.

### **SECTION 407 HAZARDOUS OCCUPANCY – (H)**

#### **407.1 – SCOPE**

- (a) Hazardous (H) Occupancy is the principal use of a building or structure, or any portion thereof, that involves highly combustible materials or flammable materials, or explosive materials or materials that have inherent characteristics that constitute a high fire hazard.
- (b) Hazardous (H) occupancies shall include among others, the following:
  - Dry Cleaning Establishments using flammable solvents
  - Explosive Manufacturing
  - Grain Elevators
  - Paint or Solvent Manufacturing (flammable base)
  - Pyroxylin Plastic Manufacturing
  - Sodium Nitrate or Ammonium Nitrate
  - Storage of Combustible Film
  - Storage or use of Highly Combustible Materials
  - Tank Farms-used to store flammable liquids or gases
- (c) Portions of all other occupancies involving highly combustible, inflammable or explosive products or materials shall be properly ventilated and properly separated from the remainder of the building in accordance with the appropriate NFPA Standard or the entire building will be classified as Hazardous Occupancy.

#### **407.2 – OCCUPANT CAPACITY**

The capacity of occupant content for hazardous occupancies shall be as set forth in Section 1105.

**407.3 – SPECIAL PROTECTIVE REFERENCES**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as hazardous occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

- 1. Special Requirements ..... [Section 407.4](#)
- 2. Special Hazardous Materials ..... [Section 407.5](#)
- 3. Dry Cleaning, Dyeing or Similar High Fire Hazard  
Occupancy Utilizing Flammable Solvents ..... [Section 407.6](#)
- 4. Grain Elevators ..... [Section 407.7](#)
- 5. Tire Recapping ..... [Section 407.8](#)
- 6. Handling or Storage of Cellulose Nitrate Film ..... [Section 407.9](#)
- 7. Combustible Fibers ..... [Section 407.10](#)
- 8. Hay Storage ..... [Section 407.11](#)
- 9. Prohibition in Fire Districts ..... [Section 301.3\(b\)](#)

**407.4 – SPECIAL REQUIREMENTS**

- (a) Storage and Handling of flammable liquids, gases and other hazardous substances shall be in accordance with the Standards of the National Fire Protection Association.
- (b) Hazardous occupancies shall not be permitted in the Fire District. (See [Section 301.3\(b\)](#))
- (c) An increase in the allowable areas or heights as set forth in [Table 400](#) shall not be permitted when the principal use of the building or structure is a hazardous occupancy or the building or structure is classified as a hazardous occupancy in accordance with [Section 407.1](#).
- (d) Buildings of Hazardous Occupancy not specifically provided in this Code, which involve the storage, manufacture, or use of highly combustible or flammable materials shall be constructed to provide a degree of fire protection adequate for the hazard involved. Such protection may exceed the fire-resistive requirements prescribed for Type I Construction, if deemed necessary by the Building Official, but in all cases the construction shall meet the minimum requirements specified for Hazardous Occupancies.
- (e) In all buildings of hazardous occupancy, approved automatic sprinklers shall be installed throughout, except that where the nature of the fire hazard is such that application of water is not effective as a means of protection, other approved means of protection shall be provided.
- (f) Buildings or structures or portions thereof, housing occupancies involving the use of hazardous or highly combustible material or processes, and their equipment, shall be erected, altered, and installed in accordance with safe practice. Except as otherwise provided in this Code, the provisions of the various regulations or standards of the National Fire Protection Association governing the particular occupancy or process shall be considered as constituting safe practice. Those standards with dates of edition as listed in Chapter II shall include but not be limited to the following:

NFPA Standards for the storage, handling and use of flammable Liquids NFPA-30

NFPA Standards for spray finishing using flammable materials NFPA-33



- N FPA Standards for dip tanks containing flammable or combustible liquids NFPA 34
  - NFPA Standards for the installation and operation of oxygen-fuel gas systems for welding and cutting NFPA 51
  - NFPA Standards for the storage and handling of liquefied petroleum gases NFPA 58
  - NFPA Recommended good practice requirements for the installation and use of combustion engines and gas turbines NFPA 37
  - NFPA Code for the Storage of Pyroxylin Plastic NFPA 40-E
  - NFPA Standards on the fundamental principles for the prevention of dust explosions in industrial plants NFPA 63.
  - NFPA Code for the prevention of dust explosions in the manufacture of aluminum powder NFPA 651.
- NOTE: The above standards are published by the National Fire Protection Association in the several volumes of National Fire Codes and may be obtained from NFPA at 470 Atlantic Avenue, Boston, Mass, 02210. (See Chapter II.)

**407.5 – SPECIAL HAZARDOUS MATERIALS**

- (a) The processing, manufacturing or storing of the materials listed in paragraphs (b) and (c), among others, shall be classified as a special fire hazard, (Hazardous Occupancy), because of the highly combustible and explosive quality of the materials involved.
- (b) The following materials or products stored or handled shall be classified as a Special Hazardous material when stored or handled in a manner or in quantities which may be hazardous to the occupants of the building:

Acids: Sulphuric, Nitric or Hydroflouric – Asphaltum – Celluloid, Chemicals: Poisonous, combustible, explosive – Cereal, flour or feed mills – Cork-Excelsior – Petroleum Products (Not retail gasoline service stations) – Pyroxylin and Pyroxylin Plastic Products – Shoddy Mills – Loose Spices and Vegetable Stocks (not retail stores) – Feather Renovating – Films – Fireworks – Gas; Irritating and flammable – Jute – Kapok – Naval Stores – Paper; Baled Waste – Oakum or Hemp Processing – Paints; Manufacturing – Starch Mills – Waste Paper – Rubber Manufacturing Plants.

- (c) Materials or products stored or handled in quantities in excess of the Gross Volume occupied space set forth below shall be classified as Special Hazardous Materials:

	In Excess of
Acetylene gas in pressure containers .....	2000cu. ft.
Artificial flowers .....	1200cu. ft.
Artificial leather .....	600 cu. ft.
Rags – Burlap, paper or cotton .....	1000 cu. ft.
Barrels – second hand .....	1800 cu. ft.
Brooms and Broom corn .....	1200 cu. ft.
Cotton (Loose) Wadding or Waste .....	400 cu. ft.
Enameling .....	2400cu. ft.

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Fertilizer (Bags only) .....	2700cu. ft.
Lacquers (Separate containers only) .....	3600cu. ft.
Matches .....	300 cu. ft.
Mattresses .....	4800 cu. ft.
Paints (Separate metal containers only) .....	6000 cu. ft.
Spray painting shops .....	3200cu. ft.
Tire Recapping .....	See <a href="#">Section 407.8</a>
Tires-storage .....	12,000 cu. ft.
Varnish- Turpentine (Separate metal containers only) .....	2400cu. ft.

### **407.6 – DRY CLEANING, DYEING OR SIMILAR HIGH FIRE HAZARD OCCUPANCY UTILIZING FLAMMABLE SOLVENTS**

- (a) A building used for dry cleaning or similar hazardous occupancy utilizing flammable solvents shall not be located within the Fire District.
- (b) Dry cleaning, dyeing, or similar establishments using combustible or flammable liquids or solvents with a flash point of one hundred ninety (190) degrees F, or lower (closed cup test), shall be of Type I, or Type II Construction, and shall not exceed one (1) story in height or ten thousand (10,000) square feet in area, without [attics](#), concealed roof spaces, [basements](#) or pits. Floors shall not be below grade.
- (c) Roofs shall be flat. If due to local conditions, the Building Official deems it desirable to vent possible explosions upwards, the roof may be of lightweight, non-combustible construction.
- (d) An approved automatic sprinkler system shall be installed throughout each drying room in accordance with [Section 901](#).
- (e) Partitions shall have not less than two (2) hour fire resistance.
- (f) Drying rooms, if under the same roof as the dry cleaning and dry dyeing rooms, shall be separated from such rooms by each wall having a fire-resistance of not less than four (4) hours. The entrance to such drying rooms shall be provided with self-closing fire doors.
- (g) Except for necessary openings for vents, ducts, piping and shafting, all openings in exterior walls shall be protected with fire doors or windows. Windows shall be of wired glass in steel sash so hung that they will readily swing out in case of explosion.
- (h) Exterior walls except those on street fronts, which are located less than ten (10) feet from adjacent property lines shall not have openings therein and shall have a fire resistance rating of not less than four (4) hours, or the equivalent, but in no case shall more than two (2) sides of the building have blank walls.
- (i) Blow-out panels shall be provided. They shall provide adequate pressure relief in case of an explosion.
- (j) Mechanical systems of ventilation, of explosion-proof type, shall be provided to insure complete and continuous change of air once every three (3) minutes in dry-cleaning and dry-dyeing rooms.

- (k) All other regulations contained in this Code pertaining to construction, ventilation, storage, heating and lighting, or the like, shall apply as well as any laws of the State regulating the construction and maintenance of dry-cleaning, dyeing, or similar plants.
- (l) The installation, ventilation, erection, alteration, maintenance or use of equipment, of buildings or structures for dry-cleaning or dry-dyeing purposes shall be in accordance with the provisions of the Standards of the National Fire Protection Association for dry cleaning and dry dyeing plants, "Dry Cleaning Plants, NFPA No. 32."

**407.7 – GRAIN ELEVATORS**

- (a) Grain elevators, or structures used to store grain, shall not be located within fifty (50) feet of adjoining property lines of other structures, except railway rights of way or adjoining navigable waters, nor shall they be located within the Fire District.
- (b) Grain elevators, or structures used to store grain, shall be constructed of steel, concrete, or other non-combustible material or with lumber exterior or interior framing, including plank and laminated walls, when the sizes of the members used conform to the requirements for Type III Construction to meet the approval of the Building Official, and all such structures, buildings, and equipment shall be erected, altered, or installed in accordance with the provisions of [Section 407.3](#).
- (c) Where combustible material, other than grain, is present in quantity sufficient to produce a serious fire, fire protection equivalent to Type I Construction shall be provided unless approved automatic sprinkler protection is provided ([Section 901](#)). In any case, the requirements for grain elevators, or grain storage buildings, shall not be less restrictive than those applying to Hazardous occupancies.

**407.8 – TIRE RECAPPING**

Tire recapping facilities shall be classified as Hazardous occupancy if they exceed the square footage shown below:

Type Construction	Square Feet
Type I	No Limit
Type II	No Limit
Type III	12,000
Type IV	9,000
Type V	9,000
Type VI	Not Permitted

**407.9 – HANDLING OR STORAGE OF CELLULOSE NITRATE FILM**

- (a) Construction of Buildings Where Films Are Stored or Processed.
  - 1. All buildings in which cellulose nitrate films are stored or processed, such as film exchanges, film laboratories, motion picture studios, etc., shall be of Type I or Type II construction and shall be equipped throughout with approved automatic sprinklers in accordance with [Section 901](#). Such buildings shall not be located in the Fire District and shall not exceed the maximum height and area limitations specified in [Table 400](#).

## CLASSIFICATION OF BUILDING BY OCCUPANCY

2. The following regulations shall govern the handling and storage of cellulose nitrate film except that they do not apply to the following: Films in original packages in quantities less than fifty (50) pounds, and film stored in motion picture projection booths (see [Section 404.11](#)).
3. Except as otherwise specified herein, the handling and storage of combustible film shall be governed by the Standards of the National Fire Protection Association for storage and handling of cellulose nitrate motion picture film, "Cellulose Nitrate Motion Picture Film, NFPA No. 40."
4. All rooms in which cellulose nitrate films are stored or handled, except motion picture projection booths and film vaults, shall be enclosed in partitions of non-combustible construction having not less than two (2) hours fire resistance. Openings in such partitions shall be protected by approved fire doors. Floor-ceiling assemblies of such rooms shall provide fire resistance of not less than two (2) hours and vents that open automatically in case of fire shall also be provided. Tables and racks used in connection with the handling of film shall be of metal or other non-combustible material and shall be at least four (4) inches away from any radiator or heating apparatus. Fire-fighting appliances using water, or water solutions, shall be provided in every room. In rooms where film is stored or handled in quantities greater than fifty (50) pounds, cabinets shall be provided with insulated metal vents. Film storage rooms in which two or more persons work, shall have at least two exits remote from each other.
5. Cellulose nitrate film in amounts of more than one thousand (1,000) pounds shall be kept in vaults constructed as prescribed in this Section.
6. Amounts of cellulose nitrate film in excess of twenty-five (25) pounds shall be kept in approved metal cabinets of capacity not exceeding three hundred seventy-five (375) pounds. Cabinets having a capacity of over fifty (50) pounds of film shall be provided with insulated metal vents of at least fourteen (14) square inches per one hundred (100) pounds of film. Cabinets holding over seventy-five (75) pounds of film shall be provided with at least one automatic sprinkler, unless so built that each roll is in a separate compartment so constructed that the film will burn out without communicating fire to film in any other compartment.
7. Unexposed film, when stored in the original shipping cases with each roll in a separate container, shall be stored only in a room provided with an approved automatic sprinkler system. ([Section 901](#).)

### (b) Film Vaults.

1. Vaults used for the storage of cellulose nitrate film shall not exceed seven hundred fifty (750) cubic feet inside and shall not be located near chimneys or other sources of heat.
2. Walls, floors and roofs of film vaults and their supports shall be of not less than four (4) hour fire resistance construction built without cracks or holes that will permit escape of gases. Drains, or scuppers, to the outside of the building shall be provided. All door openings shall be protected with approved fire doors on each face of the wall; the inner door shall be automatic, the outer door shall be of the self-closing swinging type.

3. Each vault shall have an independent vent having not less than one hundred forty (140) square inches effective area per one thousand (1,000) pounds of film capacity (equivalent to seventy (70) square inches per one hundred (100) standard rolls) but the vent area for a vault of seven hundred fifty (750) cubic feet shall in no case be less than one thousand four hundred (1400) square inches. Vents shall be of non-combustible materials and shall be located at least fifty (50) feet from all openings exposed thereto.
4. Film shall be protected against ignition by rays of the sun and by radiated heat.
5. Vaults shall not have skylights or glass windows except as specified for vents. Vents may be protected against the weather by a single thickness of glass (1/16" thick) not less than two hundred (200) square inches in area, in a sash arranged to open automatically in case of fire, or by equivalent protection.
6. Vaults shall be protected by an approved system of automatic sprinklers (Chapter IX) with a ratio of one (1) head to each sixty-two and one-half (62½) cubic feet of total vault space. A vault of seven hundred fifty (750) cubic feet shall have not less than twelve (12) sprinkler heads.
7. Wire guards shall be provided so that film cannot be placed within twelve (12) inches of heating pipes or radiators.
8. Vault heating shall be automatically controlled so as not to exceed a temperature of seventy (70) degrees F. or a steam pressure of ten (10) pounds.
9. All racks and equipment in vaults shall be of metal or other non-combustible material.

#### **407.10 – COMBUSTIBLE FIBERS**

Warehouses used to store combustible fibers such as cotton, sisal, jute, hemp, kapok, excelsior and similar materials having a flash fire hazard, shall be limited to story heights of not over twelve (12) feet, floor to ceiling, and no single storage compartment shall exceed five thousand (5,000) square feet in floor area or thirty-six thousand (36,000) cubic feet in capacity.

#### **407.11 – HAY STORAGE**

Stables, for storing hay, which do not exceed one (1) story and storage loft, or a maximum of twenty (20) feet in height, and do not exceed three thousand (3,000) square feet in floor area, may be of Type VI Construction if located thirty (30) feet or more from adjoining property lines and other structures.

### **SECTION 408 FACTORY-INDUSTRIAL OCCUPANCY – (F)**

#### **408.1 – SCOPE**

- (a) Factory-Industrial (F) Occupancy is use of a building or structure, or any portion thereof, for assembling, disassembling, repairing, fabricating, finishing, manufacturing, packaging or processing operations that are not classed as hazardous occupancies.

CLASSIFICATION OF BUILDING BY OCCUPANCY

(b) Factory-Industrial (F) Occupancy – shall include, among others, the occupancies listed in this Section, but does not include buildings used principally for any purpose involving highly combustible, flammable, or explosive products or materials (See Section 411):

- |                     |                        |
|---------------------|------------------------|
| Manufacturing Plant | Mill                   |
| Factory             | Laboratories           |
| Assembly Plant      | Dry Cleaning Plants    |
| Laundries           | (Using Non-Combustible |
| Processing Plant    | Cleaning Fluid)        |

(c) Portions of Factory-Industrial (F) Occupancy involving highly combustible, flammable or explosive products of materials shall be properly ventilated, protected and/or separated from the remainder of the building in accordance with the appropriate NFPA Standard or the entire building will be classified as Hazardous Occupancy. (See Section 407).

**408.2 – OCCUPANT CONTENT**

The capacity of occupant content of industrial occupancies shall be as set forth in [Chapter 11](#).

**408.3 – SPECIAL PROTECTIVE REFERENCES**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as Factory-Industrial occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

1. Occupancy Permit Required for Changed Floor Loads ..... [1207](#)
2. Storage and Handling of Flammable Liquids and Materials ..... [407.4](#)

**SECTION 409 INSTITUTIONAL OCCUPANCY – (I)**

**409.1 – SCOPE**

(a) Institutional (I) Occupancy is use of a building or structure, or any portion thereof, for the purpose of providing medical treatment or care and sleeping facilities for persons who are mostly incapable of self-preservation because of age, physical or mental disability, or because of security measures not under the occupants' control.

(b) Institutional (I) Occupancy – Restrained. Buildings in which more than two (2) people are detained for penal or correctional purposes, or in which the liberty of the inmates is restricted, or places of involuntary detention, shall be classified as Institutional – Restrained. Institutional Occupancy – Restrained shall include, among others, the following:

- |                                  |         |
|----------------------------------|---------|
| Mental Institutions (Restrained) | Jails   |
| Reformatories                    | Prisons |

(c) Institutional (I) Occupancy – Unrestrained. Buildings in which more than five (5) people are harbored for medical, charitable or other care or treatment shall be classified as Institutional – Unrestrained. Institutional Occupancy – Unrestrained shall include, among others, the following:

- |  |                                    |
|--|------------------------------------|
| Hospitals                                  | Homes for the Aged                 |
| Sanitariums                                | Nursing Homes                      |
| Orphanages                                 | Mental Institutions (Unrestrained) |
| Day Care Facilities (under 3 years of age) |                                    |

Residential care facilities keeping ten or more adults who are mildly or moderately retarded or similarly developmentally disabled (as determined by the state agency having licensure jurisdiction), trainable, ambulatory, and not involuntarily detained.

Residential Care Facilities for 10 or more children who are Dependent, Neglected, Abandoned, Destitute, Orphaned, Delinquent, and not involuntarily detained.

Exception: Residential care facilities keeping as many as six and less than 10 children who are dependent, neglected, abandoned, destitute, orphaned, delinquent, or children who are separated temporarily from their parents shall be classified as Group R – Residential Occupancy provided the facility meets the requirements of Section 510. Homes caring for retarded or invalid children are not included in the exception above for Group R – Residential Occupancy.

- (d) Dormitories for doctors, nurses, and able-bodied employees (not for patients or inmates) of institutional buildings shall be classified as Residential Occupancy.
- (e) Residential care facilities keeping as many as six and less than 10 adults who are mildly or moderately retarded or similarly developmentally disabled (as determined by the state agency having licensure jurisdiction), trainable, ambulatory, and not involuntarily detained shall be classified as Group R – Residential Occupancy provided the facility meets the requirements of Section 510.
- (f) “Temporary buildings housing work-release prisoners who are restricted by lock and key may be of Type IV noncombustible construction when not more than one-story in height nor more than 10,000 square feet in area.”
- (g) Residential Care Facilities which keep up to 6 ambulatory adults as determined by the State Agency having licensure jurisdiction and are Licensed under G.S.131(d)(2) may be classified as Group R – Residential Occupancy (Volume I-B) provided all walls and ceilings are protected with plaster, gypsum wallboard, or fire retardant treated wood or all combustible wall and ceiling finishes are painted with an approved fire retardant paint.
- (h) Residential care facilities which keep up to 6 adults with no more than three classified as non-ambulatory and/or semi-ambulatory as determined by the State Agency having licensure jurisdiction and are licensed under G.S. 131(d) (2) may be classified as Group R-Residential Occupancy (Volume I-B) provided the facility meets the requirements of Section 510. (Note: This requirement becomes effective on February 1, 1983.)

- (i) Residential care facilities keeping four or more non-ambulatory and/or semi-ambulatory residents as determined by the State Agency having licensure jurisdiction shall be classified as Group I – Institutional Occupancy. (Note: This requirement becomes effective on February 1, 1983.)

**409.2 – OCCUPANT CONTENT**

The capacity of occupant content of institutional occupancies shall be as set forth in [Chapter 11](#).

**409.3 – SPECIAL PROTECTIVE REFERENCES**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as Institutional Occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all Occupancies.

- 1. Storage and Handling of Flammable Liquids shall be prohibited.
- 2. Special Exit Doorway Requirements ..... [Chapter 11](#)
- 3. Special Exit Requirements for Sanitariums ..... [Chapter 11](#)
- 4. Non-Combustible Stairways Required ..... [Chapter 11](#)
- 5. Handling and Storage of Combustible Film ..... [Section 407.9](#)
- 6. Sprinklers Required ..... [Section 901.7](#)
- 7. Institutional buildings for the boarding or specialized care or nursing care on a 24-hour basis of 6 or more children, infants, convalescents and for aged persons, as defined in G.S. 131-126.1 (referred to as Group Care Facilities in this Section) shall be equipped with fire protection devices and fire extinguishers in accordance with Section A through F below:
  - A. Unless automatic sprinkler protection is provided, automatic fire detection systems installed in conformance with Pamphlets No. 71, No. 72 and No. 74 of the National Fire Protection Association shall be provided in all Group Care Facilities, such detection systems must bear the Underwriters' Laboratories label of approval and should be subject to semi-annual inspection and test conducted under contract by a qualified organization which should also provide maintenance service.
  - B. Required automatic sprinkler systems shall be in accordance with Chapter IX for systems in light hazard occupancies.
  - C. The sprinkler piping for any isolated hazardous area which can be adequately protected by a single sprinkler head may be connected directly to a domestic water supply system having a flow of at least 25 gallons per minute at 15 pounds per sq. inch residual pressure at the sprinkler head and the connection to the domestic water supply.
  - D. Every facility shall have a manually operated fire alarm system, except that visible alarm devices may be used in occupants areas. Audible alarm devices shall be used in non-occupant areas.

(The system required by this paragraph may be the same system as required by paragraph (A) above, if so equipped as to perform both functions.)



- E. Arrangements shall be made for the prompt notification of the public fire department or such other outside assistance as may be available in case of fire or other emergency. An outside bell or horn should be provided in addition to the inside alarm so connected that both will sound at the same time.

(It is highly desirable that fire alarm equipment installed for the notification of the occupants of buildings in localities under protection of regularly organized fire departments be arranged to cause automatic transmission of alarms, directly or through an approved central sending station or system. When no such connection is provided, it is recommended that a fire alarm box arranged to signal the fire department be installed either at the main entrance to the building, at the telephone switchboard or outside the building plainly visible by day or night and conveniently accessible from the main entrance.)

- F. *Fire Extinguishers:* Approved first aid fire appliances shall be provided in accordance with the standard of the National Fire Protection Association for First Aid Fire Appliances (NFPA No. 10). They shall be so located on each floor level that a person will not have to travel more than 100 feet from any point to reach the nearest unit. At least one 2 ½ gallon water type extinguisher shall be required for each 2,500 sq. feet of floor area or fraction thereof. In addition, an approved first aid fire appliance shall be installed at each kitchen and workshop.

Note: Type I and Type II Construction, three stories or less in height are required to have sprinkler system or automatic fire detection system only in unoccupied areas such as, storage rooms, kitchens, recreation rooms, etc.

## **SECTION 410 MERCANTILE OCCUPANCY – (M)**

### **410.1 – SCOPE**

- (a) Mercantile (M) Occupancy is the use of a building or structure or any portion thereof, for the display and sale of merchandise.
- (b) Mercantile (M) Occupancies shall include, among others, the following:

Shopping Malls	Markets
Stores	Restaurants (accommodating less
Shops	than 100 persons)

Restaurants or places supplying food or drink that accommodate one hundred (100) or more people, or that have a stage, or that provide dancing, (See Section 404).

### **410.2 – OCCUPANT CONTENT**

The capacity of occupant content for mercantile occupancies shall be as set forth in [Chapter 11](#).

### **410.3 – SPECIAL PROTECTIVE REFERENCE**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as mercantile occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

1. Special exit doorway requirements ..... [Chapter 11](#)
2. Sprinklers Required ..... [Section 901.7](#)
3. Shopping Malls ..... [Section 507](#)

## SECTION 411 RESIDENTIAL OCCUPANCY – (R)

### 411.1 – SCOPE

(a) Residential (R) Occupancy is the use of a building or structure, or any portion thereof, for sleeping accommodations and is not classed as an Institutional Occupancy.

(b) Residential (R) Occupancies shall include, among others, the following:

Dwellings	Lodging Houses
Multiple Dwellings (more than two families)	Convents
Hotels and Motels	Monasteries
Dormitories	Condominiums
	Townhouses

### 411.2 – OCCUPANT CAPACITY

The capacity of occupant content for residential occupancies shall be as set forth in [Chapter 11](#).

### 411.3 – SPECIAL PROTECTIVE REFERENCES

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as residential occupancies.

Refer to [Section 402.4](#) for General Protective References applicable to all occupancies.

1. Storage and handling of flammable liquids shall be prohibited in every Residential (R) Occupancy. Not more than one (1) gallon of flammable liquid, used for cleaning purposes only, may be kept in a residence, provided such flammable liquid is kept in an approved container, used especially for that purpose.
2. Fire Detection Systems in multiple family dwellings and townhouses, [Section 720](#).
3. All dwelling units or [apartments](#) within Multiple Dwellings, and units of hotels and motels shall be separated with one (1) hour fire-resistance construction (See [Section 403.2](#) and [702](#)).
4. See [Section 403.3](#) for separation required between townhouses.
5. See [Section 506](#) for High Rise provisions.
6. See [Section 720](#) for smoke detector requirements.

## SECTION 412 STORAGE OCCUPANCY – (S)

### 412.1 – SCOPE

(a) Storage (S) Occupancy is the principal use of buildings which are used for the storage of goods, wares or merchandise, excepting limited storage incidental to the display, sale or manufacture of such goods, wares or merchandise.

(b) Storage (S) Occupancy – shall include, among others, the occupancies listed in this Section, but does not include buildings principally used to store highly combustible, flammable or explosive products or materials (See Section 407).

- |                  |                               |
|------------------|-------------------------------|
| Aircraft Hangars | Storage Buildings             |
| Garages          | Freight Depots                |
| Warehouses       | Automobile Parking Structures |
| Coal Pockets     | Public Parking Decks          |

(c) Portions of Storage Occupancy involving highly combustible, flammable or explosive products or materials shall be properly ventilated, protected and/or properly separated from the remainder of the building in accordance with the appropriate NFPA Standard or the entire building will be classified as Hazardous Occupancy.

**412.2 – OCCUPANT CONTENT**

- (a) The capacity of occupant content for storage occupancies shall be as set forth in Section 1105.
- (b) In places of storage occupancies the safe floor loads, as approved by the building official, shall be posted by the building owner.

**412.3 – SPECIAL PROTECTIVE REFERENCES**

The following references to other protective requirements, as set forth in this Code, shall apply to all areas classified as storage occupancies.

Refer to [Section 402.3](#) for General Protective References applicable to all occupancies.

1. Non-combustible Stairway Requirements .....	<a href="#">Chapter 11</a>
2. Occupancy Permit for Changed Floor Loads .....	<a href="#">Section 1207</a>
3. Storage and handling of flammable liquids and materials .....	<a href="#">407.4</a>
4. Storage and handling of combustible films .....	<a href="#">407.9</a>
5. Aircraft Hangars .....	<a href="#">412.4</a>
6. Coal Pockets .....	<a href="#">412.5</a>
7. Private Garages .....	<a href="#">412.6</a>
8. Parking Lots and Automobile Parking Structures .....	<a href="#">412.7</a>
9. Public Garages .....	<a href="#">412.8</a>

**412.4 – AIRCRAFT HANGARS**

- (a) Aircraft hangars may be of any type of construction. Exterior walls that are located within thirty (30) feet and facing common property, interior lot lines or the opposite side of a public street or thoroughfare shall provide not less than two (2) hour fire resistance.
- (b) The floor areas of hangars shall not exceed those permitted for Storage Occupancies in [Table 400](#) as modified.

## CLASSIFICATION OF BUILDING BY OCCUPANCY

- (c) Where hangars have **basements**, the floor over the **basement** shall be of Type I Construction and shall be made tight against seepage of water, oil or vapors. There shall be no opening or communication between **basement** and hangar. Access to **basement** shall be from outside only.
- (d) Floors shall be graded and drained to prevent water or gasoline from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.
- (e) Heating of hangars shall be from plants located in a detached building.
- (f) The process of "doping", involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate detached building equipped with automatic sprinkler equipment in accordance with **Section 901**.

### **412.5 – COAL POCKETS**

Coal pockets, and other similar structures, shall be constructed of steel, concrete, or other non-combustible material, or of lumber sizes which meet the requirements of Type III Construction to meet the requirements of this Code and the approval of the Building Official.

### **412.6 – PRIVATE GARAGES**

- (a) Garages which are provided for the storage of motor vehicles owned by tenants of buildings on the premises, and with maximum undivided space used for storage of not more than four (4) automobiles, or trucks of one (1) ton or less capacity, but not exceeding eight hundred fifty (850) square feet, shall be considered private garages. All other garages shall be considered public garages.
- (b) Private garages may be of Type I, II, III, IV, V or VI construction, but a private garage shall not occupy space above the first floor of Type VI building or shall be erected in the fire district except as provided in **Section 304(a)2**. Private garages shall not be located within, or attached to, a building occupied for any other purpose unless it is separated from such other occupancy by walls, partitions, and floor/ceiling assemblies that have a fire resistance rating as specified in **Section 403** (Mixed Occupancy Separation). Walls, floors, partitions and floor-ceiling assemblies that effect such separation shall be continuous and unpierced. A single flush-type solid core wooden door of not less than 1 ¾ inch nominal thickness, equipped with a self-closing device, may be permitted provided the sill is raised at least eight (8) inches above the garage floor when the doorway connects directly with any room in which there is any direct-fired heating device or gas fixture. In no case, however, shall a garage have an opening directly into a room used for sleeping purposes.

### **412.7 – PARKING LOTS AND AUTOMOBILE PARKING STRUCTURES**

- (a) Parking Lots – Open sheds or canopies may be erected on two-thirds (2/3) the area of a lot, provided such construction is not less than required for Type IV Construction, and that all such construction meets the approval of the Building Official.
- (b) Automobile Parking Structures
  - (1) As defined in Section 201.2, Automobile Parking Structures shall be constructed of Type I, II or IV Construction to the allowable areas and heights prescribed for Group "S" – Storage Occupancy buildings.

- (2) Automobile parking structures having not less than fifty percent (50%) of each of at least two exterior walls open at each floor level may be erected to the area and height limits as prescribed in the following table:

**Table 412.7 – Allowable areas and height of open type automobile parking structure**

Construction Type	Allowable Area Sq. Ft. Per Tier	Allowable Height
Type I	No Limit	No Limit
Type II	No Limit	No Limit
Type IV	160,000	8 Tiers or 75 Ft.

- (3) When such structures are within ten (10) feet of a common property or building line, they shall be provided with an enclosure wall along the line of not less than one (1) hour fire resistance without openings therein, except door openings meeting the requirements of [Section 703.4](#) shall be permitted. The distance from any point on any floor level to an open exterior wall facing on a street, or to other permanently maintained open space at least 20' in width which is accessible to a street, shall not exceed two hundred (200) feet.
- (4) In such structures without exterior walls, there shall be placed a continuous protective railing not less than 3 feet 6 inches above the floor around the entire outside perimeter of the structure. If continuous wheel guards not less than 6 inches in height is not provided, enclosure walls, parapet walls, dwarf walls or barriers, at or near floor openings and the extremities of a space used as a parking garage, and which are subject to impact from motor vehicles, shall be designed and constructed to withstand safely, a horizontal thrust applied at 18 inches above the floor and of not less than 150 pounds per linear foot where the floor is level and where there is a ramp or inclined floor, 150 pounds plus each additional thrust as is commensurate with any probable additional impact because of such ramp or inclined floor. The total horizontal thrust need not be considered as more than 500 pounds per linear foot where there is a ramp or inclined floor. Parapet and dwarf guard walls which are less than 36 inches in height above the floor level and which are more than 4 feet above grade, shall be surmounted by a railing.
- (5) All such structures shall be provided with standpipes in accordance with [Section 902.2](#) regardless of structure height when (1) area per tier exceeds 30,000 sq. ft. or (2) minimum depth provision measured from the required exterior wall facing on a street or other permanently maintained open space at least 20' in width accessible to a street exceeds 200'.
- (6) The requirements of Section 610 shall also apply when two or more automobile parking structures buildings are located on the same lot.
- (7) The means of egress, exits and exit outlets and other exit provisions required by [Chapter 11](#) shall apply, except that travel distance to an exit may be a maximum of 200' and vehicular ramps are not required to be enclosed. Some pertinent provisions of [Chapter 11](#) are:

Exit definition – [Section 1102\(a\)](#).

Number of Exits required – [Section 1103.2](#).

Measurement of distance to exits – [Section 1103.1](#).

Exit enclosure – [Section 1106](#) – Up to 4 stories, one hour and over 4 stories, two hours.

Exit outlets – [Section 1112](#) – Exits from other occupancies shall not exit through parking structures and all exits from all occupancies, shall lead directly to a street or other open space that gives safe access to a street.

Exit passageways – [Section 1112.2](#) – Exit outlets may extend to the street by way of enclosed passageways which have the same fire resistance rating as required stairways when stairs do not open directly to a street.

Exit signs – [Section 1123](#) – Exit signs shall be readable and when the distance to an exit is 200', they should be readable from that distance.

#### **412.8 – PUBLIC GARAGES**

- (a) A garage shall be any building or part thereof wherein is kept or stored a motor vehicle having any gasoline or other volatile flammable fuel in its fuel storage tank, or wherein painting, body and fender work, engine overhauling or other major repair of motor vehicles is performed. This occupancy shall not include automotive service stations as defined in [Section 405.4](#). A garage exceeding eight hundred fifty (850) square feet in area or used to store more than four (4) automobiles, shall be considered a public garage.
- (b) A public garage shall be of Type I, II, III, IV, V, VI Construction. If of Type V Construction, a public garage shall not exceed one story in height, nor shall it exceed the maximum height and area allowed for Storage Occupancy. Public garages of Type VI Construction may be used only for dead storage and display of automobiles.
- (c) A public garage shall not be located within, or attached to, a building occupied for any other purpose, unless separated from the other occupancies as prescribed in [Section 403](#), but in no case by walls having fire resistance less than two (2) hours. Such separation shall be continuous and unpierced, except for doors leading to salesrooms, or offices, operated in connection with such garages, provided such openings are approved by the Building Official as being required or essential, and provided such openings are equipped with self-closing fire doors conforming to the requirements of [Section 703](#).
- (d) Unenclosed ramps shall not be considered as providing required exit facilities. Enclosed ramps shall be in accordance with the Exit Requirements of [Chapter 11](#).
- (e) [Basement](#) and sub-[basement](#) garages shall be continuously ventilated by a mechanical system with positive means for both inlet and exhaust of at least one (1) cubic foot of air per minute per square foot of floor area, controlled from a location close to the entrance door.
- (f) Garage floors shall be of concrete or similar non-combustible and non-absorbent materials. Floors which drain to sewers or storm drains shall be provided with an oil separator or trap.
- (g) Sprinkler equipment shall be provided as required in [Section 901](#).
- (h) Heating equipment, other than unit heaters suspended at least eight (8) feet above the garage floor, shall be placed in a separated room cut off by two (2) hour fire rated construction and four (4) inch reinforced concrete floor and ceiling construction.

Entrance shall be from the outside or by means of a doorway with sill raised at least eight (8) inches above the garage floor level or through a vestibule providing two doorway separations.

Nothing in this section shall prohibit the installation of other than unit heaters in garages when the heating equipment is listed for such use and is installed in accordance with its listing and the provisions of this code and other applicable ordinances.

**TABLE 400 – HEIGHT AND AREA LIMITS**

Letters in Table refer to "Notes to Table 400."

Height for types of construction is limited to the number of stories shown, or height in feet.

Allowable areas are shown in thousands of square feet per floor. The area indicated for highest story of any given building is the maximum area for each floor for entire height of building.

For Modifications to allowable heights and areas see:

402.2 Height Modifications

402.3 Area Modifications

UA = No limit of floor area

UH =No height limit

NP = Not permitted

\* = Model Codes Standardization Council (See \* Notes under Table 400 Notes)

OCCUPANCY	HEIGHT	TYPE OF CONSTRUCTION																																		
		TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V				TYPE VI																				
		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected																				
		p	Spk	p	Spk	p	Spk	p	Spk	p	Spk	p	Spk	p	Spk	p	Spk																			
*MCSC Designation		443		332		3 HH		211				100				311				300				111				100								
Maximum Height in Feet		No Limit		80		65		75				35				45				45				35				35								
(A-1) Assembly – Large (Working Stage) a,b,c,f	UH 2-8 1	UA	UA	UA	NP	NP	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP				
(A-1) Assembly – Large (Non-Working Stage) a,b,c,f	UH 2-8 1	UA	UA	UA	UA	UA	UA	UA	NP	NP	15.0	45.0	NP	NP	18.0	54.0	(e)	(e)	NP	NP	NP	NP	12.0	36.0	(e)	(e)	NP	NP	NP	NP	NP	NP				
(A-2) Assembly – Small (Working Stage) a,b,f	UH 2-8 1	UA	UA	UA	NP	NP	UA	UA	NP	NP	15.0	45.0	NP	NP	18.0	54.0	(e)	(e)	NP	NP	NP	NP	12.0	36.0	(e)	(e)	NP	NP	NP	NP	5.0	15.0	(e)	(e)	NP	NP
(A-2) Assembly – Small (Non-Working Stage) a,b	UH 3-8 2 1	UA	UA	UA	NP	NP	UA	UA	(d)	(d)	10.0	20.0	(d)	(d)	12.0	24.0	(e,d)	(e,d)	NP	NP	NP	NP	10.0	20.0	(e,d)	(e,d)	NP	NP	NP	NP	9.0	27.0	(e,d)	(e,d)	NP	NP
(B) Business a,b,f,g	UH 6-8 4-5 3 2 1	UA	UA	UA	NP	NP	UA	UA	NP	NP	10.0	20.0	(h)	(h)	10.0	20.0	(h,q)	(h,q)	NP	NP	NP	NP	8.0	16.0	(h)	(h,q)	NP	NP	(h)	(h)	6.0	12.0	NP	NP	NP	NP
(E) Educational a,b,f,s	UH 3-8 2 1	UA	UA	UA	NP	NP	UA	UA	NP	NP	10.0	20.0	(i)	(i)	15.0	30.0	(i)	(i)	NP	NP	NP	NP	10.0	20.0	(i)	(i)	NP	NP	NP	NP	9.0	27.0	(i)	(i)	NP	NP
(H) Hazardous b,f,j	4 3 2 1	NP	NP	NP	NP	NP	NP	NP	NP	NP	5.0	7.5	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	5.0	7.5	NP	NP	NP	NP	NP	NP	NP	NP				

CLASSIFICATION OF BUILDING BY OCCUPANCY

**TABLE 400 (continued)**

OCCUPANCY	HEIGHT	TYPE OF CONSTRUCTION																													
		TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V				TYPE VI															
		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected		1-Hour (o)		Unprotected															
		P	Spk	P	Spk	P	Spk	P	Spk	P	Spk	P	Spk	P	Spk	P	Spk														
		Unspk	Spk	Unspk	Spk	Unspk	Spk	Unspk	Spk	Unspk	Spk	Unspk	Spk	Unspk	Spk	Unspk	Spk														
*MCSC Designation		443		332		3 HH		211				100				311				300				111				100			
Maximum Height in Feet		No Limit		80		65		75				35				45				45				35				35			
(F) Factory-Industrial a,b,c,f,g	UH 7-8	100.0	UA	UA	NP	NP	(r)	(r)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	
	6	100.0	UA	20.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	5	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	4	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	3	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	2	100.0	UA	30.0	UA	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0
	1	100.0	UA	UA	UA	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0
(I) Institutional – Restrained f	UH 2-9	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	1	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
(I) Institutional – Un-Restrained b,c,f,l,o	UH 3-9	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	2	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	1	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
(M) Mercantile a,b,c,f,g	UH 6-8	100.0	UA	NP	NP	NP	(h)	(h)	(h)	(h)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	(h,q)	
	3-5	100.0	UA	100.0	100.0	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	2	100.0	UA	100.0	100.0	10.0	20.0	15.0	30.0	8.0	16.0	6.0	12.0	8.0	16.0	6.0	12.0	8.0	16.0	6.0	12.0	8.0	16.0	6.0	12.0	8.0	16.0	6.0	12.0	8.0	16.0
	1	100.0	UA	100.0	100.0	15.0	45.0	20.0	60.0	20.0	60.0	12.0	36.0	15.0	45.0	20.0	60.0	20.0	60.0	15.0	45.0	20.0	60.0	20.0	60.0	15.0	45.0	20.0	60.0	20.0	60.0
(R) Residential a,b,f	UH 6-9	UA	UA	UA	NP	NP	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	
	5	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	
	4	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	
	3	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	
	2	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	
	1	UA	UA	UA	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	
(S) Storage a,b,c,f,g,k,m	UH 6	100.0	UA	NP	NP	NP	(r)	(r)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	(o)	
	5	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	4	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	3	100.0	UA	20.0	UA	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
	2	100.0	UA	30.0	UA	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0
	1	100.0	UA	30.0	UA	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0	20.0	60.0

**TABLE 400 NOTES**

a. For height modifications and limitations by occupancy, see:

1. Story Increase for Sprinklers
2. Mezzanines
3. Basements
4. Assembly – Basements
5. Business
6. Educational – Basements
7. Mercantile
8. Residential

note 'p' below:  
 402.2(c)  
 402.2(d)  
 402.2(e)  
 402.2(f)  
 402.2(e)  
 402.2(f)  
 402.2(b)



**TABLE 400 NOTES (continued)**

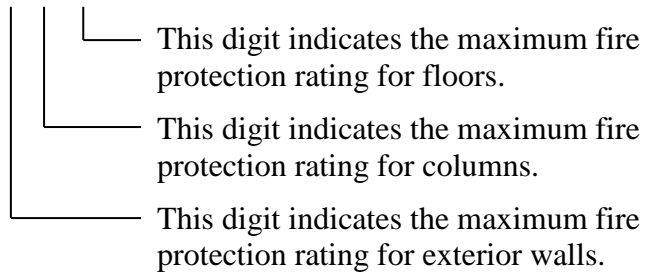
- b. For area modifications and limitations by occupancy, see:
- |                                 |                 |
|---------------------------------|-----------------|
| 1. Area increase for separation | 402.3(d)        |
| 2. Assembly                     | 402.3(g)        |
| 3. Business                     | 402.3(e)        |
| 4. Educational                  | 402.3(h)        |
| 5. Hazardous                    | 402.3(i)        |
| 6. Factory-Industrial           | 402.3(e), 901.7 |
| 7. Institutional-Unrestrained   | 409             |
| 8. Mercantile                   | 402.3(e), 901.7 |
| 9. Storage                      | 402.3(e), 901.7 |
- c. See [Section 901.7](#) for maximum unsprinklered areas.
- d. May be increased 33 1/3 percent for places of worship.
- e. One (1) hour fire-resistive floors shall be provided.
- f. See Section 506 for High Rise Requirements.
- g. See Section [402.3\(e\)](#) herein for unlimited area provisions.
- h. When five (5) or more stories in height, two (2) hour fire-resistive floors shall be required over the [basements](#) or cellar
- i. Floors located immediately above usable space in [basement](#) or cellars shall have a fire resistive rating of not less than one (1) hour except where an approved automatic sprinkler system is provided in such [basement](#).
- j. Modifications in height and area shall not be permitted in hazardous occupancies. For detail requirements, see Section 407.
- k. See [412.7](#) for allowable height and floor areas of automobile parking structures.
- l. See [901.6](#) for sprinkler requirements in [basements](#) and for buildings without access openings.
- m. See [901.7](#) for sprinkler requirements for public garages.
- n. Deleted.
- o. At least one-hour fire resistive construction shall be provided throughout all buildings except as listed in [Table 600](#).
- p. When buildings listed under this column are sprinklered, the height may be increased one story.
- q. When over two stories in height, an approved automatic sprinkler system shall be installed throughout the building, or all walls, partitions, floors, roofs and their supporting structural members shall provide not less than one (1) hour fire resistance within the building except that roofs of Type IV Construction need not be protected.
- r. When over three (3) stories in height, an approved automatic sprinkler system shall be installed throughout the building.
- s. At least one hour interior fire resistance construction shall be used throughout in all building two or more stories in height.

\* **TABLE 400 NOTES (continued)**

- t. When over two (2) stories in height, an approved automatic sprinkler system shall be installed throughout the Building.
- u. Wood frame one hour protected residential buildings may be three stories in height except when **basements** level is used as a habitable space. When the lower level of a residential building built on piles is used as habitable space or if more than 50 SF per living unit of such lower level space is enclosed, the lower level shall be counted as a story in limiting the height of the building. The maximum height in feet for pile construction shall be measured from a point 8' above highest finished floor to: (1) the average exterior grade or (2) the level of the grade under the unit, whichever is the lower grade.

These references are to the Model Codes Standardization Council's recommended types of construction and are for informational purposes only.

For example – MCSC Designation 4 4 3



**CHAPTER 5**  
**SPECIAL OCCUPANCY REQUIREMENTS**  
**SECTION 500 FIRE PROTECTION STANDARDS**

**500.1**

Except as specifically provided for by N.C. State Law, this code or subsequent rules promulgated by the N.C. Building Code Council, the standards of the National Fire Protection Association as listed in Chapter II and Appendix H shall be complied with for special occupancies or hazardous processes, materials or equipment covered by such Standards.

**SECTION 501 TEMPORARY STRUCTURES**

A special building permit for a limited time must be obtained before the erection of Temporary Structures such as seats, canopies, tents and reviewing stands. Such structures shall be completely removed upon the expiration of the time limit stated in the permit.

**SECTION 502 GREENHOUSES**

Greenhouses more than 35 feet in height shall have a non-combustible structural frame. Greenhouses not over 400 square feet in area, or 15 feet high, shall be considered accessory structures and may be of any construction except that any greenhouse with wood frames shall be located not less than 5 feet from any adjoining structure or property line.

**SECTION 503 REVIEWING STANDS, GRANDSTANDS AND BLEACHERS**

**503.1 – SCOPE**

Reviewing stands, grandstands and bleachers shall conform to the provisions of this Section.

**503.2 – DEFINITIONS**

**BLEACHERS:** Bleachers are tiered or stepped seating facilities without backrests in which an area of three (3) square feet or less is assigned per person for computing the occupant load.

**FOOTBOARDS:** Footboards are that part of a raised seating facility other than an aisle or cross aisle upon which the occupant walks to reach a seat.

**GRANDSTANDS:** Grandstands are tiered or stepped seating facilities wherein an area of more than three (3) square feet is provided for each person.

**OPEN AIR GRANDSTANDS AND BLEACHERS:** Open air grandstands and bleachers shall refer to seating facilities which are located so that the side toward which the audience faces is unroofed and without an enclosing wall.

**PERMANENT:** Permanent stands are those seating facilities which remain at a location for more than ninety (90) days.

**REVIEWING STANDS:** Reviewing stands are elevated platforms accommodating not more than fifty (50) persons. Seating facilities, if provided, are normally in the nature of loose chairs. Reviewing stands accommodating more than fifty (50) persons shall be regulated as grandstands.

**SAFE DISPERSAL AREA:** Safe dispersal area shall mean an area which will accommodate a number of persons equal to the total capacity of the stand and building which it serves in such a manner that no person within the area need be closer than fifty (50) feet from the stand or building. Dispersal areas are based upon an area of not less than three (3) square feet per person.

**TEMPORARY:** Temporary seating facilities are those which are intended for use at a location for not more than ninety (90) days.

### **503.3 – HEIGHT OF GRANDSTANDS AND BLEACHER**

- (a) Grandstands and bleachers, other than those of open skeleton frame type, when more than one (1) story in height or four hundred (400) square feet in area shall be of non-combustible construction or of not less than one (1) hour fire resistive construction. When the space under such structures is used for any purpose, it shall be separated from all parts of the grandstand or bleacher, including exits, by walls and floor-ceiling assemblies or not less than one (1) hour fire resistive construction.

**EXCEPTION:**

1. Exits under temporary grandstands need not be separated.
2. The underside of continuous steel deck grandstands, when erected outdoors, need not be fire protected when occupied for public toilets.

Grandstands or bleachers employing combustible members in the structural frame shall be limited to eleven (11) rows or nine (9) feet in height. Seatboards, toeboards, bearing or base pads and footboards may be of combustible materials.

### **503.4 – DESIGN REQUIREMENTS**

See [Chapter 12](#).

### **503.5 – GENERAL REQUIREMENTS**

- (a) Row spacing. There shall be a clear space of not less than twelve (12) inches measured horizontally between the back or backrest of each seat and the front of the seat immediately behind it. The minimum spacing of rows of seats measured from back to back shall be:
1. Twenty-two (22) inches for seats without backrests.
  2. Thirty (30) inches for seats with backrests.
  3. Thirty-three (33) inches for chair seating.
- (b) Rise – between rows. The maximum rise from one row of seats to the next shall not exceed sixteen (16) inches unless the seat spacing from back to back measured horizontally is forty (40) inches or more.
- (c) Seating capacity determination. Where bench type seating is used, the number of seats shall be based on one person for each eighteen (18) inches of length of the bench.
- (d) Aisles. Aisles required. Aisles shall be provided in all seating facilities except that aisles may be omitted when all of the following conditions exist:
1. Seats are without backrests.
  2. The rise from row to row does not exceed twelve (12) inches per row.

3. The number of rows does not exceed eleven (11) in height.
  4. The top seating board is not over ten (10) feet above grade.
  5. The first seating board is not more than twenty (20) inches above grade.
- (e) Obstructions. Obstructions shall not be placed in the required width of any aisle or exitway.
- (f) Width. Aisles serving seats on both sides shall have a minimum width of forty-four (44) inches. When serving seats only on one side, the aisle shall have a minimum width of thirty-six (36) inches.
1. Cross aisles and vomitories. Cross aisles and vomitories shall be not less than fifty-four (54) inches in clear width and shall extend to an exit, enclosed stairway or exterior perimeter ramp.
  2. Stairs and ramps. All stairs have a minimum rise of every step in a stairway of seven and one-half (7 ½) inches and a run of not less than ten (10) inches with a one-quarter (1/4) inch tolerance.  
  
Ramps shall not exceed a slope of one (1) vertical to ten (10) horizontal and shall have landings of at least five (5) feet length measured in the direction of the ramp run at the top and bottom and at least one intermediate landing shall be provided for each five (5) feet of rise.
  3. Guardrail. Perimeter guardrails or enclosing walls, or fencing shall be provided for all portions of elevated seating facilities more than thirty (30) inches above grade or floor. The height of the guardrail shall be forty-two (42) inches above the front edge of the walking surface and measured vertically and shall comply with [Section 1203.1\(c\)](#). Where the seat board is the walking surface, the height shall be measured from the front edge of the seat board.  
  
EXCEPTION: Guardrails at the front of the front row of seats which are not located at the end of an aisle and where there is no cross aisle may have a height of thirty (30) inches with a midrail.
  4. Toeboards A four (4) inch high vertical barrier shall be installed along the edge of walking platforms whereon guardrails are required.  
  
EXCEPTION: Toeboards shall not be required at the end of footboards.
  5. Footboards. Footboards shall be provided for all rows of seats above the third row or beginning at such a point where the seating plank is more than two (2) feet above grade. Where the same platform is used for both seating and footrests, footrests will not be required provided each level or platform is not less than twenty-four (24) inches wide. Footboards in bleachers at a level below the seat board it serves are not to be considered as walking platforms but shall be not less than a structural grade or 2-inch by 8-inch lumber or equivalent. When bleachers exceed eleven (11) rows in height, a walking platform not less than eighteen (18) inches in width shall be provided.

### 503.6 – SPECIAL REQUIREMENTS

- (a) Grandstands and Bleachers Within Buildings. Except as otherwise provided in this Section, grandstands and bleachers shall comply with the other applicable sections of [Chapter 11](#).

## SPECIAL OCCUPANCY REQUIREMENTS

EXCEPTION: When seats are without backrests, there may be nine (9) seats between any seat and an aisle (For Reverse folding Bleachers and portable folding bleachers, see paragraph 503.6(c)).

- (b) Open Air Grandstands and Bleachers. Except as otherwise provided in this subsection, open air grandstands and bleachers shall comply with the other applicable sections of Chapter 11.
1. Dead ends. Dead ends in vertical aisles shall not exceed a depth of sixteen (16) rows for permanent grandstands and twenty-six (26) rows for temporary grandstands.
  2. Distance to exit. The line of travel from any seat to a safe dispersal area exit ramp, enclosed stairway or vomitory shall not be more than two-hundred (200) feet. When the seats do not have backrests, the distance may be measured by direct line.
  3. Safe dispersal area. Each safe dispersal area shall have a minimum of two (2) exits. If more than six-thousand (6000) persons are to be accommodated within a dispersal area, there shall be a minimum of three (3) exits and for more than nine-thousand (9000) persons there shall be at least four (4) exits. The aggregate clear width of exits from a safe dispersal area shall be determined on the basis of not less than one (1) exit unit of twenty-two (22) inches for each five-hundred (500) persons to be accommodated and no exit shall be less than forty-four (44) inches in width.
  4. Two exits required. Two (2) exits shall be provided from every stand which accommodates more than three-hundred (300) persons.
  6. Three exits required. Three (3) exits shall be required where a grandstand or section thereof accommodates more than one-thousand (1000) persons.
  6. Four exits required. Four (4) exits shall be provided where a grandstand or section thereof accommodates more than three-thousand (3000) persons.
  7. Determination of exit width. The total width of exits in feet shall be not less than the total occupant load served divided by one hundred fifty (150) when exiting by stairs and divided by two hundred (200) when exiting by ramps, corridors, tunnels or vomitories.
  8. Minimum exit width. No exit shall be less than forty-four (44) inches in width.
- (c) For reverse folding and portable bleachers the horizontal swaying force applied to the seats in a direction perpendicular to the length of the seats shall be twenty pounds per linear foot of seats. Reserve folding bleachers and portable folding bleachers (types which are not stabilized with wall attachments) when in open, partially open or closed position, shall be so designed as to resist overturning of the units. The minimum design resisting moment shall be defined by 500 pounds located 18 inches from the extreme front or rear face of the assembly or a total overturning moment of 750 foot pounds per each 10-foot length of bleacher assembly. A factor of safety of 2 will be required making a total resisting moment of 1500 foot pounds per each 10-foot length of bleacher assembly which must either be produced by the dead weight of the bleachers or by other means.

Back and side panels must be included on all reverse folding and portable bleachers to make climbing difficult.

Other specifications shall be in accordance with NFPA No. 102, Section 4 "Folding and Telescoping Seating". If any conflict exists between these specifications and NFPA No. 102, the more severe requirements shall control.

### **SECTION 504 FARM BUILDINGS**

Farm Buildings outside municipalities are not covered by this Code.

Farm Buildings shall include those structures other than residences and structures appurtenant thereto, for on-farm use (barns, sheds, poultry houses, etc.). Maximum allowable deflection for structural members of such farm buildings should not exceed 1/180 of span. Design limitations based on deflection as prescribed elsewhere in this code shall not be applicable.

### **SECTION 505 COVERED AND ENCLOSED WALKWAYS AND TUNNELS**

#### **505.1 – SCOPE**

This section shall apply to connections between buildings such as walkways or tunnels, located at, above, or below grade level, that are used as a means of travel by persons.

#### **505.2 – DEFINITIONS**

- (a) Covered walkway. A roofed, unobstructed walkway, where the least horizontal dimension is less than thirty (30) feet, connecting buildings and used as a means of travel by persons and where less than fifty (50) percent of the perimeter is enclosed.
- (b) Enclosed walkway. A roofed, unobstructed walkway, where the least horizontal dimension is less than thirty (30) feet, connecting buildings and used as a means of travel by persons and where fifty (50) percent or more of the perimeter is enclosed.
- (c) Tunneled walkway. An un-obstructed underground walkway connecting buildings and used as a means of travel by persons.

#### **505.3 – CONSTRUCTION**

- (a) Covered walkway: A covered walkway shall be of any type of construction permitted by this code, provided the walls and openings at the point of connection to the building shall be protected so as to reasonably prevent the spread of fire from one building into the other.
- (b) Enclosed walkway: An enclosed walkway shall be required to be of a type of construction permitted for the buildings connected. Separation between the enclosed walkway and the building to which it is connected, except when used as an exit outlet, shall be of not less than one (1) hour fire resistant construction, and openings therein shall be protected in accordance with Section 703.
- (c) Tunneled walkway: A tunneled walkway shall be of a type of construction suitable for underground location. Separation between the tunneled walkway and the building to which it is connected shall be not less than two (2) hour fire resistant construction and openings therein shall be protected in accordance with Section 703.

#### **505.4 – EXITS**

See [Chapter 11](#).

## 505.5 – VENTILATION

Smoke and heat venting shall be provided for enclosed walkways and tunneled walkways. Such venting systems shall be in accordance with "Guide for Smoke and Heat Venting, NFPA 204" or other accepted engineering practice.

## SECTION 506 SPECIAL PROVISIONS FOR HIGH RISE BUILDINGS

### 506.1 – GENERAL REQUIREMENTS

- (a) Purpose – All buildings which exceed the limitations specified in [Section 506.2](#) must be of Type I or Type II construction in accordance with [Table 400](#) and [Table 600](#) and based on height being about 60, 120 or 250 feet, be specifically designed to limit the danger to occupants and fire fighters from exposure to fire, heat and smoke in a building fire by providing:
- (1) Sprinkler protection and smoke control; or
  - (2) Compartmentation and smoke control to provide "safe areas or refuge"; or
  - (3) Combination of both sprinkler protection, compartmentation and smoke control to provide safe area of refuge; and
  - (4) Communication systems and smoke free stairways to provide directions for egress to outside of building or access to "safe area of refuge".
- (b) High Rise Requirements Preemptive – All high-rise buildings shall comply with the requirements of applicable Sections of Volume I, II, III and IV of the N.C. State Building Code and when there is a conflict, the provisions of Section 506 shall apply unless expressly stated otherwise.
- (c) Central References for High Rise Requirements – The designers shall provide a central reference sheet indicating the sheet numbers and specifications sections which provide a summary of the description of the operation of and schematic drawings of required mechanical and electrical "life safety equipment" and otherwise how he proposes to comply with the provisions of this Section.
- (d) Maintaining Fire Resistive Integrity of Floors and Walls – Plans for all buildings shall indicate the tested assembly fire resistive design numbers, if any, and how the required structural and fire resistive integrity will be maintained where a penetration of a required fire-resistive wall, floor or partition will be made for plumbing, mechanical, electrical and communication conduits and other pipes or systems and also indicate in sufficient detail how the fire integrity will be maintained where required fire-resistive floors abut or intersect the exterior walls.
- (e) Materials in Concealed Spaces. Materials used within concealed spaces shall conform with the following requirements:



- (1) Materials used in piping, conduit, raceways, ducts and other systems including thermal and acoustical insulation and vapor barriers installed within floor and roof assemblies, walls and partition shall qualify as non-combustible in accordance with requirements of part (a) of the definition of non-combustible material contained in Section 201 unless the wall, floor or roof assembly, which is proposed to be used, is listed with such materials incorporated within the assembly by a nationally recognized testing laboratory in accordance with "Standard Methods or Fire Tests of Construction and Materials, ASTM E-119, latest edition.
- (2) Materials which do not meet this definition of non-combustible shall not be used within vertical shafts and shall not penetrate the walls of required fire rated vertical shafts or required fire rated corridors, walls or other fire rated walls and partitions which are required to extend to the floor slab.
- (3) This Section does not apply to insulation provided as a part of approved electrical wiring nor to electrical conduit or piping entirely encased and embedded in concrete or masonry.
- (4) Penetration of floor slab within a floor assembly may be permitted with such materials which do not meet the definition of non-combustible provided such floor assembly, with such penetrations incorporated therein, is listed by a nationally recognized testing laboratory in accordance with ASTM E-119, latest edition.
- (5) Plastic pipe (ABS and PVC) shall not be used in buildings exceeding 60' in height but may be used in buildings less than 60' in height in accordance with provisions of Section 506.1(e)(1) and (4) and the plumbing code.

\*Copies of the ACNBC Publication "Measures for Fire Safety in High Buildings" are available from the Secretary, Associate Committee on the National Building Codes, National Research Council, Ottawa, KIA, OR6, price \$1.00.

- (f) Design of Life Safety Equipment – All electrical and mechanical equipment, central alarm and communications systems, smoke control measures and sprinkler systems as herein after specified must be designed by an engineer registered in the State of North Carolina in accordance with Chapter 89 of the General Statutes. The plans for the sprinkler system shall be submitted to the Engineering and Building Codes Division of the Department of Insurance and shall bear the seal of an engineer registered in North Carolina.
- (g) Filing of Test Reports on Life Safety Equipment – The engineer performing the design for the electrical and mechanical equipment, including sprinkler systems, must file the test results with the Engineering and Building Codes Division of the Department of Insurance that such systems have been tested to indicate that they function in accordance with the standards specified in this Section and according to design criteria.
- (h) Occupancy Permit Required for Occupancy of Any Portion of Building – Occupancy of building, or any portion thereof, shall not be permitted until all fire suppression and life safety equipment has been installed and is operative in the occupied areas, the means of egress leading therefrom and required refuge areas. (Refer to [Section 105.10](#) for issuance of occupancy permit.)

## SPECIAL OCCUPANCY REQUIREMENTS

- (i) Measures that relate to limiting or controlling the movement of smoke caused by a building fire are described in ACNBC Publication "Measures for Fire Safety in High Buildings". Adoption of these measures, as applicable, is considered to be an acceptable means of complying with the requirements of this Section. It is not, however, intended that these measures should be regarded as excluding any other equally effective measure that may be developed and submitted to the Engineering and Building Codes Division of the Department of Insurance for approval.

### **506.2 – SCOPE**

All buildings shall be classified as Class I, II or III according to the following table: (1) (3).

**Table 506.2**  
**SCOPE**

Class (1)	Occupancy Group	Occupied Floor Above Average Grade Exceeding Height (3)	
Class I	Group R – Residential	60' but less than 120' above average grade or 6 but less than 12 stories above average grade.	
	Group B – Business		
	Group M – Mercantile		
	Group S – Storage		
	Group F – Industrial/Factory		
	Group H – Hazardous		
Class II	Group E – Educational	36' but less than 60' above average grade or 3 but less than 6 stories above average grade.	
	Group I – Institutional		
	Group A – Assembly		
	Group R – Residential		120' but less than 250' above average grade or 12 but less than 25 stories above average grade.
	Group B – Business		
	Group M – Mercantile		
Group S – Storage			
Group F – Industrial/Factory			
Group H – Hazardous			
Class III	Group E – Educational	60' but less than 120' above average grade or 6 but less than 12 stories above average grade.	
	Group I – Institutional		
	Group A – Assembly		
	Group E – Educational		250' or 25 stories above average grade.
	Group B – Business		
	Group M – Mercantile		
Group S – Storage			
Group F – Industrial/Factory			
Group H – Hazardous			
Class III	Group E – Educational	120' or 12 stories above average grade.	
	Group I – Institutional		
	Group A – Assembly		
	Group A – Assembly		

NOTE 1: The entire building shall comply with this section when the building has an occupied floor above the height specified, except that portions of the buildings which do not exceed the height specified are exempt from this Section, subject to the following provisions:

- (a) Low rise portions of Class I buildings must be separated from high rise portions by one hour construction.
- (b) Low rise portions of Class II and III buildings must be separated from high rise portions by two hour construction.

## SPECIAL OCCUPANCY REQUIREMENTS

- (c) Any required exit from the high-rise portion which passes through the low-rise portion must be separated from the low-rise portion by the two hour construction.

NOTE 2: The height described in [Table 506.2](#) shall be measured between the average grade outside the building and the finished floor of the top occupied story.

NOTE 3: Public parking decks meeting the requirements of [Section 412.7](#) and less than 75 feet in height are exempt from the requirements of this Section when there is no other occupancy above or below such deck.

NOTE 4: Special purpose equipment buildings, such as telephone equipment buildings housing the equipment only, with personnel occupant load limited to persons required to maintain the equipment may be exempt from any or all of these requirements at the discretion of the Engineering and Building Codes Division provided such a special purpose equipment building is separated from other portions of the building by two hour fire rated construction.

### 506.3 – AREAS OF REFUGE UTILIZING COMPARTMENTATION AND SMOKE CONTROL

- (a) Smoke Free Stairs and Elevator Shafts – Buildings of Class I, II and III shall have smokeproof stairways and pressurized stairway shafts in accordance with [Section 506.18\(a\)](#) and pressurized elevator shaft(s) as specified in [Section 506.7\(b\)\(6\)](#) to provide egress to outside or access to areas of refuge.
- (b) Required Areas of Refuge Every Fifth Floor – Class III Buildings shall be provided with a designated "area of refuge" on at least every fifth floor to be designed so that occupants above the ground floor can enter at all times and be safely accommodated in floor areas meeting the following requirements:
  - (1) Identification – Designate as "areas of refuge" on the plans and identify as such in the building.
  - (2) Location – At least one such area located at least every fifth floor.
  - (3) Size – Provide not less than 5 sq. ft. of floor space per ambulatory occupant and 16 sq. ft. of floor space per non-ambulatory occupant based on sq. ft. per occupant in Section 1105 for entire building. A minimum of 5% of the total number of occupants based on sq. ft. per occupant in Section 1105, shall be assumed to be non-ambulatory for all buildings except institutional occupancies. Institutional occupancies shall be assumed to have one-half the number of non-ambulatory occupants as there are beds furnished. Stairways meeting the requirements of [Section 1104.2](#) may be used for ambulatory occupants at the rate of 3 sq. ft. of area of trends and landings per person, but in no case shall the stairs count for more than one-third of the total occupants.

- (4) Fire Resistive Separation – Walls, partitions, floor assemblies and roof assemblies separating the area of refuge from the remainder of the building shall be non-combustible and have a fire resistance rating of not less than two hours. Duct penetrations of these walls shall not be permitted except for protected penetration of duct shafts. Metallic piping and metallic conduit, where essential, may penetrate or pass through these walls only if the openings around the piping or conduit are sealed on each side of penetrations with impervious noncombustible materials sufficiently tight to prevent the transfer of smoke or combustion gases from one side of the wall to the other. The fire door serving as the horizontal exit between compartments shall be so installed, fitted and gasketed that it will provide a substantial barrier to the passage of smoke.
- (5) Penetrations – The fire resistance of the floor or the floor-ceiling assembly shall extend to and be tight against the exterior wall so that the fire resistance and smoke integrity is maintained. No penetrations or other installations which will impair the fire or smoke integrity of the floor above and below the area of refuge are permitted.
- (6) Access Doors and Corridors – Access doors leading to area of refuge from stairway or other areas of the building shall not have locking hardware. The corridor leading to each designated area of refuge shall be protected when required by [Section 1104](#) and [702.2](#). Access corridor leading to each designated area of refuge shall provide one 22-inch unit of width of each 150 persons who may have to use such corridor to reach the designated area of refuge.
- (7) Access Stairs – Doors leading to designated areas of refuge from stairways shall not have locking hardware.
- (8) Pressurized – Except for roof "area of refuge", during a period of two hours after the start of a fire the "area of refuge" shall be pressurized so that it will not contain more than 1 percent of volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature of 97½ percent basis in the ASHRAE Guide.
- (9) Live Load – The structural system for the floor or roof area designated as area of refuge shall be designed for not less than 80 pounds per square foot live load.
- (10) Signs – All designated areas of refuge shall be marked with appropriate directional signs inside and outside each stairway. Each entrance to each area of refuge shall be marked with appropriate designating sign indicating capacity of persons the area is designed for and that "this area of refuge meets the requirements of the North Carolina State Building Code for 'Areas of Refuge'."

NOTE: The requirements for areas of refuge may be met by conforming to either of the following measures described in ACNBC publication "Measures of Fire Safety in High Buildings."\*

Measure K – Vertically Divided building with spatial separation

Measure L – Areas of Refuge with two such areas of refuge on each floor.

- (c) Compartmentation and Smoke Control Options – Class I buildings shall be provided with one of the following methods of compartmentation and smoke control or sprinklers in accordance with [Section 506.4](#):

Option No. 1 – All Floor Areas Pressurized for "Areas of Refuge" – Compartmentation and smoke control Option No. 1 requires the building be designed so that during a period of two hours after the start of a fire, all floor areas that are above the lowest exit story will not contain more than 1 percent by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 97½ percent basis according to the ASHRAE Guide.

NOTE: The requirements of Option No.1 may be met by conforming to either of the following measures described in ACNBC Publication "Measures of Fire Safety in High Buildings."\*

Measure H – Building Fully Pressurized

Measure I – Building Core Pressurized

Option No. 2 – "Area of Refuge" on at Least Every Fifth Floor – Compartmentation and smoke control Option No. 2 requires that the building be designed so that occupants above the ground floor can enter and be safely accommodated in floor areas that meet the requirements of [Section 506.3\(b\)](#).

Option No.3 – Stairways for "Areas of Refuge" – Compartmentation and smoke control Option No. 3 requires that the building be designed so that the number of occupants of above grade stories does not exceed one third of the total area in square feet of treads and landings in the exit stairs serving these stories. Stairways shall meet the requirements of [Section 506.18](#).

NOTE: The requirements of Option No.3 may be met by conforming to either of the following measures described in ACNBC Publication "Measures for Fire Safety in High Buildings"\*

Measure C – Open Air Exterior Corridor Access to Stairs and Elevators

Measure E – Protected Open Air Exterior Vestibule Access to Stairs and Elevators

Measure G – Pressurized Stair and Elevator Shafts

#### **506.4 – SPRINKLERS**

- (a) Class II and III buildings shall be completely sprinklered.
- (b) Class I buildings of Group M, Group E and Group H occupancy shall be completely sprinklered.
- (c) In all Class I, II and III buildings, every restaurant or facility serving food or beverages, including kitchen and storage facilities thereto, shall be sprinklered, and every story or part thereof used or intended to be used for the storage or handling of hazardous substances shall be sprinklered.

NOTE: All other buildings or parts of buildings shall be sprinklered when required by [Section 901](#).

- (d) Optionally, Class I buildings of Group R, Group B, Group I, A, S and F occupancy may be completely sprinklered in lieu of Option 1, 2, or 3 in [Section 506.3\(c\)](#).
- (e) When complete sprinkler system is provided as an option or required by [Section 506.4](#), the following reduction in requirements shall be allowed in Class I, II and III buildings:

- (1) Compartmentation and smoke control measures specified by [Section 506.3\(c\)](#) are not required.
  - (2) Type II Construction may be used where Type I may be required by Table 400.
  - (3) All Group B office building partitions required to be of one-hour fire resistive construction may be of noncombustible construction without a fire resistive time period. Openings in exit corridor walls serving more than 200 people shall be protected by tight-fitting, self-closing, automatic latching solid core wood or noncombustible doors that need not have a fire resistive time period. This exception shall not apply to the elevator lobby protection or stairways and vertical shafts.
  - (4) The 1" hose and nozzle is not required, however, the Fire Department risers and hose connections in required stairways are to be provided in accordance with Section 902.
  - (5) Remote operation of panels for smoke venting is omitted as per [Section 506.5\(a\)](#) and the mechanical air handling equipment may be designed for smoke removal as per [Section 506.5\(b\)](#).
  - (6) Flame spread ratings required by [Section 506.8](#) and [704.3](#) may be one class lower.
  - (7) Protection of electrical conductors required by [Section 506.12](#) may be omitted for Class I buildings.
- (f) Sprinkler systems shall be in strict accordance with NFPA No. 13 and the following requirements:
- (1) The sprinkler system must be equipped with a water flow and supervisory signal system that will transmit automatically a water flow signal directly to the Fire Department or to an independent signal monitoring service satisfactory to the Fire Department.  
  
FOOTNOTE: Refer to [Section 1103.1\(a\)](#) for 50% increase in travel distance for exits for sprinklered buildings and refer to Section 902 for other code references for sprinklered buildings.
  - (2) Supervised shut off valves and water flow devices shall be provided at the sprinkler supply connections on each floor.  
  
EXCEPTION: When sprinkler supply connections are not provided on each floor, such supervised shut off valves and water flow alarms are required only at the supply connections provided.
  - (3) Standpipes for fire department use shall be provided in required stairwells.
  - (4) The minimum water supplies for a combined sprinkler and standpipe system for a light hazard building (completely sprinklered) shall be 500 gallons per minute. The minimum water supply for other buildings (completely sprinklered) shall be 1000 gallons per minute.
  - (5) Except for exhaust fans in kitchens, washrooms and bathrooms in dwelling units, and except for fans used for smoke venting to aid in firefighting and fans providing for life support systems, air moving fans shall be stopped in any system that serves more than one story.

- (g) Class I buildings of Group E, I or A occupancy classification may be designed to meet the requirements of [Section 901.13](#).

### **506.5 – SMOKE VENTING**

Natural and mechanical ventilation methods for the removal of products of combustion shall be provided in every story of Class I, II and III buildings and shall consist of one of the following:

- (a) Panels or windows in the exterior walls which can be opened from an approved location other than the fire floor. Such venting facilities shall be provided at the rate of 20 square feet per 50 lineal feet of exterior wall in each story and distributed around the perimeter at not more than 50 foot intervals. Such panels and their controls shall be clearly identified.

EXCEPTION: When a complete automatic fire sprinkler system is installed, windows or panels manually openable from within the fire floor may be used in lieu of the remotely openable, operated panels and windows.

- (b) When a complete automatic sprinkler system is installed, the mechanical air handling equipment may be designed to accomplish smoke removal. Under fire conditions, the return and exhaust air shall be moved directly to the outside without recirculation to other sections of the building. The supply fans shall provide 100 percent outside air. The area involved shall have a minimum of an air change every 10 minutes to meet this requirement.
- (c) Any other approved design which will produce equivalent results and which is acceptable to the Building Official.

### **506.6 – REQUIREMENTS FOR CONNECTING BUILDINGS**

Where a Class I, II or III building is connected to any other building, measures shall be taken to limit the movement of contaminated air from one building into another during a fire by venting the connecting vestibule directly outside or pressurize the vestibule.

NOTE: The requirements for Connecting Buildings may be met by conforming to the following measure described in ACNBC Publication "Measures for Fire Safety in High Buildings"\*

Measure N – Vestibules connecting Buildings to be Vented to Outdoors or Pressurized.

### **506.7 – ELEVATORS**

- (a) Standards – All elevators for Class I, II and III buildings shall comply with the "Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks", A17.1 and shall also conform with the requirements of the supplement A17.1(b).
- (b) Additional Requirements for Controls and Pressurization of Hoistways – In addition to conforming to the ANSI A17.1(b), the following additional requirements must be met:
  - (1) Elevator Lobby Separation – All public elevators on all floors shall open into elevator lobbies which are separated from the remainder of the building by one- hour fire resistive construction. If the building is completely sprinklered the main floor elevator lobby separation may be omitted.



- (2) Smoke Detectors in Elevator Lobbies – Each elevator lobby or elevator entrance area (that portion of a floor, balcony or platform used to receive or discharge passengers) shall be provided with an approved and listed smoke detector located on the ceiling. Upon being activated, this smoke detector, when located on any floor except the main floor, shall cause all operable automatic elevators serving that common lobby to start automatically and return non-stop to the main floor lobby, provided smoke detectors located in the main floor lobby, when activated shall cause these elevators to return non-stop to a designated alternate smoke-free lobby leading to the outside. In addition the smoke detectors, each single elevator or group of elevators serving a common lobby shall be provided with a key operated switch (A17.1b-211.3(a)) located at the main floor which when activated shall cause all elevators to return non-stop to the main floor lobby only. After the elevators have returned to the main or alternate floor, they shall remain at that floor and shall be individually available for emergency service operation as described in A17.1b-1973, Rule 211.3(a)(4)(5)(6). Should the elevator or group of elevators be in an emergency power mode of operation when smoke detectors or the key operated switch is activated, the automatic return to the main or alternate floor shall conform to the sequential operation as provided in this section. After all cars have returned to the main or alternate floor while on emergency power, a minimum of one car in each pressurized hoistway shall remain available for emergency operation.
- (3) Signs in Lobbies – Each elevator lobby call station shall have an illuminated sign which is readable at all times and which flashes on and off to show the words "EMERGENCY – USE THE EXIT STAIRS" when any elevator lobby smoke detector is activated. The signs on all floors served by that group shall flash. The words shall be red in color and be in minimum ½" block letters.
- (4) Machine Room Protection – Elevator hoistways shall not be vented into an elevator machine room. Cable slots entering the machine room shall be sleeved beneath the machine room floor to inhibit the passage of smoke into the machine room.
- (5) Primary Emergency Elevator – At least one elevator car in each building serving all floors shall have a minimum inside car platform 4'3" wide by 6'8" front to back with a minimum clear opening width of 42" on the narrow side, unless otherwise designed to provide equivalent utility and access to accommodate an ambulance stretcher (minimum size 22" by 78") in its horizontal position. This elevator shall be identified as the "Primary Emergency Elevator" with signs both outside and inside the elevator. The identified "primary emergency elevator" shall be capable of providing transportation from all floor levels to the street level normally served by the elevator system that is above grade in the building and be located in a required pressurized hoistway.
- (6) Pressurized Hoistways – All elevators must be pressurized so that, during a period of two hours after the start of a fire, they will not contain more than 1 percent by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 97½ percent basis according to the ASHARE Guide. Elevators in pressurized hoistways must be identified as "emergency elevators." Pressurized hoistways shall be placed in an approved protected location.

(7) Sequential and Selective Operation – In Class I, II and III buildings, sequential operation of one elevator at a time on the emergency power source, as per [Section 506.7\(b\)\(2\)](#) shall be provided. A control switch, identified for emergency use only, shall be provided with a contact position for each elevator and an "automatic" position permitting one elevator to be selected to remain on emergency power or to provide power to any one elevator in the group of elevators. The control switch shall be located in the Central Control Station for Class I, II and III buildings.

(NOTE: This requirement may be met by Measure F in ACNBC "Measure for Fire Safety in High Buildings.")

(8) Protection of Hoistways from Top Floor to Street Floor – Where it is necessary to change elevators to reach any floor, the system shall be designed so that not more than one change of elevators is required when traveling from a street floor to any floor in the building and pressurization of the hoistways required above would include pressurization in the top level hoistway and the bottom level hoistway and the transfer lobby. (See [Section 701.3\(b\)](#) for access openings required for bottom level hoistways.)

**506.8 – INTERIOR FINISH**

(a) The interior finish for all walls, partitions, and ceiling including all rooms or spaces, service spaces and elevator lobbies of buildings of Classes I, II, and III shall have a flame spread rating and smoke developed classification conforming to [Table 704.3](#) and [Table 506.8](#).

**Table 506.8  
Interior Finish**

Location	Maximum Flame Spread Rating (1)(2)(4)(5)		Maximum Smoke Developed Classification	
	Wall (3) Surface	Ceiling (3) Surface	Wall Surface	Ceiling Surface
Exit stairways, vestibules to exit stairs & exit corridors	A	A	50	50
Corridors providing access to exit except within stairs	B	B	100	50
Elevator cars and lobbies	A	A	100	100
Assembly rooms	A	A	50	50
Other rooms or spaces	B	B	(7)	(7)

Notes to Tables:

(1) See [Section 704.3](#) for required flame spread ratings for each occupancy group and explanations for letter designations for flame spread ratings utilizing ASTM E-84.

- (2) Trim, millwork and doors within any room may have a flame spread rating not exceeding 200, provided they do not exceed 10 percent of the area of the wall or ceiling of the room in which they occur.
- (3) The flame spread rating required in this table for wall and ceiling finishes applies to the surface finish and in the case of carpet, it applies also to the underlayment. Wall and ceiling covering materials listed by Underwriters' Laboratories in accordance with ASTM E-84 will meet these requirements.
- (4) All noncombustible materials conforming with (a) and (b) of definition of Non-combustible (See Definition in Section 200) has a flame spread rating of less than 25 even though they may be painted with ordinary house paint.
- (5) Smoke developed classification limits for wall and ceiling surfaces and flame spread ratings for surfaces for other "Rooms and Spaces" may be sent pending evaluation of test results now being performed at the National Bureau of Standards.

NOTE: For carpet use as a floor finish, see Appendix N for further information on the regulation of carpet and underlayment flammability by the Federal Government and self-regulation by the industry.

#### **506.9 – CENTRAL ALARM AND CONTROL FACILITY (Central Control Station)**

All Class I, II and III buildings shall have a central alarm and control facility to house a central control station for fire department operations, separated from the remainder of the building by two hour fire resistive construction and be located in an area that is readily accessible to fire fighters entering the building and which takes into account the effect of back ground noise likely to occur under fire emergency conditions so that the facility can properly perform its required functions under such conditions.

- (a) Central alarm and control facility for Class I buildings shall provide for:
  - (1) The fire alarm and public address system panels.
  - (2) Emergency communication panel to automatically transmit manual and automatic alarm signal to the Fire Department either directly or through a signal monitoring service.
  - (3) Availability to fire department at all times.
  - (4) Public service telephone adjacent to emergency panel.
  - (5) Control switch to select the elevator to run on emergency power.
- (b) Central alarm and control facility for Class II buildings shall include all items in (a) above and:
  - (1) Fire detection and alarm system annunciator panels to indicate the type of signal and the floor of zone from which the fire alarm is received.
  - (2) Controls for unlocking simultaneously all stairway doors which are locked leading into buildings from the stairway side on each floor. Doors leading from the stairway side shall not have locking hardware on floors where there is a designated area of refuge.
  - (3) Sprinkler valve and water flow detector display panels.
  - (4) Controls for manually starting and stopping emergency power supply.

## SPECIAL OCCUPANCY REQUIREMENTS

- (5) Means to give an audible and visual fire alarm signal when any fire alarm, water flow alarm or detection device is activated and a switch to silence the audible signal causing a visual signal to indicate that the audible signal has been silenced.
  - (6) Means to close fire doors leading to stairways, elevator lobbies, smoke barrier partitions and areas of refuge automatically on receipt of an alarm signal, if these are normally held open, (unless this is effected automatically by proprietary smoke or fire detection or sprinkler system control equipment).
  - (7) Means to manually and selectively actuate the fire alarm devices in the building and to silence them after they have operated initially for not less than 1 minute and to indicate by a visual signal that the fire alarm has been silenced.
  - (8) Means to manually start and stop smoke control equipment provided under [506.3](#), [506.4](#), [506.5](#) and [506.18](#) or means to communicate with an auxiliary control center or centers controlling this equipment as appropriate to the measure for fire safety provided in the building.
  - (9) Two-way communication with all elevators.
  - (10) Elevator car position indicator for each elevator.
- (c) Requirements for Central alarm and control facility for Class III buildings shall include items in (b) above and:
- (1) Status indicators and controls for air handling systems.
  - (2) All buildings must be provided with full time surveillance.

### **506.10 – COMMUNICATION SYSTEM FOR OCCUPANTS OF CLASS I BUILDINGS**

- (a) One-way System for Occupants – All Class I buildings shall be provided with a one-way communication system. It shall operate from the Central Control Station and shall be established on a selective or general basis to the following terminal areas and designed to be clearly heard by all occupants of these areas:
- (1) Elevators
  - (2) Elevator lobbies
  - (3) Corridors
  - (4) Exit stairways
  - (5) Rooms and tenant spaces exceeding 1,000 sq. ft. in area
  - (6) Dwelling units in [apartment houses](#)
  - (7) Hotel guest rooms or suites
- (b) Two-way System for Fire Department – A two-way fire department communication system shall be provided in all buildings for Fire Department use. It shall operate between the Central Control Station and every elevator lobby, each entry to an enclosed exit stairways, in required exit corridors and each refuge area.

### **506.11 – TWO-WAY COMMUNICATION SYSTEM FOR CLASS II AND CLASS III BUILDINGS**

- (a) All Class II and III buildings shall be provided with an approved voice communication system or systems operated from the Central Control Station and shall consist of the following:
- (1) Selective one-way communication system as required by 506.10(a) and two-way system as per 506.10(b) for use of both fire fighters and occupants. The elevator communication system required as per 506.9(b)(9) shall be incorporated in this system. (See Section 506.9(b)(8)).
  - (2) This system shall be designed so that in the event of one circuit or speaker being damaged or out of service, the remainder of the system shall continue to be operable.
  - (3) The system shall include provision for silencing the fire alarm devices when the loudspeakers are in use, but only after the fire alarm devices have operated initially for not less than 1 minute.

### **506.12 – PROTECTION OF ELECTRICAL CONDUCTORS FROM FIRE**

- (a) Conductors furnishing electrical power to the emergency equipment and control circuits shall be protected by a two-hour fire rated horizontal or vertical enclosure or structural element which does not contain any combustible materials. Such protection shall begin at the source of the electrical power and extend to the floor level on which the emergency equipment is located. It shall also extend to the emergency equipment to the extent that the construction of the building components on that floor permit, as required by Sections 506.3(c), 506.7(b), 506.4, 506.9, 506.10, 506.11, 506.13, 506.15, 506.16, 506.18.

### **506.13 – EMERGENCY ELECTRICAL POWER SUPPLY**

- (a) Emergency Generator Capacity – Class I, II and III buildings shall be provided with an approved emergency generator power supply, located in a 2-hour fire rated enclosure, properly ventilated to the outside. The emergency generator power supply shall be capable of operating under a full load for at least 2 hours and shall be automatically switched over in the event of failure of the normal source of power supply or manually operational for emergency power supply for:

- (1) Pressurization Fans – Fans to provide required pressurization, smoke venting or smoke control for elevator shafts and stairways and areas of refuge in 506.3(c), 506.7(b) and 506.18(d).
- (2) Two Elevators – Every public elevator in a building, assuming only two elevators will operate at a time.
- (3) Fire pumps – Water supply for firefighting when the supply is dependent on electrical power supplied to the building.
- (4) Emergency illumination, exit and elevator lighting.
- (5) Emergency lighting.
- (6) Emergency Alarms and Communication Systems – Power supply for fire alarm, fire detection, voice communication systems and central alarm and control facility.

## SPECIAL OCCUPANCY REQUIREMENTS

- (7) Life support systems in all designated areas of refuge.
- (b) Automatic Transfer – Provision shall be made for automatic transfer to emergency power in not more than ten seconds for (4), (5) and (6) above.
- (c) The emergency generator location shall be such that manual starting or servicing can be readily accomplished in case of need during an emergency. The generator shall not be separated from the Central Alarm and control facility required by more than 2-story levels.

### **506.14 – MAINTENANCE OF EMERGENCY SYSTEMS**

It shall be the duty and responsibility of the owner(s) of Class I, II and III buildings to maintain all fire detection, fire control, smoke movement and venting, as required by Section 506, and similar emergency systems in proper operating condition at all times. Periodic routine inspections are recommended. Annual certification of full-test and inspections of all systems shall be provided annually to the Fire Department.

Footnote: ([Section 506.14](#)) Refer to the procedures described in Appendix C of ACNBC Publication "Measures for Fire Safety in High Buildings."\*

### **506.15 – SMOKE DETECTION SYSTEMS**

- (a) In all Class I, II and III buildings, at least one approved smoke detector capable of detecting visible and invisible particles of combustion shall be installed as follows:
  - (1) In every mechanical equipment, boiler, electrical, telephone, elevator equipment or similar room.
  - (2) Each opening where a return plenum or branch duct connects to a vertical shaft.
  - (3) In the return air portion of every air conditioning and mechanical ventilation system that serves any floor other than the floor on which the equipment is located.
  - (4) In every elevator lobby.
  - (5) The actuation of any detector shall activate the alarm system, and shall cause such other operations as are necessary to prevent the recirculation of smoke and any other functions required by this code.
  - (6) Smoke detection system shall terminate at the Central Alarm and Control Facility and be so designed that it will indicate the fire floor and also indicate the zone on that floor.

### **506.16 – MANUAL FIRE ALARM SYSTEM**

- (a) In all Class I, II and III buildings, there shall be installed an approved manually operated fire alarm system terminated at the Central Alarm and Control Facility (See [Table 1100](#) and [Section 1125](#) for other fire alarm requirements) and comply with the following requirements:
  - (1) Reporting stations shall be located in every elevator lobby and not more than 100 feet horizontally from every occupied space
  - (2) The system shall be designed to report a fire by location of the station.
  - (3) Audible and visible signal shall be given in the zone in which the station is located.

**506.17 – INTERIOR PARTITIONS**

In Class I, II and III buildings, all interior partitions including movable and relocatable partitions shall be framed and surfaced with materials which qualify as noncombustible in accordance with requirements of Part (a) and (b) of definition of noncombustible contained in Section 201.

Surface finish materials may be applied to such partitions provided they meet the flame spread ratings specified in [Section 506.8](#).

**506.18 – SPECIAL EXIT REQUIREMENTS**

- (a) Smoke-Free Stairwells – All Class II and III buildings shall be provided with a minimum of 50% of required exit stairways constructed as smokeproof stairways and all remaining required exit stairways must be pressurized so that during a period of 2 hours after the start of a fire do not contain more than 1 percent by volume of contaminated air from the fire floor assuming an outdoor temperature equal to the January design temperature of 97½ percent basis in the ASHRAE Guide.

NOTE: The requirement for pressurization of stairs may be met by Measure F in ACNBC publication "Measures for Fire Safety in High Buildings." ([Section 1104.2](#) requires all buildings exceeding 60 feet in height to be provided with at least one stairway to be constructed as a smokeproof stairwell meeting the requirements of [Section 1104](#)).

- (b) Stairway Door Locks – All stairway doors which can be locked from the stairway side shall have the capability of being unlocked simultaneously without unlatching upon a signal from the Central Control Station for Class III buildings. In Class I and Class II buildings, provision shall be made for access from the stairway side at least at every fifth floor level. Doors leading from the stairway side shall not have locking hardware on floors where there is a designated area of refuge. (See [Section 506.3\(b\)\(7\)](#))
- (c) Outside Emergency Communication – Emergency telephone or emergency signal device audible on the outside of the building and outside the stairway shall be provided at not less than every fifth floor in each required stairway for all Class I, II and III buildings.
- (d) Stairs to Roof – All required exit stairways in Class I, II and III buildings shall extend to the roof and in all cases where "areas of refuge" are designated on the roof, such stairways shall lead to the "areas of refuge" and they shall meet the requirements of [Section 506.3\(b\)](#).
- (e) Helicopter Hover Space on Roof – All Class III buildings shall be provided with an area of refuge meeting the requirements of [506.3\(b\)](#) on the roof and a clear area not less than 80' by 80' shall be provided for a helicopter to hover, without landing, to provide this possible means of emergency rescue.

**506.19 – GASEOUS FUEL SYSTEMS**

- (a) Gaseous fuel system mains shall be installed using welded piping located in two-hour fire rated shaft that is mechanically ventilated to the outside. The piping shall be sleeved and sealed at all penetrations of the shaft.
- (b) The gaseous piping entrance service shall be controlled with automatic Underwriters' Laboratories or American Gas Association Laboratories listed flow limiting valves and a remote fuel shut-off shall be provided for use in emergency.

## SPECIAL OCCUPANCY REQUIREMENTS

- (c) The gas piping system shall be air tested to 100 pounds for one hour without a drop in pressure.

FOOTNOTE: Gaseous fuels should not be used in Class I, II and III buildings except in central building services equipment in one central location and minor uses generally used by tenants should be avoided elsewhere in the building where possible.

### **506.20 – OUTSIDE AIR**

When outside air is mechanically introduced into a building as a smoke control measure the point or points of intake shall be located to minimize the possibility of contamination by combustion products. When the air intake is above the first floor level, a minimum of two (2) intake locations shall be provided. Provisions shall be provided to sense smoke contaminations at the intake locations, announce smoke conditions to the Central Alarms and control facility, select a non-contaminated smoke intake and permit manual override of the selection from the central alarm and control facility.

## **SECTION 507 ENCLOSED MALLS**

### **507.1 – SCOPE:**

This section shall apply to all types of mall-type shopping centers, either enclosed or covered. See Chapter II – Definitions.

### **507.2 – GENERAL REQUIREMENTS:**

An enclosed mall and all tenant spaces connected thereto shall be treated as a single building and shall be subject to the provisions of this code for specific use group and type of construction and shall meet the following requirements:

- (a) The mall shall be not less than thirty (30) feet in width
- (b) The minimum horizontal separation between permanent kiosks and similar structures within the mall shall be not less than twenty (20) feet. Combustible kiosks or other similar structures shall not be located within the covered mall. Displays in the mall common areas are permitted except in that portion which is required as the means of egress under [Section 1104.4](#).
- (c) The mall and all tenant spaces connected thereto shall be provided throughout with an approved automatic sprinkler system on accordance with [Section 901](#).
- (d) Smoke and heat venting shall be provided for malls in accordance with NFPA 204 or other accepted engineering practice.
- (e) A minimum four (4) inch standpipe with valved two and one-half (2 ½) inch hose connections shall be provided at not more than two hundred (200) foot intervals along the mall. Such standpipes shall be located on each floor level and shall be designed and installed in accordance with Section 902.
- (f) See [Section 1104.4](#) for exit requirements.



### 507.3 – SPECIAL REQUIREMENTS FOR MALL TYPE SHOPPING CENTERS WITH OPEN WELLS UP TO THREE LEVELS.

#### (a) Construction of Finished Mall and Tenant Space Shell

1. The entire building must be not less than Type II Fire Resistive Construction, sprinkler protected throughout as prescribed by the North Carolina Building Code. Sprinkler protection of mall area shall be provided as a matter of sound practice.
2. Construction of fire corridors and required exit stair enclosure shall be 2 hour rated.
3. Future **Balcony** Level (3rd Floor) expansion shall be restricted to commercial use only.

#### (b) Construction of Tenant Spaces

1. Store fronts onto the mall may be completely open to 10'-0" above finished floor or partially or totally closed to the mall with non-combustible or 1-hour rated construction.
2. Partitions between tenants shall be 1 hour rated to the bottom of the structure as a matter of sound practice.
3. Mezzanine space constructed by the tenant shall not exceed 1/3 of his leased premises and shall be of sprinkler protected 2-hour construction.

#### (c) Exiting Requirements from the Mall

1. Net area for occupancy computation shall be limited to 75% of the gross leasable area.
2. Net area per occupant shall be 30 square feet on both levels.
3. Mall exit capacity shall equal 50% of mall tenant occupants.
4. Maximum distance to a mall exit measured within the mall shall be 100'.

#### (d) Exiting Requirements from Tenant Spaces

1. 50% of total mall tenant space occupants shall be able to exit by means of other than through the mall.
2. Exit access through stock areas shall be clearly defined by floor painting and exit signs.
3. Small Tenant Spaces with less than 75 occupants to whom secondary exiting away from the mall is not possible shall have at least 15' of clear unobstructed opening width into the mall or two points of access to the mall located as remotely from one another as possible.
4. Each tenant shall be required by lease agreement to obtain written approval of his sales and stock area layouts by the City or County Building Inspection Department for exiting.

#### (e) Unprotected Vertical Access not Required for Exiting

1. Mall and Tenant Space escalators through 3 levels (including Future **Balcony** Level).
2. Mall monumental ramps through 3 levels (including Future **Balcony** Level).
3. Mall monumental stairs through 3 levels (including Future **Balcony** Level).

#### (f) Mall Smoke Venting and Detection

## SPECIAL OCCUPANCY REQUIREMENTS

1. Automatic Smoke detector activated smoke ports shall be provided in mall room so located to draw smoke away from tenant spaces to the center of the mall.
2. Smoke port area shall be equal to 1 square foot per 2500 cubic feet of total mall volume (all levels).

NOTE: This is a volumetric conversion of NFPA requirement of 1 square foot of smoke port area per 100 square feet of mall area computed for the Standard 25' mall ceiling height one level mall.

3. Maximum horizontal distance between smoke port areas shall be 120'.
  4. Decorative mall ceiling features shall not be so designed and located as to obstruct the path of smoke to smoke port areas.
  5. Smoke shall be further directed toward smoke ports through Promenade Level open wells by permanent or temporarily activated non-combustible baffles extending from Concourse Level ceiling to 10 feet above finished floor. Promenade Level ceiling baffles to be constructed with future **Balcony** Level expansion at the same spacing as at the Concourse Level.
  6. Ceiling and/or wall mounted smoke port activating smoke detection devices located no more than 16 feet above finished floor. Locations to be provided with **Balcony** Level shall be at the same spacing as at the Promenade Level.
- (g) Alarm System – Annunciator system shall be tied into the Centerwide music and public address system to provide, automatically, a taped message to tenant space occupants instructing them to exit through the rear exit (away from the mall) of the space occupied.

### **SECTION 508 MAKING BUILDINGS AND FACILITIES ACCESSIBLE TO AND USABLE BY THE PHYSICALLY HANDICAPPED**

See Chapter 11-X for specific requirements.

### **SECTION 509 STANDARDS FOR DAY CARE FACILITIES**

#### **509.1 – SMALL GROUP DAY CARE FACILITIES (6-15 Children)**

- (a) All small group day care homes keeping 6-15 unrelated children must meet the requirements of the State Building Code for school occupancy, except that specially designated rooms of extended or modified family residences may be used under the following conditions:
1. The facility must be licensed by a state agency or under the jurisdiction of a city or county building inspector, fire prevention inspector or fire chief, which has a responsibility to periodically reinspect the facility to make sure that the number of children being cared for is no more than the license calls for (or a maximum of 15 children whichever is less) and that the children use only the first floor or grade level rooms.
  2. The building must meet the Uniform Residential Building Code for dwellings and not be over 2,500 square feet in area on any one floor and be not over two stories in height.

3. The first floor rooms, or grade level rooms with exit to outside at grade (located at grade or first floor level) may be used provided all walls and ceilings are covered with plaster, gypsum wall board or other noncombustible surfaces. All other rooms with a flame spread rating higher than 200 must be separated from the day care use rooms by one hour rated walls and solid core doors or paint such combustible surfaces with fire retardant paint.
  4. Each room used for day care purposes must have access to two remotely located outside exits. Only one exit is required if an exterior exit door opens directly to the outside from each room to be used by the children. Access from the room door to the two remotely located outside exits must not have a dead end distance of more than 20 feet measured from the room door used by children to the point at which two separate outside exits can be reached. A dead end occurs when a hall way is so arranged that a person therein is able to travel in only one direction in order to reach either exit.
  5. All stairs from the floor used by the children that lead to a floor above or below must be closed off with one hour walls and solid core doors or equivalent.
  6. Fuel burning space heaters, fire places, floor furnaces and portable electric space heaters are prohibited unless provided with a protective screen attached securely to substantial supports. Unvented fuel burning heaters of all types are prohibited.
  7. All unoccupied spaces such as [attics](#), [basements](#) workshops, furnace rooms, etc. must be provided with Underwriters' Laboratories labeled automatic fire detection devices.
  8. The space to be used must have at least 8% of its floor area composed of windows with one half of these windows openable (or mechanically ventilated) and if space is partially below grade it must have exit direct to outside.
- (b) Exception – Small Group Day Care Facilities may have up to twenty-five children if all rooms are equipped with outside doors. Day Care Facilities with six to twenty-five children (with not more than 10 children under three years of age), which otherwise meet the Board's requirements, (with all children on the first floor) are not required to comply with the wall and ceiling requirements in [Section 509.1\(a\)\(3\)](#), Section IIB(3) or the stairway enclosure requirements in [Section 509.1\(a\)\(5\)](#), Section IIB(5) or the automatic fire detector requirements in [Section 509.1\(a\)\(7\)](#), Section IIB(7), if all rooms used for day care facilities have an exit door directly to the outside at or near grade level with proper ramp or steps to grade level. A manual fire alarm device which can be heard throughout the building shall be installed.

### **509.2 – FAMILY DAY CARE HOMES (less than 6 children)**

All family day care homes keeping less than 6 unrelated children must meet the requirements of the Uniform Residential Building Code for dwellings and be limited to not more than 2,500 square feet in area per floor if of wood frame construction. Two story dwellings may be used provided the children are kept on the first floor.

**509.3 – DAY CARE CENTERS (more than 15 children)**

- (a) All day care centers serving more than 15 children must meet the requirements of the State Building Code for Group E- Educational, except those keeping children less than three years old must meet Group I-Institutional, Un-Restrained Occupancy. Wood frame construction is restricted to one story in height and not more than 2,500 square feet in area. All walls and ceilings must have flame spread rating less than 200. The furnace room must be separated from the rest of the building with one hour rated walls and ceilings. An automatic sprinkler system or an automatic fire detection system and one hour rated walls and ceilings throughout are required for Group I-Institutional Un-Restrained Occupancy. (See pamphlet on nursing homes and boarding homes for other applicable requirements for Institutional-Unrestrained Occupancy. Minimum door widths are three feet in lieu of 44" as required in this pamphlet for nursing homes, etc. Minimum corridor widths are 6' in lieu of widths specified in nursing home pamphlets.)
- (b) Exceptions-All day care centers caring for children under three years old which do not have staff meeting the requirements of paragraph 509.5 below, or do not have an exit door directly to the outside for rooms used for children under three years of age must meet Institutional-Unrestrained of the State Building Code.

**509.4 – DAY CARE FACILITIES  
(more than 15 children) in operation prior to 4-1-72.**

- (1) A Certificate of Occupancy is required before occupying an existing building for day care purposes. If an occupancy permit has not been issued, the inspections that are a prerequisite to issuance of that permit will be incorporated into the licensing procedure.
- (2) All day care facilities must be located in buildings which do not have violations of the State Building Code applicable to general construction, plumbing, heating and electrical systems that would present hazards to the health and safety of the children.
- (3) Alternative Requirements:

Amend [Section 509.3](#) by adding the following: [Section 509.3](#) Day Care Centers (more than 15 children): "Day care facilities in operation prior to April 1,1972 are not required to comply with sections of this code which require one or more of the following:

- 1. One-hour fire rated walls and solid core doors.
- 2. One-hour fire rated ceilings.
- 3. Automatic sprinkler system.
- 4. Automatic fire detection system.

provided all rooms used for day care purposes are on the first floor for all types of construction and wood frame constructed buildings are limited to two stories in height with all children on the first floor. Such facilities must also comply with the following:

- (A) Each room used for day care purposes must have access to two outside exits. Only one exit is required if an exterior door opens directly to the outside from each of the rooms to be used by the children. Access from the room door to the two remotely located outside exits must not have a dead end distance of more than 20 feet measured from the room door used by the children to the point at which two separate outside exits can be reached. A dead end occurs when a hallway is so arranged that a person therein is able to travel in only one direction in order to reach an exit.
  - (B) All rooms used for children under three years of age must have an exit door directly to the outside, when the building is of wood frame construction. All rooms used for children under three years of age must have an exit door in the immediate vicinity of an outside exit door if the building is of other than wood frame construction.
  - (C) All walls and ceilings (excluding doors and trim) of rooms and spaces used for day care facilities which are not protected with plaster, gypsum wallboard or other non-combustible materials must be painted with fire retardant paint.
  - (D) In buildings used for purposes not under the control of the day care operator, all rooms and spaces used for day care purposes must be separated from the rest of the rooms by one hour fire rated walls and solid core doors unless all walls and ceilings of such rooms are protected as required for rooms used for day care purposes.
  - (E) Each day care center shall formulate a plan, in cooperation with the local fire department, to evacuate in case of fire or when necessary, (Fire extinguishers shall not be used until the children are safely evacuated unless the facility has sufficient staff personnel to evacuate the children safely and use fire extinguishers simultaneously.) All employees shall be instructed and kept informed of their duties under the plan. There shall be at least one unannounced fire drill monthly.
- (4) The following requirements also must be complied with:
- a. The approaches to all exits, the exits themselves, and the path of travel from the exit into the street or open space shall be continuously free of all obstructions so that full and instant use in case of fire or other emergency is possible.
  - b. All doors to rooms with occupancy of more than 50 people must be hung to open out.
  - c. All stairways, hallways and other means of exit shall be kept adequately lighted at all times when the building is occupied. All required exits and the routes to them shall be identified by readily visible signs where the exits or the way to reach them are not immediately obvious to the occupants. Exit signs are not required in one story buildings with a capacity of less than 30 persons.
  - d. The space to be used for day care purposes must have at least 8% of its floor area composed of windows with one half of these windows openable (or the rooms must be mechanically ventilated) and if the space is partially below grade it must have exit direct to outside.

## SPECIAL OCCUPANCY REQUIREMENTS

- e. Fuel burning space heaters and portable electric space heaters and floor furnaces are prohibited unless provided with a protective screen attached securely to substantial supports. All unvented fuel burning heaters of all types are prohibited. Each hazardous area must have a fire extinguisher in the immediate area. (Hazardous areas include repair shops, hobby shops, closets, rooms or spaces used for storage of equipment such as brooms, insecticides, paint, floor wax, mops, etc.)
- f. Every day care facility must have a manually operated fire alarm or other sounding device which is audible throughout the area used. The alarm shall be identified as such.
- g. At least one annual fire inspection by the local inspector or fireman is required.
- h. At least one 2½ gallon water type extinguisher shall be required for every 2,500 square feet of floor space. An approved first aid fire appliance shall be installed at every kitchen and workshop. (2¾ pound dry chemical extinguisher or a six B-C rated extinguisher).
- i. It is recommended that all combustible decorative material including rugs and curtains be rendered and maintained flameproof.

### 509.5

All day care centers (more than 15 children) regardless of age of children must meet the requirements for State Building Code for Group E – Educational instead of I – Institutional, provided the facility is certified by a State agency which enforces the following certified minimum staff-child ratio:

Age	Staff-Child Ratio	Maximum Grouping
0-1 year	1 to 5	5 children
1 year	1 to 6	6 children
2 years	1 to 7	7 children
3 years	1 to 10	18 children
4 years	1 to 12	20 children
5 years	1 to 15	25 children
6 years & older	1 to 20	25 children

### 509.6 – AUTOMATIC SMOKE DETECTOR

For specific requirements, see Section 720.

## SECTION 510 RESIDENTIAL CARE FACILITIES

### 510 –

These requirements apply to the following types of residential care facilities:

- (a) Those keeping as many as six and less than ten children who are dependent, neglected, abandoned, destitute, orphaned, delinquent and not involuntarily retained, and
- (b) Those keeping as many as six and less than ten adults who are mildly or moderately retarded or similarly developmentally disabled as determined by the state agency having licensure jurisdiction, trainable, ambulatory and not involuntarily detained, and
- (c) Those facilities keeping up to 6 adults with no more than three of this total classified as non-ambulatory or semi-ambulatory.

Note. See [Section 409.1\(c\)](#) for Residential Care Facilities classified as Group I – Institutional Unrestrained.

**510.1 –**

The facility must be licensed by a state agency which has a responsibility to periodically reinspect the facility to make sure that the number being cared for is no more than the license calls for.

**510.2 –**

All residential care facilities keeping as many as six and less than ten persons not involuntarily detained, when of other than Type I construction or Type II construction, shall not exceed two stories in height and shall not exceed 1800 square feet per floor and if wood frame construction and one story in height shall not exceed 2500 square feet in area for existing buildings. Any occupied [attic](#) shall be counted as an additional story in determining permissible building height. [Basement](#) areas used as habitable space count as a story. A [basement](#) is not counted as a story if at least 50% of its clear height is below grade. (See definition of “Story”, Chapter II).

**510.3 –**

All walls, partitions, and ceilings shall be of non-combustible materials or of 1-hour fire resistance.

**510.4 –**

Occupants must have access to two remotely located outside exits. Access from room doors to the two remotely located outside exits must not have a dead end distance of more than 20 feet measured from the room door to the point at which two separate outside exits can be reached. Occupants of all rooms above the first floor shall have unobstructed access to two separate and distinct ways to egress extending from the upper-most floor to the ground, such ways to egress to be so arranged in reference to rooms that in case of fire on one stairway the other stairway can be reached by the occupant without having to pass the stairway involved. Stairways must be enclosed on one floor level with one hour fire rated walls and a minimum of solid core door equipped with a self-closer. [Basement](#) stairs, whether used for habitable space or not, shall be enclosed with one hour fire rated walls and solid core door equipped with self-closer. (Exterior metal fire escapes meeting requirements of the North Carolina State Building Code are acceptable as exit stairs.)

All rooms for sleeping purposes shall have an outside window that can be opened without the use of tools to provide a clear opening not less than 16" in least dimensions and 432 square inches in area, or if of fixed glass, must be at least 24"x24" with the bottom of the opening not more than 4' above the floor.

**510.5 –**

If a residential care facility keeping six to nine persons is of other than Type I or Type II construction, occupants younger than six years of age shall sleep on the first floor with an adult.

**510.6 –**

Fuel burning space heaters, floor furnaces and portable electric space heaters are prohibited.

## SPECIAL OCCUPANCY REQUIREMENTS

### **510.7 –**

When of other than Type I or Type II construction, all residential care facilities keeping six to nine persons shall be equipped with U.L. approved smoke detection devices or a U.L. approved automatic fire detection system in addition to other requirements specified in [Section 901.8\(b\)](#).

### **510.8 –**

All residential care facilities keeping six to nine persons must install a manual fire alarm or signal system which is audible throughout the building.

### **510.9 –**

For every 1800 square feet of floor area and for each floor there shall be at least one fire extinguisher. Fire extinguisher shall be provided in accordance with the standards of the National Fire Protection Association for First Aid Fire Fighting Appliances. Fire extinguishers shall be inspected regularly and kept charged and filled at all times.

### **510.10 –**

All electrical and heating equipment shall be approved by Underwriters' Laboratories or other nationally recognized testing laboratories and shall be installed according to manufacturers' instructions and approved by the local inspector.

### **510.11 –**

Flammable liquids, such as gasoline, kerosene, fuel oil, etc. shall be stored outside the building.

### **510.12 –**

No locks, bolts or fasteners shall be installed on exit and room doors which would prevent occupants from getting out by the simple operation of a single knob or lever.

### **510.13 –**

All habitable rooms must have at least 8% of its floor area composed of windows with one-half of these windows openable.

### **510.14 –**

Every home shall formulate an evacuation plan (in cooperation with the local fire department) for the protection of all persons in the event of fire and for their evacuation to areas of refuge and from the building when necessary.

## **SECTION 511 FALLOUT SHELTERS**

This Section shall establish the minimum criteria which must be met before a building space can be constructed, occupied, used or designated as a fallout shelter.

### **511.1 – SCOPE AND APPLICABILITY**

The scope of this section extends to a building or to a building space when it is being used as a fallout shelter in time of national emergency or for reasonable periods of drill and instruction. If the space is being used as a shelter, the provisions of this article shall apply, and if it is not being so used, other applicable provisions of this code shall apply.



## 511.2 – DEFINITIONS

**Fallout Shelter** – A fallout shelter is any room, structure or space designated as such and providing its occupants with protection at a minimum protection factor of forty (40) from gamma radiation from fallout from a nuclear explosion as determined by an [architect](#) or engineer certified by the Office of Civil Defense as a Qualified Fallout Shelter Analyst.

*Dual-use Fallout Shelter* – A dual-use fallout shelter is a space having a normal, routine use and occupancy as well as having an emergency use as a fallout shelter.

*Single-Purpose Fallout Shelter* – A single-purpose fallout shelter is a space having no other use or occupancy than as a fallout shelter.

*Protection Factor* – A factor used to express the relation between the amount of fallout gamma radiation that would be received by an unprotected person and the amount that would be received by one in a shelter.

*Unit of Egress Width* – A unit of egress width is 22 inches, the space required for free travel of one file of persons.

## 511.3 – GENERAL

Nothing in these regulations shall be construed as preventing the dual use or multiple use of normal occupancy space as fallout shelter space, providing the minimum requirements for each such use are met.

## 511.4 – EXIT FACILITIES

There shall be no fewer than two widely spaced exits from a fallout shelter, leading directly to other spaces of the building or outdoors. In no case shall a single exit be less than 24" wide. In addition, the following requirements must be met:

(a) Dual-use fallout shelters

When requirements for normal occupancy of the space as detailed in [Chapter 11](#) exceed the preceding, the normal occupancy requirements shall govern.

(b) Single Purpose Fallout Shelters

Exits from the fallout shelter shall aggregate at least one unit of egress width for every 200 shelter occupants or fraction thereof. Interior circulation within the fallout shelter shall be governed by requirements of [Chapter 11](#) of these regulations.

## 511.5 – SPACE AND VENTILATION

A minimum of ten (10) square feet of net floor area shall be provided per fallout shelter occupant. Minor partitions, columns, and area for storage of Federal shelter supplies may be included in net area. A minimum of sixty-five (65) cubic feet of volume shall be provided per fallout shelter occupant. A minimum of three (3) cubic feet of fresh air per minute per person shall be provided.

Fallout shelter capacity or occupancy time may be limited by the volume of room and not by its net area. The following table shall be used in determining volume of space required per person:

## SPECIAL OCCUPANCY REQUIREMENTS

Time for Complete Air Change (Minutes)	Volume of Space Required Per Person (Cu. Ft.)
1000 or more	500
600	450
400	400
200	300
100	200
60	150
35	100
22	65

\* Computed as ratio: 
$$\frac{\text{net volume of space (cu. ft.)}}{\text{fresh air supply (cfm)}}$$

### 511.6 – WINDOWS

No requirements.

### 511.7 – ILLUMINATION

No special lighting levels are required.

### 511.8 – SANITATION

Toilets, either flush type operating from the normal water supply system or chemical or other types shall be provided on the basis of one toilet per 50 fallout shelter occupants. Fifty percent (50%) of the toilets may be provided outside the fallout shelter area. Empty water containers may be considered as fulfilling this requirement.

## SECTION 512 SPECIAL OCCUPANCY REQUIREMENTS

### 512.1 – SCOPE

This Section shall apply to all exhibition facilities. See Chapter II – Definitions.

### 512.2 – GENERAL REQUIREMENTS AND EXCEPTIONS

An exhibition facility, including all display spaces, shall be subject to the provisions of this code for specific use group and type of construction, except in the following specific cases:

- (a) A wall or partition that separates an exit access from a display space may have a fire resistance rating of less than one (1) hour, regardless of the occupancy load that the corridor serves, if the exhibition facility and the display areas meet the following requirements:
1. The exhibition facility, including all display spaces, is equipped throughout with an approved automatic sprinkler system in accordance with [Section 901](#).
  2. The wall or partition that separates the display spaces from the exit access is of a minimum of fire-retardant treated wood, noncombustible construction or 1 hour rated construction and, if glass is used in the wall or partition, it shall be of 1/4" fully tempered glass or 1/4" labeled wire glass.

3. The exit access shall be a minimum of ten (10) feet in width.
4. For any areas used for other than display, see [Section 403](#) for occupancy separation requirements.

## CHAPTER 6 CLASSIFICATION OF BUILDINGS BY CONSTRUCTION

### SECTION 601 CLASSIFICATION BY TYPE OF CONSTRUCTION

#### 601.1 Types

Every building shall be classified by the Building Official into one of the types of construction as set forth in this section:

TYPE I

TYPE II

TYPE III

TYPE IV

ONE (1) HOUR PROTECTED  
UNPROTECTED

TYPE V

ONE (1) HOUR PROTECTED  
UNPROTECTED

TYPE VI

ONE (1) HOUR PROTECTED  
UNPROTECTED

#### 601.2 – FIRE-RESISTANCE REQUIREMENTS

All fire-resistive requirements are expressed in terms of the number of hours of satisfactory performance in accordance with the “Standard Methods of Fire Tests of Building Construction and Materials of the American Society for Testing and Materials. ASTM E119”.

#### 601.3 – MATERIALS AND CONSTRUCTION APPROVED FOR FIRE PROTECTION

- (a) The degree of fire resistance and the materials, assemblies, and constructions providing such resistance shall be defined in Chapter XXV of this Code, except that other materials, assemblies, and constructions shall be approved, provided test data of a recognized engineering or testing laboratory are submitted, establishing that they develop the required fire-resistance ratings under tests made in accordance with the “Standard Method of Fire Tests of Building Construction and Materials, ASTM E119”.
- (b) Where structural requirements necessitate assemblies providing greater fire resistance than specified in this Chapter, such structural requirements shall govern.

#### 601.4 – FIRE DISTRICT – SEE [SECTION 301](#)

#### 601.5 – HEIGHT AND AREA – SEE [CHAPTER 4](#)

**601.6 – REGULATIONS GOVERNING EXTERIOR USE OF COMBUSTIBLE MATERIALS**

(a) Skylights ..... Section 707  
 (b) Dormer Windows ..... Section 709  
 (c) Gutters and Leaders ..... Section 711  
 (d) Towers, Spires and Cupolas ..... Section 712  
 (e) Tanks ..... Section 713  
 (f) Cooling Towers ..... Section 714  
 (g) Roof Coverings ..... Sections 301 and 706

**601.7 – REGULATIONS GOVERNING INTERIOR USE OF COMBUSTIBLE MATERIALS**

(a) Group A, Assembly Occupancies ..... Section 404  
 (b) Floor Finish ..... Section 704.3  
 (c) Ceilings and Interior Wall Finish ..... Section 704.3  
 (d) In Group H, Hazardous Occupancy, only  
     non-combustible finishes shall be used ..... Section 704.3  
 (e) Vertical Openings ..... Section 701  
 (f) Partitions ..... Section 702

**601.8 – STRUCTURAL AND ENGINEERING REQUIREMENTS**

(a) Minimum Design Loads ..... Chapter 12  
 (b) Foundations ..... Chapter 13  
 (c) Masonry and Veneered Walls ..... Chapter 14  
 (d) Steel ..... Chapter 15  
 (e) Concrete ..... Chapter 16  
 (f) Wood ..... Chapter 17  
 (g) Lathing and Plastering ..... Chapter 18  
 (h) Safeguards During Construction ..... Chapter 24  
 (i) Elevators and Escalators ..... Chapter 31  
 (j) Plastics ..... Chapter 22  
 (k) Glass ..... Chapter 20  
 (l) Aluminum ..... Chapter 19

**601.9 – FIRE PROTECTIVE REQUIREMENTS**

- (a) Roof Coverings ..... Sections 301 and 706
- (b) Protection of Wall Openings ..... Section 703
- (c) Firestopping ..... Sections 705 and 1703.1
- (d) Special Occupancies ..... Chapter 5
- (e) Means of Egress ..... Chapter 11
- (f) Plastics ..... Chapter 22
- (g) Sprinklers and Standpipes ..... Chapter 9
- (h) Separation of Furnace or Boiler Rooms ..... Section 2902

**SECTION 602 TYPE I CONSTRUCTION**

Type I Construction is that type of construction in which the structural members including exterior walls, interior bearing walls, columns, floors and roofs are of noncombustible materials and are protected so as to have fire resistance not less than that specified for the structural elements as specified in [Table 600](#). Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this chapter. (MCSC 443 – See [Table 600](#)).

**SECTION 603 TYPE II CONSTRUCTION**

Type II Construction is that type of construction in which the structural members including exterior walls, interior bearing walls, columns, floors and roofs are of noncombustible materials and are protected so as to have fire resistance not less than that specified for the structural elements as specified in [Table 600](#). Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this chapter. (MCSC 332 – See [Table 600](#)).

**SECTION 604 TYPE III CONSTRUCTION**

**604.1 – GENERAL**

Type III Construction is that type in which fire resistance is attained by the sizes of heavy timber members (sawn or glued-laminated) being not less than indicated in this Section, or by providing fire resistance not less than one (1) hour where materials other than wood of heavy timber sizes are used; by the avoidance of concealed spaces under floors and roofs; by the use of approved fastenings, construction details and adhesives for structural members; and by providing the required degree of fire resistance in exterior and interior walls. Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this chapter. (MCSC 3HH – See [Table 600](#)).

**604.2 – COLUMNS**

- (a) Wood columns may be sawn or glued-laminated and shall be not less than eight (8) inches, nominal, in any dimension when supporting floor loads, and not less than six (6) inches, nominal, in width and eight (8) inches, nominal, in depth when supporting roof and ceiling loads only.

- (b) Columns shall be continuous or superimposed throughout all stories by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or by timber splice plates affixed to the columns by means of metal connectors housed within the contact faces, or by other approved methods.

### **604.3 – FLOOR FRAMING**

- (a) Beams and girders of wood may be sawn or glued-laminated and shall be not less than six (6) inches, nominal, in width and not less than ten (10) inches, nominal, in depth.
- (b) Framed or glued-laminated arches which spring from the floor line and support floor loads shall be not less than eight (8) inches, nominal, in any dimension.
- (c) Framed timber trusses supporting floor loads shall have members of not less than eight (8) inches, nominal, in any dimension.

### **604.4 – ROOF FRAMING**

- (a) Framed or glued-laminated arches for roof construction which spring from the floor line and do not support floor loads shall have members not less than six (6) inches, nominal, in width and eight (8) inches, nominal, in depth for the lower half of the height and not less than six (6) inches, nominal, in any dimension for the upper half of the height.
- (b) Framed or glued-laminated arches for roof construction which spring from the top of walls or wall abutments, framed timber trusses and other roof framing which do not support floor loads, shall have members not less than four (4) inches, nominal, in width and not less than six (6) inches, nominal, in depth. Spaced members may be composed of two or more pieces not less than three (3) inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than two (2) inches, nominal, in thickness, secured to the underside of the members. Splice plates shall be no less than three (3) inches, nominal, in thickness. When protected by approved automatic sprinklers under the roof deck, such framing members shall be not less than three (3) inches, nominal, in width.

### **604.5 – CONSTRUCTION DETAILS**

- (a) Wall plate boxes of self-releasing type, or approved hangers, shall be provided where beams and girders enter masonry. An air space of one-half (1/2) inch shall be provided at the top, ends and sides of the member unless approved durable or treated wood is used.
- (b) Girders and beams shall be closely fitted around columns and adjoining ends shall be cross-tied to each other, or inter-tied by caps or ties, to transfer horizontal loads across the joint. Wood bolsters may be placed on tops of columns which support roof loads only.
- (c) Where intermediate beams are used to support floors, they shall rest on top of the girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they may be supported by approved metal hangers into which the ends of the beams shall be fitted closely.
- (d) Columns, beams, girders, arches and trusses of material other than wood shall have a fire resistance rating of not less than one (1) hour.

- (e) Wood beams and girders supported by walls required to have a fire resistance rating of two hours or more shall have not less than four (4) inches of solid masonry between their ends and the outside face of the wall, and between adjacent beams.
- (f) Adequate roof anchorage shall be provided.

#### **604.6 – FLOOR DECKS**

Floors shall be without concealed spaces. They shall be of sawn or glued-laminated plank, splined, or tongue and grooved, of not less than three (3) inches, nominal, in thickness, or of planks not less than four (4) inches, nominal, in width set on edge and well spiked together. The planks shall be laid so that no continuous line of joints will occur except at points of support and they shall not be spiked to supporting girders. Planks shall be covered with one (1) inch, nominal, tongue and groove flooring laid crosswise or diagonally or with one-half (½) inch plywood. Planks and flooring shall not extend closer than one-half (½) inch to walls to provide an expansion joint, and the joint shall be covered at top or bottom.

#### **604.7 – ROOF DECKS**

“Heavy Timber roof decks shall be sawn or glue-laminated, splined or tongue and grooved plank, not less than two (2) inches, nominal, in thickness, one and one-eighths (1 1/8) inch thick Interior plywood (Exterior plywood, Exterior glue), or of planks not less than three (3) inches, nominal, in width, set on edge and spiked together, as required for floors. Other types of roof decking may be used that provide, equivalent fire-resistance, if not more combustible than two (2) inch nominal wood sheathing, and is used within spans which have been proved structurally safe by approved tests.”

#### **604.8 – WALLS**

Party and fire walls shall extend not less than three (3) feet above the roof. (See Section 716).

Exterior walls shall extend not less than twenty-four (24) inches above the roof, except that parapet walls need not be constructed on buildings where the roof slopes more than four (4) inches vertical to twelve (12) inches horizontal from the back of the exterior wall of such building, or where the exterior of such buildings is located fifteen (15) feet or more distance from the property line or other building on the same property, or faces on an [alley](#) or public way fifteen (15) feet or more in width. (718)

### **SECTION 605 TYPE IV CONSTRUCTION**

Type IV Construction is construction in which the structural members including exterior walls, interior bearing walls, columns, floors and roofs are of noncombustible materials. Type IV Construction may be protected or unprotected. Fire resistance requirements for structural elements of Type IV Construction shall be as specified in [Table 600](#). Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this Chapter. (MCSC 211 & 100 – See [Table 600](#)).



## SECTION 606 – TYPE V CONSTRUCTION

Type V Construction is construction in which the exterior bearing and nonbearing walls are of noncombustible material and have fire resistance not less than that specified in [Table 600](#); and floors, roofs and interior framing are wholly or partly of wood or other approved materials. Type V Construction may be either protected or unprotected. Fire resistance requirements for structural elements of Type V Construction shall be as specified in [Table 600](#). Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this Chapter. (MCSC 311 & 300 – See [Table 600](#)).

## SECTION 607 TYPE VI CONSTRUCTION

Type VI Construction is construction in which the exterior bearing and nonbearing walls and partitions, floors and roofs and their supports are wholly or partly of wood or other approved materials. Type VI Construction may be either protected or unprotected. Fire resistance requirements for structural elements of Type VI Construction shall be as specified in [Table 600](#). Reference Note: Materials may be used as specified in [Table 600](#), or as permitted in this Chapter. (MCSC 111 & 100 – See [Table 600](#)).

## SECTION 608 EXCEPTIONS TO FIRE RESISTANCE RATINGS

### 608.1 – ELEVATOR FRAMES

Structural members of frames for elevators will not be required to have the fire protection required for structural steel, provided such members are erected within an enclosure of the prescribed fire resistance rating. [Section 701](#) – Enclosure of Vertical Openings.

### 608.2 – LINTELS

Lintels over openings in walls shall be protected to provide a fire resistance rating at least equal to that required for beams, except that when such lintels are used over openings less than four (4) feet wide, such protection may be omitted. The outer member of an assembled steel lintel, which supports face masonry that is securely bonded to backing need not be protected, provided that the load carrying member of such lintel is protected as herein required.

### 608.3 – UNPROTECTED EXTERIOR WALLS OR PANELS

Unprotected walls or panels may be permitted in exterior non-bearing walls under the following conditions:

- (1) Provided such walls are of noncombustible material. Exterior grade Fire Retardant Treated Wood may be used provided the building is no more than four (4) stories in height.
- (2) Provided such walls face a street or permanent open space of 30 feet or more in width.
- (3) Provided the requirements of [Section 703.3](#) are met.

### 608.4 – WOOD VENEERS ON EXTERIOR WALL PANELS

- (a) Wood veneers of not less than one (1) inch nominal thickness or three-eighths (3/8) inch exterior type plywood or particleboard may be used outside of the Fire District on exterior walls when all the following conditions are met.:

## CLASSIFICATION OF BUILDINGS BY CONSTRUCTION

1. The wall to which the veneer is attached faces a street or permanent open space of thirty (30) feet or more in width, and
  2. The veneer does not exceed two (2) stories in height, measured from grade, and
  3. The veneer is attached to or furred from a noncombustible backing of a minimum of a 2-hour fire-resistive rating.
  4. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than twenty-four (24) inches from the building wall.
- (b) Where the wood veneer is furred from the wall and forms a solid surface, the distance between the back of the veneer and the wall shall not exceed one and five- eighths (1 5/8) inches and the space thereby created shall be firestopped in accordance with Section 1703 and arranged so that there will be no open space exceeding one hundred (100) sq. ft. Where wood furring strips are used, they shall be of approved wood of natural decay-resistance or pressure treated wood.
- (c) Listed exterior grade fire retardant treated wood may be used inside the fire district under conditions of [608.4\(a\)](#) and [608.4\(b\)](#).

### 608.5 – UNUSABLE SPACE

In one hour fire resistant construction the ceiling may be omitted over unusable space and flooring may be omitted where unusable space occurs above.

## SECTION 609 MIXED TYPES OF CONSTRUCTION

### 609.1 – HORIZONTAL SEPARATION

When two or more types of construction occur in the same building and are not separated by the fire separation specified in [Section 403](#) for Mixed Occupancies, the entire building shall be subject to the occupancy restrictions of the least fire resistive type.

### 609.2 – VERTICAL SEPARATION

- (a) Where a building is constructed of more than one type of construction, the following limitations shall apply:

TYPE I construction shall not be supported by any other type.

TYPE II construction shall not be supported by construction other than Type I or Type II.

TYPE III construction shall not be supported by construction other than Type I, II or III.

TYPE IV construction shall not be supported by construction other than Type I, II, III or IV.

TYPE V construction shall not be supported by construction other than Type I, II, III, IV or V.

- (b) When types of construction of lower classification are erected above higher classifications, the entire building shall then be subject to the restrictions of the lowest fire resistive type of construction used in the building.

**SECTION 610 BUILDINGS LOCATED ON THE SAME LOT**

Where the exterior walls of two (2) or more buildings located on the same lot face one another, and one of the walls is not constructed as required for a fire wall, a common-property line shall be assumed between them. The fire resistance requirements for such facing walls and for the protection of openings therein shall be the same as required by this code for walls and openings facing common-property lines, as provided in [Table 600](#).

**TABLE 600 – FIRE PROTECTION REQUIREMENTS**  
**Required Fire Resistance in Hours**

All notes and symbols which are located at the heading of type of construction column for each structural element apply to all ratings listed in that column.

N.C. – Non-combustible

(NL) – No limit

H – Heavy Timber Sizes – See Section 604

\* - Horizontal separation is the distance from a common or assumed property line.

\*\* - See Section 608.3

STRUCTURAL ELEMENT	TYPE I	TYPE II	TYPE III	TYPE IV		TYPE V		TYPE VI	
				1-Hour Protected	Unprotected	1-Hour Protected	Unprotected	1-Hour Protected	Unprotected
MCSC DESIGNATION	443	332	3HH	211	100	311	300	111	100
	Section 602	Section 603	Section 604	Section 605		Section 606		Section 607	
<b>Party and Fire Walls</b>	(a) Min. 8” 75% Solid Masonry (Sec 716)	(a) Min. 8” 75% Solid Masonry (Sec 716)	(a) Min. 12” 75% Solid Masonry (Sec 716)	(a) Min. 8” 75% Solid Masonry (Sec 716)	(a) Min. 8” 75% Solid Masonry (Sec 716)	(a) Min. 12” 75% Solid Masonry (Sec 716)	(a) Min. 12” 75% Solid Masonry (Sec 716)	(a), (o,q) Min. 12” 75% Solid Masonry (Sec 716)	(a), (o,q) Min. 12” 75% Solid Masonry (Sec 716)
<b>Exterior Bearing Walls (r)(d)</b>	(% indicates percent of protected and unprotected wall openings permitted. See 703.1(a) for protection requirements)								
Horizontal Separation*	NC	NC	NC (b)	NC (c)(b)	NC (c)(b)	NC (b)(e)	NC (b)(e)	(o)	(p)(o)
0’ – 3’	4 (0%)	3 (0%)	3 (0%)	2 (0%)	1 (0%)	3 (0%)	3 (0%)	1 (0%)	1 (0%)
3’ – 10’	4 (10%)	3 (10%)	2 (10%)	1 (10%)	1 (10%)	2 (10%)	2 (10%)	1 (20%)	0 (20%)
10’ – 20’	4 (20%)	3 (20%)	2 (20%)	1 (20%)	0 (20%)	2 (20%)	2 (20%)	1 (40%)	0 (40%)
20’ – 30’	4 (30%)	3 (30%)	2 (30%)	1 (40%)	0 (40%)	1 (40%)	1 (40%)	1 (60%)	0 (60%)
Over 30’	4 (40%)	2 (40%)	2 (40%)	1 (40%)	0 (NL)	1 (NL)	1 (NL)	1 (NL)	0 (NL)
<b>Exterior Non-Bearing Walls ** (r)(d)</b>	(% indicates percent of protected and unprotected wall openings permitted. See 703.1(a) for protection requirements)								
Horizontal Separation*	NC	NC	NC	NC (c)	NC (c)	NC (e)	NC (e)	(o)	(o)
0’ – 3’	3 (0%)	3 (0%)	3 (0%)(b)	2 (0%)(b)	1 (0%)(b)	3 (0%)(b)	3 (0%)(b)	1 (0%)	1 (0%)
3’ – 10’	2 (10%)	2 (10%)	2 (10%)(b)	1 (10%)(b)	1 (10%)(b)	2 (10%)(b)	2 (10%)(b)	1 (20%)	0 (20%)
10’ – 20’	2 (20%)	2 (20%)	2 (20%)(b)	1 (20%)(b)	0 (20%)(b)	2 (20%)(b)	2 (20%)(b)	1 (40%)	0 (40%)
20’ – 30’	1 (40%)	1 (40%)	1 (40%)(b)(h)	0 (40%)(b)	0 (40%)(b)	1 (40%)(b)	1 (40%)(b)	0 (60%)	0 (60%)
Over 30’	0 (NL)	0 (NL)	0 (NL)(h)	0 (NL)	0 (NL)	0 (NL)	0 (NL)	0 (NL)	0 (NL)
<b>Inner Court Walls</b>	3	2	3	3	1	1	1	1	None
<b>Penthouse Walls</b>	2 (f)	2 (f)	2 (f)	1 (f)	NC (f)	None (f)	None (f)	None (f)	None
<b>Interior Bearing Walls</b>									
Supporting more than one floor Columns or other bearing walls	(q) 4	(q) 3	2	1	NC	1 (g)	0 (g)	1	0
Supporting one floor only	3	2	1	1	NC	1 (g)	0 (g)	1	0
Supporting a roof only	3	2	1	1	NC	1 (g)	0 (g)	1	0
<b>Interior Non-Bearing Partitions</b>	See Sections 403, 701 and 702								

CLASSIFICATION OF BUILDINGS BY CONSTRUCTION

**TABLE 600 – FIRE PROTECTION REQUIREMENTS (continued)**  
**Required Fire Resistance in Hours**

All notes and symbols which are located at the heading of type of construction column for each structural element apply to all ratings listed in that column.

N.C. – Non-combustible

(NL) – No limit

H – Heavy Timber Sizes – See Section 604

\* - Horizontal separation is the distance from a common or assumed property line.

\*\* - See [Section 608.3](#)

STRUCTURAL ELEMENT	TYPE I	TYPE II	TYPE III	TYPE IV		TYPE V		TYPE VI	
				1-Hour Protected	Unprotected	1-Hour Protected	Unprotected	1-Hour Protected	Unprotected
MCSC DESIGNATION	443	332	3HH	211	100	311	300	111	100
	Section 602	Section 603	Section 604	Section 605		Section 606		Section 607	
<b>Columns</b>									
Supporting Masonry or Bearing Walls	4	3 (j)	H (j)	1 (i)(j)	NC (i)(j)	(j)	(j)	1 (j)	(j)
Supporting Roof Only	3	2	H (h)	1	NC	1	0	1	0
Other columns	4	3	H (h)(j)	1	NC	1	0	1	0
<b>Trusses, Girders and Beams, Arches</b>									
Supporting Masonry or Bearing Walls, Columns, Girders, Trusses	4	3	H (i)	2 (i)	2 (i)	2 (i)	2 (i)	1 (i)	1 (i)
Supporting Roofs	2 (k)	1½ (m)(k)(l)	H (h)	1	NC	1	None	1	None
Other Trusses, Girders and Beams, and Arches	4	3	H (h) <a href="#">Section 604.4</a>	1	NC	1	None	1	None
<b>Floor Construction</b>	3	2	<a href="#">Section 604.3</a>	1	NC	1	0	1	0
<b>Roof Construction</b>									
<b>Deck Construction</b>	2	1½	(h) <a href="#">Section 604</a>	1	NC (l)	1 (n)	None (n)	1 (n)	None (n)
High Above Floor	2 (k)	1½ (k)(m)	<a href="#">Section 604</a>	1 (k)	NC (l)	1	None	1	None

**TABLE 600 – REFERENCE NOTES**

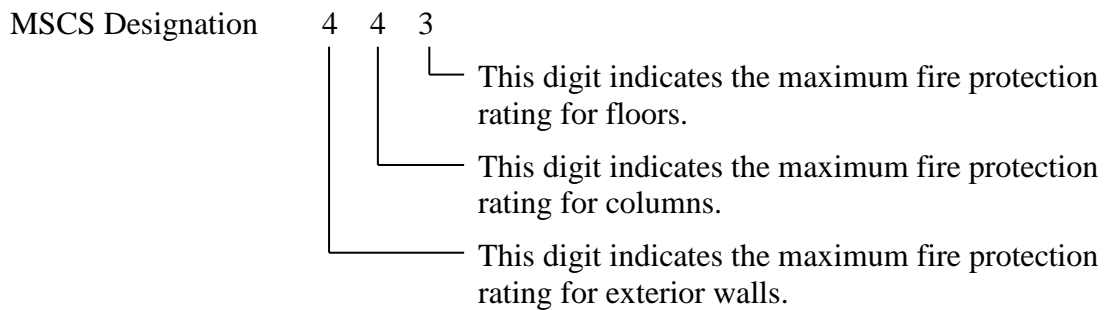
(All notes and symbols which are located at the heading of type of construction column for structural elements apply to all ratings listed in that column.)

- (a) Party and fire walls shall extend not less than three (3) feet above the roof, except that they need not extend above the roof where the roof and all structural supports are of noncombustible construction (See Section 718).
- (b) Inside any fire district, all exterior walls except walls facing a street 30 feet or more in width shall be constructed at 75% Solid Masonry Units (12" min. Thickness) in conformance with Section 716. See Note (c) and (e) for exception. No openings permitted, except required egress doors 3-hour label.
- (c) For Type IV buildings located within the fire districts, exterior walls shall provide the following fire resistance against outside exposure when building does not exceed 3500 square feet per building.
 

0 to 10 feet	1 hour
Over 10 feet	None
- (d) See Section 718 for parapet requirements.
- (e) For Type V buildings less than 2000 square feet in area per building located within the fire districts, exterior walls shall provide 2-hour fire resistance.
- (f) Where penthouse walls are set back less than five (5) feet from exterior walls, they shall conform to the fire resistance requirements for exterior walls.
- (g) The use of combustible construction for interior bearing partitions shall be limited to the support of not more than 2 floors and a roof.
- (h) Where horizontal separation of twenty (20) feet or more is provided, wood columns, arches, beams and roof deck conforming to heavy timber sizes may be used externally, except in fire districts.
- (i) This requirement applies only to structural member supporting masonry walls, except that this does not apply in one (1) story buildings or where the only masonry supported is masonry veneer.
- (J) Same rating as required for wall it supports.
- (k) In buildings of Group E and A (School and Assembly Occupancies), where structural steel members supporting a roof only are not less than twenty feet clear above any floor or balcony used for any purpose other than seating, fire protection of structural members supporting roof construction only may be omitted. If the building has 20,000 square feet or more of floor area where combustible materials could be displayed, this section does not apply.
- (l) In one story buildings, approved Fire-Retardant Treated Wood may be used as an alternate to non-combustible in buildings of Group E and A (School and Assembly) occupancies. In one story buildings, approved fire retardant treated wood may be used for structural members supporting roofs including the Trusses, Arches and Roof Decks.

**TABLE 600 – REFERENCE NOTES (continued)**

- (m) Fire proofing of structural members may be omitted on buildings of Group E and A (School and Assembly) occupancies where structural members support a roof only and are twenty feet or more clear above any floor or balcony. In one (1) story buildings approved fire-retardant (pressure treated) wood may be used as an alternate to such unprotected structural steel members.
- (n) See Sections 705 and 1703 for firestopping and draftstopping.
- (o) Buildings over 3500 square feet in area per building, 0 to 3 feet – 3 hours (20%), 3 to 10 feet – 2 hours (20%), 10 to 20 feet – 2 hours (30%), 20 to 30 feet – 1 hour (40%).
- (p) Separation of Single Family Attached Dwellings – See Section 403.3.
- (q) In buildings of Group R where either concrete or masonry bearing partitions are not spaced more than 16'-0" and where each dwelling unit is limited to 1600 square feet, interior bearing partition shall provide 2-hour fire resistance.
- (r) Exterior walls shall be fire tested in accordance with Section 601.2. The requirements for one (1) hour fire resistive exterior walls with five (5) feet or less of horizontal separation from a property line or assumed property line shall be based upon both interior and exterior fire exposure. The fire resistive requirements for one (1) hour rated exterior walls with more than five (5) feet horizontal separation from a property line or assumed property line shall be based upon interior fire exposure only. Fire rated exterior walls required to comply with Sections 703.3, 1103.2(c) and 1106.1(b) shall have their fire resistance rating based upon both interior and exterior fire exposure. [Note: Add (r) to exterior non-bearing and bearing wall section of Table]
- (s) These references are to the Model Codes Standardization Council's recommended types of construction and are for information purposes only. For example:



## CHAPTER 7 FIRE PROTECTION REQUIREMENTS

### 701 PROTECTION OF VERTICAL OPENINGS, STAIRS AND ELEVATORS

#### 701.1 – GENERAL REQUIREMENTS FOR ENCLOSURE OF VERTICAL OPENINGS OR SHAFTS

- (a) Openings in floors or roofs, except one and two family dwellings, shall be enclosed to prevent spread of fire from story to story, as herein specified, unless otherwise specifically excepted in this code.
- (b) All vertical shafts extending through more than one (1) story shall be enclosed throughout their length with construction of not less than that specified in [Table 700](#). A shaft that does not extend through the roof shall have its top enclosed with construction having fire resistance at least equal to that of the enclosing walls. Where the enclosing walls of shafts are open to the outer air at the top, such walls shall be constructed to provide fire resistance equivalent to that specified in Chapter VI for the inner court walls of such a building.

Exceptions:

- (1) Open stairways shall be permitted as specified in [Chapter 11](#).
- (2) In other than Group I occupancies, an enclosure is not required for openings which serve only one adjacent floor and are not connected with openings serving other floors and are not concealed within the building construction.
- (c) For bearing partition requirements, see Types of Construction, Chapter VI.
- (d) Parapet walls, at least thirty-six (36) inches in height above any part of the roof within five (5) feet shall be provided around all open shaft enclosures that extend through a roof. Except that where the roof is of non-combustible construction a noncombustible guardrail at least forty-two (42) inches high may be used around openings instead of a wall.
- (e) Openings in all shaft enclosures shall be limited to those necessary for the purposes of the shaft.
- (f) Floor penetrations by pipe or conduit are required to be enclosed in shafts as in the foregoing or shall be fire stopped at the floor level, whether within a partition or not, with tightly fitted non-combustible material. (See Section 2503)
- (g) Shaft enclosures shall be of non-combustible materials in Types I, II and IV construction and may be of combustible materials in Types III, V and VI construction.

#### 701.2 – STAIRWAY AND EXIT ENCLOSURES

Stairway and exit enclosures shall meet the requirements of [Chapter 11](#).

#### 701.3 – ELEVATOR ENCLOSURES

- (a) Where four (4) or more elevators serve all or the same portion of a building, they shall be located in not less than two (2) hoistways, but in no case shall more than four (4) elevators be located in any one hoistway. Such hoistway enclosure shall have fire resistance as specified in [Table 700](#).



- (b) Where an elevator is installed in a single blind hoistway, there shall be installed in the blind portion of the hoistway or blank face of the building, an emergency door at every third floor but not more than thirty-six (36) feet apart in accordance with Section 110.1 of Elevator Code (A17.1).
- (c) Elevators shall not be in a common enclosing shaft with a stairway, and the path of travel from one flight of stairs to the next shall not pass directly in front of elevator doors.
- (d) Construction at Top and Bottom of Hoistway
  - (1) Where a hoistway extends into the top floor of a building, fire resistive hoistway or machinery-space enclosures, where required, shall be carried to the underside of the roof if the roof is of fire-resistive construction, and at least three (3) feet above the top surface of the roof if the roof is of non-fire-resistive construction.
  - (2) Where a hoistway does not extend into the top floor of a building, the top of the hoistway shall be enclosed with fire-resistive construction having a fire-resistance rating at least equal to that required for the hoistway enclosures.
  - (3) Pits extending to the ground shall have non-combustible floors and shall be so designed as to prevent entry of ground water into the pit. The pit floor of any hoistway not extending to the ground shall be of fire-resistive construction having a fire-resistance rating at least equal to that required for the hoistway enclosure.

Exceptions:

- (1) Partitions between fire-resistive hoistways and machine rooms having fire-resistive enclosures and which are located at a side of or beneath the hoistway, may be of unperforated non-combustible material at least equal to No. 16 U.S. gage (.0598 inches manufacturers' standard gage) sheet steel in strength and stiffness with openings therein essential for ropes, drums, sheaves and other elevator equipment.
  - (2) Elevators which are entirely within one story or which pierce no solid floors and serve two or more open galleries, book stacks, etc., in buildings such as powerhouses, libraries, open towers and similar structures.
- (e) A metal or concrete floor shall be provided at the top of the hoistway.

Exception: Floors are not required below:

- (1) Secondary and deflecting sheaves of traction-type machines located over the hoistway.
- (2) Overhead sheaves, governors and other equipment where the elevator machine is located below or at the side of the hoistway, provided that:
  - (a) Means of access for inspection and servicing of governors is provided from outside the hoistway, conforming to the requirements of Rule 101.3(c) ANSI A17.1.
  - (b) Sheaves and other equipment (except governors) may be inspected and serviced from the top of the car, or means of access from outside the hoistway may be provided conforming to the requirements of Rule 101.3(c) ANSI A17.1.

## FIRE PROTECTION REQUIREMENTS

Machine room floors may be of concrete or may be of metal construction and secondary floors may be with or without perforations. Metal floors shall conform to the following: (See Chapter 12 of Vol. I and Section 100.3(c) of A17.1 for floor loads).

- (1) Secondary Floors if of bar-type grating, the openings between bars shall reject a ball three-quarters (3/4) of an inch in diameter.
  - (2) Secondary floors if of perforated sheet metal or of fabricated openwork construction, the openings shall reject a ball one (1) inch in diameter. (See [Section 506.7\(b\)4](#) for pressurized hoistways).
- (f) Hoistways of elevators serving more than three (3) floors shall be provided with means for venting smoke and hot gases to the outer air in case of fire.

### Exception:

Hoistways not extending into the top floor of the building, in buildings other than hotels, [apartment houses](#), hospitals and similar buildings with overnight sleeping quarters, where the hoistways are equipped with approved automatic sprinklers connected to the building water-supply system or to an approved automatic sprinkler system (See NFPA No. 13 Sprinkler System). Such systems shall be responsive to an accumulation of smoke as well as heat at the top of the hoistway.

- (g) Where fire-resistive hoistway enclosures and doors are not required by Rule 100.1a, the hoistway shall be fully enclosed. Enclosures and doors shall be unperforated to a height of six (6) feet above each floor or landing and above the treads of adjacent stairways. Enclosures shall be so supported and braced as to deflect not over one (1) inch when subjected to a force of one hundred (100) pounds applied horizontally at any point. Unperforated-metal enclosures shall be equal to or stronger than No. 18 U.S. gage sheet steel. Openwork enclosures may be used above the six (6) foot level and shall reject a ball two (2) inches in diameter, and shall be either of wire grille at least No. 13 steel wire gage or expanded metal at least No. 13 U.S. gage.
- (h) The hoistway enclosure adjacent to a landing opening shall be of sufficient strength to support in true alignment the hoistway doors with their operating mechanism and locking devices.

**TABLE 700  
MINIMUM FIRE RESISTANCE OF WALLS, PARTITIONS  
AND OPENING PROTECTIVES<sup>1</sup>**

Components	Walls and Partitions (hours)	Opening Protectives (hours)
<b>VERTICAL SHAFTS</b>		
General:		
4 or more stories	2	1-1½ B
less than 4 stories	1	1 B
Stairways & Exits:		
4 or more stories	2	1-1½ B
less than 4 stories	1 <sup>2</sup>	1 B
Elevators:		
4 or more stories	2	1-1½ B
less than 4 stories	1	1 B
<b>WALLS AND PARTITIONS</b>		
fire walls <sup>3</sup>	4	3 A
occupancy separation within tenant space	SEE SECTION 403.1	
tenant space (see also 403.2)	SEE NOTE 4 OF THIS TABLE	
Horizontal exit	1	¾ C
corridors, exit access (note 5)	2	1-1½ B
smoke partitions	1	20 min.
refuse chute access room	1	¾ C
Refuse vault	2	1-1½ B
hazardous use separation	SEE SECTION 403.1 & 407	
High rise buildings	SEE SECTION 506	
mall buildings	SEE SECTION 507	
assembly buildings	SEE SECTION 404	

1. Table 600 may require greater fire resistance of walls to insure structural stability.
2. All exits and stairways in Group H hazardous occupancies shall be two (2) hours with 1 ½ hour B doors.
3. See also Section 402.1(b) and 716.
4. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and which do not establish a corridor serving an occupant load or thirty (30) or more persons may be movable, partial or full height, temporary or permanent and may be constructed of any materials approved by this Code provided:
  - (a) They do not block required exits (without providing alternative conforming exits) and they do not establish an exit corridor.
  - (b) Their location is restricted by means of permanent tracks, guides or other approved methods.
  - (c) Flammability shall be limited to materials having a flame spread classification as set forth in Section 704.3 for rooms or areas.
5. In A, F, H, M, and S occupancies, all corridors that serve an occupancy load greater than thirty (30) persons shall have a minimum fire resistance rating of one (1) hour.

### **701.4 – RUBBISH CHUTES, LINEN CHUTES AND FLUE-FED INCINERATORS**

- (a) Every chute and incinerator flue shall be enclosed in accordance with [Section 701.1](#), and the openings therein shall be protected. No such chutes or incinerator flues shall, in new construction, open directly on any exit, or corridor to an exit, but shall be in a separate room or closet separated from the exit (or from the corridor) by an approved self-closing fire door, except that this requirement shall not apply to dwellings and that in [apartment houses](#), automatic sprinkler protection may be provided in lieu of the self-closing fire door. (Special designed pneumatic chutes with “B” label openings are exempt from these requirements).
- (b) Every incinerator flue, rubbish chute and linen or laundry chute shall be of a standard type properly designed and maintained for fire safety.
- (c) In new construction, any chute other than an incinerator chute shall be provided with automatic sprinkler protection at the top and every second floor level.

## **SECTION 702 INTERIOR WALL AND PARTITION FIRE SEPARATION REQUIREMENTS**

### **702.1 – GENERAL**

- (a) This section shall apply to the fire separation requirements of interior walls and partitions for the various occupancies and types of construction. All partitions enclosing vertical openings such as stairways, utility shafts and elevator shafts which are required to have a fire resistance rating shall extend from floor to floor or floor to roof.
- (b) All partitions required to have a fire-resistant rating shall extend from the top of the floor below to:
  - (1) The underside of a one hour or greater ceiling/floor or ceiling/roof assembly where the required rating of the partition is no more than one hour.
  - (2) The floor deck or roof deck above where the required rating of the partition exceeds one hour.
  - (3) The floor deck or roof deck above where the floor deck or roof deck do not have a rating.
  - (4) The floor deck or roof deck above where the partitions are one hour corridor partitions for Schools and Institutional Buildings.
- (c) Where a greater degree of fire resistance is required by other sections of this code, those provisions shall apply.
- (d) View panels in one (1) hour fire resistive partitions shall be limited to 1296 square inches with no dimension greater than fifty-four (54) inches or 1/4" labeled wire glass assemblies installed in steel frames, but shall not exceed twenty-five (25) percent of the wall area separating a room from a corridor.

### **702.2 – PARTITION REQUIREMENTS BY TYPE OF CONSTRUCTION**

Bearing walls shall comply with the provisions of Chapter VI, but shall provide not less than the degree of fire resistance specified in [Table 600](#).

All non-bearing partitions shall conform to the requirements of this section and have the fire resistance specified in [Table 600](#) except as specified elsewhere in this code.

Type I and Type II Construction – Partitions shall be constructed of noncombustible materials except that non-bearing framing members of Fire Retardant Treated Wood may be used.

Type III Construction – Partitions may be of any material permitted by this Code.

Type IV Construction – Partitions shall be constructed of non-combustible material or not less than (1) hour fire resistance rating.

Type V and Type VI Construction – Partitions may be of any material permitted by this code.

### **702.3 – WALL AND PARTITION REQUIREMENTS BY OCCUPANCY**

Group R – Residential – All partitions along public hallways or partitions that separate units of this occupancy or that separate units of this occupancy from other occupancies, shall be of not less than one-hour fire-resistance.

Group B – Business – Buildings more than one story in height, partitions along public hallways serving over 200 people, shall have a one-hour fire resistance rating. Floor areas occupied by multiple tenants in buildings of Type I and Type II Construction shall be separated into areas not in excess of 7,500 square feet by one-hour fire resistant partitions. Floor areas occupied by multiple tenants in Buildings of Type III, IV, V and VI Construction shall be separated into areas not in excess of 3,000 square feet by one-hour fire resistant partitions. The above tenant separations of 7500 and 3000 square feet of area are not required when the provisions of [Section 403.2](#) are met. These partitions and corridor partitions shall be continuous from the floor to the structure above and shall have all openings protected. U.L. listed wire glass in approved metal frames shall be permitted in corridor partitions of buildings of Type I and Type II Construction provided each glazed area does not exceed 36 square feet per panel.

Group M – Mercantile – Partitions separating tenants shall have at least a one-hour fire resistance rating. Partitions within individual tenant spaces may be as prescribed for the type of construction required. (See [Section 403](#) for mixed occupancy separation.)

Group E – Educational – Partitions in buildings two or more stories in height shall be of not less than one-hour fire-resistant construction. All partitions in one-story buildings, except in rooms having direct exit to outside, shall be protected with non-combustible material. (See [Section 1104.7](#))

Group I – All partitions shall be of not less than one-hour fire-resistance.

Group A – See Section 404 and Section 1106 for partition requirements.

Group S, Group F and Group H – Partitions in Group F and Group S buildings over three (3) stories, and all partitions in Group H buildings shall be of not less than one-hour fire resistance, except where greater fire-resistance is required. Combustible partitions may be used within accessory offices and rooms necessary for transacting the principal business of such occupancies, provided that such rooms are used for non- hazardous purposes.

## **SECTION 703 PROTECTION OF WALL OPENINGS**

### **703.1(a) – WHERE PROTECTION IS REQUIRED**

For the purpose of this section, when a building is divided by fire walls into two or more sections, each section shall be regarded as a separate building.

## FIRE PROTECTION REQUIREMENTS

Every building (except churches, buildings of Type VI, and public parking decks as defined in [Section 412.8](#)) shall have approved fire windows, fire doors or other approved protectives, in every opening in the exterior walls, under the following conditions:

1. In buildings where the distance is fifteen (15) feet or less from the property line.
2. In buildings where such opening is above and less than fifteen (15) feet distance from any part of a neighboring roof of combustible construction.
3. In buildings where such openings are within fifteen (15) feet of each other except when the total area of the buildings does not exceed the area allowed for type of construction.

Exceptions: Such protection shall not be required for show windows facing on a street or public place which do not extend above the second full story above grade nor shall such protection be required when the opening to be protected and the opening against which it is to be protected are facing in the same direction being located in walls in the same or parallel lines. All required opening protection shall be of approved type as defined elsewhere in this section.

### **703.2(a) – APPROVED TYPES OF FIRE WINDOWS, FIRE DOORS, AND FIRE SHUTTERS AND DAMPERS**

Fire windows, fire doors and fire shutters shall be deemed approved if listed. Every fire window, fire door and fire shutter shall bear the label of identification of an approved testing agency showing the classification. Dampers shall be listed or be a part of a listed assembly.

### **703.2(b) – FIRE TESTS FOR PROTECTIVE DOOR OR SHUTTER ASSEMBLIES**

Tests of opening protective assemblies shall be made upon complete full size assemblies, except that in any case the assembly need not exceed one hundred eight (108) Sq. Ft. in area, constructed and installed in all essentials as in actual service and subjected to a fire on one side continuously for periods in accordance with the time-temperature curve of the standard fire test specifications prescribed in Section 601 ASTM “Standard Methods of Fire Tests of Building Construction and Materials.” (E119).

Opening protective assemblies tested to establish a fire-resistive rating (one hour or more) shall be subjected to a hose stream test conducted in accordance with the standard ASTM fire test specifications. “Fire Tests of Door Assemblies, E152-58.”

The duration of the fire test shall be as follows:

For fire doors required in fire walls or 4-Hr. fire-resistive walls or partitions	3-Hrs.
For fire doors required in 3-Hr. fire-resistive walls or partitions	1½-Hrs.
For fire doors required in 2-Hr., or less, fire-resistive walls	1-Hr.
For fire shutter assemblies	¾-Hr.

When two fire door assemblies each of which has been accepted for a one and one half (1½) hour fire-resistance rating, are installed on two (2) sides of the same opening, such combined assembly shall be accepted as having a 3-hour fire-resistance rating. Similarly, two door assemblies, each having a three-quarter (¾) hour rating, shall be accepted as having a one and one-half (1½) hour rating.

Exception: Required exits through fire walls in Group E, I & A occupancies may be 1 Hr., and doors may include a wire glass vision panel not exceeding 100 square inches.

### **703.2(c) – FIRE SHUTTERS**

Tests of fire shutters to be successful shall meet the requirements for fire doors except that no restriction shall be made as to the amount of heat transmitted through the shutters.

### **703.2(d) – FIRE WINDOWS**

- (1) Fire windows shall have a fire-resistance rating of not less than three-quarters (3/4) of an hour, and shall have frame and sash of solid steel sections or of hollow metal forms fabricated by pressing, riveting, interlocking, welding or crimping together but not by the use of solder or other fusible alloy.
- (2) Wire glass not less than one-quarter (1/4) inch thick shall be used in all fire-resistant windows. Size of individual glass lights shall not exceed seven hundred and twenty (720) Sq. In. of exposed area. Continuous glazing angles shall be provided on the inside of all fire windows, except such listed casement section sash, outside glazed, having wire clips.
- (3) Maximum sizes of fire windows shall be as follows:

Hollow metal window frames shall be limited to a height not exceeding ten (10) Ft. and a maximum width of six (6) Ft. for double hung and for counterweighted type and for counterbalanced type; a maximum width of six (6) Ft. for fixed sash windows and of five (5) Ft. for all other types. Hollow metal mullions shall be used for non-bearing purposes only.

Solid section window frames shall be limited to a maximum size of eighty-four (84) Sq. Ft. with maximum dimension not exceeding twelve (12) Ft. except that solid section windows when used with the unprotected steel mullions shall be limited to seven (7) Ft. in width.

Solid section mullions when used in length exceeding twelve (12) Ft. shall be fire protected to provide the same degree of fire-resistance as is required for the wall construction of the building in which they are placed.

### **703.3 – VERTICAL SEPARATION OF OPENINGS**

Exterior openings in a building (3 stories or more in height, excluding buildings whose floors are not required by [Table 600](#) to be protected) that are located vertically above one another and which are not protected by approved types of fire windows or fire doors shall have a space of not less than three (3) Ft. between the top of one opening and the bottom of the next above, or such openings above the lowest shall be protected against fire by an approved protective device. Such wall space shall be constructed of materials having fire-resistance meeting the requirements for the exterior walls of the type of construction used for such building, as prescribed in Chapter VI of this code, and such wall space shall be of non-combustible materials having fire resistance of not less than 1-hour.

Vertical separation is not required by this section when:

- (a) A horizontal barrier of non-combustible materials having fire resistance of not less than 1 hour in the level of the separating floor construction is provided, extending outward continuously a minimum of 30 inches from the exterior wall, or
- (b) The building is fully sprinklered, or

- (c) The higher of any two successive exterior openings under consideration is set inwardly from the plane of the lower opening a horizontal distance of not less than 3 feet.
- (d) The building is of Type VI Construction.

Openings covered by this section include not only conventional penetrations of exterior walls such as by windows, glazed areas, and grills, but also unprotected exterior walls of glass.

#### **703.4 – PROTECTION OF DOOR OPENINGS IN WALLS AND PARTITIONS**

- (a) Wherever protection of door openings is required by this code and in all walls and partitions which are required to have 2-hour or more fire-resistance, door openings shall be protected with approved fire door meeting the requirements of [Section 703.2](#). In addition, wherever deemed necessary by the Building Official, approved fire doors may be required for the protection of exits or of adjoining property.
- (b) In 4-hour and 3-hour fire-resistive walls or partitions, no opening shall exceed one hundred twenty (120) Sq. Ft. in area with no dimension greater than twelve (12) Ft., and the aggregate width of all openings at any level shall not exceed twenty-five percent of the length of such wall or partition. Every door opening in such wall or partition shall be protected on each side with an approved automatic fire door; provided that when such wall or partition serves also as a horizontal exit, it shall have no openings other than door openings not exceeding forty-eight (48) Sq. Ft. in area, and one of the automatic fire doors at each opening shall be replaced by a self-closing fire door.
- (c) In 2-hour fire-resistive walls or partitions, no single door opening shall exceed one hundred eighty (180) Sq. Ft. in area. The aggregate width of all openings in such walls or partitions at any level shall not exceed that permitted for three-hour walls. Every door opening shall be protected with an approved automatic or self-closing fire door, provided that when such wall serves also as a horizontal exit, no opening shall exceed forty-eight (48) Sq. Ft. in area and protection shall be provided by an approved self-closing fire door.
- (d) In 1-hour fire-resistive walls or partitions, unless otherwise specified, all door openings shall be protected with approved metal or metal covered doors or doors of solid wood core of nominal thickness of at least one and three quarters (1¾) inch in all parts or doors having a 20-minute label.
- (e) See [Section 703.2](#) for fire-resistance requirements of fire doors.
- (f) When proof satisfactory to the Building Official is furnished that a larger size of opening than prescribed herein is necessary, the area may be increased if such opening is provided with protective devices that meet the approval of the Building Official.

#### **703.5 – FIRE SHUTTERS**

- (a) When equipped with fire shutters of the swinging type, at least one in every three openings facing a street in each story shall have such shutters arranged to be readily opened from the outside. Distinguishing marks shall be provided on these shutters.
- (b) Fire shutters of the rolling type shall be carefully counter-balanced and so arranged that they can be readily opened from the outside.



**703.6 – OPENINGS IN STAIRWAYS OR SHAFTWAYS**

Shaft walls or enclosures of vertical openings shall have no openings other than such as are necessary for the purpose of the shaftway; all openings in shafts shall be protected with approved fire doors, approved fire shutters or approved fire windows.

**703.7 – OPENINGS IN MIXED OCCUPANCY SEPARATIONS**

See [Section 403](#) and [703.4](#) for requirements governing door openings in walls and partitions required to be of fire-resistive construction.

**SECTION 704 RESTRICTIONS ON INTERIOR USE OF COMBUSTIBLE MATERIALS****704.1 – GENERAL**

Combustible materials may be used for ceilings, floor finish or other interior finish of buildings as provided in this Section. Show windows in the first story of buildings may be of wood or of unprotected metal framing.

**704.2 – FLOOR FINISH**

- (a) In buildings of Type I, or of Type II, floor finish, if of combustible material, shall be applied directly upon the floor construction except that a floor finish of wood, linoleum, rubber, tile or cork may be secured to a subfloor of wood. Where wood sleepers are used for laying wood floors in such buildings, they shall be firestopped so that there will be no open space extending under any permanent partition. Where the space between the underside of the floor and floor slab is more than 2½", such space shall be filled with non-combustible material.
- (b) Combustible insulating boards may be used for sound deadening, or insulating of floors, except that in buildings required to be of Type I, or of Type II, such insulating board shall not be more than one-half (1/2) inch thick and cemented directly to the floor slab or secured to wood sleepers firestopped as called for above and covered with approved finish flooring.

**704.3 – INTERIOR FINISH**

In every building except sprinklered buildings, flame spread ratings for walls and ceilings using ASTM Standard E84, U.L. No. 723 or NFPA 255, shall not exceed the following:

**Ceilings and Interior Wall Finish**

<i>Occupancy</i>	<i>Exits</i>	<i>Access to Exits</i>	<i>Other Spaces</i>
<b>GROUP R</b>			
Residential – apartment houses, hotels, motels	B	B	C
Residential – dormitories	B	C	C
<b>GROUP M</b>			
Mercantile – A <sup>4</sup> & B <sup>5</sup>	B		ceilings – B walls – C
Mercantile – C <sup>6</sup>	C		C
<b>GROUP H</b>	A	A	C
<b>GROUP B – Office</b>	B		C
<b>GROUP E – Educational</b>	A	A	C
<b>GROUP I</b>	A	A	A
			B in individual room with capacity not more than 4 persons
<b>GROUP A</b>			
Assembly – Class A <sup>1</sup> and B <sup>2</sup>	A	A	B
Assembly – Class C <sup>3</sup>	A	A	C
<b>Group F – Industrial</b>	C	C	C

NOTES: The flame spread rating required in this Table for wall and ceiling finishes applies to the surface finish. All non-combustible materials (see definition in Section 200) have a flame spread rating less than 25 even if they are not listed.

The flame spread rating required applies to the surface finish of walls and ceilings. Carpet and similar materials having a napped, tufted, looped or similar surface applied to walls or ceilings shall be Class A. For carpet used as a floor finish, see Appendix N for further information on the regulation of carpet and underlayment flammability by the Federal Government and self-regulation by the industry.

Wall and ceiling covering materials listed in accordance with ASTM E-84, UL 723 or NFPA 255 shall be grouped in the following classes according to their flame spread rating:

- Class A Interior Finish – Flame Spread 0 – 25
- Class B Interior Finish – Flame Spread 26 – 75
- Class C Interior Finish – Flame Spread 76 – 200

Automatic Sprinklers – where a complete standard system of automatic sprinklers is installed, interior finish with a flame spread rating not over Class C may be used in any location where Class B is normally specified, and with rating of Class B in any location where Class A is normally specified, unless specifically prohibited elsewhere in this Code.

1. Assembly – A: 1,000 persons or more
2. Assembly – B: 200 to 1,000 persons
3. Assembly – C: under 200 persons

4. Mercantile – A: stores having aggregate gross area of 30,000 square feet or more, or utilizing more than 3 floor levels for sales purposes.
5. Mercantile – B: stores less than 30,000 square feet aggregate gross area, but over 3,000 square feet, or utilizing any floors above or below street level for sales purposes, except that if more than 3 floors are utilized, store shall be Class A.
6. Mercantile – C: stores of 3,000 square feet or less gross area, used for sales purposes on street level only – ([Balcony](#) permitted).

#### 704.4 – TRIM AND OTHER INCIDENTAL FINISH

Interior finish not in excess of 10 percent of the aggregate wall and ceiling areas of any room or space may be Class C materials in occupancies where interior finish of lower flame spread rating is required. The area of doors, trim, etc. shall be counted in the 10 percent.

### SECTION 705 FIRESTOPPING AND DRAFTSTOPPING

#### 705.1 – FIRESTOPPING

- (a) Firestopping shall be provided in all walls and partitions to cut off all concealed draft openings both horizontal and vertical, and to form an effectual fire barrier between stories and between the upper story and the roof space.
- (b) Walls, including masonry walls furred with combustible material, and stud partitions shall be effectively firestopped with noncombustible material at floors, ceilings, and roofs, except in those parts of a building which are framed with wood, the firestopping may be of wood in accordance with [Section 1703.1](#).
- (c) All openings around pipes, ducts and conduits shall be firestopped with approved noncombustible materials. See [Section 1703.1](#).
- (d) All openings for belts and conveyors shall be provided with approved slotted doors, or be otherwise closed off. Belts shall not pass through fire-walls.
- (e) Approved noncombustible firestopping materials may be brick, concrete, gypsum, steel, iron, asbestos, metal lath and cement or gypsum plaster, mineral wool, rock wool, or similar approved noncombustible materials. All firestopping shall be securely fastened in place to cut off drafts and to provide an effective fire stop.
- (f) No firestopping shall be covered or concealed until inspected by the Building Official.
- (g) For firestopping of wood frame construction, see [Section 1703.1](#).

#### 705.2 DRAFTSTOPPING

- (a) Enclosed [attic](#) and floor spaces formed of combustible construction shall be divided in accordance with [Section 1703.2](#).

### SECTION 706 ROOF COVERINGS

#### 706.1 – GENERAL

Roof coverings shall be divided into the classes defined below, whose use within the Fire District shall be governed by the requirements of [Section 301.3\(d\)](#).

**706.2 – CLASS A ROOF COVERINGS**

Class A Roof Coverings shall include the following: Brick-Concrete-Slate-Tile-Corrugated Asbestos Cement-built-up 4-and 5-ply Felt, with Pitch, and Gravel or Pitch and Slag, and Built-up Asbestos Felt.

**706.3 – CLASS B ROOF COVERINGS**

Class B Roof Coverings shall include the following: corrugated iron sheets; galvanized iron sheets; galvanized iron shingles; sheet copper; galvanized iron, asphalt asbestos felt shingles; asphalt asbestos roll roofing; and asphalt asbestos cement shingles.

**706.4 – CLASS C ROOF COVERINGS**

Class C roof coverings shall include the following: asphalt rag-felt mineral surfaced individual or strip shingles conforming to the standards of the Underwriter's Laboratories, Inc. for Class "C" roofing as outlined in Underwriters' booklet UL55B, asphalt roll roofing, surfaced with mineral granules, conforming to the above standards and laid in single or double (19-inch selvage) thickness with 2 inch or more side and end laps; aluminum .019-inch thickness.

**706.5 – WOOD SHINGLES AND SHAKE**

Outside the Fire District, buildings one (1) story in height and not over six thousand (6,000) sq. ft., and two (2) story buildings not over four thousand (4,000) sq. ft. per floor located not less than ten (10) feet from the property line, may be roofed with No. 1. or No. 2 wood shingles or shakes with minimum one half (1/2) inch butt thickness, and installed with rust resistant nails. Spark arrestors shall be required where chimneys serving fireplaces occur.

Wood Shingles and Shakes may be applied to roofs with solid or spaced sheathing. Spaced sheathing shall be spaced on center equal to weather exposure of the shingles but not more than ten (10) inches. Sheathing boards shall be not less than one (1) inch by four (4) inches nominal dimensions. Shingles and shakes shall be applied in accordance with the recommendations of the Red Cedar Shingle and Handsplit Shake Bureau, and with the following exposure:

**Weather Exposure and Roof Pitch**

Roof Pitch		3/12	4/12	5/12 & Up
Shingles	16-inch	No. 1 3½"	4½"	5"
		No. 2 3¾"	4"	4"
	18-inch	No. 1 4¼"	5"	5½"
		No. 2 4¼"	4½"	4½"
	24-inch	No. 1 5¾"	6¾"	7½"
		No. 2 5¾"	6"	6"
Shakes	18-inch		7½"	7½"
	24-inch		10"	10"

**706.6 – REQUIREMENTS FOR ROOF COVERINGS**

- (a) Every roof hereafter placed on a building inside any fire district shall be covered with an approved roofing (Class A or B) of brick, concrete, tile, slate, metal, asbestos, prepared asphalt asbestos-felt shingles, or of built-up roofing finished with asphalt, slag or gravel, or other approved material.
- (b) Except where roofing is of a character permitting attachment direct to frame work, it shall be applied to a solid or closely fitted deck.
- (c) Roofings which are listed as Class A or B roof covering materials by Underwriters' Laboratories, Inc., shall be accepted as meeting the requirements of this section.
- (d) Roofings which are listed as Class A, B, or C roof covering materials by Underwriters' Laboratories, Inc., shall be accepted as meeting the requirements of this section on buildings outside any fire district.
- (e) The use of cork, fiber board or other approved insulation is permitted on top of the roof deck provided such insulation is covered with an approved type of fire resistive roof covering applied directly thereto.

**706.7 – ROOF INSULATION**

The use of cork, fiberboard or other approved insulation shall be permitted in all types of construction provided it is covered with approved roof coverings applied directly thereto.

**SECTION 707 SKYLIGHTS**

- (a) The sashes and frames of all skylights in Type VI wood frame construction may be constructed of wood. The sashes and frames of all other skylights shall be constructed of steel, wrought iron, aluminum, or other approved metal. Where it may be deemed necessary (such as in areas where acid fumes attack metals) use of wood or other metals may be used if approved by the building official as stated in, Section 109 under "ALTERNATE MATERIALS AND ALTERNATE METHODS OF CONSTRUCTION."
- (b) Skylights installed over shaft ways, vent shafts, and stair enclosures, shall be glazed with plain glass not over one-eighth (1/8) inch in thickness. Plastics may not be used in these areas.
- (c) Skylights not installed over shaftways, vent shafts, and stair enclosures, shall be glazed with wire glass, or approved plastics in accordance with the provisions of Chapter XXII.
- (d) Skylights glazed with plain glass shall be protected with a wire screen having a mesh not less than three-quarter by three-quarter ( $\frac{3}{4} \times \frac{3}{4}$ ) inch nor coarser than one by one (1 x 1) inch and made of wire no smaller than No. 12B and S. gauge. The screen shall be installed at a distance of no less than four (4) inches nor more than ten (10) inches above the glazing, at all points, and shall extend the same distance beyond the edge of glazing on all sides. A similar screen shall be placed below the skylight to serve as protection from falling glass.
- (e) Skylights glazed with wire glass shall have no panes over seven hundred and twenty (720) square inches in area or forty-eight (48) inches in any dimension.
- (f) The above provisions shall not apply to skylights used in or as the roof of greenhouses.

### **SECTION 708 MANSARD OR SLANTING ROOFS**

Every mansard or other slanting roof having a pitch of more than sixty degrees (60 degrees) hereafter placed on any building over fifty (50) feet in height, shall be of non-combustible construction providing not less than 1-hour fire resistance, except that when such building exceeds eighty (80) feet in height, such roofs shall be of construction providing not less than 1½ hour fire resistance.

### **SECTION 709 DORMER WINDOWS**

Dormer windows hereafter erected shall be of the same type of construction as the roof on which they are placed, or of the side walls of the building.

### **SECTION 710 CORNICES, BALCONIES, BAY WINDOWS**

- (a) All cornices, including those on show windows, hereafter placed on the exterior of buildings within the Fire Districts or on buildings over forty (40) feet in height located outside the Fire Districts shall be of non-combustible materials. The exterior of cornices on buildings forty (40) feet or less in height located outside of Fire Districts, except 1- and 2-family dwellings, and buildings of Type VI, Wood Frame construction, shall be of non-combustible material.
- (b) Continuous exterior cornices of wood, or on wood frames, shall be firestopped at intervals not exceeding twenty (20) feet.
- (c) Balconies, and bay windows, shall conform to the type of construction required for the building to which they are attached, except that all exterior balconies attached to, or supported by, walls of material other than wood, shall have brackets or beams of steel, concrete, or other noncombustible material.

### **SECTION 711 GUTTERS, LEADERS AND CANOPIES ON EXTERIOR WALLS**

Gutters and leaders hereafter placed on buildings other than 1- or 2-family dwellings, private garages, or buildings of Type VI construction, shall be of non-combustible material.

Canopies extending over public property shall comply with the requirements of Chapter XXVI.

Other non-load bearing permanent canopies may extend over adjacent open spaces and be of any material permitted by the code provided:

- (a) That when located in the Fire District or less than thirty (30) feet from an interior lot line or other structure the canopy and its supports shall be of non-combustible material, fire retardant treated wood, wood of Type III sizes, or of one hour fire-resistant construction;
- (b) The canopy has one long side open;
- (c) the maximum horizontal width of the canopy does not exceed 15 feet;
- (d) the fire resistance of exterior wall is not reduced.

(See Section 1406 for Parapet Wall relief opening requirements.)

**SECTION 712 TOWERS, SPIRES, CUPOLAS, AERIAL SUPPORTS, POLES, ETC.**

- (a) Any tower, spire, dome or cupola shall be of a type of construction not less in fire-resistance rating than required for the building to which it is attached except that any such tower, spire, dome or cupola which exceeds sixty (60) feet in height above grade, and all construction upon which it is supported, shall be of Type I, or Type II, construction when the area at any horizontal section of such tower, spire, dome, or cupola exceeds two hundred (200) Sq. Ft. or when it is used for any purpose other than a belfry or an architectural embellishment.
- (b) Any tower, spire, dome or cupola which exceeds twenty-five (25) feet in height above the highest point at which it comes in contact with the roof or which exceeds two hundred (200) Sq. Ft. in area at any horizontal section or which is intended to be used for any purpose other than a belfry or architectural embellishment, shall be entirely constructed of and supported by non-combustible materials. Such structures shall be separated from the building below by construction having a fire-resistance rating of not less than 1½ hours and, if access doors are provided, they shall be of approved fire-resistive type.
- (c) All structures except aerial supports not over twelve (12) feet high, flag poles, water tanks and cooling towers, hereafter placed above the roof of any building within the Fire Districts, or above the roof of any building more than fifty (50) feet in height, wherever located, shall be of noncombustible material, and shall be supported by construction of non-combustible material.

**SECTION 713 TANKS**

- (a) Tanks of more than five hundred (500) gallons capacity hereafter placed in or on a building shall be supported on masonry, reinforced concrete or steel construction, except that portion of the supporting structure which is above the roof of the building may be of heavy timbers; provided that when such construction is within the building it shall be as required for Type I.
- (b) Such tanks shall have in the bottom or on the side near the bottom, a pipe or outlet, fitted with a suitable quick opening valve for discharging the contents in an emergency through an adequate drain.
- (c) Such tanks shall not be placed over nor near a line of stairs or an elevator shaft, unless there is a solid roof or floor underneath the tank.
- (d) All unenclosed roof tanks shall have covers sloping toward the outer edges.
- (e) When hoops are used in the construction of tanks, they shall be of metal, and provision shall be made to guard against corrosion.

**SECTION 714 COOLING TOWERS**

Cooling towers in excess of 250 Sq. Ft. in base area or in excess of 15 Sq. Ft. in height, when located on buildings more than 50 Ft. in height in or out of the Fire Districts, shall be of non-combustible construction; except that drip boards may be of wood not less than one (1) inch nominal thickness and the enclosing frame work may be of wood, if covered on the exterior of the tower with non-combustible material. Cooling towers shall not exceed one-third of the supporting roof area.

### **SECTION 715 DRYING ROOMS**

- (a) Drying rooms or dry kilns located within a building shall be constructed entirely of non-combustible materials where used or intended to be used at temperatures exceeding one hundred twenty-five degrees (125 degrees) Fahrenheit; if enclosure is of metal, it shall be insulated from all combustible material by not less than a twelve (12) inch air space, one-quarter (1/4) inch asbestos or other approved insulation.
- (b) All drying rooms shall have approved ventilation.
- (c) Heating pipes, not located overhead, shall be shielded to maintain not less than two (2) inch clearance between them and the contents.

### **SECTION 716 FIRE WALLS**

#### **716.1 – CONSTRUCTION**

- (a) Fire walls shall be of non-combustible material having a fire resistance rating of not less than 4 hours, and have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.
- (b) Walls constructed of solid masonry or of hollow masonry units or of reinforced concrete shall be considered as meeting the above requirements for structural stability under fire conditions, except as otherwise specifically provided in this section.
- (c) Fire walls shall start at the foundation and extend continuously through all stories to and above the roof, except where the roof is of fire-resistive construction and the wall is carried up tightly against the underside of the roof slab. (See Section 718).
- (d) Where structural members project into hollow masonry units, the hollow space shall be filled with non-combustible material the full thickness of the wall and 6 inches or more above, between and below such members.

#### **716.2 – THICKNESS OF 75% SOLID MASONRY WALLS EXCEPT PANEL WALLS**

- (a) Fire walls of 75% solid masonry shall be not less than 12 inches thick for the uppermost 35 feet of their height and shall be increased 4 inches in thickness for each successive 35 feet or fraction thereof measured downward from the top of the wall.
- (b) Where solid 75% masonry fire walls are stiffened at distances not greater than 12 feet apart by masonry cross walls or by reinforced concrete floors or roof, they may be 12 inches thick for the uppermost 70 feet, measured downward from the top of the wall, and shall be increased 4 inches in thickness for each successive 70 feet or fraction thereof.
- (c) Fire walls of 75% solid masonry may be not less than 8 inches thick for one story buildings of Group R, B, E, I and A occupancy when building on both sides of wall is Type I, Type II or Type IV construction.

#### **716.3 – THICKNESS OF HOLLOW MASONRY (LESS THAN 75% SOLID) WALLS EXCEPT PANEL WALLS**

Fire walls of hollow masonry units including brick-faced hollow masonry walls shall have a total thickness of not less than 4 inches greater than required in [Section 716.2](#) for solid masonry walls.



#### **716.4 – THICKNESS OF REINFORCED CONCRETE AND REINFORCED BRICK MASONRY WALLS EXCEPT PANEL WALLS**

Fire walls of reinforced concrete and reinforced brick masonry shall have a thickness of not less than 1/25 of the unsupported height or width, whichever is the shorter, but in no case shall it be less than 9 inches thick for the uppermost 35 feet and increase 2 inches in thickness for each successive 35 feet or fraction thereof measured downward from the top of the wall.

#### **716.5 – EXCEPTION TO THICKNESS REQUIREMENT FOR PANEL WALLS**

Where fire walls are constructed as panel walls in a framework of individually protected columns and girders having fire resistance ratings of not less than 4 hours and no panel exceeds 40 feet in length nor 12 feet in height between supports, they may be 12 inches thick if constructed of hollow masonry units or 8 inches thick if constructed of solid masonry, reinforced brick masonry or reinforced concrete.

#### **716.6 – PARAPET REQUIREMENTS**

Parapets shall be provided on fire walls in accordance with Section 718.

#### **716.7 – SIZE AND PROTECTION OF OPENINGS**

- (a) When a building on either side of a fire wall is unsprinklered, no opening in the fire wall shall exceed 120 square feet in area with no dimension greater than 12 feet, and the aggregate width of all openings at any level shall not exceed 25 percent of the length of the wall.
- (b) When the buildings on both sides of a fire wall are equipped with an approved automatic sprinkler system, the aggregate width of openings in the fire wall are not limited.
- (c) Every opening in a fire wall shall be protected on each side of the wall with an approved automatic or self-closing fire door; except that when a fire wall serves also as a horizontal exit way it shall have no openings other than door openings not exceeding 48 square feet in area, and one of the fire doors at each opening shall be a self-closing fire door.

### **SECTION 717 ACCESSIBILITY REQUIREMENTS FOR EXTERIOR WALLS**

#### **717.1 – GENERAL**

All buildings shall have access openings on each floor of each side fronting on a street, public place or public way when the first floor area exceeds 7,500 square feet or the floor area of any floor above the first floor exceeds 5,000 square feet unless the building is sprinklered. Sprinklered buildings shall have access openings on at least one side on each floor.

#### **717.2 – ACCESSIBILITY REQUIREMENTS**

- (a) The access openings in each accessible side of a building not over 65 feet in height shall be not less than;
  - (1) Windows or windows and doors spaced not more than 50 feet apart and equivalent to 10 percent or more of the wall area of each floor of each such side; or
  - (2) Access openings not less than 32 inches wide and 48 inches high with sill not over 32 inches above the floor spaced not more than 60 feet apart on each floor of each such side.

- (b) "The access openings in each accessible side of a building over 65 feet in height shall be the same as "a" above or provide smoke towers spaced not over 100 feet on each accessible side."

### **717.3 – UNDERGROUND STRUCTURES**

- (a) Underground structures exceeding 2600 square feet in area shall be provided with at least two means of access so located and of such size as to permit its use by firemen.
- (b) Where 10 or more occupants use the underground structure and the required exits involve upward travel, such exits shall be provided with an acceptable means of removing smoke from the exits.

## **SECTION 718 PARAPETS**

### **718.1 – REQUIREMENTS – EXCEPTIONS**

Except as listed below, parapets shall be provided on all fire walls and exterior walls required to have a fire resistance rating of 2 hours or more. Parapets are not required on:

- (a) Exterior walls and fire walls connecting with roofs of fire-resistive construction;
- (b) An exterior wall of a building the roof of which is at least three (3) feet lower than the roof of, or any opening in, an adjacent building wall;
- (c) Exterior walls facing on a street having a width of 30 feet or more;
- (d) Exterior walls of a building which is 15 feet or more distant in all directions from the nearest line to which other buildings are or may be legally built and from other buildings on the same lot;
- (e) Exterior walls of a building which is 15 feet or more distant in all directions from the nearest line to which other buildings are or may be legally built but less than 15 feet distant to one or more buildings on the same lot, where the total area of the buildings within 15 feet of each other does not exceed 1 times the allowable area for any one of the buildings considered;
- (f) Exterior walls of a detached dwelling, or of a building not exceeding 1,000 square feet in area;
- (g) Exterior walls of a building where the roof has an angle of more than 20 degrees with the horizontal and is at least 15 feet from the property line or other buildings on the same property.
- (h) Exterior walls and fire walls connecting with roofs of protected non-combustible construction, or of unprotected non-combustible construction with no combustible material above the roof deck, and the wall is carried up through ceilings and tightly against the underside of the roof deck. Concealed spaces in roof decks shall be firestopped over fire walls.

### **718.2 – FIRE RATING**

Required parapets shall have fire resistance ratings not less than required for the exterior wall or fire wall on which they are provided.

**718.3 – EXTENSION ABOVE ROOF**

Required parapets on exterior walls required to have a fire resistance rating of two (2) hours shall extend not less than two (2) feet above the roof; parapets on exterior walls required to have a fire resistance rating of three (3) or four (4) hours shall extend not less than three (3) feet above the roof; parapets on fire walls shall extend at least to the same height as any part of the roof through which the fire wall passes within fifteen (15) feet of the parapet and in no case shall it extend less than three(3) feet above the point where the parapet and roof intersect.

**718.4 – THICKNESS**

Masonry and reinforced concrete parapets shall be at least as thick as the required thickness of the wall on which it is provided but need not be more than 12 inches thick on exterior walls.

**718.5 – COPING**

Parapets shall be properly coped and flashed with non-combustible, weatherproof material. All corners of masonry parapet walls shall be reinforced with at least ¼ inch bar in every third joint, continuous around the corner and extending into the masonry at least three (3) feet from the corner.

**SECTION 719 FOAM PLASTICS INSULATION****719.1 – GENERAL**

The provisions of this section shall govern the requirements and uses of foam plastic in buildings and structures.

- (a) Except where otherwise noted in this section, all foam plastics used in building construction shall be "listed" with a flame-spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E-84; and
- (b) For all such installations, the foam plastic shall be separated from habitable or occupiable spaces by an approved thermal barrier of one-half (½) inch gypsum wallboard or equivalent thermal barrier material which will limit the average temperature rise of the unexposed surface to not more than two hundred fifty (250) degrees F after fifteen (15) minutes of fire exposure complying with the ASTM E-119 standard time-temperature curve; and
- (c) Thermal barriers shall be installed in a manner that assures they will stay in place for a minimum of fifteen (15) minutes under the same test conditions.

**719.2 – SPECIFIC REQUIREMENTS**

The following requirements shall apply to all uses of foam plastic unless specifically approved in [719.3](#) or by other sections of the code.

- (a) Foam plastics may be used in the following locations:
  - (1) *Masonry or concrete construction.* Foam plastic may be used without the thermal barrier described above when the foam plastic is protected by a minimum of one (1) inch thickness of masonry or concrete.

## FIRE PROTECTION REQUIREMENTS

- (2) *Cold storage construction.* Foam plastic when tested in a thickness of four (4) inches may be used in a thickness up to ten (10) inches when the building is equipped with an approved automatic fire suppression system.

For use in rooms within buildings, this requirement shall apply to both the room and that part of the building in which the room is located.

- (3) *Walk-in coolers.* Foam plastics having a maximum flame spread of seventy-five (75) may be used in thickness up to four (4) inches in free-standing walk-in coolers or freezer units less than four hundred (400) square feet in floor area without a thermal barrier and without an automatic fire suppression system when the foam plastic is covered by a metal facing not less than thirty-two thousandths (0.032) inch thick aluminum or No. 26 gage steel. When protected by a thermal barrier, the foam plastic may be used in thickness up to ten (10) inches.

- (4) *Metal clad building units.* Foam plastic insulation building units “listed” and labeled as having a flame spread of twenty-five (25) or less may be used without thermal barriers in or on walls in a thickness of not more than four (4) inches when the foam plastic is covered by a thickness of not less than thirty-two thousandths (0.032) inch aluminum or corrosion resistant sheet steel having a base metal thickness not less than eighteen thousandth (0.0179) and the insulated area is protected with automatic sprinklers.

- (5) *Roofing.*

(A) Foam plastic may be used in Industrial or Storage occupancies in a roof covering assembly without the thermal barrier when the foam is separated from the interior of the building by plywood sheathing not less than one-half (½) inch in thickness bonded with exterior glue, with edge supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent materials.

(B) For all roof applications, the smoke developed rating shall not be limited.

- (6) *Doors.* Foam plastic having a flame spread rating of seventy-five (75) or less may be used as core material without a thermal barrier when the door is covered by a metal facing of not less than thirty-two thousandths (0.032) inch thick aluminum or No 26-gage steel.

- (7) *Siding backer board.* Foam plastic may be used as siding backer board with a maximum thickness of one-half (½) inch, provided it is separated from the interior of the building by two (2) inches of mineral fiber insulation or equivalent (or when applied as residing over existing wall construction).

- (8) *Interior trim.* Foam plastic trim defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim provided:

(A) The minimum density of twenty (20) pounds per cubic foot.

(B) The maximum thickness of the trim is one-half (½) and the maximum width is four (4) inches.

(C) The trim constitutes no more than ten (10) percent of the area of any wall or ceiling.

(D) The flame spread rating does not exceed seventy-five when tested per ASTM E-84. The smoke developed rating is not limited.

- (9) Foam Plastic insulation may be used on the walls of crawl spaces with no covering applied to the insulation, provided the air in the crawl space is not circulated to other spaces of the building and the insulation is installed according to the insulation manufacturer's recommendations.

### 719.3 – SPECIFIC APPROVAL

- (a) *Walls and ceilings* – Plastic foam not meeting the requirements of 719.2 above may be specifically approved on the basis of approved diversified tests such as, but not limited to, tunnel tests in accordance with ASTM E-84 (Tunnel Test), FM procedure 4880 (Large Scale Corner Test), UL Subject 1040 (Large Scale Corner Test), ASTM E-152 (Doors) or the room tests procedure described in SPI Bulletin PICC-401 (Enclosed Room Test), or fire tests related to actual end-use configuration. The specific approval shall be based on the end use, quantity, location, occupancy classification, and similar considerations where such tests would be applicable or practical.
- (b) *Roofing* – Foam plastic roof insulation as a part of a roof assembly which complies with Factory Mutual Standard 4450 or Underwriters' Laboratories Subject 1256 need not meet the requirements of Section 719.1 provided it is identified "for use in roofing assemblies only".

## SECTION 720 SMOKE DETECTION SYSTEMS REQUIRED (See Section 506 for High Rise Buildings)

### 720.1 – DWELLING UNITS

Every dwelling and every dwelling unit within an [apartment house](#), condominium and townhouse shall be provided with listed smoke detector, installed in accordance with the manufacturer's recommendation and listing. When actuated, the detector shall provide an audible alarm.

At least one listed detector shall be installed outside each sleeping area to warn occupants of the presence of any fire conditions. Detectors shall have either a visible light to indicate operability or an audible trouble signal. Audible trouble signals shall be designed to operate at least every minute for seven consecutive days. The alarm signaling device shall omit not less than 85 decibels at 10 feet. Detectors shall be located on or near the ceiling and installed in accordance with the manufacturer's instructions. Detectors shall be electrically operated (non-plug-in) and the primary source of power for detectors installed in new structures shall be taken from the house electrical current.

### 720.2 – CORRIDORS OF RESIDENTIAL AND INSTITUTIONAL BUILDINGS

- (a) All residential and institutional buildings (including hospitals, nursing homes, etc.) day care facilities and residential care facilities shall have installed in all interior, enclosed exit access corridors approved listed smoke detection devices. Such smoke detection devices shall be installed on or near the ceiling and in accordance with the listing and the manufacturer's recommendations, but in no case shall smoke detectors be spaced farther apart than 30 feet on centers in corridors or more than 15 feet from any wall.

## FIRE PROTECTION REQUIREMENTS

- (b) “Buildings which have corridors 75 feet or more in length, or which are more than two stories high, must be provided with a smoke detection system to be electrically interconnected to the fire alarm system required by [Section 1125](#). System smoke detectors must be tested and listed in accordance with the 'Standard for Smoke Detectors for Fire Protective Signaling Systems', ANSI/UL 268.”
- (c) “One and two story buildings with corridors less than 75 feet in length may utilize the single station device approved for dwellings, but if two or more detectors are required they must be interconnected. These detectors must be tested and listed in ‘Multiple Station’, ANSI/UL 217. They shall be powered from the building electrical system via a permanent (non-plug-in) connection.”

## CHAPTER 8 LIGHT AND VENTILATION

### SECTION 800 GENERAL

#### 800.1 – NEW BUILDINGS

For the purpose of providing adequate light and ventilation, every building shall be constructed, arranged and equipped to conform to the provisions of this chapter.

#### 800.2 – ADDITIONS AND ALTERATIONS

- (a) No building, including existing buildings, shall be altered, added to nor rearranged so as to reduce the size of a room or the amount of window space to less than that required by this chapter, or so as to create an additional room, unless such additional room is made to conform to the requirements for rooms in this chapter, except that such rooms may be of the same height as existing rooms in the same story.
- (b) No addition shall be made to a building, nor shall the lot on which it is located be diminished so that the dimensions of a required court shall be less than prescribed in this code.

#### 800.3 – STREETS

For purposes of this chapter, the term “street” shall include railroad rights-of-way, parks, and waterways.

### SECTION 801 ROOMS AND EXIT WAYS

#### 801.1 – GENERAL

Wherever the following terms are used in this section, they shall be construed as if followed by the words indicated below:

- windows – “conforming to Section 802.”
- vent shaft – “conforming to Section 803.”
- ventilating skylights – “conforming to Section 804.”
- mechanical ventilation – “conforming to Section 805.”
- court – “conforming to Section 806.”

#### 801.2 – HABITABLE ROOMS

- (a) Every habitable room shall be provided with natural light and ventilation by one or more windows, opening on a street, [alley](#) or court, except that mechanical ventilation in accordance with Section 805 may be substituted for openable windows in all occupancies with the exception of multi-family residences. Kitchens not completely enclosed and conforming to the requirements in [Section 801.7](#) for alcoves need not be separately lighted and ventilated.
- (b) Such rooms shall be not less than 7 feet wide in any part and shall contain not less than 70 square feet of floor area. Such rooms shall have a clear height of not less than 7 feet 6 inches for at least 60 square feet of net floor area or 50% of the net floor area whichever is greater.

## LIGHT AND VENTILATION

- (c) When kitchens serving dwelling units are completely enclosed, the gross floor area shall be not less than 60 square feet and not less than 90 square feet when dining space is included, except that in dwelling units having no bedrooms the gross area of the kitchen shall be not less than 50 square feet.

### **801.3 – ROOMS FOR ASSEMBLY OCCUPANCY**

- (a) Every room or space used for an assembly occupancy shall be provided with light and ventilation by means of windows or such room or space shall be provided with natural or artificial light and ventilated by an approved means of ventilation.
- (b) Where a room or space is used for assembly occupancy for more than 50 occupants and there is less than 100 cubic feet per occupant, approved mechanical ventilation shall be provided.
- (c) Where a room or space is used for an assembly occupancy for 50 or less occupants and there is less than 100 cubic feet per occupant, windows shall be provided on 2 or more sides of the room or space or approved mechanical ventilation shall be provided.
- (d) In rooms or spaces used for an assembly occupancy the lighting shall be such during occupancy that the light intensity at the floor is not less than 1.0 foot-candle except during a performance requiring dimming or darkness; provided that during the showing of motion pictures where it is the practice for patrons to proceed to and from seats at any time, such light intensity shall be not less than 1/5 of a foot-candle (See Section 1124.2).

### **801.4 – ROOMS FOR INSTITUTIONAL OCCUPANCY**

- (a) Every room used for sleeping purposes in an institutional occupancy shall be provided with natural light by one or more windows opening on a street, [alley](#) or court. Ventilation shall be by windows as required for habitable rooms or by an approved system of direct mechanical ventilation; provided that in jails and other detention buildings the opening on such street, [alley](#) or court of the windows of cells or similar rooms may be indirect.
- (b) Rooms in an institutional occupancy used for purposes involving the storage, handling or dispensing of hazardous materials such as laboratories, film developing, or operating rooms shall be ventilated by an approved direct mechanical ventilation system.

### **801.5 – BATHROOMS AND WATER-CLOSET COMPARTMENTS**

Every bathroom shall be provided with natural or artificial light and every room containing more than one flushing type fixture shall be ventilated by: one or more windows opening on a street, [alley](#) or court; or by a vent shaft which extends to and through the roof or into a court; or by a separate duct of non-combustible and corrosion resistant material not less than 72 square inches in cross section extending independently of any duct used for other purposes to and above the roof; or by a ventilating skylight, or by an approved means of direct mechanical ventilation.

### **801.6 – SERVICE PANTRIES**

Service pantries, except in dwelling units, shall be ventilated as prescribed in [Section 801.5](#) for bathrooms.



**801.7 – ALCOVES**

Any alcove opening off a habitable room, unless separately lighted and ventilated, shall be included as part of that room in computing the amount of window area required. For the purpose of determining light and ventilation requirements, any room may be considered as a portion of an adjoining room when one-half (½) of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or twenty-five (25) square feet – whichever is greater.

**801.8 – MEZZANINE SPACES**

In mezzanine spaces, which are open to and form a part of another room, the area of such mezzanine space shall be added to the floor area of the room in which it is located in computing the window area required for both spaces.

**801.9 – ROOMS HAVING SPECIAL HAZARDS**

Rooms in which, by reason of use or occupancy, dust, fumes, gases, vapors or other noxious or deleterious impurities tending to injure the health of occupants or to create a fire hazard, exist or develop, shall be provided with an approved system of ventilation to remove effectually such impurities during occupancy.

**801.10 – OTHER ROOMS**

Every room or space, other than those specifically provided for in this section, used or occupied by persons, except rooms or spaces used for storage or other purposes with infrequent occupancy, shall be provided with light and ventilation by windows opening on a street, [alley](#) or court or shall be provided with one or more ventilating skylight; or such rooms or spaces shall be provided with an approved means of direct mechanical ventilation.

**801.11 – ACCESS TO ROOMS AND WATER CLOSET**

- (a) In dwellings and multifamily houses access shall be had to every dwelling unit without passing through any other dwelling unit.
- (b) In each dwelling unit access without passing through a bedroom shall be provided to at least one water closet, unless every bedroom has direct connection with a water closet or a bathroom having water closet accommodation.

**801.12 – EXIT WAYS**

- (a) Stairways, public hall, corridors and other means of egress, except exterior stairways on [apartment house](#), shall be illuminated at all points to intensities of not less than 1.0 foot-candle at all times that the building served thereby is occupied.
- (b) Every stairway, public hall or corridor in multifamily houses and in buildings of institutional occupancy shall be ventilated either by one or more windows openings on a street, [alley](#) or court or ventilated by mechanical means approved by the building official or provided with natural ventilation to the outer air by means of a system of vent flues not less than 12 by 12 inches in size approved by the building official.

## LIGHT AND VENTILATION

- (c) If windows are used to provide light and ventilation required by this section, there shall be at least one window or ventilating skylight having glazed area of not less than 10 square feet for every 20 feet of length or fraction thereof, unless a window is placed at the end of a hall or corridor so that it will adequately light the public hall or corridor for its entire length.
- (d) Every recess or return, the depth or length of which exceeds twice the width of the hall or corridor, that is shut off from any other part by a door or doors, shall be deemed a separate hall or corridor within the meaning of this section.
- (e) Lights installed to comply with the provisions of this section that are likely to be or to become dangerous in any way to occupants, shall be protected by suitable wire netting or other means against breakage or other hazards.

### **801.13 – ARTIFICIAL LIGHTING FOR EXIT WAYS**

Artificial lighting shall be provided whenever natural lighting is inadequate. (See Section 1123)

## **SECTION 802 WINDOWS**

### **802.1 – GLAZED AREA**

The aggregate area of approved glazing material in windows required by Section 801 shall be not less than 8% of the floor area of the room served by them; in habitable rooms such glazed area shall be not less than 10 square feet, and in bathrooms it shall be not less than 3 square feet.

### **802.2 – GLAZING**

Only approved wired glass not less than ¼ inch thick shall be used for the glazing of fire windows. Other windows shall be glazed with glass or other translucent or transparent material. Glazing of material other than glass shall have a flame spread rating not greater than permitted for interior finish materials in [Section 704.3](#). Glazing of other than non-combustible material shall not have an aggregate area exceeding 20 percent of the wall area in which it is installed when such wall is required to be of non-combustible material, nor shall it be located more than 35 feet above grade.

### **802.3 – OPENINGS**

Windows or other openings required for ventilation shall have an aggregate openable area of at least 50 percent of the glazed area required for lighting.

## **SECTION 803 VENT SHAFTS**

### **803.1 – SIZE**

Vent shafts installed to meet requirements of [Section 801.5](#) or [801.6](#) shall have a cross-sectional area of not less than one-half square foot for every bathroom or water closet vented by the shaft. Except for dwellings, such shaft shall be not less than 9 square feet in any case and shall not be less than 2 feet in its least dimension.

### **803.2 – SKYLIGHTS**

Unless open to the outer air at the top for its full area, such shaft shall be covered by a skylight glazed and protected as specified in [Section 701.1](#) and having a net area of permanent openings equal to the maximum required shaft area.

**803.3 – AIR INTAKES**

- (a) Vent shafts shall be connected with a street, alley or court by a horizontal intake at a point below the lowest window opening on such shaft.
- (b) Such intake shall have a minimum unobstructed cross-sectional area of not less than 3 square feet with a minimum dimension of 12 inches.
- (c) The openings to the intake shall be not less than one foot above the bottom of the shaft and the street surface or bottom of court, at the respective ends of the duct or intake and shall be protected by substantial screens of corrosion resistant material having a mesh not larger than  $\frac{3}{4}$  inch.
- (d) Such intake shall be constructed of non-combustible, corrosion resistant material.

**SECTION 804 VENTILATING SKYLIGHTS**

Skylights installed to meet the requirements of this chapter shall be glazed and protected as specified in Section 707 and shall have glazed areas not less than required for the windows they replace. They shall be equipped with movable sashes or permanent openings of an aggregate net area not less than required for openable parts in the windows they replace, or approved ventilation of equal effectiveness shall be provided.

**SECTION 805 MECHANICAL VENTILATION****805.1 – GENERAL**

“Mechanical ventilation required by this Code or permitted as alternative to natural ventilation shall be capable of being provided with air changes per hour and cubic feet per person based on functional area listed in the “ventilation design criteria” table in Section 1500 of Volume III of the State Building Code.”

**SECTION 806 COURTS****806.1 – WIDTH**

- (a) Outer courts required to serve habitable rooms shall have a width, at any level, of not less than 4 inches for each foot or fraction thereof of the height of such court, but not less than 5 feet.
- (b) Inner courts required to serve habitable rooms shall have a width, at any level, of not less than one foot for each foot or fraction thereof of the height of such court, but not less than 10 feet.
- (c) Courts required to serve other than habitable rooms shall have a width, at any level, of not less than 3 inches for each foot or fraction thereof of the height of such court, but not less than 5 feet.

**806.2 – AREA**

- (a) The cross-sectional area of a required inner court shall be not less than  $1\frac{1}{2}$  times the square of its required width.
- (b) The area of a required outer court shall be not greater than 4 times the square of its width.

### **806.3 – STREETS AND ALLEYS**

In case a street or alley is of less width than required for a court, the building or that part dependent thereon shall be set back from such street or alley sufficiently to provide the required width, considering the street or alley as part of the court.

### **806.4 – INTAKES**

Every court serving one or more habitable rooms, that does not open for its full height on one or more sides on a street, alley or yard shall be connected at or near the bottom with a street, alley or yard by a horizontal intake or passage. Such intake or passage shall be constructed with walls, floors and ceilings having a fire resistance rating of not less than one hour, and shall have a cross-sectional area of not less than 21 square feet.

### **806.5 – UNOBSTRUCTED**

Every court shall remain unobstructed for its required width and full height, except that for outer courts, cornices and eaves projecting not more than 12 inches from a wall and for inner and outer courts ordinary window sills or belt courses, projecting not more than 4 inches from a wall, and drop awnings shall not be deemed obstructions. But this shall not prohibit in the open spaces at the ground level, in the case of buildings used for residential or institutional occupancies, clothes poles, arbors, garden trellises and other such accessories, and in the case of dwellings only, permissible garages.

### **806.6 – DRAINAGE**

The bottom of every court shall be properly graded and drained.

### **806.7 – ACCESSIBILITY**

Every court that is not otherwise accessible at the bottom, shall be made accessible by a door or other means to enable it to be properly cleaned.

## **SECTION 807 CRAWL SPACE VENTILATION**

(See [Section 1702.8](#))

## **SECTION 808 ATTIC SPACE VENTILATION**

(See [Section 1707.8](#))

## **CHAPTER 9 SPRINKLERS AND STANDPIPES**

### **SECTION 901 SPRINKLERS**

#### **901.1 – APPROVED EQUIPMENT AND LAYOUT**

Only approved sprinklers and devices shall be used in automatic sprinkler systems and the complete layout of the system shall be submitted to the Building Official for approval before installation.

#### **901.2 – REQUIREMENTS**

Every automatic sprinkler system required by the Code shall conform with the requirements of the “Standard of the National Fire Protection Association For The Installation of Sprinkler Systems” (NFPA Pamphlet No. 13), except that a single water supply of adequate pressure, capacity and reliability, equal to the primary supply required by those standards, maybe permitted by the Building Official.

#### **901.3 – OCCUPANCY CLASSIFICATIONS**

For the purpose and application of, and comparison with, the “National Fire Protection Standard For Sprinkler Systems” (NFPA Pamphlet No. 13) occupancies shall be classified as follows;

LIGHT HAZARD	– GROUP R, B, E and I
ORDINARY HAZARD	– GROUP M, A, S and F
EXTRA HAZARD	– GROUP H

#### **901.4 – MATERIAL**

Piping shall be as specified in “Standard of the National Fire Protection Association For The Installation of Sprinkler Systems” (NFPA Pamphlet No. 13).

#### **901.5 – HOSE THREADS**

All hose threads in connections shall be uniform with that used by the Fire Department of the City or authority having jurisdiction.

#### **901.6 – GENERAL**

- (a) The areas referred to in this section shall be the area enclosed by exterior walls or fire walls or a combination thereof, except that in buildings of Type I & Type II construction the area shall be that enclosed by exterior walls, fire walls or walls of non-combustible material having a fire resistance rating of not less than 2 hours, or a combination thereof.
- (b) Combustible goods or merchandise referred to in this section shall include those made of wood, paper or rubber; those containing flammable liquids; those packed with excelsior, moss, paper or foamed plastic; and other goods or merchandise of equivalent or greater combustibility.

**901.7 – SPRINKLERS REQUIRED**

Approved automatic sprinkler systems shall be installed in buildings that are:

- (a) Occupied as Group M, Mercantile, or for the manufacture, sale or storage of combustible goods or merchandise (not including garages nor automobile parking structures covered by [Section 412.7\(b\)\(2\)](#)) and exceeding the areas in [Table 901.7\(1\)](#).

**TABLE 901.7(1)  
SPRINKLERS REQUIRED FOR GROUP M, S AND F OCCUPANCIES**

	Area of any floor in square feet			
	1 story buildings	2 story buildings	Building height over 35 feet	Building height over 50 feet
Fire Resistive Type I	100,000	60,000	20,000	10,000
Fire Resistive Type II	100,000	60,000	20,000	All areas
Protected non-combustible Type IV	40,000	30,000	15,000	All areas
Unprotected non-combustible Type IV	24,000	12,000	8,000	
Heavy Timber Type III	20,000	20,000	15,000	
Ordinary Type V	20,000	12,000	8,000	
Wood Frame Type VI	12,000	8,000	All areas	

NOTE (a) – [Basement](#) or underground structures shall have approved automatic sprinkler system installed when the [basement](#) or underground structure area exceeds 2,500 square feet. In buildings used for assembly, educational, institutional or residential occupancies the automatic sprinkler systems shall be required only in such portions of the [basement](#) as are used for storage purposes or as workshops, except where such storage or work areas exceed 6,000 square feet.

- (b) “All I-Institutional (unrestrained) buildings except orphanages and day care centers which may be classified as I-Institutional shall be sprinklered with following except.
  - (1) buildings of at least Type II fire resistive construction.
  - (2) buildings of Type IV non-combustible construction, 1 hour protected not exceeding one story in height.
  - (3) buildings of Type V ordinary construction, one hour protected not exceeding 1 story in height.”
- (c) High Rise Construction – See Section 506.

(d) In places of assembly having a stage complying with [Section 404.9](#) approved sprinkler systems shall be installed at all locations on the stage side of the proscenium opening such as under roof of stage; under stage; under the gridiron rigging loft and fly and tie galleries, in dressing rooms, scene docks, workshops and storage rooms.

Note – See [Section 404.7](#).

(e) Occupied as parking or repair garages and exceeding the areas in [Table 901.7\(3\)](#).

(f) For hazardous occupancies, see [Section 407.4\(e\)](#).

**901.8 – INSTALLATION**

a. Installations of automatic sprinkler systems shall be reasonably safe to persons and property. Automatic sprinkler systems installed in conformance with the applicable provisions of this Code shall be deemed to be reasonably safe to persons and property, and, on matters not detailed in this Code, conformity of automatic sprinkler system installations to the applicable provisions of the standard listed for this Section of this Code shall be evidence that such installations are reasonably safe to persons and property.

**TABLE 901.7(3)  
SPRINKLERS REQUIRED FOR GARAGES**

Area if any floor in square feet					
Type of Garage	Type of Construction	Garage in Basement or Underground Building	One Story Garage Building	Garage in building with other occupancies above grade	Garage building over 65 feet height
Parking	Fire Resistive Type I	5000 sq. ft.		40,000	10,000
Parking	Fire Resistive Type II	5000 sq. ft.		40,000	10,000
Parking	Protected non-combustible Type IV	5000 sq. ft.		20,000	8,000
Parking	Unprotected non-combustible Type IV	5000 sq. ft.		not permitted	not permitted
Parking	Heavy Timber Type III	5000 sq. ft.		not permitted	not permitted
Parking	Ordinary Type V	5000 sq. ft.		not permitted	not permitted
Parking	Wood Frame Type VI	5000 sq. ft.		not permitted	not permitted
Repair	Fire Resistive Type I	not permitted	50,000	45,000	
Repair	Fire Resistive Type II	not permitted	50,000	45,000	
Repair	Protected non-combustible Type IV	not permitted	40,000	30,000	
Repair	Unprotected non-combustible Type IV	not permitted	30,000	20,000	not permitted
Repair	Heavy Timber Type III	not permitted	30,000	20,000	not permitted
Repair	Ordinary Type V	not permitted	20,000	not permitted	not permitted
Repair	Wood Frame Type VI	not permitted	15,000	not permitted	not permitted

- b. Automatic sprinkler systems required by the provisions of this Code shall be installed in accordance with detailed drawings of the complete sprinkler system layout which shall have been submitted to and approved by the Building Official. When ready for service, the entire system shall be inspected and tested in the presence of the Building Official; defects in the system which are revealed by such inspection and test shall be corrected prior to final approval by the Building Official.
- c. Only approved sprinklers, fittings, and valves shall be used in the installation of automatic sprinkler systems.
- d. Where approval of sprinklers, fire department connections, fittings, or valves is required by the provisions of this [Section 901](#), approval shall be based on tests and listings of such items by a nationally recognized testing laboratory.
- e. Every sprinkler system shall be provided with an approved indicating valve, so located as to be readily accessible, to control all sources of water supply except that from the fire department connection required by the provisions of [Section 901.10](#); the location of indicating valves shall be approved by the Chief of the Fire Department.
- f. Underground water mains and lead-in connections to sprinkler systems shall be flushed thoroughly before connecting them to the sprinkler system.

### **901.9 – WATER SUPPLY**

Each automatic sprinkler system shall have at least one automatic water supply of adequate pressure, capacity and reliability in accordance with NFPA #13.

### **901.10 – FIRE DEPARTMENT CONNECTION**

- a. Automatic sprinkler systems shall be provided with one or more approved fire department connections. The pipe from the fire department connection to the sprinkler system shall be not less than 4 inches in diameter, except that pipe 3 inches in diameter is permitted to connect a single hose connection to a riser not greater than 3 inches in diameter, and pipe less than 4 inches in diameter is permitted for hydraulically designed sprinkler systems, provided the connection is of sufficient size to supply the water demand required.
- b. Fire department connections shall be located neither less than 18 inches nor more than 36 inches above the level of the adjoining ground, sidewalk, or grade surface.
- c. Hose coupling threads shall conform with those used by the local fire department. Substantial caps shall be provided on each fire department hose connection.
- d. Each fire department connection shall be provided with an approved straightway check valve located inside the building, in a horizontal section of pipe, and as near as practicable to the point where the connection joins the sprinkler system; an automatic drip shall be installed between the check valve and the fire department hose connection.
- e. Hose connections shall be located and arranged to enable hose lines to be readily and conveniently attached to the inlets without interference from nearby objects, such as buildings, fences, posts, or other fire department connections; the location of the fire department connections shall be approved by the Chief of the Fire Department.



- f. Fire department connections shall be suitably marked by a sign having raised letters not less than one inch in height and width, cast on plate or fitting, and reading “AUTO-SPKR.”, “OPEN SPKR.”, “AUTO-SPKR. AND STANDPIPE”, “BASEMENT SPRINKLERS”, or other appropriate lettering.

### 901.11 – SUPERVISORY FACILITIES

- (a) The automatic sprinkler system shall be provided with approved facilities to assure that it is in proper operative condition, such as by electrical connections to a continuously manned central station or fire department headquarters to give automatic notice of any closed water supply valve or other condition that might interfere with the operation of the system; also notice of any flow of water in the system due to fire or other cause. Such facilities shall include provision for immediate alarm to the fire department in case of fire or suspected fire, and appropriate immediate action to restore the sprinkler system to operative condition in case of any impairment.
- (b) Subject to the approval of the authorities concerned, sprinkler supervision may also be provided by direct connection to fire departments, or in the case of very large establishments, to a private headquarters providing similar functions.

SEE NFPA Standard No. 71 “Central Station Signaling Systems”.

NFPA Standard No. 72 “Proprietary Signaling Systems”.

NFPA Standard No. 73 “Municipal Fire Alarm Systems”.

### 901.12 – ALTERNATIVES PERMITTED

[Apartments](#), condominiums and townhouses, three stories and less height, equipped with an automatic sprinkler system complying with NFPA-13d-1980 and

- a. Provided with a local water flow alarm, and,
- b. Provided with an approved fire department connection in the general location of the water meter, and,
- c. Installed to prevent the freezing of piping and accessories located in non-conditioned areas, may be constructed in accordance with the following provisions:
  - (1) The increase in area permitted in [Table 400](#) for sprinkler protection is limited to 50% of that allowed by meeting completely the requirements of an NFPA 13-1983 sprinkler system.
  - (2) The flame spread rating requirements outlined in [Section 704.3](#) for exits and access to exits may be Class “C” providing such exits and access to exits are sprinklered in accordance with NFPA 13D-1980.
  - (3) The maximum distance of travel to an exit permitted in [Table 1103](#) may be increased by 25% providing corridor is sprinklered in accordance with NFPA 13D-1980.
  - (4) The two-hour separation requirements of [Section 403.3](#) for townhouses may be reduced to one-hour provided townhouses on both sides of such separation are sprinklered in accordance with NFPA 13D-1980 or NFPA 13-1983.

### **901.13 – STANDPIPE EXCEPTIONS FOR SPRINKLERED BUILDINGS:**

The requirement in [Section 902.8\(c\)](#) for 65 psi pressure with 500 gpm flowing at the uppermost outlet shall be waived under the following conditions:

- a. The building is classified Group R, B, M, E, I or A.
- b. The building does not exceed five floors in height above average grade to the top occupied floor.
- c. The building is completely sprinklered with an approved automatic sprinkler system.
- d. The quantity of water required for the sprinkler system can be supplied from the water source serving the building.

## **SECTION 902 STANDPIPE SYSTEMS**

**Required standpipes shall comply with NFPA Standard #14**

### **902.1 – GENERAL CLASSES OF SERVICE**

- a. Standpipe systems are grouped into three general classes of service, based upon their intended use in the extinguishment of fire.
  - (1) Class I service means a standpipe system for use by fire departments and those trained in handling heavy fire streams (2-inch hose).
  - (2) Class II service means a standpipe system for use primarily by the building occupants until arrival of the fire department (small hose).
  - (3) Class III service means a standpipe system for use by either fire departments and those trained in handling heavy fire streams, or building occupants.

### **902.2 – STANDPIPE SYSTEMS REQUIRED**

- a. Approved standpipe systems for Class I or Class III service shall be installed for:
  - (1) Buildings which have more than one story above grade and exceed 50 feet in height.
  - (2) Parking structures which exceed 50 feet in height and as provided by [Section 412.7](#).
  - (3) [Basement](#) and underground parking structures exceeding 3,000 square feet in area.
  - (4) Repair garages which have more than one story above grade and exceed 50 feet in height, or which have parking levels exceeding 3,000 square feet in area below grade.
  - (5) Storage occupancies located below grade which exceed 5,000 square feet in area.

### **902.3 – NUMBER OF STANDPIPES**

- a. The number of standpipes shall be such that all portions of each story are within 30 feet of a nozzle attached to 100 feet of hose connected to a standpipe.

### **902.4 – LOCATION OF STANDPIPES AND HOSE OUTLETS**

- a. Standpipes shall be located where they are protected against mechanical and fire damage; standpipe risers enclosed in pipe shafts, or located in enclosed stairways or ramps, or smokeproof towers shall be considered as being protected against mechanical and fire damage.

- b. Hose outlets shall be located within easy reach of fire fighters standing on landings of stairways or ramps or on floors. Hose outlets shall be so located that they cannot be blocked by open doors or other encumbrances.
- c. Where the building has one or more smokeproof towers, hose outlets shall be located in the enclosed stairways of the smokeproof towers.
- d. Where hose outlets are to be provided near doors for exterior stairways or for enclosed stairways or ramps, the outlets shall not be more than 2 feet from the leading edge of the door.
- e. Where buildings have standpipe systems and where there is a penthouse, roof structure, machinery compartment, or heliport on the roof, a roof outlet shall be located adjacent to the access to the roof or in a bulkhead providing access to the roof.
- f. The location of hose outlets and their height above landings or floors shall be approved by the Chief of the Fire Department.

### 902.5 – INSTALLATION

- a. Installations of standpipe systems shall be reasonably safe to persons and property. Standpipe systems installed in conformance with the applicable provisions of this Code shall be deemed to be reasonably safe to persons and property, and, on matters not detailed in this Code, conformity of standpipe system installations to the applicable provisions of the standard listed for this Section of this Code shall be evidence that such installations are reasonably safe to persons and property.
- b. Only approved fittings and valves shall be used in the installation of standpipe systems.
- c. Where approval of appliances, fire department connections, fittings, valves, or other devices is required by the provisions of this Section, approval shall be based on tests and listings of such items by a nationally recognized testing laboratory.
- d. Piping for standpipes shall be designed to withstand a working pressure of not less than 175 pounds per square inch.
- e. Standpipe systems shall extend from the lowest story of the building into the uppermost story, except as provided by the provisions of [Sections 902.5\(e\)\(1\) and \(2\)](#).
  - (1) Standpipes serving portions of a building that are not the full height of the building need extend only to the uppermost story of that portion.
  - (2) Standpipes in buildings having penthouses, roof structures, machinery compartments, or heliports on their roofs, shall extend to the roof and shall be provided with not less than one roof outlet located in accordance with the provisions of [Section 902.4\(e\)](#).
- f. Standpipes shall not exceed 275 feet in height; for buildings exceeding 275 feet in height, standpipe systems shall be zoned or specially designed in accordance with the applicable provisions of the standard listed for Section 902 of this Code.
- g. Standpipes shall not be less than 6 inches in diameter, except that standpipes not exceeding 100 feet in height are permitted to be not less than 4 inches in diameter.
- h. Each connection to a water supply, except fire department connections, shall be provided with an approved indicating-type valve and a check valve located close to the supply.

## SPRINKLERS AND STANDPIPES

- i. Each standpipe for Class I service shall be equipped at each story with a 2½-inch hose connection and a hose valve, located not more than 6 feet above the floor or landing.
- j. Each standpipe for Class II service shall be equipped at each story with a 1½-inch hose connection and a hose valve, located not more than 6 feet above the floor landing.
- k. Each stand pipe for Class III service shall be equipped at each story with a 2½- inch and a 1- inch hose connection and with one or more hose valves, located not more than 6 feet above the floor or landing; the hose connections are permitted to be through one 2½-inch hose valve, provided an easily removable 2½-inch by 1½-inch adapter is provided for the hose connection.

### **902.6 – FIRE DEPARTMENT CONNECTION**

- a. Standpipe systems shall be provided with one or more approved fire department connections. The pipe from the fire department connection to the standpipe system shall be not less than 4 inches in diameter.
- b. In buildings having two or more standpipe zones, a fire department connection shall be provided for each zone.
- c. Fire department connections shall be located neither less than 18 inches nor more than 36 inches above the level of the adjoining ground, sidewalk, or grade surface.
- d. Hose coupling threads shall conform with those used by the local fire department. Substantial caps shall be provided on each fire department hose connection.
- e. Each fire department connection shall be provided with an approved straightway check valve located inside the building, in a horizontal section of pipe, and as near as practicable to the point where the connection joins the standpipe system; an automatic drip shall be installed between the check valve and the fire department hose connection.
- f. Hose connections shall be located and arranged to enable hose lines to be readily and conveniently attached to the inlets without interference from nearby objects, such as buildings, fences, posts, or other fire department connections; the locations of fire department connections shall be approved by the Chief of the Fire Department.

### **902.7 – HOSE**

- a. Hose outlets, in standpipe systems for Class II and Class III service, which are provided for the use of building occupants, shall be equipped with approved 1½-inch hose, not more than 100 feet in length, attached to the hose outlets; the hose shall be provided with approved nozzles.
- b. Hose shall be stored on approved hose racks or in approved hose cabinets.

### **902.8 – WATER SUPPLY**

- a. Water for wet standpipe systems shall be supplied from one or more adequate and reliable sources.

- b. Standpipes shall be maintained under full pressure, or full pressure shall be furnished automatically upon the opening of a hose outlet, or full pressure shall be furnished upon manual operation of an approved remote control device located at the hose station, except that dry standpipe systems are permitted to be installed in accordance with the provisions of [Section 902.9\(a\)](#).
- c. The water supply shall provide not less than 500 gallons per minute for a period of not less than 30 minutes; where more than one standpipe is required, the water supply shall provide not less than 500 gallons per minute for the first standpipe and 250 gallons per minute for each additional standpipe, the total supply not to exceed 2500 gallons per minute, for a period of not less than 30 minutes. The residual pressure at the uppermost outlet of each standpipe shall be not less than 65 pounds per square inch with 500 gallons per minute flowing except as provided in [Section 901.13](#).
- d. An approved pressure reducing device shall be installed at a 1½-inch outlet when the static pressure at the outlet exceeds 100 pounds per square inch; the device shall reduce the pressure at the outlet to 100 pounds per square inch with a flow of 75 gallons per minute.
- e. The required water supply for a standpipe system which is interconnected with an automatic sprinkler system shall include the water supply requirements for both systems.

### **902.9 – DRY STANDPIPE**

- a. Dry standpipe systems are permitted in open air parking structures provided the systems comply with the provisions of [Section 902.1](#) through [902.7](#), inclusive, and [Section 902.10](#).

### **902.10 – TESTS**

- a. Upon completion of a standpipe installation, the standpipe system, including yard piping, shall be tested hydrostatically at not less than 200 pounds per square inch pressure for 2 hours, except that, when the normal pressure is in excess of 150 pounds per square inch, the system shall be tested hydrostatically at 50 pounds per square inch in excess of the normal pressure.

### **902.11 – STANDPIPE DURING CONTRUCTION**

See [Section 2401.9\(c\)](#).

## **SECTION 903 REFERENCES**

### **903.1 – OTHER CODE REFERENCES**

Hereunder are listed the Section numbers and subjects of references in other portions of this Code pertaining to Sprinklers and Standpipes as follows:

[Table 400](#) – Height Increase for Sprinklers

[Table 400](#) – Area Increase Not Permitted (With Exception)

[Table 400](#) – Area Increase for Sprinklers

[402.3\(e\)](#) – Group “B” Business Occupancy

[402.3\(e\)](#) – Group “F” Industrial Occupancy

## SPRINKLERS AND STANDPIPES

- 402.3(e) – Group “M” Mercantile Occupancy
- 402.3(e) – Group “S” Storage Occupancy
- 404.7 – Group “A” Assembly Occupancy
- 407.4(e) – Group “H” Hazardous Occupancy
- 407.6(d) – Dry Cleaning or Similar Occupancy
- 407.7(c) – Grain Elevators
- 407.9(a) and (b) – Handling or Storage of Combustible Film
- 409.3(7) – Group “I” Institutional Occupancy
- 412.4(f) – Airplane Hangars
- 506.4 – High Rise
- 507.2(c), 507.3(a) – Malls
- 509.3(a), 509.4(3) – Day Care
- 604.4 – Type III Construction – Roof Framing
- 701.3(f) – Hoistway of Elevators
- 703.3(b) – Vertical Separation
- 704.3 – Interior Finish
- 716.7 – Size and Protection of Openings
- 717.1 – Accessibility Requirements for Exterior Walls
- 1007.2(b)(3); 1007.2(c)(2) – Number and Location of Exitways
- 1007.4(i) – Protection of Openings at Fire Escapes
- 1007.5 thru 1007.8 – Historic Buildings
- 1008.4(m) – Existing High Rise
- 1009 thru 1010 – Historic Buildings
- 1103.1 – Distance of Travel Increase for Sprinklers
- 1104.6(c) – Sprinklers Required for Windowless Schools
- 1104.8 – Sprinklers Required for Underground Structures and Windowless Buildings
- 1104.10(a)(2) – Doors in Interior Corridors of Residential Buildings
- 1125 – Fire Alarms

# CHAPTER 10

## SAFETY TO LIFE REQUIREMENTS FOR EXISTING BUILDINGS

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## **CHAPTER 10**

### **SAFETY TO LIFE REQUIREMENTS FOR EXISTING BUILDINGS**

#### **SECTION 1001 CERTIFICATE OF OCCUPANCY**

Upon written request from the owner, the building official shall issue a certificate of occupancy for an existing building, after verification by inspection, provided that at the time of issuing such certificate there are no violations of law or orders pending.

#### **SECTION 1002 DETERMINING AND POSTING OF FLOOR LOADS**

In every existing building used for business, industrial, mercantile or storage occupancy, in which heavy loads or concentrations occur or machinery is introduced, the owner or occupant shall cause the weight that each floor will safely sustain to be estimated by a competent person and filed with the building official, and when accepted by him posted as required for new buildings by Chapter XII.

#### **SECTION 1003 INTERIOR FINISH**

Within a reasonable time, as fixed by a written order of the building official, the interior finish of every existing building shall comply with [Section 704.3](#) in the areas and spaces where that section requires the interior finish to have a flame spread rating of not over 75; and when, in the opinion of the building official, the flame spread rating of interior finish in existing areas and spaces used for assembly or educational occupancies is of such magnitude as to present a hazard to life safety, he may order such interior finish to comply with [Section 704.3](#).

#### **SECTION 1004 ROOF COVERING REPAIRS**

- (a) No roof covering on an existing roof shall be renewed or repaired to a greater extent than 1/10 of the roof surface, except in conformity with the requirements of [Section 706](#).
- (b) The placing of new roof covering conforming to [Section 706](#) over existing combustible roof covering shall not be prohibited; provided the existing roof covering is removed for a distance of 4 inches along all edges of the roof and replaced by strips of weatherproof material over which the new roof coverings shall extend.

#### **SECTION 1005 CHIMNEYS AND VENTS**

- (a) All existing masonry chimneys which upon inspection by the building official are found to be without flue liner and with open mortar joints which will permit smoke or flame to be discharged into the building or which are cracked as to be dangerous shall be made safe by means of a standard flue liner or with a corrosion resistant metal pipe one inch less in diameter than the interior of the chimney with the entire annular space between the metal pipe and the walls of the chimney filled with a cement mortar and otherwise repaired if necessary or they shall be removed.
- (b) Existing chimneys and vents of metal which are corroded or improperly supported shall be replaced, unless suitable repairs are made.

## SECTION 1006 HEAT PRODUCING APPLIANCES

In case the installation of an existing heat producing appliance, heating, ventilating, air conditioning, blower or exhaust system does not conform to the code requirements for new installations, the building official may order such changes in the installation as may be necessary to remove existing fire hazards.

## SECTION 1007 MEANS OF EGRESS

### 1007.1 – GENERAL

Within a reasonable time, as fixed by a written order of the building official, every existing building shall be provided with exit facilities adequate for the safety of the occupants. Such exit facilities shall be as approved by the building official, but shall not provide less safety to the occupants than that obtained by compliance with the provisions of this section. This section shall not apply to dwellings or farm buildings.

### 1007.2 – NUMBER AND LOCATION OF EXITWAYS

- (a) Every story for 100 or more occupants as determined by Section 1105 shall have at least 2 separate exitways (as defined in [Section 1103.2](#)). A single exitway may be permitted under the conditions outlined in [1007.2\(b\)](#).
- (b) When the stairway and other floor openings have enclosures with a fire resistance rating of not less than one hour and all openings therein are protected as required in [Section 1007.8](#), a single exitway may be used for stories having less than 100 occupants in:
  - (1) A building not over 4 stories in height of Type I or Type II construction except educational and institutional occupancies.
  - (2) A building of other than Type I or Type II construction not over 2 stories and not having educational or institutional occupancies.
  - (3) Any sprinklered building not over 4 stories in height, other than educational and institutional occupancies.
- (c) Exit doorways shall be so located that the maximum distance from any point in a floor area, room or space to an exit doorway, measured along the line of travel, does not exceed:
  - 100 feet for high hazard occupancies;
  - 126 feet for educational, industrial, institutional, mercantile, residential and storage occupancies;
  - 150 feet for assembly and business occupancies.
 except that:
  - (1) Where a floor area is subdivided into smaller areas such as rooms in hotels, multifamily houses and office buildings, the distance to an exit doorway shall be measured from the corridor entrance of such rooms.

- (2) Where the building is protected by an approved automatic sprinkler system; or where the building is either of Type I, Type II or Type IV construction occupied exclusively by stocks of non-combustible material, not packed or crated in combustible material; the above distances to an exit doorway may be increased 50 percent.
- (d) In multi-family houses having two or more dwelling units above the first story, every dwelling unit shall have access to at least two exitways except as may be provided for in [Chapter 11](#) for one exitway.
- (e) Every room used as a *place of assembly* shall have at least two doorways complying with [Section 1116](#) and which open onto an exitway, except that for such rooms located on the first or grade floor a single such doorway may be used for an occupancy not in excess of 200 occupants provided the doorway has a clear width of not less than 44 inches.
- (f) Every *place of assembly* having a capacity greater than 200 occupants shall have exit ways conforming as to number and width with [Section 1103.2](#) and [1105.3](#). In applying [Section 1105.3](#) a stairway 40 inches wide may be accepted as two units.
- (g) *Institutional occupancies* shall be provided with at least two exit ways in accordance with [Section 1104.1](#).

### 1007.3 – MINIMUM REQUIREMENTS FOR EXISTING EXIT STAIRWAYS

- (a) The stairways in one of the required exit ways from any story or stories occupied by a total of 6 or more persons shall have treads not less than 7 inches in width and risers not higher than 9 inches nor more than 1.2 times the width of tread. Winder treads shall have a width of not less than 6 inches measured one foot from the narrow end. This paragraph shall not be construed as modifying the pitch and tread requirements for any new stairway construction.
- (b) All exit stairs shall be guarded at the sides by well secured balustrades or other acceptable guards wherever such are needed for the safety of users, and shall have a handrail on at least one side.

### 1007.4 – FIRE ESCAPES

Exterior fire escapes on existing buildings used for educational, institutional or assembly occupancies shall conform to the requirements for exterior stairways in [Section 1108](#). Exterior fire escapes on other buildings shall conform to the following minimum requirements:

- (a) They shall be constructed of non-combustible materials.
- (b) They shall be constructed with stairs not less than 22 inches wide between rails, having risers not higher than 9 inches and having treads not narrower than 7 inches. Ladders may be used for the upper landing of a fire escape to the roof.
- (c) Unless the stair leading to the ground at the foot of the fire escape is permanently fixed, it shall be constructed with counter-balancing devices that permit it to be easily and quickly released and placed in rigid position for use.
- (d) They shall be of sufficient strength to sustain a live load of 100 pounds per square foot or concentrated loads of 300 pounds, so located as to produce maximum stress conditions.
- (e) They shall be so placed that they can be readily and safely reached by the occupants of the building.

- (f) They shall be so located that safe egress shall be provided at the foot either directly or through an enclosed exit way to a street or to an open space that communicates with a street.
- (g) They shall be spacious enough that the movements of those using the fire escapes will not be retarded.
- (h) All balconies and stairs shall be provided with substantial guard railings at least 4 feet high, without any openings greater than 8 inches in width, except that for buildings not over 5 stories high, triple guard rails equally spaced, with top rail not less than 42 inches high may be used. (Height for stairs is to be measured at center of tread.)
- (i) Except on buildings not exceeding 3 stories in height and on buildings of wood frame construction, all doors opening on or within 10 feet of the fire escape shall be approved self-closing fire doors, and any windows opening on or within 10 feet of the fire escape shall be approved fire windows; provided that where the occupancy inside these windows or doors is such as to present a light fire hazard or is sprinklered, or the overall exit arrangements are such that this protection is of minor importance, the building official may waive this requirement.

Note: Metal Ladder Fire Escapes extending from second floor windows or doors which are already installed on existing buildings are not required to be replaced with stairway type fire escapes, provided such ladders are in good repair and do not serve more than 15 people.

### **1007.5 – VERTICAL OPENINGS WHICH SHALL BE PROTECTED**

All vertical openings including interior stairways, escalators and elevators, shall be enclosed or their floor openings otherwise protected, in accordance with Sections 1007.6. and 1007.7, except:

- (1) Vertical openings which are not required to be enclosed in new construction. See Section 1106.
- (2) Vertical openings, including stairways and elevators in buildings of other than educational or institutional occupancies, not over 2 stories in height.
- (3) Vertical openings, including stairways and elevators in buildings of other than educational or institutional occupancy, not over 4 stories in height, where the stories above the second are used for storage only.
- (4) The installation of approved automatic sprinkler systems in historic buildings shall permit the acceptance of unenclosed stairways to be recognized as exits, provided the building is not more than 2 stories in height.

### **1007.6 – REQUIRED PROTECTION FOR VERTICAL OPENINGS**

- (a) Except as provided in paragraphs (b) and (c) below, required enclosures for vertical openings shall have a fire resistance rating of not less than one hour. In buildings of Type I or Type II construction such enclosures shall consist of non-combustible materials.
- (b) In any building of Type I or Type II construction, or of other types of construction not over 4 stories high, and in any sprinklered building, required enclosures may be constructed of ¾-inch gypsum plaster on metal lath on each side of studs, or equivalent, or of wired glass in metal framework.

- (c) In any building not over 4 stories high and in any sprinklered building, existing enclosures or parts thereof constructed of plaster on wood lath or equivalent, and in good repair, may be continued in use provided they are effectively firestopped at the [basement](#) ceiling.
- (d) An enclosure required by this section may include both elevators and stairs but two or more separate stairways shall not be in a single enclosure.
- (e) In lieu of a full enclosure, stairways, including escalators not required as exitways, may be protected with an enclosure at the head or at the foot of each stairway from one floor to another. The construction of such enclosures shall be in accord with the requirements of paragraphs (a), (b) and (c) above.
- (f) In lieu of an enclosure, floor openings for elevators in industrial occupancies may be protected by substantial guards or gates with approved trap doors at each floor opening. Such trap doors shall be constructed to form a substantial floor surface when closed, and arranged to open and close by action of the elevator in ascending or descending. The guards or gates and trap doors shall be kept closed when the shaftway is not in use.
- (g) The installation of approved automatic sprinkler systems in historic buildings shall permit the acceptance of existing walls and partitions that do not comply with the provisions of Section [1007.6b](#) or [c](#), provided the walls and partitions prevent the passage of smoke and automatic sprinklers are installed in the enclosed stairways and ramps, as well as the occupied areas and spaces.

#### **1007.7 – DOOR AND WINDOW OPENINGS IN REQUIRED ENCLOSURES FOR VERTICAL OPENINGS**

- (a) All openings in required enclosures for vertical openings except window openings to the exterior of the building, shall be protected with doors in accordance with the following paragraphs. Movable transoms in such enclosures are prohibited.
- (b) Doors in such enclosures shall be metal doors or metal covered doors or approved solid wooden doors except that existing doors in acceptable existing enclosures or parts thereof in any building not over 4 stories high and in any sprinklered building, may be any substantial wood doors having any wood panels less than ½-inch thick covered on the side opposite the stair side with sheet steel of not less than 28 gauge, securely attached with bolts or screws. Any glass in doors or fixed transoms shall be wired glass.
- (c) Doors in such enclosures, except doors opening into [apartments](#), shall be automatic or self-closing.
- (d) The installation of approved automatic sprinkler systems in historic buildings shall permit the acceptance of doors that do not comply with the provisions of Section [1007.7a](#) or [b](#), provided the doors are of substantial construction and automatic sprinklers are installed in the enclosed stairways and ramps, as well as the occupied areas or spaces.

#### **1007.8 – PATH OF EXIT TRAVEL FROM STAIRWAY TO STREET**

- (a) All interior stairways required to be enclosed shall lead directly or through an enclosed passageway to a street or to an open space that communicates with a street.



- (b) The enclosure of such passageway shall conform to the requirements applying to the stair enclosure. The enclosure shall separate from the exit way all [basement](#) occupancies, and all unsprinklered business and mercantile occupancies except those of a size and character which do not constitute a serious life hazard from fire, such as newsstands, cigar stands, lunch counters and small offices.
- (c) The installation of approved automatic sprinkler systems in historic buildings shall permit the acceptance of unenclosed stairways which are not components of means of egress, provided the building is not more than 4 stories in height.

### **1007.10 – EXIT DOORS**

- (a) Doorways opening on to an exit stairway, street or to a court or open space communicating with a street, and serving as a required exit way for 50 or more occupants shall have the doors, including the doors of vestibules, so hung as to swing open in the direction of exit travel.
- (b) All doors serving in a required exit way or leading to a required exit way from rooms occupied by 50 or more occupants and all doors serving in a required exit way or leading to a required exit way from places of assembly shall be hung to swing open in the direction of exit travel. Panic hardware shall be installed in accordance with [Section 1116.2](#).
- (c) Revolving doors shall be used in exit ways only under the conditions specified in [Section 1116.4](#).

### **1007.11 – EXIT SIGNS, LIGHTING, AND MAINTENANCE**

Exit ways shall be equipped with signs and be lighted and maintained in accordance with [Section 1122](#) and [1124](#).

The 1981 General Assembly ratified and adopted Section 1008 as adopted by the Building Code Council on March 9, 1976 with the exception that only evacuation plans and smoke detector requirements apply to office buildings. All of [Chapter 10](#) including Sections [1001-1007](#) which were ratified and adopted by the 1957 General Assembly and [Section 1008](#) ratified and adopted by the 1981 General Assembly is being printed as a separate pamphlet.

[Section 1008](#) is incorporated in the General Statutes as G.S.143-138(i) and G.S. 143-138(j). The Building Code Council does not have any authority to amend the General Statutes and any amendments must be made by the Legislature.

**G.S. 143-138 (i). Special Safety to Life Requirement Applicable to Existing High Rise Buildings – Section 1008 of Chapter X of Volume I of the North Carolina State Building Code, Title "Special Safety to Life Requirements Applicable to Existing High Rise Buildings" is adopted by the North Carolina State Building Code Council on March 9, 1976, is ratified and adopted as follows:**

**SECTION 1008 SPECIAL SAFETY TO LIFE REQUIREMENTS APPLICABLE TO EXISTING HIGH RISE BUILDINGS****1008 – GENERAL**

- (a) *Applicability* – Within a reasonable time, as fixed by "written order" of the building official, **and except as otherwise provided in G.S. 143-138(j) of this section**, every building then existing, that qualifies for classification under [Table 1008.1](#) shall be considered to be a high rise building and shall be provided with safety to life facilities as hereinafter specified. All other buildings shall be considered as low rise. NOTE: The requirements of Section 1008 shall be considered as minimum requirements to provide for reasonable safety to life requirements for existing buildings and where possible, the owner and designer should consider the provisions of Section 506 applicable to new high rise buildings.
- (b) *Notification of Building Owner* – The Department of Insurance will send copies of amendments adopted to all local building officials with the suggestion that all local building officials transmit to applicable building owners in his jurisdiction copies of adopted amendments, within six months from the date the amendments are adopted, with the request that each building owner respond to the local building official how he plans to comply with these requirements within a reasonable time.

NOTE: Suggested reasonable time and procedures for owners to respond to the building official's request is as follows:

- (1) The building owner shall, upon receipt of written request from the building official on compliance procedures within a reasonable time, submit an overall plan required by 1008(c) below within one year and within the time period specified in the approved overall plan, but not to exceed five years after the overall plan is approved, accomplish compliance with this Section, as evidenced by completion of the work in accordance with approved working drawings and specifications and by issuance of a new Certificate of Compliance by the building official covering the work. Upon approval of building owner's overall plan, the building official shall issue a "written order". as per 1008(a) above, to comply with Section 1008 in accordance with the approved overall plan.
- (2) The building official may permit time extensions beyond five (5) years to accomplish compliance in accordance with the overall plan when the owner can show just cause for such extension of time at the time the overall plan is approved.
- (3) The local building official shall send second request notices as per 1008(b) to building owners who have made no response to the request at the end of 6 months and a third request notice to no response building owners at the end of 9 months.
- (4) If the building owner makes no response to any of the three requests for information on how the owner plans to comply with Section 1008 within 12 months from the first request, the building official shall issue a "written order" to the building owner to provide his building with the safety to life facilities as required by this section and to submit an overall plan specified by (1) above within six months with the five (5) year time period starting on the date of the "written order".

(5) For purposes of this section, the Construction Section of the Division of Facility Services, Department of Human Resources, will notify all non-State owned I-Institutional buildings requiring licensure by the Division of Facility Services and coordinate compliance requirements with the Department of Insurance and the local building Official.

(c) *Submission of Plans and Time Schedule for Completing Work* – Plans and specifications, but not necessarily working drawings covering the work necessary to bring the building into compliance with this Section shall be submitted to the building official within a reasonable time. (See suggested time in NOTE of Section 1008(b) above.) A time schedule for accomplishing the work, including the preparation of working drawings and specifications shall be included. Some of the work may require longer periods of time to accomplish than others, and this shall be reflected in the plan and schedule.

NOTE: Suggested Time Period for Compliance:

### SUGGESTED TIME PERIOD FOR COMPLIANCE

ITEM	CLASS I (SECTION)	CLASS II (SECTION)	CLASS III (SECTION)	TIME FOR COMPLETION
Signs in Elevator Lobbies and Elevator Cabs	1008.2(h)	1008.3(h)	1008.4(h)	180 days
Emergency Evacuation Plan	1008(b)	NOTE.....		180 days
Corridor Smoke Detectors (Includes alternative door closers)	1008.2(c)	1008.3(c)	1008.4(c)	1 year
Manual Fire Alarm	1008.2(a)	1008.3(a)	1008.4(a)	1 year
Voice Communication System Required	1008.2(b)	1008.3(b)	1008.4(b)	2 years
Smoke Detectors Required	1008.2(c)	1008.3(c)	1008.4(c)	1 year
Protection and Fire Stopping for Vertical Shafts	1008.2(f)	1008.3(f)	1008.4(f)	3 year
Special Exit Requirements – Number, Location and Illumination to be in accordance with Section 1007	1008.2(e)	1008.3(e)	1008.4(e)	3 year
Emergency Electrical Power Supply	1008.2(d)	1008.3(d)	1008.4(d)	4 year
Special Exit Facilities Required	1008.2(e)	1008.3(e)	1008.4(e)	5 year
Compartmentation for Institutional Buildings	1008.2(f)	1008.3(f)	1008.4(f)	5 year
Emergency Elevator Requirements	1008.2(h)	1008.3(h)	1008.4(h)	5 year
Central Alarm Facility Required		1008.3(i)	1008.4(i)	5 year
Areas of Refuge Required on Every Eighth Floor			1008.4(j)	5 year
Smoke Venting			1008.4(k)	5 year
Fire Protection of Electrical Conductors			1008.4(l)	5 year
Sprinkler System Required			1008.4(m)	5 year

- (d) *Building Official Notification of Department of Insurance* – The building official shall send copies of written notices he sends to building owners to the Engineering and Building Codes Division for their files and also shall file an annual report by August 15th of each year covering the past fiscal year setting forth the work accomplished under the provisions of this Section.
- (e) *Construction Changes and Design of Life Safety Equipment* – Plans and specifications which contain construction changes and design of life safety equipment requirements to comply with provisions of this Section shall be prepared by a registered [architect](#) in accordance with provisions of Chapter 83 of the General Statutes or by a registered engineer in accordance with provisions of Chapter 89 of the General Statutes or by both an [architect](#) and engineer particularly qualified by training and experience for the type of work involved. Such plans and specifications shall be submitted to the Engineering and Building Codes Division of the Department of Insurance for approval. Plans and specifications for I-Institutional buildings licensed by the Division of Facility Services as noted in (b) above shall be submitted to the Construction Section of that Division for review and approval
- (f) *Filing of Test Reports and Maintenance of Life Safety Equipment* – The engineer performing the design for the electrical and mechanical equipment, including sprinkler systems, must file the test results with the Engineering and Building Codes Division of the Department of Insurance, or to the agency designated by the Department of Insurance, that such systems have been tested to indicate that they function in accordance with the standards specified in this Section and according to design criteria. These test results shall be a prerequisite for the Certificate of Compliance required by (b) above. Test results for I-Institutional shall be filed with the Construction Section, Division of Facility Services. It shall be the duty and responsibility of the owner; of Class I, II and III buildings to maintain smoke detection, fire detection, fire control, smoke removal and venting as required by this Section and similar emergency systems in proper operating condition at all times. Certification of full tests and inspections of all emergency systems shall be provided by the owner annually to the Fire Department.
- (g) *Applicability of Chapter X and Conflicts with Other Sections* – The requirements of this Section shall be in addition to those of Section 1001 through 1007; and in case of conflict, the requirements affording the higher degree of safety to life shall apply, as determined by the building official.
- (h) *Classes of Buildings and Occupancy Classifications* – Buildings shall be classified as Class I, II or III according to [Table 1008.1](#). In the case of mixed occupancies, for this purpose, the classification shall be the most restrictive one resulting from the application of the most prevalent occupancies to [Table 1008.1](#).

FOOTNOTE: *Emergency Plan* – Owners, operators, tenants, administrators or managers of high rise buildings should consult with the fire authority having Jurisdiction and establish procedures which shall include but not necessarily be limited to the following:

- (1) Assignment of a responsible person to work with the fire authority in the establishment, implementation and maintenance of the emergency pre-fire plan.
- (2) Emergency plan procedures shall be supplied to all tenants and shall be posted conspicuously in each hotel guest room, each office area, and each school room.

- (3) Submission to the local fire authority of an annual renewal or amended emergency plan.  
 (4) Plan should be completed as soon as possible.

**1008.1 – ALL EXISTING BUILDINGS SHALL BE CLASSIFIED AS CLASS I, II AND III ACCORDING TO TABLE 1008.1.**

**Table 1008.1**  
**SCOPE**

<b>CLASS (1)</b>	<b>OCCUPANCY GROUP (3) (4)</b>	<b>OCCUPIED FLOOR ABOVE AVERAGE GRADE EXCEEDING HEIGHT (2)</b>
<b>CLASS I</b>	<b>Group R – Residential</b>  <b>Group B – Business</b> <b>Group E – Educational</b> <b>Group A – Assembly</b> <b>Group H – Hazardous</b> <b>Group I – Institutional - Restrained</b>	<b>60’ but less than 120’ above average grade or 6 but less than 12 stories above average grade</b>
	<b>Group I – Institutional - Unrestrained</b>	<b>36’ but less than 60’ above average grade or 3 but less than 6 stories above average grade</b>
<b>CLASS II</b>	<b>Group R – Residential</b>  <b>Group B – Business</b> <b>Group E – Educational</b> <b>Group A – Assembly</b> <b>Group H – Hazardous</b> <b>Group I – Institutional - Restrained</b>	<b>120’ but less than 250’ above average grade or 12 but less than 25 stories above average grade</b>
	<b>Group I – Institutional - Unrestrained</b>	<b>60’ but less than 250’ above average grade or 6 but less than 25 stories above average grade</b>
<b>CLASS III</b>	<b>Group R – Residential</b> <b>Group B – Business</b> <b>Group E – Educational</b> <b>Group A – Assembly</b> <b>Group H – Hazardous</b>	<b>250’ or 25 stories above average grade.</b>

NOTE 1: The entire building shall comply with this Section when the building has an occupied floor above the height specified, except that portions of the buildings which do not exceed the height specified are exempt from this Section, subject to the following provisions:

- (a) Low rise portions or Class I buildings must be separated from high rise portions by one hour construction.

- (b) Low rise portions or Class II and III buildings must be separated from high rise portions by two-hour construction.
- (c) Any required exit from the high-rise portion which passes through the low-rise portions must be separated from the low-rise portion by the two-hour construction.

NOTE 2: The height described in [Table 1008.1](#) shall be measured between the average grade outside the building and the finished floor of the top occupied story.

NOTE 3: Public parking decks meeting the requirements of [Section 412.7](#) and less than 75 feet in height are exempt from the requirements of this Section when there is no other occupancy above or below such deck.

NOTE 4: Special purpose equipment buildings, such as telephone equipment buildings housing the equipment only, with personnel occupant load limited to persons required to maintain the equipment may be exempt from any or all of these requirements at the discretion of the Engineering and Building Codes Division provided such special purpose equipment building is separated from other portions of the building by two-hour fire rated construction.

## 1008.2 – REQUIREMENTS FOR EXISTING CLASS I BUILDINGS

All Class I buildings shall be provided with the following:

- (a) *An approved manual fire alarm system*, meeting the requirements of [Section 1125](#) and applicable portions of NFPA 71, 72A, 72B, 72C or 72D, shall be provided unless the building is fully sprinklered or equipped with an approved automatic fire detection system connected to the Fire Department.
- (b) All Class I buildings shall meet the requirements of [Section 1001-1007](#).
- (c) **Smoke Detectors Required** – At least one approved listed smoke detector tested in accordance with UL-167, capable of detecting visible and invisible particles of combustion shall be installed as follows:
  - (1) All buildings classified as institutional, residential and assembly occupancies shall be provided with listed smoke detectors in all required exit corridors spaced no further than 60' on center or more than 15' from any wall. Exterior corridors open to the outside are not required to comply with this requirement if the corridor walls have one hour fire resistance rating with all openings protected with 1¾ inch solid wood core or hollow metal door or equivalent and all corridor doors are equipped with approved self-closing devices, the smoke detectors in the corridor may be omitted. Detectors in corridors may be omitted when each dwelling unit is equipped with smoke detectors which activate the alarm system.
  - (2) In every mechanical equipment, boiler, electrical equipment, elevator equipment or similar room unless the room is sprinklered or the room is separated from other areas by two-hour fire resistance construction with all openings therein protected with approved fire dampers and Class B fire doors. (Approved listed fire (heat) detectors may be submitted for these rooms.)
  - (3) In the return air portion of every air conditioning and mechanical ventilation system that serves more than one floor.

- (4) The activation of any detector shall activate the alarm system, and shall cause such other operations as required by this Code.
- (5) The annunciator shall be located near the main entrance, or in a central alarm and control facility.

NOTE 1: Limited area sprinklers may be supplied from the domestic water system provided the domestic water system is designed to support the design flow of the largest number of sprinklers in any one (1) of the enclosed areas. When supplied by the domestic water system, the maximum number of sprinklers in any one (1) enclosed room or area shall not exceed twenty (20) sprinklers which must totally protect the room or area.

- (d) *Emergency Electrical Power Supply* – An emergency electrical power supply shall be provided to supply the following for a period of not less than two hours. An emergency electrical power supply may consist of generators, batteries, a minimum of two remote connections to the public utility grid supplied by multiple generating stations, a combination of the above.
  - (1) *Emergency*, exit and elevator cab lighting.
  - (2) *Emergency* illumination for corridors, stairs, etc.
  - (3) *Emergency Alarms and Detection Systems* – Power supply for fire alarm and fire detection. Emergency power does not need to be connected to fire alarm or detection systems when they are equipped with their own emergency power supply from float or trickle charge battery in accordance with NFPA Standards.
- (e) *Special Exit Requirements* – Exits and exitways shall meet the following requirements:
  - (1) *Protection of Stairways Required* – All required exit stairways shall be enclosed with non-combustible one hour fire rated construction with a minimum of 1¾ inch solid core wood door or hollow metal door or 20 minute U.L. listed doors as entrance thereto. (See [Section 1007.5](#))
  - (2) **Number and Location of Exits** – All required exit stairways shall meet the requirements of Section 1007 to provide for proper number and location and proper fire rated enclosures and illumination of and designation for means of egress.
  - (3) *Exit Outlets* – Each required exit stair shall exit directly outside or through a separate one hour fire rated corridor with no openings except the necessary openings to exit into the fire rated corridor and from the fire rated corridor and such openings shall be protected with 1¾ inch solid wood core or hollow metal door or equivalent unless the exit floor level and all floors below are equipped with an approved automatic sprinkler system meeting the requirements of NFPA No. 13.
- (f) *Smoke Compartments Required for Institutional – I Buildings* – Each occupied floor shall be divided into at least two compartments with each compartment containing not more than 30 institutional occupants. Such compartments shall be subdivided with one-half hour fire rated partitions which shall extend from outside wall to outside wall and from floor to and through any concealed space to the floor slab or roof above and meet the following requirements:
  - (1) Maximum area of any smoke compartment shall be not more than 22,500 square feet in area with both length and width limited to 150 feet.

- (2) At least one smoke partition per floor regardless of building size forming two smoke zones of approximately equal size.
  - (3) All doors located in smoke partitions shall be properly gasketed to insure a substantial barrier to the passage of smoke and gases.
  - (4) All doors located in smoke partitions shall be no less than 1¾ inch thick solid core wood doors with UL ¼" wire glass panel in metal frames. This glass panel shall be a minimum of 100 square inches and a maximum of 720 square inches.
  - (5) Every door located in a smoke partition shall be equipped with an automatic closer. Doors that are normally held in the open position shall be equipped with an electrical device that shall, upon actuation of the fire alarm or smoke detection system in an adjacent zone, close the doors in that smoke partition.
  - (6) Glass in all corridor walls shall be ¼", UL approved, wire glass in metal frames in pieces not to exceed 1296 square inches.
  - (7) Doors to all patient rooms and treatment areas shall be a minimum of 1¾ inch solid core wood doors except in fully sprinklered buildings.
- (g) *Protection and Fire Stopping for Vertical Shafts* – All vertical shafts extending more than one floor including elevator shafts, plumbing shafts, electrical shafts and other vertical openings shall be protected with noncombustible one hour fire rated construction with shaft wall openings protected with 1¾ inch solid core wood door or hollow metal door. Vertical shafts (such as electrical wiring shafts) which have openings such as ventilated doors on each floor must be fire stopped at the floor slab level with noncombustible materials having a fire resistance rating not less than one hour to provide an effective barrier to the passage of smoke, heat and gases from floor to floor through such shafts. EXCEPTION: Shaft wall openings protected in accordance with NFPA No. 90A and openings connected to metal ducts equipped with approved fire dampers within the shaft wall openings do not need any additional protection.
- (h) *Signs in Elevator Lobbies and Elevator Cabs* – Each elevator lobby call station on each floor shall have an emergency sign located adjacent to the call button and each elevator cab shall have an emergency sign located adjacent to the floor status indicator. The required emergency sign shall be readable at all times and shall be a minimum of ½" high block letters with the words: "IN CASE OF FIRE DO NOT USE ELEVATOR – USE THE EXIT STAIRS" or other words to this effect.

### **1008.3 – REQUIREMENTS FOR EXISTING CLASS II BUILDINGS**

All Class II buildings must meet the following requirements:

- (a) *Manual Fire Alarm* – Provide manual fire alarm system in accordance with [Section 1008.2\(a\)](#). In addition, buildings so equipped with sprinkler alarm system or automatic fire detection system must have at least one manual fire alarm station near an exit on each floor as a part of such sprinkler or automatic fire detection and alarm system. Such manual fire alarm systems shall report a fire by floor.



(b) *Voice Communication System Required* – An approved voice communication system or systems operated from the central alarm and control facilities shall be provided and shall consist of the following:

(1) *One-Way Voice Communication Public Address System Required* – A one-way voice communication system shall be established on a selective basis which can be heard clearly by all occupants in all exit stairways, elevators, elevator lobbies, corridors, assembly rooms and tenant spaces.

NOTE 1: This system shall function so that in the event of one circuit or speaker being damaged or out of service, the remainder of the system shall continue to be operable.

NOTE 2: This system shall include provisions for silencing the fire alarm devices when the loud speakers are in use, but only after the fire alarm devices have operated initially for not less than 15 seconds.

(c) *Smoke Detectors Required* – Smoke detectors are required as per [Section 1008.2\(c\)](#). The following are additional requirements:

(1) Storage rooms larger than 24 square feet or having a maximum dimension of over 8 feet shall be provided with approved fire detectors or smoke detectors installed in an approved manner unless the room is sprinklered.

(2) The actuation of any detectors shall activate the fire alarm system.

(d) *Emergency Electrical Power Supply* – An emergency electrical power supply shall be provided to supply the following for a period of not less than two hours. An emergency electrical power supply may consist of generators, batteries, a minimum of two remote connections to the public utility grid supplied by multiple generating station, a combination of the above. Power supply shall furnish power for items listed in [Section 1008.2\(d\)](#) and the following:

(1) *Pressurization Fans* – Fans to provide required pressurization, smoke venting or smoke control for stairways.

(2) *Elevators* – The designated emergency elevator.

(e) *Special Exit Facilities Required* – The following exit facilities are required:

(1) The special exit facilities required in [1008.2\(e\)](#) are required. All required exit stairways shall be enclosed with noncombustible two-hour fire rated construction with a minimum of 1½ hour Class B-labeled doors as entrance thereto: (See [Section 1007.5](#))

(2) *Smoke-Free Stairways Required* – At least one stairway shall be a smoke free stairway in accordance with [Section 1104.2](#) (See illustration Page 26) or at least one stairway shall be pressurized to between 0.15 inch and 0.35 inch water column pressure with all doors closed. Smoke free stairs and pressurized stairs shall be identified with signs containing letters a minimum of ½ inch high containing the words "PRIMARY EXIT STAIRS" unless all stairs are smoke free or pressurized. [Approved](#) exterior stairways meeting the requirements of [Chapter 11](#) or approved existing fire escapes meeting the requirements of [Chapter 10](#) with all openings within 10 feet protected with wire glass or other properly designed stairs protected to assure similar smoke free vertical egress may be permitted. All required exit stairways shall also meet the requirements of [Section 1008.2\(e\)](#).

(3) *If stairway doors are locked from the stairway side, keys shall be provided to unlock all stairway doors on every eighth floor leading into the remainder of the building and the key shall be located in a glass enclosure adjacent to the door at each floor level (which may sound an alarm when the glass is broken). When the key unlocks the door, the hardware shall be of the type that remains unlocked after the key is removed. Other means, approved by the building official may be approved to enable occupants and fire fighters to readily unlock stairway doors on every eighth floor that may be locked from the stairwell side. The requirements of this Section may be eliminated in smoke-free stairs and pressurized stairs provided fire department access keys are provided in locations acceptable to the local fire authority.*

(f) **Compartmentation for Institutional I – Buildings Required – See [Section 1008.2\(f\)](#).**

(g) *Protection and Fire Stopping for Vertical Shafts – All vertical shafts extending more than one floor including elevator shafts, plumbing shafts, electrical shafts and other vertical openings shall be protected with non-combustible two-hour fire rated construction with Class B-labeled door except for elevator doors which shall be hollow metal or equivalent. All vertical shafts which are not so enclosed must be fire stopped at each floor slab with noncombustible materials having a fire resistance rating of not less than two hours to provide an effective barrier to the passage of smoke, heat and gases from floor to floor through such shaft.*

EXCEPTION: Shaft wall openings protected in accordance with NFPA No. 90A and openings connected to metal ducts equipped with approved fire dampers within the shaft wall opening do not need any additional protection.

(h) *Emergency Elevator Requirements –*

(1) *Elevator Recall – Each elevator shall be provided with an approved manual return. When actuated, all cars taking a minimum of one car at a time, in each group of elevators having common lobby, shall return directly at normal car speed to the main floor lobby, or to a smoke free lobby leading most directly to the outside. Cars that are out of service are exempt from this requirement. The manual return shall be located at the main floor lobby.*

NOTE: Manually operated cars are considered to be in compliance with this provision if each car is equipped with an audible or visual alarm to signal the operator to return to the designated level.

(2) *Identification of Emergency Elevator – At least one elevator shall be identified as the emergency elevator and shall serve all floor levels. NOTE: This elevator will have a manual control in the cab which will override all other controls including floor call buttons and door controls.*

(3) *Signs in Elevator Lobbies and Elevator Cabs – Each elevator lobby call station on each floor shall have an emergency sign located adjacent to the call button and each elevator cab shall have an emergency sign located adjacent to the floor status indicator. These required emergency signs shall be readable at all times and shall be a minimum of ½ inch high block letters with the words: “IN CASE OF FIRE DO NOT USE ELEVATOR – USE THE EXIT STAIRS” or other words to this effect.*

- (i) *Central Alarm Facility Required* – A central alarm facility accessible at all times to Fire Department personnel or attended 24 hours a day, shall be provided and shall contain the following:
- (1) Facilities to automatically transmit manual and automatic alarm signals to the Fire Department either directly or through a signal monitoring service.
  - (2) Public service telephone.
  - (3) Fire detection and alarm systems annunciator panels to indicate the type of signal and the floor or zone from which the fire alarm is received. These signals shall be both audible and visual with a silence switch for the audible.
- NOTE: Detectors in HVAC systems used for fan shut down need not be annunciated.
- (4) Master keys for access from all stairways to all floors.
  - (5) One way voice emergency communications system controls.

#### **1008.4 – REQUIREMENTS FOR EXISTING CLASS III BUILDINGS**

All Class III buildings shall be provided with the following:

- (a) *Manual Fire Alarm System* – A manual fire alarm system meeting the requirements of [Section 1008.3\(a\)](#).
- (b) *Voice Communication System Required* – An approved voice communication system or systems operated from the central alarm and control facilities shall be provided and shall consist of the following:
- (1) *One-Way Voice Communication Public Address System Required* – A one-way voice communication system shall be established on a selective or general basis which can be heard clearly by all occupants in all elevators, elevator lobbies, corridors, and rooms or tenant spaces exceeding 1,000 sq. ft. in area.
- NOTE 1. This system shall be designed so that in the event of one circuit or speaker being damaged or out of service, the remainder of the system shall continue to be operable.
- NOTE 2. This system shall include provisions for silencing the fire alarm devices when the loud speakers are in use, but only after the fire alarm devices have operated initially for not less than 15 seconds.
- (2) Two-way system for use by both fire fighters and occupants at every fifth level in stairways and in all elevators.
  - (3) Within the stairs at levels not equipped with two-way voice communications, signs indicating the location of the nearest two-way device shall be provided.
- NOTE: The one-way and two-way voice communication systems may be combined.
- (c) *Smoke Detectors Required* – Approved listed smoke detectors shall be installed in accordance with [Section 1008.3\(c\)](#) and in addition, such detectors shall terminate at the Central Alarm and Control Facility and be so designed that it will indicate the fire floor or the zone on the fire floor.

- (d) *Emergency Electrical Power Supply* – Emergency electrical power supply meeting the requirements of [Section 1008.3\(d\)](#) to supply all emergency equipment required by [Section 1008.3\(d\)](#) shall be provided and in addition, provisions shall be made for automatic transfer to emergency power in not more than ten seconds for emergency illumination, emergency lighting and emergency communication systems. Provisions shall be provided to transfer power to a second designated elevator located in a separate shaft from the Primary Emergency Elevator. Any standpipe or sprinkler system serving occupied floor areas 400 feet or more above grade shall be provided with on-site generated power or diesel driven pump.
- (e) *Special Exit Requirements* – All exits and exitways shall meet the requirements of [Section 1008.3\(e\)](#).
- (f) *Compartmentation of Institutional Buildings Required* – See [Section 1008.2\(f\)](#).
- (g) *Protection and Fire Stopping for Vertical Shafts* – Same as Class II buildings. See [Section 1008.3\(g\)](#).
- (h) *Emergency Elevator Requirements*

- (1) *Primary Emergency Elevator* – At least one elevator serving all floors shall be identified as the emergency elevator with identification signs both outside and inside the elevator and shall be provided with emergency power to meet the requirements of [Section 1008.3\(c\)](#).

NOTE: This elevator will have a manual control in the cab which will override all other controls including floor call buttons and door controls.

- (2) *Elevator Recall* – Each elevator shall be provided with an approved manual return. When actuated, all cars taking a minimum of one car at a time, in each group of elevators having common lobby, shall return directly at normal car speed to the main floor lobby or to a smoke free lobby leading most directly to the outside. Cars that are out of service are exempt from this requirement. The manual return shall be located at the main floor lobby.

NOTE: Manually operated cars are considered to be in compliance with this provision if each car is equipped with an audible or visual alarm to signal the operator to return to the designated level.

- (3) *Signs in Elevator Lobbies and Elevator Cabs* – Each elevator lobby call station on each floor shall have an emergency sign located adjacent to the call button and each elevator cab shall have an emergency sign located adjacent to the floor status indicator. These required emergency signs shall be readable at all times and have a minimum of ½” high block letters with the words: “IN CASE OF FIRE, UNLESS OTHERWISE INSTRUCTED, DO NOT USE THE ELEVATOR – USE THE EXIT STAIRS” or other words to this effect.
- (4) *Machine Room Protection* – When elevator equipment located above the hoistway is subject to damage from smoke particulate matter, cable slots entering the machine room shall be sleeved beneath the machine room floor to inhibit the passage of smoke into the machine room.

- (5) *Secondary Emergency Elevator* – At least one elevator located in separate shaft from the Primary Emergency Elevator shall be identified as the “Secondary Emergency Elevator” with identification signs both outside and inside the elevator. It will serve all occupied floors above 250 feet and shall have all the same facilities as the primary elevator and will be capable of being transferred to the emergency power system.

NOTE: Emergency power supply can be sized for non-simultaneous use of the primary and second emergency elevators.

(i) *Central Alarm and Control Facilities Required* –

- (1) A central alarm facility accessible at all times to Fire Department personnel or attended 24 hours a day, shall be provided. The facility shall be located on a completely sprinklered floor or shall be enclosed in two-hour fire resistive construction. Openings are permitted if protected by listed 1½ hour Class B - labeled closures or water curtain devices capable of a minimum discharge of 3 gpm per lineal foot of opening. The facility shall contain the following:
- (i) Facilities to automatically transmit manual and automatic alarm signals to the Fire Department either directly or through a signal monitoring service.
  - (ii) Public service telephone
  - (iii) Direct communication to the control facility.
  - (iv) Controls for the voice communication systems.
  - (v) Fire detection and alarm system annunciator panels to indicate the type of signal and the floor or zone from which the fire alarm is received, those signals shall be both audible and visual with a silence switch for the audible.

NOTE: Detectors in HVAC systems used for fan shut down need not be annunciated.

- (2) A control facility (fire department command station) shall be provided at or near the fire department response point and shall contain the following:
- (i) Elevator status indicator
 

NOTE: Not required in buildings where there is a status indicator at the main elevator lobby.
  - (ii) Master keys for access from all stairways to all floors.
  - (iii) Controls for the two-way communication system.
  - (iv) Fire detection and alarm system annunciator panels to indicate the type of signal and the floor or zone from which the fire alarm is received.
  - (v) Direct communication to the central alarm facility.
- (3) The central alarm and control facilities may be combined in a single approved location. If combined, the duplication of facilities and the direct communication system between the two may be deleted.

(j) *Areas of Refuge Required* – Class III buildings shall be provided with a designated “area of refuge” at the 250 ft. level and on at least every eighth floor or fraction thereof above that level to be designed so that occupants above the 250' level can enter at all times and be safely accommodated in floor areas meeting the following requirements unless the building is completely sprinklered:

- (1) *Identification and Size* – These areas of refuge shall be identified on the plans and in the building as necessary. The area of refuge shall provide not less than 3 sq. ft. per occupant for the total number of occupants served by the area based on the occupancy content calculated by Section 1105. A minimum of 2% of the number of occupants on each floor shall be assumed to be handicapped and no less than 16 sq. ft. per handicapped occupant shall be provided. Smoke proof stairways meeting the requirements of [Section 1104.2](#) and pressurized stairways meeting the requirements of [Section 1008.3\(e\)\(2\)](#) may be used for ambulatory occupants at the rate of 3 sq. ft. of area of treads and landings per person, but in no case shall the stairs count for more than one-third of the total occupants. Doors leading to designated areas of refuge from stairways or other areas of the building shall not have locking hardware or shall be automatically unlocked upon receipt of any manual or automatic fire alarm signal.
- (2) *Pressurized* – The area of refuge shall be pressurized with 100% fresh air utilizing the maximum capacity of existing mechanical building air conditioning system without recirculation from other areas or other acceptable means of providing fresh air into the area.
- (3) *Fire Resistive Separation* – Walls, partitions, floor assemblies and roof assemblies separating the area of refuge from the remainder of the building shall be noncombustible and have a fire resistance rating of not less than one hour. Duct penetrations shall be protected as required for penetrations of shafts. Metallic piping and metallic conduit may penetrate or pass through the separation only if the openings around the piping or conduit are sealed on each side of the penetrations with impervious noncombustible materials to prevent the transfer of smoke or combustion gases from one side of the separation to the other. The fire door serving as a horizontal exit between compartments shall be so installed, fitted and gasketed to provide a barrier to the passage of smoke.
- (4) *Access Corridors* – Any corridor leading to each designated area of refuge shall be protected as required by Section 1104 and 702. The capacity of an access corridor leading to an area of refuge shall be based on 150 persons per unit width as defined in [Section 1105.2](#). An access corridor may not be less than 44 inches in width. The width shall be determined by the occupant content of the most densely populated floor served. Corridors with one hour fire resistive separation may be utilized for area of refuge at the rate of 3 sq. ft. per ambulatory occupant provided a minimum of 1 cubic ft. per minute of outside air per square foot of floor area is introduced by the air conditioning system.
- (5) *Penetrations* – The continuity of the fire resistance at the juncture of exterior walls and floors must be maintained.

(k) *Smoke Venting*

Smoke venting shall be accomplished by one of the following methods in non-sprinklered buildings:

- (1) In a non-sprinklered building, the heating, ventilating and air conditioning system shall be arranged to exhaust the floor of alarm origin at its maximum exhausting capacity without recirculating air from the floor of alarm origin to any other floor. The system may be arranged to accomplish this either automatically or manually. If the air conditioning system is also used to pressurize the areas of refuge, this function shall not be compromised by using the system for smoke removal.
  - (2) Venting facilities shall be provided at the rate of 20 square feet per 100 lineal feet or 10 square feet per 50 lineal feet of exterior wall in each story and distributed around the perimeter at not more than 50 or 100 foot intervals openable from within the fire floor. Such panels and their controls shall be clearly identified.
  - (3) Any combination of the above two methods or other approved designs which will produce equivalent results and which is acceptable to the building official.
- (l) *Fire Protection of Electrical Conductors* – New electrical conductors furnishing power for pressurization fans for stairways, power for emergency elevators and fire pumps required by [Section 1008.4\(d\)](#) shall be protected by a two-hour fire rated horizontal or vertical enclosure or structural element which does not contain any combustible materials. Such protection shall begin at the source of the electrical power and extend to the floor level on which the emergency equipment is located. It shall also extend to the emergency equipment to the extent that the construction of the building components on that floor permit. New electrical conductors in metal raceways located within a two-hour fire rated assembly without any combustible therein are exempt from this requirement.
- (m) *Automatic Sprinkler Systems Required* –
- (1) All areas which are classified as Group M - mercantile and Group H - hazardous shall be completely protected with an automatic sprinkler system.
  - (2) All areas used for commercial or institutional food preparation and storage facilities adjacent thereto shall be provided with an automatic sprinkler system.
  - (3) An area used for storage or handling of hazardous substances shall be provided with an automatic sprinkler system.
  - (4) All laboratories and vocational shops in Group E - Educational shall be provided with an automatic sprinkler system.
  - (5) Sprinkler systems shall be in strict accordance with NFPA No. 13 and the following requirements:
    - (a) The sprinkler system must be equipped with a water flow and supervisory signal system that will transmit automatically a water flow signal directly to the Fire Department or to an independent signal monitoring service satisfactory to the Fire Department.

**G. S. 143-138(j). Existing High Rise Requirements Applicable to Business (Office) Buildings – G. S. 143-138(i) of this section does not apply to business occupancy (office) buildings as defined in the North Carolina State Building Code except that evacuation plans and smoke detectors as required for Class I Buildings as required in [Section 1008.2](#), Class II Buildings as required by [Section 1008.3](#), and Class III Buildings as required by [Section 1008.4](#), shall not be exempted from operation of this act as applied to business occupancy buildings.**

Note 1 – Senate Bill 520 ratified by the General Assembly June 29, 1981 inadvertently included page numbers and line numbers in the bill for each section of 1008 applicable to smoke detectors but the page number and line number were there only to reference the Sections on the printed Bill.

Note 2 – [Section 405.1](#) of the N. C. State Building Code defines business occupancy as follows:

**405.1 – Scope**

- (a) Business (B) Occupancy is the use of a building or structure, or any portion thereof, for office, professional, or service type transactions including normal accessory storage and the keeping of records and accounts.
- (b) Business (B) occupancy shall include, among others, the following: Office buildings, greenhouses, service stations, banks, bowling alleys, libraries (other than school).
- (c) Restaurants or places supplying food or drink that accommodate one hundred (100) or more people, or that have a stage, or that provide dancing or entertainment features, shall be classified as Assembly and not in Business Occupancy.

**SECTION 1009 HISTORIC BUILDINGS FOR PUBLIC DISPLAY OR EXHIBITION**

**1009.1 – GENERAL**

- (a) Historic buildings are those structures which have been so designated for purposes of this Code by the Division of Archives and History, North Carolina Department of Cultural Resources. Applications shall be submitted to the State Historic Preservation Officer.
- (b) Public display or exhibition is defined as a historic building restored to display the building itself and associated artifacts.
- (c) Where the existing occupancy of a historic building is continued, the building shall comply with the provisions of [Section 1001](#) through [1008](#).
- (d) Where the occupancy of a historic building is changed from an existing occupancy to Group B – Business or Group M – Mercantile occupancy, the building shall comply with the provisions of [Section 1010](#). Where the occupancy of a historic building is changed to an occupancy other than Business or Mercantile, the building shall comply with the provisions of this code for new buildings.
- (e) Where the occupancy of a historic building is established for public display or exhibition, the historic building is required to comply with Sections [1001-1007](#) but that such building is not required to comply with the provisions of [Section 1007](#), except as required by the provisions of [Section 1009.2](#) through [1009.6](#).



- (f) The installation of approved automatic sprinkler systems in historic buildings shall permit places of assembly with an occupant load not greater than 100 to be located in stories above the story of discharge.

### **1009.2 – MOVING OF HISTORIC BUILDINGS**

- (a) Historic buildings, other than as regulated by the provisions of Sections 1009.2b and c, which comply with the provisions of this Code for new buildings are permitted to be moved within or to the municipality.
- (b) Historic buildings which do not comply with the provisions of Section 402 are permitted to be moved to any location, provided the buildings are equipped with an approved automatic sprinkler system and comply with the provisions of this Section 1009.
- (c) Historic buildings of wood frame construction are permitted to be moved to any location, provided the distance to the nearest building or structure or location where a building may be legally built is 30 feet or more.

### **1009.3 – ADDITIONS**

- (a) Additions which increase the areas of historic buildings to areas which exceed the values allowed by the provisions of Section 402 are permitted, provided the addition is only used for maintenance and administration of the historic building or structure.
- (b) Additions permitted by the provisions of Section 1009.3a are permitted to be of wood frame construction where the historic building is of wood frame construction or where it is reconstruction of original part of building which is of wood frame construction.

### **1009.4 – REPAIRS**

- (a) Repairs are permitted provided the replaced structural members and assemblies comply with the provisions of Chapter 12.
- (b) Repairs to roof coverings which do not comply with the provisions of Section 1004 are permitted, provided the distance to the nearest building or structure or location where a building may be legally built is 30 feet or more.
- (c) Special consideration may be given by local authorities when adherence to Section (IIX) of this code would require destructive alteration or demolition of building features identifiable as contributing to the significance of the building.

### **1009.5 – MEANS OF EGRESS**

- (a) There shall be not less than two means of egress complying with the provisions of Sections 1007.2, 1007.3 and 1007.5 through 1007.10, except as permitted by the provisions of Section 1009.5b and c, and 1009.6.
- (b) One means of egress is permitted for historic buildings described by the provisions of Section 1009.1c where the building and conditions comply with all of the provisions of Section 1009.5b (1) through (6).
  - (1) Visitors are admitted by guided tours or there are supervisory attendance in all areas accessible to the visitors.
  - (2) Visitors are not permitted below the story of discharge.

- (3) The building is not more than 3 stories in height.
  - (4) The number of occupants per story does not exceed 100.
  - (5) Lunch counters and concessions for the sale of gifts are not located above the story of discharge.
  - (6) Exits and exit passageways comply with the provisions of Sections 1007.6b and c, 1007.7b and c, 1007.8 and 1007.10.
- (c) Stairs or other components of means of egress which are not considered to be able to support the anticipated loads shall be altered to comply with the provisions of Chapter 12.

### **1009.6 – INSTALLATION OF AUTOMATIC SPRINKLER SYSTEMS**

The installation of approved automatic sprinkler systems shall permit the acceptance of historic buildings and structures that do not comply with the provisions of Section 402.

## **SECTION 1010 HISTORIC BUILDINGS FOR ADAPTIVE USE**

### **1010.1 – GENERAL**

- (a) Historic buildings are those structures which have been so designated for purposes of this Code by the Division of Archives and History, North Carolina Department of Cultural Resources. Applications shall be submitted to the State Historic Preservation Officer.
- (b) Adaptive use means a change in occupancy of a historic building to Business or Mercantile occupancy other than an occupancy established for public display or exhibition is specified in Section 1009.
- (c) Where the occupancy of a historic building is changed from an existing occupancy to Group B – Business occupancy or Group M – Mercantile occupancy, the building shall comply with the provisions of Sections 1001 thru 1008 and Section 1010. Where the occupancy of a historic building is changed to an occupancy other than business or mercantile, the building shall comply with the provisions of this Code for new buildings.
- (d) Where the occupancy of a historic building is established for public display or exhibition, the building shall comply with the provisions of Section 1009.
- (e) Where the existing occupancy of a historic building is continued, the building shall comply with the provisions of Section 1001 through 1008.

### **1010.2 – MOVING OF HISTORIC BUILDINGS**

- (a) Historic buildings, other than as regulated by the provisions of Sections 1010.2b and c, which comply with the provisions of this Code for new buildings are permitted to be moved within or to the municipality.
- (b) Historic buildings which do not comply with the provision of Section 402 are permitted to be moved to any location, provided the buildings are equipped with an approved automatic sprinkler system and comply with the provisions of this Section 1010.
- (c) Historic buildings of wood frame construction are permitted to be moved to any location, provided the distance to the nearest building or structure or location where a building may be legally built is 30 feet or more.

**1010.3 – REPAIRS**

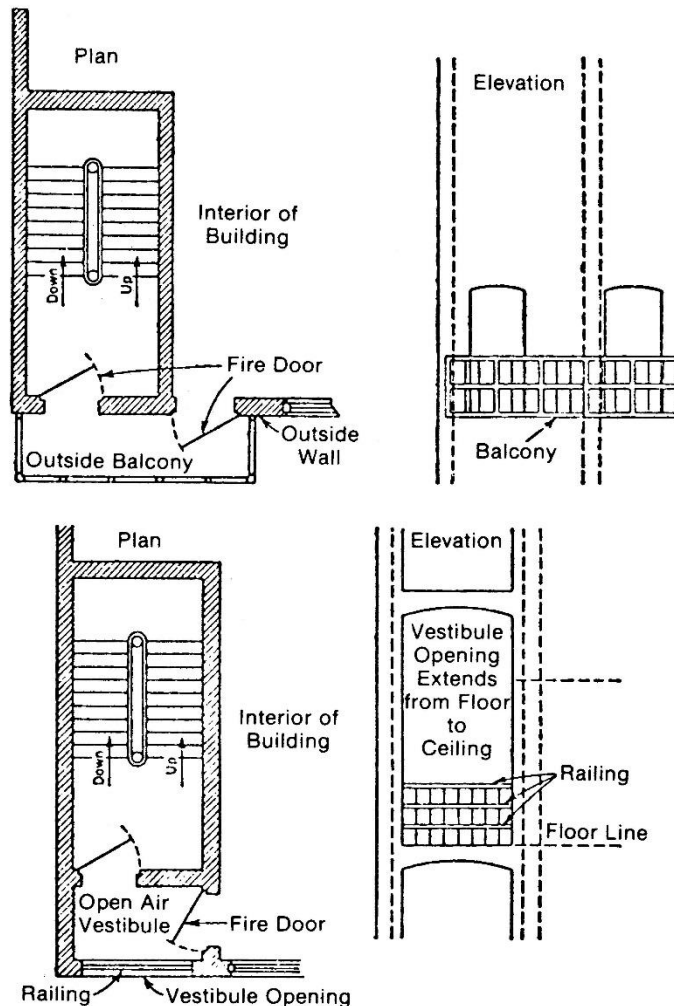
- (a) Repairs are permitted provided the replaced structural members and assemblies comply with the provisions of Chapter 12.
- (b) Repairs to roof coverings shall comply with the provisions of Section 1004.
- (c) Special consideration may be given by local authorities when adherence to Section (IIX) of this code would require destructive alteration or demolition of building features identifiable as contributing to the significance of the building.

**1010.4 – INSTALLATION OF AUTOMATIC SPRINKLER SYSTEMS**

The installation of approved automatic sprinkler system shall permit the acceptance of historic buildings and structures that do not comply with the provisions of Section 402.

**1010.5 – CEILING HEIGHTS**

Where existing ceiling heights in Historic Buildings are less than 7 feet 6 inches, rooms may be used as habitable rooms with the approval of Local Building Official.



Typical arrangements for fire towers. No direct communication with building.

SAFETY TO LIFE REQUIREMENTS FOR EXISTING BUILDINGS

**CHAPTER 11**  
**MEANS OF EGRESS**  
**Exits and Exit Access**

**SECTION 1101 GENERAL OBJECTIVES**

- (a) In every building hereafter erected means of egress shall comply with the minimum requirements of this Chapter.
- (b) Means of egress shall consist of continuous and unobstructed paths of travel and shall be so arranged and maintained as to provide free and unobstructed egress from all parts of the building or structure at all times when it is occupied. No lock or fastening to prevent free escape from the inside of any building shall be installed except in mental, penal, or corrective institutions where supervisory personnel is continually on duty and effective provisions are made to remove occupants in case of fire or other emergency. Means of egress through any room or space used as a kitchen for preparation of food shall not be permitted.
- (c) Where unusually hazardous conditions exist, additional means of egress facilities shall be provided as required by the Building Official, when necessary to assure the safety of the occupants.
- (d) No building shall hereafter be altered so as to reduce the capacity of the means of egress to less than required by this Chapter nor shall any change of occupancy be made in any building unless such building conforms with the requirements of this Chapter for the new occupancy.
- (e) Stairways, ramps and passageways used for required exits shall be of non-combustible construction except where otherwise specifically permitted by Sections 1115 – Stairways; 1112 – Exit Outlets; and 1117 – Ramps.
- (f) Every building or structure, section, or area thereof of such size, occupancy, and arrangement that the reasonable safety of numbers of occupants may be endangered by the blocking of any single means of egress due to fire or smoke, shall have at least two means of egress remote from each other, so arranged as to minimize any possibility that both may be blocked by any one fire or other emergency conditions.
- (g) Every vertical way of exit and other vertical opening between floors of a building shall be suitably enclosed or protected as necessary to afford reasonable safety to occupants while using exits and to prevent spread of fire, smoke, or fumes through vertical openings from floor to floor before occupants have entered exits.
- (h) No exit enclosure shall be used for any purpose, such as piping from flammable liquids or gases, which could interfere with its value as an exit.

**SECTION 1102 DEFINITION**

- (a) A *means of egress* is a continuous and unobstructed path of travel from any point in a building or structure to a public way and consists of 3 separate and distinct parts: (1) the exit access, (2) the exit and, (3) the exit way discharge. A means of egress comprises the vertical and horizontal ways of travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts and yards.

- (1) *Exit access* is that portion of a means of egress which leads to an entrance to an exit.

Access to Exits or Exit Way – [1103.4](#)

Exit Passageways or Exit Corridor – [1112.2](#)

NOTE: An interior aisle, corridor, hallway, or other means of travel used to reach an exit stair or doorway is not an exit, except where the maximum allowable distance of travel to an exit is exceeded – at which point it must be treated as part of the exit or is so located, arranged, and enclosed as to constitute an integral part of an exit facility. (See [Section 1112.2](#)).

NOTE: Doors of small individual rooms, as in hotels, while constituting exit access from the room, are not referred to as exits except when they lead directly to the outside of the building or other place of safety, but in a large room, such as a school auditorium, the doors constitute an integral part of the exit system and are referred to as exits from the room.

- (2) *Exit* is that portion of a means of egress which is separated from all other spaces of the building or structure by construction or equipment as required in this Code to provide a protected way of travel to the exit discharge.

Distance to Exits – [1103.1](#).

Minimum Number of Exits – [1103.2](#).

Measurement of Travel Distance to Exits – [1103.3](#).

Access to Exits – [1103.4](#).

- (3) *Exit discharge* is that portion of a means of egress between the termination of an exit and a public way.

Exit Outlets – [1112.1](#).

Exit Passageways – [1112.2](#).

Exit Discharge – [1112.1](#).

NOTE: An exit passageway serves as a horizontal means of exit travel that is protected from fire in a manner similar to an enclosed interior exit stair. Where it is desired to offset exit stairs in a multistory building, an exit passageway can be used to preserve the continuity of the protected exit by connecting the bottom of one stair to the top of the other stair that continues to the street floor. Probably the most important use of an exit passageway is to satisfy the requirement that exit stairs shall discharge directly outside from multistory buildings. Thus, if impractical to locate the stair on an exterior wall, an exit passageway can be connected to the bottom of the stair to convey the occupants safely to an outside exit door. In buildings or extremely large area, such as shopping malls and some factories, the exit passageway can be used to advantage where the distance of travel to reach an exit would otherwise be excessive. Exit passageways are different from access aisles, corridors, and hallways because the latter are not required to be protected by a fire resistive enclosure.

## SECTION 1103 ARRANGEMENT AND NUMBER OF EXITS

### 1103.1 – ARRANGEMENTS (DISTANCE TO EXITS)

- (a) Exits shall be so located that the distance from the most remote point in the floor area, room, or space served by them to the nearest exit, (in office buildings, hotels and [apartments](#) where floor areas are sub-divided into small spaces or rooms, the distance of travel to an exit shall be measured from the corridor entrance to such rooms or spaces) measured along the line of travel, shall be not more than specified in [Table 1103](#), except that where sprinklers are installed throughout a building, maximum distance of travel to an exit may be fifty (50) percent greater than these tabular values:

**TABLE 1103**

Occupancy	Dead End Limits**	Maximum Distance or Travel to an Exit (Lin. Ft.)
Group R, Residential	35	100
Group B, Business, Offices	50	150
Group M, Mercantile	50	100
Group E, Educational	20	150
Group I, Institutional	30	100
Group A, Assembly	0	150
Group S, Storage	0	150
Group F, Industrial/Factory	50	150
Group H, Hazardous	0	75

\*\* A dead end occurs when a hallway or other space is so arranged that a person therein is able to travel in one direction only in order to reach any of the exits. Although relatively short dead ends are permitted by this Code, it is better practice to eliminate them as far as possible as they increase the danger of persons being trapped in case of fire. Compliance with the dead-end limits does not necessarily mean that the requirements for remoteness of exits have been met. This is particularly true in small buildings or buildings with short public hallways. Adequate remoteness can be obtained in such cases by further reducing the length of dead ends.

**1103.2 – MINIMUM NUMBER OF EXITS**

(a) There shall be not less than two (2) approved independent exits, accessible to each tenant area, serving every story (except as modified in [Section 1103.2\(c\)](#) ) as follows:

Minimum No. of Exits	Occupancy Load
2	75-500
3	501-1000
4	more than 1000

(b) Hazardous occupancies shall have not less than two (2) independent exits accessible to each such room or space.

(c) Exceptions for one Exit for Residential and Office – There shall be not less than two (2) exits serving every floor area, except that in the following cases there may be one (1) exit.

(1) Every living unit shall have access to at least 2 separate exits which are remote from each other and are reached by travel in different directions, except that a common path of travel may be permitted for the first 20 feet (i.e., a dead-end corridor up to 20 feet long may be permitted) provided that a single exit may be permitted under any of the following conditions:

Exception 1: Any living unit, which has an exit directly to the street or yard at ground level or by way of an outside stairway or an enclosed stairway with fire- resistance rating of 1 hour or more serving that [apartment](#) only and not communicating with any floor below the floor of exit discharge or other area not a part of the [apartment](#) served, may have a single exit.

Exception 2: Any building not more than 3 stories in height with no floor below the floor of exit discharge or, in case there is such a floor, with the street floor construction of at least 1-hour fire resistance, may have a single exit, under the following conditions:

2a: The stairway is completely enclosed with floors, walls and ceilings having a fire-resistance rating of at least 2 hours with self-closing fire doors protecting all openings between the stairway enclosure and the building.

2b: The stairway does not serve any floor below the floor of exit discharge.

2c: All corridors serving as access to exits have at least a 1-hour fire-resistance rating.

2d: There is not more than 20 feet of travel distance to reach an exit from the entrance door of any living unit.

Exception No. 3: Any building 3 stories or less in height with no floor below the level of exit discharge or, in case there is such a floor, with the street floor construction of at least 1-hour fire resistance, may have a single exit, under the following conditions:

3a: The stairway is completely separated from the interior of a building by construction having a fire resistance rating of at least one hour with self-closing  $\frac{3}{4}$  hour fire protection rated doors protecting all openings between the stairway and the building.

3b: The stairway does not serve any floor below the level of exit discharge.



3c: All corridors serving as access to exits have at least one-hour fire resistance rating.

3d: There is not more than 20 feet of travel distance to reach an exit from the entrance door of any living unit.

- (2) In Office Buildings having no floor over three thousand five hundred (3,500) sq. ft. in area and not over two stories in height provided the occupant content shall not exceed 40 persons above or below the street floor. Stairs leading to the exit need not be enclosed. Maximum distance of travel to an exit shall not exceed 75 feet.
- (3) In Mercantile Occupancies at street floor level having a floor area less than 2250 sq. ft. and a distance of travel to an exit not exceeding fifty (50) feet.
- (4) In Storage Occupancies, one story only, and having a floor area less than 2,500 sq. ft., with a distance of travel 50 ft. or less.
- (5) Each mezzanine used for other than storage purposes, if greater in area than 2,000 sq. ft. or if more than 60 feet in any dimension shall have not less than two stairways to an adjacent floor.
- (d) Sufficient exit facilities shall be provided so that the aggregate capacity of all such exits, determined in accordance with this Chapter, shall not be less than the occupant content as determined from [Section 1105.1](#).
- (e) It shall be unlawful to occupy any part of a building by a greater number of persons than that for which exit capacity, as prescribed in this Chapter, has been provided.
- (f) Industrial occupancies over 5000 sq. ft. in area on any floor must have two means of egress regardless of number of people occupying such floor.
- (g) All rooms for sleeping purposes in Group R and I (except jails) shall have an outside window that can be open without the use of tools to provide a clear opening not less than 16" in least dimensions and 432 Sq. In. in area or, if of fixed glass, must be at least 24" x 24" with the bottom of the opening not more than 3' above the floor. "Windows in Group R Residential occupancies which separate sleeping rooms from atriums are acceptable as meeting these requirements."

### 1103.3 – MEASUREMENT OF TRAVEL DISTANCE TO EXITS

- (a) The travel distance to an exit shall be measured on the floor or other walking surface *along the center line of natural path of travel* starting 1 foot from the most remote point, curving around any corners or obstructions with a 1-foot clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. Where measurement includes stairs, it shall be taken in the plane of the tread nosing.
- (b) In the case of *open areas*, distance to exits shall be measured from the most remote point subject to occupancy. In the case of *individual rooms* subject to occupancy by not more than 6 persons, distance to exits shall be measured from the doors of such rooms provided the path of travel from any point in the room to the room door does not exceed 50 feet.
- (c) Where *open stairways or ramps* are permitted, as a path of travel to required exits, such as between mezzanines or balconies and the floor below, the distance shall include the travel on the stairway or ramp, and the travel from the end of the stairway or ramp to reach an outside door or other exit, in addition to the distance to reach the stairway or ramp.

- (d) Where any part of an *exterior exit access* is within 15 feet horizontal distance of any unprotected building opening, for outside stairs, the distance to the exit shall include the length of travel to ground level.
- (e) In any building used for aircraft assembly or other *occupancy requiring undivided floor areas* so large that the distances from points within the area to the nearest outside walls where exit doors could be provided are in excess of 150 feet, requirements for distance to exits may be satisfied by providing stairs leading to exit tunnels or to overhead passageways. In cases where such arrangements are not practicable the authority having jurisdiction may, by special ruling, permit other exit arrangements for 1-story buildings with distances in excess of the maximum distances specified if complete automatic sprinkler protection is provided and if the height of ceilings, ceiling curtain boards, and roof ventilation is such as to minimize the possibility that employees will be overtaken by the spread of fire or smoke within 6 feet of the floor level before they have time to reach exits, provided, however, that in no case may the distance of travel to reach the nearest exit exceed 400 feet. Where smoke venting is required as a condition for permitting distances of travel to exits in excess of the maximum otherwise allowed, the smoke venting arrangement shall be in accordance with NFPA #204.

#### 1103.4 – ACCESS TO EXITS

- (a) Exits shall be so located and exit access shall be so arranged that exits are readily accessible at all times. Where exits are not immediately accessible from an open floor area, safe and continuous passageways, aisles, or corridors leading directly to every exit and so arranged as to provide convenient access for each occupant to at least 2 exits by separate ways of travel, except as a single exit or limited dead ends are permitted by other provisions of this Code, shall be maintained.
- (b) A door from a room to an exit or to an exit access shall be of the side-hinged, swinging type. It shall swing with exit travel when the room is occupied by more than 50 persons or used for a high hazard occupancy.
- (c) In no case shall access to an exit be through a bathroom, bedroom, or other room subject to locking, except where the exit is required to serve only the bedroom or other room subject to locking, or adjoining rooms constituting part of the same dwelling or **apartment** used for single family occupancy.
- (d) Ways of exit access and the doors to exits to which they lead shall be so designed and arranged as to be clearly recognizable. No hangings or draperies shall be placed over exit doors or otherwise so located as to conceal or obscure any exit. No mirrors shall be placed on exit doors. No mirrors shall be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.
- (e) Exit access shall be so arranged that it will not be necessary to travel toward any area of high hazard occupancy in order to reach the nearest exit, unless the path of travel is effectively shielded from the high hazard location by suitable partitions or other physical barriers.
- (f) Where the floor of a way of exit access is not substantially level, such differences in elevation shall be negotiated by stairs or ramps conforming to the requirements of this chapter for exit stairs and exit ramps. Such stairs or ramps need not be enclosed unless they connect two or more separate stories.

- (g) Where a single way of exit access leads to an exit, its capacity in terms of width shall be at least equal to the required capacity of the exit to which it leads. Where more than one way of exit access leads to an exit, each shall have a width adequate for the number of persons it must accommodate.
- (h) No obstruction shall be placed in any aisle, exit, foyer, passageway or corridor.
- (i) Where the floor space of an Assembly occupancy is occupied by tables, chairs or other movable furniture, aisles at least 36 inches in clear width shall be maintained to provide ready access to exit doorways.

### **1103.5 – EXTERIOR WAYS OF EXIT ACCESS**

- (a) Access to an exit way may be by means of any exterior **balcony**, porch, gallery, or roof that conforms to the requirements of this Chapter.
- (b) Exterior ways of exit access shall have smooth, solid floors, substantially level, and shall have guards on the unenclosed sides at least equivalent to those specified in **1108.4(b)**.
- (c) Where accumulation of snow or ice is likely because of the climate, the exterior way of exit access shall be protected by a roof.
- (d) A permanent, reasonably straight path of travel shall be maintained over the required exterior way of exit access. There shall be no obstruction by railings, barriers, or gates that divided the open space into sections appurtenant to individual rooms, **apartments**, or other subdivisions.
- (e) An exterior way of exit access shall be so arranged that there are no dead ends in excess of 20 feet.
- (f) Any gallery, **balcony**, bridge, porch or other exterior exit access that projects beyond the outside wall of the building shall comply with the requirements of this Chapter as to width and arrangement. The materials of construction shall be as permitted for the building served.

## **SECTION 1104 SPECIAL EXIT REQUIREMENTS**

### **1104.1 – INSTITUTIONAL OCCUPANCIES**

- (a) Institutional occupancies, all doorways to areas housing patients, and doorways between patient occupied spaces and the required exit, and all exit doorways leading to the exterior shall be not less than 44 inches in clear width except that exit doors so located as not to be subject to use by patients, may be not less than 36 inches in clear width. Corridors shall have a minimum of one hour fire resistance rating. Such ways of egress to be so arranged in reference to rooms that in case of fire on one stairway, the other stairway can be reached by the occupant without his or her having to pass the stairway involved. All corridors in all institutional buildings shall not be less than 8' in width. Exception: Institutional facilities with less than 30 occupants may have corridors not less than 6' in width and doors 42" in width. Corridors and ramps in adjunct areas not intended for the housing, treatment or use of inpatients, may be a minimum of 6' in clear and unobstructed width.

- (b) All Institutional Occupancies shall have smoke partitions to divide into at least two compartments every story used by inpatients for sleeping and/or treatment, and any story having an occupant load of 50 or more persons, and to limit on any story the maximum area of each smoke compartment to not more than 22,500 square feet, of which neither the length or width shall not be more than 150 feet. At least 30 net square feet per occupant for the total of bed or litter patients shall be provided on each side of the smoke partition, and on stories not housing bed or litter patients at least six (6) square feet per occupant in adjoining compartments.
- (c) Smoke partitions shall be constructed of noncombustible construction of at least one hour fire resistance rating, except that in Type V and Type VI construction the partitions may be of combustible construction of one hour fire resistance. The partitions shall form an effective membrane continuous from outside wall to outside wall and from floor slab to floor/roof slab/deck thereby including continuity through all concealed spaces, such as those found, above suspended ceilings, and including interstitial structural and mechanical spaces. Transfer grilles, whether equipped with fusible link-operated dampers or not, shall not be used in these partitions.
- (d) Smoke partitions shall have openings in the corridors only. Corridor doors shall be a pair of swinging type doors, each swinging in opposite direction from each other, and the minimum width of each door shall be 44". Doors shall have a fire resistance rating of 20 minutes, shall have vision panels of ¼" labeled wire glass mounted in steel frames, and the glass area shall be limited to 720 square inches in each door. The doors shall close the opening with only the clearance necessary for proper operation under self-closing, and shall be without undercuts, louvres or grilles, babbets or bevels. Astragals are required at the meeting edges, and stops are required on the head and sides of the door frame. Positive latching hardware is not required, and center mullions are prohibited.
- (e) Corridor doors in smoke partitions shall be provided with door holding devices of the fail-safe type, which shall release the doors causing it to close upon the actuation of smoke detectors listed in accordance with ANSI/UL 268 as well as upon the application of a manual pull of not more than fifty (50) pounds against the hold-open device.
- (f) Every institutional sleeping room unless it has a door opening to the outside at ground level, shall have an exit access door leading directly to a corridor which leads to an exit. One adjacent room such as a sitting or anteroom may intervene if all doors along the path of exit travel are equipped with nonlockable hardware, except as provided in 1116.1(j), and this intervening room is not intended to serve more than 8 institutional sleeping beds.

Exception: Special nursing suites not exceeding 5,000 sq. feet providing for direct and constant visual supervision by nursing personnel shall be limited to 8 beds or bassinets.

- (g) Every institutional sleeping room shall have an outside window or outside door arranged and located so that it can be opened from the inside without the use of tools or keys to permit the venting of products of combustion and to permit any occupant to have direct access to fresh air in case of emergency. The maximum allowable sill height shall not exceed 36 inches above the floor.

Exception No. 1: The window sill in special nursing care areas may be 60 inches above the floor.

Exception No. 2: Rooms intended for occupancy of less than 24 hours, such as those housing obstetrical labor beds, recovery beds, observation beds in the emergency department and newborn nurseries, need not comply with this section.

## 1104.2 – SMOKEPROOF TOWERS REQUIRED

- (a) *General.* A smokeproof enclosure shall consist of a vestibule at each floor and continuous stairway enclosed from the highest point to the lowest point by walls of two-hour fire-resistive construction. The supporting frame shall be protected as set forth in Chapter VI.
- (b) *Where Required.* Where a floor of any story is located more than 60 feet above the average grade, one of the required exits shall be a smokeproof tower by natural ventilation except that office buildings may have a smokeproof enclosure by mechanical ventilation per [Section 1104.2\(h\)](#).
- (c) *Construction.* Stairs in smokeproof enclosures shall be of non-combustible construction.
- (d) *Outlet.* A smokeproof enclosure shall exit into a public way or into an exit passageway leading to a public way. The exit passageway shall be without other openings and shall have walls, floors, and ceiling of two-hour fire resistance.
- (e) *Barrier.* A stairway in a smokeproof enclosure shall not continue below the grade level unless an approved barrier is provided at the ground level to prevent persons from accidentally continuing into the [basement](#).
- (f) *Access.* Access to the stairway shall be by way of a vestibule or by way of an open exterior [balcony](#) of noncombustible materials.
- (g) *Smokeproof Enclosures by Natural Ventilation.*
  - (1) A smokeproof tower shall be a stairway enclosure so designed that the movement into the smokeproof tower of products of combustion, produced by a fire occurring in any part of the building, shall be limited.
  - (2) The appropriate design method shall be any system which meets the performance level stipulated in (1) above, or that given in (3) through (8) below.
  - (3) A smokeproof tower, as herein specified, shall be a continuous fire-resistive enclosure protecting a stairway from fire or smoke in the building served, with communication between the building and the tower by means of balconies directly open to the outer air.
  - (4) Stairs, enclosure walls, vestibules, balconies and other components of smokeproof towers shall be of noncombustible materials, and all other requirements herein before specified for inside stairs shall apply to stairs in smokeproof towers.
  - (5) Stairways shall be completely enclosed by walls having a 2-hour fire resistance rating and comprised of noncombustible material. There shall be no openings in walls separating the enclosure from the interior of the building. Fixed or automatic fire windows are permitted in an exterior wall not subject to severe fire exposure hazard from the same or nearby buildings.

- (6) Access to the smokeproof tower shall be provided from every story through vestibules open to the outside on an exterior wall or from balconies overhanging an exterior wall, but not subject to severe fire exposure hazard. Every such vestibule, balcony or landing shall have an unobstructed length and width not less than the required width of exit doors serving same and shall be directly open to a street or alley or yard or to an enclosed court open at the top not less than 20 feet in width and 1,000 square feet in area. Balconies or vestibules shall have guards not less than 42 inches high. Wall openings exposing balconies or vestibules shall be protected in accordance with 1108.2.
- (7) Access from a building to vestibules or balconies shall be through doorways not less than 40 inches wide. These openings and the entrances to the towers shall be provided with approved, self-closing fire doors swinging with the exit travel. Clear wired glass not exceeding 720 square inches may be provided in all doors giving access to the enclosure.
- (8) The level of a vestibule or balcony floor shall be placed no more than 8 inches below the floor level of each story where climatic conditions involve the possibility of blocking doors by snow or ice. In mild climates in which this hazard is not presented, the floor shall be approximately level. There shall be no step from the vestibule or balcony into the stair enclosure.

(h) *Smokeproof Enclosures by Mechanical Ventilation.*

- (1) *Doors.* The door from the building into the vestibule shall have a one and one-half hour fire-resistive rating and have closing devices as specified in Section 1116.1(e).

The door from the vestibule to the stairway shall be as required by Section 703.4. Wire glass, if provided, shall not exceed 100 square inches in area and shall be set in a steel frame. The door shall be provided with a drop sill or other provision to minimize air leakage.

- (2) *Vestibule size.* The vestibule shall have a minimum dimension of 44 inches in width and 72 inches in direction of exit travel.
- (3) *Vestibule ventilation.* The vestibule shall be provided with not less than one air change per minute and the exhaust shall be 150 percent of the supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but no more than 6 inches down from the top of the trap and shall be entirely within the smoke trap area. Doors, when in the open position, shall not obstruct duct openings. Duct openings may be provided with controlling dampers if needed, to meet the design requirements but are not otherwise required.

NOTE: For buildings where such air changes would result in excessively large duct and blower requirements, a specially engineered system may be used. Such an engineered system shall provide 2500 cfm exhaust from a vestibule when in emergency operation and shall be sized to handle three vestibules simultaneously and the smoke detector located outside each vestibule shall release to open the supply and exhaust duct dampers in that affected vestibule.

- (4) *Smoke trap.* The vestibule ceiling shall be at least 20 inches higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward moving air column.
- (5) *Stair shaft air movement system.* The stair shaft shall be provided with mechanical supply and exhaust air. There shall be a minimum of 2500 cfm discharge at the top of the shaft. The supply shall be sufficient to provide a minimum of 0.05-inch of water column with respect to atmospheric pressure with all doors closed and a minimum of 0.10-inch water column difference between the stair shaft and the vestibule.
- (6) *Exit doors.* The exit doors into the vestibule and into the stair shaft shall be kept closed or if deemed necessary to be kept open, they shall close automatically when released by activation of a detector meeting the requirements of [Section 1116.1\(e\)](#). The door holding devices shall be of an approved type which will release the doors so that they will close in the event of a power failure.
- (7) *Operation of ventilation equipment.* Vestibule and stair shaft mechanical ventilation may be inactive or may operate at reduced levels for normal operations as approved by the Building Official; but when the detectors referred to in paragraph 6 either fail or are activated, the mechanical equipment shall operate at the levels specified in paragraphs 3 and 5.
- (8) *Standby power.* Mechanical ventilation equipment shall be served by an approved self-contained generator set to operate whenever there is a loss of power in the normal house current. The generator shall be in a separate room having a minimum one-hour fire-resistive occupancy separation and shall have a minimum fuel supply adequate to operate the equipment for two hours.
- (9) *Acceptance and testing.* Before the mechanical equipment is accepted by the Building Official, it shall be tested in his presence to confirm that the mechanical equipment is operating in compliance with these requirements.
- (10) *Emergency lighting.* The stair shaft and the vestibule shall be provided with emergency lighting. The standby generator which is installed for the smoke-proof enclosure mechanical ventilation equipment may be used for standby emergency lighting power supply.
- (11) *Air-conditioned buildings.* In buildings with air conditioning systems or pressure air supply, serving more than one story, a smoke detector shall be placed in the return air prior to exhausting from the building or being diluted by outside air. Upon activation the detector shall cause the return air to exhaust completely from the building without any recirculation through the building. Such devices may be installed in each room or space served by a return air duct.
- (12) Mechanical elements of air supply, exhaust, and power supply shall be separate from any other system in accordance with [1104.2\(h\) \(3\)](#) above.

**1104.3 – BOILER, INCINERATOR, FURNACE ROOMS, ETC.**

Two (2) exits shall be provided from all boiler, incinerator and furnace rooms that exceed five hundred (500) square feet in area, and the largest installed piece of fuel-fired equipment exceeds 400,000 BTU input capacity. When two (2) exits are required, one may be a fixed ladder. Exits must be separated by horizontal dimensions of the room. The distance of travel to an exit shall not exceed fifty (50) feet.

**1104.4 – COVERED MALLS**

- (a) One half of the required unit of exit width for buildings connected by a covered mall shall lead to the outside by means other than through the mall. The covered mall connecting buildings shall have not less than two (2) independent exits located as remotely as practical from each other and shall have a total number of units of exit width equal to that required for the exits from the buildings which are within a 100 foot travel distance to the exit from the mall plus that required for 1 person per foot of mall width. The maximum distance of travel to an exit measured within the mall shall not exceed 200 feet. In order to provide free and unencumbered travel in the mall to the outside, each side of the mall floor area shall be provided with an unobstructed space, not less than 10 feet in width, parallel to the building lines and extending to the exit from the mall.
- (b) Enclosed and tunneled walkways shall not be accepted as a required means of egress unless they comply with the provisions of this chapter. When the length of enclosed or tunneled walkways not meeting the provisions of this chapter for required exits, is more than one and one-half (1½) times the maximum allowable distance of travel of the most restrictive occupancy being connected, one or more exits from the enclosed or tunneled walkway shall be provided. Such exits shall be located as remotely from the points of connection between the enclosed or tunneled walkway and the building as is practicable.
- (c) See also Sec. 507

**1104.5 – STAIRS AND CORRIDORS NOT TO BE USED AS RETURN AIR PLENUM – GROUP R, E, I AND A**

- (a) Stairways and required Exit corridors in Group E and A occupancies shall not be used as return air plenums when corridor serves more than 100 people. They shall not be used in Group R occupancies when the corridor exceeds 75 ft. in length. They shall not be used in Group I occupancies where corridor serves more than 15 people.
- (b) Except in institutional, educational, or residential occupancies, [Paragraph 1104.5\(a\)](#) may be waived by the authority having jurisdiction providing corridors are equipped with approved smoke detectors arranged to automatically stop supply, return and exhaust fans and close louvres or other devices mounted within the corridor doors or partitions.



**1104.6 – SPECIAL PROVISIONS FOR EDUCATIONAL OCCUPANCIES**

- (a) Interior Corridors (except as provided in 1104.7). Every interior corridor shall be at least 6' in width and be of construction having not less than 1-hour fire resistance rating, and all openings therein protected accordingly. Room doors may be 1¾-inch solid bonded core wood doors or the equivalent. Such corridor protection shall not be required when all classrooms served by such corridors have at least one door directly to the outside or to an exterior balcony or corridor. Such ways of egress to be so arranged in reference to rooms that in case of fire on one stairway, the other stairway can be reached by the occupant without his or her having to pass the stairway involved.
- (b) Any interior corridor more than 300 feet in length shall be divided into sections not to exceed 300 feet in length by smoke partitions installed in accordance with Section 1104.1(b) (c) (d) (e).
- (c) Windows for Rescue and Ventilation.

Except in buildings with complete sprinkler protection, every room or space used for classroom or other educational purposes or normally subject to student occupancy, unless it has a door leading directly to the outside of building, shall have at least one outside window which can readily be used for emergency rescue or ventilation purposes, and which meets all of the following provisions:

- (1) Is readily openable from the inside without the use of tools.
- (2) Provides a clear opening with a minimum dimension of approximately 24 inches and is approximately 5.7 square feet in area.
- (3) Bottom of window opening is not more than 32 inches above the floor.
- (4) Where storm windows, screens, or burglar guards are used, these shall be provided with quick opening devices so that they may be readily opened from the inside for emergency egress and shall be so arranged that when opened they will not drop to the ground.

NOTE: This section does not apply when all windowless classrooms open directly to an Exit corridor and have access (through an adjoining classroom) to an Exit corridor which is separated by 1-hour rated construction from the Exit corridor used as the primary Exit.

**1104.7 – SPECIAL PROVISIONS FOR FLEXIBLE PLAN AND OPEN PLAN EDUCATIONAL BUILDINGS**

- (a) Flexible plan and open plan education buildings include every building or portion of a building not having corridors which comply with 1104.6(a) and are designed for multiple teaching stations.
- (1) Flexible plan buildings have movable corridor walls and movable partitions of full height construction with doors leading from rooms to corridors.  
Flexible plan buildings without exit access doors between rooms and corridors shall be classified as open plan buildings.
  - (2) Open plan buildings have rooms and corridors delineated by use of tables, chairs, desks, bookcases, counters, low height (5 feet) partitions, or similar furnishings.

## MEANS OF EGRESS

- (b) Common Atmosphere. A common atmosphere exists between rooms, spaces or areas within a building, which are not separated by an approved smoke partition.
- (c) Separate Atmospheric. A separate atmosphere exists between rooms, spaces or areas, that are separated by an approved smoke partition.
- (d) Smoke Partition. For purposes of this Section, smoke partitions shall also include floors and openings therein.
- (e) Room. For the purposes of this Section, a room is a space or area bounded by any obstructions to egress which at any time enclose more than 80 percent of the perimeter of the space or area. Openings of less than 3 feet clear width and less than 6 feet 8 inches high shall not be considered in computing the unobstructed perimeter.
- (f) Interior Room. A room whose only means of egress is through an adjoining or intervening room which is not an exit.
- (g) Separate Means of Egress. A means of egress separated in such a manner from other required means of egress as to provide an atmospheric separation which precludes contamination of both means of egress by the same fire.
- (h) Area Limitations and Separations.
  - (1) Flexible plan and open plan buildings shall not exceed 30,000 square feet in undivided area. A solid wall or smoke partition shall be provided at maximum intervals of 300 feet and openings in such walls or partitions shall comply with 1104.6(b).
  - (2) Vertical openings shall be enclosed as required by 1106.
  - (3) Stages in places of assembly shall be separated from school areas by construction of noncombustible materials having at least a 2-hour fire resistance rating.
  - (4) Shops, laboratories, and similar vocational rooms, as well as storage rooms, shall be separated from other school areas by construction having at least a 1-hour fire resistance rating. They shall have exits independent from other areas.
- (i) General Provisions. The specific requirements of this section are not intended to prevent the design or use of other systems, equipment or techniques which will effectively prevent the products of combustion from breaching the atmospheric separation.
- (j) The provisions of this subsection shall apply only to the requirements for providing separate atmospheres. The fire-resistance requirements shall comply with other provisions of the Code.
  - (1) Walls, partitions and floors forming all of or part of an atmospheric separation shall be of materials consistent with the requirements for the type of construction, but of construction not less effective than a smoke partition. Glass lights of approved wired glass set in steel frames may be installed in such walls or partitions.
  - (2) Every door opening therein shall be protected with a fire assembly as required elsewhere in the Code, but not less than a self-closing or automatic-closing, tight-fitting smoke assembly having a fire-protection rating of not less than 20 minutes.

- (3) Ducts penetrating atmospheric separation walls, partitions or floors, shall be equipped with an approved automatic-closing smoke damper when having openings into more than one atmosphere, or the atmosphere separation shall be maintained by an approved method of smoke control.
- (4) All automatic-closing fire assemblies installed in the atmospheric separation shall be activated by approved smoke detectors.
- (5) Janitor closets and storage rooms shall be enclosed by materials having one-hour fire resistance.

Exception: Doors to janitor closets may have ventilating louvres.

(k) Means of Egress.

- (1) Each room occupied by more than 300 persons shall have one of its exit accesses through a separate means of egress. Where three or more means of egress are required, not more than two of them shall enter into the same means of egress.
- (2) Means of egress from interior rooms may pass through an adjoining or an intervening room, provided that the travel distances do not exceed those set forth in [Section 1103.1](#).

Foyers and lobbies constructed as required for corridors shall not be construed as intervening rooms.

Where the only means of egress from a room is through an adjoining or intervening room, smoke detectors shall be installed in the area of the common atmosphere through which the means of egress must pass. The detectors shall actuate alarms audible in the interior room and shall be connected to the school fire alarm system.

Exceptions:

- 1: Where the aggregate occupant load of the interior room or rooms is less than 10.
- 2: Where enclosures forming interior rooms are less than 2/3 of the floor to ceiling height and do not exceed 8 feet.
- 3: Interior rooms used exclusively for mechanical and public utility service to the buildings.

- (l) Travel Distance to Exits. No point in a building shall be more than 150 feet from an exit, measured in accordance with [1103.3](#).

Exception: An increase in the above travel distance to 200 feet shall be permitted in a building fully protected by either an automatic fire extinguishing system or by an automatic smoke detection system.

## **1104.8 – UNDERGROUND STRUCTURES AND WINDOWLESS BUILDINGS**

(a) General

- (1) Any fire area subject to occupancy by 100 or more persons, from which there is no direct access to outdoors or to another fire area and no outside light or ventilation through windows, shall be equipped with complete automatic sprinkler protection.

- (2) Any underground structure, building, or floor area lacking direct outside access or windows and having combustible contents, interior finish, or construction, if subject to occupancy by more than 1,000 persons shall have automatic smoke venting facilities in accordance with NFPA #204 in addition to automatic sprinkler protection.
- (3) Any underground structure or windowless building for which no natural lighting is provided, subject to occupancy by more than 100 persons in any room or fire area, shall be provided with emergency lighting in accordance with [Section 1123.4](#).

(b) Underground Structures

Where required exits from underground structures involve upward travel, such as ascending stairs or ramps, such upward exits shall be cut off from main floor areas and shall be provided with outside smoke venting facilities or other means to prevent the exits serving as flues for smoke from any fire in the area served by the exits, thereby making the exits impassable.

(c) Windowless Buildings.

Every windowless building shall be provided with outside access panels on each floor level, designed for fire department access from ladders for purposes of ventilation and rescue of trapped occupants. (See [Section 506.5](#) for High Rise Buildings).

**1104.9 – SMOKE VENTING FOR WINDOWLESS AND UNDERGROUND STRUCTURE**

- (a) Smoke venting facilities where required for safe use of exits in windowless buildings, underground structures, and large area factories shall be automatic in operation and in conformance with NFPA #204.
- (b) Natural draft smoke venting shall utilize roof vents or vents in walls at or near the ceiling level, such vents to be normally open or if closed shall be designed for automatic opening by approved means in case of fire.
- (c) Where smoke venting facilities are installed for purposes of exit safety in accordance with the requirements of this Code they shall be adequate to prevent dangerous accumulations of smoke during the period of time necessary to evacuate the area served, using available exit facilities with a margin of safety to allow for unforeseen contingencies. (Compliance with NFPA #204 will meet this requirement)
- (d) The discharge apertures of all natural draft smoke vents shall be so arranged as to be readily susceptible to opening by fire departments working from the exterior.
- (e) A power-operated smoke exhausting system may be substituted for required natural draft vents only by specific permission of the authority having jurisdiction.

**1104.10 – SPECIAL EXIT REQUIREMENT FOR RESIDENTIAL OCCUPANCIES**

(a) Interior Corridors shall meet the following requirements:

- (1) Every corridor leading to an exit and exit stairways from guest rooms in hotels and motels and from [apartments](#) shall be of construction having not less than one hour fire resistance rating and all openings therein protected with 1¾-inch solid bonded core wood doors or equivalent doors having a fire rating of 20 minutes.

- (2) Doors between such rooms and corridors shall be self-closing, except in sprinklered buildings.
- (3) Openings in corridor partitions other than door openings shall be protected.
- (b) Exterior corridors serving as access to exits shall meet the requirements of [1108.1](#) and be installed on the outside of the building.

## **SECTION 1105 MEANS OF EGRESS CAPACITY REQUIREMENTS**

### **1105.1 – OCCUPANT CONTENT**

- (a) For determining the exits required, the minimum number of persons or the occupant content of any floor area shall in no case be taken less than specified below:

MEANS OF EGRESS

Occupancy	Minimum Occupant Content Floor Area per Person*
<b>ASSEMBLY</b>	
Concentrated Use (without fixed seats) Includes among others: Auditoriums, Churches, Dance Floors, Lodge Rooms, Reviewing Stands, Stadiums	7 sq. ft. Net
Less Concentrated Use  Includes among others:  Restaurants (over 100 persons), Conference and Dining Rooms, Drinking Establishments, Exhibit Rooms, Gymnasiums, Lounges, Skating Rinks	15 sq. ft. Net
Fixed seats	Count the seats
Standing	3 sq. ft. Net
<b>BUSINESS</b>	
Office Buildings, Banks, Undertaking, Parlors and other business occupancies	100 sq. ft. Gross
Bowling Alleys – 5 persons for each alley (to include 15 feet of runway)	
Viewing Areas (without fixed seats)	7 sq. ft. Net
Libraries (Other than School)	
Reading Room	50 sq. ft. Net
Stack Area	100 sq. ft. Gross
<b>EDUCATIONAL</b>	
Schools – Classrooms and Recreation	20 sf. Ft. Net
Laboratories, Museums, Libraries, Shops, Vocational and similar occupancies	50 sq. ft. Net
Gymnasiums	15 sq. ft. Net
<b>HAZARDOUS</b>	100 sq. ft. Gross
<b>INDUSTRIAL</b>	100 sq. ft. Gross
<b>INSTITUTIONAL</b>	
Sleeping Area	120 sq. ft. Gross
In-Patient Area	240 sq. ft. Gross
Treatment and Out-Patient Area	100 sq. ft. Gross
<b>MERCANTILE</b>	
Stores – Street floor and sales <a href="#">basement</a>	30 sq. ft. Net
Stories – Upper sales floor	60 sq. ft. Net
Restaurants (Less than 100 persons – without stage – no entertainment or dancing)	15 sq. ft. Net
<b>RESIDENTIAL</b>	200 sq. ft. Gross
<b>STORAGE</b>	300 sq. ft. Gross
<b>MECHANICAL EQUIPMENT ROOM</b>	300 . ft. Gross

\* The occupant content of floor areas of the building shall be computed on the basis of the specific occupancy classification of the building. Where mixed occupancies occur, the occupant content of each occupancy area shall be computed on the basis of that specific occupancy.

- (b) Seating Capacity Posted. When required by the Building Official, signs stating the maximum seating capacity determined in accordance with occupant content specified in [Section 1105.1](#) shall be conspicuously posted by the owner of the building in each assembly room, auditorium or room used for a similar purpose where fixed seats are not installed. It shall be unlawful to remove or deface such notice or to permit more than this legal number of people within such space.

**1105.2 – MEASUREMENT OF MEANS OF EGRESS WIDTH**

- (a) The width of the means of egress shall be measured in units of 22 inches. Fractions of a unit shall not be counted except that 12 inches added to one or more full units shall be counted as one-half a unit.
- (b) The width shall be measured in the clear at its narrowest point. Handrails may project 3½ inches and door jambs 1 inch on each side of the measured width.

**1105.3 – CAPACITY OF MEANS OF EGRESS**

- (a) The capacity or number of persons per unit (22 inches) of means of egress through doors, corridors, stairs and other paths of exit travel shall be in accordance with Table 1105.3:

TABLE 1105.3

OCCUPANCY	Person Per Unit (22 inches) of Exit Width	
	Level Travel (Corridors, doors, ramps, etc.)	Stairs
Residential	60	45
Business	100	60
Educational	100	60
Institutional	30	22
Mercantile	100	60
Assembly	100	75
Storage	60	45
Industrial	100	60
Hazardous	60	45

- (b) The minimum aggregate width of main entrance doorways for Assembly occupancies shall be sufficient to accommodate 50 percent of the occupant content but in no case less than 36 inches. Main entrance doorways shall be considered as part of the requirements for the means of egress.
- (c) The capacity of exit stairways constructed in accordance with [Section 1115](#) shall not exceed the limits specified herein and may be used as a required exit from all floors which they serve. If, for example, three (3) stairways are required to serve the third floor of a building and a like number are required for the second floor, the total number of stairways required shall be three, not six, and the capacity of the stairway shall be determined by the floor having the highest occupant content and not the total occupant content of the building.

(d) The aggregate width of passageways, aisles or corridors serving as access to exits shall be at least equal to the required width of the exit. Where all travel to any exit is along the same access to the exit, the width of the access shall be at least equal to the exit; where there are several accesses to an exit each shall have a width suitable for the travel which it may be called on to accommodate.

(e) The minimum width of any means of egress shall be 36" in width.

Exception: Residential, Business, Storage, Industrial, Hazardous and Mercantile Occupancies (where less than thirty people are accommodated) the minimum shall be 30 inches. (See Section 1104 for special requirements.)

(f) Where exits serve more than one floor, only the occupant content of each floor, considered individually, need be used in computing the required capacity of the exits at that floor; provided that such capacity shall not be decreased at any point along the exit facility in the direction of exit travel. When exits from floors above and below converge at an intermediate floor, the capacity of the exit from such intermediate floor shall not be less than the sum of the widths of the exits converging on such intermediate floor. There shall be no reduction in the capacity of the exits along the means of egress from the building.

(g) In the case of a stairway, the exit includes the door to the stairway enclosure, stairs and landings inside the enclosure, the door from the stairway enclosure to the street or open air, or any passageway and door necessary to provide a path of travel from the stairway enclosure to the street or open air. In case of a door leading directly from the street floor to the street or open air, the exit comprises only the doorway.

NOTE: Doors of small individual rooms, as in hotels, while constituting means of escape from the room, are not referred to as exits except when they lead directly to the outside of the building or other place of safety, but in a large room, such as a school auditorium, the doors constitute an integral part of the exit system and are referred to as exits from the room. An interior aisle, corridor or hallway used to reach a stair or door exit is not an exit except where it is so located, arranged, and enclosed as to constitute an integral part of a system of travel.

#### **1105.4 – CAPACITY OF ESCALATORS OR MOVING STAIRS**

The width and exit capacity of escalators complying with the requirements of [Section 1121](#) shall be as specified for stairways except that the maximum width of escalator shall not exceed 48 inches.

### **SECTION 1106 EXIT ENCLOSURES**

#### **1106.1 – STAIRWAY ENCLOSURES**

(a) In all buildings, four (4) stories or more in height, and except in those occupied by forty (40) people or less above or below the story at street level, all interior stairways including platforms, landings and hallways connecting them to the doorway leading to the outside, shall be completely enclosed with partitions of not less than 2-hour fire-resistance. Structural members supporting all such enclosing walls and partitions, and floors or roofs that form a part of the enclosure shall have at least 2-hour fire resistance also.



- (b) In all buildings not over three (3) stories in height, all interior stairways shall be enclosed in partitions of at least one-hour fire resistance.

Private interior stairways located within a dwelling unit need not be enclosed.

- (c) In Assembly occupancies, all exit enclosures shall be not less than 2-hour fire-resistance.
- (d) Stairways in buildings classified as Industrial occupancies that are not required for exits and that serve only one floor above the first floor may not be required to be enclosed, provided the occupancy of the building is of low fire hazard and provided the omission of such stair enclosure is approved by the Building Official.
- (e) **Basement** or cellar stairs: **Basement** or cellar stairways located under stairways from upper stories shall be completely enclosed by construction providing fire resistance not less than required for the stair enclosure above the **basement** but in no case less than 1-hour fire resistance.
- (f) In stair enclosure walls or partitions protecting the stair from the interior of the building, no openings except the necessary doorways shall be permitted. Fire windows of the fixed or automatic closing type may be installed in stair enclosures provided they open to the exterior of the building and are located at least ten (10) feet from any other wall opening.

Doorways to the interior of the building shall be equipped with approved fire assemblies having a 1-hour (B) classification where 1-hour walls are involved and 1½-hour (B) assemblies where 2-hour construction is provided. Such doors are to be self-closing and are to be maintained. See [Section 1116.1\(e\)](#).

### **1106.2 – ALL VERTICAL OPENINGS TO BE ENCLOSED**

- (a) Every stairway, escalator, elevator shaft, light and ventilation shaft, chute and other opening between stories shall be enclosed or protected to prevent the spread of fire or smoke.

Exception: Where unenclosed openings are specifically permitted by [1106.3](#) and [1106.4](#) and [1107](#) or by other sections of this Code by reason of automatic sprinkler protection or other special features.

### **1106.3 – EXCEPTIONS ON EXIT ENCLOSURES**

- (a) In any Office or Industrial building with light hazard occupancy or Storage or Industrial building with ordinary hazard occupancy with automatic sprinkler protection, up to 3 communicating floor levels are permitted without enclosure protection between floors, provided all the following conditions are met:
- (1) The arrangement is permitted by the applicable occupancy section of this Code and by the authority having jurisdiction.
  - (2) The lowest or next to the lowest level is a street floor.
  - (3) The entire area including all communicating floor levels is sufficiently open and unobstructed so that it may be assumed that a fire or other dangerous condition in any part will be immediately obvious to the occupants of all communicating levels and areas.

## MEANS OF EGRESS

- (4) Exit capacity is sufficient to provide simultaneously for all the occupants of all communicating levels and areas, all communicating levels in the same fire area being considered as a single floor area for purposes of determination of required exit capacity.
  - (5) Each floor level, considered separately, has at least one-half of its individual required exit capacity provided by an exit or exits leading directly out of that area without traversing another communicating floor level or being exposed to the spread of fire or smoke therefrom.
  - (6) All requirements of this Code with respect to interior finish, protection of hazards, construction and other features are fully observed without waivers.
  - (7) The building is of Type I, II or IV Construction unless the building is sprinklered.
  - (8) These unprotected stairs cannot be used as exits from other areas which do not conform with [1106.3\(a\)\(3\)](#) above. (For example, the lowest three levels of stairs which are required exits for a six story building cannot be open.) (See [Section 1112](#) for Exit Outlets.)
- (b) Exceptions for Mercantile occupancies.
- (1) In any store, openings may be unprotected between any 2 floors, such as open stairs or escalators between street floor and [basement](#), or open stairs to second floor or balconies or mezzanines above the street floor level (not both to [basement](#) and above unless sprinklered). (See [1112](#) for Exit Outlets).
  - (2) In any Mercantile store with automatic sprinklers, openings may be unprotected between [basement](#) and street floor and between street floor and second floor, or if no openings to [basement](#), between street floor, street floor [balcony](#), or mezzanine, and second floor, but not more than between 3 floor levels.
- (c) Openings in floors of educational and institutional occupancies shall be enclosed.

### 1106.4 – SPECIAL PROVISIONS FOR ESCALATOR OPENINGS

- (a) Any escalator serving as a required exit shall be enclosed in the same manner as exit stairs.

NOTE: [Section 1121](#) includes provisions on the use of escalators as exits in various occupancies. They are not recognized as required exits in educational and institutional occupancies, residential occupancies other than hotels, or storage occupancies. Escalators as commonly installed in most occupancies are not so arranged and protected as to qualify as required exits. However, in mercantile occupancies where open stairs to second floor or [basement](#) are permitted under specified conditions, open escalators may serve on the same basis as open stairways to provide a path of travel to reach an outside exit.

- (b) An escalator not constituting an exit shall have its floor opening enclosed or protected as required for other vertical openings.

Exception: In lieu of such protection, in buildings completely protected by a standard supervised sprinkler system, escalator openings may be protected by any one of the methods as described in [1106.4\(c\)](#) through [\(f\)](#), or by the method prescribed by the appropriate NFPA standard.

(c) Sprinkler-Vent Method

- (1) Under the conditions specified in [1106.3](#), escalator openings may be protected by the "sprinkler-vent" method, consisting of a combination of an automatic fire or smoke detection system, automatic exhaust system and an automatic water curtain meeting the following requirements and of a design meeting the approval of the authority having jurisdiction.
- (2) The exhaust system shall be of such capacity as to create a downdraft through the escalator floor opening. The downdraft shall have an average velocity of not less than 300 feet per minute under normal conditions for a period of not less than 30 minutes.
- (3) Operation of the exhaust system for any floor opening shall be initiated by an approved device in the story involved and shall be by any one of the following means in addition to a manual means for operating and testing the system:
  - (a) Thermostats – fixed temperature, rate-of-rise, or a combination of both.
  - (b) Water flow in the sprinkler system.
  - (c) Approved supervised smoke detection. Smoke detection devices, if used, shall be so located that the presence of smoke is detected before it enters the stairway.
- (4) Electric power supply to all parts of the exhaust system and its control devices shall be designed and installed for maximum reliability.
- (5) Any fan or duct used in connection with an automatic exhaust system shall be of the approved type and shall be installed in accordance with the applicable standards listed in [Appendix B](#).
- (6) Periodic tests, not less frequently than quarterly, shall be made of the automatic exhaust system to maintain the system and the control devices in good working condition.
- (7) The water curtain shall be formed by open sprinklers or spray nozzles so located and spaced as to form a complete and continuous barrier along all exposed sides of the floor opening and reaching from the ceiling to the floor. Water intensity for water curtain shall be not less than approximately 3 gallons per minute per lineal foot of water curtain, measured horizontally around the opening.
- (8) The water curtain shall operate automatically from thermal responsive elements of fixed temperature type so placed with respect to the ceiling (floor) opening that the water curtain comes into action upon the advance of heat toward the escalator opening.
- (9) Every automatic exhaust system, including all motors, controls and automatic water curtain systems, shall be supervised in an approved manner, similar to that specified for automatic sprinkler system supervision.

(d) Spray Nozzle Method

- (1) Escalator openings may be protected by the spray nozzle method, consisting of a combination of an automatic fire or smoke detection system and a system of high velocity water spray nozzles meeting the following requirements and of a design meeting the approval of the authority having jurisdiction.

- (2) Spray nozzles shall be of the open type and shall have a solid conical spray pattern with discharge angles between 45 and 90 degrees. The number of nozzles, their discharge angles and their location shall be such that the escalator opening between the top of the wellway housing and the treadway will be completely filled with dense spray on operation of the system.
  - (3) The number and size of nozzles and water supply shall be sufficient to deliver a discharge of 2 gallons of water per square foot per minute through the wellway, area to be figured perpendicular to treadway.
  - (4) Spray nozzles shall be so located as to effectively utilize the full advantage of the cooling and counterdraft effect. They shall be so positioned that the center line of spray discharge is as closely as possible in line with the slope of the escalator; not more than an angle of 30 degrees with the top slope of the wellway housing. Nozzles shall be positioned, also, so that the center line of discharge is at an angle of not more than 30 degrees from the vertical sides of the wellway housing.
  - (5) Spray nozzles shall discharge at a minimum pressure of at least 25 pounds per square inch. Water supply piping may be taken from the sprinkler system, provided that in so doing an adequate supply of water will be available for the spray nozzles and the water pressure at the sprinkler farthest from the supply riser is not reduced beyond the required minimum.
  - (6) Control valves shall be readily accessible to minimize water damage.
  - (7) A noncombustible draft curtain shall be provided extending at least 20 inches below and around the opening and a solid noncombustible well way housing at least 5 feet long measured parallel to the handrail, and extending from the top of the handrail enclosure to the soffit of the stairway or ceiling above, at each escalator floor opening. When necessary, spray nozzles shall be protected against mechanical injury or tampering that might interfere with proper discharge.
  - (8) The spray nozzle system shall operate automatically from thermal response elements of the fixed temperature type, so placed with respect to the ceiling (floor) opening that the spray nozzle system comes into action upon the advance of heat towards the escalator opening. Supervised smoke detection located in or near the escalator opening may be used to sound an alarm. The spray nozzle system shall also be provided with manual means of operation.
  - (9) Control valves for the spray nozzle system, and approved smoke detection or thermastatic devices shall be supervised.
- (e) Rolling Shutter Method
- (1) Under the conditions specified in [1106.4\(a\)](#), escalator openings above the street floor only may be protected by the rolling shutter method, consisting of an automatic self-closing rolling shutter which completely encloses the top of each escalator, meets the following requirements, and the design of which meets the approval of the authority having jurisdiction.

- (2) The shutter shall close off the wellway opening immediately upon the automatic detection, by an approved heat-actuated or smoke-sensitive device, of fire or smoke in the vicinity of the escalator. In addition, there shall be provided a manual means of operating and testing the operation of the shutter.
  - (3) The shutter assembly shall be capable of supporting a weight of 200 pounds applied on any one square foot of area and shall be not less resistant to fire or heat than 24 gage steel.
  - (4) The shutter shall operate at a speed of not greater than 30 feet per minute. It shall be equipped with a sensitive leading edge, which shall arrest the progress of the moving shutter and cause it to retract a distance of approximately 6 inches upon the application of a force not in excess of 20 pounds applied on the surface of the leading edge. The shutter, following retraction, shall continue to close immediately.
  - (5) Automatic rolling shutters shall be provided with an electric contact which will disconnect the power supply from the escalator and apply the brakes as soon as the shutter starts to close and will prevent further operation of the escalator until the escalator is again in the open position.
  - (6) The electrical supply to the control devices for actuation of the automatic rolling shutter shall be so designed and installed as to provide maximum reliability.
  - (7) Rolling shutters shall be operated at least once a week in order to make sure that they remain in proper operating condition.
- (f) Partial Enclosure Method
- (1) Under the conditions specified in 1106.4(a), escalator openings may be protected by a partial enclosure, or so-called kiosk, so designed as to provide an effective barrier to the spread of smoke from floor to floor.
  - (2) Partial enclosures shall be of construction providing fire resistance equivalent to that specified for stairway enclosures in the same building, with openings therein protected by approved self-closing fire doors or may be of approved wired glass and metal frame construction with wired-glass panel doors. Such doors may be equipped with electric opening mechanism to open the door automatically upon the approach of a person. However, the mechanism shall be such as to return the door to its closed position upon any interruption of electric current supply, and the adjustment shall be such that the pressure of smoke will not cause opening of the door.

### **SECTION 1107 MONUMENTAL STAIRS**

No enclosure shall be required for a flight of “monumental” stairs (as used in public buildings, stores, hotels, office buildings, etc.) from the main street entrance floor to the floor next above or floor next below or for stairs leading to a mezzanine or balcony from the main floor when:

- (a) Such stairs are not a required part of the building exit facilities, and
- (b) Such stairs are not connected with corridors providing access to exits. Required Exit Corridors connecting with such stairs at the upper level must be separated by one hour partitions.

**SECTION 1108 OUTSIDE STAIRS AND EXTERIOR BALCONIES****1108.1 – GENERAL**

- (a) Any permanently installed stair outside of the building served is acceptable in a means of egress under the same condition as an inside stair, provided that such stairs comply with the requirements herein before stated for inside stairs, except as modified by the following paragraphs of this Section.
- (b) For stairs more than 3 stories in height guard rails shall be at least 4 feet in height around balconies and landings.
- (c) Subject to the approval of the authority having jurisdiction, outside stairs may be accepted where leading to roofs of other sections of the building or adjoining building, where the construction is fire resistive, where there is a continuous and safe means of exit from the roof, and all other reasonable requirements for life safety are maintained.

**1108.2 – ENCLOSURES**

- (a) Under all conditions where enclosure of inside stairways is required, outside stairs shall be separated from the interior of the building by fire-resistive walls the same as required for inside stairway enclosures with fire doors or fixed wired glass windows protecting any openings therein. In buildings three stories or less in height, such protection need not be required where there is provided a remote second exit.

If 4 stories or more in height openings shall be protected as follows:

- (1) Horizontally. If within 15 feet of any **balcony** , platform, or stairway, constituting a part of the exit. This provision does not apply to a platform or walkway leading from the same floor to the exit. Protection need not extend around a right-angle corner (outside angle 270 degrees) of the building if there is more than one exit.
  - (2) Below. If within 3 stories or 35 feet of any **balcony** , platform, walkway, or stairway constituting a part of the exit, or within 2 stories or 20 feet of a platform or walkway leading from any story to the exit.
  - (3) Above. If within 10 feet of any **balcony** , platform, or walkway as measured vertically, or from any stair treads as measured vertically from the face of the outside riser.
  - (4) Top story. Protection for wall openings in the top story shall not be required where stairs do not lead to the roof.
- (b) All openings below shall be protected, where a stairway is located in a court the least dimension of which is less than one-third its height, or in an alcove having a width less than one-third its height and a depth greater than one-fourth its height.
  - (c) Outside stairs in climates subject to snow and ice shall be protected to prevent accumulation of snow or ice, except in the case of main entrance stairs providing the principal access to a building where it may be assumed that normal use of the building will require removal of snow and ice as a necessary condition for the entrance of occupants. Balconies, to which access doors lead, shall be approximately level with the floor of the building or, in climates where balconies may be subject to accumulation of snow or ice, one step, no more than 8 inches below the level of the inside floor.

**1108.3 – STAIR DETAILS**

- (a) For outside stairs of monumental type, constructed of stone or concrete, the requirement for a nosing may be waived if treads are at least 11 inches wide.
- (b) Treads shall be solid.
- (c) Risers shall be solid or perforated, except that minimum of one inch lip turned up at back of each tread may be accepted.
- (d) Except where embedded in masonry or concrete or where a suitable fire-resistive and waterproof covering is provided, no structural metal member shall be employed the entire surface of which is not capable of being inspected and painted.
- (e) All supporting members for balconies and stairs, which are in tension and are fastened directly to the building, shall pass through the wall and be securely fastened on the opposite side, or they shall be securely fastened to the framework of the building. Metal members shall be protected effectively against corrosion, where they pass through walls.
- (f) **Balcony** and stair enclosures and railings shall be designed to resist horizontal force of 50 pounds per lineal foot of railing or enclosure, applied at the top of the railing or to the enclosure 42 inches above the floor or tread.

**1108.4 – EXTERIOR BALCONIES**

- (a) Any exterior **balcony**, porch, or gallery may serve as a means of egress if it complies with all the requirements as to width, arrangement and materials of construction that are specified in this Chapter for means of egress and provided they comply with the requirements of the following paragraphs of this section.
- (b) All porches, balconies, raised floor surfaces or landings located more than thirty (30) inches above the floor or grade below shall have guardrails not less than forty-two (42) inches in height, when story height exceeds three floors, guardrails not less than 48" in height shall be required. Intermediate vertical or longitudinal guardrails shall be provided to prohibit the passage of a six (6) inch sphere. A bottom rail or curb shall be provided that extends at least two (2) inches above the finished floor surface. Construction of guardrails shall be adequate in strength, durability, and attachment for its purposes as prescribed in **Chapter 12**.
- (c) Balconies, porches or galleries having structural concrete floors shall have all supporting framing members of non-combustible materials.

**SECTION 1109 INTERIOR BALCONY AND GALLERY**

- (a) The fascia of boxes, balconies and galleries shall have substantial railings not less than twenty-six (26) inches high above the floor. The railing at the ends of aisles extending to the fascia shall be not less than thirty-six (36) inches high for the width of the aisle or forty-two (42) inches high if at foot of steps.
- (b) All interior stairways and other vertical openings shall be enclosed and protected as provided in this Chapter, except that stairs may be open between **balcony** and main assembly floor in occupancies such as theaters, churches and auditoriums. The means of egress capacity required for balconies or galleries shall be determined on the same basis as those required for the occupancy use.

## MEANS OF EGRESS

- (c) The maximum distance of travel for **balcony** or gallery from any seat to an exit shall be determined on the same basis as the building occupancy.
- (d) An exit passageway in a building more than 3 stories in height or in a building of any height of Type IV or Type I and II construction, shall be of non-combustible construction. The floor shall be solid and without perforations.
- (e) For balconies with level floors or retractable seating, guard rails shall be not less than 42" high for open wells 3 stories or less in height and 48" for open wells more than 3 stories in height.

### **SECTION 1110 MEANS OF EGRESS FOR STAGE AND DRESSING ROOM AREAS OF GROUP A – LARGE ASSEMBLY**

Not less than one exit to a street, exit court, or passageway to a street, 3 feet or more in width, shall be provided from each side of the stage of every Large Assembly Place, and from each side of the sub-stage or **basement** or cellar under the stage, and an exit not less than 30 inches wide shall be provided from each fly-gallery and from the gridiron. An iron ladder shall be provided leading from the gridiron to a scuttle in the stage roof; such scuttle shall be not less than 2 feet x 3 feet in size and shall be provided with a metal-covered or non-combustible trap door. Each tier of dressing rooms shall be provided with at least two means of egress, each not less than 2 feet - 6 inches wide, one of which shall lead directly into an exit court or street. All exit stairs shall be constructed of non-combustible material as prescribed in **Section 1115**, Stair Construction. Stair exits from stage and dressing rooms need not be enclosed.

### **SECTION 1111 AISLES AND SEATING**

#### **1111.1 – GENERAL**

- (a) Every portion of any building which contains seats, tables, displays, equipment, or other material shall be provided with aisles leading to exits. Maximum dead end aisle shall be twenty (20) feet.
- (b) Aisles, cross-aisles, corridors and passageways shall be of width at least equal to the minimum width required for exits in this code, but in any case the width of an aisle or cross-aisle shall not be less than the width of the widest aisle, passage, cross-aisle or exit which it serves. An aisle shall not be less in width than forty-two (42) inches, measured at its narrowest point at the end farthest from the foyer, plus an increase of one and one-half (1/2) inches for each five (5) feet of length of such aisle from its beginning to an exit, except that aisles with seats on one side only may be six (6) inches less in width. Where egress is provided at both ends of an aisle, the aisle may have a uniform width not less than the average widths herein specified. Cross-aisles shall not be less than three (3) feet six (6) inches wide. An aisle bordering on a means of entrance shall be not less than four (4) feet wide.
- (c) In all balconies and galleries having more than 20 rows of seats, there shall be provided a cross-aisle not less than 4 feet wide leading to an exit.
- (d) There shall not be obstructions of any kind in any aisle. Aisles shall not have a slope of more than one (1) in eight (8).



- (e) Rows of seats between aisles shall have not more than 14 seats.
- (f) Rows of seats opening on to an aisle at one end only shall have not more than 7 seats. Seats without dividing arms shall have their capacity determined by allowing 18 inches per person.
- (g) Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than one hundred and fifty (150) feet measured along the line of travel. Travel distance may be increased to two hundred and twenty-five (225) feet in sprinklered buildings.
- (h) Steps shall not be used in aisles of the main auditorium floor, or in other aisles, where differences of level can be overcome by gradients not exceeding those permitted herein. Where steps are used in aisles, such steps shall extend across the full width of aisles and shall be illuminated; treads and risers shall be as required elsewhere in this Code for exit stairs. No isolated steps shall be permitted nor shall the aggregate rise of a group of steps exceed 21 inches.
- (i) In places of assembly used regularly for theatrical or similar performances, or for the display of motion pictures, the seats shall be securely fastened to the floor. In restaurants, cafeterias, cafeteriums, gymnasiums and similar multi-purpose places of assembly, the seats shall not be required to be fastened to the floor. All other Group A, Assembly occupancies seating more than 200 persons shall have seats fastened to the floor. All seats in balconies or galleries shall be secured to the floor except that in railed-in enclosures, boxes, or loges, with level floors and having no more than 14 seats, the seats need not be fastened to the floor, or have separating arms.
- (j) The spacing of rows of seats from back to back shall be not less than 30 inches, and not less than 27 inches plus the sum of the thickness of the back and the inclination of that back; but in all cases there shall be a space of not less than 12 inches between the back of one seat and the front of the seats immediately behind it as measured between plumb lines. Where individual seats are provided with automatic or self-rising devices, the space between the back of one seat and the front of the seats immediately behind it as measured between plumb lines shall be measured with the seat in the up position.

#### **1111.2 – CONTINENTAL SEATING SYSTEMS**

- (a) Chairs shall be of the fixed type installed in continuous rows across the auditorium, except in areas where aisles are designated.
- (b) Chairs shall be floor attached, riser attached, or mounted on bars which are firmly anchored to the floor or riser facing.
- (c) No chair shall be less than 20 inches in width as measured across the chair from center lines of arm rests.
- (d) Seats of chairs may be an automatic or self-rising type seat, or a non-lifting or non-automatically lifting type seat. The minimum space requirements for walkways shall be measured in the seat-down position.

## MEANS OF EGRESS

- (e) Backs of chairs may be stationary or they may be spring operated to encroach on the space between the rows when occupied, provided that such encroachment is limited to a maximum of 5 inches as measured between vertical plumb lines from a point at the center of the upper rear edge of the back before and after depressing the back to its maximum rearward position. The back shall automatically return to a stabilized position of zero encroachment when unoccupied.
- (f) Maximum number of chairs per row shall not exceed sixty (60), except as provided in paragraph (p) of this section.
- (g) The spacing of rows of unoccupied seats shall provide a clear width between rows measured horizontally as follows:
  - (automatic or self-rising seats shall be measured in the seat-up position; other seats shall be measured in the seat-down position)
  - 18 inches clear width between rows of 18 seats or less;
  - 20 inches clear width between rows of 35 seats or less;
  - 21 inches clear width between rows of 45 seats or less;
  - 22 inches clear width between rows of 46 seats or more.
- (h) The top edges of chair backs shall extend a minimum of 21 inches above the front edge of platform riser treads immediately to the rear. When it is necessary to increase riser heights in order to meet the desired sightlines to the stage or screen, a safety rail 21 inches high shall be installed along the line of chair backs at the front edge of platform riser treads and shall be anchored to the tread.
- (i) Platform riser facing shall be in a true vertical plane and the joint between the tread and facing shall not include a fillet of more than ½ inch radius.
- (j) Ventilator hoods or similar devices which are specified for attachment to floors directly under the chair seats shall not exceed 4 inches in height.
- (k) Incline of the areas of the floor on which chairs are installed shall not exceed 1 inch per foot forward or .75 inch per foot reverse. Inclines within the same limitations may be used in the tread area of platform riser systems.
- (l) Concrete floors shall have a minimum thickness of 3 inches and a minimum strength of 3000 PSI. Concrete risers for treads shall have a minimum thickness of 3 inches and riser facings a minimum thickness of 5 inches.
- (m) Pre-stressed or pre-formed concrete risers and/or steel faced riser systems shall provide permanent anchored locks between tread and facing which are designed to withstand the full amount of torsion forces generated when chairs which are attached to riser facing are occupied. Steel face risers shall have a minimum thickness of ¼ inch.
- (n) Wood floors are not approved for auditorium floors in buildings designed for continental seating systems.
- (o) Side wall exits and side aisles shall be provided in accordance with one of the following methods:

- (1) Two exits, one each side of the auditorium, may serve not more than five rows of chairs directly between these exits provided the width of these exits shall not be less than 6'-0" for each exit. They may be so placed that the ends of each fifth row may terminate no less than 18" from the side walls and the ends of the other four rows shall terminate so as to form side aisles of not less than 48-inch width.
  - (2) Two exits, one each side of the auditorium, may serve not more than four rows of chairs directly between these exits provided the width of these exits shall be not less than 5'-0" for each exit. They may be so placed that the ends of each fourth row may terminate no less than 18" from the side walls and the ends of the other three rows shall terminate so as to form side aisles of not less than 42-inch width.
  - (3) Two exits, one each side of the auditorium, may serve not more than three rows of chairs directly between these exits provided the width of these exits shall be not less than 4'-0" for each exit. They may be so placed that the ends of each third row may terminate no less than 18" from the side walls and the ends of the other two rows shall terminate so as to form side aisles of not less than 36-inch width.
- (p) The number of intervening seats between any seat and an aisle may be increased to forty-nine (49) where exit doors are provided along each side aisle of the row of seats at the rate of one pair of exit doors for each five (5) rows of seats. Such exit doors shall provide a minimum clear width of sixty-six (66) inches discharging into a foyer, lobby or to the corridor of the building. There shall be not more than five (5) seat rows between pairs of doors. Side aisles shall be not less than 44 inches in width.
  - (q) Aisles shall provide access to a cross aisles, foyer or exit.
  - (r) The length of travel to an exit door by any aisle shall not be greater than 150 feet.
  - (s) No dead-end aisle shall be greater than 20 feet in length. This does not refer to walkways required between rows of seats.
  - (t) The width of cross aisles, foyers, exit lobbies, or exit passageways shall be of sufficient width to accommodate 50% of the total occupant load served by such aisles or spaces as determined in accordance with Sections [1105.1](#) and [1105.3](#).
  - (u) Main entrance doorways and exit doorways which open directly to the outside of the building shall open directly to a street or open public space and shall be of sufficient width to accommodate 50% of the total occupant load but shall not be less than the sum of the required width of all aisles, exit passageways, exit ways, or exit foyers leading thereto.
  - (v) Where doors open from the main auditorium seating areas lighted exit signs will not be required at each individual exit doorway. When such doorways open into aisles, corridors, exit passageways, exit foyers, or exit lobbies, lighted directional exit signs shall be provided in such a manner as to be visible from each doorway leading from the main auditorium seating area.

### **1111.3 – RAILINGS**

- (a) The fascia of boxes, balconies and galleries shall have substantial railings not less than 26 inches high above the floor. The railings at the ends of aisles extending to the fascia shall be not less than 36 inches high for the width of the aisle, or 42 inches high if at foot of steps.

- (b) Cross-aisles, except where the backs of seats on the front of the aisle project 24 inches or more above the floor of the aisles, shall be provided with railings not less than 26 inches high.
- (c) In balconies, galleries, or other locations where seats are arranged on platforms or successive tiers, and the height of the rise from one platform to another exceeds 21 inches, a substantial railing of not less than 30 inches high shall be placed at the edge of the platform along the entire row of seats.

#### **1111.4 – PLACARD INDICATING CAPACITY**

A placard indicating the allowable maximum legal capacity of every occupancy, in number of occupants other than employees shall be displayed in a prominent place when required by the Building Official. Such signs shall read as follows:

“Occupancy by more than    persons is dangerous and unlawful.” Building Official

\*NOTE: See also [Section 1105.1\(b\)](#).

### **SECTION 1112 EXIT OUTLETS, EXIT PASSAGEWAYS, AND EXIT DISCHARGE**

#### **1112.1 – EXIT OUTLETS AND EXIT DISCHARGE**

- (a) All exits shall terminate directly at a public way or at an exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way. Such exit courts or passageways shall be enclosed with construction providing not less than 2 hours fire resistance. Slope of floors in exits shall not exceed one foot in ten feet.
- (b) Except in Residential, School, Institutional and Assembly occupancies, a maximum of 60 percent of the exits may discharge through areas on the floor of discharge provided all of the following are met
  - (1) Such exits discharge to a free and unobstructed way to the exterior of the building, which way is readily visible and identifiable from the point of discharge from the exit.
  - (2) The floor of discharge into which the exit discharges is provided with automatic sprinkler protection and any other portion of the level of discharge with access to the discharge area is provided with automatic sprinkler protection or separated from it in accordance with the requirements for the enclosure of exits.

EXCEPTION: The requirements of 1112.1(b)(2) may be waived if the discharge area is a vestibule or foyer meeting all of the following:

- (a) The depth from the exterior of the building is not greater than 10 feet and the length is not greater than 20 feet.
- (b) The foyer is separated from the remainder of the level of discharge by construction providing protection at least the equivalent of wired glass in steel frames.
- (c) The foyer serves only for means of egress including exits directly to the outside.
- (3) The entire area on the floor of discharge is separated from areas below by construction having a minimum of 2-hour fire resistance rating.

- (c) Stairs and other exits shall be so arranged as to make clear the direction of egress to the street. Exit stairs that continue beyond the floor of discharge shall be interrupted at the floor of discharge by partitions, doors, or other effective means.
- (d) Stairs, ramps, bridges, balconies, escalators, moving walks and other components of an exit discharge shall comply with the detailed requirements of this Chapter for such components.
- (e) Subject to the approval of the authority having jurisdiction, exits may be accepted where discharging to roofs or other sections of the building or adjoining buildings, where the roof has a fire resistance rating at least the equivalent of that required for the exit enclosure, where there is a continuous and safe means of egress from the roof, and all other reasonable requirements for life safety are maintained.

### **1112.2 – EXIT PASSAGEWAYS**

- (a) Any hallway, corridor, passage, tunnel, underfloor passageway, or overhead passageway may be designated as an exit passageway and used as an exit or exit component when conforming to all other requirements as modified by the provisions of this Section.
- (b) Protective enclosure and arrangement. When an exit passageway is used as an exit or exit component (rather than as exit access) it shall be protected by separation from other parts of the building. The separating construction shall meet the following requirements:
  - (1) The separation shall have at least a 1-hour fire resistance rating in buildings not more than 3 stories in height.
  - (2) The separation shall have at least a 2-hour fire resistance rating in buildings more than 3 stories in height, shall be constructed of non-combustible materials, and shall be supported by construction having at least a 2-hour fire resistance rating.
  - (3) Any opening therein shall be protected by an approved self-closing fire door.
- (c) Fixed wired glass panels in steel sash may be installed in such a separation in a fully sprinklered building.
- (d) Openings in exit enclosures shall be confined to those necessary for access to the enclosure from normally occupied spaces and for egress from the enclosure. In Institutional Occupancy, exit passageways used to extend exits (stairways) to a public way shall have no openings other than the exit discharge.
- (e) Any stair serving as an exit access to an exit passageway shall be fully enclosed and separated from other parts of the building.

### **1112.3 – HEADROOM**

- (a) Means of egress shall be so designed and maintained as to provide adequate headroom as provided in other sections of this Code but in no case shall the ceiling height be less than 7 feet 6 inches nor any projection from the ceiling be less than 6 feet 8 inches from the floor.

### **1112.4 – CHANGES IN ELEVATION**

- (a) Where a means of egress is not substantially level, such differences in elevation shall be negotiated by stairs or ramps conforming to the requirements of this Chapter for stairs and ramps.

**SECTION 1113 FOYER – REQUIRED**

- (a) In every Large Assembly Place a foyer consisting of a space at the main entrance of the auditorium, or place of assembly shall be provided. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or passage to every such main entrance and exit.
- (b) The width of foyer at any point shall not be less than the combined width of aisles, stairways, and passageways tributary thereto. The foyer shall be at the same level as the back of the auditorium, and exits leading therefrom shall not have a steeper gradient than one foot in 12 feet.
- (c) In theaters and similar Assembly occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of exits. Such waiting areas shall be separated from the required exitways by substantial permanent partitions or by fixed rigid railings not less than forty-two (42) inches high.

**SECTION 1114 WAITING SPACES – REQUIRED**

In theaters and similar Assembly occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of exits. Such waiting areas shall be separated from the required exitways by substantial permanent partitions or by fixed rigid railing not less than 42 inches high.

**SECTION 1115 STAIRWAY CONSTRUCTION****1115.1 – GENERAL**

- (a) Exterior and interior exit stairways shall be constructed of non-combustible materials throughout in the following buildings:
  - (1) All buildings of Type I and Type II Construction.
  - (2) All buildings classified as Educational, three (3) stories or more; Institutions; Assembly Occupancy, three (3) stories or more.
  - (3) All other buildings three (3) stories or more in height or occupied by more than forty (40) persons above or below the first story at street or grade level except buildings of Type VI Construction.
- (b) Interior stairs constructed of wood, except those with open risers, shall be firestopped as specified in [Section 705](#).
- (c) No closet shall be located beneath stairs that are in whole or part of combustible construction: such space shall be left entirely open and free from encumbrance.
- (d) The underside of interior stairways, if of combustible construction, shall be protected to provide not less than 1-hour fire-resistance.

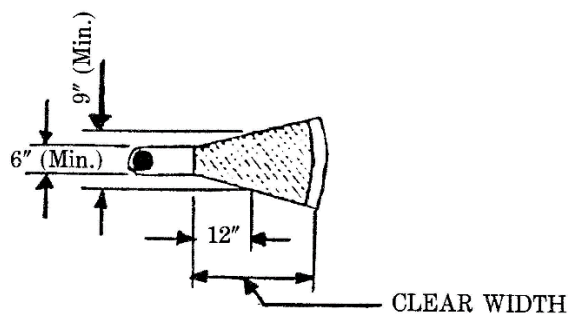
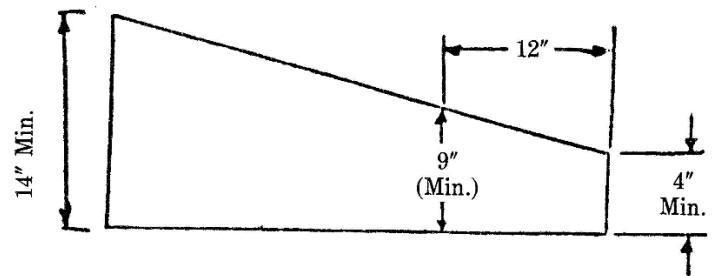
**1115.2 – BASEMENT STAIRS**

- (a) In Theaters and Assembly occupancies, no exit stair from a lower story shall lead to an exit doorway serving an exit stair from an upper story.
- (b) Stairs and other exits shall be so arranged as to make clear the *direction of egress* to the street. Exit stairs that continue to the **basement** or other lower stories shall be interrupted at the story of discharge by partitions, doors, or other effective means to make clear the direction of egress.

**1115.3 – TREADS AND RISERS**

- (a) All stairs serving as required means of egress shall be of permanent fixed construction. Treads and risers of required stairs shall be so *proportioned* that the sum of two (2) risers and a tread, exclusive of projection of nosing, is not less than twenty-four (24) inches nor more than twenty-five (25) inches. The height of riser shall not exceed seven and three-quarter (7¾) inches, and treads, exclusive of nosing, shall be not less than ten (10) inches wide.
- (b) Treads shall be of *uniform width* and risers of uniform height in any one flight of stairs.
- (c) The use of *winders* and/or spiral stairways, is *prohibited* in stairways serving as required exits.

Exception No. 1 – Spirals and winders having a clear width of not less than three (3) feet may be used as a required exitway within an individual family dwelling unit. Tread width shall be a minimum of nine (9) inches at a point twelve (12) inches from the side where the treads are narrower. Spiral stairway treads shall have a minimum width of six (6) inches. Winder treads shall have a minimum width of four (4) inches and an average width or not less than (9) inches. All risers shall be the same height for each story.



**SPIRAL TREAD**

## MEANS OF EGRESS

Exception No. 2 – Spiral stairways within an individual family dwelling unit which is not used as a required exitway or which serves a mezzanine shall have a minimum width or twenty-six (26) inches. All treads must be identical with a seven and one-half (7½) inch minimum clear tread depth at a point twelve (12) inches from the narrow edge.

- (d) Except when located within a dwelling unit, all required interior stairways shall have solid risers. Interior monumental stairs may have open risers.
- (e) All treads shall be solid except in those situations F and H occupancies where the use of solid treads will create a hazard.

### 1115.4 – LANDINGS

- (a) No flight of stairs shall have a vertical rise of more than twelve (12) feet between floors or landings.
- (b) The length and width of landings shall be not less than the width of stairways in which they occur.
- (c) In buildings classified as Assembly occupancies, flights of less than three risers shall not be used in stairways, interior or exterior, passageways, at entrance or elsewhere in connection with required exits. To overcome lesser differences in level, gradients not exceeding one foot in twelve feet may be used.

### 1115.5 – HANDRAILS

- (a) All stairs shall have walls with handrails, or well secured handrails or guards on both sides of stairs of not less than thirty (30) nor more than thirty-four (34) inches high.  
Stairs of less than forty-four (44) inches in width may have handrails on one side only.
- (b) When the required width of a flight of stairs exceeds eighty-eight (88) inches, one or more intermediate handrails, continuous between landings, substantially supported shall be provided and there shall be not more than sixty-six (66) inches between such adjacent handrails.
- (c) Ends of handrails shall be returned or shall terminate in newels or standards.
- (d) Horizontal runs of rails around open wells shall be not less than 42 inches high for buildings 3 stories or less in height. For buildings more than 3 stories in height, horizontal runs of rails around open wells shall be not less than 48 inches high.

### 1115.6 – WIDTH

- (a) Stairs serving as required means of egress shall be clear of all obstructions except that handrails attached to walls may project not more than 3½ inches at each side within the required width.
- (b) Width of stairs shall not decrease in the direction of exit travel.
- (c) The minimum width of any stair serving as a means of egress shall not be less than 44 inches.

EXCEPTION: For stairs serving less than 30 people, the minimum width may be 36" for residential, business, storage and industrial occupancies.



**1115.7 – HEADROOM**

- (a) Stairs serving as required means of egress shall have a minimum headroom clearance of six feet eight inches (6'-8"), measured vertically from the nearest nosing to the nearest soffit. This minimum shall be maintained for the full required width of stairs and landings.

**SECTION 1116 DOORWAYS****1116.1 – DOORWAYS, GENERAL**

- (a) Every exit doorway shall open into an enclosed stairway, a horizontal exit, a fire protected corridor or passageway, meeting the requirements of this chapter and providing continuous protected egress to a street, or to an exterior open space leading to a street.

The clear height of exit doorways shall be not less than six feet and eight inches (6'-8").

- (b) No exit doorway shall be less than thirty-six (36) inches in width except that in Institutional occupancies doorways serving as exits for areas housing patients shall be not less than forty-four (44) inches in width. Each door stop may project not more than three-fourths (3/4) inch into this width.
- (c) Exit doorways shall swing in the direction of exit and shall not obstruct the travel along any required exit, except that doors swung flat against the walls may project not more than seven (7) inches. No door shall at any point in its swing reduce the required width of an exit stairway or landing to less than thirty (30) inches nor interfere with full use of the stairs. Doors from individual rooms occupied by less than 50 people may open into such room or space.
- (d) No exit doorway shall open immediately upon a flight of stairs. A landing of at least the width of door shall be provided.

Doors to the enclosures of interior stair exits shall be arranged to open from the stair side at least at every third floor so that it will be possible to leave it at such floor should the fire render the lower part of the stair unusable during egress or should the occupants seek refuge on another floor.

- (e) All doors designed to be kept normally closed in connection with exits, such as doors on stair enclosures and smoke stop doors, shall be provided with reliable self-closing mechanism and shall not at any time be secured in the open position, except smoke stop doors in hospitals and smoke stop and stair enclosure doors in schools, colleges and universities may be kept open for operating convenience provided they are held in the open position by electromagnetic holders activated by approved ionization type smoke detectors.

In dormitories, doors other than those leading to hazardous areas may be held open for operating convenience by electromagnetic devices, provided that door release and closure are initiated by the smoke detection system specified in Section 720 or 506. For stairwell doors, closure must also be initiated by the required manual fire alarm system and any required sprinkler system.

## MEANS OF EGRESS

- (f) Required exit doors shall be openable from the inside without the use of a key, tool, special knowledge or effort. When exit doors are in pairs, manually operated edge or surface mounted flush bolts and surface bolts are prohibited. If approved automatic flush bolts are used, that door leaf shall have no door knob or surface mounted hardware. The unlatching of any leaf shall not require more than one (1) operation.
- (g) For required width of doorways, serving exit stairways and the exit capacity of doorways, see Sections 1105.2 and 1105.3.
- (h) Locks, if provided, shall be unlocked at all times the building is open to the public, except as may be required for mental and penal institutions. This requirement shall apply to all exterior exit doors and if a key is required to operate the door from the inside, readily visible durable sign on or adjacent to the door stating "THIS EXIT TO REMAIN UNLOCKED DURING BUSINESS HOURS" shall be provided. The sign shall be in letters no less than 1" high on a contrasting background. The locking device must be of a type that will be readily distinguishable as locked. The use of this exception may be revoked by the Building Official for due cause.
- (i) Where for operating reasons it may be undesirable to allow unrestricted communications through exit doors, alarm devices may be provided which will sound when doors are opened. Control of use of exits may also be facilitated by telltale devices which will give indication that doors have been opened. Where circumstances require more rigid control than can be secured by these methods, continuous personal supervision may be necessary, as any mechanical or electrical locking method to prevent improper use of exits is likely to interfere with their availability in any emergency.
- (j) If locks are installed on hospital, nursery, or mentally retarded sleeping room doors, they shall be of such type that they can be locked only from the corridor side, provided that doors of such rooms leading directly to the outside of the building may be subject to locking from the room side. In any case, such locks, shall be such as to be readily opened by the occupant from inside the room without the use of any key.

EXCEPTION: Doors in Homes for the Aged and in Nursing Homes may be lockable by the occupant provided that they are capable of being unlocked from the corridor side and keys are readily available to attendants.

- (k) All doorways to institutional sleeping rooms, diagnostic and treatment areas such as X-ray, surgery, physical therapy, etc., all doorways between these occupied spaces and the required exits and all exit doorways shall be at least 44 inches in width except that exit doorways so located as not to be subject to use by these occupants may be not less than 36 inches in clear width. Doors to nursery sleeping rooms, as covered in this section of the Code, shall be at least 36 inches in width.
- (l) Any door in the line of exit travel from an Institutional sleeping room shall be of the swinging type.

- (m) In every hotel, motel, dormitory, **apartment**, condominium, dwelling unit or similar residential occupancy, except 1 or 2 family dwellings, in which rooms are devoted to sleeping purposes, doors of the dwelling unit or sleeping room that open to an interior public corridor shall be not less fire resistant than 1-<sup>3</sup>/<sub>4</sub>" solid wood core doors equipped with closers. The door and closer requirements of this sub-section can be omitted if the building is fully sprinklered.
- (n) A latch or other fastening device on a door shall be provided with a knob, handle, panic bar, or other simple type of releasing device, the method of operation of which is obvious, even in darkness.

### **1116.2 – PANIC HARDWARE**

- (a) The exit doors of schools (except doors of individual school rooms), motion picture theaters, and theaters of any capacity shall be equipped with latches (fire exit bolts) which release when pressure of not to exceed 15 pounds is applied to the releasing devices in the direction of the exit travel.
- (b) The exit doors of all other places of public assembly having capacity in excess of 600 persons shall be equipped with latches (fire exit bolts) as provided in this section.
- (c) Such releasing devices shall be bars or panels extending not less than two-thirds of the width of the door and placed at heights suitable for the service required, not less than 30 nor more than 44 inches above the floor.
- (d) Only approved panic hardware shall be used.
- (e) Required panic hardware shall not be equipped with any locking or dogging device, set screw, or other arrangement which can be used to prevent the release of the latch when pressure is applied to the bar.
- (f) No lock, padlock, hasp, bar, chain, or other device, or combination thereof shall be installed or maintained at any time on or in connection with any door on which panic hardware is required by this Code, if such device prevents, or is intended to prevent, the free use of the door for purposes of egress.

### **1116.3 – POWER-OPERATED DOORS**

- (a) Where required doors are operated by power, such as doors with photo-electric actuated mechanism to open the door upon the approach of a person or doors with power-assisted manual operation, the design shall be such that in event of power failure the door may be opened manually to permit exit travel or closed where necessary to safeguard means of egress.
- (b) No power-operated door shall be counted as a required exit unless it also swings with the exit travel by manual means.
- (c) Power operating sliding doors may be used provided the sliding leaf is equipped with an emergency swing (panic release) feature.

### 1116.4 – REVOLVING DOORS

- (a) Approved revolving doors may be used between street floor and street as required exits except as noted in paragraph (e) of this section, but not within five (5) feet of the swing of the wings at foot of stairs from upper floors nor within 3 feet of the swing of the wings at head of [basement](#) stairs. Where used there shall be at least one swing door exit within 20 feet of each revolving door, with there being no fewer swing doors than revolving doors as individual exits, except as provided in paragraph (c) of this section.
- (b) Each revolving door shall receive egress credit equal to the dimension of the clear opening between the extreme ends of the enclosure walls, less that space occupied by all of the wings when collapsed in a "book-fold" manner and moved to the extreme egress position.
- (c) Approved revolving doors may serve as exits, without swinging doors, for street floor elevator lobbies if no stairways or doors from other parts of the buildings discharge through the lobby, and the lobby has no occupancy other than as a means of travel between elevator and street.
- (d) All approved revolving doors shall be:
  - (1) Equipped with means to prevent their rotation at too rapid a rate to permit orderly egress. (A rate of 12 revolutions per minute is recommended,) and
  - (2) Equipped with emergency collapsing devices such that each of the wings will collapse in either direction when a force of not more than 180 pounds is applied on the outer stile of the wings at push bar level, and all of the wings must collapse together into a "book-fold" position.
- (e) Revolving doors may be used in the following occupancy classifications in accordance with this section:
  - Residential
  - Business
  - Storage
  - Industrial
  - Mercantile
  
  - Schools – Only at main entrances of administrative buildings where not subject to emergency use.
  
  - Institutional – Only at main entrances of administrative buildings where not subject to emergency use.

### 1116.5 – SPECIAL DOORWAY REQUIREMENTS

- (a) No door, when opening or when fully open shall project beyond the building line except as provided by [Section 2601.1](#).
- (b) Every door used as a means of egress or ingress in cafes, restaurants, or in any building classified as an Assembly Occupancy, shall be considered as an exit doorway and shall meet all the requirements as set forth in this chapter.

**1116.6 – SCREEN AND STORM DOORS**

No screen door or storm door in connection with any required exit shall swing against the direction of exit travel in any case where doors are required to swing with the exit travel.

**1116.7 – TURNSTILES**

- (a) No turnstile or similar device to restrict travel to one direction, or to collect fares or admission charges, shall be so placed as to obstruct any required means of egress, except that approved turnstiles not over 3 feet high, which turn freely in the direction of exit travel, may be used in any occupancy where revolving doors are permitted. Turnstiles over 3 feet high shall be subject to the requirements for revolving doors.
- (b) Turnstiles in or furnishing access to required exits shall be of such design as to provide 22 inches clear width as the turnstile rotates.
- (c) No turnstile shall be placed in any required exit, or barring the way of access thereto or travel therefrom, unless immediately adjacent or within 20 feet there is a 36" swinging door or gate opening freely in the direction of exit travel, or an open passage serving the same general path of travel as the turnstile.
- (d) Turnstiles shall be rated the same as revolving doors as regards units of exit width and rates of travel.

**1116.8 – DOORS IN FOLDING PARTITIONS**

- (a) When permanently mounted folding or movable partitions are used to divide a room into smaller spaces, a swinging door or open doorway shall be provided as a way of exit access from each such space.

**EXCEPTION:** Under the following conditions the swinging door may be omitted and the partition may be used to enclose the space completely.

- (1) The subdivided space shall not be used by more than 20 persons at any time.
- (2) The use of the space shall be under adult supervision.
- (3) The partitions shall be so arranged that they do not extend across any aisle or corridor used as a way of access to the required exits from the floor.
- (4) The partitions shall conform to the interior finish and other applicable requirements of this Code.
- (5) The partitions shall be an approved type, shall have a simple method of release, and shall be capable of being opened quickly and easily by inexperienced persons in case of emergency.

**1116.9 – FIRE DOORS AND SMOKESTOP DOORS**

- (a) Smokestop doors, where installed to meet the requirements of this Code, shall be of metal, metal covered or approved 20-minute label with clear, wired glass panels, except that in buildings not over 2 stories in height and not required by other sections of this Code to be of fire-resistive construction, smokestop doors may be of ordinary solid bonded core wood type not less than 1-3/8 inches thick with clear wired glass panels. Such doors shall be self-closing, and shall be either single or in pairs. They shall close the opening completely with only such clearance as is reasonably necessary for proper operation. (See [Section 703.2\(b\)](#).)
- (b) Any fire door, installed in accordance with the requirements of this Code shall be of an approved type listed by a nationally recognized Testing Laboratory with follow-up inspection services. The fire protection ratings of any fire door shall be measured in accordance with NFPA No. 80. Each fire door shall be appropriate for the location in which it is installed. (Note: See Section 703).
- (c) Any swinging fire door and any door in stair enclosure walls designed to prevent the spread of fire shall be provided with approved positive latching means to hold it in the closed position against the pressure of expanding fire gases. Such latching means shall not be required for smokestop doors or for any other doors not designed to prevent the spread of fire.

**SECTION 1117 RAMPS**

- (a) The width and enclosure of exit ramps shall be as required in [Section 1112 – Exit Outlets](#).
- (b) The slope of ramps shall not exceed one foot in twelve feet.
- (c) Surface of ramps shall be of non-slip material.
- (d) Exit ramps shall be of non-combustible construction except as otherwise permitted for stairs.
- (e) Ramps shall comply with all requirements for stairways so far as those requirements are applicable.

**SECTION 1118 HORIZONTAL EXITS**

- (a) A horizontal exit is a way of passage from one building to an area of refuge in another building approximately the same level or a way of passage through or around a wall or partition to an area of refuge on approximately the same level in the same building which affords safety from fire or smoke from area of escape and areas communicating therewith.

NOTE: Horizontal exits shall not be confused with egress through doors in smoke partitions. Doors in smoke partitions are designed only for temporary protection against smoke, whereas horizontal exits provide protection against serious fire for a relatively long period of time in addition to providing immediate protection from smoke.

- (b) Horizontal exits may comprise not more than fifty percent (50%) of the required exits from any building or floor area except for exits in mechanical or equipment rooms.
- (c) The width of horizontal exits shall not be less than required for exit doorways. The exit capacity of horizontal exits shall be as specified in [Section 1105.3](#).

- (d) Horizontal exits shall be equipped with at least one (1) approved fire door of a self-closing type. No automatic sliding fire door shall be used on horizontal exits. Door openings shall be protected as specified in Section 703.
- (e) Floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas served, allowing not less than three (3) square feet net clear area per person.
- (f) The area into which a horizontal exit leads shall be provided with exits adequate to meet the requirements of this Chapter, but not including the added capacity imposed by persons entering it through horizontal exits from another area. At least one of its exits shall lead directly to the exterior.
- (g) Where there is a difference of level between connected areas, ramps, not steps, shall be used, meeting the requirements of [Section 1117](#) – Ramps.
- (h) Doors in horizontal exits shall be kept unlocked and unobstructed.

### **SECTION 1119 EXIT TO ROOF**

- (a) In all buildings four (4) stories or more in height, two enclosed exit stairways shall be continued from street grade level to or through the roof level except where roofs have a slope greater than one in four. Such stairway shall be marked at street and floor levels with a sign indicating that it continues to the roof.
- (b) Where roofs are used for roof gardens or for other purposes, stairways shall be provided as required for such use or occupancy.
- (c) Where no stairway is required to extend to the roof, scuttles with ladder shall be provided of size not less than two (2) feet by three (3) feet, giving access to the roof.
- (d) Refer to Volume 3, Elevator Code A17.1 for access to Elevator Machinery.
- (e) Refer to Volume III and IV for access to mechanical and electrical equipment.

### **SECTION 1120 ELEVATORS**

Refer to Chapter XXXI and ANSI A17.1 for elevator standards.

- (a) Elevators shall conform with the requirements of the “Safety Code for Elevators, Dumbwaiters and Escalators, ANSI A17.1” as applicable unless otherwise specified.
- (b) Elevator shafts shall be enclosed and protected from the rest of the building as specified by [Section 701.3](#).
- (c) Elevators shall not be located in a common enclosing shaft with an exit stairway. See [Section 701.3](#).

**SECTION 1121 ESCALATORS**

- (a) Only escalators of the horizontal tread type, which normally operate in the direction of exit travel shall be used as a required means of exit. Such escalators may be used as required exits provided they comply with all the requirements applying to exit stairways and are enclosed and protected from the rest of the building as required for exit stairways. (See Section 1106.)
- (b) Unless otherwise specified, escalators shall comply with the requirements for escalators (and/or moving walks) in the American Standards Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks (ANSI-A17.1), of the American Standards Association.

**SECTION 1122 EXIT SIGNS**

- (a) Exits shall be indicated by approved signs or lights in accordance with [Table 1100](#) at all times when the building is occupied.
- (b) All exits shall be marked with illuminated signs bearing the word “Exit” in letters at least 6 inches high, with the principal strokes of letters not less than 3/4 inch wide. No battery operated electric light or any type of portable lantern shall be used for primary exit illumination. No luminescent or fluorescent, or reflective materials may be used as a substitute for any of the required illumination for exit signs. All required illumination shall be so arranged that the failure of any single light unit, such as the burning out of an electric bulb, will not leave any area in darkness. All exit signs shall be illuminated at all times when the building is occupied by a reliable light source of not less than 25 watts or equivalent photometric rating that will be readable easily at a distance of 100 feet. Where a main entrance serves as an exit and is visible to the occupants, no exit sign is required over the main entrance door.
- (c) Where exit lights or signs or the exits themselves are not visible from the exit approach, directional signs of the size required for exits indicating the way of egress shall be provided. The level at which there is direct exit to the exterior shall also be clearly indicated.
- (d) An independent and separate source of power shall be provided for exit signs in all occupancy classifications listed below, subject to the occupant content noted:

Occupant		Minimum Occupant Content
Assembly	(A)	Greater than 300
Institutional	(I)	All
Mercantile	(M)	Greater than 150
Residential	(R)	Greater than 100
Educational	(E)	Greater than 300
Business	(B)	Greater than 150

- (e) Access to exits shall be marked by readily visible signs in all cases where the exit or way to reach it is not immediately visible to the occupants and in any case where exit signs are required by the applicable provisions of [Table 1100](#).



- (f) Any door, passage, or stairway, which is neither an exit nor a way of exit access and which is so located or arranged as to be likely to be mistaken for an exit, shall be identified by a sign reading “NOT AN EXIT” or similar designation or shall be identified by a sign indicating its actual character, such as “TO BASEMENT”, “STOREROOM”, “LINEN CLOSET” or the like.

NOTE: The likelihood of mistaking for exits doors, passageways, or stairways which lead to dead-end spaces where occupants might be trapped depends upon the same considerations as govern the need for exit signs.

Where ample and properly marked exits are immediately available from any area, the marking of nonexits may not be required.

- (g) Every required sign designating an exit or way of exit access shall be so located and of such size and distinctive color, and design as to be readily visible and shall provide contrast with decorations, interior finish, or other signs. No decorations, furnishings, or equipment which impair visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision to the required exit sign of such a character as to so detract attention from the exit sign.
- (h) A sign reading “EXIT”, or similar designation, with an arrow indicating the direction, shall be placed in every location where the direction of travel to reach the nearest exit is not immediately apparent.
- (i) Every sign shall be suitably illuminated by a reliable light source giving a value of not less than 5 foot-candles on the illuminated surface. Such illumination shall be continuous and where emergency lighting facilities are required, exit signs shall be illuminated from the same source.
- (j) Internally illuminated signs shall be provided in all occupancies where reduction of normal illumination is permitted, such as in motion picture theatres.
- (k) Self-powered exit signs using a tritium light source may be used as a substitute for conventional electric signs, providing they have been tested and listed by an independent testing laboratory.

**SECTION 1123 ILLUMINATION OF EXITS**

**1123.1 – GENERAL**

- (a) A separate or emergency source of illumination shall be provided in the following occupancies:

Assembly	(A)	Over 300 capacity
Institutional	(I)	All
Mercantile	(M)	Over 150 capacity
Residential	(R)	Over 100 capacity
Educational	(E)	Over 300 capacity
Business	(B)	Over 150 capacity

### **1123.2 – ILLUMINATION**

- (a) Every exit and the necessary ways of exit access thereto shall be illuminated to facilitate egress. Such illumination shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time as required to maintain the illumination to the minimum foot-candle values herein specified.
- (b) The floors of exits and of ways of exit access shall be illuminated at all points such as angles and intersections of corridors and passageways, stairways, landings of stairs, and exit doors to values of not less than 1.0 foot-candle measured at the floor.
- (c) In every auditorium or other place of assembly where pictures, motion pictures or other projections are made by means of directed light, the illumination of the floors of exit ways may be reduced during such period of projection to values of not less than 1/5 foot-candle.
- (d) Any required illumination shall be so arranged that the failure of any single lighting unit, such as the burning out of an electric bulb, will not leave any area in darkness.
- (e) The same equipment or units installed to meet the requirements for Exit Marking may also serve the function of illumination of means of egress provided that all applicable requirements of this Section for such illumination are also met.
- (f) Self-powered exit signs using a tritium light source and requiring no electrical wiring, providing they have been tested and listed by an independent testing laboratory, may be used as a substitute for conventional electric signs.

### **1123.3 – SOURCES OF ILLUMINATION**

- (a) Exit illumination shall be from a source of reasonably assured reliability, such as a public utility electric service.
- (b) Where electricity is used as a source of exit illumination, the installation shall be properly made in accordance with the minimum requirements of the National Electrical Code, Article 700.
- (c) No portable battery operated electric light nor any type of portable lamp or lantern shall be used for any required exit illumination.
- (d) No luminescent or fluorescent or reflective materials may be used as a substitute for any of the required illumination herein specified.
- (e) In hospitals and in certain institutions, emergency light and power are needed for various purposes. Such emergency electric power facilities where provided for the most essential features of hospital and institutional operation may serve the purpose of a source of illumination for exit signs, illumination of exits, fire alarm systems, automatic sprinkler and automatic smoke detector systems.

### **1123.4 – EMERGENCY LIGHTING**

- (a) In occupancies specified in [1123.1\(a\)](#), emergency lighting facilities shall be provided for exits so arranged that necessary exit illumination will be maintained in the event of failure of the normal lighting of the building.

- (b) Emergency lighting facilities shall be arranged to maintain the specified degree of illumination in the event of failure of the normal lighting for a period of at least 1½ hours.
- (c) Emergency lighting shall be provided as specified in Section 1123.5 subject to the approval of the Building Official as to the suitability of the equipment for its intended use and the conditions in the individual premises.
- (d) Electric battery operated emergency lights as described in Article 700-6, the National Electrical Code shall use only reliable types of storage batteries suitable for their intended use, and shall be provided with suitable facilities for maintenance in properly charged condition. Conventional automobile storage batteries of the lead acid type are prohibited for emergency light source or for emergency generator cranking service.
- (e) Required emergency lighting facilities, except as specifically approved otherwise, shall be automatic, not requiring any manual action to put them into operation after failure of normal lighting.
- (f) Where maintenance of illumination depends upon changing from one energy source to another, there shall be no appreciable interruption of illumination during the change-over except that in hospitals where emergency lighting is provided by a prime mover operated electric generator, a delay of not to exceed 10 seconds may be permitted.

#### **1123.5 – METHOD OF PROVIDING EMERGENCY LIGHTING**

- (a) Emergency lighting shall be so arranged as to provide the required illumination automatically in the event of any failure of normal lighting due to any fault in the main lighting system, due to any failure of public utility or other outside electric power supply, or any single manual act such as accidental opening of a switch controlling normal lighting facilities.
- (b) Emergency lighting shall be either continuously in operation, or shall be capable of repeated automatic operation without manual intervention.
- (c) Emergency lighting, subject to the approval of the Building Official, may be provided by any method or combination of methods which will produce the desired results, such as:
  - (1) Two separate electric lighting systems, with independent wiring, each adequate alone to provide the specified emergency lighting, one supplied from an outside source such as a public utility service and the other from an electric generator on the premises driven by an independent source of power, both sources of illumination being in regular simultaneous operation whenever the building is occupied during the absence of natural illumination.

- (2) An electric circuit or circuits used only for emergency lighting with two independent electric sources so arranged that on the failure of one the other will come on automatically and immediately into operation. One such independent source shall be a connection from a public utility or similar outside power source, and the other (a) an approved storage battery with suitable provision to keep it automatically charged. Such battery shall also be so provided with automatic controls that after the battery comes into operation due to failure of the primary power source, or due to turning off the primary electric source, it will be shut off after its specified period of operation and will be automatically recharged and be ready for further service when the primary current source is again turned on; or (b) such other source may be an emergency electric generator set provided and maintained as per Article 700 (700-8) of the National Electrical Code.
- (3) Unit devices (U.L. listed and labeled) with approved individual batteries providing for the same functions as specified above, except that the battery supplied light may be operated on a separate circuit at a voltage different from that of the primary light, provided the unit battery powered devices are installed and maintained according to Underwriters Laboratories Listing. (See Article 700 (700-22) of the National Electrical Code for Approved Type Batteries, etc.)

### **1123.6 – INSTALLATION METHODS**

- (a) For installation requirements, see National Electrical Code, NFPA Publication No. 70, Article 700.

### **SECTION 1124 EXIT OBSTRUCTIONS**

- (a) No obstruction shall be placed in any aisle, exit, foyer, passageway or corridor.
- (b) Where the floor space of an Assembly occupancy is occupied by tables, chairs or other movable furniture, aisles at least 36 inches in clear width shall be maintained to provide ready access to exit doorways.

### **SECTION 1125 FIRE ALARM**

- (a) A manual fire alarm system shall be installed as required by [Table 1100](#) unless the building is equipped with an automatic fire alarm system or an automatic sprinkler system.
  - (1) Electric power for the fire alarm system shall be from a source independent of the general building lighting, either a designated ‘emergency’ power circuit or tapped ahead of the main. Where [Section 1123.1\(a\)](#) requires a separate and independent source of emergency power for egress illumination, the fire alarm system shall also be similarly equipped; the installation shall be in accordance with the requirements for ‘secondary (standby) power’ in the applicable NFPA Standard for the type of fire alarm system being installed.
- (b) Alarm sending stations.
  - (1) A manual operated sending station shall be provided near each main exit and in the natural path of escape from fire, at readily accessible and visible points which are not likely to be obstructed.

- (2) Each sending station shall be located so that from any part of the building not more than 200 feet will have to be traversed in order to reach a sending station on the same floor, or 100 feet and 1 flight of stairs to reach a sending station upon another floor located in the natural path of escape from fire.
  - (3) The arrangement of sending stations, and the manner of their connection with sounding devices shall be such that there will be no difference between the sounding of actual alarms and drill signals.
- (c) Sounding devices.
- (1) A required sounding device shall be used for fire alarm purposes.
  - (2) Alarm sounding devices shall be provided of such character and so distributed as to be effectively heard in every room above all other sounds. Visible alarm devices may be used in lieu of audible devices only where specifically permitted for institutional occupancies and for places of assembly.
  - (3) Every alarm sounding device shall be distinctive in pitch and quality from all other sounding devices.

**TABLE 1100  
REQUIREMENTS FOR EXIT SIGNS AND FIRE ALARMS**

OCCUPANCY (a)	EXIT SIGNS REQUIRED (b)	MANUAL FIRE ALARM (Section 1125) (f)
Residential (411)		
Hotel (g)	15 Rooms	15 Rooms
Apartment House	More than 2 stories and more than 12 living units.	More than 2 stories and more than 12 living units.
Dormitories	All	All
Other	100 persons	Over 2 stories and over 20 sleeping rooms.
Business (405)	100 persons, or 5,000 sq. ft. per floor	500 persons or 200 above or below street floor
Mercantile (410)	100 persons, or 5,000 sq. ft. per floor	500 persons or 200 above or below street floor
Education (406)	All (b) (c)	All
Institutional (409)	Over 1 story or 30 persons	15 persons (b)
Assembly (404)	100 persons (d)	500 persons – 100 persons if part of school or if located above 1st floor (d)
Storage (412)	100 persons	100 persons
Factory/Industrial (408)	100 persons or 10,000 sq. ft. per floor	Over 1 story or 500 persons or 200 above or below street
Hazardous (407)	30 persons	All

Facility is required if occupancy equals or exceeds number designated in Table.

- (a) Number shown in parenthesis refers to Code section defining Occupancy.
- (b) Signs are not required in situations where location of exits is otherwise obvious and familiar to all occupants, such as in small elementary school buildings or from classrooms and other spaces with less than 100 people.
- (c) Schools with classrooms opening directly to outside at grade are not required to have Exit Signs.
- (d) Sanctuaries or churches are exempt from these requirements.
- (e) Visible alarm devices permitted as per Section 1125(c)2.
- (f) Fire alarm for entire building must be tied together. Isolated buildings located more than 30 feet away may have their own system.
- (g) Motels with all rooms opening directly to outside at grade are exempt from these requirements.

# **making buildings and facilities accessible to and usable by the physically handicapped**

**NORTH CAROLINA STATE BUILDING CODE  
VOLUME I GENERAL CONSTRUCTION  
SECTION (11X)**

Adopted March 13, 1973, by the North Carolina State Building Code Council In  
Accordance with an Act of the General Assembly of 1957, Chapter 1138

Effective September 1, 1973  
Including Amendments through June 24, 1977

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## **preface**

Aware of the difficulties of the physically handicapped in coping with environmental barriers, former Governor Robert W. Scott established in 1971 the Governor's Study Committee on Architectural Barriers. Governor James E. Holshouser, supporting the work of the Committee, extended it into 1973. Chaired by the Honorable Howard F. Twiggs, the Committee examined the problems of the Handicapped and made recommendations which were published in their Interim Report In 1971 and Final Report In 1972. These recommendations initiated a revision of the North Carolina Building Code's handicapped section. After a year of negotiation and compromise with all building Interests, a new, stronger, and more comprehensive section was written and approved by the Building Code Council in March 1973, and became effective September 1, 1973. Significant amendments were made in December 1973, August and December 1976, March 1977 and June 1977.

This handicapped section provides guidelines for making most new and remodeled buildings accessible to and usable by handicapped people – those in wheelchairs, on crutches, with leg braces, or with sight, hearing, or coordination defects, or those who through aging, accident, or disease move with difficulty. It is the spirit and intent of the code requirements to provide these people full and free use of all buildings and facilities in the State so that they may have the education, employment, living, and recreation opportunities necessary to be as self-sufficient as possible.

To assist the [architects](#), engineers, builders, and building inspectors who implement the code, it was suggested to the Governor's Study Committee that the handicapped section be fully illustrated so that all those involved in designing and constructing buildings could see quickly and clearly the meaning of the code requirements. Governor Holshouser generously agreed to fund the preparation of the original *Illustrated Handbook*. In addition to the code material and the illustrations, we have included for reference in [Appendix D](#) reprints of pertinent laws concerning the rights of the handicapped and the removal of architectural barriers.

To communicate graphically the critical and subtle needs of the handicapped, each section of the code has been reviewed and illustrated; the drawings are accompanied by a reference to the code section and an explanation of the code wording which is itself printed on the facing pages. Wherever the code wording is obscure or complicated, we have made a particular effort to clarify and interpret the meaning.

The illustrations are not only examples of minimal design requirements, but are also intended to show the reasons for them so that designers and builders can find new and better ways of meeting the needs of the handicapped. Since building code provisions are of necessity minimal, and are therefore often not the best possible solution, we have identified several which we find inadequate and have given alternative solutions which are identified by the symbol

**PREFERRED** \*]. We hope these notes will be helpful to those conscientious designers who want to go beyond the minimal requirements in providing for the handicapped.

The information and illustrations in this book are available for use to benefit handicapped people. Appropriate credit for their source is requested.

## acknowledgments

We express our appreciation to Ronald Mace and Betsy Laslett as authors of *An Illustrated Handbook*, which is the foundation of this publication, and for their technical assistance in preparing this edition.

The fundamental provisions of this section of the code were developed in 1972 and 1973 through meetings of a special committee of the Building Code Council consisting of Ray Moore, Chairman, Julian Altobellis and John Fox and representatives of the Governor's Study Committee on Architectural Barriers, N.C. Chapter of American Institute of Architects, Professional Engineers of North Carolina, Council of Code Officials, N.C. Home Builders Association, N.C. General Contractors of America, N.C. Association of Plumbing, Heating and Cooling Contractors, N.C. Electrical Contractors Association, Property Control Division, Department of Administration, Medical Care Commission, Department of Human Resources, Division of School Planning, Department of Public Instruction.

## note to designers and owners of buildings

The goals of the physically handicapped person are to have access to and throughout all buildings so they can live a more normal life and assume full responsibilities as citizens. This goal is shared by everyone.

The application of building regulations by designers and owners should take into account the safety of all occupants including the physically handicapped. Elevators are usually incapacitated early in a fire, and they are not counted as means of egress. Since the physically handicapped need assistance to negotiate stairs in exiting a building, designers and owners of buildings should consider specially designed spaces for the physically handicapped on a level where an approved ramp to grade is provided so the handicapped may exit the building without assistance. If this is not possible, designers and owners should consider the normal use of the building while the physically handicapped occupy it to assure provisions for a sufficient number of able-bodied persons readily available to assist the physically handicapped in the evacuation from such spaces down the stairs and other means of egress provided as exits in case of a fire or other emergency.

## si conversion units

In view of present accepted practice in this technological area, U.S. customary units of measurement have been used in this report. It should be noted that the U.S. is a signatory to the General Conference on Weights and Measures which gave official status to the International System of Units (SI) in 1960. Conversion factors for units used in this publication are:

Length:	Weight
1 in. = 2.540 cm	1 lb. = 453.00 g
1 ft. = 30.480 cm	

Temperature:  
 $^{\circ}\text{C} = 5/9 (\text{Temperature } ^{\circ}\text{F} - 32)$

## **[11x]1 scope**

- a) This standard applies to all buildings and facilities regulated by the North Carolina State Building Code, with the exception of single- and two-family detached dwellings, in accordance with the following:

### Residential – R (Sleeping Occupancy)

**Apartments**, hotels, motels, dormitories – This Standard applies to all these buildings where specifically provided for in [Section \(11X\)5](#).

### Business – B (Office Occupancy)

This Standard applies to all these buildings except that the requirements of this Standard may be waived by the enforcing authority where the code makes these requirements applicable for small buildings which are already built.

### Mercantile – M (Shopping)

Mercantile Stores and Shopping Centers – This Standard applies to all these buildings. Individual toilet rooms in small business establishments, including those within shopping malls, must comply with these requirements.

Schools – E (Educational Facilities) – This Standard applies to all these buildings and as specifically provided for in [Section \(11X\)5.2](#).

Jails, Prisons, Mental Hospitals, Orphanages and Nursing Homes and Hospitals – This Standard applies to all public areas of these buildings and as specifically provided for in [Section \(11X\)5.2](#).

### Assembly – A

Stadiums, Grandstands, Theaters, Dance Halls, Skating Rinks, etc. – This Standard applies to all public areas of these buildings and as specifically provided for in [Section \(11x\)6](#) and [\(11x\)7](#). Assembly areas which are raised above the floor or on an incline need not meet these requirements provided spectator areas which are accessible for the handicapped are designed as a part of such an assembly (Refer to [Section \(11x\)4.5](#)).

### Storage – S

Airplane Hangars, Garages and Warehouses

### Industrial – F

Industrial Plants – This Standard applies to all these buildings except that the requirements of this standard may be waived by the enforcing authority for garages with attendants, heavy storage or industrial areas and other similar type occupancies.

- b) This Standard is mandatory on all new construction of buildings and facilities as herein defined and identified. The addition of a wing unit to an existing facility shall be considered new construction, of and by itself, and would therefore be mandated under this standard.

- c) This standard is not mandatory for the restoration or authentic reconstruction of buildings designated as historic properties by the State Historic Preservation Officer (Division of Archives and History) acting on behalf of the North Carolina Historical Commission in accordance with the provision of G. S.121-8 and NCAC 4G. 0600. (For additional information on historic buildings, refer to Section 1009 and 1010.)

## **[ 11x]2 definitions**

### **(11x)2.1 – non-ambulatory disabilities**

Impairments that, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

### **(11x)2.2 – semi-ambulatory disabilities**

Impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastic and those with pulmonary and cardiac ills may be semi-ambulatory.

### **(11x)2.3 – sight disabilities**

Total blindness or impairments affecting sight to the extent that the individual functioning in public areas is insecure or exposed to danger.

### **(11x)2.4 – hearing disabilities**

Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

### **(11x)2.5 – disabilities of incoordination**

Faulty coordination of palsy from brain, spinal, or peripheral nerve injury.

### **(11x)2.6 – aging**

Those manifestations of the aging processes that significantly reduce mobility, flexibility, coordination, and perceptiveness but are not accounted for in the aforementioned categories.

### **(11x)2.7 – ramps, ramps with gradients**

The term “ramp” is defined as a sloping walkway which is attached to a building as a means of moving from one floor elevation to another without encountering any obstructions. Ramps are above normal level.

### **(11x)2.8 – walk, walks**

The term "walk" Is defined as a predetermined, prepared-surface, exterior pathway leading to or from a building which Is placed on the same level as the ground level immediately adjacent thereto.

## **international symbol of accessibility for the handicapped**



The International Symbol of Accessibility for the Handicapped should be used and prominently displayed to identify accessible facilities, including, but not limited to, entrances to buildings, elevators, accessible restrooms, water fountains, public telephones, recreation and rest areas, etc.

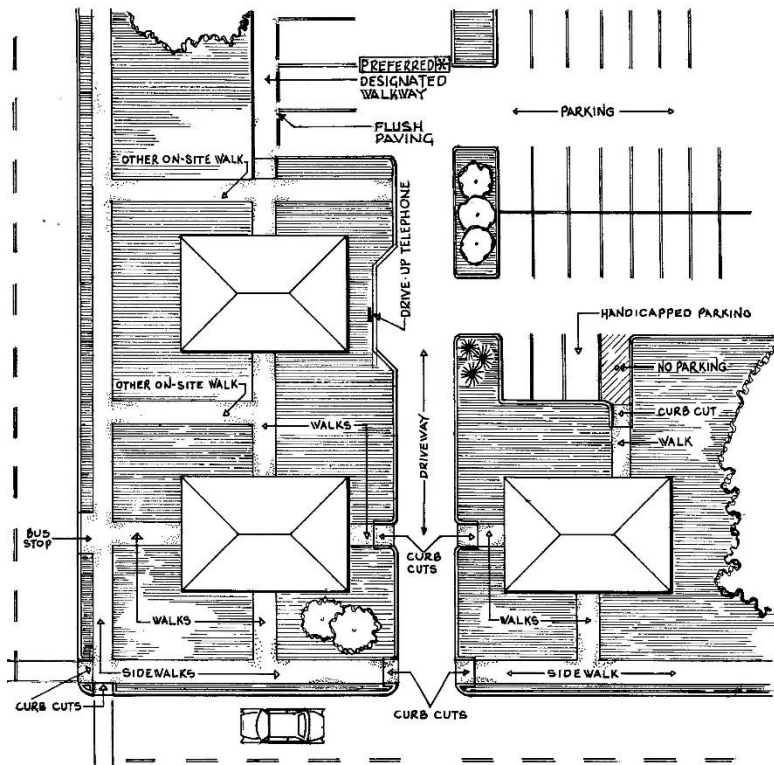
Any advertising of such facilities, including trademark signs erected to identify facilities, should display the International Symbol of Accessibility.

## [11x]3 – site development

### (11x)3.1 – grading

Access to primary entrances usually considered as major points of pedestrian flow to all buildings to which Section (11X)1 applies shall be provided for the handicapped through the proper grading or use of approach ramps. An exception shall be those primary entrances to residential units in privately owned residential projects, which are not part of schools or institutions, which are not identified in (11X)5.

NOTE: Such accessible entrances shall include primary public entrances connecting public transportation stops; primary entrances connecting parking areas specially designated for the handicapped; primary entrances connecting walkways, between buildings in a given complex (e.g., school campus buildings, apartment buildings, shopping center buildings, etc.)



ACCESS BY MEANS OF GRADING, APPROACH RAMPS, OR WALKS SHALL BE PROVIDED FOR ALL BUILDINGS EXCEPT PRIVATELY OWNED RESIDENTIAL PROJECTS (HOUSES, CONDOMINIUMS, & APARTMENTS LESS THAN 10 UNITS).

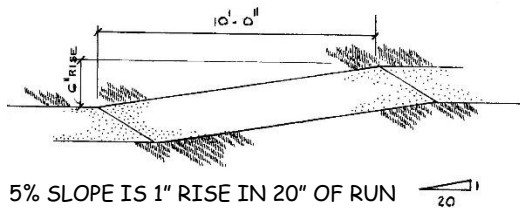
IT IS PREFERRED \* WHERE POSSIBLE, THAT DESIGNATED WALKWAYS BE PROVIDED TO ELIMINATE THE NEED FOR THE HANDICAPPED TO WALK OR WHEEL BEHIND PARKED VEHICLES

PUBLIC WALKS END AT BUILDINGS AND CONNECT THE BUILDINGS WITH PUBLIC TRANSPORTATION STOPS, HANDICAPPED PARKING AREAS, OTHER WALKWAYS, AND OTHER BUILDINGS IN THE SAME COMPLEX

PUBLIC WALKS, AS DEFINED BY THE CODE, END AT BUILDINGS AND DO NOT INCLUDE SIDEWALKS. FOR OTHER ON-SITE WALKS NOT CONNECTED TO BUILDINGS IT IS PREFERRED \* THAT STEPS, ABRUPT CHANGES IN LEVEL, AND STEEP SLOPES BE AVOIDED. DRIVE-UP TELEPHONES ARE PREFERRED \* AS A CONVENIENCE TO THE HANDICAPPED.

**(11x)3.2 – walks**

- a) Public walks connecting primary entrances as defined in (11X)3.1 shall be at least 48 inches wide and shall have a gradient no more than 5%. Where handrails are provided, the gradient may be 8.33%.
- b) Such walks shall have a continuous common surface not interrupted by steps or abrupt changes in level greater than 1/2 inch. Where walks cross driveways or parking lots, they shall blend to a common level by means of curb cuts, and slopes not to exceed 5% gradient. Care should be taken that the curb cut is not in itself a hazard to the blind.



A WALKWAY IS DEFINED AS A PREDETERMINED, PREPARED SURFACE, EXTERIOR PATHWAY LEADING TO OR FROM A BUILDING AND ON THE SAME LEVEL AS THE ADJACENT GROUND. (SEE 11X2.8 - WALKS)

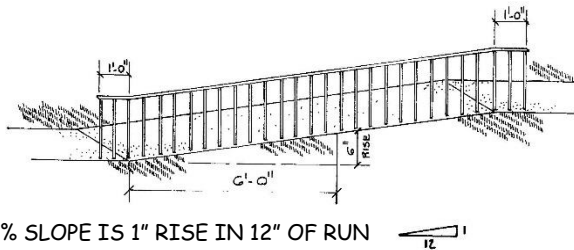
11X3.2(a) IF THE SLOPE OF THE WALK IS 5% OR LESS, THEN NO HANDRAIL IS REQUIRED.

IF THE SLOPE OF THE WALK IS GREATER THAN 5%, A HANDRAIL IS REQUIRED ON ONE SIDE (SEE 11X4.1(b) - HANDRAILS).

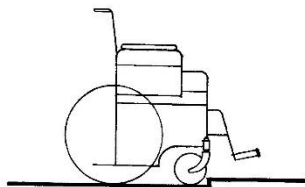
HANDRAILS ARE PREFERRED \* ON BOTH SIDES.

THE SLOPE OF A WALK MAY NOT EXCEED 8.33%.

11X3.2(b) WALKS SHALL HAVE A CONTINUOUS COMMON SURFACE NOT INTERRUPTED BY STEPS OR ABRUPT CHANGES IN LEVEL GREATER THAN 1/2".



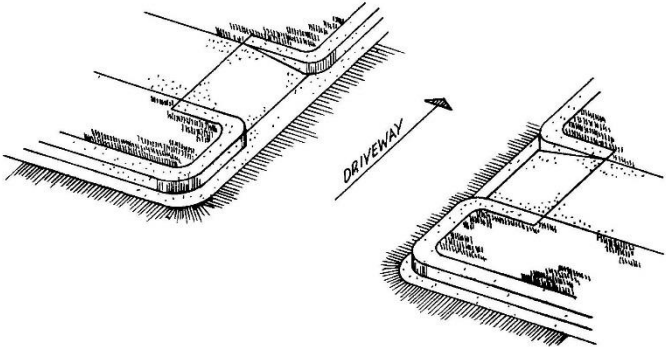
8.33% SLOPE IS 1" RISE IN 12" OF RUN



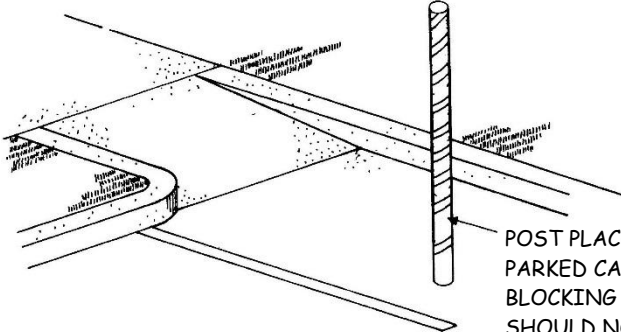
VERTICAL LEVEL CHANGES GREATER THAN 1/2" OBSTRUCT SMALL WHEELS OF CHAIR AND MAY TRIP THOSE WITH SEMI-AMBULATORY DISABILITIES (SEE 11X2.2)



11x3.2(b)  
(cont'd)

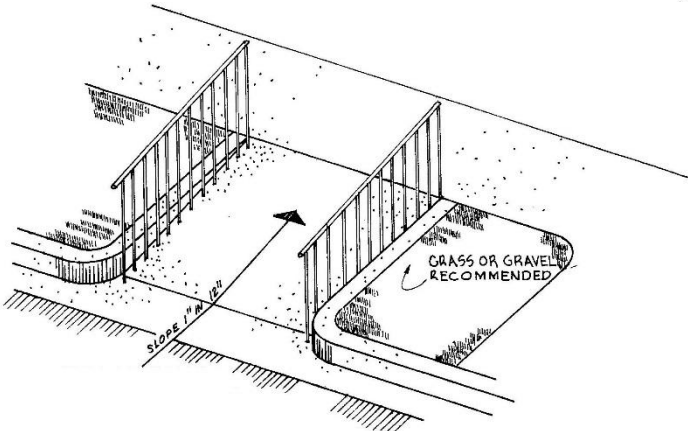


ALL WALKS CROSSING DRIVEWAYS MUST WARP DOWN TO A COMMON LEVEL WITH THE STREET. CARE SHOULD BE TAKEN SO THAT CURB CUT IS NOT IN ITSELF A HAZARD TO THE BLIND.

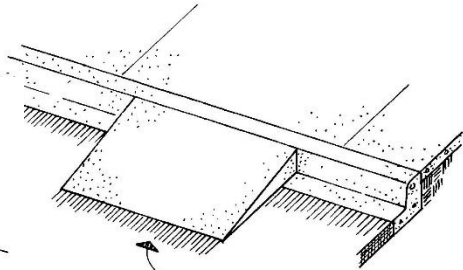


POST PLACED TO PREVENT PARKED CARS FROM BLOCKING RAMP. POST SHOULD NOT BE PLACED WHERE IT BLOCKS WHEELCHAIR ACCESS TO CARS. AT MAJOR POINTS OF PEDESTRIAN FLOW, POST SHOULD BE TALL ENOUGH & APPROPRIATELY PAINTED OR MARKED TO EASILY BE SEEN

CURB CUTS SHOULD BE LOCATED WHERE IT IS IMPOSSIBLE FOR THEM TO BE OBSTRUCTED BY CARS OR OTHER BARRIERS.

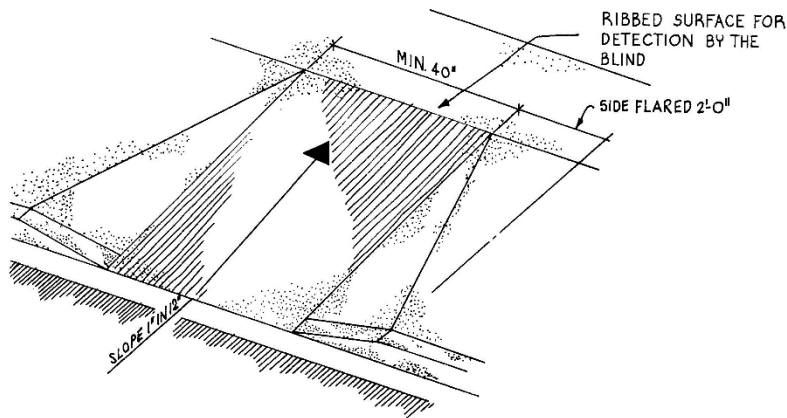


HANDRAILS CAN BE USED AT CURB RAMPS FOR PEDESTRIAN SAFETY. CARE SHOULD BE TAKEN THAT SUCH CURB RAMPS & RAILS DO NOT INTHEMSELVES BECOME A HAZARD TO THE BLIND.



AVOID PLACING CURB RAMPS IN STREET AS ABOVE. DROP OFF AT SIDE IS HAZARDOUS TO ALL UNLESS RAMP IS GREATER THAN 10'-0" WIDE WITH SIDES

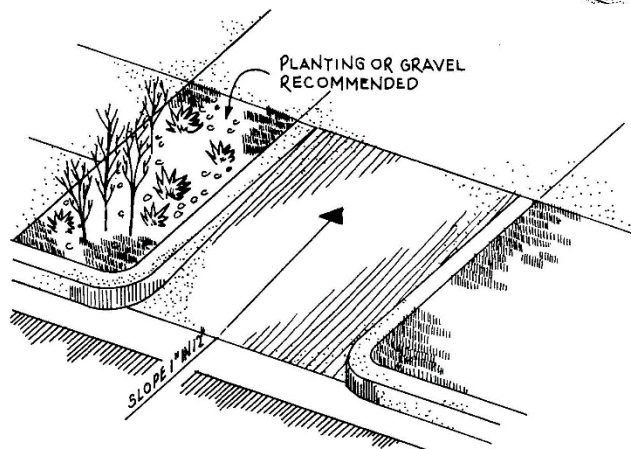
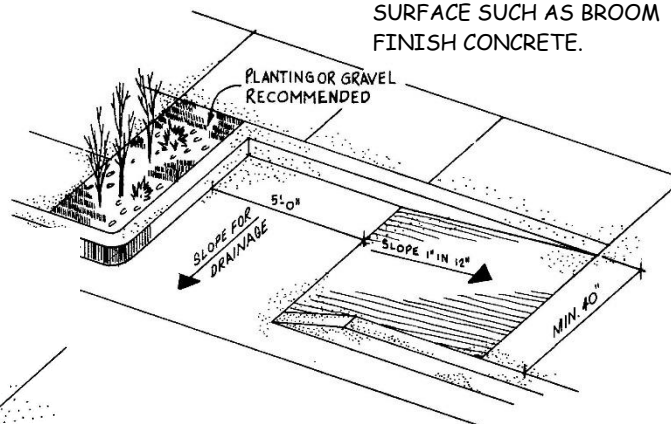
11x3.2(b)  
(cont'd)



FOR CURB CUT DETAILS REFER TO NORTH CAROLINA GENERAL STATUTE GS 136-44.14 AND THE N.C. DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS PUBLICATION, "GUIDELINES CURB CUTS AND RAMPS FOR HANDICAPPED PERSONS", AND RECOMMENDATIONS CONTAINED HERE.

CURB RAMPS MAY LEAD THE BLIND UNKNOWINGLY INTO THE STREET & MAY BE A HAZARD UNLESS THEY ARE CONSISTENTLY MARKED WITH A WARNING TEXTURE. RAMPS WHICH EXTEND INTO THE STREET & DROP-OFF ARE ALSO DANGEROUS.

CURB CUT SHOULD HAVE A TEXTURED, NON-SLIP SURFACE SUCH AS BROOM FINISH CONCRETE.



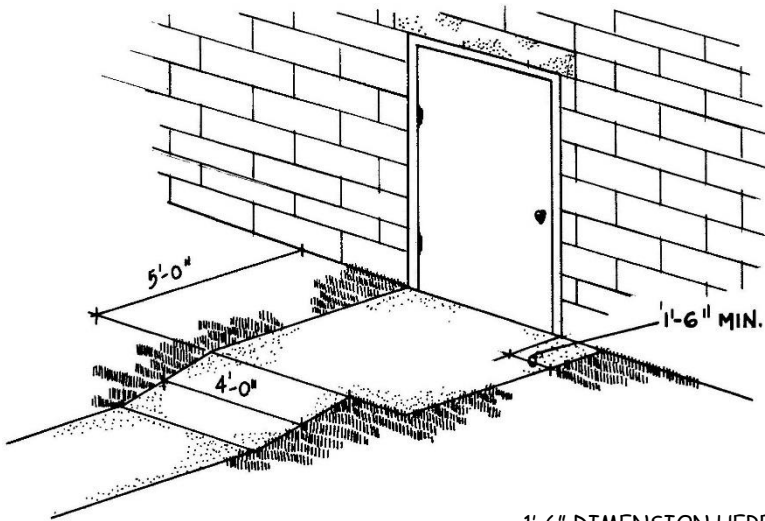
TYPE II - RADIUSED CURB  
THIS TYPE **PREFERRED\***  
BECAUSE CURB PROVIDES VISUAL DEMARCATON & DIRECTIONAL ORIENTATION FOR THE BLIND.

TYPE III - PARALLEL WHEN INSUFFICIENT DEPTH IS AVAILABLE FOR 8.33% SLOPE, RAMP MAY RUN PARALLEL TO STREET.

TYPE IV - WARPED  
SEE N.C. DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAY PUBLICATION. THIS TYPE REQUIRED AT ALL STREETS, HIGHWAYS, ROADS, ETC. IN ACCORDANCE WITH GS 136-44.14

(11x)3.2 – walks (continued)

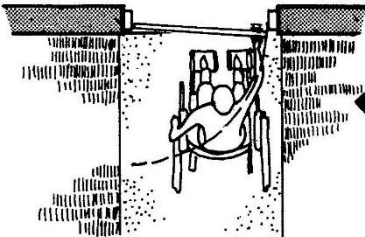
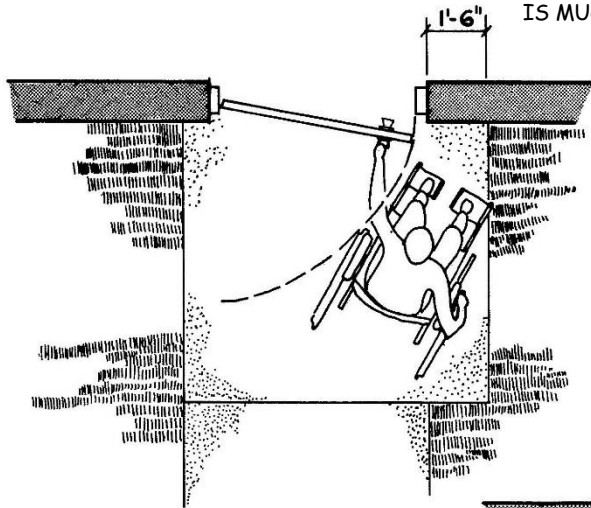
- c) All walks provided under (a) and (b) above shall be provided with a level area no less than 5 feet x 5 feet where they terminate at doors. In no case shall such walks extend less than 1 foot 6 inches beyond the strike jamb on the pull side of the door.



WALKS TERMINATING AT DOORS SHALL HAVE A 5'-0" X 5'-0" LEVEL PLATFORM EXTENDING 1'-6" BEYOND THE STRIKE JAMB ON THE PULL SIDE OF THE DOOR.

1'-6" DIMENSION HERE IS MINIMAL. WHERE IT IS POSSIBLE, A WIDER SPACE IS MUCH PREFERRED\*

THE 1'-6" ALLOWANCE TO THE SIDE OF THE DOOR IS TO ALLOW PERSONS IN WHEELCHAIRS TO MOVE TO THE SIDE OF THE DOOR AND OPEN THE DOOR WITHOUT BACKING THE CHAIR.



HERE, DOOR CANNOT BE OPENED WITHOUT BACKING THE CHAIR.

**(11x)3.3 – parking lots**

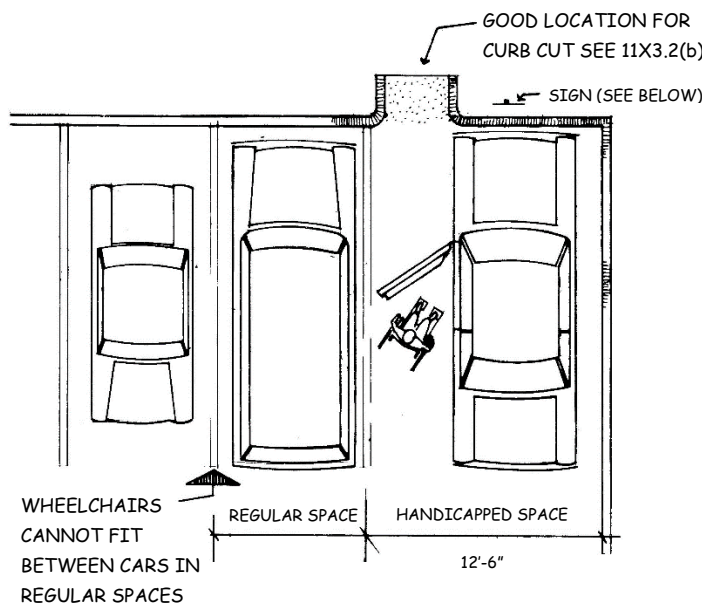
Parking lots provided for buildings to which [Section \(11X\)1](#) applies shall be provided with parking spaces as follows:

- a) Parking spaces for the handicapped shall be set aside and identified with above parking level signs for use by individuals with physical disabilities. Painted curb signs are acceptable.

The minimum number of assigned spaces shall be as follows:

- 1) A minimum of one such parking space for the handicapped shall be provided and in addition at least one space per 50 spaces shall be set aside for the handicapped.
- b) Parking spaces identified for the physically handicapped that are placed on the diagonal or vertical shall be a minimum of 12 feet 6 Inches wide and shall be located as near as possible to the main public entrance of a single building and centrally located where practical in parking lots that serve more than one building.

NOTE: General Statute 20-37.5 and 20-37.6 have been amended in the definition of handicapped and parking privileges of the handicapped. Legal signage and use of required parking spaces is included. See [Appendix D-6](#).

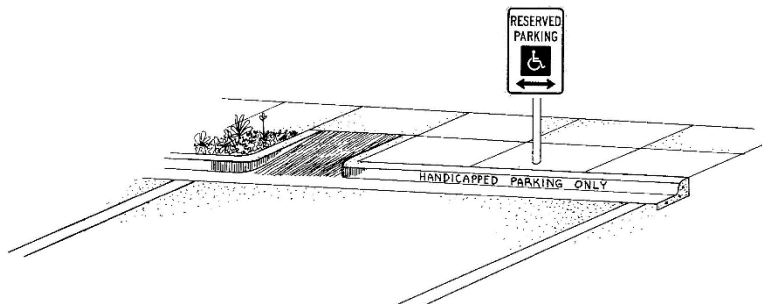


**11x3.3(a)** 2% OF TOTAL NUMBER OF SPACES OR A MINIMUM OF ONE SHALL BE SET ASIDE & DESIGNATED FOR USE OF PHYSICALLY DISABLED

SUCH PARKING SPACES SHALL BE CLEARLY MARKED BY SIGNS FOR USE OF HANDICAPPED

**11X.3.3(b)** HANDICAPPED PARKING SPACES SHALL BE A MINIMUM OF 12'-6" WIDE & LOCATED AS NEAR AS POSSIBLE TO BUILDING ENTRANCES OR CENTRALLY LOCATED IN PARKING LOTS BETWEEN BUILDINGS (SEE DESIGNATED WALKWAYS - PAGE 5.)

THE 2% REQUIREMENT FOR HANDICAPPED PARKING SPACES IS 1 IN 50. THIS IS CONSIDERED TO BE VERY MINIMAL & TWICE THIS AMOUNT IS MUCH **PREFERRED\***.



10'  
12'  
R7-8  
SIGN APPROVED FOR USE UNDER GENERAL STATUTE 20-37.6  
COLORS  
LEGEND AND BORDER — GREEN  
WHITE SYMBOL ON BLUE BACKGROUND  
BACKGROUND — WHITE

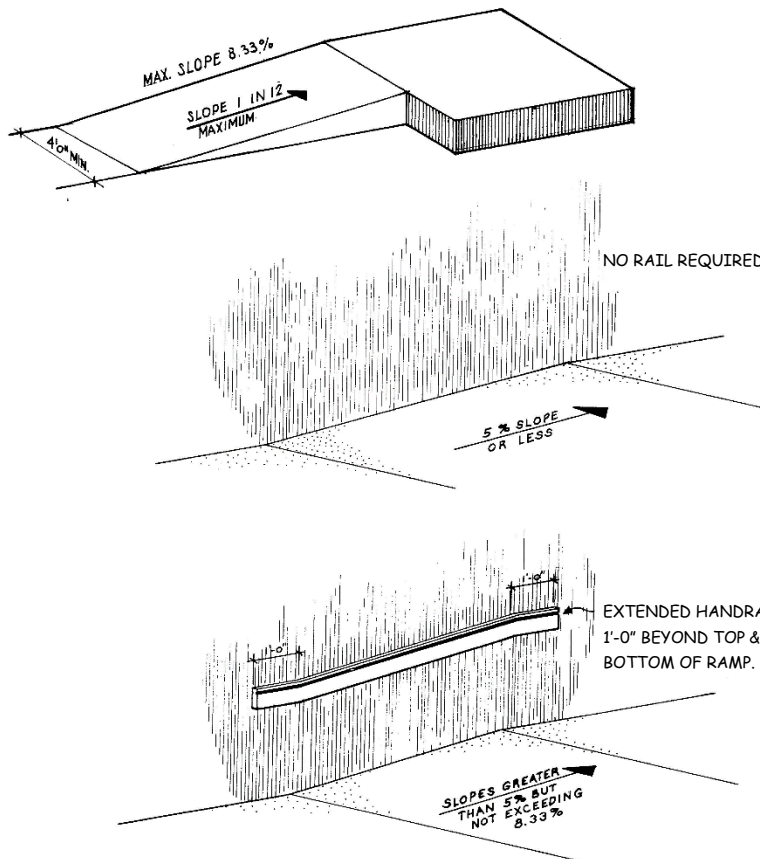
# [11x]4 buildings

## (11x)4.1 – ramps

Ramps to buildings to which [Section \(11X\)1](#) applies shall conform to the following specifications:

- a) A ramp shall not have a slope greater than 1 foot in 12 feet, or 8.33%, and shall be no less than 4 feet clear width and structurally designed to carry a minimum of 100 pounds per sq. ft. live load when free standing.
- b) 1) If ramp slopes 5% or less and there is no drop off, no handrail will be required.
- 2) If ramp slope is greater than 5%, up to and including 8.33%, and there is no drop off, then one handrail will be required.
- 3) Where ramp drops off on one or both sides, handrails are required on both sides of ramp.
- 4) Handrails where required shall be 32 inches in height measured from the surface of the ramp, and extend 1 foot beyond the top and bottom of the ramp, or turn at right angles.

A RAMP IS DEFINED AS A SLOPING WALKWAY WHICH IS ATTACHED TO A BUILDING AS A MEANS OF MOVING FROM ONE FLOOR ELEVATION TO ANOTHER WITHOUT ENCOUNTERING ANY OBSTRUCTION. (SEE 11X2.7 - RAMPS)



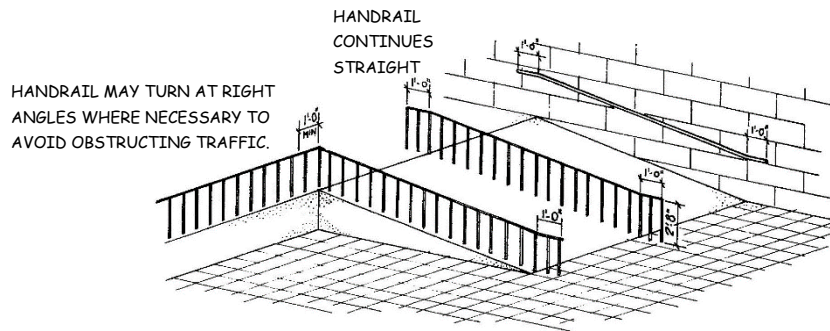
**11X4.1(a)** RAMP WIDTH MUST BE AT LEAST 4'-0". RAMP SLOPES MUST NOT BE GREATER THAN 8.33% (1" IN 12")

**11X4.1(b)** IF RAMP SLOPES 5% (1" IN 20") OR LESS, AND THERE IS NO DROP OFF, THEN NO HANDRAIL WILL BE REQUIRED.

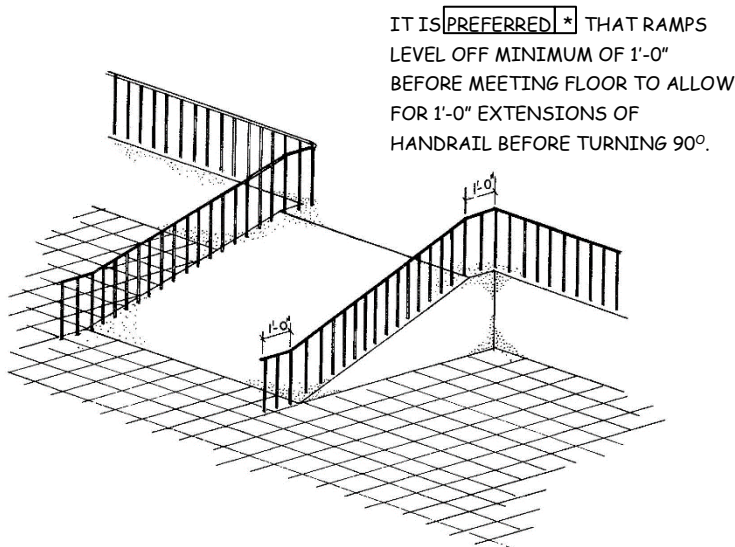
**11X4.1(b)** IF RAMP SLOPE IS GREATER THAN 5%, AND THERE IS NO DROP OFF, THEN ONE HANDRAIL WILL BE REQUIRED. SEE HANDRAIL REQUIREMENTS FOLLOWING.

**(11x)4.1 – ramps (continued)**

- c) A ramp shall have a finished surface which is hard, relatively smooth, slip resistant and that is non-resilient at all times. (Some surfaces become resilient when exposed to heat, water, etc.)
- d) A ramp shall have a level platform at the top which is at least 5 feet by 5 feet. This platform shall extend at least 1 foot on the side from which the door opens.

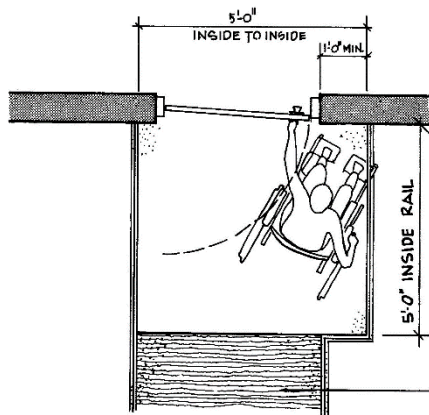


**11X4.1(b)** HANDRAILS, WHERE REQUIRED, SHALL BE CONTINUOUS, SHALL BE SMOOTH, SHALL BE 32" HIGH FROM THE SURFACE OF THE RAMP AND SHALL EXTEND 1'-0" BEYOND THE TOP AND BOTTOM OF THE RAMP, OR TURNED AT RIGHT ANGLES WHERE NECESSARY.



**11X4.1(b)** WHERE RAMP DROPS OFF ON ONE OR BOTH SIDES, HANDRAILS ARE REQUIRED ON BOTH SIDES OF RAMP.

**11X4.1(c)** THE SURFACE OF A RAMP SHALL BE HARD, SMOOTH BUT SLIP-RESISTANT, & NOT RESILIENT.



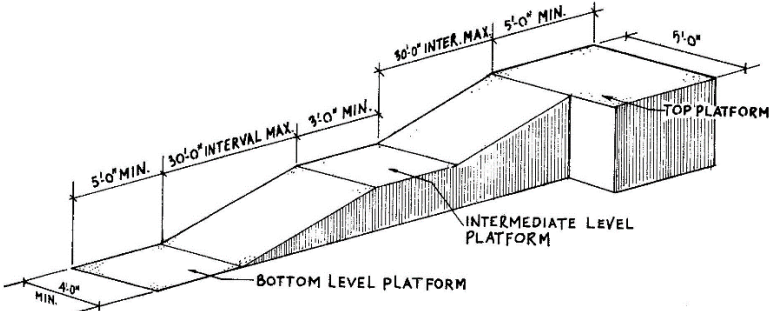
WHERE RAIL IS REQUIRED AT PLATFORM IT IS **PREFERRED \*** THAT 5'-0" x 5'-0" BE AN INSIDE TO INSIDE RAIL DIMENSION.

**11X4.1(d)** RAMPS SHALL HAVE A LEVEL PLATFORM AT LEAST 5'-0" x 5'-0" THAT SHALL EXTEND MIN. 1'-0" ON THE SIDE FROM WHICH THE DOOR OPENS.

BROOM FINISH CONCRETE, CARBORUNDUM GRIT & RUBBER ARE SUITABLE FOR SURFACE MATERIALS FOR RAMPS.

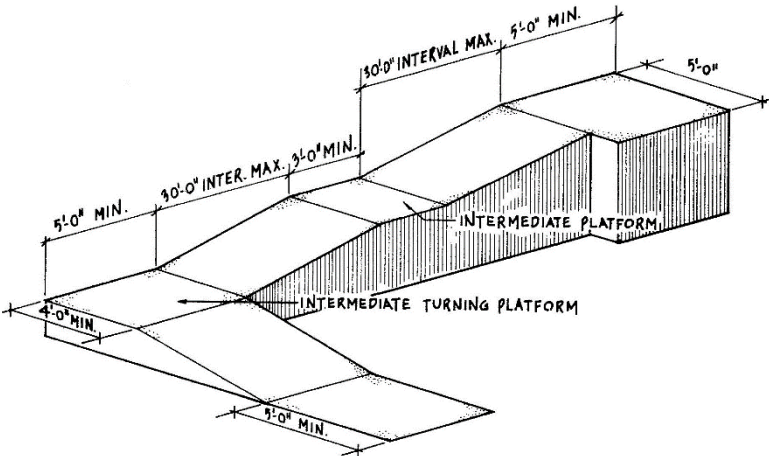
**(11x)4.1 – ramps (continued)**

- e) Each ramp shall have at least 5 feet of straight level clearance at the bottom.
- f) Straight run ramps shall have 3 feet minimum long intermediate level platforms at 30 foot intervals for purposes of rest and safety and shall have level platforms wherever they turn, at least as wide as the ramp and 5 feet long (deep).



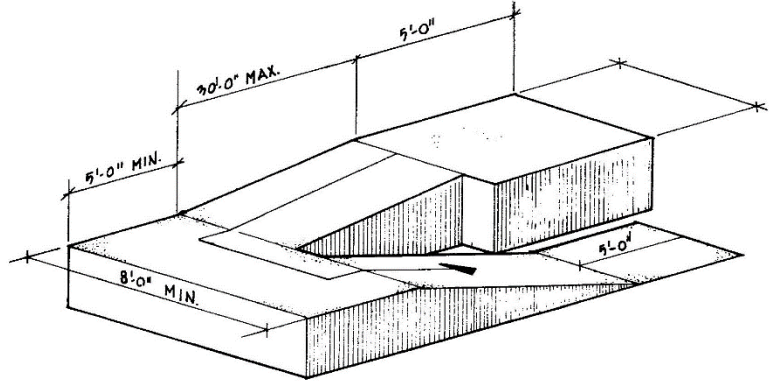
**STRAIGHT RUN RAMP**

**11X4.1(e)** RAMPS SHALL HAVE AT LEAST A 5'-0" STRAIGHT LEVEL SURFACE AT THE BOTTOM TO ALLOW STOPPING DISTANCE FOR WHEELCHAIRS.



**RAMP WITH TURNING PLATFORM**

**11X4.1(f)** RAMPS SHALL HAVE A 3'-0" LONG INTERMEDIATE LEVEL PLATFORM AT 30'-0" INTERVALS FOR REST AND SAFETY.

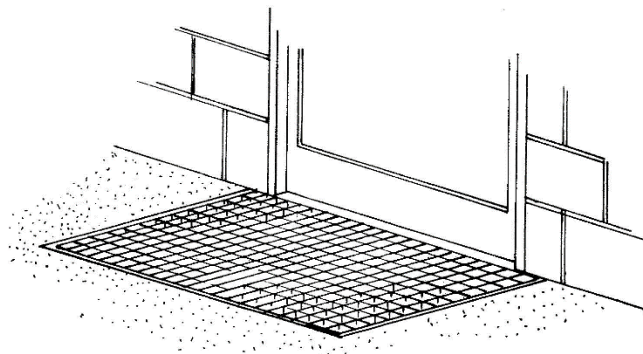
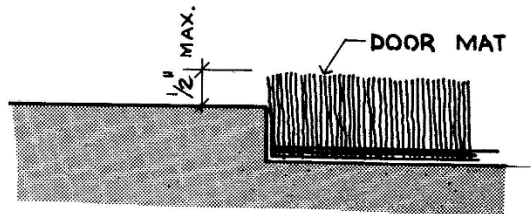
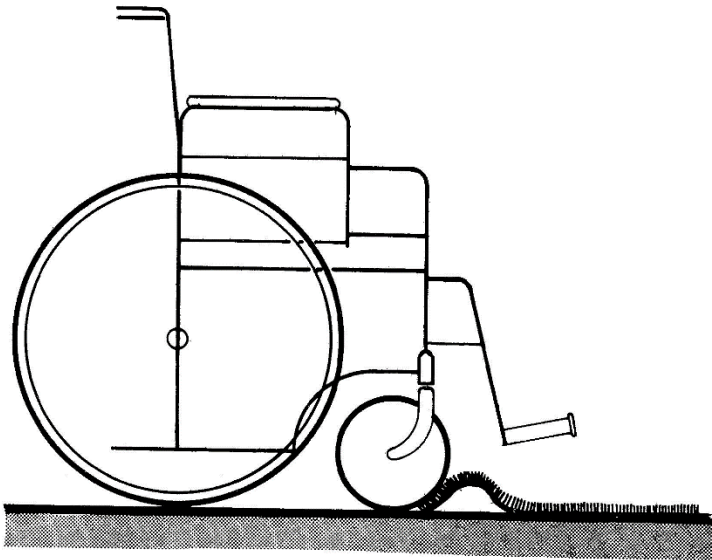


**RAMP WITH INTERMEDIATE SWITCH-BACK PLATFORM**

RAMPS SHALL HAVE LEVEL PLATFORMS WHEREVER THEY TURN TO ALLOW TURNING & STOPPING SPACE FOR WHEELCHAIRS.

**(11x)4.2 – entrances**

All primary entrances usually considered as major points of pedestrian flow to buildings to which Section (11X)1 applies shall be usable by the physically handicapped. An entrance to be usable by the physically handicapped must be approached by a continuous common surface (see 11x3.2 walks; 11x4.1 ramps; and 11x4.5 floors), and have wide doors (see 11x4.3 doors).



AN ENTRANCE TO BE USABLE BY THE PHYSICALLY HANDICAPPED MUST BE APPROACHED BY A CONTINUOUS COMMON SURFACE (SEE 11X3.2 - WALKS, 11X4.1 - RAMPS, & 11X4.5 - FLOORS).

**\*PREFERRED** DOOR MATS & GRATES SHOULD NOT BE BARRIERS.

THICK BRISTLE DOOR MATS OF HEMP OR PLASTIC BUNCH UP UNDER SMALL WHEELS OF CHAIRS PRESENTING A FORMIDABLE BARRIER. OFTEN MATS ARE THICKER THAN THE  $\frac{1}{2}$ " MAXIMUM ALLOWABLE VERTICAL LEVEL CHANGE (SEE 11X3.2(b) - WALKS).

THICK DOOR MATS (GREATER THAN  $\frac{1}{2}$ " ) SHOULD BE RECESSED INTO THE SURFACE AT LEAST  $\frac{1}{2}$  THEIR THICKNESS OF THIN MATS OF WOVEN RUBBER SHOULD BE USED.

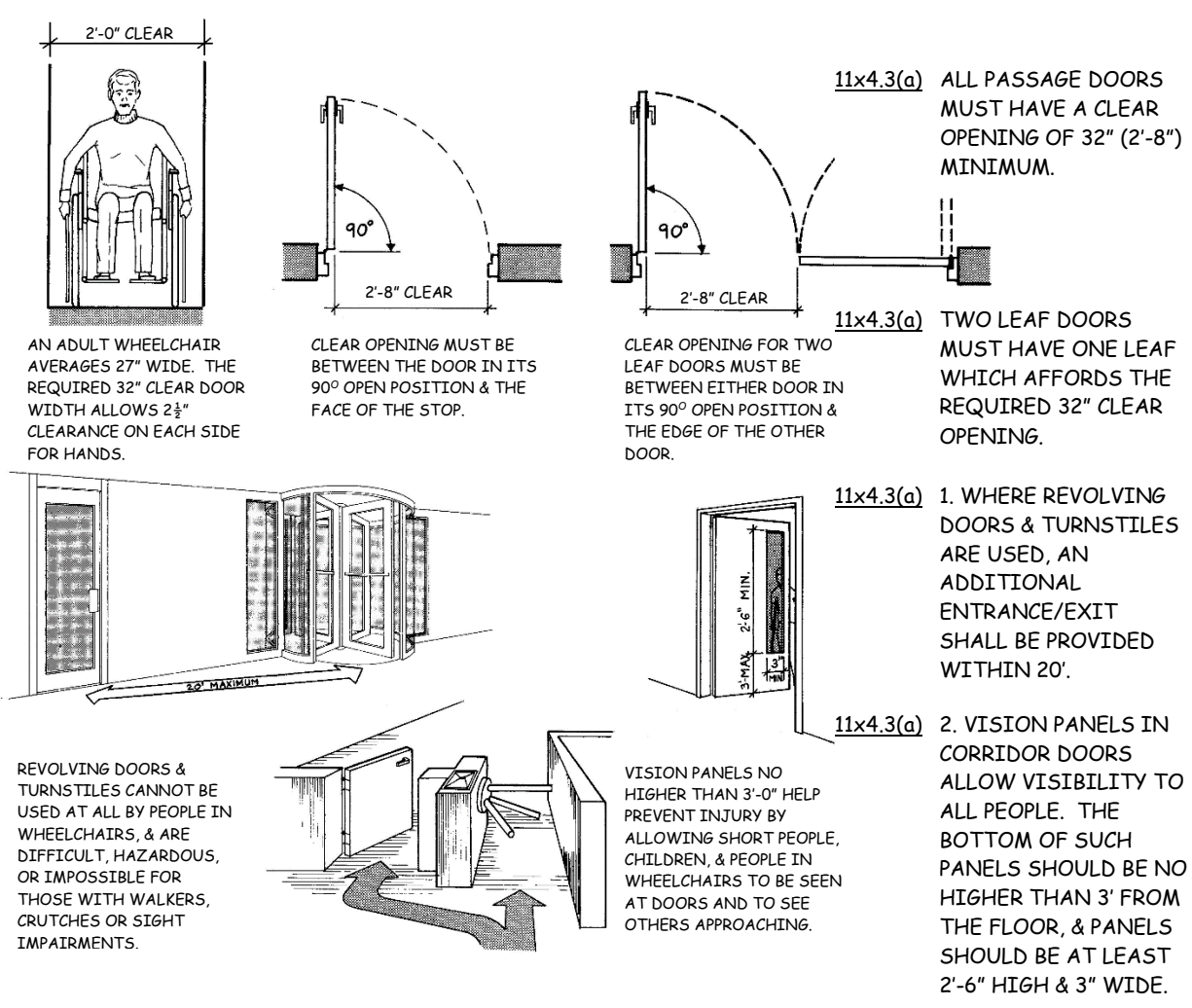
GRATES AT DOORS FOR SNOW AND SAND TRAPS SHOULD BE AVOIDED UNLESS THE MAXIMUM GRID OPENING IS NO MORE THAN  $\frac{3}{8}$ " X  $\frac{3}{8}$ ". LARGER OPENINGS ARE HAZARDOUS TO THOSE WITH CRUTCHES AND CANES AND MAKE WHEELCHAIR TRAVEL EXTREMELY DIFFICULT.



**(11x)4.3 – doors and doorways**

Exterior and Interior passage doors for buildings to which [Section \(11x\)1](#) applies shall comply with the following requirements:

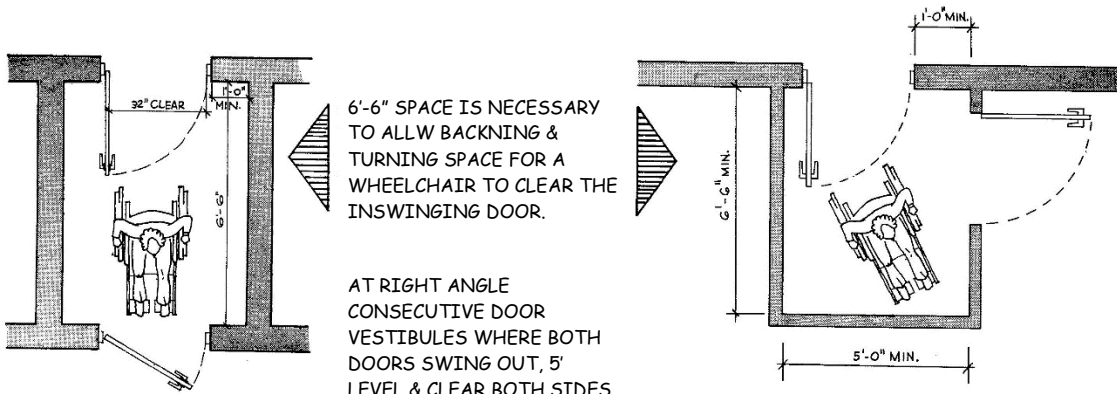
- a) Exterior and interior passage doors shall have a clear opening of no less than 32 inches when the door is open. Two-leaf doors are not usable unless they operate by a single effort, and one of the two leaves meets this requirement.
  - (1) Where revolving doors or turnstiles are used, an adjacent means of ingress- egress within 20 feet shall be provided to meet the requirements of Section (11x)4.3 (a).
  - (2) Where vision panels are used in corridor doors, they should allow visibility to people in wheelchairs. Such vision panels shall be vertically mounted with the bottom of the panel no higher than 3 feet from the finished floor, the panel width not less than 3 inches and the panel length not less than 2 feet 6 inches.



**(11x)4.3 – doors and doorways (continued)**

- b) Distance between two doors (e.g. outer and inner) must be a minimum of 6 feet 6 inches.
- c) The floor on the inside and outside of each doorway shall be level and clear for a distance of 5 feet from the door and shall extend one foot beyond the side from which the door opens.

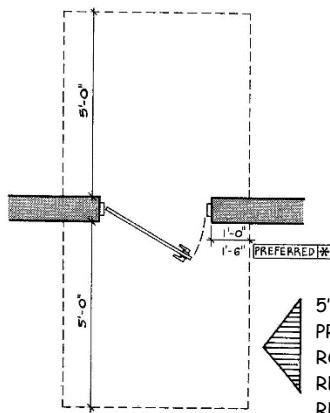
**DOUBLE DOOR ENTRANCE VESTIBULE**



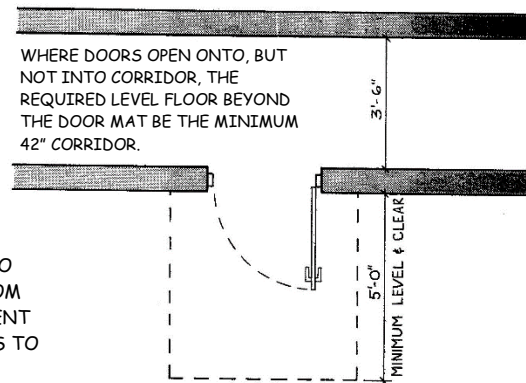
6'-6" SPACE IS NECESSARY TO ALLW BACKNING & TURNING SPACE FOR A WHEELCHAIR TO CLEAR THE INSWINGING DOOR.

AT RIGHT ANGLE CONSECUTIVE DOOR VESTIBULES WHERE BOTH DOORS SWING OUT, 5' LEVEL & CLEAR BOTH SIDES OF DOORS IS ADEQUATE. WHERE EITHER DOOR SWINGS IN THE DISTANCE BEWTEN THE INSWINGING DOOR & FACING WALL MUST BE AT LEAST 6'-6". MINIMUM VESTIBULE SPACE IS THEREFORE 5'-0" X 6'-6".

**11x4.3(b)** THE DISTANCE BETWEEN TWO CONSECUTIVE DOORS MUST BE AT LEAST 6'-6".



5'-0" AREA MUST BE LEVEL TO PREVENT WHEELCHAIRS FROM ROLLING WHEN THE OCCUPENT RELEASES THE WHEEL GRIPS TO REACH FOR DOOR HANDLE.



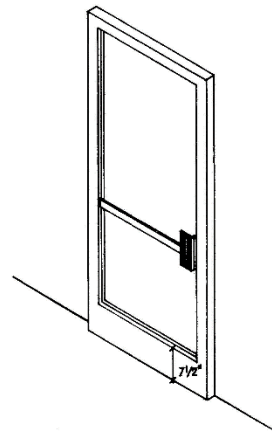
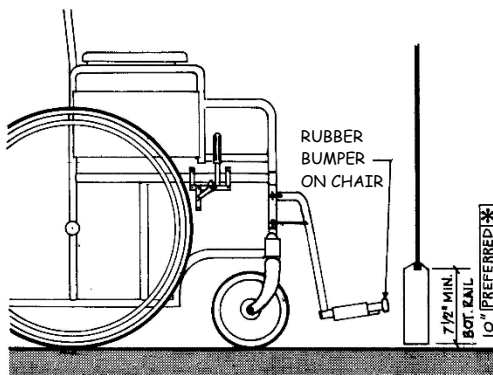
WHERE DOORS OPEN ONTO, BUT NOT INTO CORRIDOR, THE REQUIRED LEVEL FLOOR BEYOND THE DOOR MAT BE THE MINIMUM 42" CORRIDOR.

**11x4.3(c)** THE FLOOR ON THE INSIDE & OUTSIDE OF EACH DOORWAY SHALL BE LEVEL AND CLEAR FOR A 5'-0" DISTANCE FROM THE DOOR, AND SHALL EXTEND 1'-0" TO THE SIDE OF THE DOOR ON THE SIDE OPPOSITE THE HINGES.

**(11x)4.3 – doors and doorways (continued)**

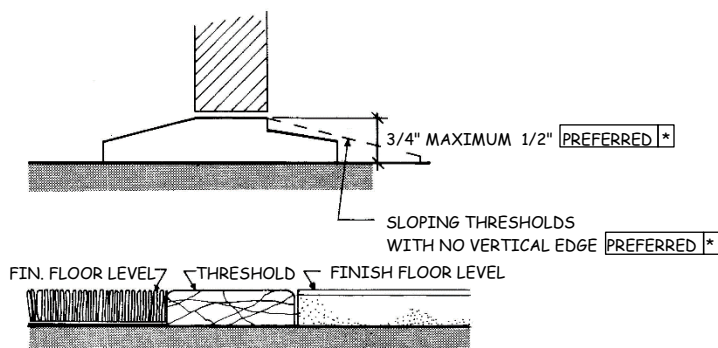
- d) Where framed glass doors are used, the bottom rail shall be a minimum height of 7½ inches. Framed glass doors may be used provided glass is protected to a height of 7½ inches by an applied panel or insert to provide an adequate pushing surface for wheelchair bumpers.
- e) Exterior thresholds shall be beveled with a maximum edge height of ¾ inch. Interior thresholds shall be flush with the floor, or beveled at not more than 5% slope with a maximum edge height of ½ inch.

**11x4.3(d)** BOTTOM RAIL OF FRAMED GLASS DOORS MUST BE AT LEAST 7½" HIGH. FRAMED DOORS WITH NARROW BOTTOM RAILS MAY BE USED PROVIDED GLASS IS PROTECTED TO A HEIGHT OF 7½" BY AN APPLIED PANEL OR INSERT TO PROVIDE AN ADEQUATE PUSHING SURFACE FOR WHEELCHAIR BUMPERS.



BOTTOM RAIL OF GLASS DOORS MUST BE LARGE ENOUGH TO ALLOW RUBBER BUMPERS ON CHAIRS TO PUSH THEM OPEN WITHOUT HITTING GLASS OR SCREENING. RAIL SHOULD HAVE SMOOTH SURFACE TO ALLOW BUMPER TO SLIDE ALONG.

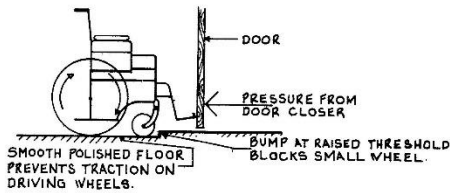
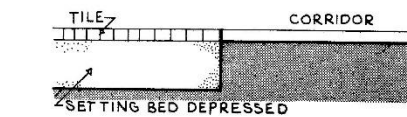
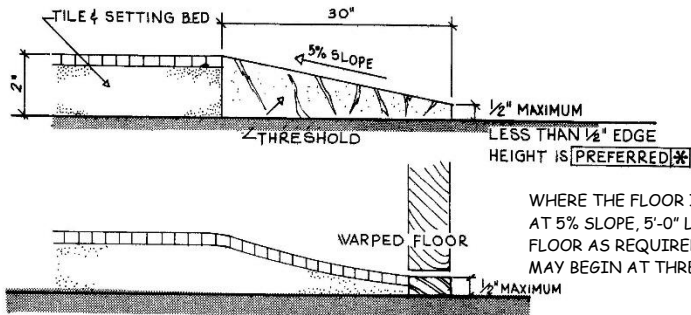
**11x4.3(e)** THRESHOLDS AT EXTERIOR DOORS SHALL BE BEVELED AND HAVE A MAXIMUM EDGE HEIGHT OF ¾".



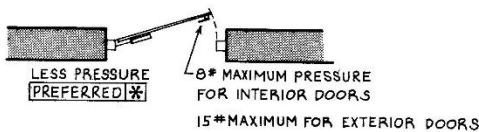
THRESHOLDS AT INTERIOR DOORS SHALL BE FLUSH WITH FLOOR OR SLOPED AT NO MORE THAN 5% AND HAVE A MAXIMUM EDGE HEIGHT OF ½".

**(11x)4.3 – doors and doorways (continued)**

- f) Where door closers are used, the pressure to open a door shall not exceed 8 pounds for interior doors applied at the handle or pull. At exterior doors or where air pressure differences require greater pressure for closers, pressure must never exceed 15 pounds and should be as light as possible. In the case of fire doors, the closing force must be adequate to assure automatic latching.



**PROBLEM:** THE CONDITION ABOVE OFTEN MAKES "HANDICAPPED" TOILET ROOMS INACCESSIBLE TO WHEELCHAIRS.



**11x4.3(e)** WHERE FLOOR LEVELS CHANGE, AS IN TOILET ROOMS WHERE TILE SETTING BEDS RAISE THE FLOOR LEVEL, THE REQUIRED 5% SLOPE RESULTS IN A 30" THRESHOLD.

TO AVOID THIS SITUATION IT IS RECOMMENDED EITHER THAT THE TOILET ROOM FLOOR BE WARPED DOWN, OR THAT THE TOILET ROOM FLOOR BE DEPRESSED IN CONSTRUCTION.

**11x4.3(f)** PRESSURE TO OPEN DOORS WITH CLOSERS SHOULD NOT BE MORE THAN 8 POUNDS FOR INTERIOR DOORS.

PRESSURE AT EXTERIOR DOORS MUST NEVER EXCEED 15 POUNDS, LIGHTER PRESSURES ARE [PREFERRED \*]. FOR FIRE DOORS, CLOSING PRESSURE MUST ASSURE AUTOMATIC LATCHING.

[PREFERRED \*] TIME DELAY DOOR CLOSERS WHICH HOLD OPEN FOR UP TO 12 SECONDS, AND AUTOMATIC POWER OPERATED DOORS, SLIDING OR PIVOTING, ARE BOTH STRONGLY RECOMMENDED AT ENTRANCES, MAJOR DOORWAYS, AND TOILET ROOMS.

**(11x)4.3 – doors and doorways (continued)**

g) Corridors which serve the above doorways shall be no less than 42 inches in width.

**(11x)4.3.1 – door hardware**

Doors that are intended for general public use shall be equipped with door hardware that is easily operable and shall not require the use of fine grasp.

Actuating mechanisms and pulls shall be operable at a height between 30 and 42 inches.

Examples of door hardware which latch and do not require the use of fine grasp are as follows: lever handles, elliptical knobs, heavily faceted knobs, push-pull latches or similar devices. Hold back latches, roller latches, magnetic latches or similar mechanisms are encouraged.

NOTE: Doors for general public use include, but are not limited to, the following: exterior entrance doors; corridor-to-corridor doors; means of egress doors as specified in Section 1102(a) (except room space doors); doors at reception areas; toilet rooms; public activity spaces (conference rooms, auditoria, cafeterias, classrooms, and similar use spaces) and as may be designated by the Building Official

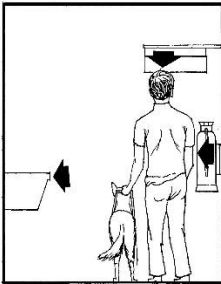
Doors to units described In Section (11x)5.1, 5.2 and 5.3 must comply with these requirements.

Where possible doors shall be

- (1) held in the open position, or
- (2) double-egress, or
- (3) push-pull, non-latching, or
- (4) automatically operated, or
- (5) eliminated.

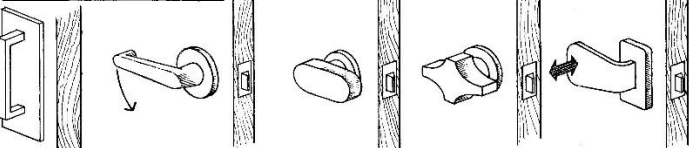
11x4.3(g) CORRIDORS MUST BE NO LESS THAN 42" WIDE.

11x4.3.1 DOORS MUST HAVE HARDWARE WHICH IS EASY TO OPERATE & GRASP & WHICH IS MOUNTED BETWEEN 30" & 42" ABOVE THE FLOOR.



NOTE: WHERE OBJECTS PROTRUDE FROM WALLS OR COLUMNS INTO CORRIDORS OR OTHER PEDESTRIAN AREAS, IT IS RECOMMENDED THAT THOSE OBJECTS BELOW 6'-6" EITHER NOT PROJECT MORE THAN 4" OR THAT THEY CONTINUE TO THE FLOOR OR TO WITHIN 8" OF THE FLOOR SO THAT THEY CAN BE DETECTED BY A BLIND PERSON USING A CANE. SEE APPENDIX E.

NOTE: PEOPLE WHO HAVE DIFFICULTY USING THEIR HANDS MAY NOT BE ABLE TO GRASP, TWIST, & PULL SUFFICIENTLY TO OPEN DOORS WHICH HAVE SMOOTH, ROUND, OR OTHER DIFFICULT-TO-GRASP KNOBS.



**NO LATCH** PREFERRED\*  
DOORS WHICH DO NOT REQUIRE LATCHES ARE PREFERRED\* AND SUCH DOORS SHOULD HAVE HANDLES WHICH ARE LARGE ENOUGH TO PUT AN ENTIRE HAND OR FOREARM THROUGH.

**LEVER HANDLES** PREFERRED\*

**ELLIPTICAL** ACCEPTABLE

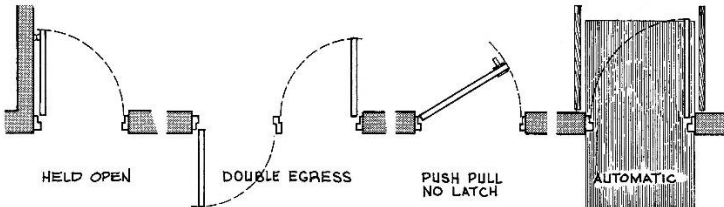
**FACETED** ACCEPTABLE

**PUSH-PULL** PREFERRED\*

GENERALLY, HANDLES WHICH ARE ECCENTRIC ABOUT THEIR PIVOT POINTS CAN BE OPERATED WITHOUT GRASPING. LEVERS ARE PREFERRED\*

DOORS WHICH DO NOT REQUIRE LATCHES ARE PREFERRED\*.

DOORS IN RESIDENTIAL & INSTITUTIONAL OCCUPANCIES SPECIFIED IN SECTIONS 11x5.1, 5.2 & 5.3 MUST COMPLY WITH THESE REQUIREMENTS.

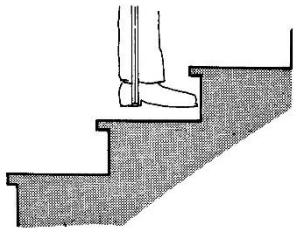


- WHERE POSSIBLE DOORS SHALL BE:
1. HELP OPEN
  2. DOUBLE EGRESS
  3. PUSH-PULL NO LATCH
  4. AUTOMATIC
  5. ELIMINATED

**(11x)4.4 – stairs**

Stairs shall conform to [Section 1115](#) and in buildings to which [Section \(11X\)1](#) applies, the following additional requirements shall be met:

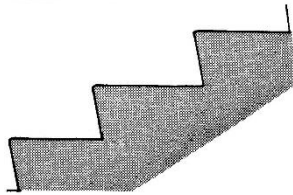
- a) Steps in stairs shall not have abrupt (squared) nosing. One inch rounded nosing is acceptable.



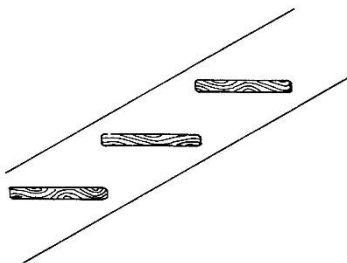
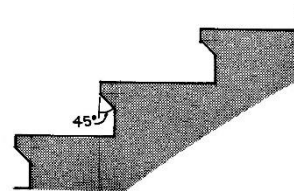
UNACCEPTABLE STAIR  
PERSONS WEARING LEG BRACES  
OFTEN TRIP BECAUSE THEY  
CANNOT DROP THE TOE TO CLEAR  
THE STAIR NOSING.

STAIRS MUST COMPLY WITH  
SECTION 1115 AND THE  
FOLLOWING.

11x4.4(a) STEP IN STAIRS SHALL  
NOT HAVE ABRUPT  
(SQUARE) NOSINGS.



ACCEPTABLE STAIR  
WITH VERTICAL OR SLANTED  
RISERS.

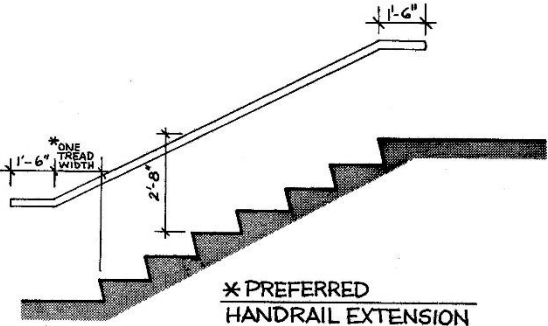


OPEN RISER STAIRS  
THE CODE IS INTENDED TO  
PROVIDE SAFE & ADEQUATE  
STAIRS FOR HANDICAPPED PEOPLE  
& IS NOT INTENDED TO  
ELIMINATE DECORATIVE OPEN  
RISER STAIRS, WHICH, FOR THE  
REASONS STATED ABOVE, ARE A  
HAZARD TO PERSONS WEARING  
LEG BRACES.

HOWEVER, OPEN RISER STAIRS,  
WHERE ALLOWED BY OTHER  
SECTIONS OF THE BUILDING  
CODE, SHOULD NOT BE  
PROHIBITED IN BUILDINGS  
WHICH HAVE, ON THE SAME  
FLOOR, RAMPS, STAIRS, OR  
ELEVATORS THAT COMPLY WITH  
THE CODE.

**(11x)4.4 – stairs (continued)**

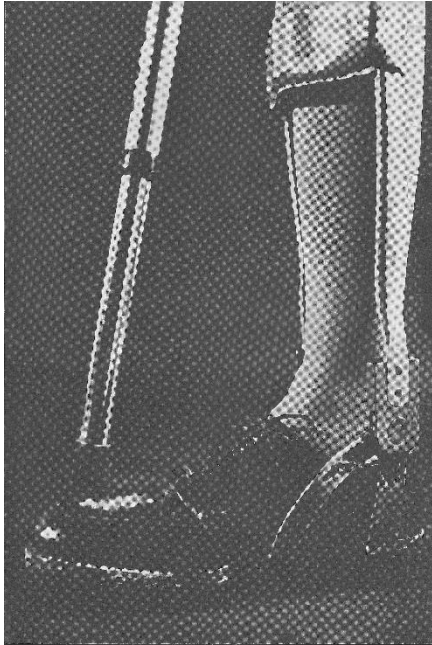
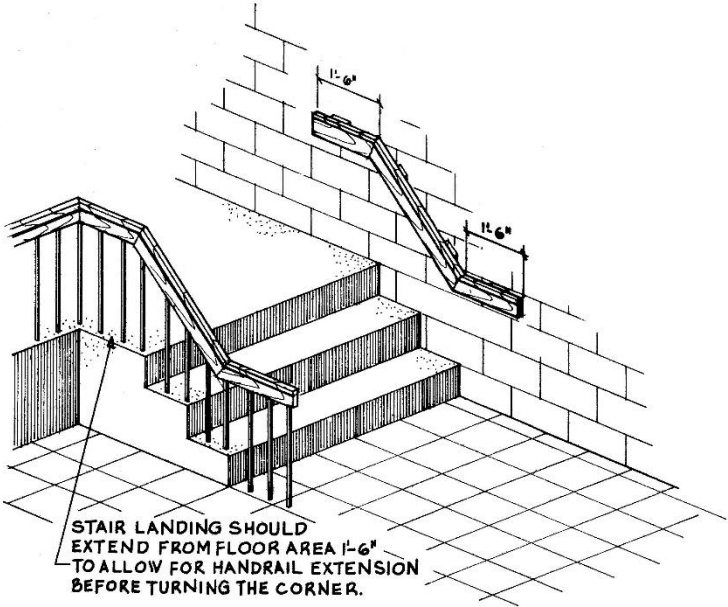
- b) Interior and exterior building stairs – other than stairs to service areas, equipment rooms, penthouses or attics – shall have handrails on both sides which are mounted 2 feet 8 inches high, as measured from the tread at the nosing. In residential occupancies, this requirement applies to those units described in (11x)5.1, 5.2 and 5.3.
- c) Stairs shall have at least one continuous handrail that extends at least 1 foot 6 inches beyond the top step and beyond the bottom step or turned at right angles. Care shall be taken that the extension of the handrails is not in itself a hazard and the extensions should be made on the side of a continuing wall.



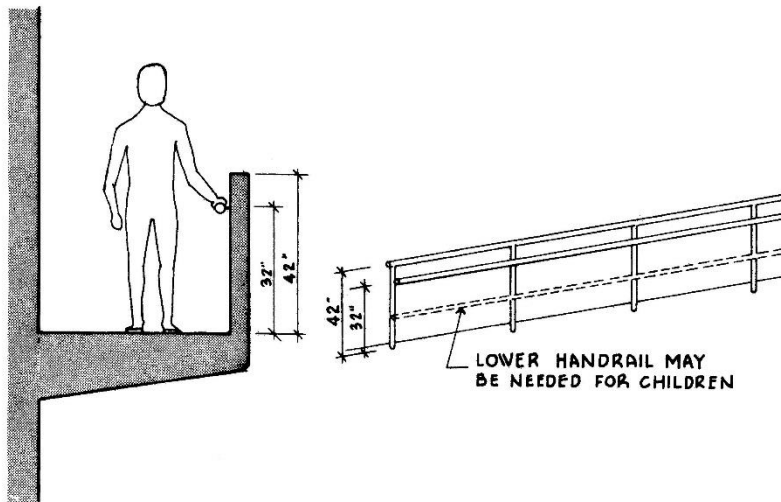
11x4.4(b) STAIRS SHALL HAVE CONTINUOUS HANDRAILS BOTH SIDES, 32" HIGH AS MEASURED FROM THE TREAD AT THE NOSING.

11x4.4(c) HANDRAILS SHALL EXTEND 1'-6" BEYOND THE TOP & BOTTOM OF THE STAIR OR TURN AT RIGHT ANGLES.

CARE SHALL BE TAKEN THAT THE EXTENSION OF THE HANDRAILS IS NOT IN ITSELF A HAZARD, AND THE EXTENSION SHOULD BE ON THE SIDE OF A CONTINUING WALL.



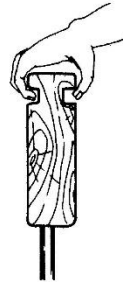
11x4.4(c) WHERE OTHER SECTIONS OF THE CODE REQUIRE RAILINGS TO BE 42" OR 48" HIGH, AN AUXILIARY HANDRAIL MUST BE INSTALLED 32" ABOVE THE FLOOR.



THIS TYPE IS DIFFICULT TO GRIP



WHERE NARROW, DEEP HANDRAILS ARE USED, CONSIDERATION SHOULD BE GIVEN TO SHAPING HANDRAILS SO AS TO PROVIDE EASIER GRIP FOR PERSONS WITH LIMITED GRIPPING POWER.



GROOVES ALLOW BETTER GRIPPING





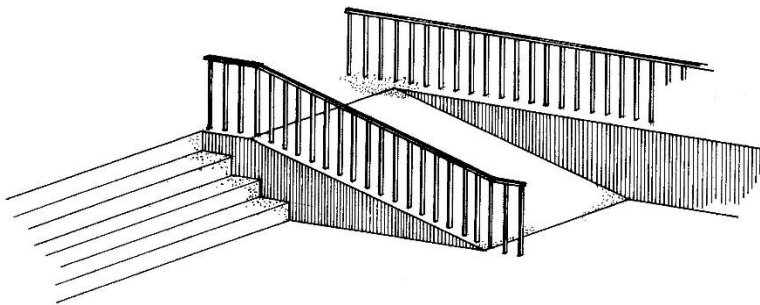
**(11x)4.5 – floors**

- a) Floors on a given story shall be a common level throughout or be connected by a ramp in accordance with (11X)4.1(a) through (11X)4.1(f). Inclusive, except that thresholds meeting requirements of 4.3(e) may be used. Stages, balconies and bleachers are not required to conform to this requirement.

EXAMPLE 1: There shall not be a difference between the level of the floor of a corridor and the level of the floor of the toilet rooms, unless proper ramps are provided. Consideration should be given to depressing toilet floor construction if ceramic tile is used to provide for common level.

EXAMPLE 2: There shall not be a difference between the level of the floor of a corridor and the level of a meeting room, dining room, or any other room, unless proper ramps are provided

EXAMPLE 3. Where raised or depressed floor areas are provided within a room for beverage bars which are not self-service facilities, such as in restaurants and beverage establishments, such floor areas need not be accessible to wheelchairs if the same facilities or services are available at an accessible floor level in a visible, contiguous area. Such inaccessible bar areas shall not constitute more than 33-1/3 % of the net main floor area (excluding balconies, etc.) of the dining or lounge area unless ramp or wheelchair lift is provided.



11x4.5(a) FLOORS ON A GIVEN STORY SHALL BE A COMMON LEVEL THROUGHOUT OR BE CONNECTED BY A RAMP IN ACCORDANCE WITH 11x4.1(a-f).

STAGES, BALCONIES & BLEACHERS ARE NOT REQUIRED TO MEET THIS REQUIREMENT (EXCEPT IN FEDERALLY FUNDED PROJECTS. SEE PUBLIC LAW 90-480)

EXAMPLE 1: SEE 11x4.3(e) DOORS PAGES 27-29

EXAMPLE 2: SEE ABOVE.

WHERE SMALL RAISED PLATFORM SEATING IS PROVIDED WITHIN A ROOM FOR SPECIFIC FACILITIES, AS IN RESTAURANTS AND LOUNGES, PLATFORMS NEED NOT BE ACCESSIBLE TO WHEELCHAIRS IF THE SAME FACILITIES ARE AVAILABLE AT THE MAIN FLOOR LEVEL IN THE SAME AREA. HOWEVER, IT IS PREFERRED ★ THAT SOME OF THESE PLATFORMS BE ACCESSIBLE.

**(11x)4.6 – toilet rooms**

On every floor where toilet rooms are planned in every building to which [Section \(11X\)1](#) applies, one toilet room for men and one toilet room for women shall have at least one fixture of each type provided, to meet the requirements of this Section (4.6). Each building shall have a minimum of 2% of total fixtures of each type to meet the requirements of this Section (4.6).

Where several toilet rooms with group facilities are provided on a floor, at least one toilet room per floor for men and one for women, if both are provided, shall have at least one fixture of each type to meet the requirements of Section 4.6(a) through (j).

Where toilet rooms do not have group facilities but are single individual toilet rooms, the toilet room itself shall be considered the toilet stall as well as a toilet room, and at least one such room for men and one such room for women shall meet the requirements of 4.6(a), (b)3, 4, 5, (c), (d), (e), (g), (h), (i), (j).

In small business establishments, a toilet stall, as described in [\(11x\)4.6\(b\)](#), may be accepted as a toilet room with the lavatory in an adjacent space. The space adjacent to the stall door shall have the ‘turn-around’ space specified in [\(11x\)4.6\(a\)](#).

ON EVERY FLOOR WHERE TOILET ROOMS ARE PLANNED, ONE TOILET ROOM FOR MEN AND ONE FOR WOMEN MUST BE PROVIDE AT LEAST ONE FIXTURE OF EACH TYPE ACCESSIBLE TO THE PHYSICALLY HANDICAPPED IN ACCORDANCE WITH THE REQUIREMENTS OF THIS SECTION (11x4.6).

A MINIMUM OF ONE FIXTURE OF EACH TYPE PER TOILET ROOM OR 2% OF TOTAL FIXTURES, WHICHEVER IS GREATER, MUST BE ACCESSIBLE TO THE HANDICAPPED.

WHERE TOILET ROOMS DO NOT HAVE GROUP FACILITIES BUT ARE SINLGE INDIVIDUAL TOILET ROOMS, THE TOILET ROOM ITSELF SHALL BE CONSIDERED AS THE TOILET STALL, AND AT LEAST ONE SUCH ROOM FOR MEN AND ONE SUCH ROOM FOR WOMEN SHALL MEET THE REQUIREMENTS O FTHE CODE.

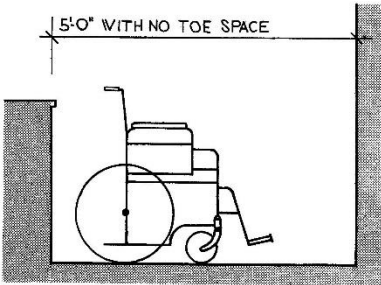
\* EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT HANDICAPPED TOILETS BUT WERE AFRAID TO ASK.

**(11x)4.6 – toilet rooms (continued)**

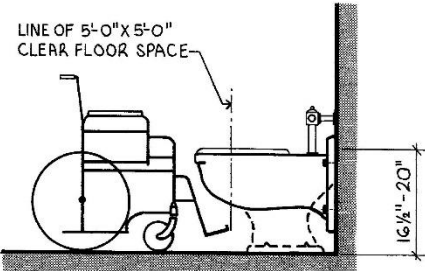
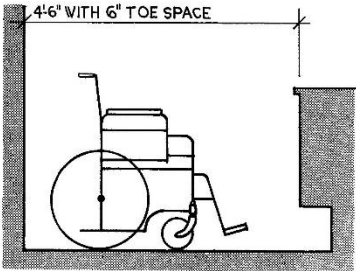
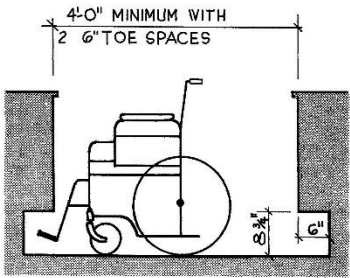
a) A clear floor area which is 5 feet by 5 feet square or a 5 feet diameter circle shall be provided. (Additional turnaround configurations are described in [Appendix A](#)) The swing of the toilet room door may overlap this area a maximum of one foot. Where total available floor space is a particularly crucial concern, and where toe space is provided under cabinets, toe space of no more than 6 inches in depth and a minimum of 8¾ inches in height on any one side, can be allowed to supplant part of the 5 feet x 5 feet clear floor space.

**EXAMPLE:** If toe space 8¾ inches in height and 6 inches in depth were provided, under cabinets on two opposite sides of the toilet room, the remaining clear floor space in addition to the toe space is 4 feet x 4 feet. However, if the depth of the toe space is 12 inches on each of two opposite sides of a toilet room, the additional clear floor space would still have to be 4 feet x 4 feet.

**11x4.6(a) CLEAR FLOOR SPACE:** MINIMUM CLEAR FLOOR SPACES IN TOILET ROOMS BETWEEN WALLS, WALLS & CABINETS, FIXTURES & WALLS, CABINETS & WALLS, MUST BE 5'-0" UNLESS A TOE SPACE OF 6" DEPTH & 8¾" HEIGHT IS PROVIDED ON ONE OR BOTH SIDES, IN WHICH CASE MINIMUM CLEAR FLOOR SPACE MAY BE 4'-0" X 4'-0".



CLEAR FLOOR SPACE OF 5'-0" IS REQUIRED TO ALLOW SUFFICIENT TURNING SPACE FOR WHEELCHAIRS.



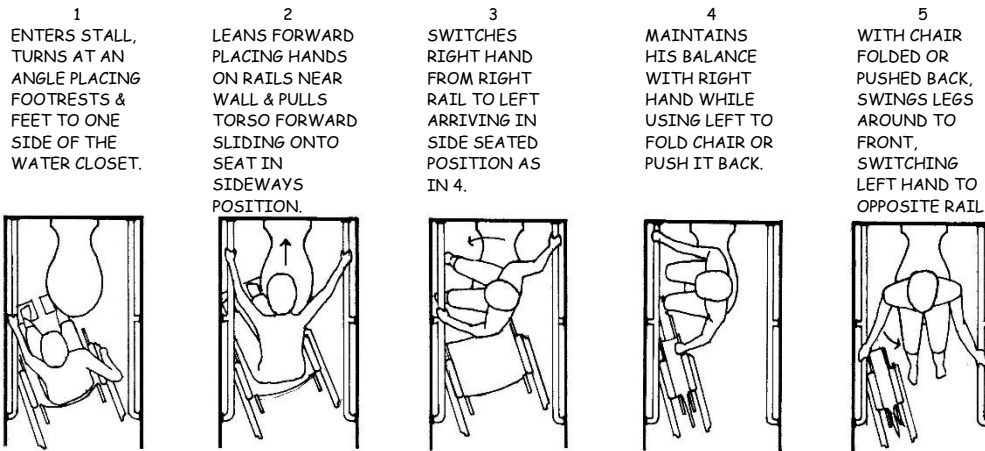
TOE SPACE UNDER WALL-HUNG FIXTURE MAY ALSO REPLACE 6" OF CLEAR FLOOR SPACE.

FLOOR MOUNTED WATER CLOSETS MUST HAVE A DEEPLY RECESSED BASE FOR FOOTRESTS.

WALL HUNG FIXTURES ARE **PREFERRED \*** TO ALLOW TOE SPACE FOR WHEELCHAIR FOOTRESTS TO FACILITATE APPROACH TO SEAT.

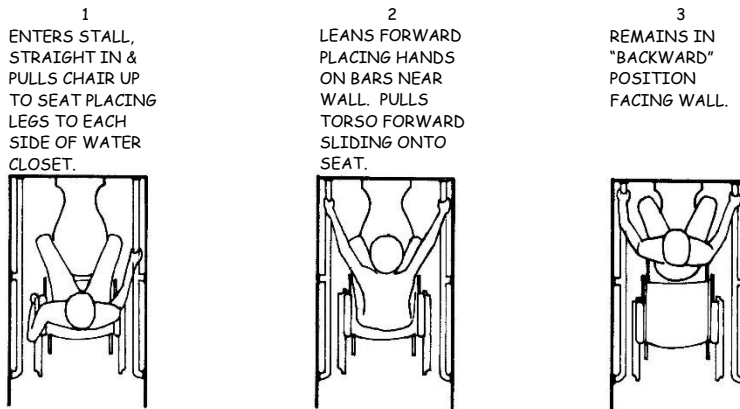
**TECHNIQUE FOR TRANSFER FROM WHEELCHAIR TO W.C. IN STALLS.**

THIS METHOD IS DIFFICULT OR IMPOSSIBLE FOR MANY PERSONS WITHOUT EXTENSIVE TRAINING.



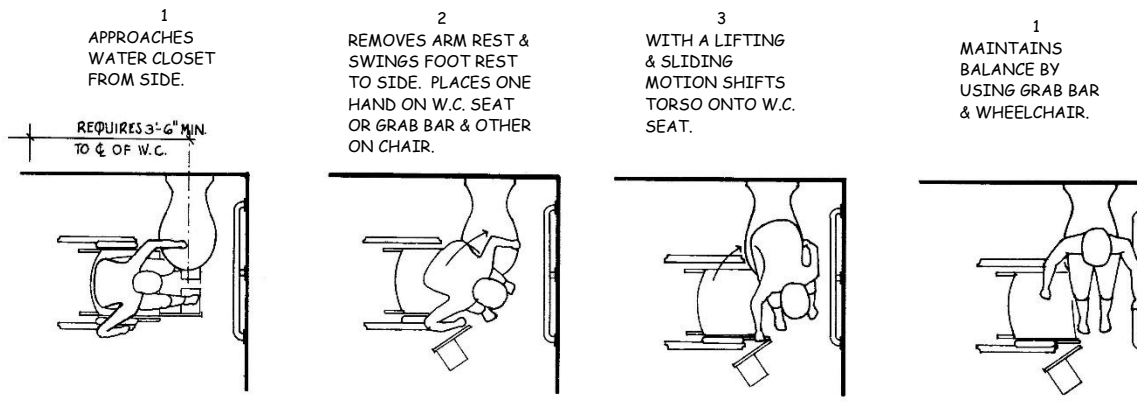
**ALTERNATE METHOD**

ALSO DIFFICULT OR IMPOSSIBLE FOR MANY.



**SIDE APPROACH METHOD**

THIS METHOD CAN BE DONE BY MOST HANDICAPPED PEOPLE.  
STALLS ALLOWING SPACE FOR THIS METHOD ARE PREFERRED \*



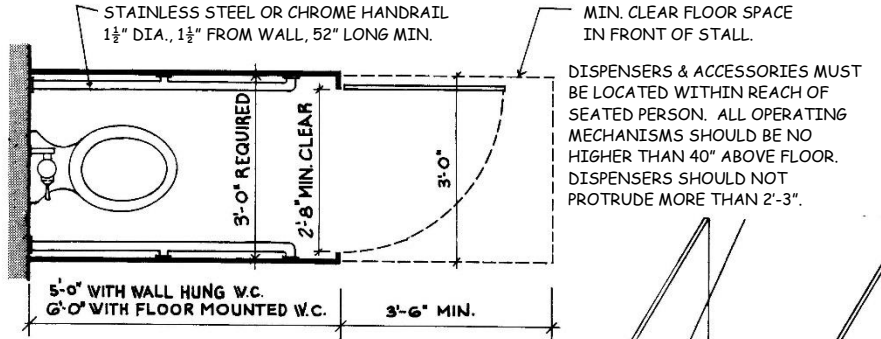
**(11x)4.6 – toilet rooms (continued)**

- b) Toilet rooms shall have at least one toilet stall that meets the following requirements:
  - 1) Is at least 3 feet wide.
  - 2) Is at least 6 feet deep. Note: 5 feet deep stall may be used if wall hung water closets are used.
  - 3) Doors shall have a clear opening of not less than 32 inches when open, shall swing out or slide, and shall be operable by a single effort.
  - 4) Has a water closet with height to top of seat of no less than 16 inches and no more than 20 inches. Water closets for children shall meet the requirements for their use.
  - 5) Has stainless or chrome plated steel handrails on each side wall. Each handrail shall be 13 inches above the seat height of the water closet and at least 52 inches long. Each handrail shall be parallel to the floor, 1½ inches in outside diameter, shall have 1½ inch clear space between rail and wall, and be fastened securely at ends and center to support a 250 pound load.
  - 6) Has a minimum clear floor space of 42 inches in depth and 36 inches in width in front of the stall door.

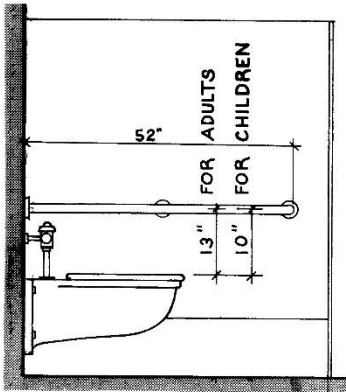
**11x4.6(b) TOILET STALLS**

AT LEAST ONE TOILET STALL IN EACH TOILET ROOM MUST MEET THE REQUIREMENTS OF 11x4.6(b) 1-6.

- 1. STALL SHALL BE 3'-0" WIDE.
- 2. STALL SHALL BE 6'-0" DEEP WHEN FLOOR MOUNTED WATER CLOSET IS USED, OR 5'-0" DEEP IF WALL MOUNTED FIXTURE IS USED.
- 3. DOORS SHALL HAVE A CLEAR OPENING OF 32" MINIMUM AND SHALL SWING OUT OR SLIDE.
- 4. TOILET SEAT, NOT RIM, SHALL BE 16½"-20" HIGH. STANDARD TOILETS FOR SMALL CHILDREN WILL MEET THEIR REQUIREMENTS.
- 5. HANDRAILS 1½" IN OUTSIDE DIAMETER AND 52" LONG SHALL BE INSTALLED ON EACH WALL PARALLEL TO FLOOR AND 1½" FROM WALL, 13" FROM SEAT. RAILS SHALL BE STAINLEDD STEEL OR POLISHED CHROME AND MOUNTED AT ENDS AND CENTER TO SUPPORT A 250 POUND LOAD.

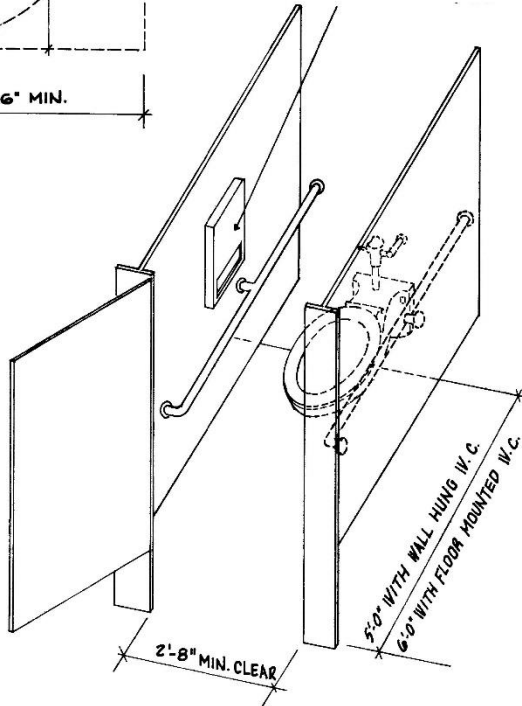


PLAN



ELEVATION

REQUIRED 6'-0" DEEP STALL MAY BE REDUCED TO 5'-0" IF WALL HUNG WATER CLOSET IS USED. (SEE 4.6(b)2)



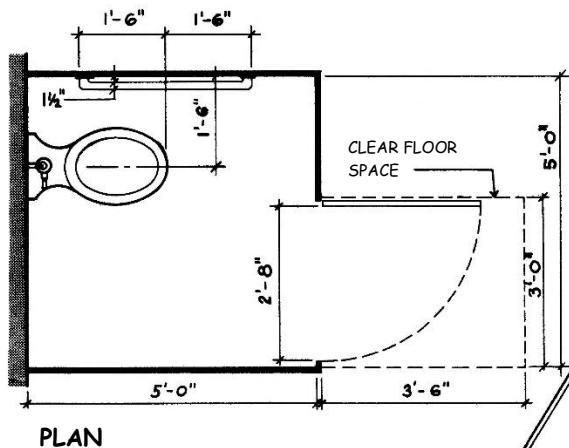
**(11x)4.6 – toilet rooms (continued)**

b) An alternate acceptable toilet stall must be a minimum of 5 feet wide and a minimum of 5 feet deep, with center line of water closet 1 foot 6 inches from side wall. Door must be 32 Inches clear minimum opening with door in 90 degree open position and located diagonally opposite position of water closet. Grab bar shall be mounted on the wall adjacent to water closet, 1½ inches in diameter with 1½ inch clearance to wall and mounted horizontally 13 inches above seat of water closet. Length of bar shall be not less than 3 feet and shall extend 1 foot 6 inches minimum in front of water closet and bar shall be capable of supporting a 250 pound load applied anywhere along its length. Standard toe clearance of toilet stall partition from the finished floor is required.

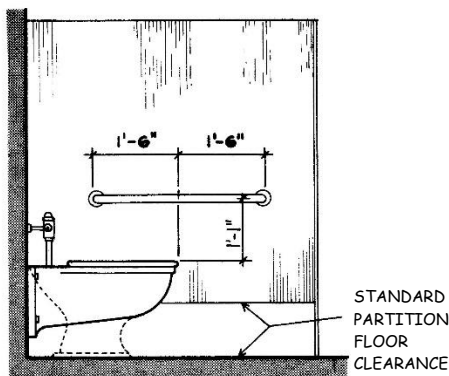
Where child's size water closets are used, the grab bar shall be 1¼ inches diameter, mounted 10 inches above the seat and With 1½ inches space between bar and wall. Grab bar must be at least 3 feet long and extend 1 foot 6 Inches beyond the front edge of the water closet and be capable of supporting a 150 pound load applied anywhere along Its length.

**5' x 5' TOILET STALL**

- 11x4.6(b) 5'x5' STALL IS USABLE BY MOST PEOPLE & HAS THE FOLLOWING REQUIREMENTS.
1. STALL MUST BE 5'x5'
  2. W.C. CENTER LINE 1'-6" FROM SIDE WALL
  3. 32" - CLR OPNG. DOOR DIAGONALLY OPPOSITE W.C.

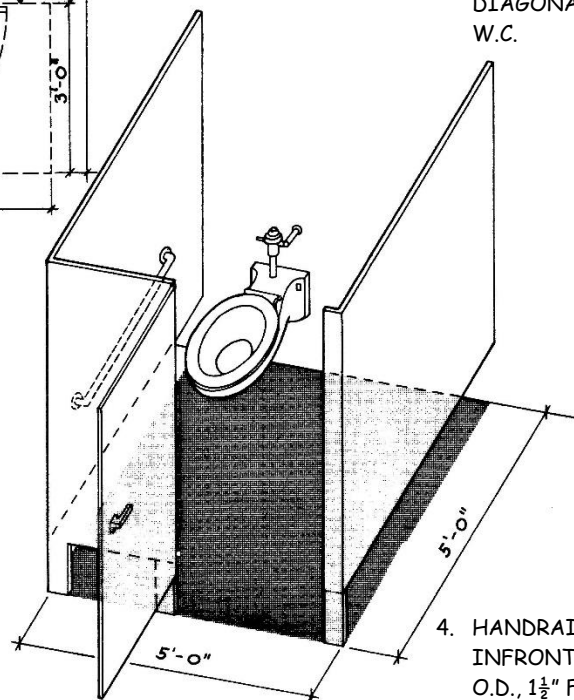


PLAN

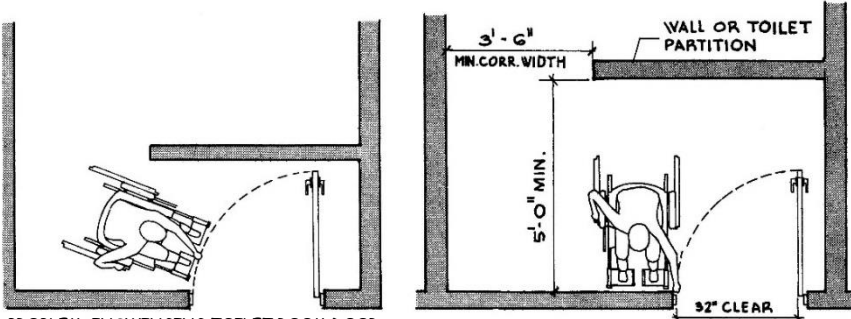


ELEVATION

STANDARD FIXTURE SEAT HEIGHT 16½"-20"



4. HANDRAIL EXTENDS 1'-6" IN FRONT OF W.C. 1½" O.D., 1½" FROM WALL, 13" ABOVE SEAT
5. STANDARD PARTITION TOE CLEARANCE.

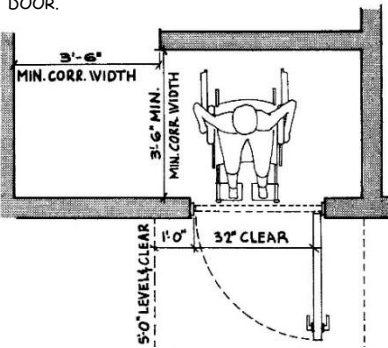


PROBLEM: INSWINGING TOILET ROOM DOOR WITH PRIVACY SCREEN & INSUFFICIENT SPACE FOR CHAIR TO TURN PERPENDICULAR TO WALL BESIDE DOOR REQUIRES LONG LATERAL REACH AND POWER TO OPEN DOOR WHILE MOVING FORWARD AND TURNING 90° TO GET THROUGH DOOR.

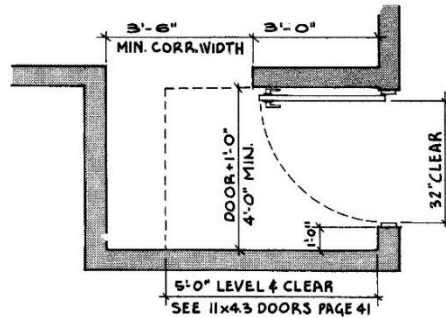
DOOR MAT SWING IN, IF 5'-0" LEVEL & CLEAR FLOOR SPACE IN ACCORDANCE WITH 11x4.3(c) DOORS IS AVAILABLE.

**TOILET ROOM DOORS & THEIR PROBLEMS.**

WHERE TOILET ROOM DOORS SWING IN, 5'-0" LEVEL & CLEAR FLOOR SPACE IS REQUIRED BEYOND DOOR. WHERE TOILET ROOM DOORS SWING OUT, THE FLOOR AREA ON THE TOILET ROOM SIDE MAY BE TREATED AS A CORRIDOR, 42" MINIMUM WIDTH. SEE 11x4.3(c) DOORS PAGE 262.



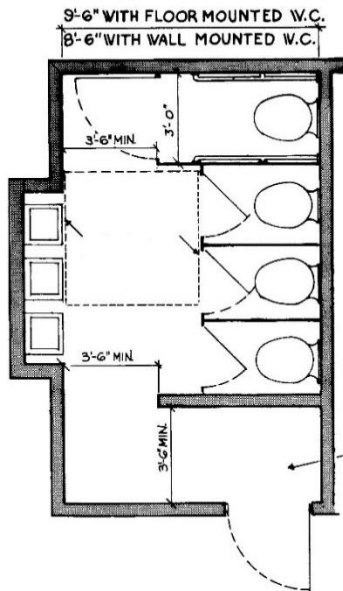
IF SPACE BETWEEN DOOR & SCREEN WALL IS LESS THAN 5'-0", DOOR MUST SWING OUT. WITH OUTSWINGING DOOR. SPACE MUST BE MINIMUM 42".



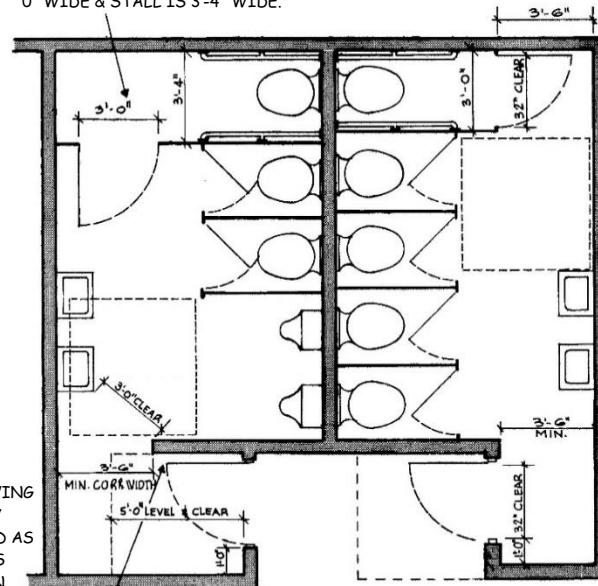
SMALLEST POSSIBLE VESTIBULE WITH INSWINGING DOOR AT PRIVACY SCREEN.

DUE TO ADDITIONAL LENGTH OF HANDICAPPED TOILET STALLS IT IS SUGGESTED THEY BE LOCATED AT END OF TOILET ROOMS THUS

STALLS MAY OCCUPY END OF ROOM & BE ENTERED FROM THE SIDE IF DOOR IS 3'-0" WIDE & STALL IS 3'-4" WIDE.



TOILET ROOM DOOR MUST SWING OUT IF PRIVACY SCREEN IS USED AS SHOWN UNLESS SPACE BETWEEN DOOR & SCREEN IS AT LEAST 5'-0" IN ACCORDANCE WITH 11x4.3



OPEN DOOR MUST NOT OVERLAP 3'-6" MIN. CLEAR CORRIDOR WIDTH.

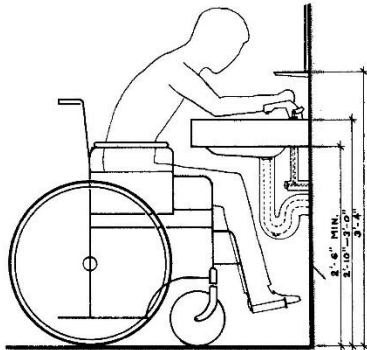
SUGGESTED ENTRY & PRIVACY SCREEN ARRANGEMENT TO PREVENT DOOR SWINGING OUT INTO THE CORRIDOR. DOORS MAY SWING IN OR OUT.

**DIAGRAMMATIC GROUP TOILET ROOM PLANS**

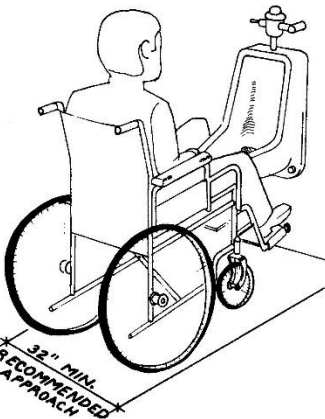
**(11x)4.6 – toilet rooms (continued)**

- c) Toilet rooms shall have at least one lavatory which when mounted allows a minimum of 30 inches clearance to the bottom of the apron, and a rim height of 34-36 inches above the finished floor. Lever, blade or multi-arm type handles for faucets are required and single lever controls are preferred.
- d) Maximum water temperatures to water outlets serving handicapped fixtures shall not exceed 120°F or exposed hot water lines and drains shall be fully insulated
- e) When mirrors and shelves are provided, at least one mirror and one shelf shall be placed above lavatories at a height not to exceed 40 inches above the floor, measured from the top of the shelf and the bottom of the mirror.
- f) Toilet rooms for men, where urinals are required, shall have at least one wall-mounted urinal with elongated lip with the rim a maximum height of 17 inches from the floor, or shall have floor-mounted urinals that are on a level with the main floor of the toilet room. Urinals for small children such as elementary school students shall meet the requirements for their use.

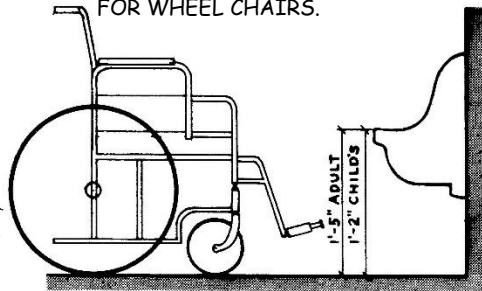
IF HOT WATER EXCEEDS 120°, SUPPLY AND DRAIN LINES MUST BE INSULATED TO PREVENT BURNING PERSONS WITH NO SENSATION IN THEIR LEGS.



PREFORMED RIGID INSULATION WITH PROTECTIVE COVER



ALTERNATE METHOD OF PROTECTION: ENCLOSE PLUMBING IN A PROTECTIVE HOUSING. CARE SHOULD BE TAKEN TO PROVIDE ADEQUATE CLEARANCE FOR WHEEL CHAIRS.



**11x4.6(c)** TOILET ROOMS SHALL HAVE AT LEAST ONE LAVATORY WHICH WHEN MOUNTED, ALLOWS 2'-6" CLEARANCE FROM THE FLOOR TO THE BOTTOM OF THE APRON AND A RIM HEIGHT OF 2'-10" - 3'-0"

FAUCETS SHALL HAVE LEVER, BLADE OR MULTI-ARM TYPE HANDLES.

**11x4.6(d)** MAXIMUM WATER TEMPERATURES TO HANDICAPPED PLUMBING FIXTURES SHALL NOT EXCEED 120°F., OR EXPOSED HOT WATER LINES & DRAINS SHALL BE FULLY INSULATED.

**11x4.6(e)** WHEN MIRRORS AND SHELVES ARE PROVIDED, AT LEAST ONE MIRROR & ONE SHELF SHALL BE PLACED ABOVE LAVATORIES 40" ABOVE THE FLOOR TO THE BOTTOM OF THE MIRROR AND THE TOP OF THE SHELF.

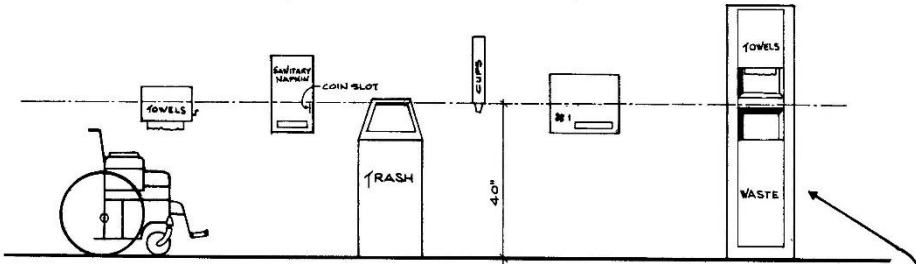
**11x4.6(f)** TOILET ROOMS FOR MEN SHALL HAVE AT LEAST ONE WALL MOUNTED URINAL WITH ELONGATED LIP, WITH THE BASIN OPENING 17" MAX. FROM THE FLOOR, OR SHALL HAVE FLOOR TYPE URINALS.



**(11x)4.6 – toilet rooms (continued)**

g) Where a towel rack, a towel dispenser and other dispensers and disposal units are provided in toilet rooms, at least 1 of each shall not exceed a height of 40 inches from the floor.

**11x4.6(g)** WHERE TOWEL RACKS, DISPENSERS, DISPOSAL UNITS, VENDING MACHINES & APPLIANCES ARE PROVIDED IN TOILET ROOMS, ONE OF EACH TYPE SHALL BE MOUNTED WITH ALL OPERATING MECHANISMS (CRANKS, COIN SLOTS, BUTTONS, ETC.) AND ITEMS THEMSELVES NO MORE THAN 40" ABOVE THE FLOOR.

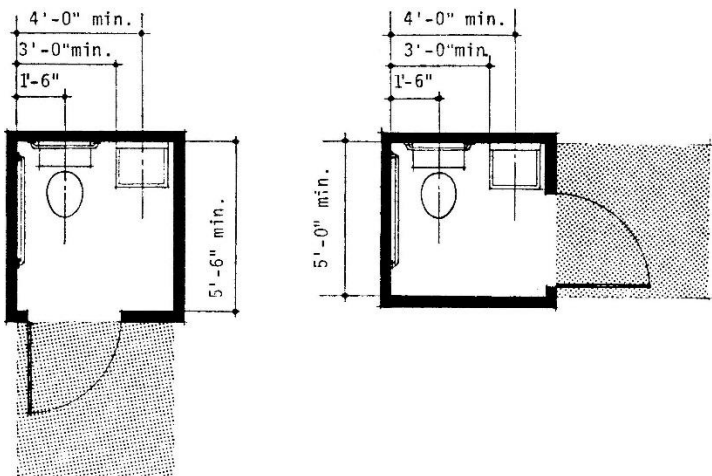


OBJECTS WHICH PROTRUDE MORE THAN 4" FROM THE WALL WITHOUT CONTINUING TO THE FLOOR OR TO WITHIN 8" OF THE FLOOR ARE A HAZARD TO THE BLIND. (SEE APPENDIX E)

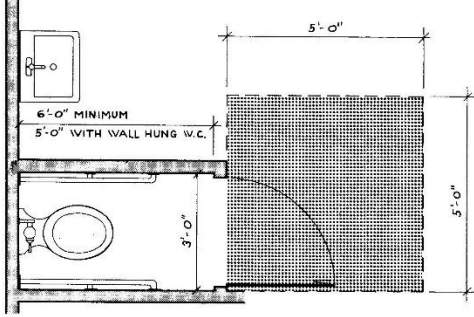
TOWEL DISPENSERS & HAND DRYERS SHOULD BE LOCATED NEXT TO SINKS AS A CONVENIENCE TO THE BLIND & TO PREVENT FLOORS FROM BECOMING WET & SLIPPERY.

THIS TYPE NOT ACCEPTABLE UNLESS SEPARATE TOWEL DISPENSER IS ALSO INSTALLED AT 40".

**11x4.6(a)** INDIVIDUAL TOILET ROOMS IN SMALL BUSINESSES MUST MEET REQUIREMENTS FOR ACCESSIBLE TOILETS.



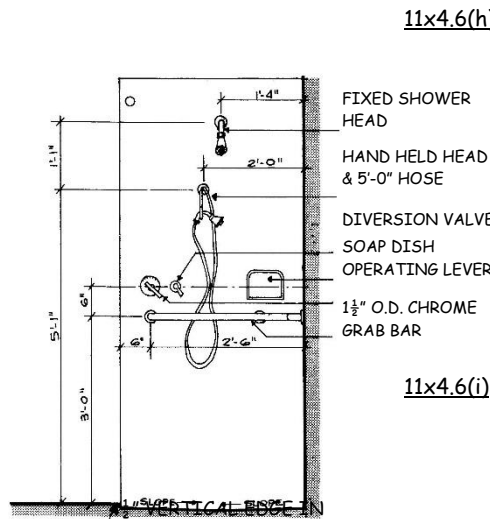
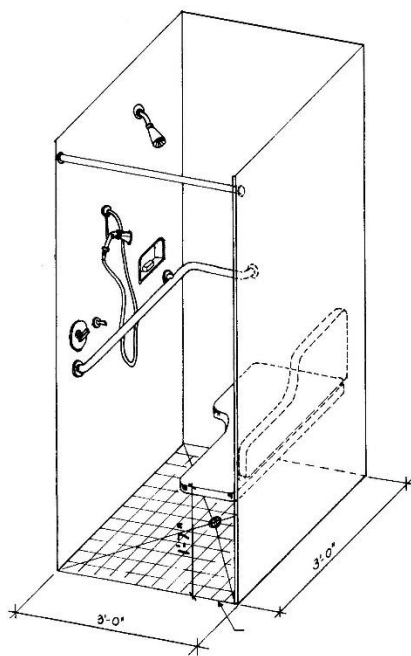
For each separate building and each rentable space in shopping centers having 2500 gross square feet and less and having five or less employees, one toilet room with lockable door may be provided. (Volume II, Section 933, Note 12)



**MINIMUM ACCESSIBLE TOILET ROOM FOR USE IN SMALL BUSINESS ESTABLISHMENTS**

**(11x)4.6 – toilet rooms (continued)**

- h) Where showers are provided, 2% or a minimum of one, whichever is greater shall be no less than 3 feet by 3 feet inside dimensions and shall not contain curbs except that thresholds for entering and leaving showers meeting the requirements of Section 4.3(e) may be used.
- i) Shower stalls equipped for handicapped shall have a floor surface which is non-slip. Where stalls are used, a seat shall be positioned 19 inches above the floor and may be hinged to fold against the wall. The shower seat shall be at least 15 inches in width from the wall and extend a minimum of 30 inches in length the full depth of the shower stall. A grab rail shall be attached to the stall wall opposite the seat and shall extend around on the back of the wall. The water control shall be lever controlled with flexible hand shower spray, and soap tray shall be placed at a height not to exceed 40 inches above the floor. All controls shall be single lever type. Doors may be used on roll-in showers. Curtains are an acceptable method for closing shower stalls for the handicapped and are preferred.
- j) Minimum toe space of 8¾ inches in height and 6 inches in depth shall be provided for cabinets in the toilet room area.



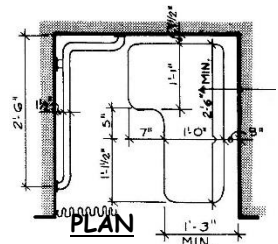
**11x4.6(h)** WHERE SHOWERS ARE PROVIDED, 2% OR A MINIMUM OF ONE WHICHEVER IS GREATER SHALL BE NO LESS THAN 3'x3' INSIDE & SHALL NOT HAVE CURBS, BUT MAY HAVE THRESHOLDS OF THEY MEET THE REQUIRMENTS OF 11x4.3(e).

- 11x4.6(i)** SHOWER STALLS EQUIPPED FOR THE HANDICAPPED SHALL HAVE THE FOLLOWING:
1. NON SLIP FLOOR SURFACE (CARBORUNDUM OF GRIT FACED TILE RECOMMENDED).
  2. SEAT 19" ABOVE FLOOR & PLACED OPPOSITE CONTROLS & GRAB BAR.
  3. GRAB RAIL OPPOSITE SEAT & AROUND BACK WALL.
  4. SINGLE LEVER WATER CONTROLS.
  5. FLEXIBLE HOSE WITH HAND HELD SHOWER HEAD.
  6. SOAP TRAY NO MORE THAN 40" ABOVE FLOOR.

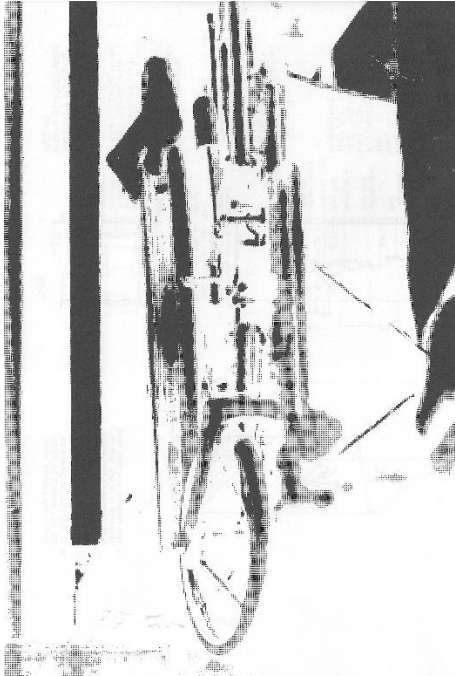
ACCORDANCE WITH THRESHOLD REQUIREMENTS IS DESIRABLE BECAUSE WHEELCHAIR USERS CAN ROLL SMALL FRONT WHEELS OVER EDGE AND PREVENT CHAIR SLIDING BACKWARDS ON WET FLOORS DURING TRANSFER FROM WHEELCHAIR TO SEAT.

**ELEVATION OF PLUMBING WALL**

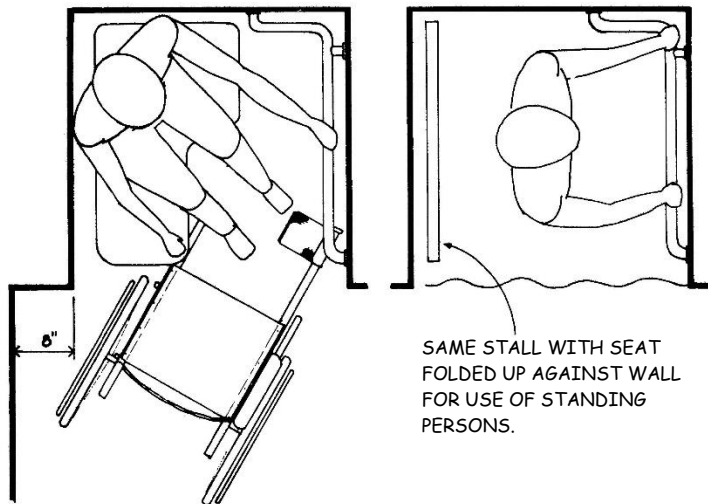
SOME PERSONS CAN ONLY MAKE TRANSFER FROM ONE SIDE SO IT IS RECOMMENDED THAT WHERE MORE THAN ONE SHOWER IS REQUIRED, ONE BE RIGHT HANDED & ONE BE LEFT HANDED. THE SEAT MUST BE LOCATED ON THE WALL OPPOSITE THE WATER CONTROL AND SHOWER HEAD.



**11x4.3(j)** CABINET IN TOILET AREAS SHALL HAVE TOE SPACES MIN. 6" DEEP & 8¾" HIGH. SEE 11x4.5(a) CLEAR FLOOR SPACE PAGE 269.



SHOWER STALL USE

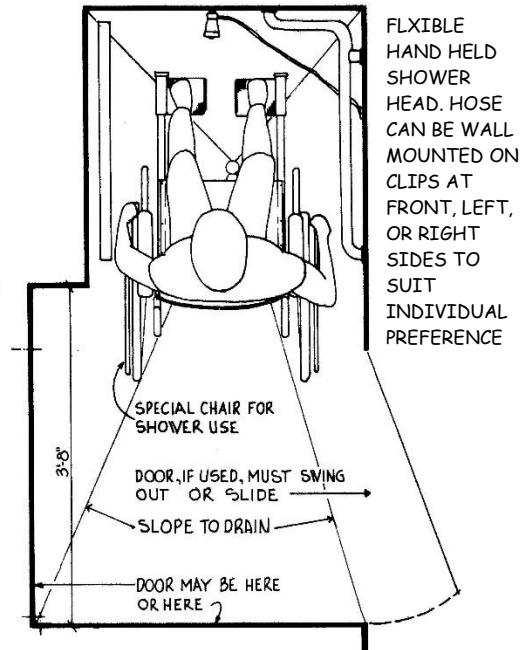


SAME STALL WITH SEAT FOLDED UP AGAINST WALL FOR USE OF STANDING PERSONS.

IN BASIC MINIMAL REQUIRED SHOWER STALL, USER MUST MAKE TRANSFER FROM CHAIR TO SHOWER SEAT. DISABLED PERSON CAN SIT IN CORNER USING WALLS FOR LATERAL SUPPORT & STILL REACH CONTROLS ON OPPOSITE WALL. SOME PERSONS CAN ONLY MAKE TRANSFER ON ONE SIDE, SO IT IS RECOMMENDED THAT ONE STALL EACH BE INSTALLED FOR LEFT AND RIGHT HAND TRANSFERS.

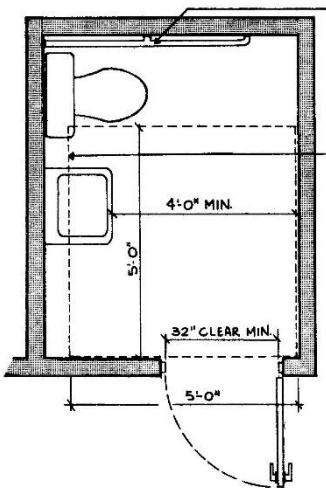
DOORS MAY BE USED ON ROLL-IN SHOWERS. CURTAINS ARE PREFERRED.

ROLL-IN SHOWER

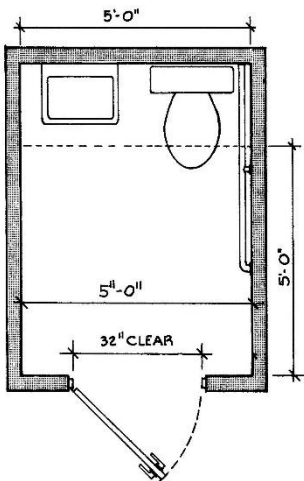


SOME HANDICAPPED PERSONS CANNOT MAKE TRANSFERS TO SEAT. MANY INDIVIDUALS PREFER "ROLL-IN" SHOWERS IN WHICH USER SHOWERS IN A WHEELCHAIR (A SPECIAL CHAIR IS REQUIRED THAT WILL NOT BE DAMAGED BY SOAP & WATER.) THE ABOVE ADDITIONAL FLOOR SPACE TO THE REQUIRED SHOWER STALL WILL ACCOMMODATE TRANSFERS, STANDING, AND ROLL-IN USERS AND IS THEREFORE MUCH **PREFERRED\***.

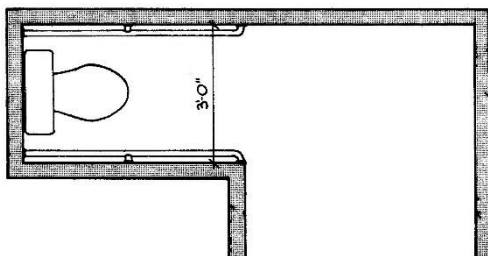
**Minimum requirements for single individual toilet rooms include 11x4.6(a), (b)3,4,5, (c), (d), (e), (g), (h), (i), & (j) for complete text see pages 271-278**



WALL MOUNTED BAR SIMILAR TO STALLS  
ARRANGEMENT MUST ALLOW UNOBSTRUCTED APPROACH TO SIDE OF W.C.  
OF THE 5'-0" x 5'-0" CLEAR FLOOR SPACE, 1'-0" MAY BE "KNEE SPACE" UNDER WALL HUNG LAVATORIES MOUNTED IN ACCORDANCE WITH 11x4.6(c). SUCH LAVATORIES MUST NOT HAVE LEGS WHICH OBSTRUCT WHEELCHAIR TURNING RADIUS.



SMALLEST POSSIBLE TOILET ROOM WITH 5'-0" x 5'-0" CLEAR FLOOR SPACE. PART OF CLEAR FLOOR SPACE MAY BE UNDER TOILET IF TOILET HAS A DEEPLY RECESSED BASE TO PROVIDE CLEARANCE AS INDICATED ON PAGE 271.  
FOR SIDE TRANSFER TOILETS A 3'-0" GRAB BAR IS ACCEPTABLE WHEN MOUNTED TO EXTEND 1'-6" BEYOND THE FRONT EDGE OF W.C.

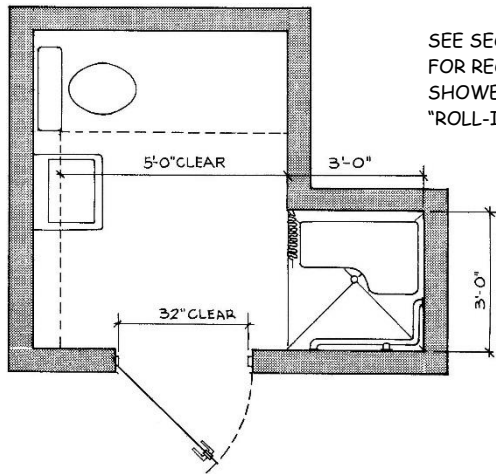


COMPARTMENT TOILET ROOM SIMILAR TO STALL REQUIRES BOTH HANDRAILS SINCE THERE IS NOT ENOUGH ROOM FOR SIDE APPROACH.

11x4.6(a) 5'-0" x 5'-0" CLEAR FLOOR SPACE MAY HAVE 1 OR 2 6" TOE SPACES.

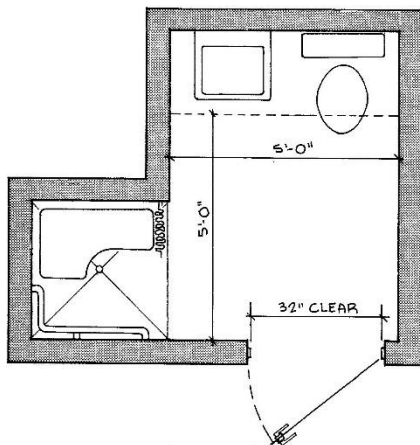
- (b) 3. DOORS TO TOILET ROOMS MUST HAVE 32" CLEAR OPENINGS.
- 4. TOILET SEAT MUST BE 16½"-20" ABOVE THE FLOOR.
- 5. IN INDIVIDUAL TOILET ROOMS, AT LEAST ONE CHROME OR STAINLESS STEEL HANDRAIL 52" LONG, 1½" DIAMETER MUST BE WALL MOUNTED 13" ABOVE THE SEAT.
- (c) LAVATORIES MUST BE MOUNTED WITH BOTTOM OF APRON 30" MINIMUM ABOVE FLOOR AND RIM 34" MAXIMUM ABOVE FLOOR.
- (d) MAXIMUM WATER TEMPERATURE MUST NOT EXCEED 120°, OR EXPOSED HOT WATER LINES & DRAINS MUST BE FULLY INSULATED
- (e) MIRRORS & SHELVES SHALL NOT BE MORE THAN 40" ABOVE FLOOR.
- (g) TOWEL RACKS & DISPENSERS SHALL NOT BE MORE THAN 40" ABOVE FLOOR.

11x4.6 SINGLE INDIVIDUAL TOILET ROOM



SEE SECTION 11x4.6(h, i, & j) PAGE 278 FOR RECOMMENDED HANDICAPPED SHOWER DETAILS & ALTERNATE "ROLL-IN" DESIGN PAGE 279.

SINGLE TOILET ROOM WITH SHOWER



SMALLEST POSSIBLE TOILET ROOM WITH SHOWER

11x4.6(h) WHERE SHOWERS ARE PROVIDED, 2% OR A MINIMUM OF ONE SHALL BE NO LESS THAN 3'-0" x 3'-0" INSIDE & SHALL NOT HAVE CURBS BUT MAY HAVE THRESHOLDS IF THEY MEET THE REQUIREMENTS OF 11x4.3(e).

11x4.6(i) SHOWERS FOR THE HANDICAPPED SHALL HAVE:

- 1) NON-SLIP FLOOR.
- 2) SEAT 19" ABOVE FLOOR & PLACED OPPOSITE CONTROLS & GRAB BAR.
- 3) GRAB RAIL OPPOSITE SEAT AND AROUND BACK WALL.
- 4) SINGLE LEVER WATER CONTROLS.
- 5) FLEXIBLE HOSE WITH HAND HELD SHOWER HEAD.
- 6) SOAP TRAY NO MORE THAN 40" ABOVE FLOOR.

11x4.6(j) CABINETS SHALL HAVE MINIMUM TOE SPACE 6" IN DEPTH & 8 $\frac{3}{4}$ " IN HEIGHT.

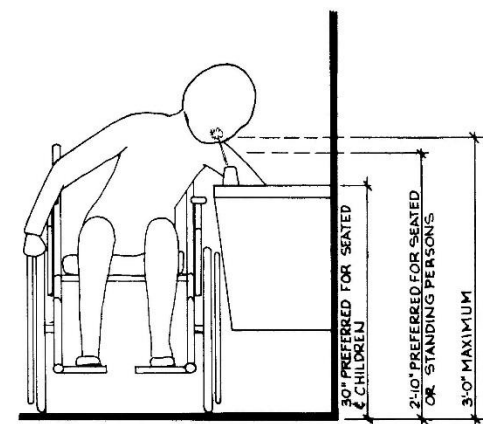
**(11x)4.7 – water fountains**

In buildings to which [Section \(11X\)1](#) applies and where water fountains are provided, such water fountains shall comply with the following requirements:

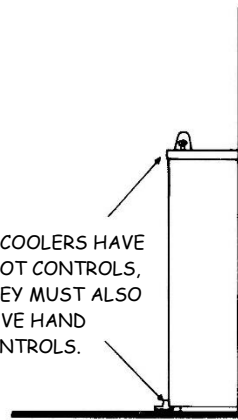
- a) Water fountains or coolers shall have upfront spouts and controls.
- b) Water fountains or coolers shall be hand-operated or hand- and foot-operated.
- c) Where provided, at least one per floor conventional wall or floor-mounted water cooler shall have a small fountain mounted on the side of the cooler, with the edge of the small fountain basin no higher than 30 inches above the floor. Wall-mounted, hand-operated coolers serve the able-bodied and the physically disabled when the cooler is mounted with the edge of the basin 36 inches from the floor.

**(11x)4.8 – telephones**

See [Appendix B](#) for recommendations.



IF COOLERS HAVE FOOT CONTROLS, THEY MUST ALSO HAVE HAND CONTROLS.



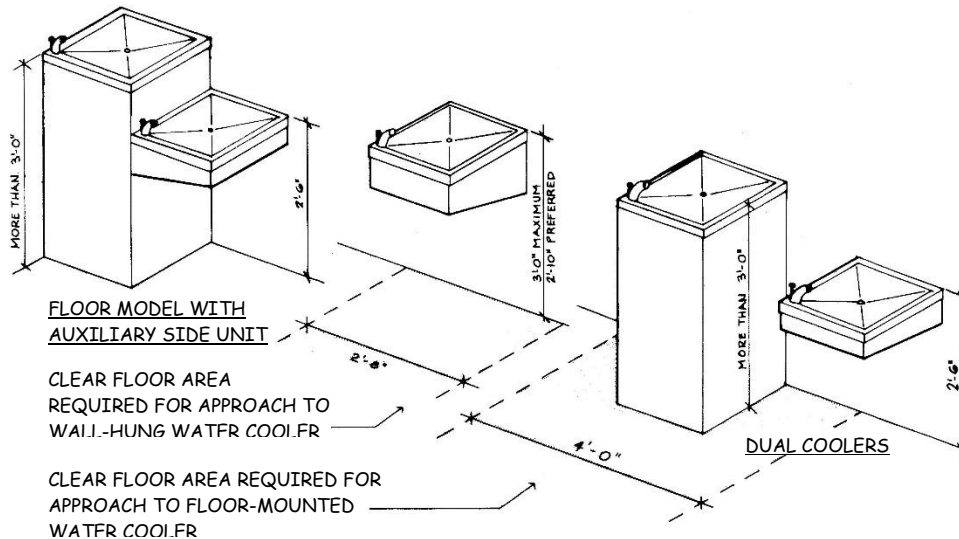
WHEREVER WATER FOUNTAINS ARE PLANNED, AT LEAST ONE PER FLOOR SHALL MEET WITH THE FOLLOWING REQUIREMENTS.

**11x4.7(a)** WATER FOUNTAINS & COLLERS SHALL HAVE UPFRONT SPOUTS & CONTROLS.

**11x4.7(b)** FOUNTAINS & COOLERS SHALL BE HAND OPERATED, OR HAND & FOOT OPERATED.

**11x4.7(c)** WHERE A SINGLE CONVENTIONAL COOLER IS USED, IT MUST BE NO MORE THAN 36" ABOVE THE FLOOR, 34" IS PREFERRED.

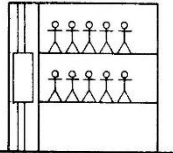
WATER COOLERS HIGHER THAN 36" MUST HAVE ADDITIONAL SMALL FOUNTAIN MOUNTED ON THE SIDE OF THE COOLER WITH THE RIM OF THE SMALL FOUNTAIN BASIN NO HIGHER THAN 30" ABOVE THE FLOOR, OR HAVE AN ADDITIONAL SEPARATE COOLER WITH ITS RIM 30" ABOVE THE FLOOR.



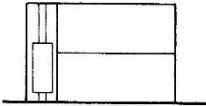
**(11x)4.9 – elevators**

- a) Unless ramps meeting the requirements of (11x)4.1 are provided to serve each floor level, at least one elevator shall be provided as follows:
  - 1) All buildings over 2 stories in height with occupancy of 100 or more persons above or below the main entrance floor, other than as specified below.
  - 2) All administrative buildings of County, Municipal and State Government over 1 story.
  - 3) All publicly-owned school buildings and other privately-owned buildings of similar occupancy (such as full-time, privately-owned schools, colleges, and universities) over one story and all non-publicly owned school buildings over three stories with over 200 persons above or below the main entrance floor level. Basements with over 100 persons are counted as a story for the purpose of this section.
  - 4) All buildings over three stories regardless of the number of persons or occupancy classification with the exception of privately-owned schools or institutional buildings.
  - 5) All privately-owned residential buildings shall have elevators in buildings over three stories.

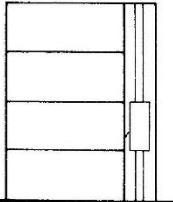
**RAMP OR ELEVATORS ARE REQUIRED TO CONNECT ALL FLOORS IN:**



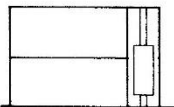
ALL BUILDINGS OVER 2 STORIES WITH 100 PEOPLE ABOVE OR BELOW THE MAIN LEVEL.



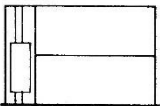
ALL PUBLIC SCHOOL BUILDINGS OVER 1 STORY.



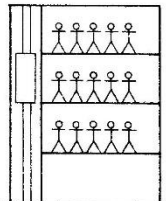
ALL BUILDINGS OVER 3 STORIES.



ALL FULL-TIME PRIVATELY-OWNED SCHOOLS, COLLEGES, & UNIVERSITIES OVER 1 STORY.

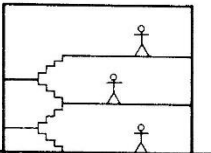


ALL COUNTY, MUNICIPAL, & STATE GOVERNMENT ADMINISTRATIVE BUILDINGS OVER 1 STORY



ALL OTHER PRIVATE SCHOOLS OR PRIVATE INSTITUTIONS OVER 3 STORIES WITH 200 PEOPLE ABOVE OR BELOW THE MAIN LEVEL.

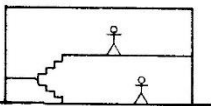
**BUILDINGS NOT REQUIRING ELEVATORS:**



PRIVATELY-OWNED NON-FULL TIME SCHOOL BUILDINGS 3 STORIES OR LESS WITH FEWER THAN 200 PEOPLE ABOVE OR BELOW THE MAIN LEVEL.

PRIVATE INSTITUTIONS 3 STORIES OR LESS WITH FEWER THAN 200 PEOPLE ABOVE OR BELOW THE MAIN LEVEL.

PRIVATE RESIDENTIAL BUILDINGS 3 STORIES OR LESS.



2 STORY BUILDINGS WITH FEWER THAN 100 PEOPLE ABOVE OR BELOW THE MAIN LEVEL.

**(11x)4.9 – elevators (continued)**

- b) Elevators shall be accessible to, and usable by, the physically disabled at all levels normally used by the general public.
- c) In no case shall interior cab dimensions of elevators normally used by the public for buildings over three stories in height be less than 5 feet x 5 feet square, or 63 inches x 56 inches rectangular, or 80 inches x 51 inches rectangular (a standard industrial size elevator). In buildings three stories and less in height the elevator may be 68 inches x 51 inches minimum 2000 pounds capacity. In passenger operated elevators, all necessary operating controls, buttons and emergency signaling devices shall be mounted between 2 feet 11 inches and 4 feet 6 inches above the floor and shall be identified with raised arabic numerals or industry-recommended symbols to the left of the controls. Numerals or symbols shall be at least ½ inch high and raised or recessed a minimum of .030 inch: they shall be permanently attached and on color contrasting background.

Hall Buttons. The centerline of the hall call buttons shall be a nominal 42 inches above the floor.

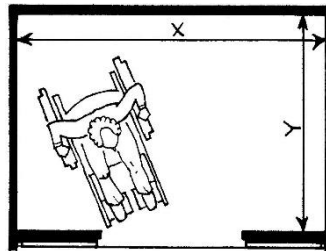
Direction buttons, exclusive of border, shall be a minimum of ¾ inch in size, raised, flush or recessed. Visual indication shall be provided to show each call registered and extinguished when the call is answered. Depth of flush or recessed buttons when operated shall not exceed 3/8 inch.

**MINIMUM CAB DIMENSIONS FOR BUILDINGS OVER 3 STORIES**

X = 5'-0"      Y = 5'-0"      OR  
 X = 5'-3"      Y = 4'-8"      OR  
 X = 6'-8"      Y = 4'-3"

**MINIMUM CAB DIMENSIONS FOR BUILDINGS 3 STORIES OR LESS**

X = 5'-8"      Y = 4'-3"



**11x4.9(b)** ALL ELEVATORS, LOBBIES, & APPROACHES NORMALLY USED BY THE GENERAL PUBLIC SHALL BE ACCESSIBLE TO AND USABLE BY THE HANDICAPPED.

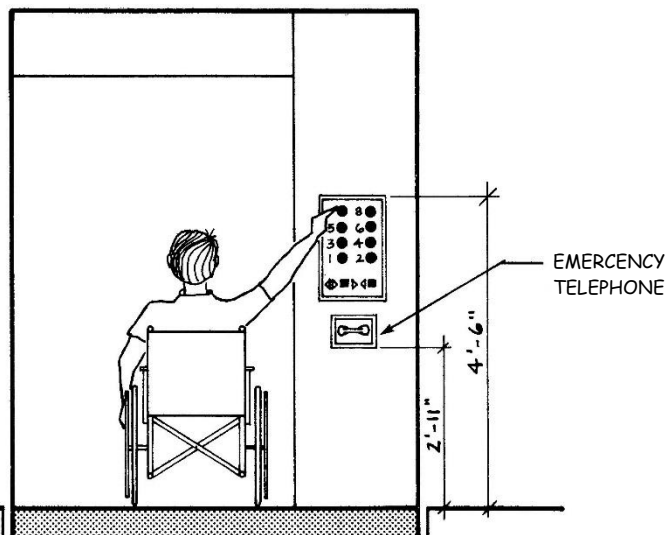
**11x4.9(c)** CAB DIMENSIONS - SEE ILLUSTRATION.

ALL ELEVATOR CONTROLS & EMERGENCY SIGNALING EQUIPMENT SHALL BE LOCATED BETWEEN 2'-11" & 4'-6" ABOVE FLOOR.

- NUMBERS & SYMBOLS FOR CONTROLS SHALL BE:
1. LOCATED TO THE LEFT OF CONTROLS,
  2. ½" HIGH MIN. & RAISED OR RECESSED .030",
  3. OF CONTRASTING COLOR,
  4. PERMANENTLY ATTACHED.

HALL BUTTONS TO CALL ELEVATOR SHALL BE MOUNTED 42" ABOVE FLOOR AT CENTER.

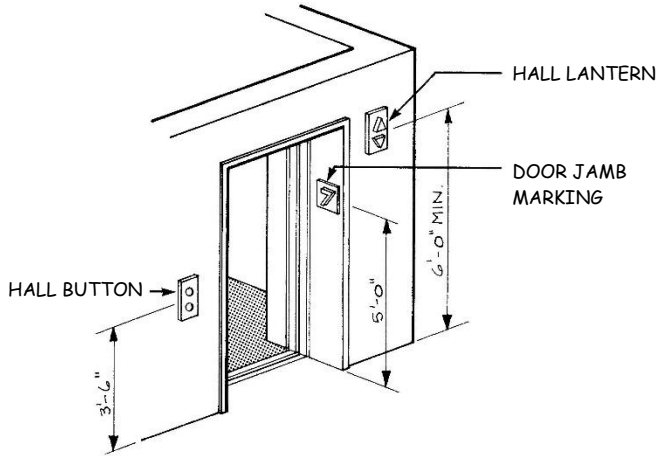
- FLOOR & HALL BUTTONS SHALL BE:
1. ¾" HIGH,
  2. RAISED, RECESSED, OR FLUSH,
  3. NO DEEPER THAN 3/8" WHEN FLUSH OR RECESSED BUTTONS ARE PUSHED.





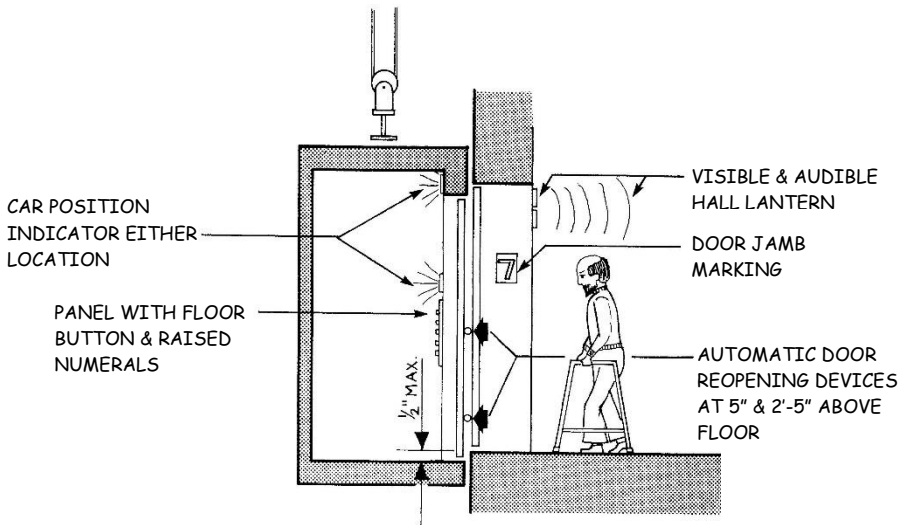
**(11x)4.9 – elevators (continued)**

- d) All elevators shall be so adjusted/controlled that the floor of the elevators when stopped, will conform to building floor levels with a 1/2 inch tolerance.
- e) Door Protective & Reopening Device. Doors closed by automatic means shall be provided with a door reopening device which will function to stop and reopen a car door and adjacent hoistway door in case the car door is obstructed while closing. This reopening device shall also be capable of sensing an object or person in the path of a closing door without requiring contact for activation at a nominal 5 inches and 2 feet 5 inches above the floor. Door reopening devices shall remain effective for a period of not less than 20 seconds. After this time, doors may close in accordance with the latest edition of ANSI A17.1.



**11x4.9(d)** ELEVATOR FLOOR LEVELS MUST STOP WITHIN 1/2" MAXIMUM OF BUILDING FLOOR LEVELS.

**11x4.9(e)** ELEVATORS SHALL BE EQUIPPED WITH AUTOMATIC SENSING & DOOR REOPENING DEVICES TO PREVENT THEIR CLOSING ON PEOPLE.



**(11x)4.9 – elevators (continued)**

- f) Car Position Indicator & Signal. A car position indicator shall be provided above the car operating panel or over the opening of each car to show the position of the car in the hoistway by illumination of the Indicator corresponding to the landing at which the car is stopped or passing. Indications shall be on a contrasting background and a minimum of 1/2 inch in height. In addition, an audible signal shall sound to tell a passenger that the car is stopping or passing a floor served by the elevator.

Special button located with emergency controls may be provided. Operation of button will activate audible signal only for desired help.

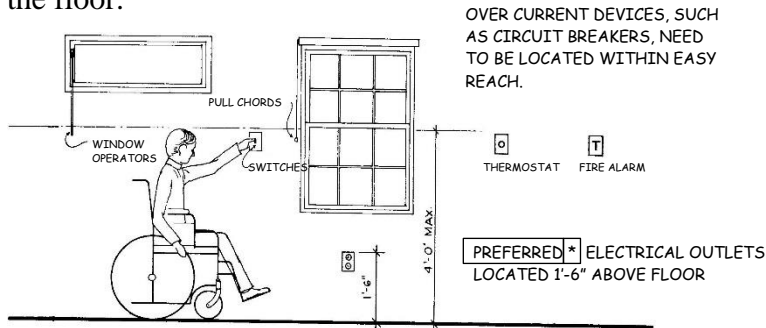
Hall Lantern. A visual and audible signal shall be provided at each hoistway entrance indicating to the prospective passenger the car answering the call and its direction of travel. The visual signal for each direction shall be a minimum of 2 inches in size and visible from the proximity of the hall call button. The audible signal shall sound once for the up direction and twice for the down direction. The center line of the fixture shall be located a minimum of 6 feet from the floor. The use of in-car lanterns conforming to above and located in jamb shall be acceptable.

- g) Door Jamb Marking. The floor designation shall be provided at each hoistway entrance on both sides of jamb at a height of 5 feet above the floor. Designations shall be on a contrasting background a minimum of 2 1/2 inches high and raised .030 inch. Applied plates

<p>1/2" MIN .030" 3/4" MIN RAISED</p>	<p>RECESSED</p>	<p><u>11x4.9(c)</u> SEE ALSO PAGE 284. <u>FLOOR BUTTONS ON CONTROL PANEL IN CAB:</u></p> <ol style="list-style-type: none"> <li>1. MOUNTED BETWEEN 2'-11" &amp; 4'-6"</li> <li>2. RAISED OR RECESSED NUMERALS OR SYMBOLS TO LEFT OF CONTROLS: 1/2" HIGH MIN. .030" RAISED OR RECESSED</li> <li>3. BUTTONS 3/4" HIGH MIN., 3/8" MAX. RECESS WHEN DEPRESSED</li> </ol>
<p>3/4" MIN.</p>		<p><u>11x4.9(c)</u> SEE ALSO PAGE 284. <u>HALL BUTTONS TO CALL ELEVATOR:</u></p> <ol style="list-style-type: none"> <li>1. MOUNTED 42" HIGH TO CENTER</li> <li>2. BUTTONS 3/4" HIGH MIN. RAISED, RECESSED, OR FLUSH</li> <li>3. 3/8" MAX. RECESS WHEN DEPRESSED</li> </ol>
<p>1/2" MIN 1 2 3 4 5 6 "THREE" OR "DING DING DING"</p>	<p><u>11x4.9(f)</u> <u>CAR POSITION INDICATOR:</u></p> <ol style="list-style-type: none"> <li>1. LOCATED ABOVE PANEL OR OVER DOORWAY</li> <li>2. VISIBLE &amp; AUDIBLE SIGNALS</li> <li>3. VISIBLE SIGNAL 1/2" HIGH MIN. &amp; OF CONTRASTING COLORS.</li> </ol>	
<p>2" MIN.</p>		<p><u>11x4.9(f)</u> <u>HALL LANTERN</u> SHOWING APPROACH &amp; DIRECTION OF ELEVATOR:</p> <ol style="list-style-type: none"> <li>1. MOUNTED 6" MIN. FROM FLOOR AT CENTERLINE</li> <li>2. VISIBLE &amp; AUDIBLE SIGNALS</li> <li>3. VISIBLE SIGNAL MIN 2" HIGH</li> <li>4. AUDIBLE SIGNAL: ONCE FOR UP TWICE FOR DOWN</li> <li>5. MAY BE LOCATED IN DOOR JAMB</li> </ol>
<p>2 1/2" MIN.</p>		<p><u>11x4.9(g)</u> <u>DOOR JAMB MARKINGS</u> OF FLOOR NUMBERS:</p> <ol style="list-style-type: none"> <li>1. MOUNTED BOTH SIDES OF JAMB</li> <li>2. 2 1/2" HIGH MIN.</li> <li>3. CONTRASTING COLORS</li> <li>4. RAISED .030"</li> </ol>

**(11x)4.10 – controls**

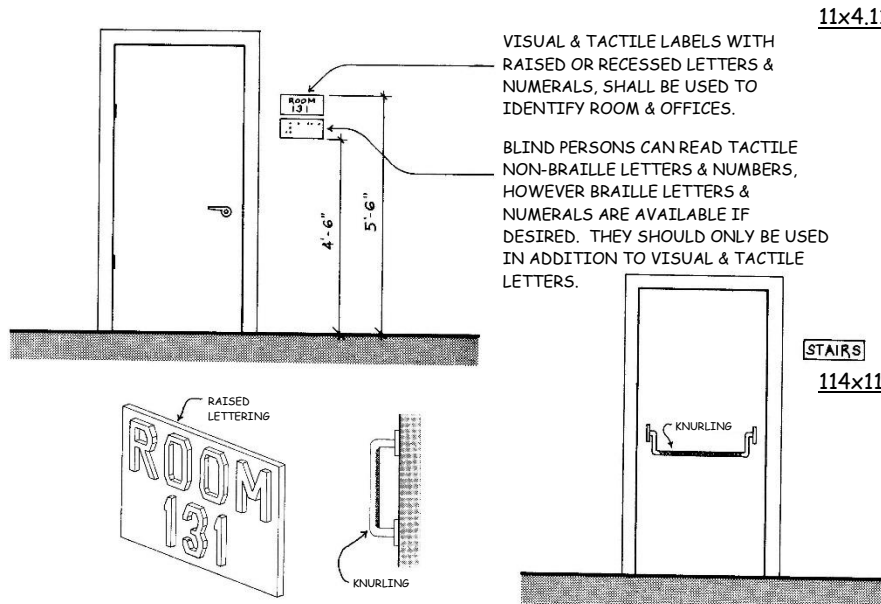
Switches and controls for light and ventilation – including windows, draperies, thermostatic controls (which can be adjusted without the use of tools), fire alarms, doors and all similar devices – where intended to be operable by occupant, shall be placed no higher than 4 feet from the floor.



**11x4.10** CONTROL DEVICES FOR LIGHT, POWER, HEAT, FIRE ALARMS & THERMOSTATS, VENTILATION, WINDOWS, DRAPERIES, DOOR, & SIMILAR CONTROLS SHALL BE MOUNTED NO HIGHER THAN 4'-0" FROM THE FLOOR.

**(11x)4.11 – identification**

- a) Spaces that would normally be utilized by the visually handicapped (i.e., reception, toilet rooms) shall be identified by a plaque with raised or notched letters and/or numbers. This plaque shall be next to an entrance doorway at a height between 4 feet 6 inches and 5 feet 6 inches, measured from the floor, and shall be on the side nearest the door handle when the door is closed.
- b) Doors to stairs, loading platforms, boiler rooms, mechanical equipment spaces, stages and fire escapes and other hazardous areas shall have knurled or carborundum-epoxy abrasive coated door handles or knobs.



**11x4.11(a)** SPACES USED BY THE VISUALLY HANDICAPPED SHALL BE IDENTIFIED BY A PLAQUE WITH RAISED OR RECESSED LETTERS & NUMERALS. PLAQUES SHALL BE MOUNTED BETWEEN 4'-6" & 5'-6" ON THE WALL NEXT TO THE DOOR ON THE SIDE NEAREST THE DOOR HANDLE OR KNOB.

**114x11(b)** DOORS TO STAIRS, LOADING PLATFORMS, BOILER ROOMS, STAGES, & FIRE ESCAPES SHALL HAVE KNURLED DOOR HANDLES OR KNOBS, OR CARBORUNDUM-EPOXY ABRASIVE COATING.

## **[11x] 5 minimum requirements for residential and institutional occupancies**

For the purpose of this Section, a residential project shall be defined as one residential building or a group of related residential buildings (such as those shown on a plat filed with a municipal or county planning department showing the relative location of buildings).

In no instance, shall units designated to be accessible to the handicapped be segregated from other units within the project by design (e.g. setting aside all residential units for the handicapped in one residential building in a large project instead of equally distributing the units designed for the handicapped throughout the project).

### **(11x)5.1 – minimum requirements for privately-owned residential occupancies including condominiums (see recommendations in [appendix C](#))**

### **(11x)5.2 – minimum requirements for the construction of publicly-owned residential projects and privately-owned hotels, motels, residential school and institutional projects**

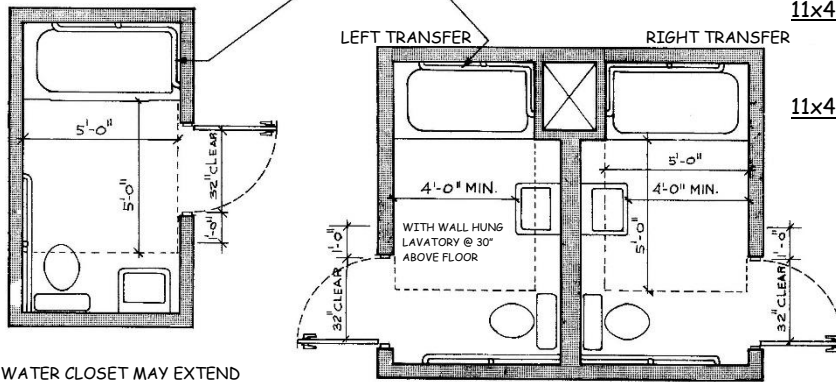
In addition to other requirements set forth in other sections of the Handicapped Section of the North Carolina State Building Code, the following standards are minimum requirements:

- a) Where 1 or more toilet rooms are provided in an individual residential unit or suite of residential units of publicly-owned projects or privately-owned hotels, motels, school and institutional projects, a minimum of 5% or a minimum of 1, whichever is greater, toilet rooms shall comply with (11x)4.6 (a), (b) 3, 4, 5, (d), (e), and (j), and have walls capable of supporting handrails which can support a 250 pound load.

**(11x)5.2 publicly-owned residential and private-owned hotels, motels, schools, and institutional projects**

**PREFERRED\*** STAINLESS STEEL OR CHROME HANDRAIL, 1½" IN DIAMETER, SHOULD BE MOUNTED 2'-0" ABOVE BOTTOM OF TUB & ALONG ONE SIDE & ONE END OF TUB. SLIDING GLASS SHOWER DOORS ON TUB SHOULD BE AVOIDED.

SMALLER GRAB BARS 1¼" IN OUTSIDE DIAMETER MAY BE ACCEPTABLE IN UNITS DESIGNED FOR THE ELDERLY.



WATER CLOSET MAY EXTEND OVER 5'-0" CLEAR FLOOR SPACE IF IT HAS DEEPLY RECESSED BASE TO PROVIDE CLEARANCE AS INDICATED ON PAGE 271.

ABOVE ARRANGMENT OF WATER CLOSET & LAVATORY ALLOWS WALL MOUNTED HANDRAIL FOR TOILET, & WATER CLOSET DOES NOT BLOCK ACCESS TO TUB.

**11x5.2(a)** 5%, OR A MINIMUM OF 1, OF THE TOTAL NUMBER OF TOILET ROOMS PROVIDED FOR IN THE ABOVE BUILDING TYPES MUST COMPLY WITH THE FOLLOWING REQUIREMENTS:

**11x4.6(a)** 5'-0" x 5'-0" CLEAR FLOOR SPACE MAY HAVE 1 OR 2 - 6" X 8¾" TOE SPACE.

**11x4.6(b)** 3. DOOR SHALL HAVE A 32" CLEAR OPENING, & SWING OUT OR SLIDE.

5. STAINLESS STEEL OR CHROME HANDRAILS, 1½" IN DIAMETER, 13" ABOVE SEAT SHALL BE INSTALLED ON EACH WALL ADJACENT TO A TOILET. SINCE THE HANDRAILS ARE REQUIRED ON EACH SIDEWALL, IF TOILET IS ADJACENT TO ONLY ONE WALL, ONLY ONE HANDRAIL IS REQUIRED.

**11x4.6(d)** MAXIMUM WATER TEMPERATURE SHALL NOT EXCEED 120°, OR EXPOSED HOT WATER LINES & DRAINS MUST BE FULLY INSULATED.

**11x4.6(e)** MIRRORS & SHELVES & **11x4.5(g)** TOWEL RACKS & DISPENSERS SHALL NOT BE MORE THAN 40" ABOVE THE FLOOR.

**11x4.6(j)** CABINETS SHALL HAVE MINIMUM TOE SPACE 6" x 8¾".

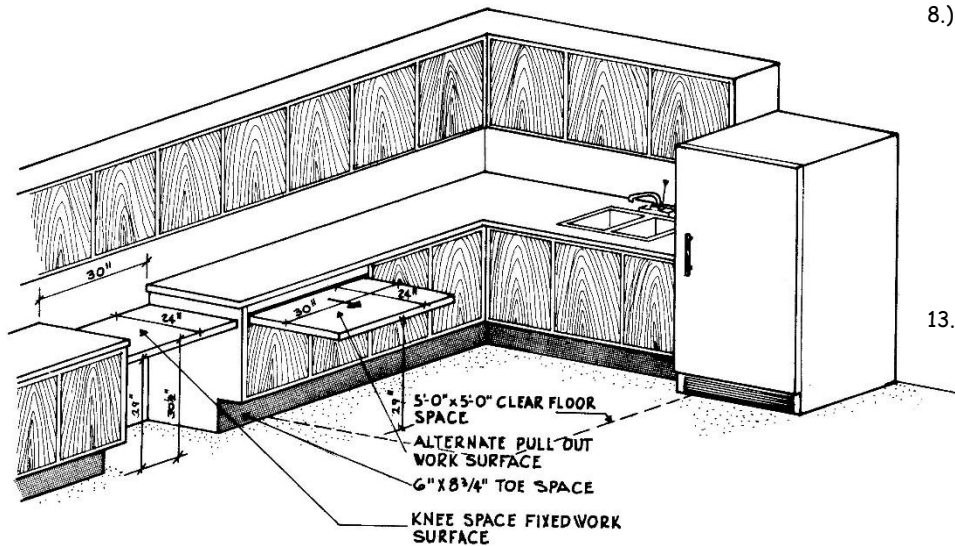
**(11x)5.2 (continued)**

- b) Where kitchens are provided in individual residential units or suites of residential units of publicly-owned residential projects or privately-owned school or institutional projects, those kitchens shall comply with Appendix C, Sub-paragraph (b)2, 8, 13 and 14.

11x5.2(b) WHERE KITCHENS ARE PROVIDED IN THE BUILDINGS TO WHICH THIS SECTION APPLIES, THEY SHALL COMPLY WITH THE FOLLOWING:

**APPENDIX C (b) KITCHENS:**

- 2.) NORMAL BASE CABINET TOE SPACE SHALL BE MINIMUM 6" DEEP & 8 $\frac{3}{4}$ " HIGH.
- 8.) MINIMUM OF 5'-0" CLEAR FLOOR SPACE BETWEEN CABINETS & CABINETS, OR CABINETS AND WALLS SHALL BE PROVIDED UNLESS 1 IR 2 6" TOE SPACES ARE PROVIDED IN ACCORDANCE WITH [11x4.6\(a\)](#).
- 13.) KNEE SPACE FOR SEATED WORK SHALL BE PROVIDED UNDER COUNTER AND SHALL BE A MINIMUM OF 30" WIDE, 29" HIGH & 24" DEEP. TOP OF THE COUNTER SHALL BE A MINIMUM 30" WIDE, 24" DEEP, & NO MORE THAN 30 $\frac{1}{2}$ " ABOVE FLOOR TO TOP.
- 14) DOORS SHALL HAVE 32" CLEAR OPENING, SHALL SWING OUT OR SLIDE & BE OPERABLE BE A SINGLE EFFORT.



KITCHEN REQUIREMENTS FOR 11x5.2 & 11x5.3

**(11x)5.3 – minimum requirements for the construction of privately owned residential units intended to be rented or leased in residential projects with more than 10 individual residential units.**

In addition to other requirements in other sections of the Handicapped Section of the North Carolina State Building Code, with the exception of (11X) 4.6, 4.7, 4.8, 4.11, 5.1, 5.2, 6 and 7, 5% or a minimum of one unit, of all individual residential units to be rented or leased in privately-owned residential projects with more than 10 individual residential units, which are not school or institutional, shall meet the following minimum requirements (Note: The other requirements of Code to be met for such units include accessible primary entrances, connecting walkways, etc.):

- a) The Individual dwelling unit or suite must be on one level throughout unless other levels are accessible by wheelchair.
- b) Kitchens shall meet or be adjustable to meet the following requirements:
  - 1) A minimum of five feet clear floor space between opposite cabinets or opposite cabinets and walls shall be provided to allow for wheelchair turns, except where 6 inches in depth and 8¾ inches in height toe space is provided. The entrance door shall open out or slide. Where total available floor space is particularly crucial, and where toe space is provided under cabinets, toe space of no more than 6 inches in depth and a minimum of 8¾ inches in height on any one side can be allowed to supplant part of the 5 feet by 5 feet clear floor space.
 

EXAMPLE: if toe space 8¾ inches in height and 6 inches in depth is provided on opposite sides under cabinets, then the clear floor space can be 4 feet x 4 feet. However, if the depth of the toe space is 12 inches on each of opposite sides of a kitchen room, the additional clear floor space would still have to be 4 feet X 4 feet.
  - 2) For seated work in a chair or a wheelchair, an opening shall be provided under the counter for knee space. This opening shall be a minimum of 30 inches in width, 29 inches in height, and 24 inches in depth or the top of the counter under which this knee space is provided shall pull out or be adjustable and be a minimum of 30 inches in width, 24 inches in depth, and no higher than 30½ inches from the floor.
  - 3) The door opening shall be no less than 32 inches clear opening. The door shall swing out or slide.

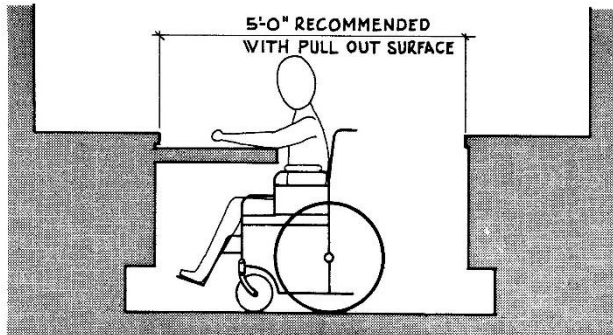
NOTE: On March 11, 1980, the North Carolina Building Code Council adopted the contents of a new manual, ACCESSIBLE HOUSING, as the legally enforceable reference document for Section (11x)5.3.

This publication covers three major items:

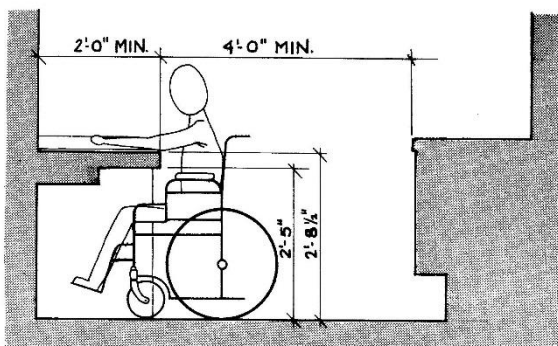
1. Clarification of adjustable and adaptable features.
2. Provision of door hardware in designated accessible units, required under [Section \(11x\)4.3.1](#) as an adaptable feature.
3. Common use facilities within [apartment](#) complexes shall meet the accessibility requirements of the Code.

**(11x)5.3 (continued)**

ACCESSIBLE HOUSING is available from the Engineering and Building Codes Division, N.C. Department of Insurance, P.O. Box 26387, Raleigh, N C. 27611. The cost is \$2.00 per copy. In North Carolina, please add 4% sales tax.



PULL-OUT OR BUILT-IN WORK SURFACE WITH KNEE SPACE



11x5.3 5% OR A MINIMUM OF 1 UNIT SHALL MEET THE OTHER REQUIREMENTS OF THE CODE FOR GRADING, WALKS, PARKING LOTS, RAMPS, ENTRANCES, DOORS, STAIRS, FLOORS, ELEVATORS, & CONTROLS.

11x5.3(a) UNITS OR SUITES MUST BE ON ONE LEVEL OR MADE ACCESSIBLE THROUGHOUT BY MEANS OF RAMPS OR ELEVATORS.

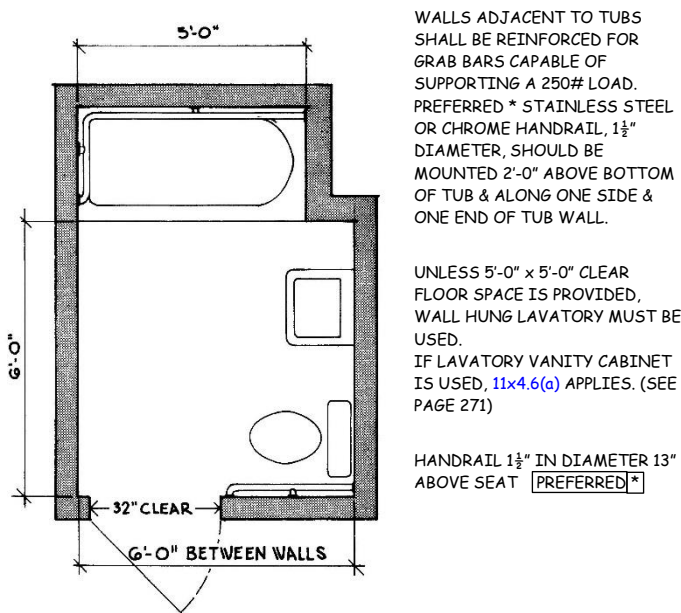
11x5.3(b) KITCHENS SHALL MEET OR BE ADJUSTABLE TO THE FOLLOWING REQUIREMENTS:

- 1.) MINIMUM 5'-0"x5'-0" CLEAR FLOOR BETWEEN CABINETS & CABINETS, OR CABINETS & WALL, EXCEPT WHERE 1 OR 2 6"x8<sup>3</sup>/<sub>4</sub>" TOE SPACES ARE PROVIDED.
- 2.) KNEE SPACE FOR SEATED WORK SHALL BE PROVIDED UNDER COUNTER & SHALL BE A MINIMUM OF 30" WIDE, 29" HIGH, & 24" DEEP.
- 3.) DOORS SHALL HAVE 32" CLEAR OPENING & SWIG OUT OR SLIDE.

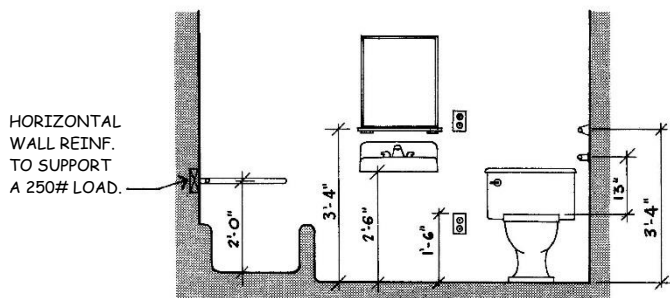


**(11x)5.3 (continued)**

- c) One full bathroom in each unit or suite shall meet or be adjustable to meet the following requirements:
- 1) The clear door opening shall be no less than 32 inches. The door shall swing out or slide.
  - 2) A minimum of 6 feet width between walls shall be required except at the end of the tub wall.
  - 3) A self-supporting wall-hung lavatory mounted 30 inches to apron shall be provided where 5 feet by 5 feet floor space is not provided.
  - 4) Walls shall be capable of supporting handrails which can support a 250 pound load
  - 5) Where mirrors are provided, at least one mirror shall be placed above lavatories no higher than 40 inches above the floor, measured from the bottom of the mirror.
  - 6) Where provided, toilet rooms shall have at least one towel rack mounted at a height not to exceed 40 inches from the floor.
  - 7) The maximum hot water temperature for all plumbing fixtures shall not exceed 120° F or exposed hot water lines and drains shall be fully insulated.



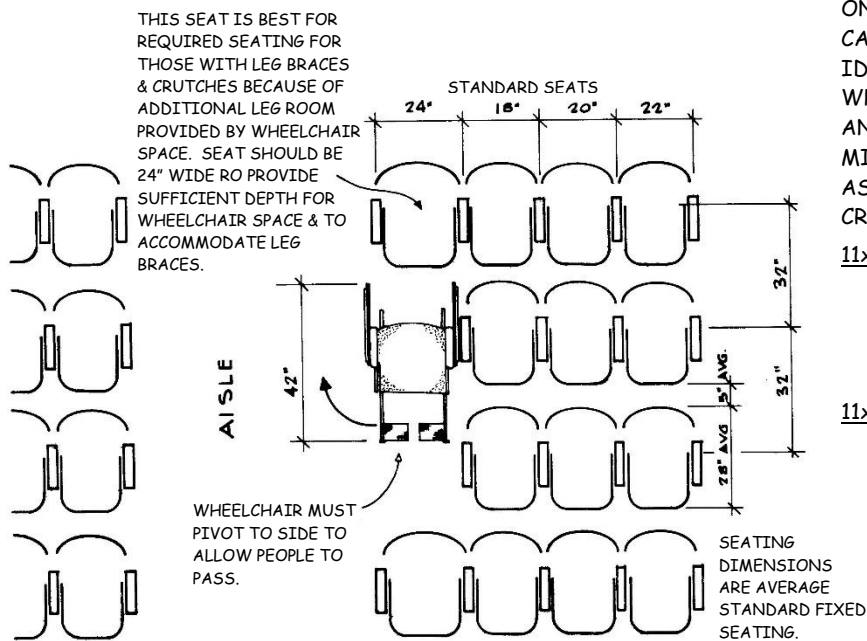
- 11x5.3(c) ONE FULL BATHROOM IN EACH UNIT OR SUITE SHALL MEET OR BE ADJUSTABLE TO THE FOLLOWING REQUIREMENTS:**
- 1.) DOOR SHALL HAVE A 32" CLEAR OPENING & SWING OUT OR SLIDE.
  - 2.) 6'-0" REQUIRED BETWEEN WALLS EXCEPT AT END OF TUB WALL.
  - 3.) WHERE 5'-0" x 5'-0" CLEAR FLOOR SPACE IS NOT PROVIDED, A WALL HUNG LAVATORY MUST BE USED.
  - 4.) WALL ADJACENT TO TOILETS AND TUBS SHALL BE CAPABLE OF SUPPORTING HANDRAILS WHICH CAN SUPPORT A 250 POUND LOAD.
  - 5.) WHERE PROVIDED AT LEAST ONE MIRROR SHALL BE PLACED ABOVE LAVATORY NO HIGHER THAN 40" ABOVE FLOOR.
  - 6.) WHERE PROVIDED AT LEAST ONE TOWEL RACK SHALL BE NOT MORE THAN 40" ABOVE FLOOR.
  - 7.) MAXIMUM WATER TEMPERATURE SHALL NOT EXCEED 120°, OR EXPOSED HOT WATER LINES & DRAINS SHALL BE FULLY INSULATED.



## [11x]6 seating for assembly

In places of assembly with fixed type seating and a capacity greater than 75 seats, identified spaces for the wheelchair handicapped shall be provided at a rate of no less than 1%, or a minimum of one, whichever is greater, of the total seating capacity. An additional number of identified seats equal to 1%, or a minimum of one, whichever is greater, of the total seating capacity shall be set aside for the handicapped with crutches and/or walkers.

- a) Such spaces and seating shall be located as an integral part of the overall floor plan of said assembly area.
- b) Seats and spaces shall be designed to conform with the requirements of accessibility for wheelchairs and crutches described in [Appendix A](#).

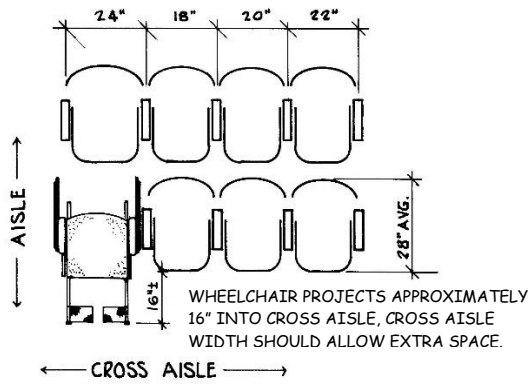


IN ASSEMBLY PLACES (THEATRES, AUDITORIUMS, COURTS, STADIA, AREANS, ETC.) WITH MORE THAN 75 SEATS, 1%, OR A MINIMUM OF ONE, OF TOTAL SEATING CAPACITY MUST BE DESIGNATED IDENTIFIED SPACES FOR WHEELCHAIR HANDICAPPED AND AN ADDITIONAL 1%, OR A MINIMUM OF ONE, MUST BE SET ASIDE FOR HANDICAPPED WITH CRUTCHES AND/OR WALKERS.

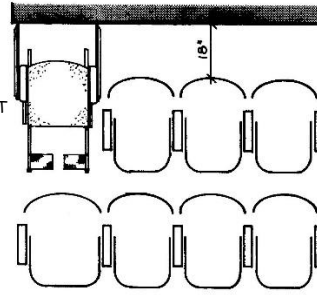
**11x6(a)** HANDICAPPED SEATING SPACES MUST BE AN INTEGRAL PART OF THE SEATING PLAN AND NOT SEGREGATED.

**11x6(b)** SEATS AND SPACES SHALL BE DESIGNATED TO CONFORM WITH THE REQUIREMENTS OF ACCESSIBILITY FOR WHEELCHAIRS AND CRUTCHES DESCRIBED IN [APPENDIX A](#). (SEE FOLLOWING PAGES.)

11x6 (continued)

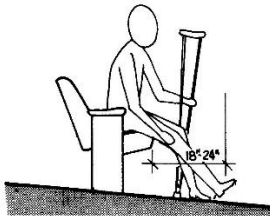


IF BACK WALL IS HELD 18" AWAY FROM TOP OF SEAT BACK WHEELCHAIR CAN PARK AS SHOWN WITHOUT BLOCKING ROW.

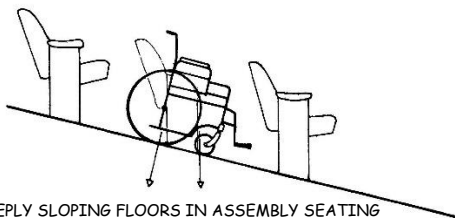
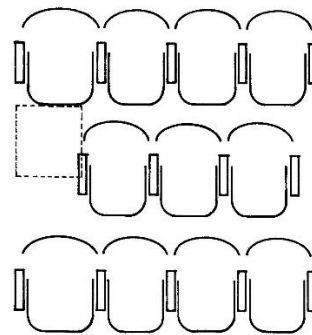


WHEELCHAIR SEATING SPACE @ BACKWALL

WHEELCHAIR SEATING SPACE @ CROSS AISLE



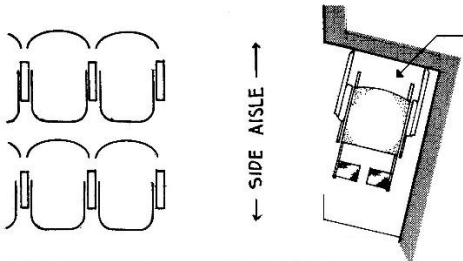
SEATING SPACE REQUIREMENTS FOR BRACES & CRUTCHES



STEEPLY SLOPING FLOORS IN ASSEMBLY SEATING AREAS OFFSET CENTER OF GRAVITY FOR WHEELCHAIRS CAUSING DISCOMFORT DURING LONG PERFORMANCES. FOR THIS REASON IT IS **PREFERRED** THAT THE WHEELCHAIR SPACES BE LOCATED WHERE FLOOR CAN REMAIN LEVEL AS AT CROSS AISLES, FRONT & REAR OF THEATER, OR IN BOXES TO THE SIDE.

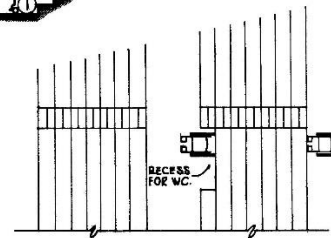
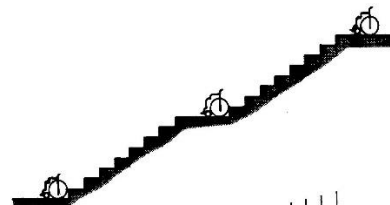


SLOPING FLOORS IN ASSEMBLY SEATING



SPECIAL WHEELCHAIR BOX @ SIDE AISLE

LEVEL FLOOR MAY BE USED BY NON-HANDICAPPED WITH PORTABLE SEATING WHEN NOT REQUIRED FOR WHEELCHAIR USE.

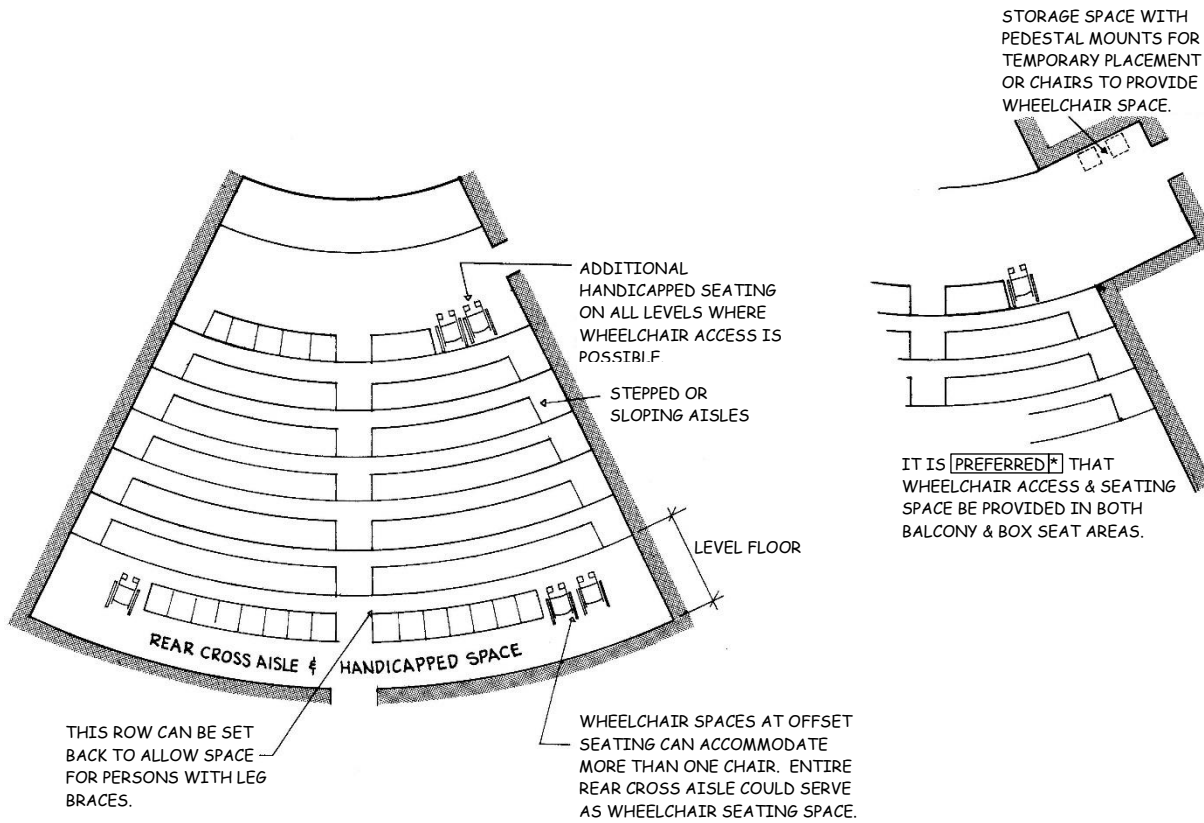
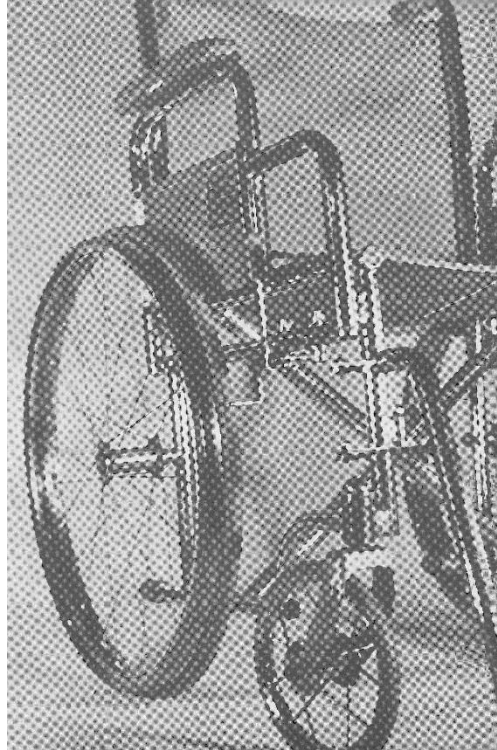


WHEELCHAIR SPACES IN ASSEMBLY AREAS HAVING STEPPED RISER SEATING CAN BEST BE LOCATED IN CROSS AISLES AT FRONT, REAR, OR CENTER OF SEATING, PROVIDED SUFFICIENT SPACE IS ALLOWED IN CROSS AISLES SO WHEELCHAIRS DO NOT INFRINGE ON REQUIRED AISLE WIDTH.

SPACES SHOULD BE LOCATED ON ALL POSSIBLE LEVELS TO GIVE HANDICAPPED SOME CHOICE OF LOCATION.

WHEELCHAIR SEATING @ STEPPED RISERS (BENCH TYPE STADIUM SEATING)

11x6 (continued)



EXAMPLE PLAN: SMALL THEATRE

## [11x]7 instructional facilities, dining halls, and other areas utilizing fixed facilities

- a) Where fixed tables are used, a minimum of 2%, or at least one, shall have 29 inches clearance under the table top, and if aprons are greater than 2 inches, they shall be recessed 1 foot. In dining areas and libraries, all fixed tables shall meet this requirement.
- b) Width between fixed tables shall be a minimum of 5 feet 5 inches.
- c) Outside rail heights of fixed tray slides in dining areas shall be no greater than 34 inches.
- d) Aisles between fixed tray slides and control railings in dining areas shall be a minimum of 34 inches.
- e) In areas with 24 or more fixed stations or seats (e.g., lecture halls, libraries, dining areas, and other work or study areas), or 2%, or at least one station or seat, shall be designed to conform with the requirements of accessibility for wheelchairs and crutches described in Appendix A.

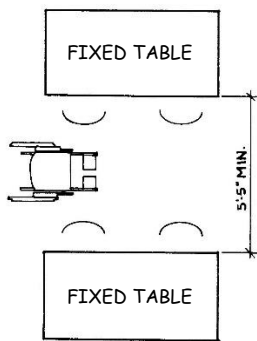
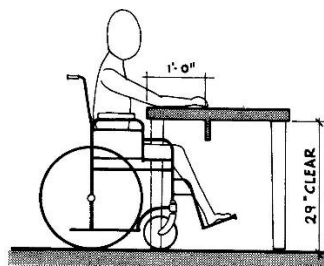
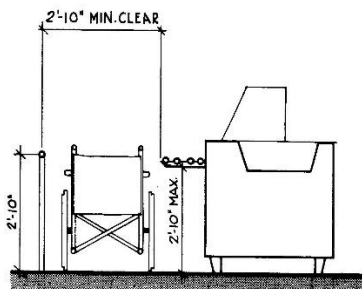


TABLE SPACING

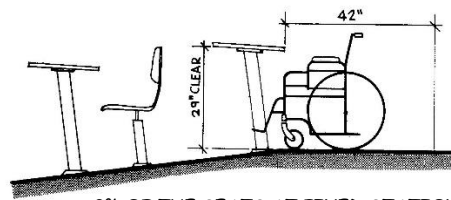


CLEARANCE UNDER TABLES MUST BE 29" CLEAR TO BOTTOM OF TABLE TOP. APRONS IF USED MUST BE RECESSED 1'-0" UNDER TABLE.

TABLE HEIGHTS



FOOD SERVICE RAILS



2% OF THE SEATS AT FIXED STATION FACILITIES MUST BE OMITTED OR PORTABLE TO PROVIDE SPACES FOR WHEELCHAIR USE.

FIXED STATION SEATING

11x7(a) WHERE FIXED TABLES ARE USED, A MINIMUM OF 2%, OR AT LEAST ONE, SHALL HAVE 29" CLEARANCE FROM FLOOR TO ALLOW WHEELCHAIR TO PULL UP UNDER TABLE. ALL TABLES IN DINING AREAS & LIBRARIES SHALL MEET THIS REQUIREMENT.

11x7(b) WIDTH BETWEEN FIXED TABLES SHALL BE 5'-5".

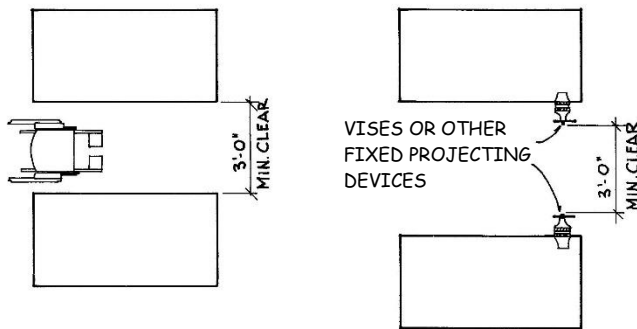
11x7(c) OUTSIDE RAIL HEIGHTS OF TRAY SLIDES IN DINING AREAS SHALL BE NO HIGHER THAN 34".

11x7(d) AISLES AT FOOD SERVICE LINES BETWEEN TRAY SLIDES & CONTROL BARS SHALL BE 34" WIDE MINIMUM.

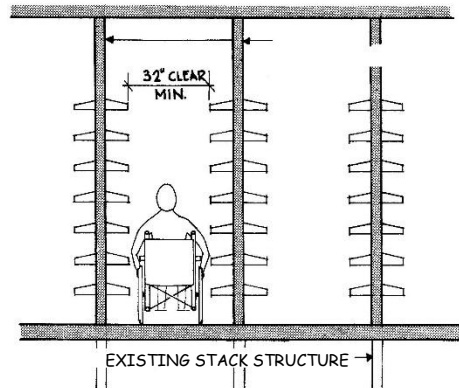
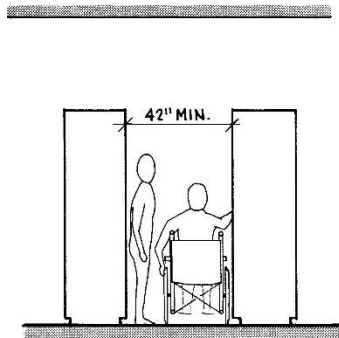
11x7(e) IN AREAS WITH 24 OR MORE FIXED INDIVIDUAL STATIONS OR SEATS, 2% OR AT LEAST ONE STATION OR SEAT MUST BE ACCESSIBLE TO WHEELCHAIRS.

**(11x)7 (continued)**

- f) In laboratories and other work or study areas using work benches, each “handicapped station” shall have a low work bench with a clear minimum of 29 inches, (floor to underside of work area) and shall not have an apron.
- g) Aisles between fixed work benches shall have a minimum clear width of 3 feet.
- h) Aisles between fixed stacks in libraries shall be a minimum width of 42 inches.



WORK BENCH SPACING



LIBRARY STACK SPACING

11x7(f) IN LABORATORIES AND OTHER WORK AREAS USING WORK BENCHES, HANDICAPPED STATIONS SHALL HAVE A LOW WORK BENCH FOR USE FROM WHEELCHAIR WITH MINIMUM CLEARANCE FROM FLOOR TO UNDERSIDE OF WORK SURFACE OF 29" & SHALL NOT HAVE APRONS.

11x7(g) AISLES BETWEEN FIXED WORK BENCHES SHALL HAVE A MINIMUM CLEAR WIDTH OF 3 FEET.

11x7(h) AISLES BETWEEN FIXED STACKS IN LIBRARIES SHALL BE A MINIMUM OF 42" CLEAR EXCEPT IN ADDITIONS & REMODELING WHERE EXISTING MULTI-TIER STRUCTURAL SYSTEMS MUST BE MAINTAINED THROUGHOUT THE BUILDING, THEN AISLES MAY BE A MINIMUM OF 32", OR IN CLOSED STACK AREAS WHERE 42" MIN. WIDE AISLES ARE PROVIDED AT EITHER END.

## appendix A – design specifications

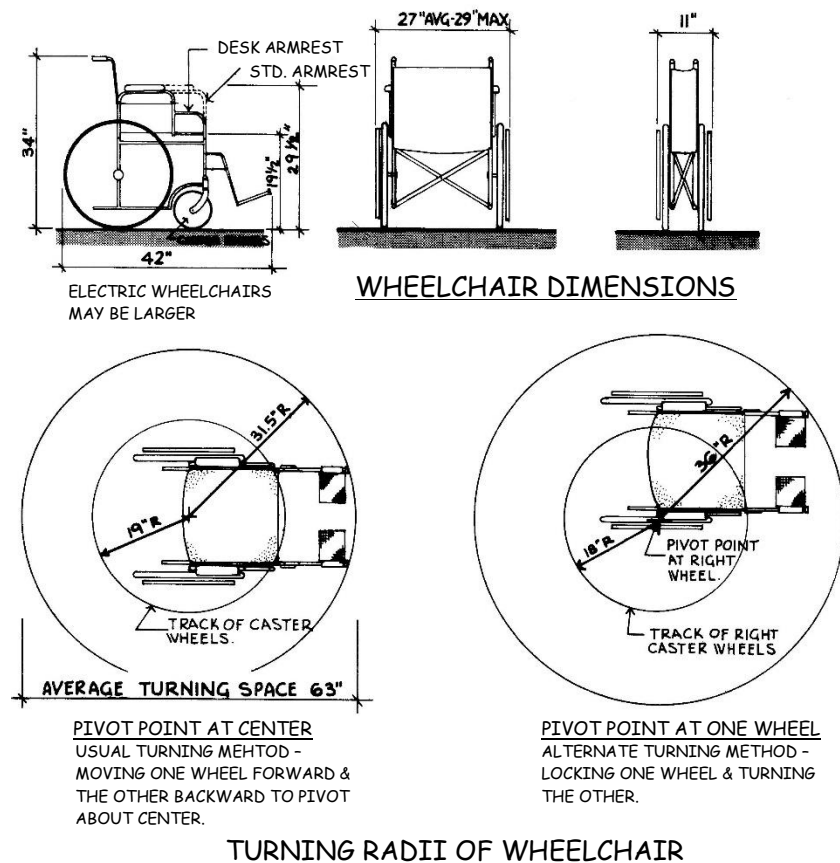
### (1) – wheelchair specifications

The collapsible-model wheelchair of tubular metal construction with plastic upholstery for back and seat is most commonly used. The standard model of all manufacturers falls within the following limits, which were used as the basis of consideration.

- 1) Length: 42 inches
- 2) Width, when open: 27 inches average, 29 inches maximum
- 3) Height of seat from floor: 19½ inches
- 4) Height of armrest from floor: 29 inches
- 5) Width, when collapsed: 11 inches

### (2) – fixed turning radius, wheel to wheel

- a) The fixed turning radius of a standard wheelchair, wheel to wheel, (the tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot) is 18 inches.



1) WHEELCHAIR SPECIFICATION:

THE MOST COMMON TYPE OF WHEELCHAIR USED BY NON-AMBULATORY PERSON OUTDOORS IS THE COLLAPSIBLE TUBULAR METAL CHAIR WITH PASTIC OR NYLON UPHOLSTERY FOR SEATS & BACKS. TO SUIT NEEDS OF VARIOUS DISABILITIES THESE ARE AVAILABLE WITH NUMEROUS ATTACHMENTS & REMOVABLE PARTS SUCH AS LEG RESTS, TILTING BACK RESTS, ETC. THE STANDARD BASIC CHAIR IS ILLUSTRATED ON THIS PAGE.

2) FIXED TURNING RADIUS OF WHEELCHAIRS

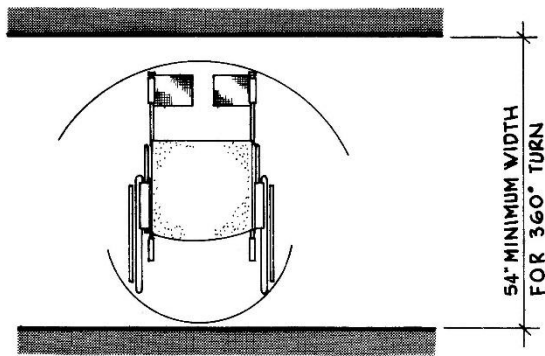
- (a) THE FIXED TURNING RADIUS OF WHEELCHAIRS, WHEEL TO WHEEL, WHEN PIVOTING ON A SPOT IS 18". I.E. DISTANCE FROM PIVOT SPOT TO TRACK OF CASTER WHEEL.
- THE TURNING RADIUS OF WHEELCHAIRS FROM PIVOT POINT AT CENTER OF CHAIR TO FORMOST PROJECTION OF THE FOOTREST IS APPROXIMATELY 31.5".

**appendix A (continued)**

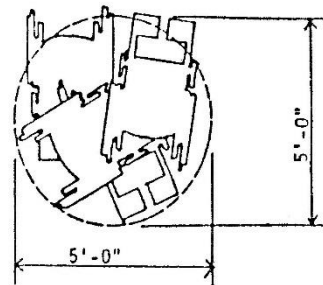
- b) The fixed turning radius, front structure to rear structure, (the turning radius of a wheelchair, left front-foot platform to right rear wheel, or right front-foot platform to left rear wheel, when pivoting on a spot) is 36 inches. The average turning space required is 63 inches x 63 inches.

NOTE: Actually, a turning space that is longer than it is wide, specifically 63 x 56 inches, is more workable and desirable. In an area with two open ends, such as might be the case in a corridor, a minimum of 54 inches between two walls would permit a 360-degree turn.

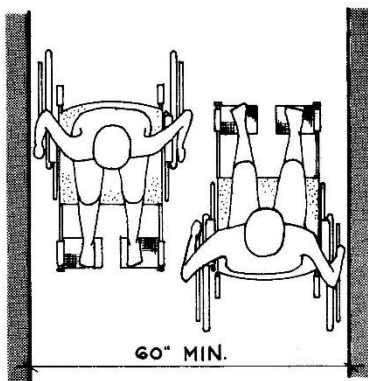
- c) A minimum width of 60 inches is required for two individuals in wheelchairs to pass each other.



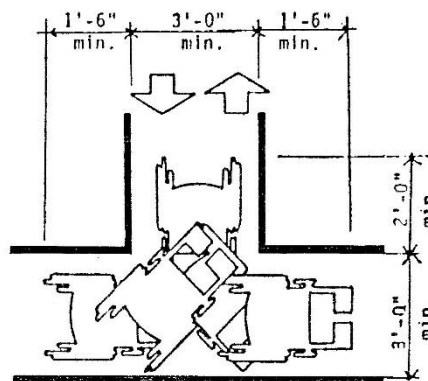
THE FIXED TURNING RADIUS FROM PIVOT POINT AT RIGHT REAR WHEEL TO LEFT FRONT FOOTREST, OR FROM LEFT REAR WHEEL PIVOT POINT TO RIGHT FRONT FOOTREST, IS 36". THE AVERAGE TURNING SPACE REQUIRED IS 63" x 63".



Turn-around area  
5'-0" diameter circle



(c) A MINIMUM WIDTH OF 60" IS REQUIRED FOR TWO INDIVIDUALS IN WHEELCHAIRS TO PASS EACH OTHER.



1 Shaped Space for 180° Turns

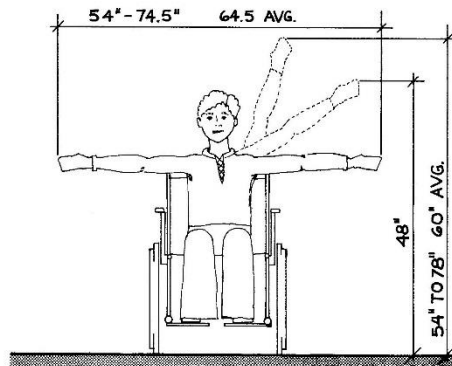
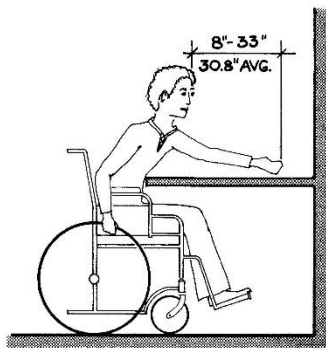


**appendix A (continued)**

**(3) – the individual functioning in a wheelchair**

Extremely small, large, strong, or weak and involved individuals could fall outside the ranges of reach and their reach could vary. However, these reaches were determined using a large number of individuals who were functionally trained, with a wide range in individual size and involvement.

- a) The average unilateral vertical reach is 60 inches and ranges from 54 inches to 78 inches.
- b) The average horizontal working (table) reach is 30.8 inches and ranges from 28.5 inches to 33.2 inches.
- c) The bilateral horizontal reach, both arms extended to each side, shoulder high, ranges from 54 inches and averages 64.5 inches.
- d) An individual reaching diagonally, as would be required in using a wall-mounted dial telephone or towel dispenser, would make the average reach (on the wall) 48 inches from the floor.



3) THE INDIVIDUAL FUNCTIONING IN A WHEELCHAIR

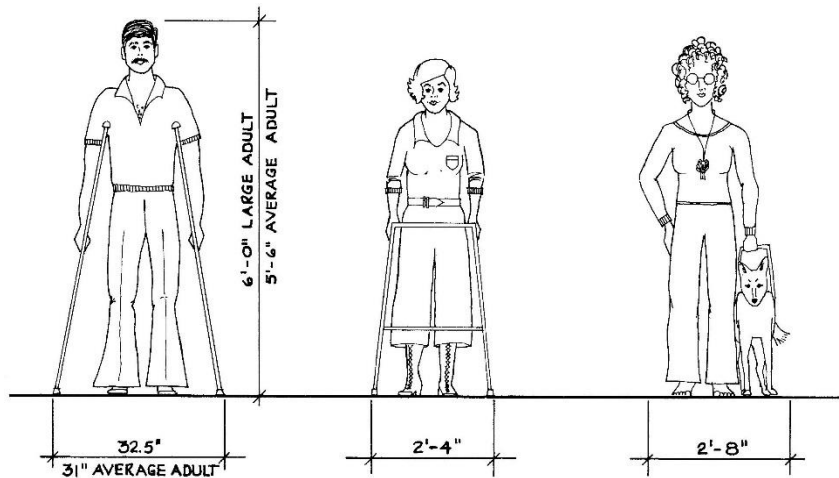
- (a) THE AVERAGE UNILATERAL VERTICAL REACH IS 60".
- (b) THE AVERAGE HORIZONTAL WORKING REACH IS 30.8".
- (c) THE BILATERAL HORIZONTAL REACH (BOTH ARMS EXTENDED TO SIDE SHOULDER HIGH) AVERAGES 64.5".

**appendix A (continued)**

**(4) – the individual functioning on crutches and walkers**

Most individuals ambulating on braces or crutches, or both, or on canes are able to manipulate within the specifications prescribed for wheelchairs, although doors present quite a problem at times. However, attention is called to the fact that a crutch tip extended laterally from an individual is not obvious to others in heavily trafficked areas, certainly not as obvious or protective as a wheelchair and is, therefore, a source of vulnerability.

- a) On the average, individuals 5 feet 6 inches tall require 31 inches between crutch tips in the normally accepted gaits.
- b) On the average, individuals 6 feet tall require 32.5 inches between crutch tips in the normally accepted gaits.



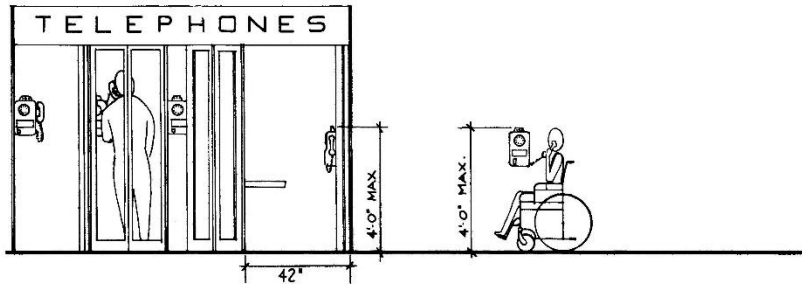
- 4) THE INDIVIDUAL FUNCTIONING ON CRUTCHES & WALKERS.
- (a) INDIVIDUALS 5'-6" TALL REQUIRE 31" BETWEEN CRUTCH TIPS.
- (b) INDIVIDUALS 6'-0" TALL REQUIRE 32.5" BETWEEN CRUTCH TIPS.

# appendix B – public telephones

All “banks” of public telephones should have at least one telephone which can be used by the physically disabled, including those in wheelchairs and those with hearing and sight disabilities.

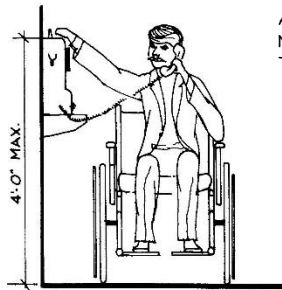
The following are minimum requirements:

- a) The dial and headset shall be placed no more than 4 feet above the floor.
- b) The telephone shall be equipped for those with hearing disabilities with an adjustable volume control for the headset with instructions for use.
- c) The telephone shall be equipped for those with sight disabilities with visual and tactile instructions for use. Large tactile letters shall be used for instructions.
- d) On every floor where telephones are installed, at least one should be placed so that the dial and headset are no more than 4 feet above the floor, and equipped for those with hearing and sight disabilities and so identified with visual and tactile instructions for use.



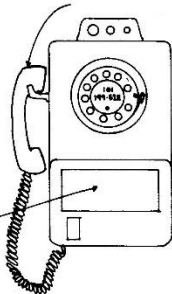
ALL BANKS OF TELEPHONES SHOULD HAVE AT LEAST ONE TELEPHONE ACCESSIBLE TO THE PHYSICALLY HANDICAPPED AND EQUIPPED AS FOLLOWS:

- 1) ALL OPERATING MECHANISMS (DIAL, HEADSET, COIN SLOT) SHOULD BE 4'-0" ABOVE THE FLOOR OR LESS.
- 2) HEADSET SHOULD HAVE ADJUSTABLE VOLUME CONTROL WITH INSTRUCTIONS.
- 3) VISUAL & TACTILE INSTRUCTIONS FOR USE SHOULD BE IN RAISED OR RECESSED LETTERING.
- 4) SINCE STANDARD ENCLOSED TELEPHONE BOOTHS ARE INACCESSIBLE TO WHEELCHAIRS, BOOTHS FOR HANDICAPPED USE SHOULD HAVE:

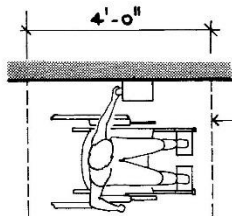


ALL OPERATING MECHANISMS NO MORE THAN 4'-0" ABOVE THE FLOOR.

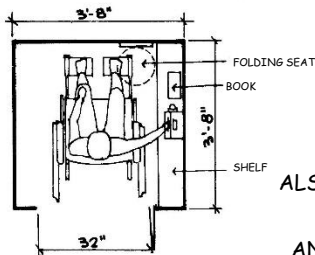
RAISED OR RECESSED LETTERING FOR INSTRUCTIONS.



- a) 42" CLEAR FLOOR SPACE BETWEEN WALLS.
- b) 32" CLEAR DOOR OPENING WITH OUTSWINGING SLIDING, OR FOLDING DOOR.



WALL MOUNTED TELEPHONES SHOULD HAVE MIN. 4'-0" CLEAR FLOOR SPACE TO ALLOW CLOSE PARALLEL APPROACH BY WHEELCHAIRS



ALSO, c) PHONE UNIT SHOULD BE MOUNTED ON SIDEWALL. AND, d) SEAT SHOULD FOLD OUT OF THE WAY.

## **appendix C – minimum suggestions for the construction of privately owned residential projects with residential units intended to be sold, primarily to the physically handicapped and /or elderly**

In addition to other requirements set forth in other sections of the Handicapped Section of the North Carolina State Building Code, 1 out of every 10 residential units should meet the requirements of this Section.

- a) The Individual dwelling unit or suite must be on one level throughout.
- b) Kitchens shall meet or be adjustable to meet the following requirements:
  - 1) All work surfaces shall not exceed 34 inches in height except for the portion over a built-in dishwasher.
  - 2) Normal base cabinet toe space shall be 6 inches minimum in depth and 8¾ inches minimum in height.
  - 3) The cooking range-oven combination shall be the drop-in type that will allow for the required toe space and all controls shall be on the front. Where separate cooking surfaces and oven are used, all controls shall be on the front. Top of the oven housing shall not exceed 52 inches in height above the floor
  - 4) Controls for vent hoods and lights over cooking units shall be mounted in the counter tops.
  - 5) An open space under the sink shall be provided. This space shall be centered with the sink and be no less than 2 feet 6 inches wide and 2 feet 5 inches high. Sink drains shall be trapped as near to the back wall of the cabinet as possible.
  - 6) Sink bowl shall not exceed 5 inches in depth.
  - 7) The bottom of all wall cabinets shall not be greater than 16 inches above the work surface of the base cabinet except for those cabinets over cooking surfaces, ovens and refrigerators. All shelving in wall cabinets shall be adjustable.
  - 8) A minimum of 5 feet clear floor space between opposite cabinets or opposite cabinets and walls shall be provided to allow for wheelchair turns except where 6 inches in depth and 8¾ inches in height toe space is provided in accordance with (11x)4.6(a).
  - 9) Hot water controls shall be provided to insure a maximum temperature of 120<sup>o</sup> F for water at the sink or exposed hot water lines and drains shall be fully insulated.
  - 10) Sink faucets shall be of the single lever type.
  - 11) Kitchen pantries or cabinets used for pantry storage shall have adjustable shelves.
  - 12) Refrigerators, where provided, shall be self-defrosting or frost free.

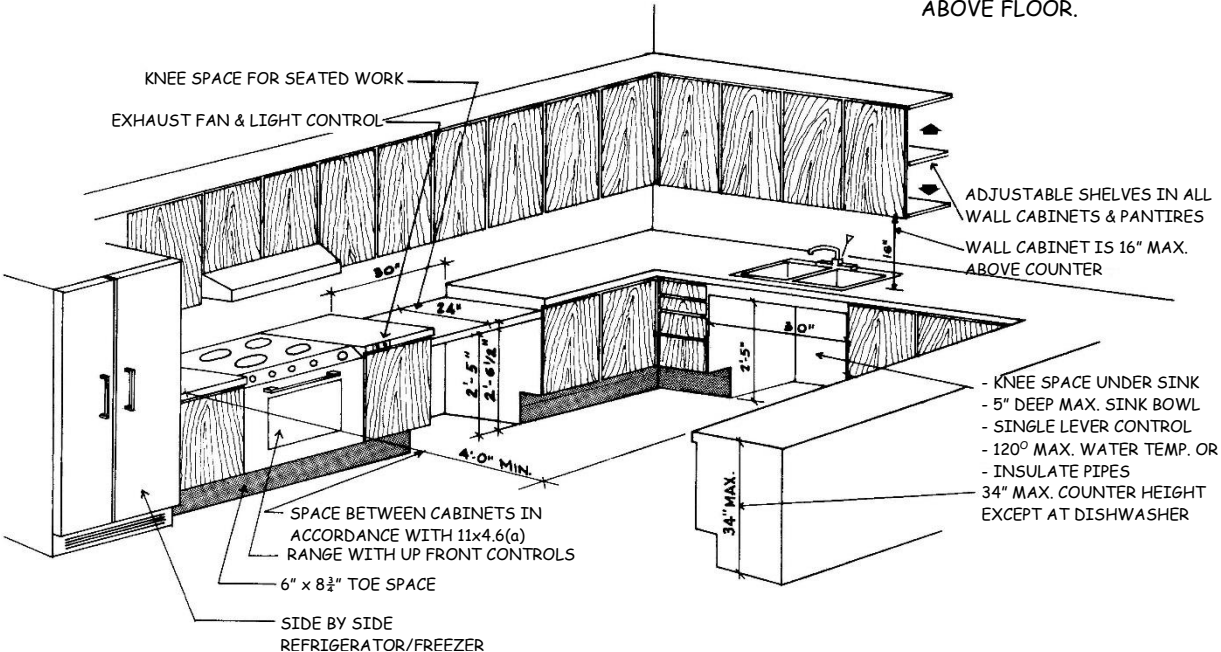
appendix C (continued)

13) For seated work in a chair or a wheelchair, an opening shall be provided under the counter for knee space. This opening shall be a minimum of 30 inches in width, 29 inches in height, and 24 inches in depth. The top of the counter under which this knee space is provided, shall be a minimum of 30 inches in width, 24 inches in depth, and no higher than 30 inches from the floor.

14) Doors shall have a clear opening of not less than 32 inches when open, shall swing out or slide, and shall be operable by a single effort.

IN ADDITION TO OTHER REQUIREMENTS, 1 OUT OF 10 RESIDENTIAL UNITS SHOULD MEET THE FOLLOWING REQUIREMENTS:

- (a) DWELLING UNITS MUST BE ON ONE LEVEL THROUGHOUT.
- (b) KITCHENS SHALL MEET OR BE ADJUSTABLE TO MEET THE REQUIREMENTS SHOWN HERE.
- (c) CLOSETS
  - (1.) CLOSET POLES SHALL ADJUST FROM 5'-0" TO 5'-4" ABOVE FLOOR.
  - (2.) CLOSET SHELVES SHALL ADJUST FROM 4'-2" TO 5'-4" ABOVE FLOOR.



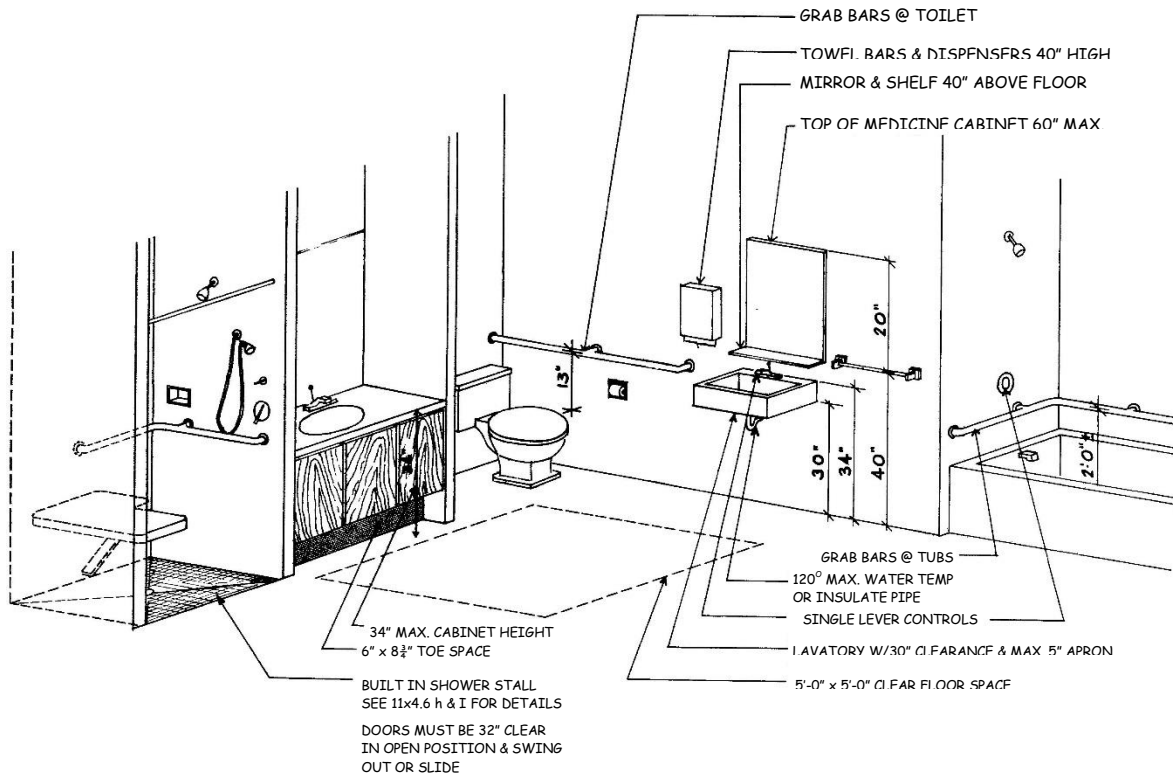
**appendix C (continued)**

- c) All closets shall meet the following requirements:
- 1) Hanging poles shall be adjustable from 4 feet above the floor to 5 feet 4 inches above the floor.
  - 2) Closet shelves shall be adjustable from 4 feet 2 inches above the floor to 5 feet 6 inches above the floor.
- d) Each bathroom in each unit or suite shall meet or be adjustable to meet the following requirements:
- 1) Doors shall have a clear opening of not less than 32 inches when open, shall swing out or slide and shall be operable by a single effort.
  - 2) A minimum of 5 feet x 5 feet clear floor space between opposite cabinets or opposite cabinets and walls shall be provided to allow for wheelchair turns except where 6 inches depth by 8¾ inches height toe space is provided in accordance with (11x)4.6 (a) with entrance door located on one side of this clear floor space.
  - 3) Stainless steel handrails shall be provided on each side wall. Each handrail shall be 13 inches above the toilet seat and 52 inches long. Each handrail shall be parallel to the floor, 1½ inches in outside diameter, shall have 1½ inches clear space between rail and wall, and be fastened securely at ends and center to support a 250 pound load.
  - 4) Lavatories shall be mounted 2 feet 10 inches above the floor to the top of the lavatory and drains shall be trapped as near to the wall as possible.
  - 5) The front of the lavatory shall be no less than 22 inches from the wall.
  - 6) Lavatories and counter tops, where provided, shall not exceed 5 inches in depth.
  - 7) The maximum hot water temperature for all plumbing fixtures shall not exceed 120° F; or exposed hot water lines and drains shall be fully insulated.
  - 8) Showers, where provided, shall be no less than 3 feet 4 inches x 4 feet 6 inches clear inside and shall not contain curbs. Doors or openings to showers shall be 3 feet 2 inches minimum in width and open out. The floor surface shall be non-slip. A seat shall be positioned 19 inches above the floor and shall be hinged to fold against the wall. A grab rail shall be attached to the stall wall opposite the seat and shall extend around on the back of the wall. The water control, diversionary shower spray end soap tray shall be placed at a height not to exceed 40 inch above the floor. All controls shall be single lever type.
  - 9) All water supply controls for lavatories and tubs shall be single lever controls.
  - 10) When mirrors and shelves are provided, at least one mirror and one shelf shall be placed above lavatories no higher than 40 inches above the floor, measured from the top of the shelf and the bottom of the mirror.
  - 11) Medicine cabinets shall have adjustable shelves with top of the cabinet mounted no higher than 6 feet above the floor.

**appendix C (continued)**

- 12) Where provided, toilet rooms shall have at least one towel rack, at least one towel dispenser, and at least one other dispenser and disposal unit mounted at a height not to exceed 40 inches from the floor.
- 13) Minimum toe space of 8¾ inches in height and 6 inches in depth shall be provided for cabinets in the toilet room.
- e) Window stool heights, except in bathrooms and kitchens, shall not exceed 30 inches above the floor.
- f) All electrical wall outlets shall be mounted a minimum of 16 inches above the floor, except to meet special requirements in kitchen and bathroom areas.

4) EACH BATHROOM SHALL MEET THE REQUIREMENTS ILLUSTRATED HERE.



- 5) WINDOW SILLS SHALL NOT EXCEED 30" ABOVE FLOOR EXCEPT AT KITCHEN AND BATHS.
- 6) ALL ELECT. OUTLETS SHALL NOT BE MOUNTED LESS THAN 16" ABOVE FLOOR EXCEPT SPECIAL OUTLETS IN KITCHEN & BATH AREAS.

## appendix D – related handicapped legislation

### 1 – An Act to Provide for Treatment of Handicapped and Disabled Persons Equal to that Afforded Other Persons N. C. General Statute 168

#### ARTICLE 1.

##### *Rights.*

**GS 168-1. Purpose and definition.** – The State shall encourage and enable handicapped persons to participate fully in the social and economic life of the State and to engage in remunerative employment. The definition of “handicapped persons” shall include those individuals with physical, mental and visual disabilities. For the purposes of this Article the definition of “visually handicapped” in G.S.111-11 shall apply (1973, c. 493, s. 1.)

**Editor’s Note.** – Session Laws 1973, c. 493, s. 3, makes the act effective July 1, 1973.

**GS 168-2. Right of access to and use of public places.** – Handicapped persons have the same right as the able-bodied to the full and free use of the streets, highways, sidewalks, walkways, public buildings, public facilities, and all other buildings and facilities, both publicly and privately owned, which serve the public. (1973, c. 493, s. 1.)

**GS 168-3. Right to use of public conveyances, accommodations, etc.** – The handicapped and physically disabled are entitled to accommodations, advantages, facilities, and privileges of all common carriers, airplanes, motor vehicles, railroad trains, motor buses, streetcars, boats, or any other public conveyances or modes of transportation; hotels, lodging places, places of public accommodation, amusement or resort to which the general public is invited, subject only to the conditions and limitations established by law and applicable alike to all persons. (1973, c. 493, s. 1.)

**GS 168-4. May be accompanied by guide dog.** – Every visually handicapped person shall have the right to be accompanied by a guide dog, especially trained for the purpose, in any of the places listed in G.S.168-3 provided that he shall be liable for any damage done to the premises or facilities by such dog. (1973, c. 493, s. 1.)

**GS 168-5. Traffic and other rights of persons using certain canes.** – The driver of a vehicle approaching a visually handicapped pedestrian who is carrying a cane predominantly white or silver in color (with or without a red tip) or using a guide dog shall take all necessary precautions and avoid injury to such pedestrian. (1973, c. 493, s. 1.)

**GS 168-6. Right to employment.** – Handicapped persons shall be employed in the State service, the service of the political subdivisions of the State, in the public schools, and in all other employment, both public and private, on the same terms and conditions as the able-bodied, unless it is shown that the particular disability impairs the performance of the work involved. (1973, c. 493, s. 1.)



- GS 168-7. Guide dogs.** – Every visually handicapped person who has a guide dog, or who obtains a guide dog, shall be entitled to keep the guide dog on the premises leased, rented or used by such handicapped person. He shall not be required to pay extra compensation for such guide dog but shall be liable for any damage done to the premises by such a guide dog. (1973, c. 493, s. 1.)
- GS 168-8. Right to habitation and rehabilitation services.** – Handicapped persons shall be entitled to such habilitation and rehabilitation services as available and needed for the development or restoration of their capabilities to the fullest extent possible. Such services shall include, but not be limited to, education, training, treatment and other services to provide for adequate food, clothing, housing and transportation during the course of education, training and treatment. Handicapped persons shall be entitled to these rights subject only to the conditions and limitations established by law and applicable alike to all persons. (1973. c. 493, s. 1.)
- GS 168-9. Right to housing.** – Each handicapped citizen shall have the same right as any other citizen to live and reside in residential communities, homes, and group homes, and no person or group of persons, including governmental bodies or political subdivisions of the State, shall be permitted, or have the authority, to prevent any handicapped citizen, on the basis of his or her handicap, from living and residing in residential communities, homes, and group homes on the same basis and conditions as any other citizen. Nothing herein shall be construed to conflict with provisions of Chapter 122 of the General Statutes. (1975, c. 635, s. 1.) **Editor’s Note.** – Session Laws 1975, c.635. s. 1, makes the act effective June 17, 1975.
- GS 168-10. Elimination discrimination in treatment of handicapped and disabled.** – Each handicapped person shall have the same consideration as any other person for individual accident and health insurance coverage, and no insurer, solely on the basis of such person's handicap, shall deny such coverage or benefits. The availability of such insurance shall not be denied solely due to the handicap, provided, however, that no such insurer shall be prohibited from excluding by waiver or otherwise, any pre-existing conditions from such coverage, and further provided that any such insurer may charge the appropriate premiums or fees for the risk insured on the same basis and conditions as insurance issued to other persons. Nothing contained herein or in any other statute shall restrict or preclude any insurer governed by Chapter 57 or Chapter 58 of the General Statutes from setting and charging a premium or fee based upon the class or classes of risks and on sound actuarial and underwriting principles as determined by such insurer, or from applying its regular underwriting standards applicable to all classes of risks. (1977, c. 894, s. 1.)
- Editor’s Note.** – Session Laws 1977, c. 894, s. 1, makes the act effective January 1, 1978.

**2 – An Act to Prescribe Standards for Curb Ramps or Curb Cuts for Handicapped Persons**  
**N. C. General Statutes 136-44.14**

**GS 136-44.14. Curb ramps or curb cuts for handicapped persons.**

- a) Curbs constructed on each side of any street or road, where curbs and sidewalks are provided and at other major points of pedestrian flow, shall meet the following minimum requirements:
  - 1) No less than two curb ramps or curb cuts shall be provided per lineal block, located at intersections.
  - 2) In no case, shall the width of a curb ramp or curb cut be less than 40 inches.
  - 3) The maximum gradient of such curb ramps or curb cuts shall be eight and thirty-three one-hundredths percent (8.33%) (12 inches slope for every one-inch rise) in relationship to the grade of the street or road.
  - 4) One curb ramp or curb cut may be provided under special conditions between each radius point of a street turnout of an intersection, if adequate provisions are made to prevent vehicular traffic from encroaching on the ramp.
- b) Minimum requirements for curb ramps or curb cuts under subsection (a) shall be met (i) in the initial construction of such curbs, and (ii) whenever such curbs are reconstructed, including, but not limited to, reconstruction for maintenance procedures and traffic operations, repair, or correction of utilities.
- c) The Department of Transportation, Division of Highways, Design Section, is authorized and directed to develop guidelines to implement this Article in consultation with the Governor's Study Committee on Architectural Barriers (or the Committee on Barrier-Free Design of the Governor's Committee on Employment of the Handicapped if the Governor's Study Committee on Architectural Barriers ceases to exist). All curb ramps or curb cuts constructed or reconstructed in North Carolina shall conform to the guidelines of the Highway Design Section.
- d) The Department of Transportation, Division of Highways, Highway Design Section, is authorized and directed to provide free copies of this Article together with implementary guidelines and standards, to municipal and county governments and public utilities operating within the State. (1973, c. 718, ss. 1-4.)

**Editor's Note.** – Session Laws 1973, c.718, s. 5, makes the act effective Sept. 1, 1973.

**3 – An Act to Provide Tax Credits for Removal of Architectural Barriers to the Handicapped  
N. C. General Statutes 105-130.5(a) (8), (b) (10), and (c) (24)**

**GS 105-130.5. Adjustments to federal taxable income in determining State net income.**

- a) The following additions to federal taxable income shall be made in determining State net income:
  - 8) Depreciation or amortization claimed for federal income tax purposes in connection with facilities for the handicapped as such facilities are defined in subdivision (10) of subsection (b) of this section, provided the cost of such facilities has been previously deducted for State income tax purposes.
- b) The following deductions from federal taxable income shall be made in determining State net income:
  - 10) The entire amount of the cost of renovation to an existing building or facility owned by a taxpayer in order to permit physically handicapped persons to enter and leave such building or facility or to have effective use of the accommodations and facilities therein. The deduction shall be taken in the year the renovation is completed, and shall be made in lieu of any depreciation or amortization of the cost of such renovation. “Building or facility” shall mean only a building or facility, or such part thereof as is intended to be used, and is actually used, by the general public. If such building or facility is owned by more than one owner, the cost of renovation shall be apportioned among or between the owners as their interests may appear. The minimum renovation required in order to entitle a taxpayer to claim the deduction herein provided shall include one or more of the following: the provision of ground level or ramped entrances, free movement between public use areas, and washroom and toilet facilities accessible to and usable by physically handicapped persons.
- c) The following other adjustments to federal taxable income shall be made determining State net income:

- 24) Deduction for Removal of Architectural Barriers to the Handicapped. – Any taxpayer who shall renovate an existing building or facility owned by such taxpayer in order to permit physically handicapped persons to enter and leave such building or facility, or to have effective use of the accommodations and facilities therein shall be allowed a deduction for the entire amount of the cost of such renovation. The deduction shall be allowable in the year the renovation is completed and shall be in lieu of any depreciation or amortization of the cost of such renovation. “Building or facility” shall mean only a building or facility, or such part thereof as is intended to be used, and is actually used, by the general public. If such building or facility is owned by more than one owner, the cost of renovation shall be apportioned among or between the owners as their interests may appear. The minimum renovation required in order to entitle a taxpayer to claim the deduction herein provided shall include one or more of the following: the provision of ground level or ramped entrances, free movement between public use areas, and washroom and toilet facilities accessible to and usable by physically handicapped persons. (1939, c. 158, s. 322; 1941, c. 50, s. 5; 1943, c. 400, s. 4, c. 668; 1945, c. 708, s. 4; c. 752, s. 3; 1947, c. 501, s. 4; c. 894; 1949, c. 392, s. 3; 1951, c. 643, s. 4; c. 937, s. 4; 1953, c. 1031, s. 1; c. 1302, s. 4, 1955, c. 1100, s. 1; c. 1331, s. 1; cc. 1332, 1342; c. 1343, s. 1; 1957, c. 1340, ss. 4, 8; 1959, c. 1259, s. 4; 1961, c. 201, s. 1; c. 1148; 1963, c. 1169, s. 2; 1965, c. 1048; 1967, cc. 259, 550; c. 892, s. 6; c. 1110, s. 3; c. 1252, s. 2; 1969, cc. 725, 1082, 1123; c. 1175, s. 2; 1971, c. 1087, s. 2; c. 1206, s. 2.)

**4 – An Act to Amend the Income Tax Act to Provide a Credit Against Income Tax for the Construction of Dwelling Units Which Satisfy North Carolina Building Code Standards for Handicapped Living Units  
House Bill 1224, ratified by General Assembly of North Carolina, 1973 Session (2nd Session, 1974)**

The General Assembly of North Carolina enacts:

Section 1: Division I of Article 4, Subchapter I of Chapter 105 of the North Carolina General Statutes is hereby amended by adding a new section thereto to be designated as G. S. 105-130.22 and to read as follows:

**“GS 105-130.22 Tax Credit for construction of dwelling units for handicapped persons. –**

There shall be allowed to corporate owners of multi-family rental units located in North Carolina as a credit against the tax imposed by this division, an amount equal to five hundred fifty dollars (\$550.00) for each dwelling unit constructed by such corporate owner which conforms to the requirements of Section (11x) of the North Carolina Building Code for the taxable year within which the construction of such dwelling unit is completed; provided, that credit will be allowed under this section only for the number of such dwelling units completed during the taxable year which were required to be built in compliance with Section (11x) of the North Carolina Building Code (This provision shall be effective with respect to taxable years beginning on and after January 1, 1979.); provided further, that if the credit allowed by this section exceeds the tax imposed by this division reduced by all other credits allowed by the provisions of this division, such excess shall be allowed against the tax imposed by this division for the next succeeding year; and provided further, that in order to secure the credit allowed by this section the corporation shall file with its income tax return for the taxable year with respect to which such credit is to be claimed, a copy of the occupancy permit on the face of which there shall be recorded by the building inspector the number of units completed during the taxable year which conforms to Section (11x) of the North Carolina Building Code. When he has recorded the number of such units on the face of the occupancy permit, the building inspector shall promptly make and forward a copy of the permit to the Special Office for the Handicapped, Department of Insurance (This provision shall be effective with respect to taxable years beginning on and after January 1, 1979.)”

Section 2: Division II of Article 4, Subchapter I of Chapter 105 of the North Carolina General Statutes is hereby amended by adding a new section thereto to be designated as G. S. 105-151.1 and to read as follows:

**“GS 105-151.1 Tax credit for construction of dwelling units for handicapped persons. –** There shall be allowed to resident owners of multi-family rental units located in North Carolina as a credit against the tax imposed by this division, an amount equal to five hundred fifty dollars (\$550.00) for each dwelling unit constructed by such resident owner which conforms to the recommendations of Section (11X) of the North Carolina Building Code for the Taxable year within which the construction of such dwelling unit is completed; provided, that credit will be allowed under this section only for the number of such dwelling units completed during the taxable year which were required to be built in compliance with Section (11X) of the North Carolina Building Code (The provision shall be effective with respect to taxable years beginning on and after January 1, 1979.); provided further, that if the credit allowed by this section exceeds the tax Imposed by this division reduced by all other credits allowed by the provisions of this division, such excess shall be allowed against the tax imposed by this division for the next succeeding year; and provided further, that in order to secure the credit allowed by this section the taxpayer shall file with his income tax return for the taxable year with respect to which such credit is to be claimed, a copy of the occupancy permit on the face of which there shall be recorded by the building inspector the number of units completed during the taxable year which conform to Section (11X) of the North Carolina Building Code. When he has recorded the number of such units on the face of the occupancy permit, the building inspector shall promptly make and forward a copy of the permit to the Special Office for the Handicapped, Department of Insurance (This provision shall be effective with respect to taxable years beginning on and after January 1, 1979.)”

**Editor’s Note. –** The original provisions of this act became effective for income years beginning on and after January 1, 1974. This printing includes amendments from House Bill 1418, ratified by the General Assembly, 1979 Session.

## 5 – Penalty for Violation of North Carolina State Building Code

General Statutes of North Carolina 143-138(h):

- (h) Violations: Any person who shall be adjudged to have violated this Article or the North Carolina State Building Code shall be guilty of a misdemeanor and shall upon conviction be liable to a fine, not to exceed fifty dollars (\$50.00), for each offense. Each 30 days that such violation continues shall constitute a separate and distinct offense. In case any building or structure is erected, constructed or reconstructed, or its purpose altered, so that it becomes in violation of the North Carolina State Building Code, either the local enforcement officer or the State Commissioner of Insurance or other State Official with responsibility under G.S. 143-139 may, in addition to other remedies, institute any appropriate action or proceedings (i) to prevent such unlawful erection, construction or reconstruction, or alteration of purpose, (ii) to restrain, correct or abate such violation, or (iii) to prevent the occupancy or use of said building, structure or land until such violation is corrected. (1957. c. 1138; 1969. c. 567; c. 1229, ss. 2-6; 1971, c. 1100. ss. 1,2; c. 476. ss. 84, 128, 138, 152, s. 5.)

It has been established in courts of Law that the Building Code has the force of law. O’Neal, 243 N. C. 714, 92 S. E. 2d 189 (1956); or, Drum V. Bisaner, 252 N. C. 305, 113 S. E. 2nd 560 (1960)

In instances in which there is a violation of the Building Code, no great effort is necessary to prove negligence on the part of the party or parties responsible because it has been established in courts of law that a violation of the Building Code is negligence per se – Lindstrom V. Chesnutt, 15 N. C. App. 15, 189 S. E. 2d 749 (1972).

## 6 – An Act to Amend G.S. 20-37.5 Relative to the Definition of Handicapped and to Amend G.S. 20-37.8 Relative to Parking Privileges for the Handicapped.

The General Assembly of North Carolina enacted as Senate Bill 235 in the 1977 session:

G.S. 20-37.5 is hereby rewritten to read as follows:

**“GS 20-37.5. Handicapped – definition.** – As used in this Article, handicapped shall mean:

- (1) any person who has an obvious physical disability that requires the use of a wheelchair, braces, walkers, or crutches, and those who have lost the use of one or both legs; or
- (2) any person who, as determined and certified by a physician, is severely restricted in mobility by a pulmonary or cardiovascular disability, arthritic condition, orthopedic or neurologic impairment.”

**GS 20-7(d)** as same appears in the 1975 Cumulative Supplement to the 1975 Replacement Volume 1C of the General Statutes is hereby amended by striking the period after the word “require” and before the word “The” appearing in line 11 thereof and inserting the following words and punctuation: “and shall include such test as is necessary to assure that applicants recognize the ‘International symbol of access’ for the handicapped (sign R7-8, Manual on Uniform Traffic Control Devices) and devices relative to handicapped drivers as set forth in Article 2A of this Chapter.”

**GS 20-88.1** is hereby amended by adding the following provision at the end thereof:  
“provided that any program supported in whole or in part from the fund established herein shall include instructions as to rights and privileges of the handicapped and the signs and symbols used to assist the handicapped relative to motor vehicles including but not limited to the ‘International symbol of accessibility’ and symbols and devices as provided in Article 2A of this Chapter.”

The General Assembly of North Carolina enacted revisions as Senate Bill 210 in the 1979 Session:

Section 1. G.S.20-37.6 is rewritten to read as follows:

**“GS 20-37.6. Handicapped; drivers and passengers; parking privileges.**

- (a) Any vehicle driven by or transporting a person who is handicapped as defined by G.S. 20-37.5 or transporting a person who is visually impaired as defined by G.S. 111-11 as certified by a licensed ophthalmologist, optometrist, or Division of Services for the Blind, may be parked for unlimited periods in parking zones restricted as to length of time parking is permitted. This provision has no application to those zones or during times in which the stopping, parking, or standing of all vehicles is prohibited or which are reserved for special types of vehicles. Any qualifying vehicle may park in spaces designated by aboveground markings as restricted to vehicles distinguished as being driven by or as transporting the handicapped or as transporting the visually impaired.
- (b) Handicapped car owners; distinguishing license plates. If the handicapped or visually impaired person is a registered owner of a vehicle, this vehicle may display a distinguishing license plate. This license plate shall be issued for the normal fee applicable to standard license plates. Any vehicle owner who qualifies for the distinguishing license plate may also receive up to two distinguishing placards as provided for in G.S. 20-37.6(c). Any vehicle owner who is a disabled veteran, as defined in G.S. 20-81.4, and also handicapped, as defined in G.S. 20-37.5, may receive free of charge, in lieu of a registration plate issued pursuant to G.S. 20-81.4(a), a distinguishing license plate.



- (c) Handicapped drivers and passengers; distinguishing placards. A person who is either handicapped or visually impaired may apply for issuance of a distinguishing placard to be designed by the Division of Motor Vehicles of the Department of Transportation, in cooperation with the Office for the Handicapped of the Department of Insurance. Any organization which, as determined and certified by the State Vocational Rehabilitation Agency, regularly transports handicapped or visually impaired people, may also apply. The placard shall be at least 6 inches by 12 inches in size and shall contain all the information the Division of Motor Vehicles deems necessary for purpose of designation and enforcement. The placard shall be displayed on the driver's side of the dashboard of a vehicle only when the vehicle is being driven by a duly licensed handicapped driver or is being used to transport handicapped or visually impaired passengers. When the placard is properly displayed, all parking rights and privileges extended to vehicles displaying a distinguishing license plate issued pursuant to G.S. 20-37.6(b) shall apply. The Division of Motor Vehicles shall establish procedures for the issuance of the distinguishing placards, may charge a fee sufficient to pay the actual cost of issuance. Two placards may be issued to an applicant on request. Applicants who are organizations may receive one placard for each transporting vehicle. Any applicant who is a disabled veteran, as defined in G.S. 20-81.4, and also handicapped, as defined in G.S. 20-37.5, may receive up to two placards free of charge.
- (d) Designation of parking places. Designation of parking spaces for the physically handicapped and the visually impaired on streets and in other areas, including public vehicular areas specified in G.S. 20-4.01(32), shall be by the use of sign R7-8, Manual on Uniform Traffic Control Devices. Nonconforming signs in use prior to July 1, 1979, shall not constitute a violation during their useful lives, which shall not be extended by other means than normal maintenance.
- (e) Enforcement of handicapped parking privileges. It shall be unlawful:
- (1) To park or leave standing any vehicle in a space designated with a sign pursuant to subsection (d) of this section for handicapped persons or visually impaired persons when the vehicle does not display the distinguishing license plate or placard as provided in this section.
  - (2) for any person not qualifying for the rights and privileges extended to handicapped or visually impaired persons under this section to exercise or attempt to exercise such rights or privileges by the unauthorized use of a distinguishing license plate or placard issued pursuant to the provisions of this section;
  - (3) to park or leave standing any vehicle so as to obstruct a curb ramp or curb cut for handicapped persons as provided for by North Carolina Building Code or as designated in G.S. 136.44.14;

- (4) for those responsible for designating parking spaces for the handicapped to erect or otherwise use signs not conforming to G.S. 20-37.6(e) for this purpose.

This section is enforceable in all public vehicular areas specified in G.S. 20-4.01(32).

(f) Penalties for violation.

- (1) The penalty for a violation of G.S.20-37.6(e)(1),(2) and (3) shall be twenty five dollars (\$25.00) and whenever evidence shall be presented in any court of the fact that any automobile, truck, or other vehicle was found to be parked in a properly designated handicapped parking space in violation of the provisions of this section, it shall be *prima facie* evidence in any court in the State of North Carolina that the vehicle was parked and left in the space by the person, firm, or corporation in whose name the vehicle is registered and licensed according to the records of the Division of Motor Vehicles. No evidence tendered or presented under this authorization shall be admissible or competent in any respect in any court or tribunal except in cases concerned solely with a violation of this section.
- (2) The penalty for violation of G.S. 20-37.6(e)(4) shall be fifty dollars (\$50.00) and whenever evidence shall be presented in any court of the fact that any such nonconforming sign or markings are being used it shall be *prima facie* evidence in any court in the State of North Carolina that the person, firm, or corporation with ownership of the property where said nonconforming signs or markings are located is responsible for violation of this section. Building Inspectors and others responsible for North Carolina State Building Code violations specified in G.S. 143-138(h) where such signs are required by the Handicapped Section of the North Carolina State Building Code, may cause a citation to be issued for this violation and may also initiate any appropriate action or proceeding to correct such violation.
- (3) A law enforcement officer, including security officer who has authority to enforce laws on the property of his employer as specified in G.S. Chapter 74A, may cause a vehicle parked in violation of this section to be towed; and such officer shall be a legal possessor as provided in G.S. 20-161(d)(2). This law enforcement officer, or security officer, shall not be held to answer in any civil or criminal action to any owner, lienholder or other person legally entitled to the possession of any motor vehicle removed from such space pursuant to this section, except where such motor vehicle is willfully, maliciously, or negligently damaged in the removal from aforesaid space to place of storage.

(4) Notwithstanding any other provision of the General Statutes, the provisions of this section relative to handicapped parking shall be enforced by State, county, city and other municipal authorities in their respective jurisdictions whether on public or private property in the same manner as is used to enforce other parking laws and ordinances by said agencies.”

NOTE: Revisions effective July 1, 1983, are included.



R7-8

SIGN APPROVED FOR USE UNDER GENERAL STATUTE 20.37.6

COLORS

LEGEND AND BORDER - GREEN  
WHITE SYMBOL ON BLUE BACKGROUND  
BACKGROUND - WHITE

**“GS 20-37.7. Vehicles designated for out-of-state handicapped; parking privileges. –**

- (a) Any vehicle displaying an out-of-state license plate, placard or other evidence of handicap or visual impairment issued by the appropriate authority of the appropriate jurisdiction may park in any space reserved for the handicapped or the visually impaired pursuant to G.S. 20-37.6.
- (b) Upon presentation of an out-of-state license plate, placard or other evidence of handicap or visual impairment issued by the appropriate authority of the appropriate jurisdiction at a trial held for violation of G.S. 20-37.6, the judge shall dismiss the case.”

**appendix E – protruding objects**

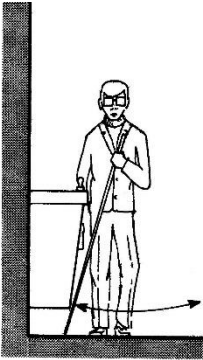
In corridors, in major pedestrian paths and on free-standing columns in such areas, protruding objects which are located less than 6 feet 6 inches from the finished floor and which project more than 4 inches from the wall or column must either:

- (1) continue to the floor, or
- (2) to within 8 inches of the floors, or
- (3) be located in protected areas which are recessed or enclosed by wing walls. Such a protected area should have a contrasting floor texture.

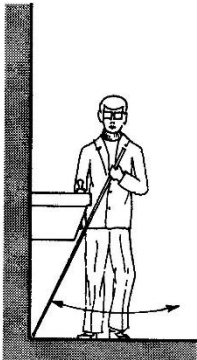
appendix E (continued)

MANY PEOPLE, ESPECIALLY THOSE WITH SIGHT IMPAIRMENTS OR THOSE WHO ARE BLIND, & CHILDREN MAY BE INJURED BY BUMPING INTO OBJECTS WHICH PROTRUDE FROM WALLS.

BLIND OR SIGHT IMPAIRED PEOPLE WHO USE A LONG CANE TECHNIQUE FOR GUIDANCE CAN DETECT PROTRUDING OBJECTS IF THE OBJECTS STAND ON THE FLOOR OR ARE NO HIGHER THAN 8" ABOVE THE FLOOR.



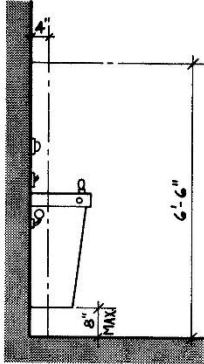
OBJECTS WHICH CONTINUE TO 8" ABOVE FLOOR OR LESS WILL BE DETECTED BY CANES.



OVERHANGING PROTRUDING OBJECTS WILL NOT BE DETECTED BY THE LONG CANE TECHNIQUE.

WALL MOUNTED OBJECTS BELOW 6'-6" MUST NOT PROJECT MORE THAN 4" UNLESS THEY CONTINUE TO THE FLOOR OR TO WITHIN 8" OF THE FLOOR.

MOST DOOR KNOBS, HANDLES, THERMOSTATS, SWITCHES, AND HANDRAILS WILL FIT WITHIN THE ALLOWABLE 4".



IN ALL AREAS OF MAJOR PEDESTRIAN CIRCULATION OBJECTS BELOW 6'-6" WHICH PROTRUDE FROM WALLS, COLUMNS, OR POSTS MORE THAN 4" MUST CONTINUE TO THE FLOOR OR NO MORE THAN 8" ABOVE THE FLOOR

OR

1. PROTRUDING OBJECTS MUST BE RECESSED INTO WALLS;

OR

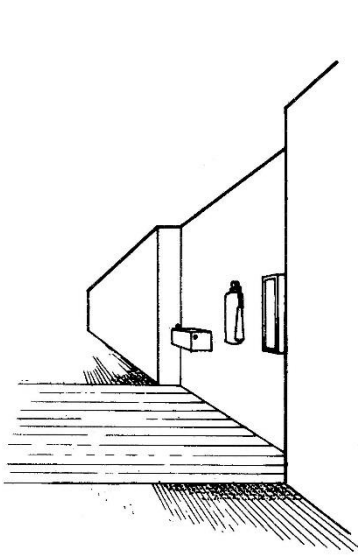
2. PLACED IN RECESSED AREAS;

OR

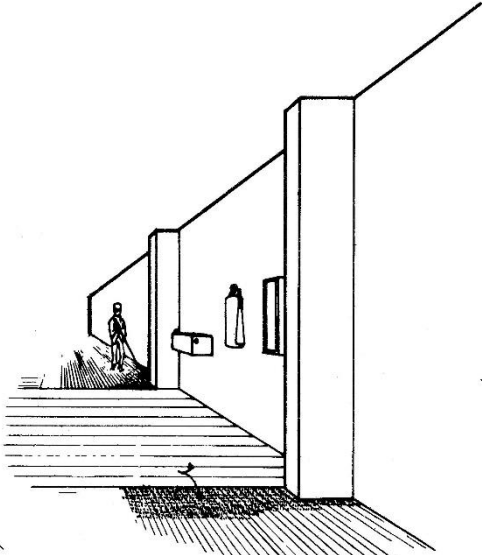
3. PLACED IN AREAS PROTECTED BY PROTRUDING WING WALLS WHICH CONTINUE TO THE FLOOR,

AND

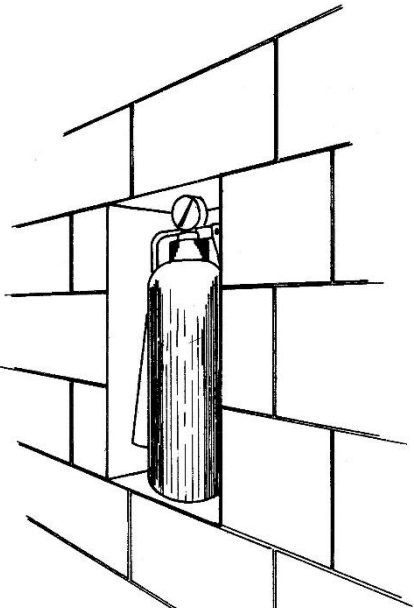
4. PROTRUDING OR RECESSED AREAS SHOULD HAVE FLOOR FINISHES WHICH CONTRAST WITH SURROUNDING FLOOR IN BOTH COLOR & TEXTURE.



OBJECTS WHICH PROTRUDE MORE THAN 4" MAY BE GROUPED IN RECESSED AREAS.



OBJECTS WHICH PROTRUDE MORE THAN 4" MAY BE GROUPED & ENCLOSED BY PROTRUDING WING WALLS.



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Individual Functioning in .....	App. A(1) .....	299, 300
Turning Radii .....	App. A(3) .....	301
Two, to Pass .....	App. A2a,2b) .....	299
	App. A(c) .....	300
<b>WINDOW STOOL HEIGHT</b>		
(Residential) .....	App. C(e) .....	307

## **CHAPTER 12 MINIMUM DESIGN LOADS**

### **1201 GENERAL**

#### **SECTION 1201 GENERAL**

##### **1201.1 – SAFE SUPPORT REQUIRED**

All buildings or other structures, and all parts thereof, shall be designed and constructed to support safely all loads, including dead loads, without exceeding the allowable stresses (or ultimate strengths when appropriate load factors are applied) for the materials of construction in the structural members and connections.

##### **1201.2 – PROGRESSIVE COLLAPSE**

Buildings and structural systems shall provide such structural integrity that the hazards associated with progressive collapse, such as that due to local failure caused by severe overloads or abnormal loads not specifically covered herein, are reduced to a level consistent with good engineering practice.

##### **1201.3 – ADDITION TO EXISTING STRUCTURES**

When an existing building or other structure is enlarged or otherwise altered, all portions thereof affected by such enlargement or alteration shall be strengthened, if necessary, so that all loads will be supported safely without exceeding the allowable stresses (or ultimate strengths when appropriate load factors are applied) for the materials of construction in the structural members and connections.

##### **1201.4 – LOAD TESTS**

- (a) The Building Official may require a load test of any construction whenever there is reason to question its safety for the intended use. Such tests are to be made at the expense of the owner or his agent. The construction shall sustain a superimposed load equal to twice the design live load for a period of at least 24 hours and shall recover at least seventy-five (75) percent of its maximum deflection within twenty-four (24) hours after the load is removed. Such load tests of constructions are not intended to be used as a method for determination of acceptable allowable working stresses of a material as an alternate to the established standard method of determining such stresses. Exception: See Chapter 20 in ACI 318 for concrete load test.
- (b) Test Standards – To determine the safe working load, when not capable of design by accepted engineering analysis, every system of construction, sub-assembly or assembled unit and its connections shall be tested in accordance with standards listed in appendices D, E and F, or specific standards approved by the Building Code Council.

## SECTION 1202 DEAD LOADS

### 1202.1 – WEIGHTS OF MATERIALS AND CONSTRUCTIONS

In estimating dead loads for purposes of design, the actual weight of materials and construction shall be used, provided that in the absence of definite information, values satisfactory to the building official may be assumed.

NOTE: For information on dead loads, see Appendix J.

### 1202.2 – WEIGHT OF FIXED SERVICE EQUIPMENT

In estimating dead loads for purposes of design, the weight of fixed service equipment, such as plumbing stacks and risers, electrical feeders, heating, ventilating and air-conditioning systems, shall be included, whenever it is carried by structural members.

**TABLE 12A  
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS**

OCCUPANCY OR USE	LIVE LOAD (LBS. Per Sq. Ft.)
Area of refuge	80
Air-conditioning (machinery space)	200***
Amusement park structure	100***
<a href="#">Apartments</a> (see Residential)	
Armories and drill rooms	150
Assembly halls and other places of assembly:	
Fixed seats	60
Moveable seats	100
Platforms (assembly)	100
<a href="#">Attic:</a>	
Nonstorage	
Storage	20
<a href="#">Balcony:</a>	80****
Exterior	100
On private <a href="#">apartments</a> and townhouses only and not exceeding 100sq. ft.	60
Bowling alleys, poolrooms, and similar recreation areas	75
Catwalks	25
Ceiling, accessible furred	10
Corridors:	
First floor	100
Other floors, same as occupancy served except as indicated	
Dance halls and ballrooms	100
Dining rooms and restaurants	100
Dormitories:	
Nonpartitioned	80
Partitioned	40
Dwellings (see Residential)	
Elevator machine room	150***
Fallout Shelters – (dual use)	
To be determined by normal occupancy requirements.	
Concentrated loads due to water storage shall be considered.	
Fallout Shelters – (single purpose)	40
Concentrated loads due to water shall be considered.	
Fan Room	150***

**TABLE 12A (continued)**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS**

OCCUPANCY OR USE	LIVE LOAD (LBS. Per Sq. Ft.)
File Room:	
Addressograph	150****
Card	125****
Letter	80****
Fire escapes	100
On multi- or single-family residential buildings only	40
Garages	
General storage and/or repair	100
Private pleasure car storage	50
For trucks and buses use AASHTO * Lane loads (see Table 12B for concentrated load requirements)	
Grandstands (see Review stands)	
Gymnasiums, main floors and balconies	100
Hospitals:	
Operating rooms, laboratories	60
Private rooms	40
Wards	40
Corridors, above first floor	80
Hotels, (see Residential)	
Laboratories, scientific	100
Laundries and Bakeries	150***
Libraries:	
Reading rooms	60
Stack rooms (books & shelving at 65 pcf) but not less than	150
Corridors, above the first floor	80
Manufacturing	
Heavy	150
Light	100
Marquees	75
Morgue	125
Office Buildings:	
Business machine equipment	100***
Offices	50
Lobbies	100
Corridors, above first floor	80
File and computer rooms require heavier loads based upon anticipated occupancy	

**TABLE 12A (continued)**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS**

OCCUPANCY OR USE	LIVE LOAD (LBS. Per Sq. Ft.)
Penal institutions:	
Cell blocks	40
Corridors	100
Printing plants:	
Composing rooms	100
Linotype rooms	100
Paper storage (50 pcf per foot of storage height)	
Press rooms	150***
Public rooms	100
Residential:	
Multi-family houses:	
Private <a href="#">apartments</a>	40
Public rooms	100
Corridors	80
Dwellings:	
First floor	40
Second floor and habitable <a href="#">attics</a>	30
Uninhabitable <a href="#">attics</a>	20
Hotels:	
Guest rooms	40
Public rooms	100
Corridors serving public rooms	100
Corridors	80
Rest rooms	60
Review stands, bleachers and stadiums	100**
Schools:	
Classrooms	40
Corridors	80
Sidewalks, vehicular driveways, and yards, subject to trucking	250
Skating rinks	100
Stairs and exitways	100
Storage, hay and grain	300****
Storage warehouse	
Light	125
Heavy	250
Stores:	
Retail:	
First floor, rooms	100
Upper floors	75
Wholesale	125
Telephone exchange	150***



**TABLE 12A (continued)  
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS**

OCCUPANCY OR USE	LIVE LOAD (LBS. Per Sq. Ft.)
Theaters:	
Dressing rooms	40
Grid-iron or fly gallery –	
Grating	60
Well beams, 250 lb per lin ft per pair	
Header beams, 1000 lb per lin ft.	
Pin rail, 250 lb per lin ft.	
Aisles, corridors, and lobbies	100
Orchestra floors	60
Balconies	60
Projector room	100
Stage floors	150
Transformer rooms	200***
Vaults in offices	250****
Yards and terraces, pedestrians	100

\* American Association of State Highway and Transportation Officials.

\*\* For detailed recommendations, see American National Standard for Tents, Grandstands, and Air-Supported Structures Used for Places of Assembly Z20.3 (NFPA No. 102).

\*\*\* Use weight of actual equipment when greater.

\*\*\*\* Increase when occupancy exceeds this amount.

**1202.3 – PROVISION FOR WEIGHT OF PARTITIONS NOT SHOWN ON PLANS**

In office buildings or other buildings, where partitions might be erected or subject to rearrangement, provision for partition weight shall be 30 psf in addition to the prescribed live load, the sum of which shall not be less than 80 psf. Where the prescribed live load is equal to or greater than 80 psf, the additional provisions for partitions shall not be required.

**SECTION 1203 LIVE LOADS**

**1203.1 – UNIFORMLY DISTRIBUTED LOADS**

(a) **REQUIRED LIVE LOADS:** The live loads to be assumed in the design of buildings and other structures shall be the greatest loads that probably will be produced by the intended use or occupancy, but in no case less than the minimum uniformly distributed unit loads required by [Table 12A](#).

## MINIMUM DESIGN LOADS

- (b) **LOADS NOT SPECIFIED:** For occupancies or uses not listed in [Table 12A](#), the live load shall be determined in a manner satisfactory to the building official.
- (c) **THRUSTS ON HANDRAILS:** Stairway railings, both exterior and interior shall be designed to resist a horizontal thrust of fifty (50) pounds per linear foot applied at the top of the railing.

**Balcony** railings, both exterior and interior shall be designed to resist a horizontal thrust of fifty (50) pounds per linear foot applied at the top of the railing or at least a two hundred (200) pound thrust at any point.

(For stadiums and grandstands see NFPA No. 102)

### 1203.2 – CONCENTRATED LOADS

- (a) Floors shall be designed to support safely the uniformly distributed live loads prescribed in [1203.1](#) or the concentrated load in pounds given in [Table 12B](#), whichever produces the greater stresses. Unless otherwise specified, the indicated concentration shall be assumed to occupy an area of 2½ feet square and shall be so located as to produce the maximum stress conditions in the structural members.

**TABLE 12B  
CONCENTRATED LOADS**

LOCATION	LOAD (LB)
Elevator machine room grating (on area of 4 sq. in)	300
Finish light floor plate construction (on area of 1 sq. in)	200
Garages	*
Office floors	2000
Scuttles, skylight ribs, and accessible ceilings	200
Sidewalks	8000
Stair treads (on area of 4 sq. in. at center of tread)	300

\* Floors in garages or portions of buildings used for storage of motor vehicles shall be designed for the uniformly distributed live loads of [Table 12A](#) or the following concentrated loads: (1) for passenger cars accommodating not more than nine passengers, 2000 pounds acting on an area of 20 sq. in; (2) mechanical parking structures without slab or deck, passenger cars only, 1500 pounds per wheel; (3) for trucks or buses, maximum axle load on an area of 20 sq. in.

- (b) **ROOF STRUCTURES.** Any panel point of the lower chord of roof trusses or any point of other primary structural members supporting roofs over garage, manufacturing, and storage floors shall be capable of carrying safely a suspended concentrated load of not less than 2000 pounds in addition to one half (½) the specified live load. For the purpose of this paragraph only, a primary member is a member carrying 200 square feet or more of roof load.

### 1203.3 – PARTIAL LOADING

The full intensity of the appropriately reduced live load applied only to a portion of the length of a structure or member shall be considered if it produces a more unfavorable effect than the same intensity applied over the full length of the structure or member. Due consideration should be given for partial loading on roofs.

**1203.4 – IMPACT LOADS**

The live loads specified in 1203.1 (a) shall be assumed to include adequate allowance for ordinary impact conditions. Provision shall be made in the structural design for uses and loads which involve unusual vibration and impact forces.

- (a) **ELEVATORS:** All moving elevator loads shall be increased 100% for impact, and the structural supports shall be designed within the limits of deflection prescribed by American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks. A17.1, and American National Standard Practice for the Inspection of Elevators (Inspectors' Manual), A17.2.
- (b) **MACHINERY:** For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact; (1) elevator machinery, 100%; (2) light machinery, shaft or motor driven, 20%; (3) reciprocating machinery or power-driven units, 50%; (4) hangars for floors or balconies, 33%., all percentages increased if so recommended by the manufacturer.
- (c) **CRANEWAYS:** All craneways shall have their design loads increased for impact as follows:
- (1) A vertical force equal to 25% of the maximum wheel live load shall be applied to support girders and their connections for cab operated traveling crane. (Only 10% increase for pendant operated traveling crane is required).
  - (2) The lateral force on crane runways to provide for the effect of moving crane trolleys shall be 20 percent of the sum of the weights of the lifted load and of the crane trolley (but exclusive of other parts of the crane.) The force shall be assumed to be applied at the top of the rail, acting in either direction normal to the runway rails, and shall be distributed with due regard for lateral stiffness to the structure supporting these rails.
  - (3) The longitudinal force shall be taken as 10 percent of the maximum wheel loads of the crane applied at the top of rail.

**1203.5 – REDUCTION IN LIVE LOADS**

- (a) **LIVE LOADS 100 POUND-FORCE PER SQUARE FOOT OR LESS.** For live loads of 100 psf or less, the design live load on any member supporting 150 square feet or more may be reduced at the rate of 0.08% per sq. ft. of area supported by the member, except that no reduction shall be made for areas to be occupied as places of public assembly, for garages, \* or for roofs.

\* Private pleasure car storage garages may be reduced by the above formula where R does not exceed 40%.

The reduction shall exceed neither R as determined by the following formula, nor 60%:

$$R = 23 \left( 1 + \frac{D}{L} \right)$$

where

R = reduction in percent

D = dead load per square foot of area supported by the member

L = design live load per square foot of area supported by the member

MINIMUM DESIGN LOADS

- (b) LIVE LOADS EXCEEDING 100 POUND-FORCE PER SQUARE FOOT. For live loads exceeding 100 psf, no reduction shall be made, except that the design live loads on columns may be reduced 20% provided the area is over 150 square feet.

**1203.6 – RESTRICTIONS ON LOADING**

It shall be unlawful to place, or cause to permit to be placed, on any floor or roof of a building or other structure a load greater than that for which such floor or roof is approved by the Building Official.

**1203.7 – DEFLECTION**

The deflection of structural members shall not exceed the values set forth in Table 12C based upon the factor set forth in Table 12D.

**TABLE 12C  
MAXIMUM ALLOWABLE DEFLECTION FOR STRUCTURAL MEMBERS\***

TYPE OF MEMBER	MEMBER LOADED WITH LIVE LOAD PLUS K TIMES THE DEAD LOAD **
Roof Member Supporting Plaster or Floor Member	L/360
Roof Member Supporting Dry-Wall Ceiling	L/240
Roof Member Not Supporting Finish ceiling	L/180

\* L = Length of member in same units as deflection

\*\* K = Factor as determined in Table 12D

**TABLE 12D – VALUE OF K**

WOOD		REINFORCED CONCRETE*			STEEL
Unseasoned	Seasoned <sup>1</sup>	A's = 0	A's = 0.5 As	A's = As	
1.0	0.5	2.0	1.2	0.8	0

1 Seasoned lumber is lumber having a moisture content of less than 16 per cent at the time of installation and used under dry conditions of use such as in most covered structures.

A's = Area of compressive reinforcing steel in flexural members.

As = Area of non-prestressed tensile reinforcing steel in flexural members.

\* K factor for prestressed concrete shall be determined by engineer analysis.

**1203.8 – MINIMUM ROOF LOADS**

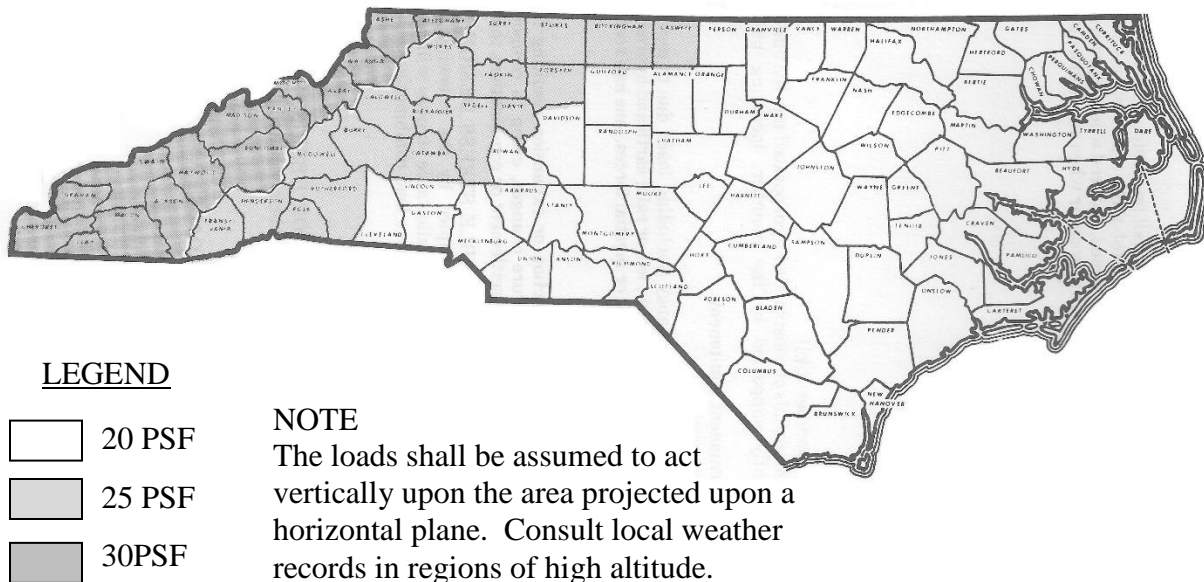
- (a) FLAT, PITCHED OR CURBED ROOFS: Ordinary roofs, either flat, pitched, or curved shall be designed for a live load of not less than the value shown in Table 12E and Figure 12A in addition to the dead, mechanical equipment and wind loads.

- (b) PARTIAL LOADING: See Section 1203.3.

**TABLE 12E**  
**MINIMUM ROOF LIVE LOADS**  
 (See Figure 12A for Map of N.C.)

County	Lbs/Sq. Ft.	County	Lbs/Sq. Ft.
Counties not listed .....	20	Iredell .....	25
Alexander .....	25	Jackson .....	30
Alleghany .....	30	Macon .....	30
Ashe .....	30	Madison .....	30
Avery .....	30	McDowell .....	25
Buncombe .....	30	Mitchell .....	30
Burke .....	25	Polk .....	25
Caldwell .....	25	Rockingham .....	25
Catawba .....	25	Rutherford .....	25
Caswell .....	25	Stokes .....	25
Cherokee .....	30	Surry .....	25
Clay .....	30	Swain .....	30
Davie .....	25	Transylvania .....	25
Forsyth .....	25	Watauga .....	30
Graham .....	30	Wilkes .....	26
Haywood .....	30	Yancey .....	30
Henderson .....	25	Yadkin .....	25

Note: The loads shall be assumed to act vertically upon the area projected upon a horizontal plane. Consult local weather records in regions of high altitude.



**Figure 12A – MINIMUM ROOF LIVE LOADS**

## MINIMUM DESIGN LOADS

### (c) SPECIAL CONDITIONS:

- (1) Where loads in Table 12E are in excess of 20 pounds per square foot of horizontal projection any excess over this amount may be reduced for each degree of pitch over 20 degrees by  $(S/40)$  minus  $1/2$ , where  $S$  is the total snow load in pounds per square foot.
  - (2) When the effect of the shape of roof structure as determined by actual test or experience indicates lesser or greater snow-retention value than specified herein, the roof load shall be modified as directed or approved by the Building Official.
  - (3) When valleys are formed by a multiple series of roofs, special provision shall be made for the increased load at the intersections.
- (d) PONDING: To assure adequate drainage after long-time deflection due to dead load, all roofs shall be designed to support the loads listed in 1203.8(a) plus the effects of additional deflection due to ponding of water. Means for relief shall be provided that will prevent overload by impounded water – such as scuppers in parapets, see [paragraph 1406.1\(d\)](#).
- (e) SPECIAL-PURPOSE ROOFS. When used for incidental promenade purposes, roofs shall be designed for a minimum live load of 60 psf; and 100 psf, when designed for roof-garden or assembly uses. Roofs to be used for other special purposes shall be designed for appropriate loads, as directed or approved by the building official.

**1203.9 – COMBINATION OF LOADS**

- (a) **COMBINING LOADS.** All loads listed herein shall be considered to act in the following combinations, whichever produce the most unfavorable effects in the building, foundation, or structural member concerned, reduced when appropriate, according to 1203.5. The most unfavorable effect may occur when one or more of the contributing loads are not acting.

- |           |                   |
|-----------|-------------------|
| (1) D     | (5) D + L + W     |
| (2) D + L | (6) D + L + T     |
| (3) D + T | (7) D + W + T     |
| (4) D + W | (8) D + L + W + T |

where

D = dead load consisting of:

- (a) the weight of the member itself
- (b) the weight of all materials of construction incorporated into the building to be permanently supported by the member, including built-in partitions
- (c) the weight of permanent equipment
- (d) forces due to prestressing

L = loads due to intended use and occupancy (including loads due to movable partitions and to traveling cranes): snow, ice, or rain; earth and hydrostatic pressure; horizontal components of static or inertial forces. (one half roof live load may be used with total crane load).

W = wind load

T = loads, forces, and effects due to contraction or expansion resulting from temperature changes, shrinkage, moisture changes, creep in component materials, movement due to differential settlement or combinations thereof

- (b) **PROBABILITY FACTORS FOR ALLOWABLE STRESS DESIGN.** The total of the combined load effects may be multiplied by the following load combination probability factors: An increase in the allowable stresses will not be allowed in conjunction *with a decrease* due to the above load combinations.
- (1) 1.00 for combinations (1) through (3)
  - (2) 0.75 for combinations (4) through (7)
  - (3) 0.66 for combination (8)
- (c) **PROBABILITY FACTOR FOR LOAD FACTOR DESIGN.** Load factor design of structural steel and Reinforced Concrete shall be permitted using the load factors as required by Chapters XV and XVI.

**SECTION 1204 SPECIAL LOADS****1204.1 – SOIL AND HYDROSTATIC PRESSURE**

- (a) **PRESSURE ON BASEMENT WALLS.** See 1301.4.

## MINIMUM DESIGN LOADS

- (b) UPLIFT ON FLOORS. In the design of **basement** floors and similar approximately horizontal construction below grade, the upward pressure of water, if any, shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic head shall be measured from the underside of the construction to the maximum expected water level.

### 1204.2 – MINIMUM LATERAL LOADS

- (a) EXTERIOR PANELS. All exterior panels, trim, facades, mansards, and other building elements used to enclose a structure, either non-load bearing or load bearing shall be designed so the connections to the main frame will resist a lateral load of 0.2 of elements total dead weight in addition to wind loads plus eccentrically applied dead load.
- (b) INTERIOR NON-LOAD BEARING PARTITIONS. All interior non-load bearing partitions shall be designed to resist a minimum lateral load of 5 psf.

## SECTION 1205 WIND LOADS

### 1205.1 – DESIGN FOR WIND LOADS REQUIRED

- (a) Buildings and structures and every part thereof shall be designed to withstand the forces of wind pressures assumed in any direction. No allowances shall be made for the effect of shielding by other structures.
- (b) The floor, roof or other horizontal bracing system shall be designed and constructed to transfer horizontal forces to the parts of the structural frame designed to carry the forces to the ground.

Where horizontal or vertical shear-resisting elements are designed to transfer forces through diaphragm action, the analysis shall include the design of chord members at or near the extremities of the diaphragm and the method by which the forces are transferred to the resisting elements. The total shear in any horizontal plane shall be distributed to the various elements of the lateral force-resisting system in proportion to their rigidities, taking into consideration the rigidity of the horizontal bracing system or diaphragm.

- (c) For buildings whose heights exceed five times the least horizontal dimension, and for buildings whose dynamic properties tend to make them wind sensitive, detailed analysis of loads shall be required.
- (d) The following criteria for determining wind loads are based on a *recurrence frequency* of 50 years.

### 1205.2 – BASIS FOR WIND PRESSURE DETERMINATION

- (a) Primary systems, defined as structural members, frames, and systems providing the primary stability for the building or structure, shall be designed for wind pressures determined by this procedure, except as specified in Paragraph (d) of this subsection:
  - (1) Determine wind velocities and velocity pressure as per Tables 12F and 12G respectively.
  - (2) Determine the velocity pressure from the basic wind velocity according to the height of the structure;



- (3) Determine the design wind pressures by multiplying the velocity pressure(s) by appropriate primary system shape factors.
- (b) Components, defined as purlins, girts, sheathing, wall panels, and similar secondary members that transfer wind loads to the primary structural frames or systems, and their connections shall be designed for wind pressures determined by this procedure:
  - (1) Determine wind velocities and velocity pressures as per Tables 12F & 12G respectively. Increase velocity pressures, if required, for components supporting small areas against wind pressure.
  - (2) Determine the design wind pressure(s) by multiplying the velocity pressure(s) by appropriate component shape factors.
- (c) Signs, fences, walls, and small screened enclosures at grade: See [Section 1205.6](#).
- (d) The Building Official *may accept* a design based on pressures determined by other valid, recent nationally recognized data. The Building Official *may require* evidence to support the design pressures used in the design of structures not included in the this section. See Section 1205.1(c). Where design pressures are determined by any deviation from the procedures specified herein, the plans shall so state, including the source of the data used.

### **1205.3 – BASIC WIND VELOCITIES AND VELOCITY PRESSURES**

- (a) The basic design wind velocities to be used for wind loads shall be as set forth in Table 12F and Figure 12B.
- (b) Velocity pressures for primary systems shall be as set forth in Table 12G.
- (c) Velocity pressures for components shall be as set forth in Table 12G if the component supports a tributary area 1000 sq. ft. or greater. Velocity pressures for components supporting a tributary area of 200 sq. ft. shall be increased 15% with a linear increase in velocity pressure for intermediate tributary areas.

**TABLE 12F**  
**BASIC DESIGN WIND VELOCITIES<sup>1</sup>**  
 (See Figure 12B for Map of NC)

COUNTY	MPH	COUNTY	MPH
Counties not listed .....	80	Hyde .....	110
Beaufort .....	100	Johnston .....	90
Bertie .....	100	Jones .....	100
Bladen.....	90	Lenoir .....	100
Brunswick .....	110	Martin .....	100
Camden .....	100	Nash .....	90
Carteret .....	110	New Hanover .....	110
Chowan .....	100	Northampton .....	90
Columbus .....	100	Onslow .....	110
Craven <sup>2</sup> .....	See Map	Pamlico .....	110
Cumberland .....	90	Pasquotank .....	100
Currituck .....	110	Pender .....	110
Dare .....	110	Perquimans .....	100
Duplin .....	100	Pitt .....	100
Edgecombe .....	90	Robeson .....	90
Franklin .....	90	Sampson .....	90
Gates .....	100	Scotland .....	90
Greene .....	100	Tyrrell .....	100
Halifax .....	90	Warren .....	90
Harnett .....	90	Washington .....	100
Hertford .....	90	Wayne .....	90
Hoke .....	90	Wilson .....	90

<sup>1</sup> The basic design wind velocity for the Outer Banks and parts of Carteret, Onslow, Pender, New Hanover and Brunswick counties on the seaward side of the Intra-coastal Waterway shall be 120 mph.

<sup>2</sup> The basic design wind velocity Northwest of the Trent River, then down Neuse River to Pamlico County line is in 100 MPH zone. The basic design wind velocity Southeast of the above line is 110 MPH zone.

**TABLE 12G  
VELOCITY PRESSURES IN POUNDS PER SQUARE FOOT<sup>2</sup>**

HEIGHT ABOVE GROUND, FEET <sup>1</sup>	BASIC DESIGN WIND VELOCITY, MPH				
	80	90	100	110	120
0 - 30	13	16	20	24	29
31 - 50	18	22	28	34	40
51 - 100	21	27	33	40	48
101 - 200	26	33	40	49	58
201 - 300	30	38	47	57	67
301 - 400	33	42	52	62	74
401 - 500	36	45	55	67	80
501 - 800	39	50	62	74	89
801 - 1,000	43	55	68	82	97
Over 1,000	45	56	70	84	100

<sup>1</sup> Measured above the average level of the ground adjacent to the structure.

<sup>2</sup> To be modified by shape factors.

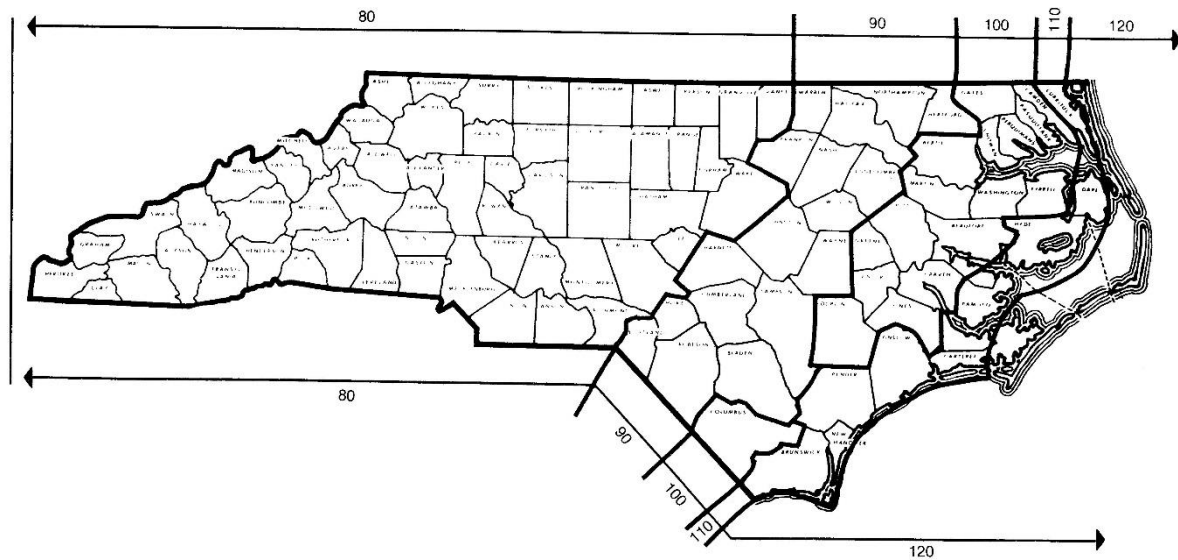
**TABLE 12H  
SHAPE FACTORS FOR PRIMARY SYSTEMS – VERTICAL SURFACES<sup>1</sup>**

VERTICAL SURFACES	FACTOR
Rectangular Prismatic structures	+1.3 <sup>2</sup>
Cylinders	+0.7
Partial open structures <sup>3</sup>	
percent solid	
10%	+0.35
20%	+0.55
40%	+0.80
60%	+1.00
80%	+1.20
100%	+1.30

<sup>1</sup> + indicates forces inward, - indicates forces outward

<sup>2</sup> Includes +0.8 on windward and - 0.5 on leeward sides

<sup>3</sup> Such as open parking structures, open storage facilities, or process structures without walls; shape factor to be applied to gross area of surface.



**Figure 12B – BASIC DESIGN WIND VELOCITIES IN MPH**

**TABLE 12I  
SHAPE FACTORS FOR PRIMARY SYSTEMS – HORIZONTAL SURFACES<sup>1</sup>**

Horizontal Surface <sup>2</sup>	Factor	
	Normal to Windward 1/3 of Surface	Normal to Leeward 2/3 of Surface
<b>Enclosed Buildings</b>		
Open on any face less than 10% of total area of that face.	-1.00	-0.75
Open on any face 10% to 30% of total area of that face.	-1.25	-1.00
Open on any face more than 30% of total area of that face.	-1.50	-1.25
<b>Overhangs and Eaves</b>	-1.50	-1.50

<sup>1</sup> + indicates forces inward, - indicates forces outward

<sup>2</sup> Includes surfaces with less than 10° inclination to horizontal

**TABLE 12.J  
SHAPE FACTORS FOR PRIMARY SYSTEMS – INCLINED SURFACES<sup>1 2</sup>**

Inclined Surface Degree from Horizontal	Factor <sup>3</sup>	
	Normal to Windward Surface	Normal to Leeward Surface
70-90	+0.80	-0.70
60-70	+0.65	-0.70
50-60	+0.55	-0.70
40-50	+0.25	-0.70
30-40	-0.45	-0.90
20-30	-0.95	-0.90
10-20	-1.13	-0.90
Overhangs and Eaves	-1.50	-1.50

<sup>1</sup> + indicates forces inward, - indicates forces outward

<sup>2</sup> For buildings with one or more sides open, add -0.8 to all negative factors.

<sup>3</sup> Shape factors tabulated are for wind perpendicular to ridge of sloped roofs. Roofs are also to be designed for wind parallel to ridge, using shape factors in Table 12I on all roof surfaces.

**1205.4 – SHAPE FACTORS FOR PRIMARY SYSTEMS**

- (a) Appropriate shape factors for primary systems for conventional buildings are as set forth in Table 12H, 12I and 12J.
- (b) Shape factors for curved roofs shall be determined from Table 12J, dividing the curved portion into not less than five equal segments, and using the slope of the chords of each segment.
- (c) For the design of conventional one and two story buildings, shape factors from NAVFAC DM-2, may be used in lieu of those specified in Paragraphs (a) and (b) of this Subsection. When this source is used, the plans shall show the basis of the design.
- (d) For shape factors not included in the tables referenced, refer to engineering practice standards in Appendix M.

**1205.5 – SHAPE FACTORS FOR COMPONENTS**

- (a) Shape factors for fixed components are as set forth in Table 12K.
- (b) Rigid awnings, canopies and canopy shutters intended to be positioned to close an opening during periods of high wind shall be designed as required by paragraph (a) of this subsection. Where such components are intended to be removed or repositioned during periods of high wind, they shall be designed in their open position using shape factors that are 60 percent of those set forth in Table 12K, but the minimum design wind pressure shall be not less than 15 psf.

**TABLE 12K  
SHAPE FACTORS FOR COMPONENTS<sup>1</sup>**

Surface	Factor	
	Pressure Inward	Pressure Outward
Vertical Surface		
Exterior walls of enclosed buildings, including fixed glass, glazing, and supporting members		
Openings <sup>2</sup> on any face less than 10% of the total area of that face	+1.1	-1.1
Openings <sup>2</sup> on any face 10% to 30% of the total area of that face	+1.1	-1.3
Openings <sup>2</sup> on any face more than 30% of the total area of that face	+1.1	-1.5
Operative windows and sliding glass doors, including parts	+1.1	-1.5
Horizontal Surfaces	Table 12I	
Inclined Surfaces	Table 12J	
Fins, parapets, and similar projecting elements	1.4 in either direction	

<sup>1</sup> + signifies forces inward, - signifies forces outward

<sup>2</sup> Openings are defined as doors, windows, louvers or any other wall openings.

**1205.6 – SIGNS, OUTDOOR DISPLAY STRUCTURES, FENCES AND SCREENED ENCLOSURES**

- (a) Basic wind velocity and velocity pressures for signs, (including outdoor display structures, fences or walls) shall be determined according to Subsections 1205.3(a) and 1205.3(c).
- (b) For the purpose of determining shape factors, all signs shall be classified as either open or solid. Signs in which the projected area exposed to wind consists of 70 percent or more of the gross area as determined by the over-all dimensions shall be classified as solid signs; those in which the projected exposed area is derived from open letter, figures, strips, and structural framing members, the aggregate total area of which is less than 70 percent of the gross area so determined, shall be classed as open signs.
- (c) Shape factors for open signs shall be taken at 1.6, to be applied to the projected net area.
- (d) Shape factors for solid signs shall be taken as 1.4 for length to height ratios of 20 or less and 2.0 for ratios greater than 20 to be applied to the projected gross area.

- (e) Wind loading on appurtenances and structural supports shall be accounted for. No shielding effect of one element by another shall be considered when the distance between them exceeds four times the smaller projected dimension of the windward element. In determining the pressure on the sign and the stress in any member, the wind shall be assumed to produce a pressure having a linear variation across the face of the sign with an eccentricity in any direction relative to the centroid of the sign equal to 10% of the dimension of the sign in that direction.
- (f) The design wind pressures for screen-enclosed buildings (and supports for the screening) which are at or near grade level shall be as set forth in Table 12L.

**TABLE 12L  
DESIGN WIND PRESSURES FOR SCREENED ENCLOSURES<sup>1 2</sup>**

Percent of Gross Area Solid	Pressure Inward or Outward on Walls	Pressure Upward or Downward on Roof
Less than 40%	13 psf	7 psf
40% to 50%	26	14
50% to 60%	32	17
More than 50%	39	21

<sup>1</sup> See [Subsection 1205.6\(f\)](#) for buildings for which this table is applicable.

<sup>2</sup> Apply design wind pressures to gross screened area or to roof.

**1205.7 – STABILITY**

- (a) Calculations to determine overturning and uplift forces shall be made with the shape factors set forth in Tables 12H, 12I, and 12J.
- (b) The overturning moment calculated from the wind pressure shall not exceed 2/3 of the dead load resisting moment.
- (c) The uplift forces calculated from the wind pressure shall not exceed 2/3 of the resisting dead loads.
- (d) Anchorage of the roof to walls and columns and of walls and columns to the foundation to resist overturning, uplift, and sliding forces shall be provided. Resistance to overturning, uplift and sliding shall be provided at individual building elements as well as for the structure as a whole.

**1205.8 – STRESSES**

Provision shall be made for wind stresses during erection of all buildings or structures.

**1206 Deleted**

**1207 OCCUPANCY PERMITS FOR CHANGED LOADING**

Plans for other than residential buildings filed with the Building Official with applications for permits shall show on each drawing the live loads per square foot of area covered, for which the building is designed, and occupancy permits for buildings hereafter erected shall not be issued until the floor load signs, required by Section 105 have been installed. No changes in the occupancy of a building now existing or hereafter erected shall be made until a revised occupancy permit has been issued by the Building Official certifying that the floors are suitable for the loads characteristic of the proposed occupancy by a registered [architect](#) or registered engineer.



# CHAPTER 13

## FOUNDATIONS EXCAVATIONS AND WALLS, FOOTINGS, PILES, CAISSONS

### SECTION 1300 INTRODUCTION

#### **1300.1 – GENERAL**

The following sections outline minimum criteria that have, in the past, been found suitable for application to soils existing in North Carolina. These criteria are by necessity very general and are minimal for average soil conditions. It is strongly emphasized that North Carolina has variable sub-surface conditions from one Geological Province to another and that there is frequently considerable variation within a single Providence. Therefore, building foundation designs, excavation bracing designs, and lateral earth pressure designs should be based on the results of a subsurface investigation at the building site. The investigation shall be planned and supervised by a designer who shall be responsible for the interpretation of the field and laboratory tests results.

The term "designer" as used in this chapter of the Code shall be interpreted as meaning a Professional Engineer, or [Architect](#), registered in North Carolina or his authorized representative.

The intent of the following sections is to provide conservation design parameters for consideration by designers, unfamiliar with the local soil conditions, to use in preliminary design when adequate test data cannot be obtained and to guide local Building Officials. Higher design soil stresses and structural material stresses may be allowed by the Building Official when adequate test data, calculations, and/or other supporting information is submitted by the designer. The upper limit for design of foundation units shall be based on the maximum structural material stresses allowed by this Code.

#### **1300.2 – INSPECTION**

Subsurface conditions not anticipated from the pre-design investigation but exposed during construction shall be brought immediately to the attention of the designer. The inspection of the construction of all retaining walls, shallow footings, piles, caissons, or other foundation support systems shall be the responsibility of the designer of record.

The reports of all inspections and any field or laboratory test data shall be submitted to the Building Official at his request.

- (a) **RETAINING WALLS.** Inspection of retaining wall construction shall consist of observation and, in the case of walls exceeding 5'-0" in height, testing as required for; (1) The foundation support system as outlined in Section 1300.2(b), 1300.2(c), and 1300.2(d); (2) Certification of the quality of construction materials for conformance with specifications; (3) Determination of similarity of actual soil conditions to those anticipated in the design; (4) Examination of backfill materials and any drainage systems for compliance with plans and specifications.

- (b) **FOOTING OR MATS.** Inspection and, if necessary, testing of footing or mat excavations shall be made to ensure the presence of foundation materials similar to those assumed in the design. The bearing materials shall be evaluated for continuity and for the strength and compressibility parameters on which the design bearing pressure was based. Unanticipated conditions shall be evaluated by the designer to determine any necessary design modifications. Field changes to the design drawings shall be documented and submitted to the Building Official at his request.
- (c) **PILING.** Based on the initial pile installation and any pile load test(s) results, criteria for minimum piling embedment and minimum driving resistance shall be established for production piles and the Building Official shall be notified of the final driving criteria. The installation of all production piles shall be inspected by the designer and shall meet these criteria. All piles driven for load testing shall be driven under the direct observation of the designer. Complete driving records for each production pile shall be kept and identified by pile number and location. A plan showing clearly the designation of each individual pile by an identifying system shall be prepared and attached as part of the permanent record of the pile inspection. The tip and butt elevation, type of pile, and its conditions shall also be recorded. The type, size, and working condition of the driving hammer, the type of cushioning and the addition of new cushion material, as well as any unusual characteristics of the pile, driving procedure, or operating function of the hammer shall be recorded. A summary report on the pile installation shall be submitted to the Building Official at his request.
- (d) **DRILLED PIERS.** The installation of all caisson or drilled piers shall be inspected by the designer. The designer shall enter each excavation, except as discussed in Section 1304.3(b), and inspect the exposed bearing material for adequate bearing capacity, continuity, and cleanliness. General attention shall be given to the stability of the walls of belled piers for the possibility of sloughing when concrete is placed and liners removed. Each pier shall be identified by number and location and the pertinent data recorded; including any exceptions to the plans and specifications.

The designer shall observe the placing of any steel, the influx of ground water from the time of last inspection to the time of pour, and the pulling of liners as the pour takes place. On any pier where sloughing of the sidewalls and/or influx of water causes serious doubts about the continuity of the concrete shaft, the full length of the shaft shall be cored to evaluate its condition. A summary report on the caisson or drilled pier installation shall be submitted to the Building Official at his request.

## **SECTION 1301 EXCAVATION AND WALLS**

### **1301.1 – GENERAL**

- (a) **INVESTIGATION.** A subsurface investigation should be conducted at the site. Soil properties used in the analysis shall be selected on the basis of a reasonable number of tests. When excavating for buildings or excavations accessory thereto, such excavations shall be properly assured against any danger to life and property.
- (b) **PERMANENT WALLS.** Permanent excavations shall have retaining walls of such strength as to prevent movement or caving of the adjoining soil together with any surcharged loads on that soil.

- (c) **LIMITS OF EXCAVATIONS.** Excavation for any purpose shall not extend closer than one (1) foot to a surface drawn at 45 degrees to the horizontal through the lower edge of any adjacent existing footing or foundation, unless such footing or foundation is first properly underpinned or otherwise protected against movement.

### **1301.2 – SUPPORT OF ADJOINING STRUCTURES**

- (a) **NOTICE TO ADJACENT OWNERS.** Notice to the owner of adjoining buildings or structures shall be served at least 30 days before an excavation is commenced, and it shall state the depth and location of the proposed excavation.
- (b) **EXCAVATIONS LESS THAN 10 FEET DEEP.** When an excavation extends not more than 10 feet below the established curb grade nearest the point of excavation under consideration, the owner of the adjoining building or structure, the footings or foundations of which are to be underpinned or protected under the requirements of this section, shall be notified in writing by the one causing the excavation to be made. The owner of the adjoining structure or building shall be afforded the necessary license to enter the premises where the excavation is to be made, and at his own expense, shall provide the necessary underpinning or protection.
- (c) **EXCAVATIONS MORE THAN 10 FEET DEEP.** When an excavation extends more than 10 feet below the established curb grade nearest the point of excavation under consideration, the one causing the excavation to be made, if given the necessary license to enter the adjoining premises, shall provide at his own expense the underpinning and protection required by that part of the excavation which extends to a depth greater than 10 feet or more below the established curb grade nearest the point of excavation under consideration, whether or not the existing footings or foundations extend to the depth of 10 feet or more below the curb grade; or he may shore and brace the sides of his excavation so as to prevent effectively any soil movement into his excavation. If permanent lateral support is provided, the method used must satisfy the requirements of the Building Official. If the necessary license is not afforded the person causing the excavation to be made, it shall be the duty of the owner failing to afford such license to provide the required underpinning or protection, for which purpose he shall be afforded the necessary license to enter the premises where such excavation is to be made.
- (d) **ESTABLISHMENT OF CURB GRADE.** If there is no established curb grade, the depth of excavation shall be referred to the level of the ground at the point under consideration. If any existing building or structure, the footings or foundations of which are required to be underpinned or protected, is so located that the curb grade level to which it is properly referred is at a higher level than the level to which the excavation is properly referred, then such part of the required underpinning or protection that is necessary due to the difference in these levels shall be made and maintained at the joint expense of the owner of the building or structure and the person causing the excavation to be made. For the purpose of determining such part of the underpinning, or protection that is necessary due to such difference in levels, the level to which a building more than five feet back of the street line is properly referred shall be considered to be the level of the natural ground surfaces adjoining the building or structure.

- (e) **PARTY WALLS.** A party wall which is in good condition and otherwise suitable for continued use, shall be underpinned or protected as required at the expense of the person causing the excavation to be made.
- (f) **PROTECTION DURING ENTRY.** Where the necessary license has been given to the person making an excavation to enter any adjoining structure for the purpose of underpinning or protecting it, the person receiving such license shall provide for such adjoining structure adequate protection against injury due to the elements resulting from such entry.
- (g) **BACKFILL.** Only approved granular materials shall be used for backfill under this section. It shall be sufficiently compacted to have a strength not less than that of the adjacent soil mass to prevent lateral displacements of the soil of the adjoining property after the removal of the shores or braces.
- (h) **OTHER CONSTRUCTION ACTIVITIES.** The party making an excavation shall take such action as necessary to prevent movement of or damage to adjacent structures. Adjoining property owners shall be protected against construction activities that include, but are not limited to ground water lowering, vibration, soil densification, surcharges from materials stockpiling and erosion or loss of ground.

### **1301.3 – FOUNDATION WALLS**

- (a) **MINIMUM THICKNESS.** Foundation walls shall be not less in thickness than the walls immediately above them and not less than 12 inches for unit masonry walls, or 8 inches for cast-in-place concrete walls; except that solid masonry walls extending not more than 5 feet, and hollow walls of masonry or walls of hollow units extending not more than 4 feet below the adjacent finished ground level may be 8 inches in thickness. These depths may be increased to a maximum of 7 feet with the approval of the Building Official when he is satisfied that soil conditions will allow such an increase. The total height of 8-inch foundation wall and wall supported shall not exceed that permitted by this Code for 8 inch walls. In all cases, however, foundation walls shall have sufficient strength and thickness to resist all lateral pressures required by this Code.

Foundation walls of 8-inch thickness (except as provided above and conforming to the provisions following) may be used as foundations for dwellings with walls of brick veneer on frame walls or with 10-inch cavity walls, provided that the dwelling is not more than 2 stories in height and the total height of the walls, including the gable, is not more than 20 feet. Foundation walls of 8-inch thickness supporting brick veneer or cavity walls, shall be corbeled with solid units to provide a bearing the full thickness of the wall above. The total projection shall not exceed 2 inches with individual corbels projecting not more than 1/3 the height of the unit. The top corbel course shall not be higher than the bottom of floor joists and shall be a full header course.

Foundation walls of cast-in-place concrete when supporting one story basementless structures may be 6 inches thick if the total height of the foundation wall and the wall supported is within the allowable height permitted by this Code for 6 inch walls.

All-weather wood foundations are permitted for buildings of type VI construction when the following requirements are met.

1. The foundation shall be designed, fabricated, and installed in accordance with the All-Weather Wood Foundation Design Fabrication and Installation Manual, revised January 1982, of the National Forest Products Association with the following exceptions:
    - (a) The minimum thickness of the stone layer under the footing shall be 12 inches.
    - (b) For design purposes, the maximum allowable soil bearing pressure shall be 2000 pounds per square foot and the lateral loads from the soil shall be based on a minimum equivalent-fluid weight of 40 pounds per cubic foot for sandy soils and 50 pounds per cubic foot for clayey soils or as determined by an Engineer registered in North Carolina who is experienced in soils engineering.
    - (c) Adequate anchorage shall be provided to transfer all wind and soil pressures into supporting soil.
    - (d) Foundation shall not be used for basements when the [basement](#) sump pit does not freely drain by gravity to grade or a storm sewer. Sump pumps are not permitted.
  2. Design shall be performed by an Engineer registered in the State of North Carolina whose seal shall be affixed to all foundation drawings.
  3. Materials, fabrication and installation shall be inspected and a certificate of compliance furnished by either an Engineer registered in North Carolina or by an independent third party inspection agency approved by the North Carolina Building Code Council for this type of service.
- (b) VENTS AND CRAWL SPACE. Foundation vents and crawl spaces shall be provided as specified in chapter XVII.

#### **1301.4 – EARTH PRESSURES ON WALLS AND OTHER PERMANENT OR TEMPORARY RETAINING STRUCTURES**

Every foundation wall or other wall serving as an earth retaining structure shall be designed to resist lateral earth pressure, in addition to any vertical loads acting thereon. The incident lateral earth pressure, any fluid pressures, and any additional horizontal pressure resulting from probable surcharge loads shall be considered in the wall design. In addition to the static pressures, consideration shall be given to the dynamic forces generated by compaction of backfill behind the wall. The designer shall consider the deflection conditions that may occur, both in service and during construction, as well as the properties of the back-fill material to be used, in his choice of lateral earth pressures. In some areas of North Carolina swelling soils are present. Any proposed backfill borrow material shall be evaluated and soils with significant swelling potential shall not be used.

### **SECTION 1302 FOOTINGS, COMBINED FOOTINGS AND MATS**

#### **1302.1 – GENERAL**

- (a) INVESTIGATION. A subsurface investigation should be conducted at the site. Soil properties used in the analysis shall be selected on the basis of a reasonable number of tests.
- (b) DESIGN. The base area of all footings and foundations shall be proportioned as specified in [Section 1302.3](#). Footings and foundations shall be constructed of reinforced concrete, or plain concrete.

(c) **DEFINITIONS.** The terms used in this Code shall be interpreted in accordance with generally accepted engineering nomenclature. In addition, the following more specific definitions are used for earth materials in the Piedmont Region.

- (1) **Weathered Rock** – Broken and partially weathered rock of sufficient hardness to refuse soil sampling tools, normally has Standard Penetration resistance (ASTM D-1586) in excess of 50 blows per inch.
- (2) **Disintegrated Rock** – Mechanically undisturbed rock that has been chemically weathered to such state or condition that it can be drilled with soil boring tools but yet retains the texture and structure of the parent material; normally has Standard Penetration resistance (ASTM D-1586) in excess of 30 blows per foot.
- (3) **Residual Silt** – Extensively weathered residual soil material retaining the general structural pattern of the parent rock. Breaks down to cohesionless, silt sized particles with slight remolding; medium to low values of Standard Penetration resistance; frequently micaceous.

### **1302.2 – BEARING CAPACITIES OF SOIL AND ROCK**

Footings, combined footings, and mats shall be so designed that the allowable bearing capacities are not exceeded and excessive settlements do not occur. Where the settlement characteristics of the soil are not definitely known, or are in question, the Building Official may require field and/or laboratory tests to determine the predicted overall settlement under the loading of the proposed structure. The type, number and location of tests shall be selected and the results evaluated by the designer. Where various portions of the same structure are supported by soils of differing settlement characteristics, special provision shall be made in the design to prevent damaging differential settlements. Either of two methods may be used to determine the appropriate design bearing pressures:

- (a) **BEARING CAPACITY FROM ENGINEERING ANALYSIS.** Footings and foundations for structures not meeting the criteria for the use of Presumptive Bearing Values or where suspect soil conditions exist shall be designed for bearing capacity values from an engineering analysis supported by a reasonable number of tests. The types and numbers of tests shall be selected and evaluated by the designer in accordance with standard soil mechanics and foundation engineering practice. The bearing capacity values, as well as any special foundation requirements or conditions shall be shown on the plans and attested by the designer. All such foundations shall be founded on stable natural soil or controlled compacted fill below the frost line and no less than 12" below finished grade.
- (b) **PRESUMPTIVE BEARING CAPACITY.** Presumptive bearing pressures may be used, not exceeding the values shown in Table 1302, provided that all of the following criteria are satisfied:
  - (1) Presumptive bearing pressures are acceptable only for lightly loaded structures where column loads are less than 100 kips per column and wall loads do not exceed 3.0 kips per linear foot.
  - (2) Finished grades, included cut or fill operations do not differ from the natural grades by more than 5 feet.
  - (3) Sufficient histories of favorable foundation performance are available from adjoining sites for similar loading conditions.

All such foundations shall be founded on stable natural soil or controlled compacted fill, below the frost line and no less than 12" below finished grade.

The designer shall determine, based on the available historic data, that the expected settlements are within tolerable limits and that the foundations bear on stable soils. The presumptive values assigned and the required soil type shall be shown on the plans for field verifications.

**TABLE 1302  
BEARING CAPACITIES OF VARIOUS SOILS AND ROCKS**

Class	Material	Allowable Bearing Value in Tons Per Square Foot <sup>1</sup>
1	Massive igneous or metamorphic rocks all in sound condition (Minor cracks allowed)	100
2	Massive sedimentary rocks (when interbedded, strength shall be determined by weakest member)	20
3	Weathered Rock <sup>3</sup>	40
4	Disintegrated Rock <sup>3</sup> (assume similar to dense sand)	10 <sup>2</sup>
5	Residual silt <sup>3</sup> (assume similar to loose sand)	1 to 3 <sup>2</sup>
6	Dense Sand	3 <sup>2</sup>
7	Stiff Clay	2 <sup>2</sup>
8	Loose Sand	1 <sup>2</sup>
9	Soft Clay	1 <sup>2</sup>
10	Compacted controlled fill	1.5 <sup>2</sup>

<sup>1</sup> The allowable bearing value given in this section or when determined in accordance with the provisions of [Section 1302.2\(a\)](#) will assure that the soils will be stressed within limits that lie safely below their strength. However, such allowable bearing pressures for class 5 and classes 7 through 10 do not assure that the settlements will be within tolerable limits for a given structure.

<sup>2</sup> Alternatively the allowable bearing value may be calculated from soil properties determined by field or laboratory tests.

<sup>3</sup> See [Paragraph 1302.1\(c\)](#).

Where the bearing capacity is judged to be suspect by the Building Official, field and/or laboratory tests or other adequate proof of the allowable bearing pressure for the particular location under the loading of the proposed structure may be required.

### 1302.3 – FOOTING DESIGN

- (a) **SIZE.** Footings shall be proportioned to sustain the applied loads and induced reaction, without exceeding the allowable stresses specified in this Code. In no case shall the unit load per square foot under any portion of the footing due to a combined dead, live, wind and/or any other loads exceed the allowable bearing capacities of the soil or rock upon which the footing rest as determined by [Section 1302.2](#). The total reduced live load occurring in the column immediately above the footing shall be the live load used in the above computation. Column footings shall not be less than 24 x 24 inches and wall footings shall not be less than 16" in width.
- (b) **MATERIALS.** Concrete in footings shall have an ultimate compressive strength of not less than 2500 pounds per square inch at age of 28 days.
- (c) **CONCRETE DESIGN.** Procedure design of footings shall be in accordance with Chapter XVI of this Code and ACI 318.

## SECTION 1303 PILES

### 1303.1 – GENERAL

- (a) **INVESTIGATION.** A subsurface investigation should be conducted at the site to examine both the materials in which the piles will be embedded and the underlying materials that will be significantly stressed by the pile foundation. The design pile lengths and capacities shall be selected on the basis of a reasonable number of soil tests.
- (b) **PILE CAP DESIGN.** The design and details of pile caps shall be in accordance with Chapter XVI of this Code and ACI 318.
- (c) **SPECIAL TYPES OF FOUNDATIONS.** Proprietary or special types of deep foundations not specifically covered in this code may be used if, in the judgment of the Building Official, the proposed design is justified by test data and experience records submitted by the designer. In no case shall the design criteria exceed the limits specified in the various subsections of Section 1303.

### 1303.2 – ALLOWABLE LOADS

- (a) **GENERAL.** All piles used to support any building or part thereof shall be constructed in such a manner as not to impair their strength. The allowable load on single piles may be determined from an analysis of subsurface conditions as described in [Section 1303.2\(b\)](#), or, for granular soils, by the pile driving formula given in [Section 1303.2\(c\)](#) or by pile load tests as described in [Section 1303.2\(d\)](#) or by the presumptive pile capacity values given in [Section 1303.2\(e\)](#).



- (b) **SUBSURFACE EVALUATION.** Pile foundations for structures not meeting the criteria for the use of presumptive pile capacity values or when suspect soil conditions exist may be designed for capacities determined by an engineering analysis based on a reasonable number of soil tests. The type and number of tests shall be selected and evaluated by the designer in accordance with standard soil mechanics and foundation engineering practice. The design pile capacities as well as any special foundation requirements or conditions shall be shown on the plans and attested by the designer. Design capacities determined in accordance with [Section 1303.2\(b\)](#) shall not exceed 60 tons for piles driven end bearing to materials of class I nor 40 tons for other soil conditions. If higher design capacities are desired, they shall be determined by the provisions of [Section 1303.2\(d\)](#).
- (c) **DRIVING RESISTANCE.** Subject to the limitations prescribed in this section for the various types of piles, the allowable loads for piles driven into granular or non-cohesive soils up to a maximum of 40 tons per pile may be determined by the value of  $R_d$  obtained from the following formula. If higher design capacities are desired, they shall be determined by the provisions of [Section 1302.2\(b\)](#). Other dynamic analysis currently in use in foundation engineering practice may be accepted by the Building Official if adequately justified by test data and experience records submitted by the designer. Pile hammers shall be operated at the full rated speed, pressure, and stroke as shown in the manufacturers catalog. The minimum driving energy for piles intended to carry 10 tons shall be 7,500 foot pounds and for 25 tons or more shall be 15,000 foot pounds.

$$R_d = \frac{2E_n}{s + 0.1} \times \frac{W_r + K W_p}{W_r + W_p}$$

In which

$R_d$  = Computed design pile load capacity, pounds (Maximum 80,000 pounds)

$s$  = Penetration of the pile in inches/blow averaged over the last 6 inches driven

$E_n$  = Manufacturer's maximum rated energy, foot-pounds

$W_r$  = Weight of hammer ram, pounds

$W_p$  = Weight of pile (including driving appurtenances), pounds

$K$  = Shall be taken as .2 for piles whose weight is 50 pounds per linear foot or less, as .4 for piles whose weight is in the range of 50 to 100 pounds per linear foot and as .6 for piles (or the mandrels of steel shell piles) whose weight is greater than 100 pounds per linear foot.

When the allowable load is determined by formula, piles with an average diameter or side of 8 inches or less shall be driven with a power hammer whose rated energy is at least 7,500 pounds; piles with an average diameter or side greater than 8 inches and not more than 18 inches shall be driven with a power hammer whose rated energy is at least 15,000 foot pounds; piles with an average diameter or side of more than 18 inches shall be driven with a power hammer whose rated energy is at least 26,000 foot pounds.

- (d) **PILE LOAD TEST.** The design load on piles may be determined by the designer based on an analysis of the results of pile load tests performed in accordance with ASTM D-1143. The allowable pile load shall be determined by the application of a safety factor of 2 to the ultimate pile capacity as determined by the intersection of the initial and final tangents to a curve fitted to the plotted results of the pile load test. The fitted curve shall not extend to any point at which the pile continued to move under the applied load. Pile capacities determined under this paragraph shall in no case produce stresses in the pile in excess of the maximum allowable stresses given in [Section 1303.4](#).
- (e) **PRESUMPTIVE PILE CAPACITY.** Presumptive pile capacities may be used, not exceeding the values shown in Table 1303, provided that all of the following criteria are satisfied:
  - (1) Presumptive pile capacities are acceptable only for lightly loaded structures where column loads are less than 100 kips per column and wall loads do not exceed 3 kips per linear foot.
  - (2) Finished grades, including cut or fill operations do not differ from the natural grades by more than 5 feet.
  - (3) Sufficient histories of favorable foundation performance are available from adjoining sites for similar structural loading conditions.

The designer shall determine, based on the available historic data, that the expected settlements are within tolerable limits and that the foundations bear on stable soils. The presumptive values assigned and the required soil type shall be shown on the plans for field verifications.

Piles may be loaded to the values shown in the table following provided that the exploratory borings show no soft or significantly compressible strata below the proposed pile tip elevation. See [Section 1302.2\(b\)](#) for presumptive capacity values for various classes of earth materials.

**TABLE 1303  
PRESUMPTIVE ALLOWABLE LOADS ON PILES**

	Granular Materials	Cohesive Soils
Friction Piles	½ ton per ft. of embedment in supporting stratum.	1/3 of the average unconfined compressive strength of the stratum multiplied by the surface area of the pile embedded in the supporting stratum.
End Bearing Piles	Bearing pressures shall not exceed the values given in Table 1302.	

NOTE: For H piles the surface area shall be taken as the area of the enclosing rectangle times the embedded length. The end area shall be the actual steel area.

**1303.3 – DESIGN**

- (a) **GROUP ACTION.** In no case shall the spacing of piles be such that the average stress in the supporting strata will exceed the safe bearing capacity of those strata determined by the provisions of [Section 1302.2](#).
- (b) **SPACING.** The minimum center-to-center spacing of piles shall not be less than twice the average diameter of a round pile, or less than 1.75 times the diagonal dimension of a rectangular or rolled structural steel pile. For piles driven to materials of Classes 1 through 3, Table 1302, the minimum spacing shall not be less than 2'-0". For piles driven into materials of Classes 4 through 8, the minimum spacing shall not be less than 2'-6". Classes 9 and 10 are considered not suitable for pile support.
- (c) **BRACING.** A column or pier supported by piles, unless connected to permanent construction that provides adequate lateral support shall rest on not less than three piles. When the supporting capacity of a single row of piles is adequate for the wall of a structure, effective measure shall be taken to provide for eccentricity and lateral forces, or the piles shall be driven alternately in lines spaced at least one foot apart and located symmetrically under the center of gravity of the loads carried. A single row of piles without lateral bracing may be used for private dwellings not exceeding two stories in height, provided the centers of the piles are located within the width of the foundation wall.
- (d) **UPLIFT AND HORIZONTAL LOADS.** Loadings other than axial compression may be carried by piling provided that the design capacity values are determined by an engineering analysis of soil properties as described in [Section 1302.2](#).
- (e) **SPLICES.** Splices shall be such that the resultant vertical and lateral loads at the splices are adequately transmitted. Splices shall be so constructed as to provide and maintain true alignment and position of the component parts of the pile during installation and subsequent thereto. Except for piles that can be visually inspected after driving, splices shall develop not less than fifty percent of the value of the pile in bending. Proper consideration shall be given to the design of splices at sections of piles which may be subject to tension or to bending.
- (f) **PROTECTION.** Piles shall be adequately protected by approved preservatives or by impervious encasements that will not be rendered ineffective by driving to such depths or at such horizons as boring records or site conditions indicate possible deleterious action on pile materials because of soil constituents or water levels.
- (g) **PREDRILLING, JETTING, AND SPUDING.** Piles may be placed in holes preformed by boring, jetting or spuding or combination of these methods. Such preformed holes should not extend to a depth greater than 5 feet above the top of the design bearing strata except for rolled steel sections or open end steel pipe driven into drilled sockets in rock. Piles shall be inserted into the preformed holes as soon as the hole is completed and driving shall commence immediately.
- (h) **REDRIVING.** Observations and measurements shall be made during the process of driving piles to determine whether any previously driven pile has been lifted from its original seat by the action of adjacent piles. When such observations indicate that one or more piles have heaved, they shall be redriven to the originally specified resistance.

**1303.4 – TYPE OF PILES**

(a) **GENERAL.** The stresses in any pile shall not exceed those described in the following sections and shall be calculated as the total design load on the pile divided by its critical cross-section. The critical cross-section of piles designed as end bearing piles shall be taken as the minimum cross-section of the pile exclusive of any sharply tapered point. For piles designed as friction piles the critical section shall be taken at the top of that portion of the pile embedded in the supporting stratum. Piles may be designed as short columns except where piles extend above permanent ground level.

(b) **WOOD PILES.**

(1) **MINIMUM STANDARDS**

The minimum acceptable standard for size and quality of wood piles is ASTM D-25, Standard Specification for Round Timber Piles. The pile supplier shall provide certification that all piles meet the requirements of [Section 1303.4\(b\)\(1\)](#) and [1303.4\(b\)\(2\)](#) of this code.

(2) **PRESERVATIONS.** Wood piles used to support permanent structures shall be pressure impregnated with coal tar creosote to a minimum final retention of 12lbs. per cubic ft. in accordance with AWWA C-3, unless it is established that the cut-off on untreated wood piles will be below lowest ground-water level assumed to exist during the life of the structure. The treated pile cut-offs shall have at least two successive coats of hot creosote liberally applied and (a) shall be encased in a pile cap so that no part of the pile will be exposed to the air or (b) the cut-off shall be exposed and accessible for inspection. The cut-off on all wood piles shall be along a horizontal plane.

(3) **ALLOWABLE STRESSES-**The maximum allowable load on a timber pile shall be determined by [Section 1303.2](#) provided that the design load does not cause a stress in the timber beyond the limits specified by ASTM D 2899. The allowable stress for commonly used wood species are shown in Table 1304.

**TABLE 1304**  
**ALLOWABLE WORKING STRESSES FOR PRESSURE TREATED TIMBER PILING:**  
**VALUES AT TIP OF PILE**

(Allowable working stresses are determined in accordance with "Establishing Design Stresses for Round Wood Piles" ASTM D 2899)

Species	Compression Parallel to Grain, psi**	Bending psi**	Shear Horiz. psi**	Compression Perp. To Grain, psi**	Modulus of Elasticity
Douglas Fir* (all varieties)	1150	2300	110	225	1,500,000
Southern Yellow Pine* (Market Wtd. Avgs.)	1150	2300	110	225	1,400,000
Southern Red Oak	950	2400	110	325	1,100,000

\* Working stresses of Douglas Fir and Southern Pine may be increased by 0.2 percent for each foot of distance from the tip of the pile to the critical section. For compression parallel to grain, an increase of 2.5 psi per foot is recommended.

\*\* The allowable stresses tabulated above have been reduced to compensate for heat processes used to condition piling before pressure treatment. Where pressure treated piles have been air dried, or where untreated piling are used, working stresses may be increased by dividing tabulated values by 0.85.

### (c) STEEL PILES

(1) GENERAL. Steel piles may consist of pipe, rolled shapes, or built-up structural shapes.

(2) STEEL PIPE PILES. Steel pipe piles shall consist of steel pipe conforming to ASTM Standard A252. They may be driven either open-ended or with ends closed. Steel pipe piles driven open-ended shall have a nominal outside diameter of not less than 10 inches and a nominal wall thickness of not less than 0.25 inch or if 14 inches or over, in nominal outside diameter, the nominal wall thickness shall not be less than 0.375 inch. Pipe of less wall thickness may be driven open-ended if a suitable cutting shoe is provided. If steel pipe piles are to be driven with closed ends, a forged or cast steel point or flat plate end of approved design shall be used. Steel pipe piles driven with ends closed may be of smaller sizes and wall thickness than specified above but no such pile of uniform section shall have a nominal outside diameter of less than 8-5/8 inches. In no case shall the wall thickness be less than 0.219 inches if the pile is to be considered a steel pipe pile under this section.

(3) **STRUCTURAL STEEL PILES.** Structural steel piles shall conform to the requirements of ASTM Standards A36 or A572. Sections of such piles shall be of H form, with flange projection not exceeding fourteen times the minimum thickness of metal in either web or flange and with total flange width at least eighty-five percent of the depth of the section. No section shall have a nominal thickness of metal less than 3/8 inch, nor a nominal depth in the direction of the web less than 8 inches. Other structural sections or combinations of sections having flange widths and depths of not less than 10 inches and thickness of metal not less than 3/8 inch may also be used.

(4) **ALLOWABLE STRESSES.** The maximum allowable load shall be determined by [Section 1303.2](#) provided that the design load does not cause a stress in the steel of piles driven under this section of the specifications greater than 12,600 psi and a stress in any concrete used to fill pipe piles, driven either open or closed end, greater than 25% of its ultimate 28-day compressive strength. Pipe piles to be filled with concrete shall be clean and dry before concrete is placed.

(d) **CONCRETE PILES**

(1) **GENERAL** – Concrete piles shall be designed in accordance with the recommendations of ACI 543 Paragraph 2.3 except that for unreinforced Cast-in-place piles the stress in the concrete shall not exceed 25% of the ultimate 28-day strength of the concrete. Materials used for the construction of concrete piles and methods of quality control shall be as specified in Chapters XV and XVI of this code. The maximum load on individual piles shall in no case exceed the limits specified in Section 1303 of this Code.

(2) **PRESTRESSED AND PRECAST CONCRETE PILES** – Piles shall be reinforced to resist both handling and driving stresses. The Building Official may require the contractor to furnish him with all data necessary for checking the computations of the theoretical and allowable stresses.

The maximum allowable stresses due to externally applied load shall not exceed following:

**Prestressed Concrete Piles**

- fc. =  $0.33 f'c - 0.27 fpe$  (compression)
- fc. = 28 day compressive strength of the concrete
- fpe. = effective prestress stress on the gross section

**Precast Concrete Piles**

- fc. =  $.33 f'c$  (concrete – compression)
- fs =  $.4 fy$  (steel – compression or tension)
- fc = 28 day compressive strength of the concrete
- fy = specified yield strength of nonprestressed reinforcement

A minimum protective cover shall be provided as follows:

**Prestressed**

- 2½” for piles subjected to sea water or other severe exposure
- 1½” for other exposures

**Precast**

2½" for piles subjected to sea water or other severe exposure

1¼" for number 5 bars and smaller and

1½" for number 6 thru number 11 bars for other exposures

The diameter or least dimension of prestressed concrete piles, shall not be less than 10 inches. Diameter or least dimension of precast concrete piles shall not be less than 9 inches.

Prestressed and precast concrete piles shall not be driven until the concrete is seven (7) days old and has obtained a minimum compressive strength of at least 5000 pounds per square inch, nor shall they, in the opinion of the Building Official, be handled or driven in any way that might damage the pile.

- (3) **CAST-IN-PLACE, STEEL SHELL, CONCRETE PILES.** Piles shall have a steel shell driven, with or without a mandrel, in intimate contact with the soil and left permanently in place. The diameter of tapered or step-tapered piles, cast-in-place, shall not be less than 8 inches at the point, measured immediately above the sharply tapered portion, and shall have an average diameter of not less than 10 inches. Cylindrical piles shall have a diameter of not less than 10¼ inches. Any pile reinforcement required shall be kept at least 1 inch clear of the exterior casing. Reinforcing for cast-in-place concrete piles shall be considered necessary only when uplift, unbalanced lateral forces, or unsupported lengths are to be considered. The concrete shall be placed in such a manner as to insure the exclusion of any foreign material and to secure a full size shaft.

The maximum allowable stress shall be 33% of the 28-day compressive strength of the concrete and no supporting capacity shall be assigned to the steel shell. The maximum allowable stress may be increased to 40% for that portion of the pile meeting the following criteria;

- (a) Thickness of casing is not less than 14 gauge.
- (b) Diameter of the pile is not greater than 16 inches.
- (c) Strength ratio of the  $f_y / f'_c$  is not less than 6.

The interior of each pile shall be inspected prior to the placement of concrete and all water or other foreign material shall be removed from the pile shell before concrete is placed.

- (4) **CAST-IN-PLACE CONCRETE PILES WITHOUT PERMANENT STEEL SHELLS.** Cast-in-place concrete piles may be constructed by the technique of pumping cement grout down the hollow stem of an auger as it is being withdrawn or by placing high slump concrete through a hollow mandrel prior to withdrawing the mandrel. The minimum allowable diameter shall be 12 inches.

For piles placed by the auger-cast technique, the quality of the cement grout shall be controlled by the collection, from the end of the auger as it is withdrawn, of a sample sufficient to form a set of three test specimens, either 2 inch cubes or 2 inch by 4 inch cylinders, for each 75 cubic yard of grout placed. The grout shall be injected by the use of a positive displacement mortar pump and the speed of withdrawal of the auger shall be such that the auger head is below the surface of the grout at all times.

The quality of concrete placed in cast-in-place piles by the hollow mandrel method shall be controlled by sampling and testing as described in the requirements for structural concrete, Chapter XVI of this Code.

The minimum 28-day strength of grout for auger cast piles shall be 4,000 psi and the minimum 28-day strength of concrete for hollow mandrel piles shall be 4,500 psi.

The maximum allowable design load on the pile shall not produce a stress in the pile in excess of 400 psi unless the pile is demonstrated by test to be continuous and essentially of design size. If each pile is so tested, the maximum design stress may be 800 psi.

- (5) **COMPACTED CONCRETE PILES (PRESSURE INJECTED FOOTINGS).** Compacted Concrete Piles shall include an expanded concrete base formed by ramming zero-slump concrete into place under specific energy of impact, and a concrete shaft for transmitting load to the base. They may be used in deep deposits of granular material (Classes 6 and 8) or at the top surface of dense materials (Classes 1, 2, 3, 4, and 6) as defined in Table 1302.

The allowable unit load shall be determined by the following dynamic formula relating to the injection of the concrete base:

$$R = \frac{BWH (V)^{2.3}}{60}$$

V = total volume of concrete rammed in footing, cubic feet.

in which R = design load capacity of a single pile, pounds

B = number of blows required to inject the last 5 cubic feet of concrete, while height of concrete in drive-tube is no more than 6 inches.

W = weight of drop-hammer operating inside tube, pounds

H = height of free fall of hammer on zero-slump concrete at bottom of tube, feet.

Allowable load shall be limited by the values of Table 1302, computation being made on the assumption that load spreads from junction of shaft and base at an angle of 60° to the horizontal and the bearing area shall be taken at planes 6 feet or more below said junction.

Design loads of 160 tons and over shall be confirmed by load tests as provided in [Section 1303.2\(d\)](#).

Shafts on compacted concrete piles may be permanently cased in thin steel shell or in pipe, or may be precast or uncased concrete. In all cases the stress in the concrete at design load shall be limited to 25% of the ultimate 28-day strength of the concrete. Concrete shall be placed in such a manner as to insure the exclusion of any foreign material and to secure a full size shaft.

Uncased shafts, fully supported by surrounding soil, and not less than 16 inches in diameter, shall be considered as piers to which the bracing provisions of [Section 1303.3\(c\)](#) shall not apply.



**SECTION 1304 DRILLED PIERS OR CAISSONS****1304.1 – GENERAL**

- (a) **INVESTIGATION.** A subsurface investigation should be conducted at the site to examine both the material through which the caisson or pier will be drilled and the underlying materials that will be significantly stressed by the foundation unit. The design bearing elevation and bearing and friction capacities shall be selected on the basis of a reasonable number of soil or rock tests.
- (b) **MINIMUM SIZE.** If piers or caissons are belled, such bells shall have at least a 4" thickness of concrete at the edge and the sides shall slope at an angle of not less than 45 degrees with the horizontal unless they have been designed as reinforced concrete cantilevers. In no case shall the shaft of a belled pier or caisson be less than 2.0' minimum horizontal dimensions or of a straight shaft pier or caisson be less than 2'-6" minimum horizontal dimension unless a permanent steel shell is left between concrete and soil.
- (c) **DESIGN.** The shafts of piers or caissons shall be designed as concrete columns with continuous lateral support. The unit compressive stress in the concrete shall not exceed 33% of its ultimate 28-day compressive strength nor 1200 psi. No steel reinforcement is required in concrete filled, drilled piers or caissons unless required by the load imposed thereon. Where steel reinforcement is used the shaft shall be designed in accordance with the requirements of Section XVI of this Code and ACI 318.

**1304.2 – ALLOWABLE LOADS**

- (a) **GENERAL.** All caissons or piers used to support any building or part thereon shall be constructed in such a manner as not to impair their strength. The allowable load on individual units may be determined from an analysis of subsurface conditions as described in Section 1304.2(b) or by caisson load test as described in Section 1304.2(c) or by the presumptive caisson capacity values given in Section 1304.2(d). The provisions of [Section 1303.3\(c\)](#) shall not apply to caissons constructed as specified under Section 1304 of this Code.
- (b) **BEARING CAPACITY FROM ENGINEERING ANALYSIS.** The design lengths and end bearing pressures shall be selected on the basis of an analysis of subsurface conditions supported by a reasonable number of tests. These tests may be made in the laboratory on undisturbed soil samples or rock cores or in situ by a bore-hole or bottom of excavation tests. The testing and inspection program shall be planned to ensure that the material tested is continuous to a depth of at least one caisson diameter below the bottom of the excavation. The bearing pressure so selected shall not produce stresses in the shaft in excess of those provided in Section 1304.1(c).
- (c) **LOAD TEST.** The design bearing pressure of drilled piers or caissons may be determined by the analysis of the results of load tests performed in accordance with the requirements of [Section 1303.2\(d\)](#) of this Code.
- (d) **PRESUMPTIVE CAISSON CAPACITY.** Presumptive capacities may be used, not exceeding the values given below provided the following criteria are satisfied:

- (1) Presumptive caisson capacities are acceptable only for lightly loaded structures where column loads are less than 100 kips per column and wall loads do not exceed 2.0 kips per linear foot.
- (2) Finished grades, including cut or fill operations do not differ from the natural grades by more than 5 feet.
- (3) Sufficient histories of favorable foundation performances are available from adjoining sites for similar structural loading conditions.

The designer shall determine, based on the available historic data, that the expected settlements are within tolerable limits and that the foundations bear on stable soils. The presumptive values assigned and the required soil types shall be shown on the plans for field verification.

The design bearing pressure may be determined from the presumptive bearing values given in Table 1302 provided that exploratory borings show that no softer or more compressible strata lies below the design bottom elevation. The bearing area of the caisson or pier shall not be less than that determined by dividing the sum of the applied column load (dead load plus full live load plus wind load) and the total weight of the pier or caisson by the presumptive bearing pressure. A caisson designed under this paragraph shall in no case be less than 2'-6" in diameter.

### **1304.3 – CONSTRUCTION**

- (a) **DRY METHOD.** Construction of drilled piers or caissons shall be by non-displacement methods. Except as noted in paragraph 1304.3(b) the excavation shall be dewatered to permit hand cleaning of the bearing surface and inspection of the bearing material in place prior to placement of any concrete.
- (b) **WET METHOD.** With the approval of the Building Official, the concrete for drilled piers or caissons may be placed below the surface of still water or slurry by means of a properly operated tremie tube, concrete pump, or bottom dump bucket. Concrete placed under this section of the code shall be handled in such a manner that fresh concrete entering the caisson does so at a point below the top of the mass of wet concrete in order that it shall be not mixed with the water or slurry filling the hole. As soon as an adequate seal has been effected, the water or slurry remaining on top of the concrete shall be pumped out and the rest of the caisson concreted as in paragraph 1304.3(a).
- (c) **LINERS.** The excavation for drilled piers or caissons shall be protected against caving or sloughing by temporary steel liners that may be removed as the concrete is placed. The surface of the wet concrete shall remain at least 4' above the bottom of the liner while the liners are being withdrawn. The design of the shaft shall be calculated from the interior dimensions of the smallest liner.

## CHAPTER 14 MASONRY CONSTRUCTION

### SECTION 1401 GENERAL

- (a) All masonry construction shall conform to the provisions of this chapter and other applicable sections of this Code.
- (b) In all cases masonry shall be of adequate thickness, strength and proportions to support all superimposed loads within the allowable working stresses prescribed.
- (c) All masonry materials are required to meet the specifications as outlined in Section 1402. If the Building Official has reason to doubt the materials meeting the applicable specification he may require tests on the materials.
- (d) Masonry units may be re-used when clean, whole and conforming to the other requirements of this chapter, except that the allowable working stresses shall be 50 percent of those permitted for new masonry units.
- (e) The wall thickness and other specified dimensions are nominal dimensions. The actual masonry or wall dimensions may vary from the nominal dimensions by not more than one-half (½) inch.

### SECTION 1402 MATERIALS

#### **1402.1 – BRICK**

Brick of clay, shale, sand-lime or concrete shall be of a quality at least equal to that required by ASTM Specifications (62) for clay or shale building brick; (C73) for sand-lime brick; or (C55) for concrete building brick. When in contact with the ground, such as foundation work, or when used in retaining walls, the brick shall be of at least Grade SW for clay or shale or sand-lime brick, or Grade N for concrete brick. When exposed to the weather above ground the brick shall be of at least Grade MW for clay or shale or sand-lime brick, or Grade N for concrete brick.

#### **1402.2 – STRUCTURAL CLAY TILE**

Structural clay tile shall be of a quality at least equal to that required by ASTM “Standard Specifications for Structural Clay Load-Bearing Wall Tile” (C34) grade LB when used for bearing walls or piers or Grade LBX when exposed to the weather or soil, or equal to the “Standard Specifications for Structural Clay Non-Load-Bearing Tile” (C56) when used for interior non-load-bearing purposes, or equal to “Standard Specifications for Structural Clay Floor Tile” (C57) when used as a structural unit in combination reinforced floor or roof construction. (Tile meeting ASTM (C34) Grade LB may be used in on-grade floors.)

#### **1402.3 – CERAMIC AND SALT GLAZED STRUCTURAL CLAY FACING TILE OR BRICK**

All glazed masonry building units shall conform to the applicable requirements for solid or hollow clay masonry units of [Sections 1402.1](#) and 1402.2.

#### **1402.4 – HOLLOW AND SOLID CONCRETE MASONRY UNITS**

- (a) Hollow concrete masonry units shall be of a quality at least equal to that required by ASTM “Standard Specifications for Hollow Load-Bearing Concrete Masonry Units” (C90) or “Standard Specifications for Solid Load-Bearing Concrete Masonry Units” (C145) when used for bearing walls or piers or when in contact with the ground or exposed to the weather, or equal to “Standard Specifications for Hollow Non-Load-Bearing Concrete Masonry Units” (C129) when used for non-bearing purposes and not exposed to the weather.
- (b) Structural concrete filler-block or floor tile when included in strength calculations in ribbed floor construction shall have webs and shells not less than one inch thick and shall develop an average compressive strength on the net area not less than that of the rib concrete.

#### **1402.5 – CAST STONE**

Cast stone shall be of a quality at least equal to that required by "Specifications for Cast Stone" (704) of the American Concrete Institute.

#### **1402.6 – PLAIN CONCRETE**

Concrete that is either unreinforced or contains less reinforcement than the minimum amount specified for reinforced concrete (Chapter XVI) shall be classed as plain concrete. Plain concrete used for structural purposes shall conform to the requirements of Section 1602 and have a minimum compressive strength,  $f'_c$  of 2500 psi.

#### **1402.7 – NATURAL STONE**

Natural stone for masonry shall be sound and free from loose or friable inclusions; and shall meet the strength, fire-resistance, durability, and resistance to impact for the proposed use. The Building Official may require satisfactory written evidence to this effect.

#### **1402.8 – ARCHITECTURAL TERRA COTTA AND CERAMIC VENEER**

All architectural terra cotta and ceramic veneer shall have a strong homogenous body and shall conform to the applicable requirements of Section 1402.2. All units of the anchor type shall have the necessary anchor holes and shall be so formed as to engage properly with the supporting structure. All units of the adhesion type shall have keyed or scored back surfaces.

#### **1402.9 – GYPSUM MASONRY UNITS**

Gypsum partition tile or block shall be of a quality at least equal to that required by ASTM "Standard Specifications for Gypsum Partition Tile or Block" (C52).

#### **1402.10 – STRUCTURAL GLASS BLOCK UNITS**

Structural glass block shall comply with the provisions of Section 1413.

#### **1402.11 – MORTAR AND GROUT MATERIALS, PROPORTIONS AND WORKABILITY**

- (a) Mortar and its ingredients as delivered to the mason shall be of a quality at least equal to that required by ASTM “Standard Specifications for Mortar for Unit Masonry” (C270).
- (b) Masonry cement shall be of a quality at least equal to that required by ASTM “Masonry Cement” (C91).

- (c) The type of mortar delivered to the mason for any specific job shall be as required in 1402.12
- (d) Grout shall conform to the applicable requirements of ASTM “Specifications for Mortar and Grout for Reinforced Masonry” (C476).
- (e) The volume of aggregate in mortar shall be at least two and one-quarter times but not more than three times the volume of cementitious material.
- (f) Gypsum mortar shall be composed of one part of unfibered calcined neat gypsum to not more than three parts sand by weight. Only gypsum mortar shall be used with gypsum tile and block units.

**1402.12 – TYPES OF MORTAR REQUIRED**

Masonry shall be laid in mortar of the types specified in Tables 1, 2 and 3. Calcium chloride shall not be used in any mortar for any reason.

**TABLE 1 - TYPES OF MORTAR**

Type	Average Compressive Strength 2 inch cubes at 28 days, psi
M	2500
S	1800
N	750
O	350

**TABLE 2 - MORTAR PROPORTIONS BY VOLUME\***

Mortar Type	Portland Cement Cu. Ft.	Masonry Cement Cu. Ft.	Hydrated Lime or Lime Putty Cu. Ft.	Aggregate Measured in Damp Loose Condition Cu. Ft.
M	1	None	¼	Not less than 2¼ and not more than 3 times the sum of the volumes of cement and lime used.
	1	1	None	
S	1	None	Over ¼ to ½	
	½	1	None	
N	1	None	Over ½ to 1¼	
	None	1	None	
O	1	None	Over 1¼ to 2½	
	None	1	None	

\* For the purpose of these specifications, the weight of one cubic foot of the respective materials used shall be considered to be as follows:

Portland Cement	94 pounds
Masonry Cement	weight printed on bag
Hydrated Lime	40 pound
Lime Putty (Quicklime)	80 pounds
Sand, damp and loose	80 pounds of dry sand

**TABLE 3  
TYPE OF MORTAR REQUIRED**

Type of Masonry	Types of Mortar Permitted
Foundations: (Below grade masonry)	
Walls of Solid Units	M, S or N
Walls of Hollow Units	M or S
Hollow Walls	M or S
Masonry Other Than Foundation Masonry	
Piers of Solid Masonry	M, S or N
Piers of Hollow Units	M or S
Walls of Solid Masonry	M, S, N or O
Walls of Hollow Masonry	M, S or N
Hollow Walls and Cavity Walls	
(a) Design Wind Pressure Exceeds 20 psf.	M or S
(b) Design Wind Pressure 20 psf or less.	M, S or N
Glass Block Masonry	M, S or N
Non-Bearing Partition and Fireproofing	M, S, N, O or Gypsum
Gypsum Partition Tile or Block	Gypsum
Fire Brick	Refractory Air Setting
Masonry Other Than Above	M, S or N

**1402.13 – CERAMIC TILE**

- (a) Ceramic tile units shall be as defined in ASTM C242 and shall be of a quality at least equal to that required by American National Standards Institute.
- (b) Ceramic Tile set in cement mortar shall be installed in accordance with American National Standards Institute A108.1, A108.2 and A 108.3 1967 with mortar mixes as specified therein for particular uses.
- (c) Organic adhesive to be used in installing ceramic tile shall conform with requirements of American National Standards Institute A136.1.
- (d) Ceramic tile set in dry-set mortar shall be installed in accordance with American National Standards Institute A108.5 and the dry-set mortar shall conform with requirements of American National Standards Institute for Dry-Set Portland Cement Mortar, A118.1.

**1402.14 – METAL ANCHORS AND TIES**

Cross wire or metal anchors which serve as ties in multi-wythe masonry walls shall be of corrosion-resistant metal or shall be coated with a corrosion-resistant metal, or other approved coating. Where corrosion-resistant anchors, or ties are called for, they shall be copper-coated or zinc-coated or of other noncorrodible metal having equivalent corrosion-resistant qualities.

- (a) Zinc coatings on iron or steel shall conform to ASTM Specifications A153 Class B-1, B-2, or B-3.
- (b) Zinc coatings on wire shall conform to ASTM Specification A116 Class 1.
- (c) Copper coated wire shall conform to ASTM Specification B277 Grade 30 HS.

All wire used as anchors, joint reinforcement or ties shall conform to ASTM Specification A82. Steel bar reinforcement shall conform to ASTM Specification A615.

**1402.15 – PREFABRICATED JOINT REINFORCEMENT**

Prefabricated wire reinforcement for embedment in horizontal mortar joints shall consist of two or more smooth or deformed longitudinal wires weld connected to the cross wires. The distance between welded contacts of cross wires with each longitudinal wire shall not exceed six inches and 16 inches respectively for smooth and deformed longitudinal wire. Longitudinal wires and cross wires shall be not less than No. 9 gage where used in 3/8 inch or thicker mortar joints and not less than No. 12 gage where used in thinner mortar joints. Cross wires shall be corrosion-resistant and shall be not less than No.9 gage where joint reinforcement is used to bond the facing and backing of masonry or where joint reinforcement is used to bond cavity walls. The out-to-out spacing of longitudinal wires shall be such that the wires will be thoroughly embedded in the mortar joints. “Refer also to [Section 1407.8](#).”

**1402.16 – SURFACE BONDING CEMENT**

Hollow concrete masonry units for one story dwellings, utility buildings, warehouses and commercial buildings and multiple dwellings may use surface bonding cement applied in approximately 1/8” thicknesses in lieu of conventional mortar joints under the following conditions:

- (a) The pre-blended package mixture of portland cement and additives with glass fibers and a waterproofing agent must be mixed and applied according to the manufacturer’s instructions.
- (b) The minimum material strengths "as shown by yearly independent testing reports shall be”-:

(1) COMPRESSIVE	7 days	1500 psi
ASTM C109 or C349	28 days	2800 psi
(2” x 2” cubes)		
(2) FLEXURAL	7 days	500 psi
ASTM C348	28 days	1000 psi
(2” x 12” x ½” bars)		

- (c) Design:

- (1) Unreinforced Hollow Unit Masonry: Walls with a running bond pattern may be designed as unreinforced masonry based on Section 1403.7 of the Code with the following modifications. The allowable 28-day working stresses on the net cross-sectional masonry area of 6, 8 or 12-inch thick walls are as given in Table 4.
- (2) Surface bonding cement shall not be used for unreinforced cantilever walls unless provision is made for anchoring the wall at the base with grouted reinforcing according to Section 1403.7.



- (3) Bolt values in the Code for grouted masonry are not applicable to this type of construction, unless the entire embedded portion of the bolt is set in grout.
- (4) The first masonry course of all masonry bonded walls shall be set on a conventional wall footing or a thickened floor slab using a full mortar bed of Type S mortar.
- (5) Reinforced Hollow Unit Masonry: Walls with running bond may be designed in accordance with design criteria set forth in Section 1403.7, with the following restrictions:
  - (a) The value of  $f'_m$  shall not exceed 85 percent of  $f'_m$  determined in accordance with Section 1403.7 of the Code for grouted hollow concrete units.
  - (b) The modulus of elasticity and shear modulus shall be based on 60 percent of  $f'_m$ .
  - (c) The maximum  $h/t$  limitation for reinforced bearing walls is to remain the same.

**TABLE 4  
ALLOWABLE STRESSES<sup>4</sup> IN SURFACE BONDING CEMENT**

Allowable Stresses	Uninspected	Inspected <sup>5</sup>
Compression	75 psi	150 psi
Flexural Tension		
Vertical Span <sup>1</sup>	7 psi	14 psi
Horizontal Span	12 psi	24 psi
Racking Shear <sup>2</sup>	240 plf	480 plf
Modulus of Elasticity <sup>3</sup>	430000 psi	860000 psi

- <sup>1</sup> Values are also allowable for shear in flexure.
- <sup>2</sup> Values are for solid wall panels having a height/width ratio of one. Uplift forces are to be resisted by a mechanical means such as embedded reinforcement or other acceptable means.
- <sup>3</sup> Where determinations involve rigidity considerations in combination with other materials or where deflections are involved, the modulus of elasticity under the column for special inspection shall be used.
- <sup>4</sup> The stresses are based on masonry units complying with [Section 1402.4](#) and having the following characteristics:

NOMINAL WALL THICKNESS (Inches)	FACE SHELL THICKNESS (Inches)	MODIFIED DESIGN SECTION MODULUS (Inches Cubed)	MODIFIED DESIGN NET AREA (Inches Squared)
6	1	46	27
8	1¼	81	33
12	1½	160	39

(Where the Section Modulus and Net Area are for a 1-foot length of wall.)

- <sup>5</sup> For definition of inspected, see Specifications For the Design and Construction of Load-Bearing Concrete Masonry, NCMA or ACI Committee Report 531.

- (d) Where surface bonding mortar is to be used for multi-story construction, its use shall be determined by a structural analysis. The Building Official may require a copy of the structural analysis for his file. He may also require the designer or other qualified person to supervise the work.

## **SECTION 1403 WORKING STRESSES**

### **1403.1 – GENERAL REQUIREMENTS**

- (a) In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.
- (b) The thickness of masonry walls shall be sufficient at all points to withstand all vertical and horizontal loads as specified in Chapter 12, Minimum Design Loads.
- (c) Stresses shall be calculated on actual rather than nominal dimensions.
- (d) The maximum allowable stresses in masonry shall not exceed those set out in this section, unless it can be determined by accepted engineering analysis that the design meets all safety requirements; see Section 1403.3.

### **1403.2 – WORKING STRESSES IN UNREINFORCED MASONRY**

Except as permitted in other sections of this Code, the compressive stresses in unreinforced masonry shall not exceed the values given in [Table 5](#).

The eccentricity of vertical load and the effects of lateral load shall be considered.

### **1403.3 – HIGHER WORKING STRESSES**

Higher stresses than herein specified may be used, but only if it is clearly established to the satisfaction of the Building Official, by test, or other approved evidence, that material of a higher grade or a superior workmanship than is generally provided in accepted practice will be employed under approved inspection. The use of higher stresses, however, shall not be allowed until a statement, giving the reasons for such permission together with the facts and circumstances on which it is based, has been placed on file and made a part of the official record of the permit.

### **1403.4 – ALLOWABLE STRESSES IN COMPOSITE WALLS**

In composite walls or other structural members composed of different kinds or grades of masonry units or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the units and mortars of which the wall or member is composed.

### **1403.5 – ALLOWABLE STRESSES IN PLAIN CONCRETE**

Unless designed in accordance with the provisions of Chapter XVI, structural members of plain concrete shall be proportioned for allowable stresses not to exceed 25 percent for compression and 3 percent for tension in extreme fiber in flexure of the compressive strength of the concrete. When the ratio of height to thickness exceeds 10, the percentage for compression stress shall be reduced proportionately to 18 percent for a ratio of height to thickness of 20.

**TABLE 5  
ALLOWABLE COMPRESSIVE STRESSES IN UNIT MASONRY**

Construction; grade of unit	Allowable compressive stresses gross cross-sectional area (except as noted)			
	Type M Mortar	Type S Mortar	Type N Mortar	Type O Mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:				
	psi	psi	psi	psi
8,000 plus, psi .....	400	350	300	200
4,500 to 8,000 psi .....	250	225	200	150
2,500 to 4,500 psi .....	175	160	140	110
1,500 to 2,500 psi .....	125	115	100	75
Grouted <sup>1</sup> solid masonry brick and other solid units of clay or shale; san-lime or concrete brick:				
4,500 plus, psi .....	350	275	200	---
2,500 to 4,500 psi .....	275	215	155	---
1,500 to 2,500 psi .....	225	175	125	---
Solid masonry of solid concrete masonry units:				
Grade N .....	175	160	140	100
Grade S .....	125	115	100	75
Masonry of hollow units .....	85	75	70	---
Piers of hollow units, cellular spaces filled, as in <a href="#">Section 1405.6</a> .....				
	105	95	90	---
Hollow walls (cavity or masonry bonded) <sup>2</sup>				
Solid units:				
2,500, psi plus .....	140	130	110	---
1,500 to 2,500 psi .....	100	90	80	---
Hollow units .....	70	60	55	---
Stone ashlar masonry:				
Granite .....	800	720	640	500
Limestone or Marble .....	500	450	400	325
Sandstone or cast stone .....	400	360	320	250
Rubble stone, coursed, rough or random ...	140	120	100	80

<sup>1</sup> See Section 1410.

<sup>2</sup> On gross cross-sectional area of wall minus area of cavity between wythes (leaves). The allowable compressive stresses for cavity walls are based upon the assumption that the floor loads bear upon but 1 of the 2 wythes. When hollow walls and cavity walls are loaded concentrically, the allowable stresses may be increased by 25 percent.

**1403.6 – CONCENTRATED LOADS**

- (a) A fifty percent increase in the allowable working-stresses shown in [Table 5](#) shall be permitted for concentrated loads meeting the bearing requirements of [Section 1409.3](#) where such loads are supported upon *not less than a 4-inch height of solid masonry units or hollow masonry units with the cells filled solidly with mortar or grout*. The clear distance between the application of two adjacent concentrated loads on a wall shall be not less than the sum of the widths of the bearings or bearing plate
- (b) For piers and columns the bearing plate shall not exceed Sixty percent of the cross-sectional area of the pier or column and the resultant reaction of all vertical and horizontal loads shall fall within the middle third of the member.
- (c) Concentrated loads shall not be considered as distributed in masonry *laid in stack bond unless* one continuous 1/4-inch round reinforcing bar or its equivalent is placed in the horizontal bed joints for each 4 inches of wall thickness and spaced not less than 16 inches on centers vertically.

**1403.7 – ENGINEERED DESIGNS**

Where the height, thickness and lateral support of masonry construction is determined by a structural analysis, the requirements in Sections 1402, 1403, 1404, and 1405 may be waived in deference to design procedures and allowable stresses set forth in "Recommended Building Code Requirements for Engineering Brick Masonry", SCPI, or "Specification For the Design and Construction of Load-Bearing Concrete Masonry", NCMA or ACI Committee Report 531. The Building Official may require copy of structural analysis for his file. He may require the designer or other qualified person to supervise the work.

**SECTION 1404 WALL THICKNESS****1404.1 – GENERAL**

The minimum thickness of all masonry bearing or non-bearing walls shall be sufficient to resist or withstand all vertical or horizontal loads required by this Code and the fire-resistance requirements set out in Chapter X XV. (See Section 1403.7)

**1404.2 – THICKNESS OF BEARING WALLS**

The minimum thickness of masonry bearing walls shall be at least 12 inches in thickness for the uppermost 35 feet of their height and shall be increased 4 inches in thickness for each successive 35 feet or fraction thereof measured downward from the top of the wall.

**EXCEPTIONS:**

- (a) **STIFFENED WALLS:** Where solid masonry bearing walls are stiffened at distances not greater than 12 feet apart by masonry cross-walls or by reinforced concrete floors, they may be of 12-inch thickness for the uppermost 70 feet, measured downward from the top of the wall, and shall be increased 4 inches in thickness for each successive 70 ft. or fraction thereof.
- (b) **TOP STORY WALLS:** The top-story bearing wall of a building not exceeding 35 feet in height may be of 8-inch thickness, provided the roof construction imparts no lateral thrust to the walls, and providing the walls meet lateral support requirements of [Section 1405.1](#).

- (c) **ONE-STORY WALLS:** The walls of one story building may be not less than 8 inches in thickness and must meet all the requirements of (b) above.
- EXCEPTION:** The walls of one-story single family dwellings and private garages may be not less than 6 inches in thickness provided the following conditions are met.
- (1) The masonry units and mortar shall meet the minimum requirements of Section 1402.
  - (2) The height shall not exceed 20 feet.
  - (3) The roof construction shall impart no lateral thrust to the walls.
  - (4) The lateral support conditions must meet the requirements of [Section 1405.1](#).
- (d) **WALLS OF RESIDENCE BUILDINGS:** In residence buildings not more than three stones in height, walls other than coursed rough or random-rubble stone walls, may be 8-inch thickness when not over 35 feet in height, provided the roof is designed to impart no horizontal thrust. Such walls in one-story buildings or private garages may conform to exception (c) above, and the provisions of [Section 1405.1](#).
- (e) **PENTHOUSES AND ROOF STRUCTURES:** Masonry walls above roof level, 12 feet or less in height, enclosing stairways, machinery rooms, shafts, or penthouses, may be of 8-inch thickness and may be considered as neither increasing the height nor requiring any increase in the thickness of the wall below.
- (f) **WALLS OF PLAIN CONCRETE:** Plain concrete walls may be 2 inches less in thickness than required otherwise in this section but not less than 8 inches except that they may be 6 inches in thickness when meeting the provisions of exception (c) above.
- (g) **CAVITY WALLS:** Cavity walls shall not exceed 35 feet in height. The cavity between wythes shall be not less than 2 inches (actual) nor more than 4 inches in width, and the minimum wythe thickness shall be not less than 4 inches, except where 3-inch thick wythes are specifically permitted. The backing wythe shall be at least as thick as the facing wythe. (See Section 1401.)
- (1) Where both the facing and backing wythes have a thickness of 4 inches, the height of such cavity walls shall not exceed 25 feet.
  - (2) Where both the facing and backing wythes are composed of solid masonry units, the wythes may be 3-inches thick but the height of such cavity walls shall not exceed 20 feet.
- (h) **MASONRY BONDED HOLLOW WALLS:** Masonry bonded hollow walls shall not exceed 35 feet in height. The cavity between wythes shall not be less than 2 inches (actual) nor more than 4 inches in width, and the minimum wythe thickness shall not be less than 3 inches. The backing wythe shall be at least as thick as the facing wythe. (See Section 1401.)
- (i) **COMPOSITE OR FACED WALLS:** Neither the height of faced (composite) walls nor the distance between lateral supports shall exceed that prescribed for the masonry of either of the types forming the facing or the backing.
- (j) **STONE WALLS:** Rough or random or coursed rubble stone walls shall be 4 inches thicker than required for solid masonry walls of the same height, but in no case less than 16 inches in thickness.

### **1404.3 – THICKNESS OF NON-BEARING WALLS**

- (a) EXTERIOR NON-BEARING WALLS: Non-bearing exterior masonry walls may be 4 inches less in thickness than required for bearing walls but the thickness shall be not less than 8 inches except where 6-inch walls are specifically permitted.
- (b) EXTERIOR PANEL, APRON OR SPANDREL WALLS: Panel, apron or spandrel walls that do not exceed 13 ft. in height above their support shall not be limited in thickness, provided they meet the fire-resistance requirements of Chapter XXV and are so anchored to the structural frame as to insure adequate lateral support and resistance to wind or other lateral forces (See Section 608).

### **1404.4 – FOUNDATION WALLS**

See [Section 1301.3](#).

### **1404.5 – INTERIOR BEARING PARTITIONS**

The top three stories of Group R, B, E and I occupancies may be 8-inch in thickness provided the loads and stresses are not exceeded.

## **SECTION 1405 LATERAL SUPPORT**

### **1405.1 – EXTERIOR WALLS**

- (a) Exterior masonry walls, whether they be bearing or non-bearing shall be supported either horizontally or vertically (whichever distance is the lesser) at right angles to the face of the wall at intervals not exceeding those shown in [Table 6](#) except that an additional 6 ft. will be permitted for gables in residential structures and private garages that do not exceed one story in height. (See Section 1403.7.) Where a structural analysis indicates that the stresses in exterior walls containing openings exceed those permitted in Section 1403 the ratios in [Table 6](#) should be reduced accordingly.
- (b) The lateral support requirements in [Table 6](#) are minimum. In all cases the walls shall have sufficient strength to transfer all lateral and vertical loads without exceeding the stress limitations set forth in other sections of this code.

### **1405.2 – BEARING INTERIOR PARTITIONS**

Masonry bearing partitions shall be supported either vertically or horizontally (whichever distance is the lesser) at right angles to the face of the wall at intervals not exceeding 24 times the wall thickness for solid masonry units, and 20 times the wall thickness for hollow masonry units when laid in Type M, S or N mortar. Gypsum partition tile or block shall not be used in bearing walls. (See Section 1403.7)

### **1405.3 – NON-BEARING INTERIOR PARTITIONS**

- (a) Non-bearing partitions shall be supported either vertically or horizontally (whichever distance is the lesser) at right angles to the face of the wall at intervals not exceeding 45 times the nominal wall thickness exclusive of plaster for solid masonry or 36 times the nominal wall thickness exclusive of plaster for hollow masonry. (See Section 1403.7).

- (b) The height of freestanding (not supported at top or by pilasters) non-bearing partitions shall not exceed 22 times the nominal wall thickness for solid masonry or 15 times the nominal wall thickness for hollow masonry, provided that if the wall does not extend through the floor then dowels will be required to secure the wall to the floor slab.
- (c) Gypsum partition tile shall not be used for partitions to receive portland cement plaster, ceramic tile, marble or structural glass, unless self-furring metal lath is placed over the gypsum tile. Gypsum partition tile or block shall not be used where they will be subjected to continuous dampness
- (d) Only gypsum cement mortar shall be used in the erection of gypsum partition tile or block.

**1405.4 – METHOD OF SUPPORT**

- (a) Lateral support shall be provided by intersecting walls, pilasters, columns, or other vertical members of sufficient strength to provide the required support when the distance is measured horizontally; or by floors, roofs, or other horizontal structural elements which are of sufficient strength to provide the required support when the distance is measured vertically.
- (b) Sufficient bonding or anchorage shall be provided between the walls and its supports to resist the assumed wind or other horizontal forces acting either inward or outward. All structural elements relied upon for lateral support shall have sufficient strength and stability to transfer the horizontal force acting in either direction to adjacent structural members or to the ground. When floors or roofs are depended upon for receiving horizontal forces, provisions shall be made in the buildings to transfer the lateral forces to the ground.

**TABLE 6  
LATERAL SUPPORT EXTERIOR WALLS**

Wall Construction <sup>1</sup>	Design Wind Pressure psf <sup>2</sup>							
	15	20	25	30	35	40	45	50
	Maximum Ratio of Unsupported Height or Length to Thickness							
Grouted, solid brick or plain concrete walls	24	24	23	21	19	18	16	14
Solid Conc. Mas. Units	24	24	22	20	18	17	16	14
Hollow concrete Mas. Units or Mas. Bonded Hollow Walls	20	18	16	14	13	12	11	10
Cavity – Brick or Solid Concrete Mas. Unit <sup>3</sup>	20	17	15	14	13	12	11	10
Cavity – Hollow Conc. Mas. Units or Brick and Hollow Conc. Mas. Units <sup>3</sup>	15	13	12	10	10	9	8	7

<sup>1</sup> All masonry units to be laid in M, S, or N mortar. Where type N mortar is used and the wall spans in the vertical direction the ratios in Table 6 shall be reduced by 10 percent.

<sup>2</sup> Lateral support ratios may be determined by straight line interpolation between the nearest upper and lower design wind pressure values listed above.

<sup>3</sup> In computing the ratio for cavity walls the value of thickness shall be the sum of the nominal thickness or the inner and outer wythes.

### **1405.5 – PILASTERS**

- (a) **UNREINFORCED MASONRY:** When relied upon to provide the required lateral support to walls, the width of unreinforced pilasters shall be not less than one-tenth (1/10) the space between such pilasters and the thickness shall be not less than four (4) inches thicker than the wall supported. See (c) below.
- (b) **REINFORCED MASONRY AND OTHER REINFORCED PILASTERS:** May be the same thickness as the wall supported. See (c) below.
- (c) In all cases, pilasters shall have sufficient strength to transfer all lateral and vertical loads without exceeding the stress limitations set forth in other sections of this code.

### **1405.6 – PIERS**

The unsupported height of masonry piers shall not exceed 10 times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar. When hollow masonry units are solidly filled with concrete or Type M, S or N mortar, the allowable compressive stress may be increased as provided for in [Table 5](#).

## **SECTION 1406 PARAPET WALLS**

### **1406.1 – GENERAL**

- (a) Parapet walls may be of plain solid masonry, hollow masonry units, cavity wall design or reinforced masonry as provided in this section.
- (b) All parapet walls shall be properly coped with non-combustible, weatherproof material of a width not less than the thickness of the parapet wall.
- (c) Proper flashings shall be installed in such a manner as to prevent moisture entering the wall through the joints in the coping.
- (d) There shall be placed in all parapet walls scuppers or relief openings as close as practical to each downspout of not less than 4 to 6 inches in size and spaced not more than 6 inches above the roofline unless the roof is especially designed for water cooling, in which case the scuppers may be raised to provide for retaining the water.

### **1406.2 – PLAIN MASONRY PARAPET WALLS**

Parapet walls of plain solid masonry construction shall be not less than 8 inches in thickness and their height shall not exceed 4 times the nominal wall thickness. Parapet walls for fire walls and party walls shall be a minimum of 36 inches (Section 718). Parapet walls of plain hollow masonry construction shall be not less than 8" in thickness and their height shall not exceed 3 times the nominal wall thickness.

### **1406.3 – CAVITY WALL PARAPETS**

Cavity wall parapets may be used when the facing and backing are constructed of solid masonry units and when they conform to all of the other requirements for cavity walls, except their height shall not exceed 4 times the combined nominal thickness of the facing and backing masonry units.



### 1406.4 – REINFORCED MASONRY PARAPET WALLS

Unless reinforced to withstand safely wind loads to which they may be subjected, reinforced masonry parapet walls may be considered adequate if they conform to one of the following:

- (a) When solid masonry parapet walls are reinforced both horizontally and vertically with not less than ¼-inch rods spaced not more than 2 ft. on centers, the height shall be not more than 6 times the nominal wall thickness.
- (b) When solid masonry parapet walls are reinforced both horizontally and vertically with a minimum of ¼-inch round rods horizontally on 16-inch centers and 3/8-inch round rods vertically on 24-inch centers, the height shall not exceed 8 times the nominal wall thickness.

## SECTION 1407 BONDING

### 1407.1 – GENERAL

The facing and backing of masonry walls and partitions shall be bonded in such a manner to provide for common action of the wythes of the material used. Bonding may be accomplished as outlined in [Sections 1407.2, 1407.3, 1407.4, 1407.5, 1407.6, 1407.7, or 1407.8.](#)

### 1407.2 – BONDING WITH HEADERS

Where solid masonry, faced or composite wall construction is bonded by means of masonry headers, no less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches into the backing. The distance between adjacent full-length headers shall not exceed 24 inches either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 3 inches, or headers from opposite sides shall be covered with another header course overlapping the header below at least 3 inches.

### 1407.3 – BONDING WITH METAL TIES

- (a) Where solid masonry, cavity, faced or composite wall construction is bonded with metal ties, the ties shall be corrosion resistant 3/16 inch diameter metal ties or wire of equivalent stiffness embedded in the horizontal mortar joints. There shall be one metal tie for not more than each 3 square feet of wall area. Ties in alternate courses shall be staggered, the maximum vertical distance between ties shall not exceed 24 inches, and the maximum horizontal distance shall not exceed 36 inches. Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls the ends of ties shall be bent to 90 degree angles to provide hooks not less than 2 inches long. Additional bonding ties shall be provided at all openings spaced not more than 3 feet apart around the perimeter and within 12 inches of the opening. Walls bonded in accordance with this section shall conform to the allowable stress, lateral support, thickness (excluding cavity), height and mortar requirements for cavity walls unless the collar joint in such walls are filled with mortar.
- (b) Cavity walls shall be bonded in accordance with the requirements of [Section 1407.3 \(a\).](#)

**1407.4 – BONDING WITH HOLLOW MASONRY UNITS**

Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 3ft., by lapping at least 4 inches over the unit below or by lapping with units at least 50 percent greater in thickness than the unit below at vertical intervals not exceeding 17 inches, or bonded with corrosion-resistant metal ties conforming to the requirements of [Section 1407.3\(a\)](#).

**1407.5 – ASHLAR, NATURAL OR CAST STONE**

(a) CONSTRUCTION: In ashlar masonry, bond stones uniformly distributed shall be provided to the extent of not less than 10 percent of the area of exposed faces.

Rubble stone masonry 24 inches or less in thickness shall have bond stones with a maximum spacing of 3ft. vertically and 3ft. horizontally and, if the masonry is of greater thickness than 24 inches, shall have one bond stone for each 6 square ft. of wall surface on both sides.

(b) MINIMUM THICKNESS: Stone masonry walls shall in no case have a minimum thickness of less than 16 inches.

**1407.6 – MASONRY BONDED HOLLOW WALLS**

(a) In masonry bonded hollow walls, the facing and backing shall be bonded so that no less than 4 percent of the wall surface of each face is composed of masonry bonding units extending not less than 3 inches into the backing. The distance between adjacent bonders shall not exceed 24 inches either vertically or horizontally.

(b) Where the bonding units have a compressive strength of 4500 psi gross area, the facing and backing may be bonded so that not less than 2 percent of the wall area is composed of bonders.

(c) Both wythes of masonry bonded hollow wall shall be on a common support. Expansion joints shall be provided as required.

**1407.7 – STACK BOND OF MASONRY WALLS**

Where masonry units are laid in stack bond, continuous prefabricated joint reinforcement or other steel bar or wire reinforcement shall be embedded in the horizontal mortar beds at vertical intervals not to exceed 16 inches. The longitudinal bar or wire of such reinforcement shall be corrosion resistant and not less than No. 9 gage and at least one longitudinal bar or wire shall be provided for each 6 inches of wall thickness or fraction thereof.

**1407.8 – BONDING WITH PREFABRICATED JOINT REINFORCEMENT**

Where prefabricated joint reinforcement is used for the bonding of the facing and backing of stack bond, cavity, faced or composite, or other multi-wythe constructed, masonry walls, there shall be one cross wire serving as a tie for not more than each 2 ft. of wall area. The vertical spacing of the reinforcement shall not exceed 16 inches. Cross wires on prefabricated joint reinforcement shall be corrosion resistant and shall be not less than No. 9 gage.

## SECTION 1408 ANCHORAGE

### 1408.1 – GENERAL

All structural elements depending upon one another for continuity or support shall be securely anchored in such a manner as to resist all forces which might tend to separate the structural elements. It is particularly important that adequate anchorage be provided between the roof structure and load-bearing masonry walls to prevent the uplifting and subsequent separation of the roof from the masonry wall as the result of wind pressures.

### 1408.2 – ROOF ANCHORAGE

Roof structures shall be securely anchored to load-bearing masonry walls. Anchorage shall be provided to resist the wind forces set forth in Section 1205. Minimum anchorage shall be provided in one of the following manners or its equivalent. However, in all cases the anchor system shall comply with 1205.7.

- (a) Anchorage may be provided by ½-inch bolts extending a minimum of 15 inches into the masonry and spaced not more than 6 feet on centers. A steel plate having a minimum surface area of 6 square inches shall be securely attached to the head of the bolt and completely embedded in the masonry.
- (b) Where a continuous bond beam at least 8 inches deep and having a minimum continuous reinforcing of 0.2 square inches is provided at the top of the wall, anchorage may be provided by one of the following methods:
  - (1) Welding ½-inch anchor bolts to longitudinal reinforcing.
  - (2) Hooking tightly around the longitudinal reinforcing through 180°.
  - (3) Headed concrete anchors (½ inch round is the minimum stud diameter) with head below longitudinal reinforcing.

With this type of anchorage, bolt need only extend into the wall a minimum of 6 inches.

- (c) See Section 1205 for anchorage of roofs in areas of high winds.
- (d) When shown by structural analysis, alternate anchorage systems may be used.

### 1408.3 – FLOOR ANCHORAGE

- (a) Wood floor joists or beam bearing on masonry walls shall be securely anchored to the walls at intervals not exceeding 6 ft. by metal anchors having a minimum cross-section of 0.25 square inches and at least 16 inches long, securely fastened to the joists or beams at one end of the anchor by means of a single bolt or other approved method, and the other end of the anchor securely built not less than 3½ inches into the masonry. Where joists run parallel to walls, such anchors shall engage not less than 3 joists, and the joists shall be solidly bridged at the anchor.
- (b) Steel floor joists not supporting a concrete slab floor shall be anchored in a manner providing anchorage equivalent to that required for wood floor joists. Concrete slabs bearing on masonry walls shall be considered to provide adequate anchorage without additional anchorage.

**1408.4 – ANCHORING INTERSECTING WALLS AND PARTITIONS**

Masonry walls that meet or intersect shall be adequately bonded or anchored as follows:

- (a) Intersecting bearing walls may be bonded either by laying a true bond of at least 50 percent of the units at the intersection or by using corrosion-resistant metal ties embedded in the bed joints. When metal ties are used for such bonding, they shall be corrosion-resistant 3/16-inch diameter steel rods bent to a rectangular shape and spaced at intervals not exceeding 16 inches vertically. They shall be placed in such a manner as to extend at least 3 inches into each intersecting wall.
- (b) Non-bearing partitions, when intersecting walls or partitions, shall be anchored with metal ties or clips at least 7/8 inch wide and not less than 16 gage galvanized iron at intervals of not less than 32 inches vertically.

**SECTION 1409 MISCELLANEOUS DETAILS****1409.1 – CHANGE IN WALL THICKNESS**

Except for permissible chases and recesses, walls shall not vary in thickness between their lateral supports. Where cavity walls or walls of hollow masonry units are decreased in thickness, a course of solid masonry not less than 4 inches in thickness shall be interposed between the wall below and the thinner wall above, or the hollow units in the top course of the thicker wall shall be filled solidly with concrete or Type M, S, or N mortar.

**1409.2 – CHASES**

- (a) Chases in masonry walls shall not be deeper than 1/3 the wall thickness, nor longer than 1 ft. horizontally except that chases below windows may equal the width of the opening above.
- (b) No chase shall be cut or built in an 8-inch wall or within the required area of a pier, except that in buildings of residential occupancy not more than 2 stories in height, chases not more than 4 inches deep may be built in 8 inch walls.
- (c) Chases shall not be cut in cavity walls, hollow walls or walls of hollow units but, when permitted, may be built in.

**1409.3 – SUPPORTED STRUCTURAL MEMBERS**

- (a) When combustible structural members frame into walls of thicknesses not greater than 12 inches, they shall project not more than 4 inches into the wall and shall be so spaced that the distance between embedded ends is not less than 4 inches. The space above, below, and between such members shall be filled solidly with burnt-clay materials, mortar, concrete, or equivalent fire-resistive material to a depth of not less than 4 inches on all sides of the members.
- (b) Beams, joists, girders or other concentrated loads supported by a wall or pier shall have bearing at least 4 inches in length upon solid masonry or upon a bearing plate of adequate design and dimensions to distribute safely the loads on the wall or pier and in no case shall the stresses be greater than allowed in Section 1403.

**1409.4 – SUPPORT ON WOOD**

No masonry shall be supported on combustible construction, except that prefabricated partitions, weighing not more than 30 pounds per square foot, properly strapped or reinforced and provided with proper nailing devices for attachment may be supported on combustible construction, provided the supporting construction has been designed to carry such loads.

**1409.5 – CORBELLING**

The maximum horizontal projection of corbelling from the face of the wall from which it projects shall not exceed  $\frac{1}{2}$  of the nominal wall thickness. Individual corbels or the maximum projection of one unit shall not exceed  $\frac{1}{2}$  the height of the unit nor  $\frac{1}{3}$  its bed depth. For corbelling or chimneys see [Section 2700.3](#).

**1409.6 – ARCHES AND LINTELS**

The masonry above openings shall be supported by well buttressed arches or lintels of metal or masonry, plain or reinforced, which shall bear on the wall at each end for not less than 4 inches. In addition, the bearing area shall be sufficient to prevent a concentration of compressive stresses greater than those allowed in [Table 5](#), Section 1403.

**1409.7 – PROTECTION AGAINST FREEZING**

All masonry shall be protected against freezing for at least 24 hours after laying. No masonry shall be built upon frozen material.

**1409.8 – WETTING OF MASONRY UNITS**

- (a) Brick of clay or shale shall be wetted when laid unless their gain in weight is less than 0.025 ounces per square inch of surface when immersed flatwise in  $\frac{1}{8}$  inch of water for one minute.
- (b) Structural clay tile having absorptions (1-hour boil) of 12 percent or more shall be wetted before laying.

**1409.9 – CONSTRUCTION PRECAUTIONS**

Except when carried independently by girders at each floor, no wall shall be built up more than 25 feet in height in advance of other walls of the building. Walls shall be adequately braced during erection. Masonry walls in locations where they may be exposed to high winds during erection shall not be built higher than 10 times their thickness unless adequately braced or until provision is made for the prompt installation of permanent bracing at the floor or roof level immediately above the story under construction. Back fill shall not be placed against foundation walls until they have been braced to withstand the horizontal pressure.

**1409.10 – USE OF EXISTING WALLS**

- (a) An existing masonry wall may be used in the alteration or extension of a building, provided that under the new conditions it meets the requirements of this Code and is structurally sound or can be made so by reasonable repairs.
- (b) No existing wall shall be used for the alteration or extension of a building, or increased in height without specific written permission from the Building Official.

## SECTION 1410 PLAIN GROUTED MASONRY

### 1410.1 – GENERAL

- (a) Grouted masonry shall conform to all requirements of Section 1401 to 1409 inclusive, except as modified by this Section.
- (b) Plain grouted masonry is that form of construction made with clay, shale or concrete masonry units in which the interior joints are filled by pouring grout therein as the work progresses.
- (c) The masonry units in either the facing or backing, but not necessarily both, at the time of laying, shall absorb in 24 hours of cold immersion an amount of water weighing at least 5 percent of the dry weight of the unit.

### 1410.2 – MORTAR AND GROUT

- (a) Only Types M, S or N mortar shall be used. Grout shall be Types M, S or N mortars with the addition of sufficient water to give the required pouring consistency segregation of the constituents of the mortar.
- (b) In grout spaces of 2 inches or more in both horizontal dimensions, the grout may contain an addition of pea gravel equal to not more than 2 parts by volume of the cement. Such pea gravel shall be graded with not more than 5 percent passing the No. 8 sieve and with not less than 95 percent passing the 3/8-inch sieve.
- (c) Brick pieces or chips may be embedded into grout in such spaces, provided each piece or chip is surrounded by not less than 1/2 inch of grout.
- (d) Where the minimum continuous clear openings of a grout space exceeds 6 inches, it may be filled and treated as unreinforced monolithic concrete.

### 1410.3 – BOND

Where all interior joints are filled with grout, masonry headers shall not be used, but metal wall ties may be used to prevent spreading of the wythes and to maintain the vertical alignment of the wall.

### 1410.4 – CONSTRUCTION REQUIREMENTS

All masonry units in the 2 outer tiers or wythes shall be laid plumb with full bed and head joints. All interior joints shall be filled with grout. One of the outer tiers may be carried up not more than 8 inches before grouting, but the other face tier shall be carried up not more than 5 inches above the grout. Each pour of grout shall be stopped at least 1½ inches below the top and properly puddled. The longitudinal vertical joints (collar joints) shall be not less than ¾ inch in width.

## SECTION 1411 REINFORCED MASONRY

### 1411.1 – GENERAL REQUIREMENTS

- (a) Reinforced concrete masonry shall conform to the provisions of “Specification For the Design and Construction of Load-Bearing Masonry: NCMA” or “ACI Committee Report 531”.

- (b) Reinforced Clay-Brick Masonry shall conform to the provisions of “Recommended Building Code Requirements for Engineering Brick Masonry” – SCPI.
- (c) The Building Official may require a copy of the structural analysis (by an [Architect](#) or Engineer) for his file. He may require the designer or other qualified person to supervise the work.

## **SECTION 1412 REINFORCED GYPSUM CONCRETE**

### **1412.1 – GENERAL**

- (a) Reinforced Poured Gypsum Concrete shall conform to the requirements of “Specifications for Gypsum Concrete, ASTM C317.”
- (b) The design and application of reinforced gypsum concrete shall be in accordance with the requirements of “Specifications for Reinforced Gypsum Concrete, ANSI A59.1.”
- (c) A competent inspector, satisfactory to the Building Official, shall be present on the work at all times when cast-in-place gypsum concrete is being mixed or deposited.

## **SECTION 1413 STRUCTURAL GLASS BLOCK**

### **1413.1 – WHERE PERMITTED**

Masonry of glass blocks may be used in non-load-bearing exterior or interior walls and in openings which might otherwise be filled with windows, either isolated or in continuous bands, provided the glass block panels have a thickness of not less than 3½ inches at the mortar joint and the mortared surfaces of the block are satisfactorily treated for mortar bonding.

### **1413.2 – SIZE OF PANELS**

Glass block panels for exterior walls shall not exceed 144 square feet of unsupported wall surface nor 23 feet in length nor 20 feet in height between supports. For interior walls, glass block panels shall not exceed 250 square feet of unsupported area nor 25 feet in one direction between supports.

### **1413.3 – REINFORCEMENT OF EXTERIOR PANELS**

- (a) ANCHORAGE: Exterior glass block panels shall be held in place in the wall opening to resist both external and internal pressures due to wind. Panels shall be set in recesses at the jambs and, for panels exceeding 10 feet in horizontal dimension between supports, at the head as well, so as to provide a bearing surface at least one inch wide along the panel edges; except that when approved by the Building Official for panels exceeding neither 100 square feet in area nor 10 feet in either horizontal or vertical dimension, and situated 4 stories or less, anchorage may be provided by means of non-corrodible perforated metal strips.

- (b) **PLACING REINFORCEMENT:** Glass block panels shall have reinforcement in the horizontal mortar joints, extending from end to end of mortar joints, but not across expansion joints, with any unavoidable joints spliced by lapping the reinforcement not less than 6 inches. The reinforcement shall be spaced not more than 2 feet apart vertically. In addition reinforcements shall be placed in the joint immediately below and above any openings within a panel. The reinforcement shall consist of 2 parallel, longitudinal, galvanized steel wires, No. 9 gage or larger, spaced 2 inches apart, and having welded thereto No. 14 or heavier gage cross wires at intervals not exceeding 8 inches, or the equivalent approved by the Building Official.

#### **1413.4 – MORTAR**

Glass block shall be laid in Type M, S or N mortar. Both vertical and horizontal mortar joints shall be at least 1/4 inch and not more than 3/8 inch thick and shall be completely filled.

#### **1413.5 – EXPANION JOINTS**

Every exterior glass block panel shall be provided with expansion joints at the sides and top. Expansion joints shall be entirely free of mortar, and shall be filled with resilient material.

### **SECTION 1414 VENEERED WALLS**

#### **1414.1 – GENERAL**

- (a) Veneer as used in this section refers to a facing of brick, tile, concrete, masonry units, metal, including metal coated with porcelain enamel, glass or similar material securely attached to a wall for the purpose of providing ornamentation, protection, or insulation but not so bonded as to exert a common reaction under load.
- (b) Veneer shall not be assumed as supporting any load other than its own weight, neither shall it be assumed to add to the strength of the wall.
- (c) Exterior veneer shall not be attached to wood at any point more than 20 feet above the adjacent ground elevation.

#### **1414.2 – VENEER OF STRUCTURAL MASONRY UNITS**

Veneer of structural masonry units shall apply to all veneer composed of units meeting the physical requirements of this Chapter, set in mortar and not less than 1-5/8 inches in actual thickness for solid masonry units, and not less than 3 inches in actual thickness for hollow masonry units.

#### **1414.3 – SUPPORT OF VENEER OF MASONRY UNITS**

The weight of all masonry veneer 1-5/8 inches or greater in actual thickness shall be supported upon footings, foundation walls or other approved non-combustible structural supports.

#### **1414.4 – ANCHORAGE OF VENEER OF MASONRY UNITS**

- (a) All masonry veneer 1-5/8 inches or greater in actual thickness shall be attached to the supporting wall either by headers as provided in [Section 1407.2](#), or with corrosion-resistant metal ties or other approved methods.



- (b) Veneer ties, if of strand wire, shall be not less than No.6 W. & M. gage wire with the end of the wire bent to a 90-degree angle to form a hook not less than 2 inches long embedded in the mortar joint. Veneer ties, if of corrugated sheet metal, shall be not less than 22 U.S. gage. Each metal tie shall support not more than 3 square feet of wall area and shall not be spaced farther apart than 16 inches vertically and 32 inches horizontally.
- (c) Brick or tile facing against concrete shall be anchored to the concrete by the use of dovetailed anchors inserted in slots built into the concrete. Anchors shall be at least 7/8 inch wide and not less than 16 gage galvanized iron. They shall be spaced not more than 18 inches vertically and 24 inches horizontally.
- (d) Two-inch split furring and 2-inch open back (split) tile (soaps) shall be anchored to the backing with hardware cloth ties consisting of 1/2 inch mesh, No. 20 gage galvanized iron fabric, at least 4 inches wide and extending at least 3 inches into the masonry and to within 1/2 inch of the face of the furring, or by other approved ties. Ties shall be spaced not farther apart than 24 inches vertically and 36 inches horizontally.

#### **1414.5 – HEIGHT OF VENEER OF MASONRY UNITS**

- (a) Masonry veneer 1-5/8 inches or greater in thickness shall not be attached to wood framing at any point more than 20 feet above the foundation, except in gables. Such veneer attached to masonry walls shall not exceed 35 feet in height above approved supports.
- (b) All masonry veneer extending more than 35 feet from the ground shall be supported at each floor level with compressible joints below the supporting shelf angles.

#### **1414.6 – VENEER OF NON-STRUCTURAL UNITS**

Veneer of non-structural units shall apply to all veneer less than 1-5/8 inches in thickness and the units shall not be assumed to support any superimposed loads.

#### **1414.7 – ANCHORAGE GENERAL**

Non-structural materials used as veneer shall be anchored to the supporting wall by corrosion-resistant metal ties not less in thickness than No.9 W. & M. gage wire, and spaced not more than 12 inches apart both horizontally and vertically or by other approved devices or methods. Such attachments and their supports shall be capable of resisting a horizontal force equal to the wind loads specified in this Code, but in no case less than 20 pounds per square foot.

#### **1414.8 – ADHESION TYPE ANCHORAGE**

- (a) MATERIAL: Approved units or units less than 1-5/8 inches in thickness of flat tile, stone or adhesion type architectural terra cotta manufactured with keyed or scored back surface may be cemented to a masonry or concrete wall or to exterior portland cement mortar on high rib metal lath with a Type M or S mortar provided the mortar bond is sufficient to withstand a shearing stress of 50 pounds per square inch after curing for 28 days. No individual unit so attached shall exceed 30 inches in any one dimension and shall not have more than 540 sq. inches of superficial face area.

- (b) **INSTALLATION:** Just before setting, each piece shall be soaked in clean water for one hour or more and the surface of the backing wall shall be saturated with water applied through the hose nozzle at a pressure of at least 25 pounds per square inch. A brush coat of neat portland cement and water shall then be applied both to the backing and the back side of the veneer. The mortar shall average 3/4 inch in thickness. One-half of the mortar (3/8 inch) shall be applied to the veneer unit and half to backing just prior to setting. Pieces distributed after having been tapped into place shall be removed immediately, after which additional mortar shall be applied as required above and the piece reset.

**1414.9 – METAL VENEER – REQUIREMENTS**

- (a) **MATERIAL:** Metal veneers that are exposed to the weather shall be of corrosion-resistant metal, or metal covered front and back with porcelain enamel or given other approved treatment or coating to render them corrosion-resistant.
- (b) **ATTACHMENT:** Exterior metal veneer shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other approved devices or methods. The spacing of the fastenings or ties shall not exceed 24 inches either vertically or horizontally, except where wider spacing is deemed adequate and specifically approved by the Building Official; but where units exceed 4 sq. ft. in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by No. 9 W. & M. gage wire (0.0173 square inch). Such attachments and their supports shall be capable of resisting a horizontal force equal to the wind loads specified in this Code, but in no case less than 20 pounds per square foot.
- (c) **SUPPORTS:** Metal supports for exterior metal veneer shall be protected by painting, galvanizing, or by other approved equivalent coating or treatment. Wood studs, furring strips, or other wood supports for exterior metal veneer shall be pressure treated with an approved preservative or otherwise protected against decay in an approved manner.
- (d) **PROTECTION:** All joints and edges in metal veneer that are exposed to the weather shall be caulked or painted with approved durable waterproofing material, or shall be protected by other approved means to prevent penetration of moisture.

No masonry backup shall be required for metal veneer except as is necessary to meet the fire-resistance requirements of this Code.

- (e) **GROUNDING METAL VENEERS:** Metal veneers fastened to supporting elements which are not a part of the grounded metal framing of a building shall be made electrically continuous by contact or interconnection of individual units and shall be effectively grounded. The conductor used to ground the veneer shall have no greater resistance than the conductor used to ground the electrical system within the building. Where a metal veneer is applied to a building with no electrical wiring system, grounding shall be required only if determined to be necessary by the Building Official.

**1414.10 – GLASS VENEER – REQUIREMENTS**

- (a) **AREA:** The area of a single section of thin exterior structural glass veneer shall not exceed 10 sq. ft. where not more than 15ft. above the level of the sidewalk or grade level directly below, and shall not exceed 6 sq. ft. where more than 15ft. above that level.

- (b) **LENGTH OR HEIGHT:** The length or height of any section of thin exterior structural glass veneer shall not exceed 49 inches.
- (c) **THICKNESS:** The thickness of thin exterior structural glass veneer shall be not less than 11/32 inch.

#### **1414.11 – ATTACHMENT**

Thin exterior structural glass veneer shall be set only after backing is thoroughly dry and after application of an approved bond coat applied uniformly over the entire surface of the backing so as to effectively seal the surface. Glass shall be set in place with an approved mastic cement in sufficient quantity so that at least 50 percent of the area of each glass unit is directly bonded to the backing by mastic not less than 1/4 inch thick and not more than 5/8 inch thick. Bond coat and mastic shall preferably be from the same manufacturer and shall bond firmly together.

#### **1414.12 – GLASS AT SIDEWALK LINE**

Where glass extends to sidewalk surface, each section shall rest in an approved metal molding, and set at least 1/4 inch above the highest point of the sidewalk. The space between the molding and the sidewalk shall be thoroughly caulked and made watertight.

#### **1414.13 – JOINTS**

- (a) **ABUTTING EDGES:** Unless otherwise specifically approved by the Building Official, all abutting edges of thin exterior structural glass veneer shall be ground square. Mitered joints shall not be used except when specifically approved for wide angles.
- (b) **TREATMENT OF JOINTS:** All joints shall be uniformly buttered with an approved jointing compound and all horizontal joints shall be held to not less than 1/16 inch by an approved non-rigid substance or device.
- (c) **EXPANSION JOINTS:** Where thin exterior structural glass veneer abuts non-resilient material at sides or top, expansion joints not less than 1/4 inch wide shall be provided.

#### **1414.14 – SHELF ANGLES**

When thin exterior structural glass veneer is installed above the level of the top of a bulkhead facing, or at a level more than 36 inches above the sidewalk level, the mastic cement binding shall be supplemented with approved non-ferrous metal shelf angles located in the horizontal joints in every course. Such shelf angles shall be of not less than 18 U.S. gage and not less than 2 inches in length, and shall be spaced at approved intervals, with not less than 2 angles for each glass unit. Shelf angles shall be secured to the wall or backing with expansion bolts, toggle bolts, or by other approved methods.

#### **1414.15 – MECHANICAL FASTENINGS**

- (a) **WHERE REQUIRED:** All thin exterior structural glass veneer installed above the level of the heads of show windows and all such veneer installed more than 12 feet above sidewalk level, shall, in addition to the mastic cement and shelf angles, be held in place by the use of approved fastenings at each vertical or horizontal edge, or at the 4 corners of each glass unit.
- (b) **ATTACHMENT TO BACKING:** Fastenings shall be secured to the wall or backing with expansion bolts, toggle bolts, or by other approved method.

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- (c) **TYPE AND DESIGN:** Fastenings shall be of approved type and be so designed as to hold the glass veneer in a vertical plane independently of the mastic cement. Shelf angles providing both support and fastenings may be used.

### **1414.16 – FLASHING**

Exposed edges of thin exterior structural glass veneer shall be flashed with overlapping corrosion-resistant metal flashing and caulked with a waterproof compound in an approved manner to effectively prevent the entrance of moisture between the glass veneer and the backing.

## **CHAPTER 15**

### **STEEL CONSTRUCTION**

#### **SECTION 1501 GENERAL**

The quality, design, fabrication and erection of steel and iron used structurally in buildings or structures shall conform to the provisions of Sections 1502 through 1509 of this chapter.

#### **SECTION 1502 STRUCTURAL STEEL CONSTRUCTION**

The design, fabrication and erection of structural steel for buildings shall conform to the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of American Institute of Steel Construction.

#### **SECTION 1503 COLD-FORMED STEEL CONSTRUCTION**

The design, fabrication and erection of cold-formed steel construction shall conform to the Specification for the "Design of Cold-Formed Steel Structural Members" of American Iron and Steel Institute, and Addendum No. 1 and Addendum No. 2.

All individual structural members and assembled panels of cold-formed steel construction, except where fabricated of approved corrosion-resistive steel or of steel having corrosion-resistive metallic or other approved coating, shall be protected against corrosion with an acceptable shop coat of paint, enamel, or other approved protection.

#### **SECTION 1504 COLD-FORMED STAINLESS STEEL CONSTRUCTION**

The design, fabrication and erection of cold-formed stainless steel construction shall conform to the "Specification for the Design of Cold-Formed Stainless Steel Structural Members" of American Iron and Steel Institute.

#### **SECTION 1505 OPEN WEB STEEL JOIST CONSTRUCTION**

The design, fabrication and erection of open web steel joist construction shall comply with the following specifications:

"Standard Specifications for Open Web Steel Joists, H-Series" adopted by American Institute of Steel Construction and Steel Joist Institute.

"Standard Specifications for Longspan Steel Joists, LH-Series, and Deep Longspan Steel Joists, DW- and DLH-Series" adopted by American Institute of Steel Construction and Steel Joist Institute.

"Standard Specifications for Joist Girders", adopted by Steel Joist Institute.

#### **SECTION 1506 STRUCTURAL STEEL CABLES**

The design, deflection, connections, protective coatings, fabrication, erection and inspection of building construction utilizing steel cables shall conform to the "Criteria for Structural Applications of Steel Cables for Building" of American Iron and Steel Institute.

### **SECTION 1507 WELDING**

Details of design, workmanship and technique for welding, inspection of welding and qualification of welding operators shall conform to the “Structural Welding Code” of American Welding Society, AWS D1.1. Details for welding steel sheets shall conform to the “Specification for Welding Sheet Steel in Structures”, AWS D1.3, by the American Welding Society.

### **SECTION 1508 HIGH STRENGTH BOLTS**

The design and assembly of structural joints and connections using high-strength steel bolts shall conform to the “Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts”, approved by the Research Council of Structural Connections of the Engineering Foundation.

### **SECTION 1509 GENERAL REQUIREMENTS**

The delivery of rolled steel plates, shapes, sheet piling, and bars for structural use shall conform to the “Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use”, ANSI/ASTM A6, approved by American Society for Testing and Materials.

## **CHAPTER 16**

### **CONCRETE CONSTRUCTION**

#### **SECTION 1601 GENERAL**

All structures of reinforced concrete, including prestressed concrete, shall be designed and constructed in accordance with the provisions of “Building Code Requirements for Reinforced Concrete (ACI 318)”.

Structural members of plain concrete may be designed and constructed in accordance with the provisions of “Building Code Requirements for Structural Plain Concrete”, ACI 322.

#### **SECTION 1602 CONCRETE QUALITY**

##### **1602.1 – GENERAL**

- (a) Concrete shall be proportioned and produced to provide an average compressive strength sufficiently high to minimize the frequency of strength tests below the value of the specified compressive strength of the concrete,  $f'_c$ . See Section 1602.2(b)(1).
- (b) Requirements for  $f'_c$  shall be based on tests of cylinders made and tested in accordance with ASTM methods as prescribed in Section 1602.2 and 1602.3.
- (c) Unless otherwise specified,  $f'_c$  shall be based on 28-day tests. For high-early strength concrete, the test age for  $f'_c$  shall be as indicated in the plans or specifications.

##### **1602.2 – SELECTION OF CONCRETE PROPORTIONS**

- (a) Proportions of ingredients for concrete shall be established on the basis of paragraphs (b) through (h) of this section to provide:
  - (1) Conformance with the strength test requirements of Section 1602.3.
  - (2) Adequate workability and proper consistency to permit the concrete to be worked readily into the forms and around reinforcement under the conditions of placement to be employed, without excessive segregation or bleeding.
  - (3) Resistance to freezing and thawing and other aggressive actions, where required.

The criteria of paragraphs (b) through (d) of this Section are solely for the purpose of establishing required mixture proportions and do not constitute a basis for conforming the adequacy of concrete strength, which is covered in Section 1602.3.

- (b) Except as permitted in Paragraph (d) or required by Paragraphs (e), (f) or (g) of this Section, proportions, including water-cement ratio, shall be established on the basis either of laboratory trial batches or of field experience with the materials to be employed. The proportions shall be selected to produce an average strength at the designated test age exceeding  $f'_c$  by the amount indicated below, when both air content and slump are the maximums permitted by the specifications.

- (1) Where the concrete production facility has a record, based at least 30 consecutive strength tests representing similar materials and conditions to those expected, the strength used as the basis for selecting proportions shall exceed the required  $f'c$  by at least:

- 400 psi if the standard deviation is less than 300 psi
- 550 psi if the standard deviation is 300 to 400 psi
- 700 psi if the standard deviation is 400 to 500 psi
- 900 psi if the standard deviation is 500 to 600 psi

Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at least 30 consecutive tests or the statistical average for two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.

- (2) If the standard deviation exceeds 600 psi or if a suitable record of strength test performance is not available, proportions shall be selected to produce an average strength at least 1200 psi greater than the required  $f'c$ .

Using the methods of "Recommended Practice for Evaluation of Compression Test Results of Field Concrete (ACI 214)," the amount by which the average strength must exceed  $f'c$  may be reduced to an appropriate level below 1200 psi after sufficient test data become available from the job to indicate that, at the lower average strength, the probable frequency of tests more than 500 psi below  $f'c$  will not exceed 1 in 100 and that the probable frequency of an average of three consecutive tests below  $f'c$  will not exceed 1 in 100.

- (c) When laboratory trial batches are used as the basis for selecting concrete proportions, strength tests shall be made in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39) on specimens prepared in accordance with "Method of Making and Curing Test Specimens in the Laboratory" (ASTM C192). A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The curve shall be based on at least three points representing batches which produce strengths above and below that required. Each point shall represent the average of at least three specimens tested at 28 days or the earlier age designated.

The maximum permissible water-cement ratio (or minimum cement content) for the concrete to be used in the structure shall be that shown by the curve to produce the average strength indicated in Paragraph (b) unless a lower water-cement ratio or higher strength is required by Paragraphs (e), (f), or (g) of this Section.



(d) If suitable data from trial batches or field experience cannot be obtained, permission may be granted to base concrete proportions on the water-cement ratios and cement factors shown in Table 1602.2A. This table shall be used only for concrete to be made with cements meeting the strength requirements for Type I, Type II, or Type III *or, for air-entrained concrete only, Type IA, Type IIA, or Type IIIA of "Specification for Portland Cement" (ASTM C150)*, and shall not be applied to concrete containing lightweight aggregates or admixtures other than those for entraining air. Application of this method for estimating proportions does not remove the requirement to meet compressive strength test criteria of Section 1602.3 and the water-cement ratio limits of Paragraphs (e), (f) and (g) of Section 1602.2.

**TABLE 1602.2A – MAXIMUM PERMISSIBLE WATER-CEMENT RATIOS AND MINIMUM CEMENT CONTENTS FOR CONCRETE (WHEN STRENGTH DATA FROM TRIAL BATCHES OR FIELD EXPERIENCE ARE NOT AVAILABLE)**

Specified compressive strength f'c psi*	Minimum sks. cement per cu. yd. concrete	Maximum permissible water-cement ratio			
		Non-air-entrained concrete		Air-entrained concrete	
		Absolute ratio by weight	U.S. gal. per 94-lb. bag of cement	Absolute ratio by weight	U.S. gal. per 94-lb. bag of cement
2500	5	0.65	7.3	0.54	6.1
3000	5½	0.58	6.6	0.46	5.2
3500	6	0.51	5.8	0.40	4.5
4000	6½	0.44	5.0	0.35	4.0
4500	7	0.38	4.3	0.30	3.4
5000	7½	0.31	3.5	**	**

\* 28-day strengths for cements meeting strength limits of ASTM C150 Type I, IA, II or IIA and 7-day strengths for Type III and IIIA; with most materials, the water-cement ratios and cement contents shown will provide average strengths greater than indicated in Section 1602.2(b) as being required.

\*\* For strengths above 4500 psi with air-entrained concrete, proportions should be selected by the methods of Sections 1602.2(b) and (c).

(e) Concrete that, after curing, will be subject to freezing temperatures while wet shall contain entrained air within the limits of Table 1602.2B. For such concrete made with normal weight aggregate, the water-cement ratio shall not exceed 0.53 by weight. When the concrete is made with lightweight aggregate, the specified compressive strength f'c shall be at least 3000 psi.

**TABLE 1602.2B – CONCRETE AIR CONTENT FOR VARIOUS SIZES OF CONCRETE AGGREGATE**

Nominal maximum size of coarse aggregate, in.	Total air content, percent by volume
3/8	6 to 10
1/2	5 to 9
3/4	4 to 8
1	3.5 to 6.5
1½	3 to 6
2	2.5 to 5.5
3	1.5 to 4.5

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- (f) When made with normal weight aggregate, concrete that is intended to be watertight shall have a maximum water-cement ratio of 0.48 for exposure to fresh water and 0.44 for exposure to sea water. With lightweight aggregate, the specified compressive strength  $f'_c$  shall be at least 3750 psi for exposure to fresh water and 4000 psi for exposure to sea water.
- (g) Concrete that will be exposed to injurious concentrations of sulfate-containing solutions shall conform to Paragraph (f) above and be made with sulfate-resisting cement.
- (h) Where different materials are to be used for different portions of the work, each combination shall be evaluated separately.

### **1602.3 – EVALUATION AND ACCEPTANCE OF CONCRETE**

- (a) Samples for strength tests of each class of concrete shall be taken not less than once a day nor less than once for each 150 cu. yd. of concrete or for each 5000sq. ft. of surface area placed. The samples for strength tests shall be taken in accordance with “Method of Sampling Fresh Concrete” (ASTM C172). Cylinders for acceptance tests shall be molded and laboratory-cured in accordance with “Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field” (ASTM C31) and tested in accordance with “Method of Test for Compressive Strength of Molded Concrete Cylinders” (ASTM C39). Each strength test result shall be the average of two cylinders from the same sample tested at 28 days or the specified earlier age.
- (b) When the frequency of testing of Paragraph (a) above will provide less than five tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five are used. When the total quantity of a given class of concrete is less than 50 cu. yd., the strength tests may be waived by the Building Official if, in his judgment, adequate evidence of satisfactory strength is provided.
- (c) The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the required  $f'_c$  and no individual strength test results fall below the required  $f'_c$  by more than 500 psi.
- (d) Strength tests of specimens cured under field conditions in accordance with Section 7.4 of “Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field” (ASTM C31) may be required by the Building Official to check the adequacy of curing and protection of the concrete in the structure. Such specimens shall be molded at the same time and from the same samples as the laboratory cured acceptance test specimens. Procedures for protecting and curing the concrete shall be improved when the strength of field-cured cylinders at the test age designated for measuring  $f'_c$  is less than 85 percent of that of the companion laboratory-cured cylinders. When the laboratory-cured cylinder strengths are appreciably higher than  $f'_c$  the field-cured cylinder strengths need not exceed  $f'_c$  by more than 500 psi even though the 85 percent criterion is not met.

- (e) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below  $f'c$  or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate that the load carrying capacity may have been significantly reduced, tests of cores drilled from the area in question may be required in accordance with “Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete” (ASTM C42). Three cores shall be taken for each case of a cylinder test more than 500 psi below  $f'c$ . If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 F. relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.
- (f) Concrete in the area represented by the core tests will be considered structurally adequate if the average of the three cores is equal to at least 85 percent of  $f'c$  and if no single core is less than 75 percent of  $f'c$ . To check testing accuracy, locations represented by erratic core strengths may be retested. If these strength acceptance criteria are not met by the core tests, and if structural adequacy remains in doubt, the responsible authority may order load tests as outlined in “Building Code Requirements for Reinforced Concrete” ACI 318, Chapter 20, for the questionable portion of the structure, or take other action appropriate to the circumstances.

### **SECTION 1603 MINIMUM SLAB THICKNESS**

The minimum thickness of concrete floor slabs supported directly on the ground shall be not less than three and one-half inches ( $3\frac{1}{2}$ "") unless designed by an [architect](#) or engineer. An approved vapor barrier shall be installed underneath the slab.

### **SECTION 1604 VERMICULITE CONCRETE**

Vermiculite concrete, when used in roof systems and slabs-on-grade, shall comply with the “Specifications for Vermiculite Concrete Roofs and Slabs-on-Grade, ANSI A122.1.”

### **SECTION 1605 WALLS**

Except as permitted by ACI Code (ACI 318) reinforced concrete walls shall conform to the limitations of this section.

- (a) Reinforced concrete bearing walls shall have a thickness of at least  $1/25$  of the unsupported height or width, whichever is the shorter.
- (b) Reinforced concrete bearing walls of buildings shall be not less than 6 inches thick for the uppermost 15 feet of their height; and for each successive 25 feet downward, or fraction thereof, the minimum thickness shall be increased 1 inch. Reinforced concrete bearing walls of two story dwellings may be 6 inches thick throughout their height, provided that the permissible load provided in ACI 318 Chapter 14 is not exceeded.

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- (c) The area of the horizontal reinforcement of reinforced concrete walls shall be not less than 0.0025 and that of the vertical reinforcement not less than 0.0015 times the area of the wall. These values may be reduced to 0.0020 and 0.0012, respectively, if the reinforcement is not larger than 5/8 inch in diameter and consists of either welded wire fabric or deformed bars with a specified yield strength of 60,000 psi or greater.
- (d) Walls more than 10 inches thick, except for **basement** walls, shall have the reinforcement for each direction placed in two layers parallel with the faces of the wall. One layer consisting of not less than one-half and not more than two-thirds the total required shall be placed not less than 2 inches nor more than one-third the thickness of the wall from the exterior surface. The other layer, comprising the balance of the required reinforcement, shall be placed not less than 3/4 inch and not more than one-third the thickness of the wall from the interior surface. Bars, if used, shall not be less than #3 bars, nor shall they be spaced more than 18 inches on centers. Welded wire reinforcement for walls shall be in flat sheet form.
- (e) In addition to the minimum prescribed in (c) there shall be not less than two #5 bars around all window or door openings. Such bars shall extend at least 24 inches beyond the corner of the openings.
- (f) Reinforced concrete walls shall be anchored to the floors, or to the columns, pilasters, buttresses, and intersecting walls with reinforcement at least equivalent to #3 bars 12 inches on centers, for each layer of wall reinforcement.
- (g) Panel and enclosure walls of reinforced concrete shall have a thickness of not less than 4 inches and not less than 1/30 of the distance between the supporting or enclosing members.
- (h) Exterior **basement** walls and foundation walls shall not be less than 8 inches.
- (i) Prestressed concrete walls (cast-in-place or precast) shall be designed in accordance with ACI 318 and Prestressed Concrete Institute Design Handbook.

### SECTION 1606 FOOTINGS

- (a) In reinforced concrete footings, the thickness above the reinforcement at the edge shall be not less than 6 inches for footings on soil, nor less than 12 inches for footings on piles.
- (b) In unreinforced concrete footings, the thickness at the edge shall be not less than 8 inches for footings on soil, nor less than 14 inches above the tops of the piles for footings on piles.

### SECTION 1607 COLD WEATHER CONCRETING

When the mean daily temperature is below 40°F on the day of placing the concrete or the day following the placing, the concrete shall be placed and protected according to the ACI Standard "Recommended Practice for Cold Weather Concreting (ACI 306)." There shall be one exception to the provision of ACI 306 which is: Calcium chloride shall not be used in prestressed concrete and for all concrete which will contain embedments of or remain in contact with aluminum, galvanized metal or prestressed concrete.

Calcium chloride may be used as an additive in plain and reinforced concrete in amounts not to exceed 2% by weight of the cement only if it is not injurious to the physical or chemical characteristics of the resulting concrete.

# CHAPTER 17

## WOOD CONSTRUCTION

### SECTION 1700 GENERAL

#### 1700.1 – GENERAL

- (a) The quality and design of wood members and their fastenings used for load supporting purposes shall conform to good engineering practice.
- (b) All members shall be framed, anchored, tied and braced so as to develop the strength and rigidity necessary for the purposes for which they are used.
- (c) Preparation, fabrication and installation of wood members and the glues, connectors, and mechanical devices for the fastening thereof shall conform to good engineering practices.
- (d) The detailed requirements contained in this Chapter are based on sound engineering principles such as those in the Standards hereunder and are intended for light frame construction in general use for structures having light loads and closely spaced framing. Where additional structural requirements should be applied because of the nature of the structure, the Standards hereunder shall be accepted as good engineering practice.
- (e) For heavily loaded or engineered timber construction, structural design based on the recommendations of the Standards hereunder shall be accepted as conformance with good engineering practice. Other sections of this Chapter which are applicable, shall apply to heavily loaded or engineered timber construction as well as light frame construction.
- (f) For engineered plywood and structural-use panel diaphragm design, the Supplement A to Chapter XVII shall apply.

National Forest Products Association:

National Design Specification – Wood Construction and Supplement thereto.

Wood Construction Data No. 5 – Heavy Timber Construction Details.

American Institute of Timber Construction:

Timber Construction Standards – AITC 100.

Inspection Manual – AITC 200.

Timber Construction Manual – Second Edition. Part II Only

Standard Specifications for Structural Glued Laminated Timber of Douglas Fir, Western Larch, Southern Pine and California Redwood AITC 117, including supplements 2 and 3.

Standard Specifications for Hardwood Glued Laminated Timber AITC 119.

Standard Specifications for Structural Glued Laminated Timber Using “E” Rated and Visually Graded Lumber of Douglas Fir, Southern Pine, Hem-Fir, and Lodgepole Pine, AITC 120.

American Plywood Association:

Plywood Design Specification .....	APA
Design and Fabrication Specifications for Plywood-Lumber Components .....	APA
APA Design/Construction Guide – Residential & Commercial .....	APA
Performance Standards and Policies for Structural-Use Panels .....	APA
Cantilevered In-Line Joist System .....	APA

Truss Plate Institute, Inc.:

Design Specification for Metal Plate Connected Wood Trusses – TPI.

American Wood Preservers Institute:

Pole Building Design

National Particleboard Association:

How To Install Particleboard Underlayment

- (g) For engineered particleboard structural diaphragm design, the Supplement B to Chapter XVII shall apply.

**1700.2 – DETERMINATION OF REQUIRED SIZE**

- (a) All wood structural members shall be of sufficient size to carry the dead and required live loads without exceeding the allowable working stresses as contained in the Standards listed in [Section 1700.1\(f\)](#).
- (b) Where applicable as determined by end use, allowable working stresses may be determined by “Machine Stress Rating” as approved by the American Lumber Standards Committee.
- (c) Where minimum sizes of lumber members are shown herein, they shall be construed as meaning nominal sizes. Minimum dressed sizes corresponding to nominal sizes shall conform with the provisions of the American Lumber Standards.
- (d) For convenience, nominal sizes may be shown on the plans. If rough sizes or finished sizes greater or smaller than American Lumber Standard dressed sizes are to be used, computations shall be predicated upon such actual sizes, provided they are specified on the plans or in a statement appended thereto.

**1700.3 - QUALITY OF MATERIALS**

- (a) All lumber, including end-jointed lumber, used for load supporting purposes shall be identified by the Grade Mark of an approved Lumber Grading or Inspection Bureau or Agency. The glued joints in end-jointed lumber when used for load supporting purposes shall be certified to be in accordance with the appropriate provisions of the American National Standard for Structural Glue Laminated Timber AN-SI/AITC A-190.1-1983.
- (b) Structural glued laminated timber shall be manufactured and identified as required in the American National Standard for Structural Glue Laminated Timber ANSV/AITC A-190.1-1983.

- (c) All plywood when used structurally (including among others, use for siding, roof and wall sheathing, subflooring, diaphragms and built-up members) shall conform to the performance standards for its type in Product Standard PS 1 for Construction and Industrial Plywood. Each panel or member shall be identified for grade and glue type by the trademarks of an approved testing and grading agency. Plywood components shall be designed and fabricated in accordance with the applicable standards listed in [Section 1700.1\(f\)](#) and identified by the trademarks of an approved testing and inspection agency indicating conformance with the applicable standard. In addition, all plywood, when permanently exposed in outdoor applications, shall be of Exterior type, except that plywood roof sheathing exposed to the outdoors on the underside may be Interior type bonded with exterior glue.
- (d) Wood Shingles and/or shakes shall be identified by the grade-mark of a grading or inspection bureau or agency recognized as being competent.
- (e) Fiberboard for its various uses shall conform to “Voluntary Product Standard, Cellulosic Fiber Insulating Board, PS 57” and the applicable “Standards of IB Specification No. 1, No. 2, or No. 3.”
- (f) Hardboard shall conform to The Applicable Product Standard, “PS 58 Basic Hardboard, PS 59 Prefinished Hardboard Paneling, or PS 60 Hardboard Siding,” and shall be identified as to classification. Hardboard siding shall be not less than ¼” thickness. Underlayment-Hardboard shall meet the strength requirements of 7/32” of 1/4” Service hardboard that is planed or sanded on one side to a thickness of 0.215 plus or minus 0.005 inches.
- (g) Particleboard shall conform to American National Standard for Mat-Formed Wood Particleboard, ANSI A208.1. Particleboard shall be tested and listed by an approved independent agency, association or testing laboratory. Each panel shall be marked with: manufacturer's name or trademark, ANSI Standard A208.1, the grade, density in pounds per square foot, the thickness in fractions of an inch, and the inspection/testing agency.
- Particleboard floor underlayment shall conform to Type 1-M-1 of the American National Standard. Underlayment shall be not less than one quarter (1/4) inch thickness and shall be installed in accordance with the installation instructions of the National Particleboard Association. Type 2-M-1 of the American National Standard shall be used for underlayment in areas susceptible to excessive moisture such as bathrooms, kitchens, laundry rooms, etc.
- Particleboard subfloor or combination subfloor-underlayment shall conform to one of the Grades in [Table 1705.6D](#).
- (h) All lumber and plywood required to be preservatively treated in Section 1702 shall bear an approved AWPB Quality Mark or that of an independent inspection agency that maintains continuing control, testing and inspection over the quality of the product as described in the Quality Control Standards listed in [Appendix C](#).
- (i) Hardwood and decorative plywood shall be manufactured and identified as required in “Voluntary Product Standard Hardwood and Decorative Plywood”, PS 51.

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- (j) All structural-use panels shall conform to performance criteria for their end use, as well as to applicable qualification and quality assurance policies, defined in Performance Standards and Policies for Structural-Use Panels. Each panel shall be identified for end-use grade and exposure durability classification by the trademark of an approved testing and grading agency. Structural-use panels, when permanently exposed in outdoor applications, shall be classified Exterior, except that roof sheathing of Exposure 1 durability classification may be exposed to the outdoors on the underside.

All structure-use panels other than panels marked PS 1 must be marked Exposure 1 or Exterior. Underlayment in areas susceptible to excessive moisture such as bathrooms, kitchens, laundry rooms, etc. must be marked Exposure 1.

### 1700.4 – MINIMUM LUMBER GRADES

The minimum grade of lumber used for light frame construction shall be:

- (a) For Joists and Rafters: Those obtained in “Design Values for Joists and Rafters” as published by National Forest Products Association.
- (b) For Exterior Load Bearing Studs: No. 3 Grade or Stud Grade. Utility and Standard Grade may be used in accordance with the following restrictions:
- (1) Walls must be constructed in a composite system of an exterior panel consisting of material listed in paragraph 1706.2(d) and interior panels consisting of gypsum board (1/2” thick or greater) or plywood. Panels shall be securely fastened to the studs and plates per Table 1704.1.
  - (2) Construction is limited to one story structures and the top story of multi-story wood structures.
  - (3) Construction is permitted within areas of the State with design winds of 80 mph or less.
- (c) For interior non-load bearing studs: Utility Grade. For interior load bearing studs: Standard Grade. Exception: Utility grade may be used to support roof and ceiling loads only of one story buildings and the top story of multi-story buildings.
- (d) Studs in exterior walls subject to Basic Design Wind Velocities higher than 80 mph shall be checked for structural adequacy.

End-Jointed lumber may be used interchangeably with solid sawn lumber of the same grade and species. Such uses shall include, but not limited to light framing, studs, joists, planks and decking.

### 1700.5 – MOISTURE CONTENT

All lumber members 2” and less in thickness shall contain not more than 19% moisture at the time of permanent incorporation in a building or structure.

This requirement shall equally apply to lumber that has been pressure treated to comply with the AWPB Std. LP-2.



## SECTION 1701 CONSTRUCTION PRACTICES

### 1701.1 – PREPARATION OF BUILDING SITE

- (a) All building sites shall be graded so as to provide drainage under all portions of the building not occupied by basements or cellars.
- (b) All stumps and roots shall be removed from the soil to a depth of at least twelve (12) inches.

### 1701.2 – REMOVAL OF DEBRIS

After all work is completed, loose wood and debris shall be completely removed from all spaces under the building. All wood forms and supports shall be completely removed. Loose or casual wood shall not be stored in contact with the ground under any building.

### 1701.3 – FOUNDATIONS

Foundations shall be designed and constructed in accordance with the provisions of [Chapter 13](#) and [Section 1205.7\(d\)](#). Where spot piers are used, unless properly designed, spacing of such piers shall not exceed eight (8) feet center to center.

## SECTION 1702 PROTECTION AGAINST DECAY AND TERMITES

### 1702.1 – WOOD SUPPORTS EMBEDDED IN GROUND

Where wood is permitted to be embedded in or in contact with, the ground for support of permanent structures, it shall have an approved pressure preservative treatment, *suitable for ground contact use* except where continuously below the ground-water line or continuously submerged in fresh water.

### 1702.2 – UNEXCAVATED SPACES

When wood Joists or the bottom of wood structural floors without joists are closer than eighteen (18") inches, or wood girders are closer than twelve (12") inches to exposed ground located within the periphery of the building over crawl space or unexcavated areas, they shall be of approved wood of natural decay resistance, or pressure treated wood.

### 1702.3 – SILLS ON EXTERIOR WALLS

All sills which rest on concrete or masonry exterior walls and are less than eight (8") inches from exposed earth shall be of approved wood of natural decay resistance or pressure treated wood.

### 1702.4 – SLEEPERS AND SILLS ON CONCRETE SLAB

Sleepers and sills on concrete or masonry slabs which are in direct contact with the earth shall be of approved wood of natural decay resistance or pressure treated wood.

**1702.5 – POSTS OR COLUMNS ON THE EXTERIOR OF THE BUILDING OR IN BASEMENTS OR CELLARS**

Wood posts or columns *on the exterior of the building or in basements or cellars, and which support permanent structures* shall be supported by masonry or concrete piers at least 8 inches above the exposed earth. Untreated wood posts or columns in addition to the above shall also be supported by metal pedestals projecting at least 1 inch above concrete or masonry piers, floors or decks.

**1702.6 – GIRDERS ENTERING MASONRY OR CONCRETE WALLS**

Ends of wood girders entering masonry or concrete walls shall be provided with a one-half (½) inch air space on top, sides and ends unless approved wood of natural decay resistance or pressure treated wood is used.

**1702.7 – CLEARANCE BETWEEN SIDING AND EARTH**

Clearance between wood siding and earth on the exterior of a building shall be not less than six (6) inches.

**1702.8 – CRAWL SPACE VENTILATION**

Crawl spaces under buildings without basements shall be ventilated by approved mechanical means or by openings in foundation walls. Openings shall be arranged to provide cross ventilation and shall be covered with corrosion resistant wire mesh of not less than ¼" nor more than ½" in any dimension. Openings in foundation walls shall not be less than the following:

- (1) Where wood floor systems are used such openings shall have a net area of not less than 2 sq. ft. for each 100 linear feet of exterior walls, plus 1/3 SQ. ft. for each 100 sq. ft. of crawl space.
- (2) Where other than wood floor systems are used, such openings shall be not less than 1 sq. ft. of net opening for each 15 lineal feet or major fraction thereof of exterior wall.
- (3) Where an approved vapor barrier is installed over the ground surface, the required net area of openings may be reduced by 50 percent.
- (4) Where combustion equipment is installed within a crawl space, air for combustion shall be provided in accordance with Section 1507 of Volume 3 (Heating and Ventilation).

**1702.8.1 – ACCESS TO CRAWL SPACE**

Usable crawl spaces under buildings without basements shall be provided with a minimum of one (1) access opening not less than eighteen (18") inches by twenty-four (24") inches. Access opening shall be readily accessible and provided with a door or device that may be easily removed or operated.

If access to equipment is thereby afforded, the opening shall be adequate for the removal and replacement of such equipment.

**1702.9 – APPROVED WOOD OF NATURAL RESISTANCE**

- (a) Approved wood for natural resistance to decay shall be all heartwood of any of the following species: Bald Cypress (*Tidewater Red*), Black Locust, Black Walnut, and Cedars, and Redwood.

- (b) Approved wood for natural resistance to termites shall be all heartwood of Bald Cypress, (*Tidewater Red*), Redwood or Eastern Red Cedar.

#### **1702.10 – APPROVED PRESSURE PRESERVATIVE TREATMENT**

The Standards of the American Wood Preservers Bureau and/or the American Wood Preservers Association shall be deemed as approved in respect to pressure treated wood.

#### **1702.11 – APPROVED PRE-CONSTRUCTION SOIL TREATMENT**

The Standards of the National Pest Control Association shall be deemed as approved in respect to pre-construction soil treatment for protection against termites.

#### **1702.12 – SPECIAL TERMITE PROTECTIONS**

In territories where hazard of termite damage is known to be very heavy the building official may require floor framing of termite resistant wood, pressure treated wood, soil treatment or other approved methods of termite protection.

#### **1702.13 – STRUCTURAL WOOD AND GLUED LAMINATED TIMBER**

All structural wood and glued laminated timber subjected to alternate wetting or drying, supporting frames, balconies, walkways, ramps, platforms, etc., shall be pressure treated with an approved preservative or an approved wood of natural resistance as per [Paragraph 1702.9](#).

#### **1702.14 – FIELD FABRICATION TREATMENT**

When field fabrication of pressure preservative treated wood is necessary, the cut ends shall be treated in accordance with AWP Standard M4-80.

### **SECTION 1703 FIRE PROTECTION**

#### **1703.1 – FIRESTOPPING**

- (a) Firestopping shall be provided to cut off all vertical and horizontal concealed draft openings. Firestopping shall be as indicated in this Section and as provided in [Section 705](#).
- (b) Firestopping, when of wood, shall consist of two (2) inch nominal lumber, or two (2) thicknesses of one (1) inch nominal lumber with broken lap joints, or one backed by three-fourth (3/4) inch plywood and shall effectively fill all spaces for the entire width or depth of the framing or structural member.
- (c) Firestopping, when of other materials as provided in [Section 705](#), shall be securely and tightly fitted into place. In the case of spaces between chimneys and wood framing, such spaces shall be solidly filled with mortar or loose incombustible matter supported on non-combustible supports.
- (d) Firestopping shall be installed in Type V and Type VI construction in the following locations:
- (1) In concealed spaces of stud walls and partitions, including furred spaces, at ceiling and floor levels.
  - (2) At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.

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- (3) In concealed spaces, between stair stringers at the top and bottom of the run.
- (4) At openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels with noncombustible materials, except in the case of approved metal chimney installations as set forth in Section 2708 Factory-Built Chimneys.
- (5) In concealed spaces created by an assembly of floor or roof joists, fire-stopping shall be provided for the full depth of the joists at the ends and over the supports.

### 1703.2 – DRAFTSTOPPING

Draftstopping shall be provided in Type V and Type VI construction in the following locations:

#### (a) Floor-Ceiling Assemblies

- (1) Multi-Family (two or more) Dwellings, Motels, Hotels. In the floor-ceiling assemblies above and in line with the tenant separation when tenant separation walls do not extend to the floor sheathing above.
- (2) Other Buildings. In floor-ceiling assemblies so that horizontal areas do not exceed 1000 sq. ft.

#### (b) Attic

- (1) Multi-Family (two or more) Dwellings. In the [attic](#), mansard, overhang, or other concealed roof space above and in line with the tenant separation when tenant separation walls do not extend to the roof sheathing above. Where corridor walls provide a tenant separation, draftstopping shall only be required above one of the corridor walls.
- (2) Motels, Hotels. The [attic](#), mansard, overhang, or other concealed roof space shall be divided into horizontal areas of not more than two thousand (2000) square feet with partitions extending from a tenant separation wall to the roof sheathing above.
- (3) Other Buildings. In [attic](#) spaces so that concealed areas do not exceed 3000 sq. ft.

Exceptions: for (b)(1), (b)(2), and (b)(3).

- (i) Where flat roofs with solid joist construction is used, draftstopping over tenant separation walls is not required.
- (ii) Where approved sprinklers are provided, draftstopping shall not be required.

Ventilation of concealed roof spaces shall be maintained in accordance with [Section 1707.8](#).

Draftstopping materials shall be not less than one-half (1/2) inch gypsum board, three-eighth (3/8) inch plywood or other approved materials adequately supported.

The integrity of all draftstops shall be maintained.

Draftstopping shall not be covered or concealed until inspected by the Building Official.

### 1703.3 – FIRE RESISTANCE RATINGS

When fire resistance ratings are specified by this Code, it shall be provided in conformance with the requirements of [Appendix K](#) and [Chapter 25](#).

**1703.4 – FIRE CUTS**

Where joists, beams, or girders enter and terminate in a masonry wall, they shall be provided with a fire cut of three (3) inches or provided with wall plate boxes or self-releasing type or approved hangers, and if located in a required fire resistance wall shall be separated from the opposite side of the wall by at least four (4) inches of solid masonry.

**SECTION 1704 FASTENINGS****1704.1 – NAILING AND STAPLING REQUIREMENTS**

The number and size of nails or staples connecting wood members shall not be less than those specified in [Table 1704.1](#) – Nailing Schedule. Where nails of a type other than those shown in the Table are used, the number and spacing shall be in accordance with the manufacturer’s instructions.

**1704.2 – OTHER FASTENINGS**

Where framing anchors, clips, staples, glues, or other methods of fastening are used, they shall be installed in accordance with the manufacturer’s instructions.

**SECTION 1705 FLOOR FRAMING****1705.1 – SILLS ON FOUNDATIONS**

Sills on continuous foundation walls shall be not less than two (2) inches in thickness and shall be anchored thereto by ½-inch bolts spaced not more than six (6) feet apart and which are embedded at least six (6) inches in concrete or 15 inches in masonry units. Girders supported on piers shall be provided a true and even bearing surface.

**1705.2 – BEAMS AND GIRDERS**

- (a) Beams and Girders shall be designed in accordance with [Section 1700.1\(d\)](#) or [1700.2\(a\)](#).
- (b) The Building Official shall require the seal of an [architect](#) or engineer on any laminated timber design, bracing and anchor, if the span is over 20 feet.

**1705.3 – FLOOR JOISTS**

- (a) Maximum spans for floor joists shall be in accordance with the “Span Tables for Joists and Rafters”, as published by the National Forest Products Association; or may be designed in accordance with [Section 1700.1\(d\)](#) or [1700.2\(a\)](#).

Spans for field-glued plywood-lumber and veneer-faced structural-use panel-lumber floor systems using approved adhesives shall be as set forth in “APA Design/Construction Guide – Residential & Commercial”, as published by the American Plywood Association. [Approved](#) adhesives for the APA by Glued Floor System shall be those meeting the requirements of AFG-01, *Adhesives for Field - Gluing Plywood to Wood Framing*, as published by the American Plywood Association. Buildings and structures, other than one or two family dwellings, which are to be field glued shall be designed by a registered [architect](#) or engineer and the local or state building inspector may require written design computations for any specific project.

- (b) Except where supported on a 1-by-4-inch ribbon strip and nailed to the adjoining stud, the ends of each joist shall have not less than 1½ inches of bearing on wood or metal nor less than three (3) inches on masonry.
- (c) Except in Dwellings floor joists, having a depth to thickness ratio exceeding six (6) and /or the design live load is in excess of forty (40) pounds per square foot, shall be supported laterally by bridging or blocking installed at intervals not exceeding eight (8) feet.
- (d) Joists shall be supported laterally at the ends by solid blocks or diagonal struts except where the ends of joists are nailed to a beam (wood or steel with an attached nailer), header, band joists or to an adjoining stud.
- (e) Notches on the ends of joists shall not exceed one-fourth the depth. Holes bored for pipes or cable shall not be within two (2) inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches for pipes in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.
- (f) Joists framing from opposite sides of a beam, girder or partition shall be lapped at least four (4) inches and fastened, or the opposite joists shall be tied together in an [approved](#) manner.
- (g) Joists framing into the side of a wood girder shall be supported by framing anchors, on ledger strips not less than 2 by 2 inches, or by other [approved](#) methods.

#### **1705.4 – FRAMING AROUND OPENINGS**

Trimmer and header joists shall be doubled when the span of the header exceeds four (4) feet. The ends of header joists more than six (6) feet long shall be supported by framing anchors, joist hangers, or other [approved](#) methods unless bearing on a beam, partition or wall. Tail joists over twelve (12) feet long shall be supported at header by framing anchors or on ledger strips not less than 2 by 2 inches.

#### **1705.5 – JOIST SUPPORTING PARTITIONS**

Bearing partitions parallel to joists shall be supported on beams, girders, walls, or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth, unless such joists are of sufficient size to carry the additional load.

**1705.6 – SUBFLOOR**

- (a) Except as provided in [Section 1705.6\(b\)](#), all floor joists shall be covered with subflooring of any of the following types:

## Lumber

Joist Spacing*	Minimum Net Thickness For Lumber Placed	
	Perpendicular to Joists	Diagonally to Joists
24"	1 1/16"	3/4"
16"	5/8"	5/8"
12"	5/8"	5/8"

\*Joints in subflooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on at least two joists.

## Plywood

Plywood applied in accordance with the provisions of [Table 1705.6A](#) and fastened in accordance with [Table 1704.1](#); proper grade of Plywood with exterior glue is required in areas subject to dampness such as slab on grade, kitchens and bathrooms.

## Particleboard

Particleboard applied in accordance with the provisions of [Table 1705.6D](#) and fastened in accordance with [Table 1704.1](#).

## Structural-Use Panels

Structural-use panels applied in accordance with the provisions of [Table 1705.6A](#) and fastened in accordance with [Table 1704.1](#).

- (b) Subflooring may be omitted when joist spacing does not exceed 16 inches and nominal 1-inch tongued and grooved wood strip flooring is applied perpendicular to the joists.
- (c) When resilient flooring is applied directly to plywood subfloor, it shall be applied in accordance with the provisions of [Table 1705.6B](#) and fastened in accordance with [Table 1704.1](#).
- (d) When resilient flooring is applied directly to particleboard subfloor, it shall be applied in accordance with the provisions of [Table 1705.6D](#) and fastened in accordance with [Table 1704.1](#).
- (e) When resilient flooring is applied directly to structure-use panel subfloor, the panel shall be identified for single-floor use and shall be applied over joists spaced no farther apart than the rating indicated on the panel. Structural-use panels for single-floor use at rated spans of 24" or less support 100 psf floor live load plus 10 psf dead load at rated maximum span. Panels with rated span of 48" support 65 psf live load. Panels shall be fastened in accordance with [Table 1704.1](#).

**1705.7 – PLANK-AND-BEAM FRAMING**

- (a) Beams supporting plank floors shall not exceed the limitations set forth in [Section 1705.2](#).

- (b) The allowable plan for 2" planks shall be determined in accordance with [Section 1700.1\(d\)](#) or [1700.2\(a\)](#).

### **1705.8 – ANCHORAGE OF THE FLOOR FRAMING TO MASONRY WALLS**

Wood Floor Construction which rests on masonry walls shall be anchored thereto in accordance with [Section 1408.3](#).

### **1705.9 – STAIR FRAMING**

- (a) Stair framing shall be supported adequately on floor framing or on walls or partitions.
- (b) Except in public stairs where the number and size of stringers shall be determined by engineering analysis, two (2) rough stringers shall be provided for each set of stairs, cut to receive finish treads and risers of uniform width and height.
- (c) Unless stringers are supported on walls or partitions, the minimum effective depth at each notch shall be not less than three and one-half (3½) inches.

## **SECTION 1706 VERTICAL FRAMING**

### **1706.1 – EXTERIOR WALL FRAMING**

- (a) Stud Size and Spacing: Studs in one- and two-story buildings shall be not less than 2 by 4 inches with the wide face perpendicular to wall. In three-story building, studs in first story shall be not less than 3x4 on 16" center or 2x6 on 16" center or 2x4 on 12" center or two (2)-2x4 spiked together spaced not more than 16" on center.
- (b) Studs supporting floors shall be 2 x 4 spaced not more than 16 inches on center or 2 x 6 spaced not more than 24 inches on center. Studs supporting ceilings and roofs shall be spaced not more than 24 inches on center.
- (c) The height of stud bearing walls is limited to 10 feet between lateral bracing (for 24 inch spacing).

### **1706.2 – BRACING OF EXTERIOR STUD WALLS**

- (a) Not less than three studs shall be installed at every corner of an exterior wall.
- (b) Stud walls shall be braced by one of the following methods:
  - (1) Nominal 1 by 4 inch continuous diagonal strips set into the face of the studs and top and bottom plates at each corner of building.
  - (2) Wood boards of 3/8" (net) minimum thickness, applied diagonally.
  - (3) Wood sheathing panels 2 by 8 feet of 5/8" minimum thickness applied horizontally.
  - (4) Plywood sheathing panels not less than 48" wide and 96" long applied either vertically or horizontally. Fastener and plywood thickness must be in accordance with [Table 1705.6C](#).
  - (5) Fiberboard sheathing, gypsum sheathing and particleboard sheathing as specified in [Section 1706.2\(d\)](#) when applied vertically in panels 4 feet wide and not less than 8 feet long and properly installed in accordance with [Table 1704.1](#).



- (6) Structural-use sheathing panels not less than 48" wide and 96" long applied either vertically or horizontally, with all edges supported by framing or blocking. Panels and fastenings must be as specified in [Section 1706.2\(d\)\(6\)](#).
- (c) Sheathing shall be applied on the exterior walls of all Type VI buildings more than one-story in height, except when back-plastered stucco construction is used.
- (d) Sheathing, where required for exterior walls, shall be applied solidly over the wall surface and shall be one or more of the following materials:
- (1) Wood Boards and sheathing panels five-eighths inch (5/8") minimum thickness.
  - (2) Plywood not less than five-sixteenths inch (5/16") thick for 16" stud spacing or not less than three-eighths inch (3/8") for 24" stud spacing. Plywood of exterior type complying with [Section 1706.7\(c\)](#), including [Table 1705.6C](#), may also serve as siding. Sheathing paper may be omitted over plywood except where exterior stucco finish, brick-veneer, and exterior wall coverings which permit passage of water are used.
  - (3) Fiberboard not less than seven-sixteenths (7/16") inches thick.
  - (4) Gypsum not less than one-half inch (1/2") thick.
  - (5) Particleboard when it conforms to American National Standard ANSI A208.1 grades in [Table 1706.2A](#).
  - (6) Structural-use sheathing panels with a rated wall span of 16 inches or roof span of 16 or 20 inches shall have a maximum stud spacing of 16"; panels with a rated wall or roof span of 24 inches shall have a maximum stud spacing of 24". Panels may be installed either vertically or horizontally, and shall be fastened in accordance with [Table 1704.1](#).
- (e) Studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with bearing partitions. End joints in double top plates shall be offset at least 24 inches. In lieu of double top plates, a continuous header may be used.
- (f) For Platform Frame Construction, studs shall rest on a single bottom plate.
- (g) If sheathing not conforming to [Section 1706.2\(d\)](#) is used on buildings of more than one story in height within areas of the State with design winds of 100 mph or less per Figure 12B, the following items are required:
- (aa) For the first floor of two-story construction and the second floor of three-story construction, the maximum aspect ratio (length / width) shall not exceed two (2), and the minimum total length of interior partitions in each direction shall be not less than the least dimension of the structure, and the following shall be installed:
    - (1) *80 mph Zone*: Install minimum 1/2" thick gypsum wallboard throughout fastened to top plates, bottom plates, and all studs with 1-5/8" Gypsum Wallboard (GWB) nails at a maximum spacing of 8 inches. Install 1 – 1" x 4" let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 3 - 8d nails at each end and 2 - 8d nails at each stud.

- (2) *90 mph Zone*: Install minimum ½” thick gypsum wallboard throughout fastened to top plates, bottom plates, blocking, and all studs with 1” long (GWB) nails at a maximum spacing of 7 inches if all horizontal joints between studs are blocked with minimum 2” x 4” or at a maximum spacing of 4 inches if unblocked. Install 1 – 1” x 6” let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 5 - 8d nails at each end and 3 - 8d nails at each stud.
- (3) *100 mph Zone*: Install minimum ½” thick gypsum wallboard throughout fastened to top plates, bottom plates, blocking, and all studs with 1-5/8” GWB nails at a maximum spacing of 4 inches and block joints between studs with minimum 2” x 4”. Install 1 – 1” x 6” let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 5 - 8d nails at each end and 3 - 8d nails at each stud. Let-in braces shall be notched into the face of the studs and plates, shall extend from top plate to bottom plate where possible, and shall be installed at approximately 45° where possible. Where let-in braces cannot be installed, knee braces top and bottom at approximately 45° extending across at least 3 stud spaces shall be notched into the face of the studs and plates. Interior partitions shall extend full height and be anchored to framing.
- (bb) For first floor of three-story construction and for those structures not complying with (aa) above, [approved](#) structural sheathing shall be applied on the first floor unless lateral load resistance is designed by an engineer and computations submitted to the building official.
- (cc) Story heights in buildings complying with (aa) above shall be limited to 10 feet.
- (dd) ¼ inch thick plywood paneling or 5/16 inch thick particleboard paneling may be used in lieu of gypsum wallboard in (aa) with same nailing and blocking requirements.

### 1706.3 – OPENINGS IN EXTERIOR WALLS

- (a) “Double studs shall be provided on each side of openings three (3) feet to six (6) feet in width and triple studs shall be provided on each side of openings exceeding six (6) feet and up to ten (10) feet in width. For openings exceeding ten (10) feet in width supports shall be designed in accordance with standard engineering practice.”
- (b) Headers shall be provided over each opening in exterior bearing walls. Headers shall not exceed the spans shown in [Table 1706.3](#), or may be of solid lumber of equivalent cross-section. Where the opening does not exceed three (3) feet, each end of the header shall be supported on a stud or framing anchor.
- (c) “Each end of header shall be supported on one stud where the opening is three (3) feet to six (6) feet in width and supported on two studs where the opening exceeds six (6) feet and up to (10) feet in width. For openings exceeding ten (10) feet in width the header bearing shall be based on design in accordance with standard engineering practice.”

### 1706.4 – POST AND BEAM FRAMING

- (a) Where post and beam framing is used in lieu of stud and joist construction, the posts shall be located to support the beams above and shall be designed in accordance with [Section 1700.1\(d\)](#) or [1700.2\(a\)](#).

- (b) Intermediate framing shall be attached to the posts and braced in the manner specified in [Section 1704.2](#).

### 1706.5 – INTERIOR BEARING PARTITIONS

- (a) Studs in one- and two-story buildings shall be not less than 2 x 4 inches with the wide face perpendicular to the partitions. In three-story buildings, studs in the first story shall be not less 3 by 4 inches or 2 by 6 inches or 2 x 4 inches 12” on center or 2 – 2 x 4 spiked together spaced not more than 16” on center.
- (b) Studs supporting floors shall be spaced not more than 16 inches, those supporting ceilings and roofs shall be spaced not more than 24 inches.
- (c) Double studs shall be provided on each side of openings exceeding three (3) feet in width, and triple studs shall be provided on each side of openings exceeding six (6) feet in width.
- (d) Headers shall be provided over each opening in bearing partitions. Headers shall not exceed the spans shown in [Table 1706.3](#), or may be solid lumber of equivalent cross-section. Where the opening does not exceed three (3) feet, each end of the header shall be supported on a stud or framing anchor. Where the opening exceeds three (3) feet in width each end of the header shall be supported on one stud and where the opening exceeds six (6) feet, each end shall be supported by two studs.
- (e) Studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with exterior walls. End joints in double top plates shall be offset at least 24 inches. For platform frame construction, studs shall rest on a single bottom plate.

### 1706.6 – INTERIOR NON-BEARING PARTITIONS

- (a) Framing for non-bearing partitions shall be of adequate size and spacing to support the finish applied thereto in accordance with the manufacturers recommendations. In non-bearing walls and partitions, studs may be spaced not more than 28” o.c. and may be set with the long dimension parallel to the wall.
- (b) Openings in the non-bearing partitions may be framed with single studs and headers.

### 1706.7 – EXTERIOR WALL COVERINGS

Exterior wall coverings of other than the following shall be of a material [approved](#) for exterior use and shall be applied in accordance with the manufacturers recommendations when not otherwise covered by the Code.

- (a) WEATHERBOARDING. Wood siding patterns known as rustic drop siding or shiplap shall have an average thickness in place of not less than 19/32” and shall have a minimum thickness of not less than 3/8”. Bevel siding shall have a minimum thickness measured at the butt section of not less than 7/16” and a tip thickness of not less than 3/16”. Siding of lesser dimensions may be used provided such wall covering is placed over sheathing which conforms to the provisions of [Section 1706.2](#).

## WOOD CONSTRUCTION

- (b) **WOOD SHINGLES OR SHAKES.** Wood shingles or shakes attached to sheathing other than wood or plywood shall be secured with [approved](#) mechanically-bonding nails or by corrosive resisting common nails on shingle nailing boards securely nailed to each stud with two (2) 8d nails. Wood shingles or shakes may be applied over fiberboard shingle backer and fiberboard sheathing with [approved](#) non-corrosion annular grooved nails. The minimum thickness of wood shingles or shakes between nailing boards shall be not less than three-eighths inches (3/8”).
- (c) **PLYWOOD.** Plywood shall be of the exterior type and shall have a thickness of three-eighths (3/8”) inches, except as provided in [Table 1705.6C](#). All Plywood joints shall be backed solidly with nailing pieces not less than two (2) inches in width, unless wood or plywood sheathing is used, or joints are lapped horizontally, or otherwise made waterproof.
- (d) Fiberboard Siding shall be medium density not less than one-half (1/2”) nominal thickness.
- (e) Hardboard Siding shall conform with the requirements of Section [1700.3\(f\)](#).
- (f) Particleboard siding used for covering the exterior of outside walls shall be one of the Exterior Type 2-M grades conforming to the American National Standard ANSI 208.1 and shall be clearly marked “Exterior Bond”. Particleboard panel siding shall be installed in accordance with [Table 1704.1](#) and [Table 1706.7](#). Nails shall be spaced not less than three-eighths (3/8) inch from edges and ends of sheathing. Unless applied over five-eighths (5/8) inch net wood sheathing or one-half (1/2) inch plywood sheathing, joints shall occur over framing members and shall be covered with a continuous wood batt; or joints shall be lapped horizontally or otherwise made waterproof to the satisfaction of the Building Official.
- (g) Asbestos Shingles attached to sheathing other than wood or plywood shall be secured with [approved](#) mechanically-bonding nails or by corrosion-resistive common nail, on shingle nailing boards securely nailed to each stud with two (2) 8d nails, except that asbestos shingles may be attached directly to fiberboard nail-base sheathing with corrosion-resistive annular grooved nails. Asbestos shingles shall have a minimum thickness of five thirty-second (5/32) inches.
- (h) **MASONRY VENEER.** Masonry veneer shall conform to the requirements of Chapter X IV – Masonry Construction. Brick or other unit veneers shall be backed with solid sheathing covered with waterproof building paper, except where the sheathing is water-repellant. Brick veneer shall be securely attached to the structure as required in Section [1414.4](#).
- (i) **STUCCO.** Stucco or exterior plaster shall conform to requirements of Section [1803](#).
- (j) **METAL.** Exterior wall coverings may be of formed metal not less than twenty-eight (28) Manufacturer's Standard Gauge.
- (k) **SOLID MASONRY.** Solid masonry walls shall conform to requirements of Chapter 14 – Masonry Construction.
- (l) Flashing shall be provided as necessary to prevent the entrance of water at openings in, or projections through, exterior walls; at intersections of exterior wall coverings of different materials, unless such materials provide a self-flashing joint; at other points subject to the entrance of water.

## SECTION 1707 ROOF AND CEILING FRAMING

### 1707.1 – CEILING JOIST AND RAFTER FRAMING

- (a) Maximum spans for ceiling joists and rafters shall be in accordance with “Span Tables for Joists and Rafters” as published by the National Forest Products Association; or may be designed in accordance with [Section 1700.1\(d\)](#) or [1700.2\(a\)](#).
- (b) Where rafters meet to form a ridge, they shall be placed directly opposite each other and nailed to a ridge board of not less than 1 inch in thickness, and not less in depth than the cut end of the rafters.
- (c) Ceiling joists and rafters shall be nailed to each other where possible and the assembly shall be nailed to the top wall plate in an adequate manner to secure the roof framing to the walls.
- (d) Ceiling joists shall be continuous or where they meet over interior partitions, shall be securely joined to provide a continuous tie across the building.
- (e) Where ceiling joists are not parallel to rafters, sub-flooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building.
- (f) Valley rafters shall be doubled. Hip rafters may be single members. Valley and hip rafters shall be two (2) inches deeper than jack rafters.
- (g) Collar beams of 1 x 6 inch boards shall be installed in the upper third of the roof height to every third pair of rafters.
- (h) Notches on the ends of joists shall not exceed one-fourth the depth. Holes bored for pipes or cable shall not be within 2 inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches for pipes in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

### 1707.2 – TRUSSED RAFTERS

- (a) Trussed rafters shall be designed in accordance with accepted engineering practice. Members may be joined by nails, glue, bolts, timber connectors or other [approved](#) framing devices.
- (b) For allowable deflection see [Table 12C](#).
- (c) The design of metal plate connected wood roof trusses shall comply with the “Design Specifications For Light Metal Plate Connected Wood Roof Trusses.” TPI.
- (d) The Building Official shall require the seal of an [architect](#) or engineer on any truss design, bracing, and anchor, if the truss spans over 30 feet.
- (e) Moisture content of lumber used in trusses shall not exceed 19% at time of fabrication.

### 1707.3 – ROOF JOISTS

- (a) Maximum spans for roof joists shall be in accordance with “Span Tables for Joists and Rafters,” as published by the National Forest Products Association; or may be designed in accordance with [Section 1700.1\(d\)](#) or [Section 1700.2\(a\)](#).

## WOOD CONSTRUCTION

- (b) Joists shall be supported laterally at the ends by solid blocks or diagonal struts. Such bridging may be omitted where ends of joists are nailed to a header, band joist or to an adjoining stud.
- (c) Notches on the ends of joists shall not exceed one-fourth the depth. Holes bored for pipes or cables shall not be within 2 inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches for pipes in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

### 1707.4 – ROOF SHEATHING

- (a) All rafters and roof joists shall be covered with sheathing as follows:

#### Lumber

Solid sheathing – Wood boards of 5/8 inch (net) minimum thickness.

Spaced sheathing – Wood boards of 3/4 inch (net) minimum thickness.

#### Plywood

Applied in accordance with the provisions of [Table 1705.6A](#) and nailed in accordance with [Table 1704.1](#).

#### Insulating Roof Deck.

Fiberboard insulating roof deck not less than 1½-inch nominal thickness.

#### Particleboard

Applied in accordance with the provisions of [Table 1707.4](#) and nailed in accordance with [Table 1704.1](#).

#### Structural-Use Panels

Structural-use panels applied in accordance with the provisions of [Table 1705.6A](#) and fastened in accordance with [Table 1704.1](#).

- (b) Joints in lumber sheathing shall occur over supports unless end-matched lumber or [approved](#) clips are used in which case each piece shall bear on at least two rafters or joists.

### 1707.5 – PLANK AND BEAM ROOF

Beams shall be supported on posts, piers or other beams and shall conform to [Section 1705.2](#). Roof planks shall conform to [Section 1705.7](#).

### 1707.6 – ANCHORAGE OF ROOF FRAMING TO MASONRY WALL

Wood roof construction which rests on masonry walls shall be anchored thereto in a manner equivalent to that specified in [Section 1408.2](#).

### 1707.7 – ACCESS TO ATTIC SPACE

[Attic](#) spaces shall be provided with an interior access opening not less than twenty-two inches by thirty inches (22" x 30"). Access opening shall be readily accessible and provided with a lid or device that may be easily removed or operated.

**1707.8 – VENTILATION OF ATTIC SPACE**

Attic spaces shall be ventilated in accordance with the following:

- (a) For gabled and hipped roofs ventilation shall be provided to furnish cross ventilation of each separate space with weather protective vents. The ratio of total net free ventilating area to the area of the ceiling shall be not less than 1/150. That ratio may be reduced to 1/300 provided: (1) A vapor barrier having a transmission rate not exceeding one perm is installed on the warm side of the ceiling, or (2) at least 50% of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated (at least 3'-0" above eave or cornice vents) with the balance of the required ventilation provided by eave or cornice vents.
- (b) For flat roofs, blocking and bridging shall be arranged so as not to interfere with the movement of air. Such roofs shall be ventilated along the overhanging eaves, with the net area of opening being not less than 1/250 of the area of the ceiling below.

**1707.9 – ROOF COVERING**

- (a) Any roof covering permitted in this Code may be applied to dwellings. (See Chapter VII – Fire Protection Requirements, [Section 706](#), Roof Coverings). Whenever composition roofing is used, solid sheathing shall be applied.
- (b) Flashing shall be placed around openings and extensions of mechanical appliances or equivalent through the roof and otherwise as necessary to provide adequate drainage.

**SECTION 1708 FRAMING AT CHIMNEYS AND FIREPLACES****1708.1 – CHIMNEYS**

- (a) All wood beams, joists and stud' shall be trimmed away from chimneys. Headers, beam, joists and studs shall be not less than 2 inches from the outside face of a chimney or from masonry enclosing a flue. Ends of wood girders may be supported on a corbeled shelf of a chimney in a dwelling, for domestic low type heat appliances and for building heating equipment for heating a total volume of occupied space not to exceed 25,000 cubic feet, provided there is not less than 8 inches of solid masonry between the ends and the flue lining.
- (b) A clearance of not less than 4 inches shall be provided between the exterior surface of chimneys for commercial and industrial type incinerators and combustible material.
- (c) Combustible lathing, furring or plaster grounds shall not be placed against a chimney at any point more than 1½ inches from the corner of the chimney; but this shall not prevent plastering directly on the masonry or on metal lath and metal furring; nor shall it prevent placing chimneys for low heat appliances entirely on the exterior of a building against the sheathing.
- (d) All spaces between chimneys and wood joists, beams or headers shall be firestopped by placing non-combustible material to a depth of one inch at the bottom of such spaces.

**1708.2 – FIREPLACES**

- (a) Headers, beams, joists and studs shall be not less than 2 inches from outside face of a fireplace.

## WOOD CONSTRUCTION

Headers supporting trimmer arches at fireplaces shall be not less than 20 inches from the face of the chimney breast. Trimmers shall be not less than 6 inches from the inside face of the nearest flue lining.

- (b) Woodwork shall not be placed within 6 inches of a fireplace opening. Woodwork above and projecting more than 1½ inches from a fireplace opening shall not be placed less than 12 inches from the top of a fireplace opening.
- (c) Woodwork shall not be placed within 4 inches of the back face of a fireplace.
- (d) The clearance between woodwork and a factory-built fireplace [approved](#) as a result of tests by a nationally recognized testing laboratory need not comply with paragraph (c) of this section provided the factory-built fireplace is installed in accordance with the conditions of approval.



<b>TABLE 1704.1 – FASTENING SCHEDULE</b>	Fastener	Number or Spacing
Joist to sill or girder, toe nail	8d common	3
Bridging to joist, toe nail each end	8d common	2
Ledger strip	16d common	3 at each joist
1" x 6" subfloor or less to each joist, face nail	8d common	2
Over 1" x 6" subfloor to each joist, face nail	8d common	3
2" subfloor to joist or girder, blind and face nail	16d common	2
Sole plate to joist or blocking, face nail	16d common	16" o.c.
Top or sole plate to stud, end nailed	16d common	2
Stud to sole plate, toe nail	8d common	4
Doubled studs, face nail	16d common	24" o.c.
Doubled top plates, face nail	16d common	16" o.c.
Top plates, laps and intersections face nail	16d common	2
Continuous header, two pieces	16d common	16" o.c. along each edge
Ceiling joists to plate, toe nail	8d common	3
Continuous header to stud, toe nail	8d common	3
Ceiling joists, laps over partitions, face nail	16d common	3
Ceiling joists to parallel rafters, face nail	16d common	3
Rafter to plate, toe nail	8d common	3
1-inch brace to each stud and plate, face nail	8d common	2
1"x8" sheathing or less to each bearing, face nail	8d common	2
Over 1"x8" sheathing to each bearing, face nail	8d common	3
Built-up corner studs	16d common	24" o.c.
Built-up girders and beams	20d common	32" o.c. at top and bottom and staggered 2 ends and at each splice
2-inch Planks	16d common	2 each bearing

**TABLE 1704.1 – FASTENING SCHEDULE (continued)**

Plywood, Particleboard and Structural-Use Panel Subfloor		
1/2"	6d Common, annular or spiral thread	6" o.c. edges and 10" o.c. intermediate
5/8", 3/4"	8d Common or 6d annular or spiral thread	6" o.c. edges and 10" o.c. intermediate
1", 1-1/8"	10d Common or 8d annular or spiral thread	6" o.c. edges and 6" o.c. intermediate
1/2"	16 ga. galvanized wire staples, 3/8" minimum crown	4" o.c. edges and 7" o.c. intermediate
5/8"	1-5/8" length	2 1/2" o.c. edges and 4" o.c. intermediate
Plywood, Particleboard and Structural-Use Panel Roof & Wall Sheathing		
1/2" or less	6d Common	6" o.c. edges and 12" o.c. intermediate
5/8" or greater	8d Common	6" o.c. edges and 12" o.c. intermediate
5/16", 3/8", 1/2"	16 ga. galvanized wire staples, 3/8" min. crown. Length of 1" plus Sheathing thickness	4" o.c. edges and 8" o.c. intermediate
5/8", 3/4"		2" o.c. edges and 5" o.c. intermediate
1/2" Fiberboard Sheathing*	1-1/2" Galvanized roofing nail or 6d common nail	3" o.c. edges and 6" o.c. intermediate
25/32" Fiberboard Sheathing*	1-3/4" Galvanized roofing nail or 8d common nail	3" o.c. edges and 6" o.c. intermediate
1/2" Gypsum Sheathing	12 gage 1-1/4" Large Head Corrosion-Resistive	4" o.c. edges and 8" o.c. intermediate
Particleboard Siding		
3/8", 1/2" <sup>1</sup>	6d <sup>2</sup>	
5/8" <sup>3</sup>	8d <sup>2</sup>	
3/4" <sup>4</sup>	8d <sup>2</sup>	
Particleboard Wall Sheathing		
3/8", 1/2"	6d <sup>5</sup>	
5/8", 3/4"	8d <sup>5</sup>	

**TABLE 1704.1 – FASTENING SCHEDULE (footnotes)**

- \* Fiberboard sheathing may be stapled using 16 gage galvanized staples 1-1/8" long for 1/2" sheathing and 1-1/2" long for 25/32" sheathing. Staples to have minimum crown of 7/16" and spaced 3" o.c. at edges and 6" o.c. at other bearings.
- \*\* Use annular or spiral thread nails for combination subfloor-underlayment.
- <sup>1</sup> Siding applies to 5/8-inch wood sheathing or 1/2-inch plywood or 1/2-inch particleboard sheathing.
- <sup>2</sup> Corrosion resistant nails spaced 6-inches on center at edge and 8-inches on center at intermediate supports. Nails shall have a minimum edge distance of 3/8-inch.
- <sup>3</sup> Siding applied to studs spaced 16-inch on center maximum.
- <sup>4</sup> Siding applied directly to studs spaced 24-inches on center maximum.
- <sup>5</sup> Nails spaced 6-inches on center at edges and 12-inches at intermediate supports. Nails shall have a minimum edge distance of 3/8".

**TABLE 1705.6A – ALLOWABLE SPANS FOR PLYWOOD AND STRUCTURAL USE PANEL FLOOR AND ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN PERPENDICULAR TO SUPPORTS<sup>1</sup>**

Panel Identification Index <sup>2</sup>	Roof		Floor
	Maximum Span (Inches)	Load (psf) <sup>3</sup>	Maximum Span <sup>4</sup> (Inches)
	Edges Blocked of other Support	Edges Unblocked	
12/0	12	12	0
16/0	16	16	0
20/0	20	20	0
24/0	24 <sup>5</sup>	20	0
24/16	24	24	16
30/12	30	26	12 <sup>6</sup>
32/16	32	28	16 <sup>7</sup>
36/16	36	30	16 <sup>7</sup>
42/20 <sup>8</sup>	42	32	20 <sup>7</sup>
48/24	48	36	24

<sup>1</sup> These values apply for Structural I and II, C-D Sheathing and C-C plywood grades only. Span shall be limited to values shown because of possible effect of concentrated loads.

Edges may be blocked with lumber or other [approved](#) types of edge support.

<sup>2</sup> Identification Index appears on all panels in the construction grades listed in footnote (1).

<sup>3</sup> For Plywood Loads, see APA Design/Construction Guide – Residential and Commercial. For Structural-Use Panel Loads, See [Section 1706.2\(b\)\(6\)](#).

<sup>4</sup> For Structural-Use Panel and Plywood edges shall have [approved](#) tongue and groove joints or shall be supported with blocking unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32" wood strip or 1½" light weight concrete is installed. Allowable uniform load based on deflection of 1/360 of span is 165 psf.

<sup>5</sup> 32/16" Structural I, when continuous over one support, may be laid with face grain parallel to supports provided all panel edges are blocked or other [approved](#) type edge support is provided, the spacing of the supports does not exceed twenty-four inches (24") on center, and the live load does not exceed 30 pounds per square foot. For other grades, a minimum thickness of five-eighths inch (5/8") 5 ply is required.

<sup>6</sup> Mat be 16" if 25/32" wood strip flooring is installed at right angles to joists.

<sup>7</sup> Mat be 24" if 25/32" wood strip flooring is installed at right angles to joists.

<sup>8</sup> For joists spaced 24" o.c. plywood sheathing with Identification Index numbers 42/20 or greater can be used for subfloors when supporting 1½" lightweight concrete. Lightweight concrete fill must have a density of 100 pounds per cubic foot minimum.

**TABLE 1705.6B – ALLOWABLE SPANS FOR PLYWOOD  
COMBINATION SUBFLOOR-UNDERLAYMENT  
PLYWOOD CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN  
PERPENDICULAR TO SUPPORTS**

		Maximum support spacing <sup>(1)(5)</sup>		
		16" o.c. <sup>(2)(3)</sup>	20" o.c. <sup>(2)(3)</sup>	24" o.c. <sup>(2)</sup>
Plywood Grade	Plywood Species Group	Panel thickness (inch)	Panel thickness (inch)	Panel thickness (inch)
Underlayment,	1	1/2	5/8 <sup>4</sup>	3/4 <sup>4</sup>
C-C Plugged, and	2 & 3	5/8 <sup>4</sup>	3/4 <sup>4</sup>	7/8 <sup>4</sup>
Sanded Exterior Type	4	3/4 <sup>4</sup>	7/8 <sup>4</sup>	1 <sup>4</sup>

- 1 Spans shall be limited to values shown based on possible effect of concentrated loads.
- 2 Underlayment, C.C Plugged, Sanded Exterior type – allowable uniform load based on deflection of 1/360 of span for spans 24" or less is 125 psf and for spans 48" 65 psf.
- 3 If a 25/32" wood finish floor is laid perpendicular to supports, thickness shown for 16 inch and 20 inch spans may be used for 24 inch span.
- 4 Except for 1/2 inch, underlayment grade and C.C Plugged panels may be of nominal thickness 1/32 inch less than the nominal thicknesses shown when marked with the reduced thickness.
- 5 Plywood edges shall be [approved](#) tongue and groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32" wood strip.

**TABLE 1705.6C – PLYWOOD EXTERIOR WALL COVERINGS**

Panel thickness shall be not less than 3/8" nominal except for "303 Specialty Siding" panels which are grooved, striated, brushed, or have other surface texture. Average thickness of "303 Specialty Siding" panels after texturing shall be not less than 5/16".

Nailing of plywood shall be as indicated:

	Plywood <sup>1</sup> thickness	Nail Size	Nail Type	Panel Edges	Nail-Spacing on Supports <sup>2</sup> Intermediate
Panel Siding <sup>3</sup>	3/8", 1/2"	6d	Non-corrosive, box or casing nails	6"	12" on each stud
	5/8" & Thicker	8d		6"	12" on each stud
Lap Siding	3/8"	6d	Non-corrosive, box or casing nails	4"	One nail per stud on widths 12" or less. 8" for widths greater than 12"
	1/2" & Thicker	8d			
303 Specialty Siding <sup>3</sup>	3/8", 1/2"	6d	Non-corrosive, box or casing nails	6"	12" on each stud
	5/8" & Thicker	8d		6"	12" on each stud
Texture 1-11 <sup>3</sup>	5/8"	8d	Non-corrosive, box or casing nails	6"	12" on each stud

<sup>1</sup> Minimum edge distance of 3/8".

<sup>2</sup> Special Requirement: Nails on ship-lap edges 3/8" from exposed edge and slant driven towards it; do not set.

<sup>3</sup> In direct-to-stud applications 4 and 5-ply panels of 1/2" nominal thickness or more may be used over studs 24" o.c. if texturing does not penetrate through the face veneer. Other panels shall be used with face grain vertical on studs spaced 16" o.c. or with face grain horizontal on studs spaced 24" o.c.

**TABLE 1705.6D**

**ALLOWABLE SPANS FOR PARTICLEBOARD SUBFLOOR  
AND COMBINED SUBFLOOR-UNDERLAYMENT<sup>1 5</sup>**

Grade	Thickness	Maximum Spacing of Supports <sup>2 3 4</sup>	
		Subfloor	Combined Subfloor-Underlayment
2-M-W	21/32	16	16
	3/4	19.2	19.2
2/M-F	3/4	19.2	19.2
2-M-3	3/4	19.2	19.2

<sup>1</sup> All panels are continuous over two or more supports and the tongue-and-groove panels are installed with the long dimension perpendicular to supports.

<sup>2</sup> Uniform deflection limitation, 1/360th of the span under 100 psf minimum load.

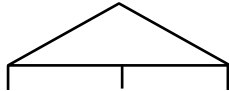
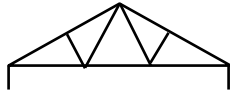
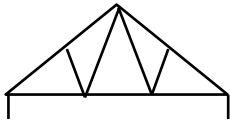
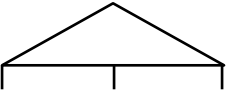
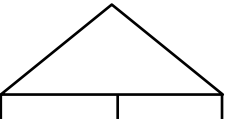
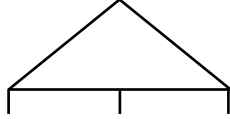
<sup>3</sup> Edges shall have tongue-and-groove joints or shall be supported with blocking.

<sup>4</sup> A finish wearing surface is to be applied to the top of the panel.

<sup>5</sup> Floor sheathing conforming with this table shall be deemed to meet the design criteria of [Section 1705.6](#).

**TABLE 1706.3 – MAXIMUM SPANS FOR HEADERS\***

In this table, headers consist of two pieces of nominal 2-inch framing lumber set on edge and nailed together. The span for the two pieces is expressed as a percentage of the maximum allowable span for floor joists of the same species and grade spaced 16 inches on centers and subjected to a live load of 40 pounds per square foot. Spans for floor joists are included in [Section 1705.3\(a\)](#).

Exterior Wall Openings		Bearing Partition Openings		
Rafters with Bearing Partition (Slope of 3 in 12 or less) No <b>attic</b> Storage	Trussed Rafters (Slope of 3 in 12 or less) No <b>attic</b> Storage	Trussed Rafters (Slope over 3 in 12) <b>Attic</b> Storage	Rafters with Bearing Partition (Slope of 3 in 12 or less) No <b>Attic</b> Storage	Rafters with Bearing Partition (Slope over 3 in 12) <b>Attic</b> Storage
				
	Rafters with Bearing Partition (Slope over 3 in 12) <b>Attic</b> Storage			
				
Buildings up to 26 ft. wide – 1 story or 2nd story of 2-story buildings				
60%	45%	40%	50%	35%
Buildings up to 26 ft. wide – 1st story of 1½ or 2-story buildings				
40%	35%	35%	35%	30%
Buildings 27 to 32 ft. wide – 1 story or 2nd story of 2-story buildings				
55%	40%	35%	45%	35%
Buildings 27 to 32 ft. wide – 1st story of 1½ or 2-story buildings				
35%	35%	35%	35%	30%

Note 1 – Span for a header of two 2x4's should not exceed 2'-6" in bearing partitions under **attic** storage nor 3'-0" elsewhere.

Note 2 – Example – [Section 1705.3\(a\)](#) – for the species and grade in question, may show a span of 14 feet for 2x8 floor joists spaced 16 inches on center under a 40-pound live load. If the factor from the table is 35%, the allowable span for a header consisting of 2 pieces of 2x8 of this grade and species would be 35% of 14 feet or 4 feet, 11 inches.

\*Headers may be designed in accordance with Section 1700.1(d).

**TABLE 1706.2A**  
**ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING**  
 (Not Exposed to the Weather, Long Dimension of the Panel Parallel or Perpendicular to Studs)

GRADE	THICKNESS (inches)	STUD SPACING (Inches)	
		Siding Nailed to Studs	Sheathing Under Coverings Specified in <a href="#">Section 1706.7(b)</a> and <a href="#">1706.7(g)</a> Parallel or Perpendicular to Studs
2-M-W	5/16	16	---
AND	3/8	24	16
2-M-F	7/16	24	24
2-M-1	3/8	16	---
2-M-2	1/2	16	16

**TABLE 1706.7**  
**ALLOWABLE SPANS FOR EXPOSED PARTICLEBOARD PANEL SIDING<sup>1</sup>**

GRADE	STUD SPACING (Inches)	MINIMUM THICKNESS (inches)		
		SIDING		EXTERIOR CEILINGS AND SOFFITS
		DIRECT TO STUDS	CONTINUOUS SUPPORT	DIRECT TO SUPPORTS
2-M-W	16	3/8	5/16	5/16
2-M-F	24	1/2	5/16	3/8
2-M-1	16	5/8	3/8	
2-M-2	24	3/4	3/8	

<sup>1</sup> Exterior Bond will be clearly marked on panel.



**TABLE 1707.4**  
**ALLOWABLE LOADS FOR PARTICLEBOARD ROOF SHEATHING<sup>1 2 4</sup>**

GRADE	THICKNESS (Inches)	MAXIMUM ON-CENTER SPACING OF SUPPORTS (Inches)	LIVE LOAD (lbs. per sq. foot)	TOTAL LOAD (lbs. per sq. foot)
	3/8 <sup>3</sup>	16	45	65
2-M-W	7/16 <sup>3</sup>	16	105	105
AND	7/16 <sup>3</sup>	24	30	40
2-M-F	1/2	16	110	150
	1/2	24	40	55

<sup>1</sup> Panels are continuous over two or more spans.

<sup>2</sup> Uniform load deflection limitation: 1/180th of the span under live load plus dead load and 1/240th of the span under live load only.

<sup>3</sup> Edge shall be tongue-and-groove or supported with blocking or edge clips.

<sup>4</sup> Roof sheathing conforming with this table shall be deemed to meet the design criteria of [Section 1707.4](#).

**SUPPLEMENT A  
TO  
CHAPTER XVII  
PLYWOOD AND STRUCTURAL-USE PANEL DIAPHRAGMS  
GENERAL**

Plywood and structural-use panel diaphragms may be used to resist horizontal forces in horizontal and vertical distributing or resisting elements, provided the deflection in the plan of the diaphragm, as determined by calculations, tests, or analogies drawn therefrom, does not exceed the permissible deflection of attached distributing or resisting elements.

Permissible deflection shall be that deflection up to which the diaphragm and any attached distributing or resisting element will maintain its structural integrity under assumed load conditions, i.e., continue to support assumed loads without danger to occupants of the structure.

Connections and anchorages capable of resisting the design forces shall be provided between the diaphragms and the resisting elements. Openings in diaphragms which materially affect their strength shall be fully detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

Size and shape of diaphragms shall be limited as set forth in Table 1. In buildings of wood construction where rotation is provided for, transverse shear resisting elements normal to the longitudinal element shall be provided at spacings not exceeding 2 times the width for plywood and structural-use panel diaphragms. In masonry or concrete buildings plywood and structural-use panel diaphragms shall not be considered as transmitting lateral forces by rotation.

**TABLE 1  
MAXIMUM DIAPHRAGM DIMENSION RATIOS**

Type	Horizontal Diaphragms Maximum Span-Width Ratios	Vertical Diaphragms Maximum Height-Width Ratios
Nailed on edges	4:1	3½:1
Blocking omitted at intermediate joints	4:1	2:1

Horizontal and vertical diaphragms sheathed with plywood or structural-use panels may be used to resist horizontal forces not exceeding those set forth in Table 2 and 3, may be calculated by principles of mechanics without limitations by using values for nail strength and panel shear strength given elsewhere in this code. Panel thickness for horizontal diaphragms shall not be less than set forth in [Tables 1705.6](#) for corresponding joist spacing and loads, except that one-fourth inch (1/4") may be used where perpendicular loads permit.

All boundary members shall be proportioned and spliced where necessary to transmit direct stresses. Framing members shall be at least two inches nominal in width. In general panel edges shall bear on the framing members and butt along their center lines. Nails shall be placed not less than three eighths inch (3/8") in from the panel edge, not more than twelve inches (12") apart along intermediate supports, and six inches (6") along panel edge-bearings, and shall be firmly driven into the framing members. No unblocked panel less than twelve inches (12') wide shall be used.

**TABLE 2. ALLOWABLE SHEAR IN POUNDS PER FOOT FOR HORIZONTAL PLYWOOD AND STRUCTURAL-PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR, LARCH OR SOUTHERN PINE FOR WIND AND SEISMIC LOADING<sup>4</sup>**

Panel Grade	Common Nail Size	Min. Nail Penetration in Framing (inches)	Minimum Nominal Panel Thickness (inch)		Veneer-Faced Panels	Other Panels	Minimum Nominal Width of Framing Member	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS			
								Nail Spacing (in) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4) and at all panel edges (Cases 5 & 6) <sup>2</sup>				Nails spaced 6" max. at support edges			
												Case 1 (No Unblocked Edges of Continuous Joints Parallel to Load)		All other configurations (Cases 2, 3, 4, 5 & 6)	
								Nail Spacing (in.) at other panel edges (Cases 1, 2, 3 & 4)							
								6	4	2 1/2 <sup>3</sup>	2 <sup>3</sup>				
								6	6	4	3				
STRUCTURAL I	6d	1-1/4	1/4 or 5/16	---			2	185	250	375	420	165	125		
								3	210	285	420	475	185	140	
	8d	1-1/2	3/8	---			2	270	360	530	600	240	180		
								3	300	400	600	675	265	200	
	10d	1-5/8	1/2	---			2	320	425	640	730	285	215		
								3	360	480	720	820	320	240	
	C-D Sheathing, C-C Exterior, STRUCTURAL II and other grades covered in PS 1. Structural-Use Panels	6d	1-1/4	1/4 or 5/16	3/8		2	170	225	335	380	150	110		
				3/8	1/2		3	190	250	380	430	170	125		
8d		1-1/2	1/2	5/8			2	270	360	540	610	240	180		
								3	300	400	600	675	265	200	
10d		1-5/8	5/8	3/4			2	290	385	575	655	255	190		
								3	325	430	650	735	290	215	
							2	320	425	640	730	285	215		
								3	360	480	720	820	320	240	

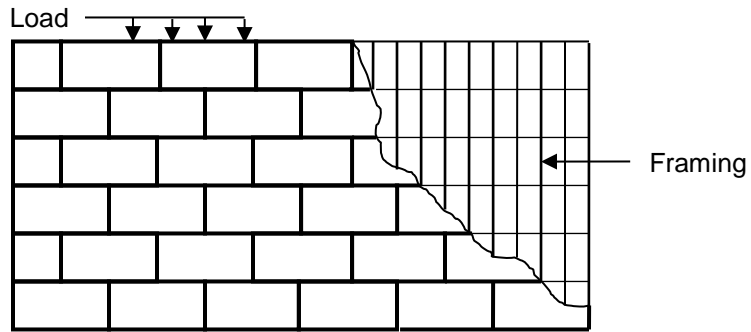
1 For framing of other species: (1) Find species group of lumber in NFPA National Design Specification. (2) Find shear value from table for nail size, and for Structural I panels (regardless of actual grade). (3) Multiply value by 0.82 for Lumber Group III or 0.65 for Lumber Group IV.

2 Space nails 12 in. o.c. along intermediate framing members for roofs, and 10 in. o.c. for floors.

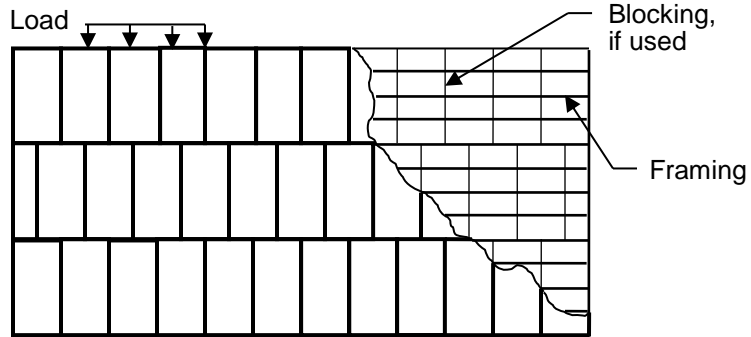
3 Where nails are spaced 2 in or 2-1/2 in. o.c., framing shall be 3-in. nominal or wider, and nails shall be staggered.

4 These values are for short-term loads due to wind or earth and must be reduced 25 percent for normal loading.

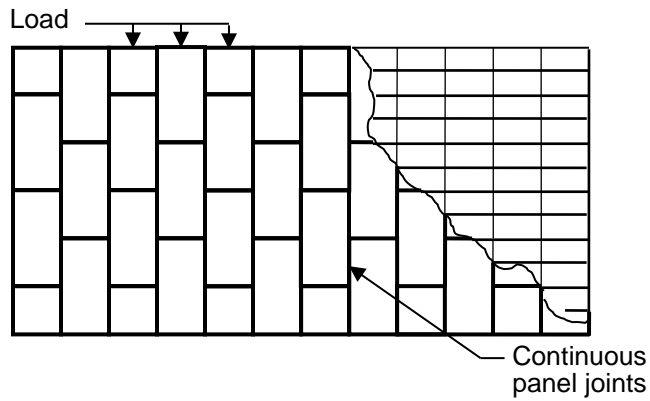
**Case 1**



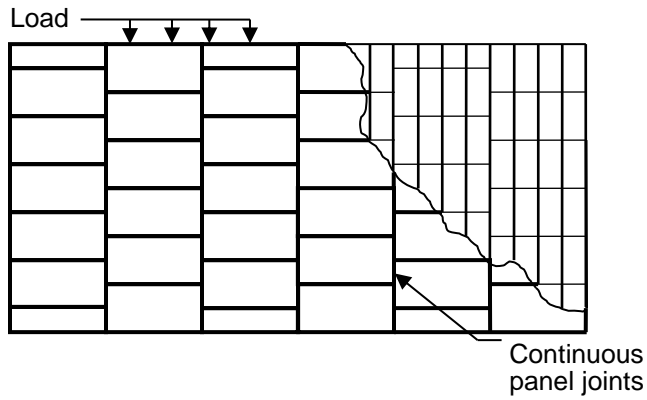
**Case 2**



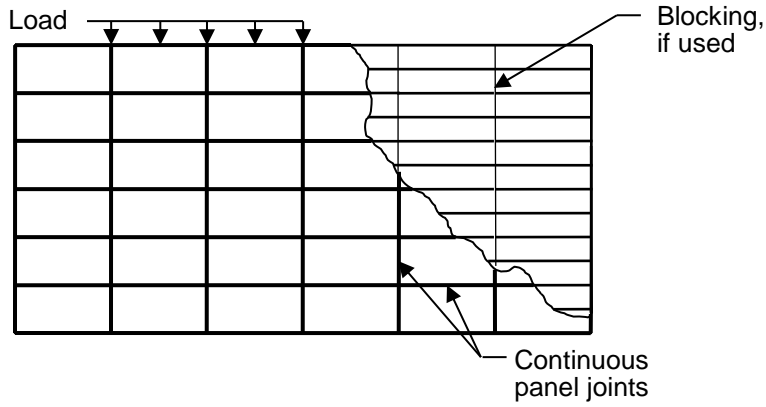
**Case 3**



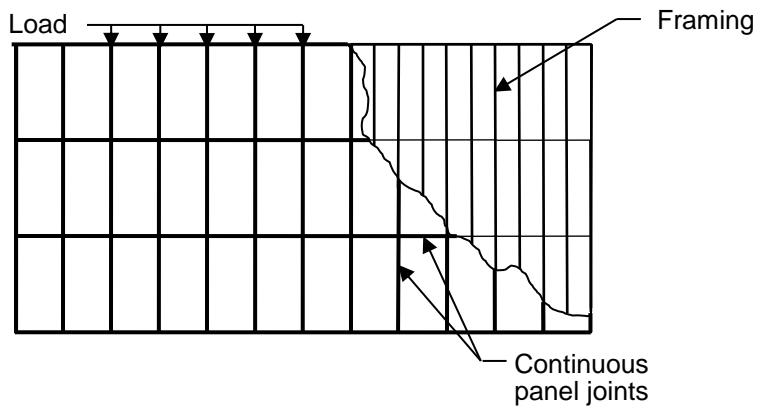
**Case 4**



**Case 5**



**Case 6**



**TABLE 3. ALLOWABLE SHEAR IN POUNDS PER FOOT FOR PLYWOOD AND STRUCTURAL-USE PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS FIR, LARCH OR SOUTHERN PINE<sup>1</sup> FOR WIND OR SEISMIC LOADING<sup>6</sup>**

Panel Grade	Minimum Nominal Panel Thickness <sup>3</sup> (inch)		Minimum Nail Penetration (Common or Galvanized) in Framing (inches)	Nail Size (Common or Galvanized Box)	Panel Direct To Framing				Panel Applied Over 1/2" Gypsum Sheathing				
					Nail Spacing at Panel Edges (in) <sup>2</sup>				Nail Size (Common or Galvanized Box)	Nail Spacing at Panel Edges (in)			
	Veneer-Faced Panels	Other Panels	6	4	3	2 <sup>5</sup>	6	4		3	2 <sup>5</sup>		
Structural I	5/16	---	1-1/4	6d	200	300	390	510	8d	200	300	390	510
	3/8	---	1-1/2	8d	230 <sup>4</sup>	360 <sup>4</sup>	460 <sup>4</sup>	610 <sup>4</sup>	10d	280	430	550	730
	1/2	---	1-5/8	10d	340	510	665	870	---	---	---	---	---
C-D Sheathing, C-C Exterior, STRUCTURAL II, Plywood Panel Siding and other grades covered in PS 1. Structural-Use Panels	5/16 <sup>3</sup>	3/8	1-1/4	6d	180	270	350	450	8d	180	270	350	450
	3/8	1/2	1-1/2	8d	220 <sup>4</sup>	320 <sup>4</sup>	410 <sup>4</sup>	530 <sup>4</sup>	10d	260	380	490	640
	1/2	5/8	1-5/8	10d	310	460	600	770	---	---	---	---	---
Plywood Panel Siding and other grades covered in PS-1	5/16 <sup>3</sup>	---	1-1/4	Nail Size (Galvanized Casing) 6d	140	210	275	360	Nail Size (Galvanized Casing) 8d	140	210	275	360
	3/8	---	1-1/2	8d	160	240	310	410	10d	160	240	310	410

- <sup>1</sup> For framing of other species: (1) Find species group of lumber in the NFPA National Design Specification. (2)(a) For common or galvanized box nails, find shear value from table for nail size, and for STRUCTURAL I panels (regardless of actual grade). (b) For galvanized casing nails, take shear value directly from table. (3) Multiply this value by 0.82 for Lumber Group III or 0.65 for Lumber Group IV.
- <sup>2</sup> All panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space nails 6 inches o.c. along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thicknesses, space nails 12 inches o.c. on intermediate supports.
- <sup>3</sup> Thickness at point of nailing on panel edges governs shear values.
- <sup>4</sup> Shears may be increased 20 percent provided (1) studs are spaced a maximum of 16 inches o.c., or (2) panels are 1/2-inch or greater in thickness, or (3) if panels are plywood and are applied with face grain across studs.
- <sup>5</sup> Framing shall be 3-inch nominal or wider, and nails shall be staggered.
- <sup>6</sup> These values are for short-term loads due to wind or earthquake and must be reduced 25 percent for normal loading.

**SUPPLEMENT B**  
to  
**CHAPTER XVII PARTICLEBOARD DIAPHRAGMS**  
**GENERAL**

Particleboard diaphragms may be used to resist horizontal forces in horizontal and vertical distributing or resisting elements, provided the deflection in the plane of the diaphragm, as determined by calculations, tests or analogies drawn therefrom, does not exceed the permissible deflection of attached distributing or resisting elements.

Permissible deflection shall be that deflection up to which the diaphragm and any attached distributing or resisting element will maintain its structural integrity under assumed load conditions, i.e., continue to support assumed loads without danger to occupants of the structure.

Connections and anchorages capable of resisting the design forces shall be provided between the diaphragms and the resisting elements. Openings in diaphragms which materially affect their strength shall be fully detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

Size and shape of diaphragms shall be limited as set forth in [Table 4](#). In buildings of wood construction where rotation is provided for, transverse shear resisting elements normal to the longitudinal element shall be provided as spacings not exceeding two (2) times the width for particleboard diaphragms. In masonry or concrete buildings, particleboard diaphragms shall not be considered as transmitting lateral forces by rotation.

**TABLE 4**  
**MAXIMUM DIAPHRAGM DIMENSION RATIOS**

Type	Horizontal Diaphragms Maximum Span Width Ratios	Vertical Diaphragms Maximum Span Width Ratios
Particleboard, nailed all edges	4:1	3½:1
Particleboard, blocking omitted at intermediate joints	4:1	2:1

#### Design

Horizontal and vertical diaphragms sheathed with particleboard may be used to resist horizontal forces not exceeding those set forth in [Table 5](#) for horizontal diaphragms and [Table 6](#) for vertical diaphragms.

Particleboard for horizontal diaphragms shall be as set forth in [Table 1707.4](#) for roofs and [Table 1705.6D](#) for floors.

Particleboard for shear walls shall be as set forth in [Table 1706.2A](#) and [1706.7](#).

Grades of particleboard and maximum spans for subfloor-underlayment shall be as set forth in [Table 1705.6D](#).

All boundary members shall be proportioned and spliced where necessary to transmit direct stresses. Framing members shall be at least 2-inch nominal in the dimension to which the particleboard is attached. In general, panel edges shall bear on the framing members and butt along their center lines. Nails shall be placed not less than 3/8 inch in from the panel edge, shall be spaced not more than 6 inches on center along panel edge bearings, 12 inches apart along intermediate supports, spaced as shown in Tables 5 and 6, and shall be firmly driven into the framing members. No unblocked panels less than 12 inches wide shall be used.

**TABLE 5  
ALLOWABLE SHEAR IN POUNDS PER FOOT FOR HORIZONTAL  
PARTICLEBOARD DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR-LARCH OR  
SOUTHERN PINE<sup>1</sup>**

Grade	Maximum Nominal Thickness (In inches)	Common Nail Size	Minimum Nominal Penetration In Framing (In inches)	Minimum Nominal Width of Framing Member (In inches)	BLOCK DIAPHRAGM				UNBLOCKED DIAPHRAGM		
					Nail Spacing at Diaphragm Boundaries (All Cases) and Continuous Panel Edges Parallel to Load (Cases 3, 4, 5 & 6)				Nails Spaced 6" Max. of Supported End		
					6	4	2½	2	Load Perpendicular to Unblocked Edges & Continuous Panel Joints (Case 1)		All Other Configurations (Cases 2, 3 & 4)
					Nail Spacing at Other Panel Edges						
					6	5	4	3			
2-B-W and 2-B-F	3/8 <sup>3</sup>	6d	1-1/4	2	185	250	375	420	165	125	
				3	210	280	420	475	185	140	
	3/8 <sup>3</sup>	8d	1-1/2	2	240	320	480	545	215	160	
				3	270	360	540	610	240	180	
	7/16	8d	1-1/2	2	255	340	505	575	230	170	
				3	285	380	570	645	255	190	
	1/2	8d	1-1/2	2	270	360	530	600	240	180	
				3	300	400	600	675	265	100	
	1/2	10d	1-3/8	2	290	385	575 <sup>2</sup>	655 <sup>2</sup>	255	190	
				3	325	430	650	735	290	215	
3/8 & 11/13 <sup>3</sup>	10d	1-3/8	2	320	425	640 <sup>2</sup>	730 <sup>2</sup>	285	215		
			3	360	480	720	820	320	240		
2-B-3	3/8	6d	1-1/4	2	185	250	375	420	165	125	
				3	210	280	420	475	185	140	
	3/4	8d	1-1/2	2	240	320	480	545	215	160	
				3	270	360	540	610	240	180	

1 These values are for short-time loads due to wind or earthquake and must be reduced 25 percent for normal loading. Space nails 10 inches on center for floors and 12 inches on center for roofs along intermediate framing members. Allowable shear values for nails in framing members of other species set forth in the National Forest Products Association National Design Specification for Wood Construction shall be calculated for all grades by multiplying the values by the following factors: Group III, 0.82, and Group IV, 0.65.

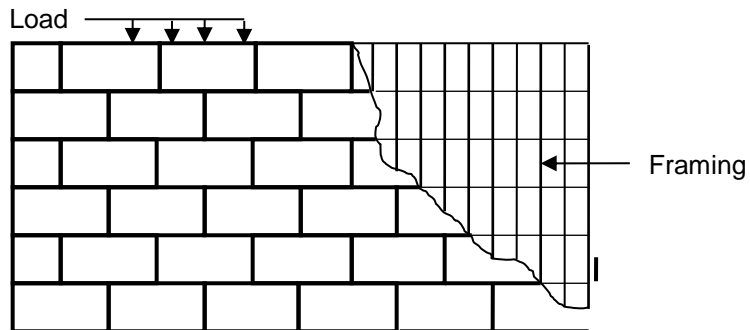
2 Reduce tabulated allowable shears 10 percent when boundary members provide less than 3-inch nominal nailing surface.

3 Values may be applied to thicker panels with the minimum nail penetrations.

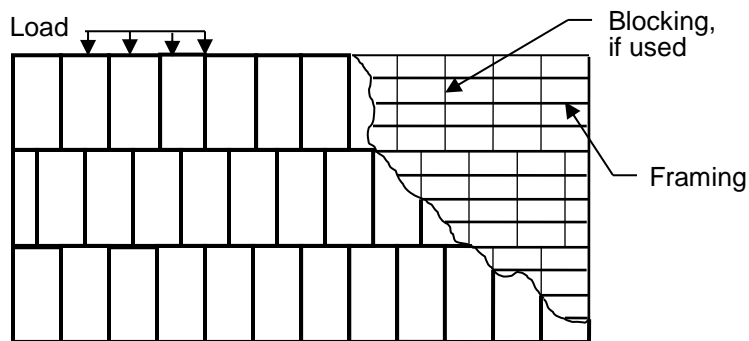


NOTE: Framing may be located in either direction for blocked diaphragms.

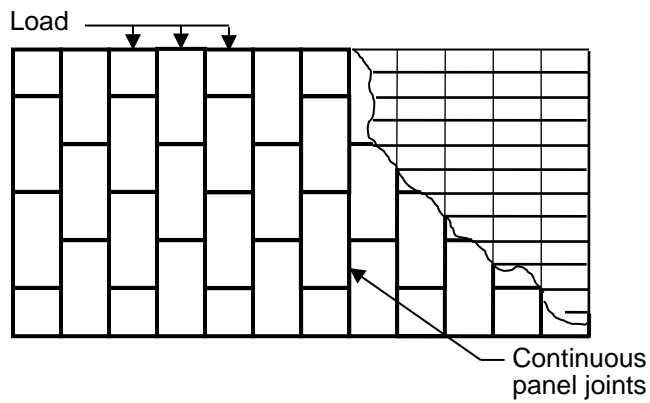
**Case 1**



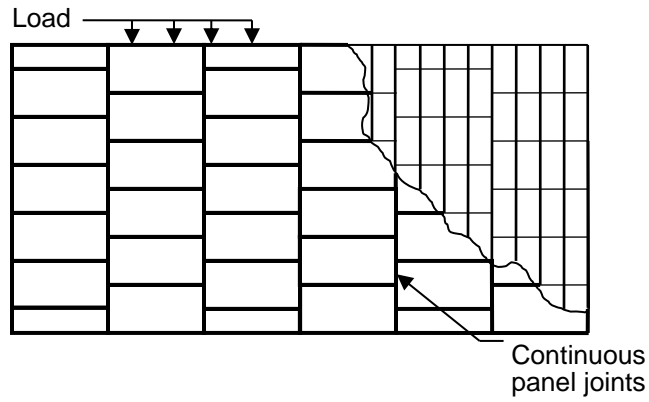
**Case 2**



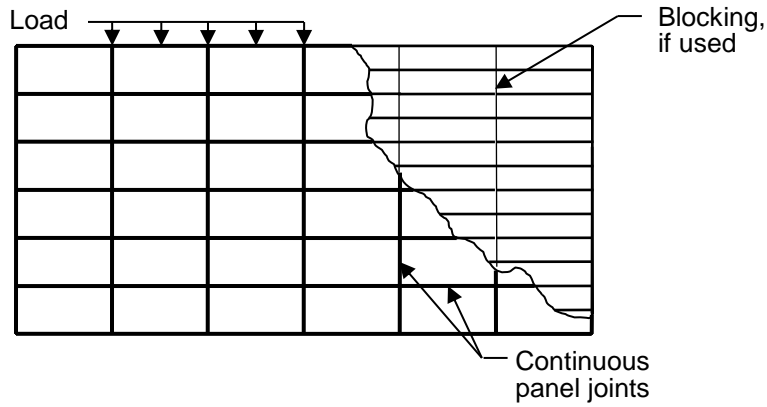
**Case 3**



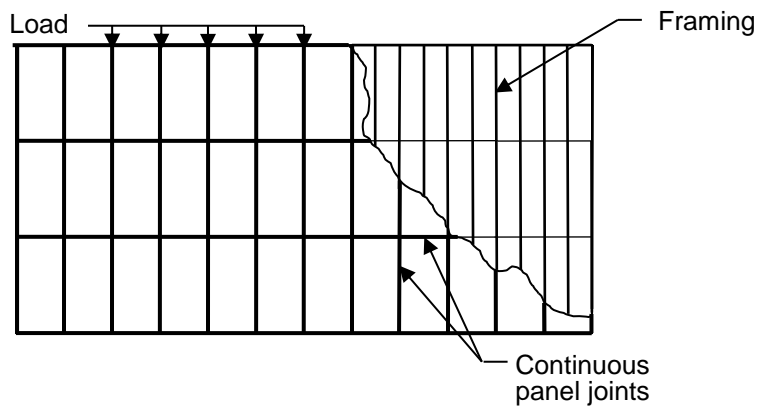
**Case 4**



**Case 5**



**Case 6**



**TABLE 6**  
**ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES IN POUNDS PER**  
**FOOT FOR PARTICLEBOARD SHEAR WALLS WITH FRAMING OF**  
**DOUGLAS FIR-LARCH OR SOUTHERN PINE<sup>1</sup>**

Grade	Minimum Nominal Thickness (In inches)	Nail Size (Common or Galvanized Box)	Minimum Nail Penetration In Framing (In inches)	PANELS APPLIED DIRECT TO FRAMING				Nail Size (Common or Galvanized Box)	PANELS APPLIED OVER ½-INCH GYPSUM SHEATHING			
				Nail Spacing at Panel Edges					Nail Spacing at Panel Edges			
				8	4	2½	2		6	4	2½	2
	3/16 and 3/8 <sup>4</sup>	6d	1-1/4	180	270	400	450	8d	180	270	400	450
2-B-W And 2-B-F	3/8 <sup>4</sup> 7/16 and 1/2	8d	1-1/2	220 <sup>3</sup>	320 <sup>3</sup>	470 <sup>3</sup>	530 <sup>3</sup>	10d	260	380	570 <sup>2</sup>	610 <sup>2</sup>
	1/2 and 3/8	10d	1-3/8	310	460	690 <sup>2</sup>	770 <sup>2</sup>	---	---	---	---	---

- 1 All panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space nails at 6 inches on center along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches on center and 12 inches on center for other conditions and panel thicknesses. These values are for short-time loads due to wind or earthquake and must be reduced 25 percent for normal loading. Allowable shear values for nails in framing members of other species set forth in National Forest Products Association National Design Specification for Wood Construction shall be calculated for all grades by multiplying the values for common and galvanized box nails in the table by the following factors: Group III, 0.82, and Group IV, 0.65.
- 2 Reduce tabulated allowable shears 10 percent when boundary members provide less than 3-inch nominal nailing surface.
- 3 The values for 3/8-inch panels applied direct to framing may be increased 20 percent, provided studs are spaced a minimum of 16 inches on center.
- 4 Values for 3/8-inch thicknesses may be applied to thicker panels with minimum nail penetration.

**CHAPTER 18**  
**LATHING, PLASTERING AND GYPSUM WALLBOARD**

**SECTION 1800 GENERAL**

**1800.1 – SCOPE**

- (a) Lathing, plastering and gypsum wallboard application shall be done in the manner and with the materials specified in this Chapter, and when required for fire protection shall also comply with the provisions of Chapter VII.
- (b) No plaster shall be applied until the lathing has been inspected and **approved** by the Building Official.
- (c) The Building Official may require that test holes be made in the wall for the purpose of determining the thickness and/or proportioning of the plaster, provided the permit holder has been notified twenty-four (24) hours in advance of the time of making such tests.
- (d) Joint treatment of gypsum wallboard shall not be applied until the wallboard application has been inspected and **approved** by the Building Official.

## SECTION 1801 MATERIALS

Materials	Designation
Aggregate	
Sand – Shall be washed and when used with portland cement for scratch coat plastering and amount of sand retained on a No. 16 sieve shall not be less than 10% or more than 40%	ASTM C 35
Perlite	ASTM C 35
Vermiculite	ASTM C 35
Gypsum Plaster	ASTM C 28
Gypsum Veneer Plaster	ASTM C 587
Gypsum Veneer Base	ASTM C 588
Water Resistive Gypsum Backing Board	ASTM C 630
Bonding Compounds for Interior Plastering	ASTM C 631
Lime-Special Finishing Hydrated Lime Type “S”	ASTM C 206
Quicklime for structural purposes (Lime putty shall be made from quicklime or hydrated lime and shall be prepared in an <a href="#">approved</a> manner.)	ASTM C 5
Keene’s Cement	ASTM C 61
Portland Cement Type I, II, or III	ASTM C 150
Type I-A, II-A, or III-A	ASTM C 175
EXCEPTION: <a href="#">Approved</a> types of plasticizing agents may be added to portland cement Type I or Type II in the manufacturing process, but not in excess of 12 percent of the total volume. Plastic or water-proofed cements so manufactured shall meet the requirements for portland cement as specified in ASTM C 150 except in respect to the limitation on insoluble residue, air- entrainment and additions subsequent to calcination.	
Masonry Cement Type II	ASTM C 91
Portland Blast Furnace Slag Cement	ASTM C 205 Type IS Type IS-A
Gypsum Lath	ASTM C 37
Metal and Wire Lath, Metal Accessories and Channels	ANSI A42.4
Gypsum Wallboard	ASTM C 36
Gypsum Backing Board	ASTM C 442
Joint Reinforcing Tape and Adhesive Materials	ASTM C 474 ASTM C 475
Steel Studs (for use with Gypsum Sheet Materials)	ASTM C 645
Screws (for use with Steel Studs covered by ASTM C 645)	ASTM C 646
Water Resistant Gypsum Backing Board	ASTM C 630
Gypsum Board Floor and Roof Substrate	ASTM C 707

### **SECTION 1802 APPLICATION OF INTERIOR LATHING AND PLASTERING**

- (a) Interior lathing and furring shall be done in accordance with the procedures set forth in “Specifications for Interior Lathing and Furring, ANSI A42.4”.
- (b) Interior gypsum plastering shall be done in accordance with the procedures set forth in “Specifications for Gypsum Plastering, ANSI A42.1”, or the Recommended Specifications, “Gypsum Plastering” as published by the Gypsum Association. Portland cement plaster shall be in accordance with the provisions of “Specifications for Portland Cement Plastering, ANSI A42.3”.

### **SECTION 1803 APPLICATION OF EXTERIOR LATHING AND PLASTERING**

- (a) Exterior use of gypsum plaster shall be in strict conformance with the applicable requirements of “Recommended Specifications – Gypsum Plastering” published by the Gypsum Association and the provisions of “Interior Lathing and Furring, ANSI A42.4”.
- (b) Exterior use of portland cement plaster shall be in conformance with the applicable requirements of “Specifications for Portland Cement Stucco, ANSI A42.2”.

### **SECTION 1804 PNEUMATICALLY PLACED PORTLAND CEMENT PLASTER**

- (a) Pneumatically placed portland cement plaster shall be a mixture of portland cement and aggregate conveyed by air through a pipe or flexible tube, and deposited by air pressure in its final position.
- (b) Rebound material may be screened and reused as aggregate in an amount not greater than twenty-five (25) percent of the total sand in any batch.
- (c) Pneumatically placed portland cement plaster shall consist of a mixture of one part cement to not more than five parts of aggregate. Plasticity agents may be used as specified elsewhere in this Chapter. Except when applied to concrete or masonry, such plaster shall be applied in not less than two coats to a minimum total thickness of seven-eighths (7/8) inch.

### **SECTION 1805 APPLICATION OF GYPSUM WALLBOARD**

Interior and exterior application and finishing of gypsum board shall be done in accordance with the procedures set forth in the Gypsum Association “Recommended Specifications for the Application and Finishing of Gypsum Board, GA-216”.

### **SECTION 1806 APPLICATION OF LIGHT GAUGE STEEL STUDS**

When screw type steel framing members are used in non-load bearing and/or noncombustible fire resistive assemblies, they shall conform to the “Gypsum Association Specification for the Installation of Screw Type Steel Framing Members” to receive gypsum board.

**SECTION 1807 ALLOWABLE PARTITION HEIGHTS****TABLE NO. 1 – ALLOWABLE PARTITION HEIGHTS BASED ON WALLBOARD AND NO. 25 GAUGE STUDS<sup>1</sup> ACTING AS A COMPOSITE SECTION<sup>2</sup>**

STUD SPACING (In Inches)	FACING ON EACH SIDE	STUD DEPTH (In Inches)					
		1-5/8	2-1/2	3-1/4	3-5/8	4	6
		HEIGHT IN FEET AND INCHES					
16	½"-one ply	11'0"	14'8"	17'10"	19'5"	20'3"	18'10"
24	½"-one ply	10'0"	13'5"	16'0"	17'3"	18'5"	17'8"
24	½"-two ply	12'4"	15'10"	18'3"	19'5"	20'8"	19'0"

<sup>1</sup> The tabulated stud heights are based on 25 gauge steel studs and installed in conformance with Gypsum Association specifications for installation of screw type steel framing members to receive gypsum board.

<sup>2</sup> Gypsum board product must have a minimum thickness of ½" and may be applied vertically or horizontally.

## **CHAPTER 19**

### **ALUMINUM CONSTRUCTION**

#### **SECTION 1901 GENERAL**

The quality, design, fabrication and erection of aluminum used structurally in buildings or structures shall conform to good engineering practice, the provisions of this Chapter and other applicable requirements of the Code.

#### **SECTION 1902 STRUCTURAL ALUMINUM CONSTRUCTION**

- (a) The design, fabrication and assembly of structural aluminum for buildings or structures shall conform to Specifications for Aluminum Structures, third edition, of The Aluminum Association.
  
- (b) The use of aluminum alloys, other than those listed in Specifications for Aluminum Structures shall be permitted for structural members and assemblies, provided standards of performance not less than those required by the Specifications are substantiated to the satisfaction of the Building Official.



## CHAPTER 20 GLASS

### SECTION 2001 GLASS

#### 2001.1 – LABELING

Each light shall be labeled showing Type, Thickness and Manufacturer except where permanent marking is required. To identify glass with special impact resistance characteristics, laminated and fully-tempered glass shall be identified permanently by the manufacturer, except labeling of heat-strengthened Spandrel glass may be omitted.

#### SECTION 2002 GLASS DIMENSIONAL TOLERANCES

There are established glass dimensional tolerances. Where minimum dimensions are required, the nominal values stated are subject to the tolerances shown in “Federal Specification DDG-00451b.”

#### SECTION 2003 MAXIMUM AREA\$-MINIMUM THICKNESS

#### 2003.1 – IMPACT LOADS

- (a) Glazing in hazardous locations such as glass doors, including fixed glazed side light panels immediately adjacent to such doors, fixed glass panels adjacent to any floor area normally used as a walking surface, sliding glass door units, including fixed glass panels which are a part of such units, shower doors, tub enclosures and storm doors shall be safety glazing materials and meet the requirements of [Table 2006](#).

#### EXCEPTIONS:

The following products, materials, and uses are exempt from Section 2003.1 and [Table 2006](#).

1. Wired glass used in doors or other assemblies to retard the passage of fire, where such door or assembly is required by this code.
2. Louvers of jalousie door, see Section 2005.
3. Openings in doors through which a 3 inch diameter sphere is unable to pass.
4. Leaded glass panels where no individual piece of glass has an area greater than 30 square inches.
5. Glazing materials used as curved glazed panels in revolving doors.
6. Commercial refrigerated cabinet glazed doors.
7. Glazing materials used in garage doors used for vehicular traffic.
8. Glazed panels more than 12 inches from a door provided one of the following conditions are met;
  - a. The lower edge of the glass panel is 18 inches above the walking surface.

## GLASS

- b. There is a horizontal member on the walking surface aide permanently attached no less than 1½” in width which is located between 24 and 36 inches above the walking surface (intermediate horizontal glass retaining members are acceptable).
- c. The glass area is 9 square feet or less in size.

### 2003.2 – WIND LOADS

- (a) For safety, glass or glass areas in exterior walls, in screens, in partitions and in other openings subject to wind loading shall be capable of safely withstanding the wind loads as shown in Section 1205.1 acting either inward or outward. In the case of regular plate, float or sheet glass supported on four sides, the design factor shall be not less than two and one-half (2.5).
- (b) Adjustment Factors for other types of glass are given in [Table 2006](#).

### SECTION 2004 GLASS SUPPORTS

- (a) Glass supports such as sash members, glazing stops or glazing clips shall be considered firm when deflection of the support at design load does not exceed 1/175of the span.
- (b) Where other than firm support on all sides is provided (3 sides, 2 sides, cantilever, or highly flexible, for example), detailed shop drawings, specifications and rational analysis and /or test data assuring safe performance for the specific installation shall be prepared by engineers experienced in this work and shall be submitted for and receive, if warranted, formal approval by the Building Official.

### SECTION 2005 JALOUSIES (IMPACT, AND /OR WIND LOAD)

Thickness shall be not less than seven-thirty seconds (7/32) inch. Length shall be not more than forty-eight (48) inches. Edges shall be seamed. Other types may be considered only if detailed shop drawings, specifications and rational analysis and/or be test data assuring safe performance for the specific installation shall be prepared by engineers experienced in this work and shall be submitted for and receive, if warranted, formal approval by the Building Official.

### TABLE 2006 – IMPACT LOADS – GLAZING

All safety glazing materials must be permanently labeled to indicate it conforms to ANSI Z97.1. Laminated glass may be permanently labeled or accompanied by a certificate certifying conformance to ANSI Z97.1.

Safety Glazing Material must be used for the following specific hazardous locations:

1. All bathtub doors and enclosures.
2. All shower doors and enclosures.
3. All storm doors or combination doors.
4. All sliding glass doors (patio type).
5. All swinging exit and entrance doors both framed and unframed styles.

6. All glazing in fixed panels having a glazed area in excess of 9 square feet with the lowest edge less than 18 inches above the finished floor level, sidewalks, patios or designed walking surface on either side within 36 inches of such glazing. (includes glazed panels on multi-storied structures)
7. All glazing in operable or inoperable openings adjacent to a door in all buildings and within the same wall plane as the door whose nearest vertical edge is within 12" of the door in a closed position and whose bottom edge is less than 36" above the floor or walking surface.

**TABLE 2007 – RELATIVE RESISTANCE TO WIND LOAD  
(Assuming equal thickness)**

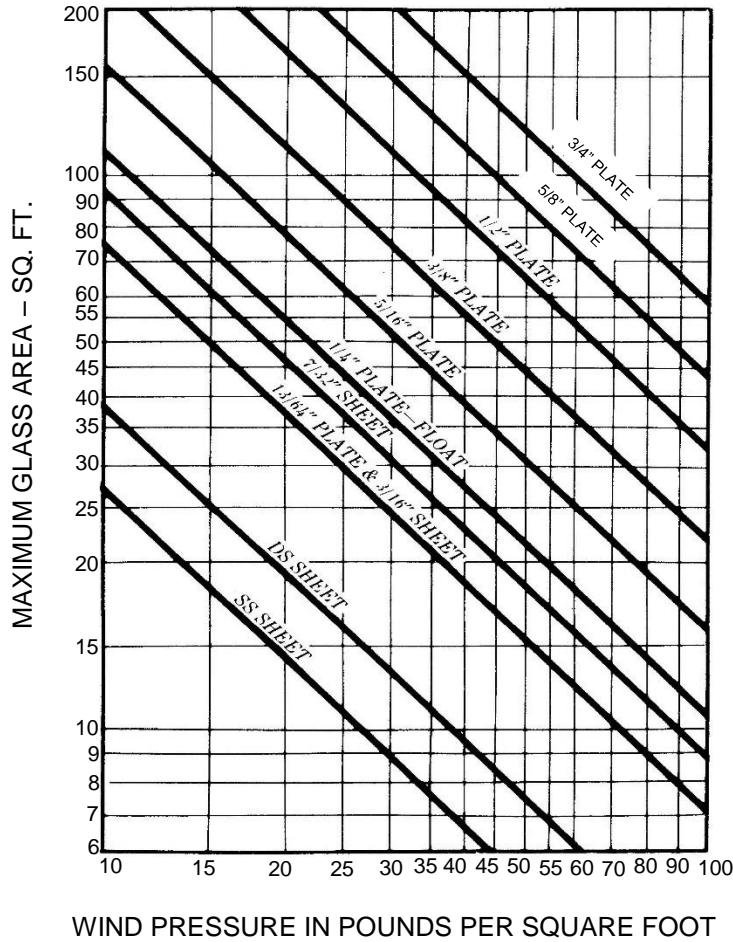
<b>Glass Type</b>	<b>Approximate* Relationship</b>
Laminated	0.6
Wired Glass	0.5
Heat Strengthened	2.0
Fully Tempered	4.0
Metal Edge Double Glazing**	1.5
Rough-rolled Plate	1.0
Sandblasted	0.4
Regular Plate or Sheet	1.0

\* Before using Wind Load Chart, divide the Design Wind Load from 1205 by the value shown here for the glass type involved.

\*\* Use thickness of the thinner of the two lights, not thickness of unit.

**WIND LOAD CHART**  
**REQUIRED NOMINAL THICKNESS OF REGULAR PLATE,**  
**FLOAT OR SHEET GLASS**  
**BASED ON MINIMUM THICKNESS ALLOWED IN FEDERAL**  
**SPECIFICATION DDG-00451B BEFORE WEATHERING**

**DESIGN FACTOR – 2.5**



**DESIGN WIND LOAD FROM SECTION 1205.1 – POUNDS PER SQUARE FOOT**  
**CHART APPLIES FOR RATIOS OF WIDTH-TO-LENGTH FROM 2:10 TO 10:10**

**CHAPTER 21**  
**PRE-FABRICATED CONSTRUCTION AND MANUFACTURED**  
**BUILDINGS**  
**(See General Statutes 143-139.1)**

**SECTION 2101 GENERAL**

**2101.1 – SCOPE**

The requirements of this code including Volume I – General Construction. Volume II – Plumbing, Volume III – Heating and Volume IV – Electrical shall apply to all buildings of pre-fabricated construction and manufactured buildings with the exception of mobile homes and dwellings. Title VI of the Mobile Home Construction and Safety Standards of the Housing and Community Development Act of 1974 requires all mobile homes constructed after April 15, 1976 to comply with Mobile Home and Construction Safety Standards issued by HUD. Dwellings of pre-fabricated construction and manufactured dwellings shall comply with the “N. C. Uniform Residential Building Code” or the “One and Two Family Dwelling Code” developed by Building Officials Conference of America, Southern Building Code Congress and International Conference of Building Officials.

**2101.2 – DEFINITIONS**

- (1) “BUILDING COMPONENT” means any subsystem, subassembly, or other system designed for use in or as part of a structure, which may include structural, electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety and is usually of “closed construction”.
- (2) “BUILDING SYSTEM” means plans, specifications and documentation for a system of manufactured buildings or for a type or a system of building components, which may include structural, electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building system.
- (3) “CLOSED CONSTRUCTION” means any building, building component, assembly or system manufactured in such a manner that all concealed parts or processes of manufacture cannot be inspected before installation at the building site without disassembly, damage or destruction.
- (4) “COMPLIANCE ASSURANCE PROGRAM” means the system, documentation and methods for assuring that manufactured buildings and building components including their manufacture, storage, transportation, assembly, handling and installation conform with this Code and the rules and regulations promulgated pursuant thereto.
- (5) “DWELLING” means a building occupied exclusively for residence purposes and having (1) One dwelling unit; or (2) two dwelling units; or (3) one dwelling unit with not more than five boarders or roomers served with meals or sleeping accommodations or both.

## PRE-FABRICATED CONSTRUCTION AND MANUFACTURED BUILDINGS

- (6) "EVALUATION AND INSPECTION AGENCY" means an **approved** person or organization, private or public, including a governmental agency, determined by the N. C. Building Code Council to be qualified by reason of facilities, personnel, experience and demonstrated reliability and independence of judgment, to investigate, evaluate and approve building systems and conduct or supervise compliance assurance programs and to issue labels.
- (7) "INDEPENDENCE OF JUDGMENT" means not being affiliated with or influenced or controlled by building manufacturers or by producers, suppliers or vendors of products or equipment used in manufactured buildings, pre-fabricated construction and building components which might affect capacity to render reports and findings objectively and without bias.
- (8) "INSTALLATION" means the process of affixing, or assembling and affixing, manufactured buildings, pre-fabricated construction or building components on the building site, or to an existing building.
- (9) "LABEL" means an **approved** device or seal evidencing certification in accordance with this Code and the rules and regulations promulgated pursuant thereto.
- (10) "LOCAL ENFORCEMENT AGENCY" means the agency or agencies of local government with authority to make inspections of buildings and to enforce the laws, ordinances and regulations enacted by the State and by the local government which establish standards and requirements applicable to the construction, alteration, repair, occupancy or demolition of buildings.
- (11) "LOCAL GOVERNMENT" means any county, city, municipal corporation, town or other political subdivision of this State with authority to establish standards and requirements applicable to the construction, alteration, repair, occupancy or demolition of buildings.
- (12) "MANUFACTURED BUILDING" means any building which is of "closed construction" and which is made or assembled in manufacturing facilities, on or off the building site, for installation or assembly and installation, on the building site. "Manufactured Building" also means any building of open construction for which certification under this Code is sought by the manufacturer and which is made or assembled in manufacturing facilities away from the building site for installation, or assembly and installation, on the building site. "Manufactured building" does not mean "mobile home."
- (13) "MOBILE HOME" means a factory-assembled, movable dwelling designed and constructed to be towed on its own chassis, comprised of frame and wheels, to be used without a permanent foundation and distinguishable from other types of dwellings in that the standards to which it is built include provisions for its mobility on that chassis as a vehicle.
- (14) "OPEN CONSTRUCTION" means any building, building component, assembly, or system manufactured in such a manner that all portions can be readily inspected at the building site without disassembly, damage or destruction.
- (15) "PREFABRICATED CONSTRUCTION" means construction of prefabricated units of "open construction" which are fabricated prior to erection or installation in a building or structure and may be shipped to their final on site location either as individual prefabricated units or prefabricated subassemblies.

- (16) “PREFABRICATED SUBASSEMBLY” means a built up combination of more than one structural element designed and fabricated as an assembled section of the building or structure which is of “open construction” and is to be incorporated into the structure by field erection of two or more such assemblies.
- (17) “PREFABRICATED UNIT” means an individual element of the building or structure of “open construction” such as a beam, girder, plank, strut, column or truss the integrated parts of which are prefabricated prior to incorporation into the structure, including the necessary means for erection and connection at the site.

## SECTION 2102 LOADS

Live, dead and wind load requirements shall conform to requirements set forth in Chapter 12.

## SECTION 2103 STRUCTURAL DESIGN

### 2103.1 – DESIGN STANDARDS

Structural design shall be in accordance with the requirements of this Code in conformance with “accepted engineering design standards” **approved** by the Building Code Council. Any deviations from “accepted engineering design standards” must be **approved** by the Building Code Council and published as amendments to “acceptable engineering design standards” for all designers to use.

### 2103.2 – DESIGN STANDARD ALTERNATE

Where the size and spacing of framing members on materials are in conflict with, or not covered by this Code, they will be acceptable if the assembly meets the load requirements of this Code, provided they conform to the requirements as set forth for tests under Section 2104. The Building Official may require structural analysis by an **Architect** or Registered Professional Engineer.

## SECTION 2104 TESTS

### 2104.1 – TEST STANDARDS

All tests when used as an alternate to design, shall be performed by an independent testing laboratory or licensed **architect** or registered professional engineer in accordance with “nationally recognized testing standards” as **approved** by the Building Code Council.

### 2104.2 – APPROVAL OF TESTS FOR MANUFACTURED BUILDINGS OF “CLOSED CONSTRUCTION”

All tests performed for manufactured buildings of “closed construction” must be witnessed by an “evaluation agency” **approved** by the Building Code Council. “Manufactured buildings” or “building components” labeled by agency **approved** by the Building Code Council must have “test frequency” and “monitoring inspection frequency” **approved** by the Council if the tests are to substitute for the engineering design.

### 2104.3 – APPROVAL OF TESTS FOR PREFABRICATED CONSTRUCTION AND MANUFACTURED BUILDINGS OF “OPEN CONSTRUCTION”

- (a) Every manufacturer of prefabricated construction shall file with the Building Official, duplicate copies of a certificate from a recognized testing laboratory, which states that tests have been made on this particular type of prefabricated construction and showing the live, dead and wind load capacities in pounds per square foot, uniformly distributed, together with a detailed physical description of the panels tested.
- (b) Panels and other elements tested for load shall sustain, without failure, for a period of twenty-four (24) hours, a superimposed load equal to two (2) times the live load. Recovery within twenty-four (24) hours, after removal of the full test load, shall be not less than seventy-five (75) percent of the observed deflection. The measured deflection of any panel or element under full live load shall be not over one three-hundred-and-sixtieth (1/360) of the clear span.

Exception: The measured deflection of any wall or roof panel or element under full live load shall be not over one two-hundred-and-fortieth (1/240) of the clear span, providing they are not plastered.

Such load tests of constructions are not intended to be used as a method for determination of acceptable allowable working stresses of a material as an alternate to the established standard method of determining such stresses.

- (c) When it is definitely ascertained by the Building Official that the requirements of this Code have been met, a permit shall be issued. A copy of all testing laboratory certifications shall be filed as a permanent record in the office of the Building Official.

## SECTION 2105 DESIGN APPROVALS AND INSPECTIONS

### 2105.1 – MANUFACTURED BUILDINGS

- (a) “*Closed Construction*” – According to G. S. 143-139.1 manufacturers may have their designs or “building systems” evaluated and **approved** by an agency **approved** by the Building Code Council without further inspections except as may be required for the enforcement of the code relative to the connection of units and components and enforcement of local ordinances governing zoning, utility connections and foundations. (See procedures for approval and/or agencies to label mobile homes and “methods and procedures required of **approved** agencies to follow” **approved** by the Building Code Council available as separate pamphlet.) Manufactured buildings of “closed construction” which do not have label of an agency **approved** by the Building Code Council are subject to inspection by local authorities, and manufacturers may have to ship units so they are open enough so local inspection may be made in order to obtain local approval.
- (b) “*Open Construction*” – “Prefabricated construction” and “manufactured buildings of open construction” are not required to be labeled by an agency **approved** by the N.C. Building Code Council but they must be sufficiently open for inspection because they are subject to inspection in the same manner as on-site built construction.

### 2105.2 – DWELLINGS

Same procedures as for manufactured buildings.



**2105.3 – MOBILE HOME**

- (a) *All mobile home units (new or used) manufactured between Sept, 1, 1971 and June 15, 1976* – All new and used mobile home units manufactured between September 1, 1971 and June 15, 1976 must bear the label of Underwriters’ Laboratories (UL), Nationwide Consumer Testing Institute, Pittsburgh Testing Laboratories or Glendon R. Mayo and Associates. Dealers are subject to \$500 fine in accordance with G. S. 143-149 and 151 and no electricity may be furnished to such units which are not so labeled in accordance with Section 143-150.
- (b) *All mobile home units (new or used) manufactured prior to September 1, 1971* – Units must comply with local ordinances.
- (c) *Units manufactured after June 15, 1976* – The Department of Housing and Urban Development has authority and responsibility for approval of inspection agencies to evaluate, inspect and label mobile homes in conformance with the federal standards.

**SECTION 2106 ERECTION AND INSTALLATION****2106.1 – HANDLING LOADS**

All manufactured buildings, building components and prefabricated construction and pre-assembled units shall be designed in such a manner to allow loading, transportation, unloading and assembly without overstressing any portion of the component or unit.

**2106.2 – ASSEMBLY PROCEDURES**

During the progress of installation, caution shall be taken to be sure that temporary bracing, or other supports are provided to avoid collapse or partial collapse.

**2106.3 – MANUFACTURED BUILDINGS**

- (a) *“Closed Construction”* – Manufactured buildings and units which bear the label of an agency **approved** by the Building Code Council are only subject to inspection by local authorities to the extent if the unit as erected complies with the Code. Such inspections limited to inspection to determine “damage in transit” or “alterations and additions” made to the unit after they were inspected and labeled plus inspections to determine compliance with connection between units, zoning, utility connections and foundations.
- (b) *“Open Construction”* – Manufactured buildings of “open construction” and prefabricated construction shall be subject to the same erection and installation requirements as other buildings required by this Code.

**2106.4 – DWELLING**

Same procedures as for manufactured buildings.

**2106.5 – MOBILE HOME**

Refer to the State of North Carolina Regulations for Mobile Homes for information on erection and installation including foundations, and tie-downs, electrical, plumbing, and heating, utility connections.

## CHAPTER 22 LIGHT-TRANSMITTING PLASTICS

### SECTION 2201 GENERAL

#### 2201.1 – SCOPE

- (a) The provisions of this chapter shall govern the quality and methods of application of plastics for use as light-transmitting materials in buildings and structures. When used as interior finish plastic materials shall meet the requirements of [Section 704.3](#). Light-transmitting plastics materials which meet the performance requirements for walls and roofs may be used in accordance with the other applicable Chapters of this Code.
- (b) Plastic materials may be of any class as defined by this section. Before any plastic material is [approved](#) for use, the manufacturer shall file with the department technical data which relates to the proposed use of the material. The data shall include the pertinent physical, mechanical, and thermal properties such as weather resistance, expansion coefficient and combustibility characteristics. The department shall determine the adequacy of the data. Where the department determines that the material is satisfactory for the intended use, approval of the material shall be given subject to the limitations specified in this Chapter.
- (c) All plastic materials [approved](#) for use under this Code shall be identified by the trade formula number or name or other acceptable identification. Each unit or package shall bear the approval number or other identification mark of the approving authority.

#### 2201.2 – DEFINITIONS

- (a) **Approved plastic:** A thermoplastic, thermosetting or reinforced plastic material which has self-ignition temperature six hundred fifty (650) degrees Fahrenheit or greater when tested in accordance with “Standard Method of Test for Ignition Properties of Plastics, ASTM D 1929”, a smoke density rating no greater than four hundred fifty (450) when tested in accordance with “Standard Method of Test for Surface Burning Characteristics of Building Materials, ASTM E 84” in the way intended for use, or a smoke density rating no greater than seventy-five (75) when tested in the thickness intended for use by “Standard Method for Measuring the Density of Smoke from the Burning or Decomposition of Plastics, ASTM D 2843”; products of combustion no more toxic than those of untreated wood when burned under similar conditions and which meets one of the combustibility classifications listed below:
  - CC 1 – Plastic materials which have a burning extent of one (1) inch or less when tested in nominal .060-inch thickness by ASTM D 635, “Test for Flammability of Self-Supporting Plastics”.
  - CC 2 – Plastic materials which have a burning rate of two and one-half (2.5) inches per minute or less when tested in nominal .060-inch thickness by ASTM D 635 or in the thickness intended for use.
- (b) **Light diffusing system:** a suspended construction consisting in whole or in part of lenses, panels, grids or baffles suspended below independently mounted electrical lighting sources.

- (c) Plastic glazing: plastic materials which are glazed or set in frame or sash and not held by mechanical fasteners which pass through the glazing material.
- (d) Plastic roof panels: plastic materials which are fastened to structural members or to structural panels or sheathing and which are used as light-transmitting media in the plane of the roof.
- (e) Plastic wall panels: plastic materials which are fastened to structural members or to structural panels or sheathing and which are used as light-transmitting media in exterior walls.
- (f) Glass fiber reinforced plastic: plastic reinforced with glass fiber having not less than twenty (20) percent of glass fibers by weight.
- (g) Thermosetting materials: a plastic material which is capable of being changed into a substantially non-reformable product when cured.
- (h) Thermoplastic material: a plastic material which is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

### 2201.3 – DESIGN AND INSTALLATION

- (a) Structural requirements: All plastic materials and their assemblies shall be of adequate strength and durability to withstand the loads and forces specified in Chapter 12 for their [approved](#) use.
- (b) Connections and supports: Fastenings shall be adequate to withstand design loads as prescribed elsewhere in this Code. Adequate allowance shall be made in the fastenings and supports for differential expansion and contraction of the connected materials.

## SECTION 2202 GLAZING OF UNPROTECTED OPENINGS

### 2202.1 – GENERAL

- (a) Doors, sash, and openings which are not required to be fire protected may be glazed with [approved](#) plastic materials in Group R buildings and in all types of Group E buildings. In other classes of construction and occupancy, such openings not required to be fire protected may be glazed or equipped with [approved](#) plastic materials subject to the following requirements:
  1. The area of such glazing shall not exceed twenty-five (25) percent of the wall face of the story in which it is installed.
  2. The area of a pane of glazing installed above the first story shall not exceed sixteen (16) square feet and the vertical dimension of a pane shall not exceed four (4) feet. There shall be a minimum three (3) feet vertical spandrel wall between stories.
  3. Approved plastics shall not be installed more than seventy-five (75) feet above grade level.

## 2202.2 – EXCEPTIONS

- (a) Approved plastic materials may be installed in areas up to fifty (50) percent of the wall area of each story in structures less than seventy-five (75) feet in height which are provided on each floor above the first floor with continuous architectural projections constituting an effective fire canopy extending at least three (3) feet from the surface of the wall in which the glazing is installed. The size and the dimensions of the individual units shall not be limited in such installations except as required to meet structural loading requirements.
- (b) When complete automatic fire sprinkler protection is provided in the building, the permissible area of glazing permitted by [2202.1\(a\)1](#) may be increased to a maximum of fifty (50) percent of the wall face of the story in which it is installed, and shall be exempt from the provisions of [2202.1\(a\)2](#) and [3](#).
- (c) Combinations or plastic glazing and plastic wall panels shall be subject to the area, height, percentage limitations and separation requirements applicable to the class of plastics as prescribed for wall panel installations.

## SECTION 2203 EXTERIOR WALL PANELS

### 2203.1 – GENERAL

- (a) Approved plastic materials may be used as wall panels in exterior walls not required to have a fire resistive rating, except Groups I, A-I, and H. occupancies, subject to the following requirements:
  - 1. Area limitation and separation requirements of exterior wall panels shall be as provided in [Table 2203.1](#).
  - 2. Vertical spandrel wall separation between stories shall be as follows:
    - (A) Three (3) feet for CC 1 plastic wall panels.
    - (B) Four (4) feet for CC 2 plastic wall panels.
  - 3. Approved plastics shall not be installed more than seventy-five (75) feet above grade level.

**TABLE 2203.1 – AREA LIMITATIONS AND SEPARATION REQUIREMENTS FOR PLASTIC WALL PANELS\***

Fire Separation (ft.)	Class of Plastic	Max. % area of Ext. Walls in Plastic Panels	Max. sq. ft. Single Area	Minimum Separation Panels (ft.)	
				Vertical	Horizontal
6 ft. or less	---	NP	NP	---	---
6 ft. or more But less than 11 ft.	CC 1	10	50	8	4
	CC 2	NP	NP	---	---
11 ft. or more But less than 30 ft.	CC 1	25	90	6	4
	CC 2	15	70	8	4
Over 30	CC 1	30	300	3**	0
	CC 2	25	100	6**	3

\* See Section 2202.2(c) for combination of glazing and wall panel areas permitted.

\*\* See Section 2202.1(a) 2.

**2203.2 – EXCEPTIONS**

- (a) In structures which are provided, on any floor above the first, with continuous architectural projections constituting an effective fire canopy extending at least thirty-six (36) inches from the surface of the wall in which plastic wall panels are installed, there need be no vertical separation at that floor except that provided by the vertical thickness of the projection.
- (b) When complete automatic fire sprinkler protection is provided in the building the maximum percent area of plastic panels in the exterior wall and the maximum square feet of single area given in Table 2203.1 may be increased one hundred (100) percent, but in no case shall the area of plastic wall panels exceed fifty (50) percent of the wall area. These uses shall be exempt from height limitations.

**SECTION 2204 ROOF PANELS**

**2204.1 – GENERAL**

Transparent or translucent plastic panels may be used in roofs not required to have a fire-resistive rating and in all roofs where sprinkler protection is provided, except for Occupancy Classifications I, A-1 and H, provided:

- (a) That on structures or over occupancies required to have fire-retardant or non-combustible roofing, the panels conform to the slope of the roof which shall be at least four inches in twelve inches (4" in 12") or steeper, and each area of plastic panels shall be separated from every other area of plastic panels by at least eight feet (8') laterally and ten feet (10') along the slope of the roof.

## LIGHT-TRANSMITTING PLASTICS

- (b) All plastic roof panels shall be attached directly to the building framework or shall be mounted individually in steel or other [approved](#) metal frames.
- (c) Corrugated panels shall be pitched in the direction of the corrugations.

### 2204.2 – AREA LIMITATIONS

Plastic sections installed on roofs required to have a fire-retardant or non-combustible roofing shall conform to the following area limitations:

- (a) CLASS A PLASTICS: No section shall exceed three hundred square feet (300 sq. ft.) in area, and the aggregate area of such sections shall not exceed 20 percent of the floor area of the room or occupancy sheltered by the roof.
- (b) CLASS B PLASTICS: No section shall exceed three hundred square feet (300 sq. ft.) in area, and the aggregate area of such sections shall not exceed 12percent of the floor area of the room or occupancy sheltered by the roof.
- (c) CLASS C AND D PLASTICS: No section shall exceed one hundred square feet (100 sq. ft.) in area, and the aggregate area of such sections shall not exceed 7½ percent of the floor area of the room or occupancy sheltered by the roof.

**TABLE 2204  
AREA LIMITATIONS FOR PLASTIC ROOF PANELS AND SKYLIGHTS**

Class of Plastic	Maximum Area	
	Individual Unit or Panel (sq. ft.)	Maximum Aggregate Area (% of floor area)
CC 1	300	30
CC 2	100	25

### 2204.3 – EXCEPTIONS

- (a) One story buildings not more than sixteen (16) feet in height and not exceeding twelve hundred (1,200) square feet in area and not closer than eleven (11) feet to another building are exempt from the limitations of [Section 2204.2](#).
- (b) Low hazard uses such as swimming pool shelters, etc., are exempt from the area limitations of [Section 2204.2](#) provided they do not exceed five thousand (5,000) square feet in area and are not closer than eleven (11) feet to the property line of adjacent buildings.
- (c) Roof coverings over terraces and patios of one and two family dwellings shall be permitted with [approved](#) plastics.

## SECTION 2205 SKYLIGHTS

### 2205.1 – GENERAL

Provisions for the use of [approved](#) plastics in skylights are as follows:

- (a) The skylight shall not be installed over shaftways, vent shafts or stair enclosures.

- (b) The skylight shall not be installed in Occupancy Classification H.
- (c) The plastic shall be mounted on a curb at least four inches (4") above the plane of the roof on a curb constructed of materials consistent with the construction of the roof upon which the skylight is mounted.
- (d) The plastic units shall be installed five feet (5') apart. Units shall not be installed closer than five feet (5') from an adjacent wall. In no case shall such units be installed within the minimum allowable distance from any wall openings that are required to be fire protected.
- (e) Panels shall have a minimum allowable slope of three inches in twelve inches (3" in 12"). The maximum allowable length of the panel shall be ten feet (10'). Corrugated panels shall be installed with the corrugations running with the inclined plane.
- (f) Dome-shaped or curved units shall rise a distance of .1 times the maximum span or five inches (5"), whichever is greater.
- (g) All edges of plastic units shall be enclosed in metal.

### **2205.2 – CLASS A PLASTIC**

Class A plastics may be used in skylights provided:

- (a) The maximum area enclosed within the curb of units shall not exceed three hundred square feet (300 sq. ft.).
- (b) The aggregate area of all such units shall not exceed 33 1/3 percent of the floor area of the room sheltered by the roof in which the units are installed.

### **2205.3 – CLASS B PLASTIC**

Class B plastics may be used in skylights under the same conditions as allowed in subsection 2205.2 except that the aggregate area shall not exceed 25 percent of the floor area sheltered by the roof upon which it is erected.

### **2205.4 – CLASS C AND D PLASTICS**

Class C and D plastics may be used in skylights provided:

- (a) The maximum area enclosed within the curb of units equipped with flat or corrugated plastic sheets not exceed one hundred square feet (100 sq. ft.).
- (b) The aggregate area of all such units shall not exceed 20 percent of the floor area of the room sheltered by the roof in which the units are installed.
- (c) Flat or corrugated units shall slope from the horizontal at least four inches in twelve inches (4" in 12") and shall not exceed eight feet (8') from the bottom to the top of the inclined plane.

## **SECTION 2206 LIGHT DIFFUSERS IN CEILINGS**

### **2206.1 – LIGHT DIFFUSING SYSTEMS**

- (a) Plastic light-diffusing systems shall not be installed in Groups I, A-1, or H occupancies unless protected with automatic sprinkler systems. Plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers.

## LIGHT-TRANSMITTING PLASTICS

(b) Approved plastic materials shall comply with [Section 704.3](#), unless the plastic panels meet the following requirements:

1. Fall from their mounting at an ambient temperature of at least two hundred (200) degrees Fahrenheit below the ignition temperature of the plastic material as measured by ASTM D-1929;
2. Remain in place at an ambient room temperature of one hundred seventy-five (175) degrees Fahrenheit for a period of not less than fifteen (15) minutes;
3. The maximum length of any single plastic panel shall not exceed ten (10) feet and the maximum area of any single light diffuser shall not exceed thirty (30) square feet.

(c) A plastic light-diffusing system shall not be installed in areas required to be equipped with automatic sprinklers unless appropriate tests by a recognized laboratory have shown that such system does not prevent effective operation of the sprinklers or unless sprinklers are located both above and below the light-diffusing system to give effective sprinkler protection.

### **2206.2 – ELECTRICAL LIGHTING FIXTURES**

Plastics light-transmitting panels and light diffuser panels installed in [approved](#) electrical lighting fixtures shall comply with [Section 704.3](#) unless the plastic panels meet the requirements of [Section 2206.1\(b\)](#).

### **2206.3 – AREA LIMITATIONS**

Unless the occupancy is protected by an [approved](#) automatic sprinkler system, the area of [approved](#) plastic materials when used in required fire exits or corridors shall not exceed thirty (30) percent of the aggregate area of the ceiling in which they are installed.

## **SECTION 2207 PARTITIONS**

### **2207.1 – GENERAL**

Refer to control of partitions in the applicable section of the Code.

## **SECTION 2208 EXTERIOR VENEER**

### **2208.1 – GENERAL**

(a) Exterior plastic veneer shall be of [approved](#) plastic materials and shall meet the following requirements:

1. Plastic veneer shall not be attached to any exterior wall to a height greater than thirty-five (35) feet above grade in locations other than in the Fire District.
2. Sections of plastic veneer shall not exceed two hundred (200) square feet in area.
3. Sections of plastic veneer shall be separated by a minimum of four (4) feet vertically.

## **SECTION 2209 AWNINGS AND SIMILAR SHELTERS**

Approved plastic may be used on awnings and similar structures in conformance with general provisions of other sections of the Code.



**SECTION 2210 GREENHOUSES**

Approved plastic may be used in lieu of plain glass in green houses.

**SECTION 2211 SIGNS AND OUTDOOR DISPLAYS**

The use of plastics in signs, outdoor displays and similar structures shall be governed by provisions of Chapter XXIII.

**SECTION 2212 BATHROOM ACCESSORIES**

Approved plastics shall be permitted as glazing shower stalls, shower doors, bathtub enclosures, and similar accessory units provided they meet the human impact requirements of the applicable Code.

## CHAPTER 23 SIGNS AND OUTDOOR DISPLAYS

### SECTION 2301 GENERAL

#### 2301.1 – OUTDOOR ADVERTISING DISPLAYS

Outdoor advertising displays, means any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be so constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which are displayed in any manner whatsoever out of doors. Every outdoor display shall be classified and conform to the requirements of that classification as set forth in this chapter.

#### 2301.2 – CLASSIFICATIONS

For the purpose of this chapter and the regulations and provisions thereof, outdoor advertising displays shall be classified into one of the following type signs:

- (a) **SPECTACULAR SIGNS** – means an “Outdoor Advertising Display Sign” advertising copy usually animated, constructed of metal, wired for lights or luminous tubing, or both, with copy action controlled by the flashed circuit breakers or matographs and attached on an open face steel structure built especially for the purpose.

Spectacular signs may be built upon the ground, attached to a wall, or above the roof, or projecting from a wall, provided that such spectacular sign meets the requirements of the provisions of this Code governing ground, roof, wall, projection or marquee signs, depending upon where such sign is built, as set forth below.

Spectacular signs shall be illuminated with electricity only.

- (b) **GROUND SIGN** – means an “Outdoor Advertising Display Sign” when such sign is supported by uprights or braces in or upon the ground.
- (c) **ROOF SIGN** – means an “Outdoor Advertising Display Sign” erected, constructed, or maintained above the roof of any building.
- (d) **WALL SIGN** – means an “Outdoor Advertising Display Sign” that shall be affixed to the wall of any building. when such sign shall project not more than twelve (12) inches from the building.
- (e) **PROJECTION SIGN** – means an “Outdoor Advertising Display Sign” which is affixed to any building wall or structure and extends beyond the building wall, structure, building line or property line more than twelve (12) inches.
- (f) **MARQUEE SIGN** – means a projecting sign attached to or hung from a marquee and said marquee shall be known to mean a canopy or covered structure projecting from and supported by a building, when such canopy or covered structure extends beyond the building, building line or property line.

- (g) SHINGLE SIGN – means a projection or wall sign not over six (6) square feet in area, constructed of metal or other non-combustible material attached securely to a building and not projecting more than twenty-four (24) inches over public property.

### **2301.3 – PERMITS REQUIRED**

- (a) No “Outdoor Advertising Display Sign” shall hereafter be erected, constructed, altered or maintained except as provided in this Code, until after permit for the same has been issued by the Building Official as required in Section 105 and the fee paid.
- (b) EXCEPTION

No permit fee shall be required for a shingle sign over a show window or door of a store or business establishment, announcing without display or elaboration, only the name of the proprietor and nature of the business; nor shall a permit be required for a ground sign advertising for sale or rent property, providing such sign is not over fifteen (15) feet square in area. (See Local Ordinance.)

### **2301.4 – IDENTIFICATION OF SIGNS**

Every Outdoor Advertising Display Sign hereafter erected, constructed or maintained, for which a permit is required shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the number of permit issued for said sign by the Building Official.

### **2301.5 – UNSAFE SIGNS**

Should any sign become insecure or in danger of falling or otherwise unsafe in the opinion of the Building Official, the owner thereof, or the person or firm maintaining the same, shall upon written notice from the Building Official, forthwith in the case of immediate danger and in any case within ten (10) days, secure the same in a manner to be **approved** by the Building Official, in conformity with the provisions of this Code or remove such sign. If such order is not complied with in ten (10) days the Building Official shall remove such sign at the expense of the owner or lessee thereof.

### **2301.6 – MAINTENANCE**

All signs for which a permit is required, together with all their supports, braces, guys and anchors shall be kept in repair and unless of galvanized or non-corroding metal shall be thoroughly painted at least once every two years. The Building Official may order the removal of any sign that is not maintained in accordance with the provisions of this section. Such removal shall be at the expense of the owner or lessee.

### **2301.7 – UNLAWFUL SIGNS**

In case any sign shall be installed, erected, or constructed in violation of any of the terms of this Code the Building Official shall notify by registered mail or written notice served personally, the owner or lessee thereof to alter such sign so as to comply with this Code or of the Zoning Regulations and to secure the necessary permit therefor, or to remove the sign. If such order is not complied with in ten (10) days the Building Official shall remove such sign at the expense of the owner or lessee thereof.

### **2301.8 – LOCATION RESTRICTIONS**

No Outdoor Advertising Display Sign shall be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. No sign shall be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for legal ventilation.

Combustible ground signs and roof signs, as defined in [Section 2301.2\(b\)](#) and [\(c\)](#), shall not be permitted in primary and secondary fire districts.

### **2301.9 – SIGNS PROJECTING OVER PUBLIC PROPERTY**

Signs projecting from a building or extending over public property shall maintain a clear height of nine (9) feet above the sidewalk and all such signs shall not extend more than eighteen (18) inches from the curbline.

## **SECTION 2302 STRUCTURAL REQUIREMENTS**

### **2302.1 – DESIGN AND STRESS DIAGRAMS REQUIRED**

Before a permit shall be granted, the erector of every Outdoor Advertising Sign with the exception of shingle signs and light cloth temporary signs, shall submit to the Building Official a design and stress diagram or plan, containing the necessary information to enable the Building Official to determine that such sign complies with all the regulations of this Code.

### **2302.2 – WIND PRESSURE**

In the design and erection of all Outdoor Advertising Display Signs, the effect of wind shall be carefully considered. All signs shall be so constructed as to withstand the wind pressure as specified in [Section 1205](#).

### **2302.3 – WORKING STRESSES**

- (a) In all Outdoor Advertising Display Signs, the allowable working stresses shall conform with the requirements of [Section 1205](#) of this Code, except as specified below.
- (b) The allowable working stresses for steel and wood shall be in accordance with the provisions of Chapter XV – “Structural Steel” and Chapter XVII – “Wood.”
- (c) The working strength of chains, cables, guys or steel rods shall not exceed one-fifth (1/5) of the ultimate strength of such chains, cables, guys or steel rods.

## **SECTION 2303 CONSTRUCTION**

### **2303.1 – GROUND SIGNS**

- (a) No ground sign constructed primarily of wood material shall be at any point over twenty-four (24) feet above the ground level or located in the primary or secondary Fire District.
- (b) Lighting reflectors may project beyond the face of the sign.
- (c) The bottom coping of every ground sign shall be at least three (3) feet above the ground or street level, which space may be filled with platform decorative trim or light wooden construction.

- (d) Every ground sign shall provide rigid construction to withstand wind action in all directions.
- (e) Any person or persons, partnership, firm or corporation occupying any vacant lot or premises by means of a ground sign, shall be subject to the same duties and responsibilities as the owner of the lot or premises, with respect to keeping the same clean, sanitary, inoffensive, free and clear of all obnoxious substances and unsightly conditions on the ground in the vicinity of such ground sign on said premises for which they may be responsible.
- (f) Wherever anchors or supports consist of wood embedded in the soil, the wood shall be pressure-treated with an [approved](#) preservative.
- (g) Signs higher than 30 feet will be allowed provided they are designed to meet the same structural and fire protection requirements as buildings of equivalent height. Design calculations must be filed with the Building Official or the persons having jurisdiction.

### 2303.2 – ROOF SIGNS

- (a) All roof signs shall be so constructed as to leave a clear space of not less than six (6) feet between the roof level and the lowest part of the sign and shall have at least five (5) feet clearance between the vertical supports thereof; no portion of any roof sign structure shall project beyond an exterior wall.
- (b) Every roof sign shall be constructed entirely of steel construction, or other noncombustible material, including the upright supports and braces, except that only the ornamental molding and battens behind the steel facing and the decorative lattice work may be of wooden construction.
- (c) The bearing plates of all roof signs shall distribute the load directly to or upon masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.
- (d) No roof sign having a tight or solid surface shall be at any point over twenty-four (24) feet above the roof level.
- (e) Open roof signs in which the uniform open area is not less than forty (40) percent of total gross area may be erected to a height of seventy-five (75) feet on buildings of Type I or Type II Construction and on other type buildings to a height of forty (40) feet, all such installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition as set forth in Section 2301.7.

### 2303.3 – WALL SIGNS

- (a) Wall signs attached to exterior walls of solid masonry, concrete or stone, shall be safely and securely attached to the same by means of metal anchors, bolts or expansion screws of not less than three-eighths (3/8) inch in diameter and shall be embedded at least five (5) inches. No wooden blocks shall be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. No wall sign shall be supported by anchorages secured to an unbraced parapet wall.
- (b) The surface face of all exterior wall signs must be of non-combustible material or exterior type fire retardant treated wood but the ornamental molding surrounding same may be of wooden construction. Temporary cloth signs with wood frames may be kept in place for a period not exceeding thirty (30) days.

- (c) The surface face of all interior wall signs shall be of non-combustible material or fire retardant treated wood.

#### **2303.4 – PROJECTING SIGNS**

- (a) All projecting signs shall be constructed entirely of metal or other non-combustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. No staples or nails shall be used to secure any projecting sign to any building or structure.
- (b) The dead load of projecting signs, not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys, or steel rods having net cross sectional dimension of not less than three-eighths (3/8) inch in diameter. Such supports shall be erected or maintained at an angle of at least 45 degrees with the horizontal to resist the dead load and at an angle of 45 degrees or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds thirty (30) square feet in one facial area, there shall be provided at least two such supports on each side not more than eight feet apart to resist the wind pressure.
- (c) ANCHORAGE – All supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chain, guys or steel rod, with a minimum five-eighths (5/8) inch bolt or lag screw, by an expansion shield. Turn buckles shall be placed in all chains, guys or steel rods supporting projecting signs.
- (d) Chains, cables, guys, or steel rods used to support the live or dead load of projecting signs may be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but no such supports shall be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.
- (e) No projecting sign shall be erected on the wall of any building so as to project above the roof or cornice wall or above the roof level where there is no cornice wall; except that a sign erected at a right angle to the building, the horizontal width of which sign perpendicular to such wall does not exceed eighteen (18) inches may be erected to a height not exceeding two (2) feet above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner, shall be deemed to be erected at a right angle to the building wall.

#### **2303.5 – MARQUEE SIGNS**

Marquee signs shall be constructed entirely of metal or non-combustible material and may be attached to, or hung from a marquee, and such signs when hung from a marquee shall be at least eight (8) feet at its lowest level above the sidewalk or ground level, and further, no such sign shall extend outside the line of such marquee. Marquee signs may be attached to the sides and front of a marquee, and such sign may extend the entire length and width of said marquee, provided such sign does not extend more than six (6) feet above, nor one (1) foot below such marquee, but under no circumstances, shall the sign or signs have a vertical dimension greater than eight (8) feet.

**2303.6 – SPECTACULAR SIGNS**

All permits for spectacular signs shall be issued by the Building Official upon application therefor, after approval by the department having jurisdiction over electricity, upon payment of the required permit fee. The permit to erect or maintain a spectacular sign shall be good for one (1) year. The Building Official may issue a renewal of the permit issued hereunder upon the expiration thereof or within thirty (30) days thereafter upon the payment by the applicant of a renewal fee and by surrendering the old permit, accompanied by satisfactory proof in the form of an affidavit that the sign is as safe as when originally licensed and that the wiring or piping of the same is in good condition. All spectacular signs shall be constructed of non-combustible materials.

**SECTION 2304 USE OF PLASTIC MATERIALS**

- (a) Notwithstanding any other provisions of this Code, plastic materials which burn at a rate no faster than 2.5" per minute when tested in accordance with ASTM D635 shall be deemed **approved** plastic and may be used as the display surface material and for the letters and decorations and facings on signs and outdoor display structures, provided, that on the first fire district the structure of the sign in which the plastic is mounted or installed is incombustible.
- (b) Individual plastic facings of electric signs shall not exceed 200 square feet in area.
- (c) In no case shall the area of plastic on a display surface exceed 1,100 square feet.
- (d) Letters and decorations mounted upon an **approved** plastic facing or display surface may be made of **approved** plastics.

## CHAPTER 24 SAFEGUARDS DURING CONSTRUCTION

### SECTION 2401 GENERAL

The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of this chapter and OSHA requirements.

#### **2401.1 – ALLOWABLE USE OF PUBLIC PROPERTY DURING CONSTRUCTION**

The amount of space and conditions under which public property may be used for construction or demolition purposes shall be as set forth below if permitted by local governing authority:

- (a) One-third (1/3) of the width of street that is adjacent to the curb in front of the building being erected and for which a permit has been issued. If street in front of property adjoining such building is to be used for similarly limited storage, a due waiver of claim against the applicable governing authority for damages on account of such use, issued by the owner of such property, shall be filed with the Building Official before such use shall be permitted.
- (b) Street or sidewalk space may be used in accordance with the following provisions:
  - 1. That such one-third (1/3) allocated space or any portion thereof shall not come within five (5) feet of a rail or railway track.
  - 2. That a walkway be constructed in the outer portion of the permissible occupied street space, conforming to the requirements of [Section 2401.3](#).
  - 3. That building material, fence, shed or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, lamp post, manhole, fire alarm box, or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.
  - 4. That a ten (10) foot clear roadway be maintained through any [alley](#) located along the building site.
  - 5. That proper precaution shall be made during construction to prevent concrete, mortar washings, or any other material from entering a sewer.
  - 6. The person or persons to whom a permit is issued for such purposes as stated herein, shall post with the applicable governing authority a bond of such type and amount as may be deemed advisable by the applicable governing authority as protection from any and all liability.

#### **2401.2 – WHERE COVERED WALKWAYS ARE REQUIRED**

- (a) During the erection or demolition of any building exceeding one (1) story in height that is located at a distance less than ten (10) feet or less than one-quarter (1/4) of the height of the building from any street or [alley](#) property line, or when required by the Building Official, a roof covering for the entire length of the project shall be provided over the temporary or permanent sidewalk, from the time the construction or demolition extends above the second floor level until materials are no longer being used or handled on the front above such walk.



- (b) Buildings having their exteriors altered or repaired in an extensive manner involving any hazard shall be provided with a covered walk as required for new structures during erection.

**Exception:**

Where, in the opinion of the Building Official, a covered walk is not necessary, a permit may be issued to block off part of the sidewalk and have a temporary walk constructed as provided in [Section 2401.3](#).

**2401.3 – CONSTRUCTION OF WALKWAYS, FENCES AND PROTECTIVE COVERINGS**

Before any construction work is commenced the owner or his agent shall construct a temporary walkway in conformity with this section.

- (a) All fences, barriers, or temporary structures of any kind located on public highways, shall be so constructed as not to obstruct vision at the intersection of streets.
- (b) Walkways shall be not less than four (4) feet wide in the clear except that in congested districts the Building Official may require a walkway as wide as, in his opinion, is necessary. Walks shall be built in a safe and substantial manner and be maintained in that condition at all times. A smooth handrail of substantial construction, not less than three (3) feet high, shall be provided on the traffic or street side of the walkway, and also on the building side when considered necessary by the Building Official.
- (c) Where the distance from building to street or [alley](#) property line is less than half the height of the building, a fence of substantial solid construction at least eight (8) feet high shall be provided on the building side of the walkway.
- (d) Roof coverings over walkways, as required by Section 2401.2, shall be constructed of not less than one layer of two (2) inch nominal dimension wood plank spanning not over three (3) feet between supports, or equivalent decking. The framework supporting the walkway covering shall be well braced and designed to support at least one hundred fifty (150) pounds per square foot but the top deck shall be designed to carry not less than two hundred fifty (250) pounds per square foot. The roof covering shall be of width sufficient to cover the entire walkway or sidewalk, and shall be made watertight. Suitable provision shall be made for adequate lighting of the walk under the covering, at all times. A minimum clearance of eight (8) feet six (6) inches shall be maintained above walkways.

**2401.4 – WALKWAYS OVER EXCAVATED AREAS**

When the area occupied by the sidewalk or temporary walkway is to be excavated, such walk shall be made of boards not less than two (2) inches nominal dimension designed to support a load of not less than one hundred and fifty (150) pounds per square foot, provided with suitable ramps at each end. Such walkways shall be provided with a fence and handrails on each side.

**2401.5 – STORAGE OF MATERIALS OVER WALKWAYS**

Whenever a roof of a walkway is used for the storing of materials, it shall be designed for the load to which it is to be subjected and a railing and footboard shall be installed so as to prevent the materials from spilling into the street. The posts or other supporting members on the street side shall be protected so as to insure against failure due to impact from street traffic.

### **2401.6 – WALKWAYS TO BE KEPT IN REPAIR**

The street side of any barricade or fence, handrails and sidewalks shall be kept reasonably smooth and in good repair while construction work is in progress, or while such barricades, fences, or walkways are placed on or over public property.

### **2401.7 – CLEANING OF SIDEWALKS AND STREETS**

The owner or his agent, upon the completion of the building, shall immediately remove all walkways, debris and all other obstructions and leave such public property in as good a condition as it was before such work was commenced.

### **2401.8 – RED LIGHTS REQUIRED**

Every walkway shall be kept well lighted continuously between sunset and sunrise and the outer edge of the occupied space of the street or sidewalk shall have placed thereon “red lights” which shall burn continuously between sunset and sunrise.

### **2401.9 – SAFETY REQUIREMENTS DURING CONSTRUCTION**

- (a) Construction Scaffolds, Hoists, Equipment, Etc. – All equipment such as temporary stairs, ladders, ramps, scaffolds, hoists, runways, barricades, chutes, elevators, etc., as required for the execution of any construction work shall be substantially constructed and erected to insure the safety of the workmen using them or passing under, on or near them. Where a large amount of scaffolding is used the Building Official may require the use of non-combustible material or fire retardant treated wood. The flame proofing of tarpaulins may also be required by the Building Official where, in his opinion, the fire hazard warrants such precaution.
- (b) Sanitation – Adequate sanitary facilities for the convenience of all workmen shall be provided. These facilities shall be kept in a clean and sanitary condition throughout the duration of the work. The temporary workman’s convenience shall be enclosed, screened, and weatherproofed and shall be connected to a sewer. Upon removal of the temporary facilities the sewer connection shall be removed and the sewer capped. In lieu of connecting to a sewer, the temporary facility may be a portable, enclosed, chemically treated, tank-tight unit.
- (c) Standpipes – In buildings under construction four (4) stories or more in height, standpipes where required by the Code shall be installed as the work progresses. Connection outlets shall be provided at each floor level and all such connections and fittings from ground level up shall be designed to fit the fire department equipment. All standpipes shall be not less than two and one-half (2-1/2) inches in diameter and so located that one hundred (100) feet of one and one-half (1-1/2) inch hose will reach within forty (40) feet of the most remote part of each floor area.

**2401.10 – PROTECTION OF ROOFS AND SKYLIGHTS OF ADJOINING BUILDINGS**

When a building or structure is to be carried above the roof of an adjoining building, protection for the skylights and roof of such adjoining building shall be provided, at his own expense, by the person constructing or causing the construction of such building or structure; provided that if the owner, lessee or tenant of the adjoining building should refuse permission to have the roofs and skylights protected, the responsibility and expense for the necessary protection shall devolve on the person refusing such permission.

# CHAPTER 25

## FIRE RESISTANCE STANDARDS FOR MATERIALS AND CONSTRUCTION

### SECTION 2501 GENERAL

- (a) Fire protection requirements of this Code are based on fire resistance ratings. Materials, thicknesses, and assemblies which have successfully performed under tests made by a recognized laboratory in accordance with the requirements of the “Standard Methods of Fire Tests of Building Construction and Materials, ASTM E119,” shall be accepted by the Building Official for specific ratings, as shall those described in [Appendix K](#) of this Code. “Fire Resistance Directory” of Underwriters Laboratories is hereby adopted for design and listing of materials acceptable under this code for attainment of specific ratings.
- (b) Thicknesses as established by said tests shall be construed as establishing minimum requirements for fire resistance only, and shall not preclude the application of other requirements of this code where consideration of strength, durability or stability require greater thicknesses.
- (c) No combustible materials shall enter into the construction of assemblies except as provided in the foregoing prescribed tests and designs.
- (d) Fire doors, curtains, shutters, windows, or other protection required for openings in fire resistive walls, shall be in accordance with the requirements of Section 703.
- (e) Walls or partitions, floors, roof-ceiling or floor-ceiling assemblies having required fire resistance rating shall not be penetrated by electrical, telephone, plumbing, air conditioning, intercommunication systems or similar facilities unless the penetrations are made in such a manner that the required fire resistance is not decreased. (See [Section 105.4\(c\)](#).)

#### **2501.1 – MATERIALS FOR FIRE PROTECTION**

Materials prescribed herein for fire-resistance and fire protection shall conform with the requirements of this Chapter.

#### **2501.2 – CONCRETE**

- (a) Concrete used for fire-protection shall consist of one part (by volume) portland cement and not more than two parts of sand and four parts of [approved](#) aggregate, not over  $\frac{3}{4}$ ” diameter, reinforced with wire or metal fabric.
- (b) Grade A Concrete is concrete in which the coarse aggregate consists of blast-furnace slag, limestone, calcareous gravel, trap rock, burnt clay or shale, cinders containing not more than 25% of combustible material and not more than 5% of volatile material, and other materials meeting the requirements of this Code and containing not more than 30% quartz, chert, flint, and similar materials.
- (c) Grade B Concrete is concrete in which the coarse aggregate consists of granite, quartzite, siliceous gravel, sandstone, gneiss, cinders containing more than 25% but not more than 40% of combustible materials and not more than 5% of volatile material, and other materials meeting the requirements of this Code and containing more than 30% quartz, chert, flint, and similar materials.

**2501.3 – BRICK**

Brick shall be laid in Type M, S, N or O mortar. Clay and shale brick shall conform to the American Society for Testing and Materials “Standard Specifications for Building Brick (Solid Masonry Units Made From Clay or Shale)” (ASTM C62). Concrete brick shall conform to the American Society for Testing and Materials “Standard Specifications for Concrete Building Brick” (ASTM C55). Sand-lime brick shall conform to the American Society for Testing and Materials “Standard Specifications for Sand-Lime Building Brick” (ASTM C73).

**2501.4 – CLAY OR SHALE TILE**

Hollow clay or shale tile shall be laid in Type M, S, N, O or gypsum mortar. Clay or shale tile used in non-bearing partitions, and for fireproofing shall meet the requirements of the American Society for Testing and Materials “Standard Specifications for Structural Clay Non-Load Bearing Tile” (ASTM C56). Clay or shale tile used in exterior walls and in all load-bearing walls or load-bearing partitions, shall comply with the requirements of the American Society for Testing and Materials “Standard Specifications for Structural Clay Load-Bearing Wall Tile” (ASTM C34).

**2501.5 – GYPSUM**

- (a) Gypsum partition tile blocks shall contain not more than 12 percent by weight of binding material, shall be laid in gypsum mortar, and shall meet the requirements of the American Society for Testing and Materials “Standard Specifications for Gypsum Partition Tile or Block” (ASTM C 52).
- (b) Poured gypsum used for fire-proofing and floor and roof construction shall contain not more than 12 percent of wood chips, shavings or fiber, measured in a dry condition, as a percentage, by weight, of the dry mix. Gypsum mortar shall be composed of one part gypsum and not more than three parts clean, sharp, well-graded sand, by weight.
- (c) Fibered plaster may be used where unsanded or neat gypsum plaster is prescribed.
- (d) All plaster mixes for sanded gypsum plasters shall be measured by dry weight.
- (e) When gypsum plaster is used with an aggregate, the proportions shall be as required in [Chapter 28](#) or [Appendix K](#).

**2501.6 – GYPSUM LATH, GYPSUM WALLBOARD, AND GYPSUM SHEATHING BOARD**

- (a) Gypsum lath shall comply with the provisions of the American Society for Testing and Materials “Standard Specifications for Gypsum Lath” (ASTM C37). Perforated gypsum lath shall have perforations not less than,  $\frac{3}{4}$ ” in diameter, with one perforation for not more than 16 square inches of lath surface.
- (b) Gypsum lath shall be nailed to wood studs or joists in all constructions required to be fire-resistive, with No. 13 gage, 1-1/3”, 19/64” flat-head blued nails at intervals not exceeding 4” on centers, (Five nails per lath for support of 16 inch lath), or equivalent attachment.
- (c) Gypsum wallboard shall comply with the provisions of the American Society for Testing and Materials “Standard Specifications for Gypsum Wallboard” (ASTM C36).

- (d) Gypsum sheathing board shall comply with the provisions of the American Society for Testing and Materials “Standard Specifications for Gypsum Sheathing Board” (ASTM C79).

### **2501.7 – METAL OR WIRE LATH**

- (a) Wherever metal lath or wire lath and plaster are used as required protection against the spread of fire, the weight of lath shall be not less than 2.5 lbs. per square yard when used in vertical position, and not less than 2.75 lbs. per square yard when used in horizontal position. Wire lath shall be not lighter than 2½ meshes per inch, or equivalent.
- (b) Weight tags shall be left on all metal lath or wire lath until inspected and approved by the Building Official.
- (c) Metal lath for ceilings below wood joists in construction which is required to be fire-resistant shall be attached with 1½”, 11 gage, 7/16” head barbed roofing nails spaced at intervals not to exceed 6” on centers, or equivalent attachment.
- (d) Whenever the word wire lath is used in fire-resistive plastering it shall not preclude the use of paper back wire lath. Whenever paper back wire lath is used it shall be in accordance with the Requirements for Paper-Backed Wire Fabric as prescribed in Chapter XVIII of this Code.

### **2501.8 – CONCRETE BLOCK**

Hollow concrete masonry units used in exterior walls and in all walls or partitions shall comply with the requirements of the American Society for Testing and Materials “Standard Specifications for Hollow Load-Bearing Concrete Masonry Units” (ASTM C90 and Non-Load Bearing C129).

### **2501.9 – VERMICULITE**

Vermiculite, when used as an aggregate with plaster, shall conform in particle size to the American Society for Testing and Materials “Standard Specifications for Inorganic Aggregates for use in Gypsum Plaster” (ASTM C35). The weight of vermiculite shall be not less than 6 nor more than 10 lbs. per cu. ft., as determined by measurement in a cubic-foot box, using the shoveling procedure as outlined in the American Society for Testing and Materials “Tentative Method of Test for Unit Weight of Aggregate” (ASTM C29).

### **2501.10 – PERLITE**

Perlite, when used an aggregate with plaster, shall conform in particle size to the American Society for Testing and Materials “Standard Specifications for Inorganic Aggregates for use in Gypsum Plaster” (ASTM C35). The weight of perlite shall be not less than 7 nor more than 15 lbs. per cu. ft., as determined by measurement in a cubic-foot box, using the shoveling procedure as outlined in the American Society for Testing and Materials “Tentative Method of Test for Unit Weight of Aggregate” (ASTM C29).

## **SECTION 2502 FIRE RESISTANCE RATINGS FOR MATERIALS AND CONSTRUCTION**

### **2502.1 – REFERENCE TABLES**

- (a) Fire resistance ratings for materials, construction and assemblies of construction materials see Sec. 2501(a) for reference and adopted standards.

- (b) The fire resistance ratings as stipulated in this Code are not intended to be all inclusive but rather those which are acceptable as the result of having successfully performed under accepted tests as prescribed in Section 2501. Other fire resistance ratings may be accepted by the Building Official as fire protection on compliance with Section 2501 of this Code, such as *Building Materials Directory* of Underwriters Laboratories or test by National Bureau of Standards.

## **2502.2 – COLUMN PROTECTION**

The entire column, including its connections to beams or girders, shall be protected with the fire protection material to be used. Where the column extends through a ceiling, the fire protection material of the column shall be continuous from the top side of the floor, through the ceiling, to the underside of the floor above.

## **SECTION 2503 MAINTAINING FIRE RESISTANCE RATINGS**

### **2503.1 – GENERAL**

- (a) The provisions of this Section apply to assemblies (beams, girders, trusses, columns, walls or partitions, floors or floor-ceiling assemblies, and roofs or roof-ceiling assemblies) required to have a fire resistance rating.
- (b) Assemblies shall be designed and constructed to maintain the required minimum fire resistance ratings set forth by provisions of this Code. Assemblies which have been tested or investigated, and assigned fire resistance ratings, shall not be altered in design, construction, or materials from that which was tested or investigated, except that alterations are permitted either when permitted by other provisions of this Code or when adequate technical data is submitted to enable the Building Official to determine that the fire resistance rating of the assembly will not be less than that required for compliance with the provisions of this Code.
- (c) Openings in or through an assembly, other than doorways or windows, shall be limited in number, size, and distribution to those occurring in the tested assembly, except as permitted by other provisions of this Code.
- (d) No openings in or through an assembly which is required to have a fire resistance rating shall be made after the assembly has been constructed, except as permitted by other provisions of this Code.
- (e) No pipes, wires, cables, conduits, ducts, or service equipment of any type shall be embedded in the fire protection material of any member.
- (f) Where the fire protection material of an assembly is subject to damage from moving vehicles, handling of merchandise, or other sources, the fire protection material shall be protected against such possible damage.

### **2503.2 – FLOORS, ROOFS, OR FLOOR-CEILING OR ROOF-CEILING ASSEMBLIES**

- (a) Pipes, wires, cables, conduits, ducts, chimneys, vents or similar items, which extend vertically through one or more floors, floor-ceiling assemblies, or a roof or roof-ceiling assembly, shall be enclosed in shafts constructed in accordance with the provisions of [Section 701.1](#) except as permitted by the provisions of [Section 2503.2\(b\)](#).

- (b) No holes are permitted through any floor or roof which is part of a floor-ceiling or roof-ceiling assembly, except as permitted by the provisions of Section 2603.2(b) 1 through 4. (See [Section 506.1\(c\)](#) for materials which do not meet the definition of non-combustible.)
1. Approved trench headers, header ducts, trench-header ducts, raceways, or junction boxes for electrical, communication, radio or television wiring or cables, or similar installations are permitted provided the items were inserted in the tested assembly, or investigated for use in the assembly, and the items are installed in accordance with the conditions of their listing as to size, design, attachment, and location.
  2. Approved outlet fittings for electrical or communication service are permitted provided the fittings were inserted in the tested assembly, or investigated for use in the assembly. Assemblies which utilize steel floor and form units and trench headers, header ducts, trench-header ducts, raceways, or junction boxes, but have not been tested with outlet fittings installed or investigated for use of such fittings, are permitted to have [approved](#) outlet fittings for electrical communication service installed, provided the underside of the steel floor and form units is entirely covered with the same thickness of [approved](#) fire protection material as is required beneath the trench header, header duct, trench-header duct, raceway, or junction box.
  3. Floors or floor-ceiling assemblies which utilize air cells of steel floor and form units for distribution of air to room air control units located directly above the assembly are permitted provided the assemblies have been tested with such air control units installed, or investigated for use of such units. Other floors or floor-ceiling assemblies which utilize air cells of steel floor and form units for distribution of air are permitted to be used to distribute air only to the space beneath the assembly.
  4. Holes in floors, necessary for the installation of soil pipe and waste pipe for bathtubs, showers, urinals, and water closets, are permitted provided the pipes are enclosed beneath the floor through which they pass. The enclosure shall be in the form of a cage or box, and shall be of a design and construction which is [approved](#) for beam protection providing a fire resistance rating of not less than 1 hour. When the enclosure is adjacent to a beam or girder, it shall be in addition to the protection required for the beam or girder. When the floor through which the pipes pass is part of an [approved](#) floor-ceiling assembly utilizing a fire resisting ceiling, the enclosure is not required, provided the ceiling is not pierced by the piping.
- (c) No holes or openings for pipes, wires, cables, conduits, ducts, vents, recessed light fixtures, or similar items are permitted in the fire resisting ceiling of a floor-ceiling or roof-ceiling assembly, except in buildings 1 story in height, not having basements, or as permitted by the provisions of [Sections 2503.2\(c\) 1, 2, 3, and 4](#).
1. One electrical outlet box not exceeding 16 square inches in area is permitted for light fixtures in such ceilings, in each 90 square feet of ceiling area.
  2. Recessed light fixtures are permitted in a fire resisting ceiling provided the assembly has been tested with such fixtures installed, or investigated for use of such fixtures. Such fixtures shall be of the type, size, proportionate area, arrangement, and design tested, or investigated for use in the particular assembly.



3. Pipes, ducts, additional or larger electrical outlets than specified in [Section 2503.2\(c\)1](#), or similar items are permitted provided the assembly has been tested with such items installed, or investigated for the use of such items. The proportionate area and arrangement of openings for such items in the installed ceiling shall not exceed the proportionate area and arrangement of such items in the assembly tested or investigated and no opening shall be larger than that in the assembly tested or investigated.
  4. Holes in fire resisting ceilings, for automatic sprinkler heads or other fire extinguishing or smoke detection system components, are permitted.
- (d) Access tiles for fire resisting ceilings, together with any clips, tabs, supports, or other accessories necessary for the installation of such tiles, are permitted provided the assembly has been tested with such items installed, or investigated for the use of such items.
  - (e) Roof insulation shall not be installed on roof-ceiling or floor-ceiling assemblies unless the assemblies were tested with such insulation inserted, or investigated for use of such insulation; this shall not prohibit the use of Class A, Class B, or Class C roof coverings which utilize only hot mopped asphalt and saturated felt.
  - (f) Roof insulation shall be of the thickness specified for the design or investigation.

### **2503.3 – WALL OR PARTITION ASSEMBLIES**

- (a) No pipes, wires, cables, ducts, or service equipment shall pass through, be embedded or recessed in, or enter into wall or partition assemblies except as permitted by other provisions of this Code.
- (b) Wall or partition assemblies shall not have penetrations for installation of cabinets, which will reduce the required fire rating.
- (c) Pipes of noncombustible material for plumbing, drainage, heating or air conditioning systems are permitted to pass through wall or partition assemblies and through openings in wall or partition assemblies enclosing shafts as permitted by the provisions of [Section 2503.3\(f\)](#).
- (d) Openings for steel electrical outlet, switch, or junction boxes not exceeding 16 square inches in area, in hollow wall or partition assemblies utilizing wood or metal studs or metal framing or channels are permitted, provided such openings are not less than 24 inches O.C. at a side of the assembly and are staggered not less than 24 inches O.C. when openings are provided on both sides of the assembly.
- (e) Openings for electrical outlet, switch, or junction boxes in wall or partition assemblies constructed of hollow masonry units are permitted, provided the void space(s) exposed by such an installation are filled with concrete, mortar, or grout within not less than 4 inches of the boxes. (See [Section 506.1\(c\)](#) for materials which do not meet the definition of non-combustible.)
- (f) Openings in shaft enclosures for vent pipes; chimney and vent connectors; electrical conduit; and piping for plumbing and drainage systems, heating and air conditioning systems, standpipe systems, and fixed fire extinguishing systems, when such items are of noncombustible material and are necessary to provide connections to services in a shaft, are permitted.

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- (g) Approved wall opening protective devices for electrical or telephone wiring are permitted provided the devices were inserted in the tested assembly, or investigated for use in the assembly.

## CHAPTER 26 USE OF PUBLIC PROPERTY

### SECTION 2601 GENERAL

The use of public property or any portion thereof, shall be in accordance with the provisions of this chapter, except signs which shall conform to the requirements of Chapter XXIII, Signs and Outdoor Displays, and allowable use of public property during construction, [Section 2401.1](#).

#### **2601.1 – DOORS AND WINDOWS**

No door shall open or project upon public property more than 12". Exit doors, as specified in [Chapter 11](#), which are required to open in the direction of exit travel, shall be set back from the property line by means of vestibules or similar enclosures. Windows which swing over public property shall have a clearance of not less than eight feet above the sidewalk or ground level.

#### **2601.2 – MARQUEES, CANOPIES OR FIXED AWNINGS**

(See Section 2605.)

- (a) Fixed awnings or marquees shall be entirely of non-combustible construction inside the Fire District.
- (b) All combustible materials used in the construction of other awnings or marquees, shall be protected with not less than one hour fire-resistance protection as specified in [Appendix K](#). All glazing in marquees or fixed awnings shall be of wired glass.
- (c) Every fixed awning or marquee shall be at least nine feet in the clear, between the lowest point or projection and a sidewalk immediately below. (See 2305.5 – Marquee Signs.)
- (d) No fixed awning or marquee shall extend or occupy more than two-thirds (2/3) of the width of sidewalk measured from the building, except that such fixed awning or marquee may occupy the entire width of the sidewalk, provided it is twelve feet in the clear above the sidewalk. The overall height of any marquee, including signs, shall not exceed eight (8) feet, measured from the roof of such marquee.
- (e) Marquees constructed with a roof live load of not less than forty (40) pounds per square foot shall be permitted the full width of the building (front) and full depth of the building, corner location.

#### **2601.3 – MOVABLE AWNINGS (METAL OR CANVAS)**

- (a) Metal or canvas awnings may extend over public property for a distance of not more than five (5) feet, provided such awnings or any part thereof maintain a clear height of eight (8) feet above the sidewalk.
- (b) All such movable awnings shall be supported on metal frames attached to the building.

#### **2601.4 – PROHIBITIVE LOCATIONS**

- (a) Every canopy, awning or marquee shall be so located as not to interfere with the operation of any exterior standpipe, stairway or exit from the building.
- (b) Awnings or marquees shall not be used as a landing for any fire escape or exterior stair.

### **2601.5 – CONSTRUCTION REQUIREMENTS**

Marquees, canopies and awnings shall be so constructed and anchored to the building so as to support all live and dead loads as specified in Chapter 12.

### **2601.6 – ROOF DRAINAGE REQUIRED**

The roof of every fixed awning, canopy or marquee shall be sloped to down spouts at the building, which shall conduct all drainage under the sidewalk to the curb.

## **SECTION 2602 OTHER PROJECTIONS**

### **2602.1 – GENERAL**

- (a) Every projection of any character over or upon public property shall maintain a clear height above the sidewalk or ground level of not less than eight feet. The allowable projection over public property shall not exceed the following measurements from the building.
- (b) Bay windows, porches, balconies, fire escapes, window air conditioners – three (3) feet.
- (c) Cornices, Belt Courses, sills, pilasters, water tables or any decorative features – six (6) inches.
- (d) See [Section 710](#) for fire protective requirements.

### **2602.2 – SIDEWALK OR STREET OBSTRUCTIONS**

Public property shall be maintained clear of any and all obstructions, including among others, posts, columns, display of wares or merchandise and sidewalk signs, except as permitted by local ordinance.

## **SECTION 2603 SPACE UNDER PUBLIC PROPERTY**

### **2603.1 – SPACE UNDER SIDEWALK**

Where space under the sidewalk is used for any purpose a special permit shall be required.

### **2603.2 – SIDEWALK LIGHTS**

When glass is set in the sidewalk to provide light for spaces underneath, the glass shall be supported by metal or reinforced concrete frames and such glass shall be not less than one-half (1/2) inch in thickness. Where such glass is over twelve (12) square inches in area, it shall have wire mesh embedded in the glass. All portions of sidewalk lights shall be of not less strength than required in [Table 12A](#) and 12B for sidewalks.

## **SECTION 2604 MOVING OF BUILDINGS**

### **2604.1 – GENERAL**

No building or part of any building shall be moved through or across any sidewalk, street, [alley](#) or highway within the governmental limits without first obtaining a permit from the Building Official and other local authorities having jurisdiction.

**2604.2 – WRITTEN APPLICATION MUST BE FILED**

The Building Official may require written application setting forth the following information.

- (a) Type and kind of building to be moved.
- (b) The original cost of such building.
- (c) The extreme dimensions of the length, height and width of the building.
- (d) Its present location and proposed new location by lot, block, subdivision and street numbers.
- (e) The approximate time such building will be upon the streets, and the contemplated route that will be taken from present to new location.
- (f) Clearance from other authorities as required. (Such as public utilities, police departments, street department, etc.)
- (g) Owners of property which might be affected.

**2604.3 – BUILDING OFFICIAL SHALL REJECT WHEN**

- (a) If in the opinion of the Building Official, the moving of any building will cause serious injury to persons or property or serious injury to the streets or other public improvements, or the moving of the building will violate any of the requirements of this Code or of the Zoning Regulations, the permit shall not be issued and the building shall not be moved over the streets. All buildings to be moved must meet requirements of this Code.
- (b) Any building being moved for which permit was granted shall not be allowed to remain in or on the streets for more than forty-eight hours.

**2604.4 – BOND REQUIRED**

The Building Official, as a condition precedent to the issuance of such permit, may require a bond to be executed by person desiring such removal permit, with corporate surety to his satisfaction. Such bond shall be made payable to applicable governing body and for such amount as he prescribes. It shall indemnify the applicable governing body against any damage caused by the moving of such building to streets, curbs, sidewalks, shade trees, highways and any other property which may be affected by the moving of a building. Such surety bond shall also be conditioned upon and liable for strict compliance with the terms of said permit, as to route to be taken and limit of time in which to effect such removal and to repair or compensate for the repair and to pay said applicable governing body as liquidated damages an amount not exceeding fifty dollars (\$50.00) to be prescribed by the Building Official for each and every day's delay in completing such removal or in repairing any damage to property or public improvement or in clearing all public streets, [alleys](#) or highways of all debris occasioned thereby.

**2604.5 – NOTICES TO BE GIVEN BY BUILDING OFFICIAL**

Upon the issuance of said moving permit, the Building Official shall send copy of permit to the Superintendent of Fire Alarm, Chief of Fire Department, telephone or light companies, or others whose property may be affected by such removal. The Building Department shall set forth in all notices the route that will be taken, time started, and approximate time of completion.

### **2604.6 – PUBLIC SAFETY REQUIREMENTS**

- (a) **LIGHTS REQUIRED:** Every building which occupies any portion of public property after sundown, shall have sufficient light continuously burning between sunset and sunrise for the protection of the public.
- (b) **NUMBER AND LOCATION:** There shall be a minimum of five red lights placed on each street side of the building; such red lights shall be attached to the building in such a fashion as to indicate extreme width, height, and size.
- (c) **FLARES REQUIRED:** There shall be placed in addition to the red lights on the building, flares at regular intervals for a distance of two hundred feet up the street on each side of the building.
- (d) **FLAGMEN REQUIRED:** When more than fifty percent of the street, measured between curbs, is occupied at night by the building, or when in the opinion of the Building Official, flagmen are necessary to divert or caution traffic, the owner or person moving such building shall employ at their expense, two flagmen, one at each street intersection beyond the building; such flagmen shall remain at these intersections, diverting or cautioning traffic from sunset to sunrise. Red lights shall be employed in flagging traffic at night.

### **SECTION 2605 ROOFED AREAS OF PUBLICWAYS AND ENCLOSED MALLS** (See [Section 2601.2](#) and [2602](#))

#### **2605.1 – GENERAL**

All publicways and Malls used by public as a path of travel between buildings, or sections of buildings, shall have a suitable and adequate accessibility for fire department apparatus.

#### **2605.2 – ROOFED PUBLICWAYS OR MALLS**

- (a) When the entire Publicway or Mall is roofed over between groups or section or buildings, the controlling area limitations shall consist of the sum of all occupied areas connected to the roofed area and not separated therefrom by fire walls, and
  - (1) Roofs shall be constructed of non-combustible materials.
  - (2) Automatic smoke ventilation shall be provided in accordance with NFPA 204 with a venting ratio of 1:100 and 120 feet maximum space between vents, unless sprinklered.
  - (3) When an automatic sprinkler system is required, sprinklers may be omitted in the unoccupied Publicway provided there are no combustible goods, merchandise or decorations to be stored or displayed in this area.

#### **2605.3 – PERMANENT AWNINGS OVER PUBLICWAYS OR MALLS**

- (a) Permanent awnings may extend over sidewalks, parallel to and attached to the fronts of buildings facing on Publicway or Mall where the walls of the buildings and the construction of the permanent awnings, except for the skylights, are non-combustible, provided:
  - (1) The maximum horizontal width of the permanent awning does not exceed fifteen feet;
  - (2) The open space between a permanent awning and a building or permanent awning on the opposite side of Publicway or Mall shall be 30 feet or more;

- (3) The length of the permanent awning parallel to the building fronts, shall be broken across the entire width by breaks 10 feet or more wide, so spaced that there will be one such break in every 150 feet length of permanent awning. Space formed by breaks may be covered by a skylight containing material easily pierced by firefighting personnel;
- (b) One permanent non-combustible awning detached from buildings, may extend parallel to the fronts of buildings in one length of the Publicway or Mall, provided;
  - (1) The maximum horizontal width of the permanent awning does not exceed 20 feet;
  - (2) An open space of 30 feet or more is maintained between the permanent awning and parallel buildings or other permanent awnings;
- (c) Permanent non-combustible awnings may cross one length of the Publicway or Mall at intervals of not less than 100 feet, provided:
  - (1) The maximum horizontal width of the permanent awning does not exceed 30 feet;
  - (2) Ample clearances are provided under the awnings for passage of fire department apparatus.

## **CHAPTER 27**

### **CHIMNEYS, FIREPLACE STOVES, FIREPLACES AND VENTING SYSTEMS**

#### **SECTION 2700 MASONRY CHIMNEYS – GENERAL**

##### **2700.1 – CONSTRUCTION**

- (a) Masonry chimneys shall be designed and constructed to withstand wind load, and earthquake load where applicable.
- (b) Masonry chimneys shall not support loads from other structural members of buildings except where the chimney is designed as a wall or column.
- (c) Masonry chimneys shall be supported on adequate foundations of masonry or reinforced concrete, or on floor or floor-ceiling assemblies constructed of only noncombustible materials and having a fire resistance rating of not less than 3 hours, provided the assembly and its supports are designed and constructed to safely support the additional loads, except as permitted by the provisions of Sections [2700.3\(a\)](#), [2706.2\(c\)](#), and [2707.2\(c\)](#).
- (d) Masonry chimneys are permitted to be constructed as part of the masonry or reinforced concrete walls of buildings.

##### **2700.2 – LINING AND CAPS**

- (a) Where masonry chimneys conduct corrosive gases and vapors, and the refractory lining is not suitable to resist the action of the gases and vapors, an additional lining either of metal or coated metal shall be installed. The lining shall be capable of resisting softening or cracking at the temperatures of the gases and vapors occurring at the inlets to the chimney.
- (b) The walls of masonry chimneys which conduct corrosive gases and vapors shall be topped with special lead, metal-alloy, or ceramic caps.

##### **2700.3 – CORBELING**

- (a) Where chimneys are constructed as part of the masonry wall of a building, the walls of chimneys are permitted to be supported by corbels, provided the thickness of the wall below the corbel is not less than 12 inches. Corbels shall not exceed 1 inch projection for each projected course. The maximum projection of a corbel shall not exceed 6 inches, except where the corbel projects equally on both sides of the wall, and provided that, in the second story of 2-story dwellings, the corbeling of chimneys on the exterior side of the wall does not exceed the wall thickness. Corbels shall be made with solid units and, where corbels are on walls of hollow masonry units, there shall be not less than 3 courses of solid units below the corbels.



- (b) Where a chimney is designed to support vertical loads from the building and corbels are used to support beams or girders, a corbel shall project not more than 4 inches. The thickness of the masonry below the corbel shall be not less than 12 inches except, where there are corbels on opposite sides of the chimney and the vertical loads are of similar magnitude, the thickness of the masonry above and below the corbel shall be not less than 8 inches. Corbels shall not exceed 1 inch projection for each projected course. Corbels shall be made with solid units. The masonry above a corbel shall have sufficient strength for structural integrity.

#### **2700.4 – CHANGE IN SIZE OR SHAPE AT ROOF**

- (a) A change in the size or shape of a chimney, where the chimney passes through the roof, shall not be made within a distance of 6 inches above or below the roof joists or rafters.

#### **2700.5 – THIMBLES**

- (a) Thimbles for chimneys or vent connectors shall be of fire clay, iron, or a material compatible with the lining material. Thimbles shall be installed with the installation of the lining.
- (b) Thimbles shall be located to provide adequate pitch or rise of chimney or vent connector and, where the floor above the appliance is constructed of wood or other combustible materials, the location of the thimble shall provide the minimum clearance required for the connector.

#### **2700.6 – CLEANOUT OPENINGS**

- (a) Cleanout openings shall be provided in chimneys connected to appliances burning solid fuel. Cleanout openings shall be equipped with ferrous metal doors designed and constructed to be closed when not open for cleaning purposes.

#### **2700.7 – SMOKE TEST**

- (a) Masonry chimneys shall be proved tight by a smoke test after erection and before being put into use.

### **SECTION 2701 MASONRY CHIMNEYS FOR RESIDENTIAL TYPE APPLIANCES**

#### **2701.1 – GENERAL**

- (a) Masonry chimneys for residential type appliances, in addition to complying with the provisions of Section 2700, shall comply with the provisions of this section 2701.

#### **2701.2 – CONSTRUCTION**

- (a) Masonry chimneys for residential type appliances shall be constructed of solid masonry units, or reinforced concrete, with walls not less than 4 inches in thickness or rubble stone masonry not less than 12 inches in thickness. Masonry shall be laid with full head and bed joints in Type M, Type S, or Type N mortar.
- (b) Masonry chimneys for residential type appliances shall be lined with clay flue lining not less than 5/8 of an inch in thickness or with materials having durability and resistance to corrosion, softening, or cracking from flue gases at temperature up to 1,800°F.

- (c) Each section of clay flue lining shall be set in a complete bed of medium-duty fireclay refractory mortar, or another refractory mortar having a pyrometric cone equivalent of not less than 26, on the end of the previous section. The joints between sections shall be left smooth on the inside walls of the lining. The setting of each section shall precede the construction of the masonry for the walls of the chimney.
- (d) Where the walls of masonry chimneys are less than 8 inches in thickness, clay flue linings shall be separated from the walls of the chimney. Linings shall be held in place with mortar from joints in chimney walls at locations near joints in clay flue linings. The space between linings and walls shall not be filled with mortar.
- (e) Flue linings shall start from a point not less than 8 inches below the lowest intake or, in the case of fireplaces, from the top of the smoke chamber. Linings shall extend for the entire height of the chimney to a level not less than 8 inches above the cap, splay, or wash.
- (f) Chimneys shall be capped to form a wash from the lining to the outside edge of the chimney. Caps, splays, or washes shall be of concrete, or Type M or Type S mortar.
- (g) Where a chimney has only two flues and the flues are not separated by a masonry wythe, the joints of the adjacent flue linings shall be staggered not less than 7 inches.
- (h) Where a chimney has more than two flues, masonry wythes, not less than 4 inches in width, shall be constructed in the chimney to separate the linings so that not more than two linings are adjacent in one section of the chimney. The wythes shall be bonded to the walls of the chimney. Where there are two flues in one section of the chimney, the joints of the flue linings shall be staggered not less than 7 inches.

### **2701.3 – HEIGHT**

- (a) Masonry chimneys for residential type appliances shall extend not less than 3 feet above the highest point where they pass through the roof of a building, and not less than 2 feet above any point of the building within 10 feet or any point of an adjacent building within 10 feet.

### **2701.4 – CLEARANCE**

- (a) Clearance to masonry chimneys for residential type appliances shall comply with the provisions of [Section 2718.1](#).

## **SECTION 2702 MASONRY CHIMNEYS FOR LOW HEAT INDUSTRIAL TYPE APPLIANCES**

### **2702.1 – GENERAL**

- (a) Masonry chimneys for low heat industrial type appliances, in addition to complying with the provisions of Section 2700, shall comply with the provisions of this Section 2702.

### **2702.2 – CONSTRUCTION**

- (a) Masonry chimneys for low heat industrial type appliances shall be constructed of solid masonry units, or reinforced concrete, with walls not less than 8 inches in thickness or rubble stone masonry not less than 12 inches in thickness. Masonry shall be laid with full head and bed joints in Type M, Type S, or Type N mortar.

- (b) Masonry chimneys for low heat industrial type appliances shall comply with the provisions of [Sections 2701.2\(b\) through \(h\)](#).

### **2702.3 – HEIGHT**

- (a) The height of masonry chimneys for low heat industrial type appliances shall comply with the provisions of [Section 2701.3](#).

### **2702.4 – CLEARANCE**

- (a) Clearance to masonry chimneys for low heat industrial type appliances shall comply with the provisions of [Section 2718.1](#).

## **SECTION 2703 MASONRY CHIMNEYS FOR MEDIUM HEAT INDUSTRIAL TYPE APPLIANCES**

### **2703.1 – GENERAL**

- (a) Masonry chimneys for medium heat industrial type appliances, in addition to complying with the provisions of Section 2700, shall comply with the provisions of this Section 2703.

### **2703.2 – CONSTRUCTION**

- (a) Masonry chimneys for medium heat industrial type appliances shall be constructed of solid masonry units, or reinforced concrete, with walls not less than 8 inches in thickness or rubble stone masonry not less than 12 inches in thickness. Masonry shall be laid with full head and bed joints in Type M, Type S, or Type N mortar.
- (b) The chimneys shall be lined with medium-duty fireclay refractory brick, or another refractory having a pyrometric cone equivalent of not less than 29, not less than 4½ inches in thickness, laid in medium-duty fireclay refractory mortar, or another refractory mortar having a pyrometric cone equivalent of not less than 26. The lining shall start not less than 2 feet below the lowest chimney connector entrance and extend for the entire height of the chimney to a level not less than 4 inches above the chimney wall.
- (c) Walls of masonry units shall have caps made of cast iron, reinforced concrete, or special materials required by the provisions of [Section 2700.2\(b\)](#).

### **2703.3 – HEIGHT**

- (a) Masonry chimneys for medium heat industrial type appliances shall extend not less than 10 feet above all roofs, parapets, penthouses, and roof structures less than 25 feet from the chimney. Masonry chimneys for medium heat industrial type appliances shall extend not less than 10 feet above independent structures, such as water-cooling towers or ground signs, less than 25 feet from the chimney, where the structure may adversely affect the operation of the chimney.

### **2703.4 – CLEARANCE**

- (a) Clearance to masonry chimneys for medium heat industrial type appliances shall comply with the provisions of [Section 2718.1](#).

## SECTION 2704 MASONRY CHIMNEYS FOR HIGH HEAT INDUSTRIAL TYPE APPLIANCES

### 2704.1 – GENERAL

- (a) Masonry chimneys for high heat industrial type appliances, in addition to complying with the provisions of Section 2700, shall comply with the provisions of this Section 2704.

### 2704.2 – CONSTRUCTION

- (a) Masonry chimneys for high heat industrial type appliances shall be constructed with double walls having an air space of not less than 2 inches between them. Outer walls or shells shall be of solid masonry units or reinforced concrete and not less than 8 inches in thickness. Inner walls shall be of masonry, not less than 8 inches in thickness, of which the inside wythe shall be of high-duty fireclay refractory brick; or another refractory having a pyrometric cone equivalent of not less than 31½. Refractories shall be laid in high-duty fireclay, refractory mortar, or another refractory mortar having a pyrometric cone equivalent of not less than 27. Refractories and mortar shall comply with the provisions of the standards listed for this Section 2704.2(a).
- (b) The refractory lining shall start at the base of the chimney and extend for the entire height of the chimney to a level not less than 4 inches above the chimney wall.
- (c) The space between outer and inner walls shall be vented with openings through the outer wall or shell. Openings shall be not less than 2 inches by 4 inches, spaced not less than 7 feet in a horizontal plane, and located not less than 18 inches or more than 24 inches above the base of the chimney.
- (d) Outer walls of masonry units, and inner walls, shall have independent caps made of cast iron, reinforced concrete, or special materials required by the provisions of [Section 2700.2\(b\)](#).

### 2704.3 – HEIGHT

- (a) Masonry chimneys for high heat industrial type appliances shall extend not less than 20 feet above all roofs, parapets, penthouses, and roof structures less than 50 feet from chimney. Masonry chimneys for high heat industrial type appliances shall extend not less than 20 feet above independent structures, such as water-cooling towers or ground signs, less than 50 feet from the chimney, where the structure may adversely affect the operation of the chimney.

### 2704.4 – CLEARANCE

- (a) Clearance to masonry chimneys for high heat industrial type appliances shall comply with the provisions of [Section 2718.1](#).

## SECTION 2705 MASONRY CHIMNEYS FOR RESIDENTIAL TYPE INCINERATORS

### 2705.1 – GENERAL

- (a) Masonry chimneys for residential type incinerators shall be designed and constructed in accordance with the provisions for masonry chimneys for residential type appliances in Section 2701.

- (b) Masonry chimneys for residential type incinerators shall be equipped with spark arresters complying with the provisions of [Section 2706.5](#).

## **SECTION 2706 MASONRY CHIMNEYS FOR COMMERCIAL – INDUSTRIAL TYPE INCINERATORS**

### **2706.1 – GENERAL**

- (a) Masonry chimneys for commercial-industrial type incinerators, in addition to complying with the provisions of Section 2700, except the provisions of [Section 2700.1\(c\)](#), shall comply with the provisions of this Section 2706.

### **2706.2 – CONSTRUCTION**

- (a) Masonry chimneys for commercial-industrial type incinerators operating at temperatures not greater than 1,400°F shall comply with the provisions of [Section 2703.2](#), except that the refractory lining shall start at the base of the chimney.
- (b) Masonry chimneys for commercial-industrial type incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of [Section 2704.2](#).
- (c) Masonry chimneys for commercial-industrial type incinerators are permitted to be supported on the walls of incinerators, provided the walls and foundations are designed and constructed to safely support the additional loads and the chimneys do not cause any stresses in the other parts of the incinerator, including the roofs of combustion chambers, which the incinerator has not been designed to withstand.
- (d) Where commercial-industrial type incinerators do not include effective means for arresting sparks and fly ash, chimneys shall be equipped with spark arresters complying with the provisions of [Section 2706.5](#).

### **2706.3 – HEIGHT**

- (a) The height of masonry chimneys for commercial-industrial type incinerators operating at temperatures not greater than 1,400°F shall comply with the provisions of [Section 2703.3\(a\)](#).
- (b) The height of masonry chimneys for commercial-industrial type incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of [Section 2703.3\(a\)](#).

### **2706.4 – CLEARANCE**

- (a) Clearance to masonry chimneys for commercial-industrial type incinerators shall comply with the provisions of [Section 2718.1](#).

### **2706.5 – SPARK ARRESTERS**

- (a) Spark arresters, including bolts, rivets, screws and supporting members, shall be of stainless steel and shall comply with the provisions of the standards listed for this [Section 2706.5\(a\)](#).
- (b) Spark arresters shall be securely attached to chimneys with supports designed and constructed to prevent movement of the arrester. Support systems shall be designed for simple replacement of arresters.
- (c) Spark arresters shall have a height of not less than 1.3 times the diameter of the chimney flue or the smaller dimension of a rectangular chimney flue.

- (d) The net free area of spark arresters shall be not less than 4 times the net free area of the upper terminus of the chimney flue on which the spark arrester is located.
- (e) Openings shall be of a size that will not permit the passage of spheres having a diameter larger than ½ inch, or block the passage of spheres having a diameter of less than 3/8 of an inch.

## **SECTION 2707 MASONRY CHIMNEYS FOR CHUTE-FED INCINERATORS**

### **2707.1 – GENERAL**

- (a) Masonry chimneys for chute-fed incinerators, in addition to complying with the provisions of Section 2700, except the provisions of [Section 2700.1\(c\)](#), shall comply with the provisions of this Section 2707.

### **2707.2 – CONSTRUCTION**

- (a) Masonry chimneys for chute-fed incinerators operating at temperatures not greater than 1,400°F shall comply with the provisions of [Section 2703.2](#) except that the refractory lining shall start at the base of the chimney.
- (b) Masonry chimneys for chute-fed incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of [Section 2704.2](#).
- (c) Masonry chimneys for chute-fed incinerators are permitted to be supported on the walls of incinerators, provided the walls and foundations are designed and constructed to safely support the additional loads and the chimneys do not cause any stresses in other parts of the incinerators, including the roofs of combustion chambers, which the incinerator has not been designed to withstand.
- (d) Where chute-fed incinerators do not include effective means for arresting sparks and fly ash, chimneys shall be equipped with spark arresters complying with the provisions of [Section 2706.5](#).

### **2707.3 – HEIGHT**

- (a) The height of masonry chimneys for chute-fed incinerators operating at temperatures not greater than 1,400°F shall comply with the provisions of [Section 2703.3\(a\)](#).
- (b) The height of masonry chimneys for chute-fed incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of [Section 2703.3\(a\)](#).

### **2707.4 – CLEARANCE**

- (a) Clearance to masonry chimneys for chute-fed incinerators shall comply with the provisions of [Section 2718.1](#).

## **SECTION 2708 FACTORY-BUILT CHIMNEYS**

### **2708.1 – USE**

- (a) Only [approved](#) factory-built chimneys shall be installed in or outside of buildings.

**2708.2 – APPROVAL**

- (a) Approval of factory-built chimneys shall be based on tests and listings of factory-built chimneys by a nationally recognized testing laboratory.

**2708.3 – INSTALLATION**

- (a) Approved factory-built chimneys that have been tested and listed by a nationally recognized testing laboratory shall be installed in accordance with the conditions of the listing with regard to intended use, maximum height, minimum installation clearances, and type of support.
- (b) Approved factory-built chimneys, which extend through two or more stories of a building or through one or more floors and a roof, and which are in buildings in which vertical openings are required to be enclosed, shall be in shafts which have enclosing walls or partitions having a fire resistance rating of not less than 1 hour, in buildings less than 4 stories in height, and not less than 2 hours, in buildings 4 stories or more in height. The enclosing walls or partitions shall be constructed of noncombustible or **approved** limited-combustible materials, or **approved** limited-combustible assemblies. When a shaft is located on an exterior wall such that 3 sides of the shaft are not common to the exterior wall, the outside extreme wall is not required to meet the fire resistance rating stated above and shall be constructed to provide for the visual inspection of the chimney installation. All interior surfaces of the shaft except the outside extreme wall shall be non-combustible.
- (c) Approved factory-built chimneys installed in dwellings are not required to be in enclosed shafts, but shall be enclosed to avoid over-heating or combustible materials stored in closets or other storage space and, where they extend through accessible spaces, shall be enclosed to avoid danger of burns to persons and damage to the chimney.
- (d) Where permitted by the listing, **approved** factory-built chimneys are permitted to be supported by the structural members or buildings.
- (e) Approved factory-built chimneys, except as permitted by the provisions of Section 2708.3(f), shall extend not less than 3 feet above the highest point where they pass through the roof of a building, and not less than 2 feet above any point of the building within 10 feet or any point of an adjacent building within 10 feet.
- (f) The terminus of chimneys equipped with mechanical exhausters is permitted to terminate at a location not less than 3 feet from an adjacent building or building opening and not less than 10 feet above grade or walkways.

**SECTION 2709 METAL CHIMNEYS (SMOKESTACKS) – GENERAL****2709.1 – CONSTRUCTION**

- (a) Metal chimneys shall be constructed of sheet steel or cast iron. Sheet steel shall have a thickness not less than as required in Table 2709.1.

**TABLE 2709.1**

Manufactures Standard Gauge No.	Area (Square Inches)
16	Up to 154
14	155 to 201
12	202 to 254
10	Larger than 254

- (b) Sheet steel shall be properly welded or riveted.
- (c) Joints shall be gas tight.
- (d) Metal chimneys shall be designed and constructed to withstand wind loads, and earthquake loads where applicable.
- (e) Metal chimneys shall be supported on foundations of masonry or reinforced concrete, or on floor-ceiling or roof-ceiling assemblies constructed of only noncombustible materials and having a fire resistance rating of not less than 2 hours, provided the floor-ceiling or roof-ceiling assembly and its supports are designed and constructed to support the additional loads of the chimney and the walls enclosing the chimney, except as permitted by the provisions of Section 2709.1(f), 2713.2(c), and 2714.2(a).
- (f) Metal chimneys are permitted to be supported on heat producing appliances where the chimney is not required to be installed in an enclosed shaft, provided the appliance is capable of supporting the weight of the chimney, the appliance is attached to the floor to transfer the loads from the chimney, and the floor supporting the appliance is designed and constructed to support the additional loads of the chimney.
- (g) Where metal chimneys are supported at intermediate points by the structural elements of a building, expansion joints shall be provided at each support.

**2709.2 – LINING**

- (a) Where metal chimneys conduct corrosive gases and vapors and the refractory lining is not suitable to resist the action of the gases and vapors, an additional lining either of metal or coated metal shall be installed. The lining shall be capable of resisting softening or cracking at the temperatures of the gases and vapors occurring at the inlets to the chimney.
- (b) Lining made of castable or plastic refractories shall be secured to the walls of chimneys with anchors of corrosion resistant steel capable of supporting the refractory load at 1,500°F.

**2709.3 – INSTALLATION IN SHAFTS**

- (a) Metal chimneys installed in buildings, except as permitted by the provisions of Section 2709.3(c), shall be in shafts enclosed with continuous walls constructed of only noncombustible materials. The enclosure walls shall have a fire resistance rating of not less than 2 hours where the building is 4 or more stories in height, and not less than 1 hour where the building is less than 4 stories in height.



- (b) Walls for enclosing shafts shall extend from the floor of the lowest story of the building, for the entire height of the chimney to a level not less than 12 inches above the highest point where the chimney passes through the roof of the building, except that where buildings are of fire-resistive or protected limited-combustible type of construction, enclosure walls are permitted to begin at the floor of the story where the appliance or incinerator is located.
- (c) Where appliances or incinerators are located in the uppermost story of a building, metal chimneys are not required to be in enclosed shafts.
- (d) Where a residential type or low heat industrial type appliance, or an incinerator, is located in a separate room enclosed with wall, partition, floor-ceiling, or roof-ceiling assemblies of noncombustible or **approved** limited combustible materials, or **approved** limited-combustible assemblies, and having a fire resistance rating of not less than 1 hour, the walls enclosing the chimneys are permitted to start at the lower surface of the ceiling of the appliance or incinerator room. The floor-ceiling assembly supporting the appliance or incinerator shall be of only noncombustible material and shall comply with the provisions of Section 2709.1(e).
- (e) Where the walls or partitions have openings for inspection and maintenance, openings shall be protected with **approved** access fire doors, or **approved** self-closing doors suitable for Class B openings.

#### **2709.4 – CLEARANCE**

- (a) Metal chimneys shall have sufficient clearance from walls or partition enclosing shafts in which chimneys are located, to permit inspection and maintenance of the chimney, but in no case shall the clearance be less than 12 inches.
- (b) Metal chimneys which are not required to be located in enclosed shafts shall have guards of noncombustible material installed around the chimney, to avoid danger of burns to persons and overheating of combustible materials and products.
- (c) Metal chimneys located outside of buildings shall be located not less than 36 inches from doors or windows.

### **SECTION 2710 METAL CHIMNEYS FOR RESIDENTIAL AND LOW HEAT INDUSTRIAL TYPE APPLIANCES**

#### **2710.1 – GENERAL**

- (a) Metal chimneys for residential and low heat industrial type appliances, in addition to complying with the provisions of Section 709, shall comply with the provisions of this Section 2710.
- (b) Single wall metal chimneys as outlined in Table 2709.1 shall not be installed in dwellings and in buildings for multifamily occupancy conforming to the provisions of Volume I North Carolina State Building Code.

#### **2710.2 – HEIGHT**

- (a) Metal chimneys for residential and low heat industrial type appliances, except as permitted by the provisions of Section 2710.2(b), shall extend not less than 3 feet above the highest point where they pass through the roof of the building, and not less than 2 feet above any point of the building within 10 feet of any point of adjacent building within 10 feet.

- (b) The outlet of metal chimneys for residential or low heat industrial type appliances equipped with exhausters are permitted to terminate at a location not less than 3 feet from an adjacent building, or building opening, and not less than 10 feet above grade or walkways. In no case, shall the outlet be terminated at a location where the flue gases may present a hazard to people, overheat nearby combustible materials, or enter building openings in the vicinity of the outlet.

### **2710.3 – CLEARANCE**

- (a) Clearance to metal chimneys for residential and low heat industrial type appliances shall comply with the provisions of Sections 2709.4 and 2718.2.

## **SECTION 2711 METAL CHIMNEYS FOR MEDIUM HEAT INDUSTRIAL TYPE APPLIANCES**

### **2711.1 – GENERAL**

- (a) Metal chimneys for medium heat industrial type appliances, in addition to complying with the provisions of Section 2709, shall comply with the provisions of this Section 2711.

### **2711.2 – CONSTRUCTION**

- (a) Metal chimneys for medium heat industrial type appliances shall be lined with medium-duty fireclay refractory brick, or another refractory having a pyrometric cone equivalent of not less than 29, not less than 4 inches in thickness, laid in medium-duty fireclay refractory mortar, or another refractory mortar having a pyrometric cone equivalent of not less than 26.
- (b) Linings, except as permitted by the provisions of Section 2711.2(c), shall be not less than 4 inches in thickness for circular chimneys having a diameter of 18 inches or more, and for rectangular chimneys where the larger dimension is 18 inches or more.
- (c) Linings for circular chimneys having a diameter less than 18 inches, and for rectangular chimneys where the larger dimension is less than 18 inches, are permitted to be 2 inches in thickness.
- (d) Linings shall start not less than 2 feet below the lowest chimney connector entrance and extend, for the entire height of the chimney, to a level not less than 1 inch above the chimney wall.
- (e) Refractories and mortar shall comply with the provisions of the standards listed for this Section 2711.2(e).

### **2711.3 – HEIGHT**

- (a) Metal chimneys for medium heat industrial type appliances shall extend not less than 10 feet above all roofs, parapets, penthouses, and roof structures, less than 25 feet from the chimney. Metal chimneys for medium heat industrial type appliances shall extend not less than 10 feet above independent structures, such as water-cooling towers or ground signs, less than 25 feet from the chimney, where the structure may adversely affect the operation of the chimney.

**2711.4 – CLEARANCE**

- (a) Clearance to metal chimneys for medium heat industrial type appliances shall comply with the provisions of Sections 2709.4 and 2718.2.

**SECTION 2712 METAL CHIMNEYS FOR HIGH HEAT INDUSTRIAL TYPE APPLIANCES****2712.1 – GENERAL**

- (a) Metal chimneys for high heat industrial type appliances, in addition to complying with the provisions of Section 2709, shall comply with the provisions of this Section 2712.
- (b) Metal chimneys for high heat industrial type appliances shall not be installed in buildings of wood frame, ordinary, or heavy timber types of construction.

**2712.2 – CONSTRUCTION**

- (a) Metal chimneys for high heat industrial type appliances shall be lined with high-duty fireclay refractory brick, or another refractory having a pyrometric cone equivalent of not less than 31. Refractories shall be laid in high-duty fireclay mortar, or another refractory mortar having a pyrometric cone equivalent of not less than 27.
- (b) The refractory lining shall start at the base of the chimney and extend, for the entire height of the chimney, to a level not less than 4 inches above the chimney wall.
- (c) Refractories and mortar shall comply with the provisions of the standards listed for this Section 2712.2(c).

**2712.3 – HEIGHT**

- (a) Metal chimneys for high heat industrial type appliances shall extend not less than 20 feet above all roofs, parapets, penthouses, and roof structures, less than 50 feet from the chimney. Metal chimneys for high heat industrial type appliances shall extend not less than 20 feet above independent structures such as water-cooling towers or ground signs, less than 50 feet from the chimney, where the structure may adversely affect the operation of the chimney.

**2712.4 – CLEARANCE**

- (a) Clearance to metal chimneys for high heat industrial type appliances shall comply with the provisions of Section 2709.4 and 2718.2.

**SECTION 2713 METAL CHIMNEYS FOR RESIDENTIAL TYPE INCINERATORS****2713.1 – GENERAL**

- (a) Metal chimneys for residential type incinerators, in addition to complying with the provisions of Section 2709, shall comply with the provisions of this Section 2713.

**2713.2 – CONSTRUCTION**

- (a) Metal chimneys for residential type incinerators, installed in spaces open to outside air but provided with a cover, such as sheds, breezeways or carports, are permitted to be constructed of galvanized sheet steel not less than No. 20 galvanized sheet gage, provided the chimney is not enclosed and is readily examinable for its entire length.

- (b) Metal chimneys for residential type incinerators located in a yard, and not enclosed with combustible materials, shall comply with the provisions of Section 2709.
- (c) Metal chimneys for residential type incinerators located as described in Section 2713.2(a) and (b) are permitted to be supported on the walls of incinerators, provided the incinerator is designed and constructed to safely support the additional load and the incinerator is attached to a permanent base.

### **2713.3 – HEIGHT**

- (a) Metal chimneys for residential type incinerators shall extend not less than 3 feet above the highest point where they pass through the roof of a building, and not less than 2 feet above any point of the building within 10 feet or any point of an adjacent building within 10 feet.

### **2713.1 – CLEARANCE**

- (a) Clearance to metal chimneys for residential type incinerators shall comply with the provisions of Sections 2709.4 and 2718.2.

## **SECTION 2714 METAL CHIMNEYS FOR COMMERCIAL-INDUSTRIAL TYPE AND CHUTE-FED INCINERATORS**

### **2714.1 – GENERAL**

- (a) Metal chimneys for commercial-industrial type and chute-fed incinerators, in addition to complying with the provisions of Section 2709, shall comply with the provisions of this Section 2714.

### **2714.2 – CONSTRUCTION**

- (a) Metal chimneys for commercial-industrial type and chute-fed incinerators are permitted to be supported on the walls of incinerators, provided the walls and foundations are designed and constructed to safely support the additional loads, and the chimneys do not cause any stresses in other parts of the incinerator, including the roofs of combustion chambers, which the incinerator has not been designed to withstand.
- (b) Metal chimneys for commercial-industrial type and chute-fed incinerators operating at temperatures not greater than 1,400°F shall comply with the provision of Section 2711.2, except that the refractory lining shall start at the base of the chimney.
- (c) Metal chimneys for commercial-industrial type and chute-fed incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of Section 2712.2.

### **2714.3 - HEIGHT**

- (a) The height of metal chimneys for commercial-industrial type and chute-fed incinerators operating at temperatures not greater than 1,400°F shall comply with the provisions of Section 2711.3.
- (b) The height of metal chimneys for commercial-industrial type and chute-fed incinerators operating at temperatures greater than 1,400°F shall comply with the provisions of Section 2712.3.

**2714.4 – CLEARANCE**

- (a) Clearance to metal chimneys for commercial-industrial type and chute-fed incinerators shall comply with the provisions of Section 2709.4 and 2718.2.

**SECTION 2715 GAS VENTS AND TYPE L  
LOW-TEMPERATURE VENTING SYSTEMS****2715.1 – GENERAL**

- (a) Gas vents and type L low temperature venting systems shall be in accordance with Volume III North Carolina State Code.

**SECTION 2716 MASONRY FIREPLACES****2716.1 – GENERAL**

- (a) Masonry fireplaces shall be provided with chimneys designed and constructed to effectively remove the products of combustion. Chimneys shall be masonry chimneys or, where permitted by the individual listing, approved factory-built chimneys having approved adapters.

**2716.2 – CONSTRUCTION**

- (a) Masonry fireplaces shall be constructed of solid masonry units or of reinforced concrete with the back and sides of the thickness specified in this Section 2716.2. Where a lining of low-duty fireclay refractory brick, not less than 2 inches in thickness, laid in medium-duty fireclay refractory mortar, is provided, the total thickness of the back and sides, including the lining, shall be not less than 8 inches. Where another lining, such as cast iron or cast steel, or no lining is provided, the thickness of the back and sides shall be not less than 12 inches.
- (b) Masonry fireplaces shall be supported on foundations of masonry or reinforced concrete, or on floor-ceiling assemblies constructed of only noncombustible materials and having a fire resistance rating of not less than 3 hours, provided the floor-ceiling assembly and its supports are designed and constructed to safely support the additional loads.
- (c) Where the masonry supporting a fireplace is designed to support vertical loads from the building and corbels are used to support beams or girders, a corbel shall project not more than 4 inches. The thickness of the masonry below the corbel shall be not less than 12 inches. Corbels shall not exceed 1 inch projection for each projected course. Corbels shall be made with solid units. The masonry above a corbel shall have sufficient strength for structural integrity. The lintel spanning the fireplace shall be designed and constructed to safely support the additional concentrated load transferred by the member.
- (d) Steel fireplace units incorporating a firebox liner of steel, not less than ¼ of an inch in thickness, and an air chamber are permitted, provided the back and sides are constructed of solid masonry units and are not less than 4 inches in thickness. Warm air ducts used with steel fireplace units of the circulating air type shall be constructed of steel or masonry.

- (e) Masonry fireplaces shall be provided with hearth extensions of masonry, reinforced masonry, or reinforced concrete at each fireplace opening, and shall be designed and constructed to carry all required loads. The hearth extensions are permitted to be supported at their outer edges on wood, other combustible material, or limited combustibles material, except that the edge at the intersection of the hearth and heart extension shall be supported on non-combustible material, such as the concrete or masonry supporting the hearth, or shall be an extension of the hearth. Combustible or limited-combustible forms or centers used during the construction of hearths and hearth extensions shall be removed when the construction is completed. The surfacing materials of hearth extensions shall be of brick, stone, tile, or other noncombustible materials.
- (f) Where a fireplace opening is less than 6 square feet in area, the hearth extension shall extend not less than 16 inches in front of, and not less than 8 inches beyond each side of, the fireplace opening. Where a fireplace opening is 6 square feet or more in area, the hearth extension shall extend not less than 20 inches in front of, and not less than 12 inches beyond each side of, the fireplace opening.

### **2716.3 – CLEARANCE**

- (a) Clearance to masonry fireplaces shall comply with the provisions of [Section 2718.5](#).

## **SECTION 2717 FACTORY-BUILT FIREPLACES AND FIREPLACE STOVES**

### **2717.1 – GENERAL**

- (a) Factory-built fireplaces and factory-built stoves shall be listed and shall be installed in accordance with the conditions of the listing. Hearth extensions shall be provided in accordance with [Section 2716.2\(e\)](#) and [\(f\)](#).

## **SECTION 2718 CLEARANCES FOR CHIMNEYS, VENTS, AND FIREPLACES**

### **2718.1 – MASONRY CHIMNEYS**

- (a) The minimum clearances, from the outside face of masonry chimneys connected to residential or industrial type appliances or incinerators, to wood, other combustible materials, or limited-combustible materials, shall be not less than as set forth in [Table 2718.1](#) except as modified by the provisions of [Section 2718.1\(b\) through \(e\)](#).

**TABLE 2718.1 – MINIMUM CLEARANCE FOR MASONRY CHIMNEYS**

Type of Appliance or Incinerator	Clearance in Inches
Residential Type Appliances	2
Low Heat Industrial Type Appliances	2
Medium Heat Industrial Type Appliances	4
High Heat Industrial Type Appliances	15
Residential Type Incinerators	2
Commercial-Industrial Type Incinerators with Operating Temperature not greater than 1,400°F	4
Commercial-Industrial Type Incinerators with Operating Temperature greater than 1,400°F	15
Chute-Fed Incinerators with Operating Temperature not greater than 1,400°F	4
Chute-Fed Incinerators with Operating Temperature greater than 1,400°F	15

- (b) Masonry chimneys which are completely on the exterior of a building, against the sheathing, are not required to comply with the provisions of this [Section 2718.1](#).
- (c) Ends of wood girders are permitted to be supported on a corbeled shelf of a chimney for residential type appliances, provided there is not less than 8 inches of solid masonry between the ends of the girders and the flue lining.
- (d) Lathing, furring, or plaster grounds of combustible or limited-combustible material shall not be placed against a masonry chimney, except that, for masonry chimneys for residential type and low heat industrial type appliances, lathing, furring, or plaster grounds of combustible or limited-combustible material are permitted to be placed against the chimney at a point not more than 1½ inches from the corner of the chimney. This shall not prohibit plastering directly on a masonry chimney or on metal lath and metal furring.
- (e) Spaces between wood beams, headers, or joists and masonry chimneys shall be firestopped by placing noncombustible material to a depth of 1 inch at the bottom of such spaces.

### **2718.2 – METAL CHIMNEYS**

- (a) The minimum clearance from interior or exterior metal chimneys, connected to residential or industrial type appliances or incinerators, to wood, other combustible materials, or limited-combustible materials, shall be not less than as set forth in [Table 2718.2](#). except as modified by the provisions of [Sections 2718.2\(b\) through \(f\)](#).

**TABLE 2718.2 – MINIMUM CLEARANCES FOR METAL CHIMNEYS**

<b>Type of Appliance or Incinerator</b>	<b>Clearance in Inches</b>	
	<b>Interior</b>	<b>Exterior</b>
Residential Type Appliances	18	6
Low Heat Industrial Type Appliances	18	6
Medium Heat Industrial Type Appliances	36	24
High Heat Industrial Type Appliances	120	96
Residential Type Incinerators	18	6
Commercial-Industrial Type Incinerators with Operating Temperature not greater than 1,400°F	36	24
Commercial-Industrial Type Incinerators with Operating Temperature greater than 1,400°F	120	96
Chute-Fed Incinerators with Operating Temperature not greater than 1,400°F	36	24
Chute-Fed Incinerators with Operating Temperature greater than 1,400°F	120	96

- (b) Metal chimneys over 18 inches in outside diameter shall have a clearance of not less than 4 inches from a wall or partition, constructed of noncombustible material, which does not enclose a shaft.
- (c) Metal chimneys not over 18 inches in outside diameter shall have a clearance of not less than 2 inches from a wall or partition, constructed of noncombustible material, which does not enclose a shaft.
- (d) Where residential type and low heat industrial type appliances, or incinerators, are located in the uppermost story, metal chimneys which pass through a roof or roof-ceiling assembly constructed of combustible or limited-combustible materials shall have a clearance to combustible and limited-combustible materials, including framing, deck, roof covering, and ceiling, of not less than 18 inches; or the combustible and limited-combustible materials shall be shielded with a ventilating jacket or collar, made of galvanized steel or corrosion resistant metal, and the metal chimney shall have a clearance of not less than 6 inches to the combustible and limited-combustible materials. The shield portion shall be located not less than 3 inches from the chimney and from the combustible or limited-combustible materials, and shall extend not less than 9 inches above the level of the roof deck and not less than 9 inches below the ceiling, or below the framing where there is no ceiling. Where the opening in the roof is covered with a hood or similar device, the hood or device shall be constructed of noncombustible material and shall be not closer than 2 inches to all components of the ventilating jacket or collar and to the roof covering, to provide for passage of air.



- (e) Where medium heat industrial type appliances, or commercial-industrial type or chute-fed incinerators having operating temperatures not greater than 1,400°F, are located in the uppermost story, metal chimneys which pass through a roof or roof-ceiling assembly constructed of combustible or limited-combustible materials shall have a clearance to combustible and limited-combustible materials, including framing, deck, roof covering, and ceiling, of not less than 36 inches; or the combustible and limited-combustible materials shall be shielded with a ventilating jacket or collar, made of galvanized steel or corrosion resistant metal, and the metal chimney shall have a clearance of not less than 18 inches to the combustible and limited-combustible materials. The shield portion shall be located not less than 9 inches from the chimney and from the combustible or limited-combustible material, and shall extend not less than 15 inches above the level of the roof deck and not less than 15 inches below the ceiling, or below the framing where there is no ceiling. Where the opening in the roof is covered with a hood or similar device, the hood or device shall be constructed of noncombustible material and shall be not closer than 4 inches to all components of the ventilating jacket or collar and to the roof covering, to provide for passage of air.
- (f) Where high heat industrial type appliances, or commercial-industrial type or chute-fed incinerators having operating temperature greater than 1,400°F, are located in the uppermost story, metal chimneys which pass through a roof-ceiling assembly constructed of combustible or limited-combustible materials shall have a clearance to combustible and limited-combustible materials, including framing, deck, roof covering, and ceiling, of not less than 120 inches; or the combustible and limited-combustible materials shall be shielded with a ventilating jacket or collar, made of galvanized steel or corrosion resistant metal, and the metal chimney shall have a clearance of not less than 60 inches to the combustible and limited-combustible materials. The shield portion shall be located not less than 30 inches from the chimney and from the combustible or limited-combustible material, and shall extend not less than 36 inches above the level of the roof deck and not less than 36 inches below the ceiling, or below the framing where there is no ceiling. Where the opening in the roof is covered with a hood or similar device, the hood or device shall be constructed of noncombustible material and shall be not closer than 8 inches to all components of the ventilating jacket or collar and to the roof covering, to provide for passage of air.

### **2718.3 – FACTORY-BUILT CHIMNEYS**

- (a) The minimum installation clearance from factory-built chimneys to enclosure walls and roofs, constructed of combustible or limited-combustible materials, shall be in accordance with the conditions of their listings by a nationally recognized testing laboratory.
- (b) Clearances to floors, joists, and ceilings shall be provided by the installation of factory-furnished firestop spacers or supports that are parts of the chimney.
- (c) Spaces between wood beams, headers, or joists and factory-built chimneys, except those that are enclosed in shafts, shall be firestopped by placing noncombustible material to a depth of 1 inch at the bottom of such spaces, or with firestop spacers, or with supports that are parts of the chimney.

**2718.4 – VENTS**

- (a) The minimum installation clearances from Type B and Type BW gas vents, and Type L low-temperature venting systems, to combustible or limited-combustible materials, and to enclosure walls or partitions and roofs constructed of combustible or limited-combustible materials, and to enclosure walls or partitions and roofs constructed of combustible or limited-combustible materials, shall be in accordance with the conditions of their listings by a nationally-recognized testing laboratory.
- (b) Spaces between wood beams, headers, or joists and Type B and Type BW gas vents, and Type L low-temperature venting systems, except vents and venting systems installed in walls or enclosed in shafts, shall be fire-stopped by placing noncombustible material to a depth of 1 inch at the bottom of such spaces, or with [approved](#) firestop spacers.
- (c) Spaces between wood beams, headers, or joists and Type B and Type BW gas vents, and Type L low-temperature venting systems, installed in walls, shall be firestopped with [approved](#) firestop spacers.
- (d) The minimum installation clearances from single-wall metal pipe vents to combustible or limited-combustible materials shall be not less than as set forth in [Table 2718.4](#), except as modified by the provisions of [Sections 2718.4\(c\)](#) and [\(f\)](#).
- (e) Where a single-wall metal pipe vent passes through an exterior wall constructed of combustible or limited-combustible materials, or through a roof constructed of combustible or limited-combustible materials, the vent shall be guarded at the point of passage through the wall or roof by a metal ventilating thimble in accordance with the provisions of Volume III North Carolina State Code.
- (f) Where a single-wall metal pipe vent passes through an exterior wall constructed of combustible materials, or through a roof constructed of combustible or limited-combustible materials, the vent is permitted to not have a metal ventilating thimble at the wall or roof, provided all combustible and limited-combustible material is cut away from the vent, at the point of passage, a distance sufficient to provide the minimum clearance set forth in [Table 2718.4](#). Materials used to fill up the clearance opening shall be noncombustible materials.

**TABLE 2718.4 – MINIMUM CLEARANCES FOR SINGLE-WALL METAL PIPE VENT**

<b>Type of Appliance</b>	<b>Clearance in Inches</b>
Appliances which do not produce flue gases which exceed 480°F at the inlet to the vent, in accordance with the provisions of Volume III North Carolina State Code.	6
Appliances suitable for use with Type L Low-temperature venting systems, in accordance with the provisions of Volume III North Carolina State Code.	9
Boilers and furnaces with gas conversion burners and draft hoods.	9
Appliances with draft hoods, which produce flue gases which exceed 480°F at the inlet to the vent.	9
Appliances burning gas fuel, other than as described above.	18

**2718.5 – MASONRY FIREPLACES**

- (a) Wood beams, headers, joists, and studs shall have a clearance of not less than 2 inches from the front faces and sides of masonry fireplaces, and not less than 4 inches from the back faces of masonry fireplaces. Wood headers supporting masonry trimmer arches or concrete hearth extensions shall be located not less than 16 or 20 inches from the face of the chimney breast, depending upon the size of the fireplace opening, in accordance with the provisions of [Section 2716.2\(f\)](#). Wood trimmers shall be not less than 6 inches from the inside face of the nearest flue lining.
- (b) Woodwork, such as studs and paneling, shall not be placed within 4 inches of the back of a masonry fireplace.
- (c) Spaces between wood headers or trimmers and masonry fireplaces shall be firestopped by placing noncombustible material to a depth of one inch at the bottom of such spaces.
- (d) Woodwork, such as wood trim and mantles, shall not be placed within 6 inches of a masonry fireplace opening. Woodwork above and projected more than 1½ inches from a masonry fireplace opening shall be not less than 12 inches from the top of the fireplace opening.

## **CHAPTER 28**

### **PLUMBING**

The design and installation of plumbing systems, including sanitary and storm drainage, sanitary facilities, and storm water shall comply with the requirements as outlined in Volume II of this Code. Water supplies and sewage are regulated by the N. C. State Board of Health and Local Board of Health.

#### **NORTH CAROLINA STATE BUILDING CODE**

##### **Volume II**

##### **PLUMBING**

(Available from Engineering Division, N.C. Department of Insurance. Box 26387, Raleigh, N.C. 27611)

## CHAPTER 29

# HEAT PRODUCING APPLIANCES, HEATING, VENTILATING, AIR CONDITIONING, BLOWER AND EXHAUST SYSTEMS

### SECTION 2900 INSTALLATION STANDARDS

- (a) Heat producing appliances and systems (including incinerators) shall be designed and installed so as to be reasonably safe to persons and property. Heat producing appliances and systems (including incinerators) designed and installed in conformance with the applicable provisions of Volume III shall be evidence that the design and installation of such appliances and systems are reasonably safe to persons and property.
- (b) Ventilating, air conditioning, blower and exhaust systems shall be installed so as to be reasonably safe to persons and property. Installation of such appliances and systems in conformance with the applicable provisions of Volume III shall be evidence that such appliances and systems are installed so as to be reasonably safe to persons and property.
- (c) BOILERS: See N. C. State Boiler Code published by N. C. Department of Labor, Raleigh.

### SECTION 2901 FURNACE AND BOILER ROOM

- (a) All Fossil Fuel Fired Heating Equipment (not electrical) with an input capacity of 250,000 B.T.U. (British Thermal Units) or over, installed in any building shall be enclosed and separated from the rest of the building by walls, partitions, floor and ceiling of not less than one-hour fire resistive construction. Not more than two fuel-fired units shall be installed in any one tenancy in any one building unless all are enclosed and separated by walls, floors and ceilings of one-hour fire resistive construction. Except as noted below, in “F” and “S” occupancies, fuel fired units, applied according to their listing, may be installed directly in the occupied space.
- (b) Fossil Fuel Fired Heating Equipment (not electrical) of any input capacity installed in a building (Other than “F” and “S” occupancies) having a capacity for its particular use of more than seventy-five persons, or Group “I” Institutional occupancy, or Group “E” Educational occupancy, or Group “A” Assembly occupancy, or Group “H” Hazardous occupancy, shall be separated from the rest of such building by walls or partitions, floor and ceiling construction having a fire-resistive rating or not less than one-hour, except as required below.
- (c) See [Section 405.4\(c\)](#) and [412.8\(h\)](#) of Volume I for special categories of “F” and “S” Buildings in which direct fuel fired equipment may not be installed in the occupied space. If the unit installed is classified as a boiler, controls must meet requirements of the N.C. Boiler Code. When listed equipment is not available for the intended use, equipment with controls [approved](#) by FM or FIA will be acceptable.

HEAT PRODUCING APPLIANCES, HEATING, VENTILATING, AIR CONDITIONING, BLOWER AND EXHAUST SYSTEMS

- (d) Every steam boiler carrying more than fifteen (15) pounds per square inch pressure with a rating in excess of ten (10) boiler horsepower, installed in a building other than one of Group “G” Industrial occupancy, shall be located in a separated room, or compartment, and separated from the rest of the building by walls or partitions having at least two-hour fire-resistance and by floor or ceiling construction having not less than two-hours fire-resistance, provided, however, that when in the opinion of the Building Official it is desirable to provide for the venting of a possible explosion upward this rating may be reduced in accordance with the hazard existing.

**SECTION 2902 SPECIAL REQUIREMENTS FOR FURNACE AND FUEL ROOM AREAS IN PUBLIC OWNED SCHOOL BUILDINGS**

- (a) Furnace and fuel room areas shall be separated from other sections of the building by a two-hour noncombustible fire-resistive wall with no opening into this area except to the outside of the building. The roof or ceiling construction shall have a fire-resistance rating of not less than 2 hours.
- (b) In existing school buildings the furnace and fuel room areas shall be separated from other sections of the building by a two-hour noncombustible fire-resistive wall with no openings into this area except to the outside of the building. An existing roof construction not having a fire-resistance rating of 2 hours shall be protected with two layers of one-inch thick plaster on metal lath, the two layers separated by a one inch air space, or [approved](#) equal by Building Official. Care shall be taken to secure a draft tight seal at walls.
- (c) An A.G.A. approved enclosed furnace incorporating an integral total enclosure and using only outside air for combustion may be installed in classrooms of schools under the following conditions:
  - (1) One story buildings with classrooms above grade.
  - (2) They may be installed only on outside walls or above roof, with all gas piping to be exposed (if above ground) on outside of building and protected from mechanical injury.
  - (3) The vent shall extend above the roof.
  - (4) The furnace shall bear the label of A.G.A. or U.L. as an “enclosed furnace”. The vent shall be A.G.A. or U.L. labeled.
  - (5) The installation shall be in accordance with conditions of label and NFPA-54.

**SECTION 2903 ACCESSIBILITY (GENERAL)**

- (a) The installation of heating and air conditioning equipment shall in all cases be such as to make the equipment accessible for cleaning, servicing and maintenance. All roof mounted installations shall meet requirements of Volume III Section 304.0 Heating Code. Buildings of more than one story in height shall have an inside means of access to the roof.

- (b) Access to all equipment (such as furnaces, appliances, controls, electric strip heaters, all dampers, electronic air cleaners, coils) shall have access door of sufficient size for equipment to be removed and installed without the removal of the door or trim. A suitable access opening (minimum 22" x 30") with a suitable passage (minimum 36" x 36") or as **approved** by the Building Official, shall be provided to all equipment installed in an **attic** and/or in an overhead storage area. There shall be a minimum 24" wide catwalk in **attic** from the access entrance to the control side of equipment. Permanent steps, folding stair, stairway or portable ladder shall be provided to serve access openings.

## CHAPTER 30 ELECTRICAL INSTALLATIONS

### SECTION 3001 NATIONAL ELECTRICAL CODE ADOPTED

Except as may be provided otherwise by rules promulgated by the Building Code Council, the electrical systems of a building or structure and the premises on construction started after April 1, 1984 shall be installed in conformity with the 1984 edition of the "NATIONAL ELECTRICAL CODE" NFPA #70-1984 as adopted by the National Fire Protection Association.

### SECTION 3002 GARAGE RECEPTACLES

Section 210-8(a)(2) to read as follows:

210-8(a)(2). Where 125-volt, single-phase, 15- and 20- ampere receptacles are installed in garages, at least one of the receptacles shall have ground-fault circuit-interrupter protection for personnel and shall be so identified.

*Note: The wording in this Section is identical to the wording contained in Section 210-8(a)(2) of the 1981 State Electrical Code.*

### SECTION 3003 SMOKE DETECTOR OUTLETS

Add Section 210-71 to the State Electrical Code entitled:

#### **210-71 – AUTOMATIC SMOKE DETECTOR OUTLETS REQUIRED IN RESIDENTIAL DWELLING UNITS**

210-71. Automatic Smoke Detector Outlets Required in Residential Dwelling Units. A minimum of one 120-volt outlet shall be installed outside each sleeping area in each dwelling unit within single-family dwellings, two-family dwellings, [apartment houses](#), condominiums and/or town houses for the connection of [approved](#) fixed automatic smoke detectors (non-plug-in) as required in the State Building Code. Such outlets shall be located on or near the ceiling in accordance with the listing and the instructions of the manufacturer of the [approved](#) automatic smoke detector.

Exception: The 120 volt outlets specified in this section shall not be required when an [approved](#) automatic smoke detecting system is installed which provides equivalent protection and whose primary source of power is 120 volts.

*Note: The wording in this Section is identical to the wording contained in Section 210-27 of both the 1978 and the 1981 Editions of the State Electrical Code.*

### SECTION 3004 VOLUME IV – ELECTRICAL

Please refer to this pamphlet which contains Administrative Rules and Regulations and State Laws pertaining to enforcement of the Electrical Code.

### SECTION 3005 CO-GENERATING SYSTEMS

Add a new Article and Section to the state electrical code as follows:

Article 703, entitled Co-Generating Systems



703-1. Induction Generators. Induction generator (motor) installations shall be equipped with the necessary automatic equipment to prevent backfeed of power into the power supplier's system when the power supplier's local system is not energized by its own source of power. Protective equipment and installation of same to prevent backfeed to the serving utility company's system shall be **approved** by the power supplier.

*Note: The wording in this new Article is identical to the wording contained in Article 751 of both the 1978 and the 1981 editions of the State Electrical Code.*

## CHAPTER 31 ELEVATORS

The Department of Labor shall have general supervision of the administration and enforcement of those sections of the North Carolina State Building Code which pertain to elevators, dumbwaiters, escalators and moving walks. (G.S. 143-139).

### SECTION 3101 GENERAL

Except as may be provided in other sections of Volume I and otherwise by rules promulgated by the Building Code Council, elevators, dumbwaiters, escalators and moving walks shall be constructed and installed in conformity with the “AMERICAN STANDARD SAFETY CODE FOR ELEVATORS, DUMBWAITERS, ESCALATORS AND MOVING WALKS” (A17.1).

### SECTION 3102 EXCEPTIONS

The following sections of the above referenced Elevator Code shall be changed and the sections of Volume I covering this subject is included as follows:

*Delete Rule 100.1 – Enclosures of Hoistways* – This section is covered in Section 701 of Volume I.

*Delete Rule 100.2 – Construction at Top and Bottom of Hoistway* – This section is covered in Section 701 of Volume I.

*Delete Rule 100.4 and 100.5* – This section is covered in [Section 701](#) and [Section 506.7\(b\)\(6\)](#) – Pressurized Hoistway in Volume I.

*Delete Rule 20.4.2(a) – Materials for Enclosures and Enclosure Linings* – This section is covered in [Section 506.8](#) and [Section 704.3](#) – Interior Finishes of Volume I.

*Change Rule 211.1 – Car Emergency Signals for Elevators Operated Without A Designated Operator in the Car* – Add the following parenthetical note: “(NOTE: Rule 211.1 and [Section 506.10](#) and [11](#) of Volume I require a communication system within the elevator cab and in the absence of an alarm connected to a twenty-four hour watchman system or security system connected to such alarm, a telephone is required connected to a twenty-four hour manned security system or the telephone exchange system.)”

*Delete Section 800 – Protection of Floor Openings* – This section covered in [Chapter 11](#) of Volume I.

## CHAPTER 32

### EFFICIENT ENERGY UTILIZATION IN NEW BUILDINGS

#### SECTION 3201 REQUIREMENTS FOR DWELLINGS AND APARTMENTS THREE STORIES AND LESS IN HEIGHT

(EFFECTIVE APRIL 1, 1982)

##### 3201.1 GENERAL REQUIREMENTS

- (a) These insulation requirements apply to all new dwellings which are heated and/or cooled regardless of the type of fuel used (electric, oil, gas, or wood) as follows:
  - (1) All one- and two-family dwellings specified in Section I of Volume I-B.
  - (2) All new multiple-family dwellings (apartments and condominiums) three (3) stories and less in height specified in Section 400 of Volume I.
- (b) It is imperative that close attention be paid to workmanship in the installation of the materials specified if the full benefits of these requirements are to be realized.
  - (1) The vapor-resistant facing furnished on blanket and roll type insulation shall always face the interior of the structure. Insulation shall be wedged between pipes and electrical outlets and the external surface of the wall.
  - (2) If unfaced blankets or rolls are used a vapor barrier of at least 4 mil polyethylene, or its equivalent shall be stapled to the studs or foil backed gypsum board shall be used on the interior wall.
  - (3) Voids shall not exist at the top or bottom of the stud cavity.
  - (4) All cracks around windows and doors shall be filled with insulation with a vapor barrier properly installed.
  - (5) Vapor barriers shall be carefully checked to assure that no tears exist and any tear shall be patched.
  - (6) The manufacturers' installation procedures for all insulation shall be strictly adhered to.
- (c) On blanket and roll-type insulation furnished with a vapor facing, the R-Value of the insulation shall be marked at three foot intervals on the exposed facing,
- (d) For unfaced blankets and rolls, the manufacturer shall furnish sufficient identifying markings to indicate the insulation R-Value.
- (e) When the exterior sheathing or exterior siding of any insulated stud cavity wall has a permeance of less than 0.6 perm (ASTM Dry Cup Method) the interior vapor barrier shall be a minimum of 4 mil polyethylene or its equivalent with all penetrations sealed by either taping or caulking. Unless the sheathing manufacturer specifically requires moisture relief vents, no moisture vents are required.
- (f) The required thermal value of any one assembly, such as roof/ceiling, wall, or floor may be increased and the thermal value for other components decreased, provided the overall heat loss from the entire building envelope does not exceed the total resulting from conformance to the required thermal values.

**3201.2 MAXIMUM “U” VALUES FOR EXTERIOR WALLS AND CEILINGS**

- (a) All buildings which are heated or mechanically cooled shall have sections exposed to the exterior or unheated spaces constructed to comply with the maximum “U” value shown in Tables A and B

**TABLE A**  
**MAXIMUM "U" VALUES FOR CEILING AND WALL SECTIONS**

Flat Roof Deck <sup>1</sup>	Masonry Wall Construction		Frame Wall Construction		Doors and Windows
“U”	Ceilings “U”	Walls “U”	Ceilings “U”	Walls “U”	
.09	.05	.10	.05	.08	1.13 <sup>2</sup>

1. Indicates construction with rigid roof insulation and exposed structural system. Where ceiling cavity exists, use value for ceilings.
  2. In any room where 20% or more of the exterior wall is composed of windows and doors their maximum “U” Value shall be 0.65 (This will require insulating glass and doors or storm windows or doors). An exterior wall is any wall that faces to the outside of or is adjacent to any unconditioned space, such as: garages, carports, storage rooms, or porch areas. In any room that has two or more exterior walls, the total percentage of window and door area may be combined and used in any one of these walls.
- (b) Blown or poured type loose fill insulation may be used in **attic** spaces where the slope of the roof is a minimum of 2½ feet in 12 feet and there is at least 30 inches clear headroom at the roof ridge. (Clear headroom is defined as the distance from the top of the bottom chord of the truss or ceiling joists to the underside of the roof sheathing.)
- (1) When soffit vents are installed, adequate baffling of the vent opening shall be provided to deflect the incoming air above the surface of the material and shall be installed at the soffit on a 60 degree angle from horizontal.
  - (2) Baffles shall be in place at the time of inspection.
- (c) When loose fill insulation is proposed, the R-value of the material shall be determined in accordance with ASTM Standards C-687, C-236 and C-518.
- (1) The “R” value shall be shown on the building plans together with the total number of bags required and net coverage per bag.
  - (2) Upon completion of the installation of insulation, an insulation certification card shall be furnished by the insulation applicator and posted at a conspicuous location within the structure.
  - (3) This certification shall indicate the R-value, minimum thickness, maximum net coverage and weight per square foot of the insulation installed.
- (d) Minimum ventilation for roof-ceiling cavities shall conform to the following requirements. The required net free vent area may be reduced 50% if an **approved** vapor barrier is installed behind the ceiling finish material.

- (1) Gabled Roofs – Screened louvers having a net free area of 1 square foot for each 300 square feet of ceiling area shall be provided at each gabled end.
- (2) Hip Roofs – Screened soffit vents having a net free area of 1 square foot for each 900 square feet of ceiling area and screened outlet vents located near the roof peak having a net free area of 1 square foot for each 1600 square feet of ceiling area shall be provided.
- (3) Flat Roofs – Screened openings having a net free area of 1 square foot for each 250 square feet of ceiling area shall be provided along the overhanging eaves. Blocking and bridging shall be arranged so as not to interfere with the movement of air.
- (4) Cathedral ceilings with joist cavities shall have a screened soffit intake and a screened outlet at the roof ridge or at the intersection of the roof with a vertical surface. The intake and outlet openings shall each have a net free area of 1 square foot for each 250 square feet of roof surface. There shall be 1 inch minimum clearance between the bottom of the roof deck and the insulation.

**3201.3 – MAXIMUM “U” VALUES FOR FLOORS**

- (a) For floors over unheated basements, unheated garages, breezeways or ventilated crawl spaces with operable vents, the thermal value of the floor section shall not exceed the values shown in Table B. (A **basement** is considered unheated unless it is provided with a positive heat supply equivalent to at least 16% of the total calculated heat loss of the structure or is provided a positive heat supply to maintain a minimum temperature of 50°F.)

**TABLE B – FLOOR SECTION MAXIMUM “U” VALUES<sup>1</sup>**

Structural Slab	Wood and Steel Framing
U	U
.12	.08

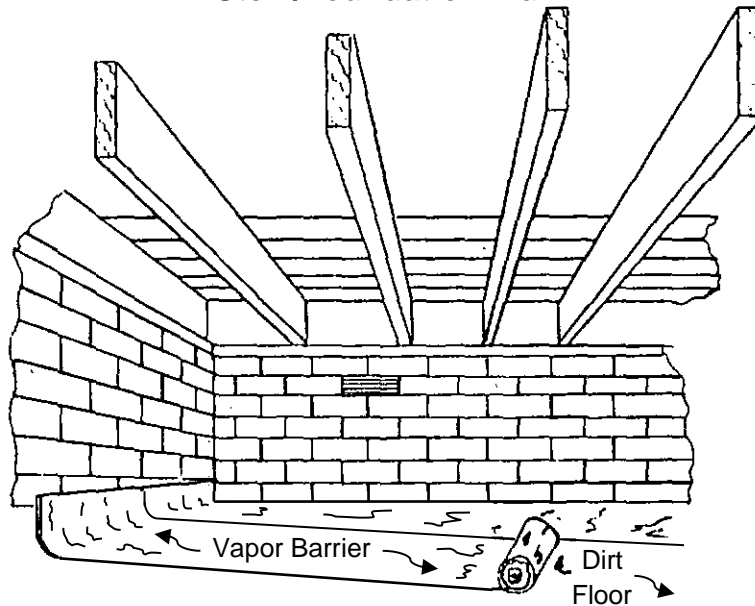
<sup>1</sup> U Value for heat flow down.

- (b) Insulation may be omitted from floors over unheated areas if the crawl space foundation walls are insulated. (See Diagram 1)
  - (1) The U value of insulated foundation walls from above a point 12 inches below grade or top of footing shall not exceed 0.17 (R=5.88). (“Foundation wall insulation for underfloor supply plenums shall have a minimum of R-11. See Volume III, Section 609-L”.)
  - (2) A minimum of 76 to 80% of the crawl space ground area shall be covered with a 6-mil polyethylene vapor barrier or its equivalent.

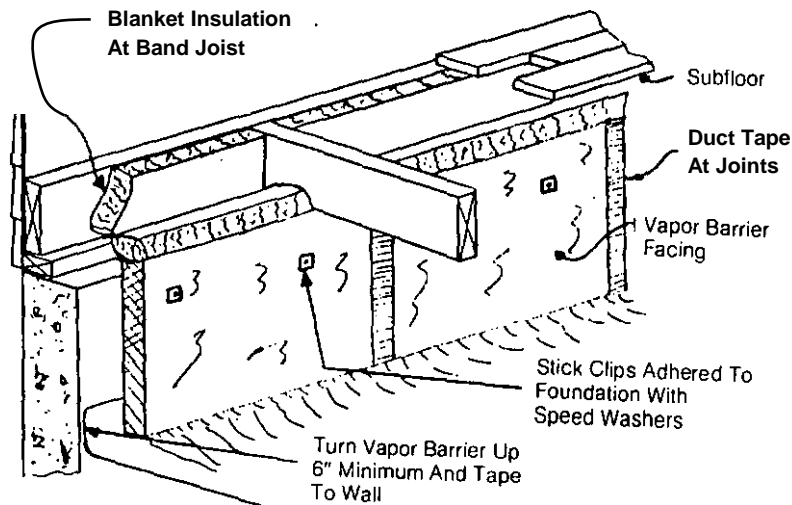
- (c) Crawl spaces under buildings without basements shall be ventilated by [approved](#) mechanical means or by openings in the foundation walls. Openings shall be arranged to provide cross-ventilation and shall be covered with corrosion resistant wire mesh of not less than ¼ inch nor more than ½ inch in any dimension. Such wall openings shall have a net free area of not less than 2 square feet for each 100 linear feet of exterior wall plus 1/3 square feet net free area for each 100 square feet of crawl space area. Where at least 75 to 80% of the crawlspace ground surface is covered with a 6-mil polyethylene vapor barrier or its equivalent the areas specified above may be reduced 60 percent. It is recommended that a maximum of 80% of the crawl space ground surface be covered to prevent excessive drying of the flooring. Vents shall be so placed as to provide ventilation at all points and to prevent dead air pockets.

Diagram 1

Stem/Foundation Wall



Stem Wall



- (d) When used, crawl space ventilation openings shall not be covered with insulation. Vents shall be of the closeable type and insulation shall be attached to the closing device. When fuel burning equipment is located in crawl space, adequate means for combustion air shall be provided.
- (e) **Basement** walls below a point 12 inches below grade need not be insulated. Walls above a point 12 inches below grade shall be insulated in accordance with Table A.

- (f) Slab-on-grade floors shall be insulated around the perimeter of the floor exposed to the outside with rigid insulation having a minimum “R” value of 8.76 and specifically designed and recommended by the manufacturer for this type application.
  - (1) The insulation may be installed vertically on the interior or the exterior of the foundation wall with the insulation extending 24 inches below the top of the slab. In areas where the frost line is deeper than 24 inches, the insulation shall extend to the frost line.
  - (2) Insulation may be installed downward to the bottom of the slab then horizontally beneath the slab for a total distance of 24 inches.
  - (3) Insulation extending above grade shall be protected from physical damage.
- (4) With either method, the entire slab edge thickness exposed to the outside shall be insulated.

#### **3201.4 – WEATHER STRIPPING OF EXTERIOR DOORS AND WINDOWS**

- (a) All doors and windows opening to the exterior or to unconditioned areas such as garages shall be fully weatherstripped, gasketed or otherwise treated to limit infiltration.
- (b) A non-hardening sealant shall be used to caulk around all window and door frames.

#### **3201.5 – CONSERVATION OF HOT WATER**

- (a) All shower heads shall be of the water conserving type. Maximum flow rate shall be 3 gpm per head.
- (b) Manufactured automatic electric, gas fired, and oil fired storage water heaters shall be tested, certified, and labeled by the manufacturer as having a performance efficiency equal to or exceeding ANSI/ASHRAE/IES 90A-1980 STANDARD – 1982 LEVELS.

### **SECTION 3202 REQUIREMENTS FOR NON-RESIDENTIAL**

#### **3202.1 – GENERAL REQUIREMENTS**

- (a) These requirements apply to any building or portion of a building classified according to its use or occupancy as Group R (Residential not covered by Sections 3201.1 through 3201.5), Group B (Business), Group E (Educational), Group M (Mercantile), Group I (Institutional), Group A (Assembly), and Group F (Factory-Industrial) provided with heating and/or cooling. Group S (Storage) shall comply with Group F requirements when provided with other than spot heating and /or cooling.
- (b) Buildings of 15,000 SF gross heated and/or cooled area or less shall comply with Sections 3202.1 through 3202.7 and with Section 3202.8 (Prescriptive Criteria) or with Section 3202.9 (Performance Criteria). Buildings exceeding 15,000 SF gross area shall comply with Sections 3202.1 through 3202.7 and with Section 3202.9 (Performance Criteria).
- (c) Additions to existing buildings may be made without making the existing building comply.
- (d) The form “Thermal Envelope Criteria” shall be submitted to indicate compliance with Section 3202.8.
- (e) The form “Building Energy Performance Criteria” shall be submitted to indicate compliance with Section 3202.9.



**3202.2 – DEFINITIONS AS LISTED BELOW APPLY TO THIS CHAPTER**

- (a) Building Envelope – The building envelope is considered to include walls, glass, roofs, and floors enclosing heated and/or cooled spaces.
- (b) Coefficient of Heat Transmission – The time rate of heat flow expressed in BTU per hour per square foot per degree Fahrenheit difference, (BTU/Hr-Ft<sup>2</sup> - °F), normally called the U-value. The U-value applies to single materials and to combinations of materials. The U-value shall be calculated in accordance with Chapter 22 of the ASHRAE Handbook of Fundamentals, 1977 Edition.
- (c) Gross Glass Area – The gross area of exterior glass consists of all window areas, including sash, exterior glass doors and other non-opaque areas exposed to outdoor air or unconditioned space and enclosing a heated and/or cooled space.
- (d) Gross Roof Area – The gross area of the building roof consists of the total interior surface, including skylights, exposed to a heated and/or cooled space.
- (e) Gross Wall Area – The gross area of exterior walls consist of all areas. including foundation wall, peripheral edges of floors, exterior glass areas, where such surfaces are exposed to outdoor air or unconditioned space and enclose a heated and/or cooled space.
- (f) Gross Floor Area – The gross floor area is the sum of the areas of the several floors of the building, including basements, mezzanines, and intermediate floored tiers and penthouses of head room height measured from the interior faces of exterior walls.
- (g) Heated and/or Cooled Space – Space within a building which is provided with positive heat supply *designed* to maintain a space temperature of 50°F or higher and/or a positive cooling supply *designed* to maintain a space temperature of 80°F or lower.
- (h) Process Related Energy – Energy expended for the primary purpose of conducting some specific activity for which the building was constructed rather than energy required for maintaining general comfort conditions.

The following energy-consuming loads are *not* considered to be process related energy; and shall be included with other loads in the analysis of building performance:

- Domestic H.W. Heating
- General Purpose Receptacles
- General Purpose Lighting
- Pool Heating (Except for therapeutic purposes in Type I occupancy)

The final determination as to process related energy shall rest with the authority having jurisdiction.

- (i) Exterior Decorative Lighting – Exterior decorative lighting is any exterior lighting for which the major use is other than security, safety, or special signage.

**3202.3 – THERMAL ZONES**

For the purpose of this Chapter, four thermal zones are established for the State of North Carolina. Table I tabulates the counties in each thermal zone.

**TABLE I**

ZONE I	Beaufort	Duplin	Pender
	Bladen	Hoke	Robeson
	Brunswick	Hyde	Sampson
	Carteret	Jones	Scotland
	Chowan	Lenoir	Tyrrell
	Craven	New Hanover	Washington
	Columbus	Onslow	
	Dare	Pamlico	
Zone II	Anson	Greene	Perquimans
	Bertie	Harnett	Pitt
	Cabarrus	Hertford	Randolph
	Camden	Johnston	Richmond
	Chatham	Lee	Rowan
	Cumberland	Lincoln	Stanly
	Currituck	Martin	Union
	Davidson	Mecklenburg	Wake
	Edgecombe	Montgomery	Wayne
	Gaston	Moore	Wilson
	Gates	Pasquotank	
ZONE III	Alamance	Franklin	Polk
	Alexander	Granville	Rockingham
	Burke	Guilford	Rutherford
	Caldwell	Halifax	Stokes
	Caswell	Iredell	Surry
	Catawba	McDowell	Vance
	Cleveland	Nash	Warren
	Davie	Northampton	Wilkes
	Durham	Orange	Yadkin
	Forsyth	Person	
ZONE IV	Alleghany	Graham	Mitchell
	Ashe	Haywood	Swain
	Avery	Henderson	Transylvania
	Buncombe	Jackson	Watauga
	Cherokee	Macon	Yancey
	Clay	Madison	

**3202.4 – INFILTRATION**

Exterior joints around windows and door frames, between wall cavities and window or door frames, between wall and foundation, between wall and roof, between wall panels, at penetrations of utility services through walls, floors and roofs and all other openings in the exterior envelope shall be caulked, gasketed, weatherstripped or otherwise sealed.

**3202.5 – HEATING, VENTILATING AND AIR CONDITIONING**

- (a) Heat gains and losses shall be computed for any building to which this code applies and shall be calculated in accordance with the methodology outlined in Chapters 21, 22, 24, 25 and 26 of the ASHRAE Handbook of Fundamentals, 1977. U-factors for heating calculations may be modified to account for mass effects by multiplying the calculated U-factor by the adjustment factors shown in Table II.

**TABLE II**

Component WGT(LB/SF)	Mass Adjustment Factor		
	Zones I & II	Zone III	Zone IV
0-15	1.00	1.00	1.00
16-40	0.90	0.95	0.97
41-80	0.83	0.88	0.90
81-120	0.78	0.83	0.85
121+	0.75	0.81	0.83

- (b) Maximum ventilation air quality shall be 33 1/3 percent of the minimum value for each occupancy type from ASHRAE Standard 62-73. The ventilation air quantity may be increased as required to provide sufficient make-up air for necessary exhaust systems plus an amount for building pressurization equal to 5% of total air circulation.

Make-up air for kitchen hoods shall not be pre-heated or pre-cooled using non-renewable energy sources unless other measures have already reduced the load to that equivalent to a load not greater than that which would be imposed by exhausting air at the rate of 25 CFM per sq. ft. of hood face area.

- (c) For calculations to certify compliance with this Section of the Code the following shall apply:
- (1) Outdoor temperatures shall be in accordance with Table III.

**TABLE III**

ZONE (See Table I)	Winter	Summer	
	DB	DB	WB
I	20°F	92°F	81°F
II	15°F	94°F	78°F
III	10°F	90°F	76°F
IV	0°F	86°F	74°F

- (2) Indoor design temperatures shall not exceed 68°F for heating nor be less than 78°F for cooling.
- (3) Temperatures listed in Table III are intended to be used primarily to establish uniformity in certifying code compliance.

The actual design temperature difference (indoor to outdoor) may vary from that resulting from the use of the above code compliance temperatures when:

- A. Building use so dictates and/or
- B. Prevalent local outdoor temperature conditions deviate from those listed.

Justification for such deviation shall be stated on the energy compliance form.

- (4) Temperature controls shall be arranged so that when the interior temperature is between 68°F and 78°F no heating or cooling energy is used.
- (d) If self-contained terminal heating and cooling equipment is to be utilized, the installed output capacity shall not exceed 110% of the sum of the space heat loss, plus ventilation air heating requirements, or of the sum of the space heat gain, plus ventilation air cooling requirements, unless specific approval is granted from the authority having jurisdiction.
- (e) If central station equipment is to be utilized, the installed output capacity shall not exceed 110% of the sum of the building heat loss, plus ventilation air heating requirements, or of the sum of the building heat gain, plus ventilation air cooling requirements, unless specific approval is granted from the authority having jurisdiction.
  - (1) Buildings included under occupancy type E, which are unheated during unoccupied periods may utilize central station heating systems having a capacity not to exceed 130% of the sum of the building heat loss, plus ventilation air heating requirement. However, if total fossil fuel fired central station heating capacity exceeds 2,000,000 BTUH, output rating multiple units must be installed unless a single unit can be shown to be as energy efficient.
- (f) All energy consuming equipment shall be sized and/or selected on the basis of heating/cooling loads calculated in accordance with 3202.5(a), (b), (c), (d), and (e), subject to the following exceptions:
  - (1) Packaged equipment shall be selected on the basis of the closest possible unit rating higher than the actual calculated heating/cooling load.
  - (2) Equipment which is oversized to allow for future addition or building expansion may be **approved** by the authority having jurisdiction.
- (g) Systems requiring simultaneous heating and cooling are inherently inefficient and are strongly discouraged. When more efficient methods of heating are unable to meet system design objectives, these systems may be used subject to the following restrictions:
  - (1) Single zone reheat systems shall be controlled to sequence reheat and cooling.
  - (2) Systems serving multiple zones shall be equipped with controls to automatically reset the system cold air temperature to the highest temperature level that will satisfy the zone requiring the coldest air or the warm air temperature to the lowest level that will satisfy the zone requiring the warmest air.
- (h) For those buildings designed to be heated to a space temperature below 50°F or cooled to a space temperature above 80°F, the level of energy use shall not exceed the amount that would be consumed in complying with the requirements of Tables IV and V.

- (i) All central air handling systems in buildings required to comply with Section 3202.9, Performance Criteria, shall be designed to use automatically up to 100% of the fan capacity for cooling with outdoor air whenever such use will result in a lower energy consumption than mechanical cooling. This requirement shall be waived by the authority having jurisdiction under the following conditions:
  - (1) Fan system capacity is less than 5,000 cubic feet/ min. or 134,000 Btu /h total cooling capacity.
  - (2) The quality of the outdoor air is so poor as to require extensive treatment of the air.
  - (3) The need for humidification or dehumidification requires the use of more energy than is conserved by the outdoor air cooling.
  - (4) If the use of outdoor air cooling affects the operation of other systems so as to increase the overall energy consumption of the building.
  - (5) Internal/external zone heat recovery or other energy recovery is used.
  - (6) When cooling is accomplished by a circulating liquid which transfers space heat directly or indirectly to a heat rejection device such as a cooling tower without the use of a refrigeration system.

**3202.6 – LIGHTING**

- (a) The maximum allowable load for lighting shall not exceed 2.5 watts per gross square foot.
- (b) For building spaces larger than 200 SF, circuiting and individual switching or dimming shall be provided so that:
  - (1) Lighting energy can be reduced by at least one-half.
  - (2) Lighting can be turned off.
- (c) Exterior Decorative lighting shall not exceed 2 percent of the total interior lighting load.

**3202.7 – SERVICE WATER HEATING**

- (a) Manufactured automatic electric, gas fired, and oil fired storage water heaters shall be tested, certified, and labeled by the manufacturer as having a performance efficiency equal to or exceeding ANSI/ASHRAE/IES 90A – 1980 STANDARD – 1982 LEVELS.
- (b) Non-storage type water heaters used as hot water generators or boosters shall be installed with automatic controls to prevent any energy usage when there is no demand for hot water.
- (c) All service hot water piping and hot water storage tanks other than automatic manufactured storage water heaters shall be insulated to meet or exceed the following minimum requirements:

- (1) Insulation thickness shall be as follows and shall have a maximum K factor or 0.27.
- (2) PIPING INSULATION
  - 0-2½” size ..... 1” thick
  - 3” and larger ..... 1½” thick
- (3) Hot water storage tanks & heaters ..... 2” thick

- (d) Combination service water heating/space heating boilers may be utilized only if the manufacturer tests, certifies and labels the boiler as having a performance efficiency equal to or exceeding ANSI/ASHRAE/IES/90A – 1980 STANDARD at 1982 LEVELS, for storage water heaters.
- (e) Conservation of Hot Water –
  - (1) Showers used for other than therapeutic or safety reasons shall be equipped with flow control devices to limit flow to a maximum of 3 gpm per shower head.
  - (2) Lavatories in restrooms of public facilities shall:
    - (aa) Be equipped with outlet devices which limit the flow of hot water to a maximum of 0.5 gpm or, be equipped with self-closing valves that limit delivery to a maximum of 0.25 gallons of hot water for recirculating systems and to a maximum of 0.50 gallons for non-recirculating systems, and
    - (bb) Be equipped with devices which limit the outlet temperature to a maximum of 110°F.

**3202.8 – PRESCRIPTIVE CRITERIA**

The total building heat loss, including infiltration and/or ventilation, calculated in accordance with Section 3202.5, shall not exceed the values shown in Table IV.

**TABLE IV**

Thermal Zone	Heat Loss BTUH/GSF
I	23
II	26
III	27
IV	30

**3202.9 – PERFORMANCE CRITERIA (BUILDINGS EXCEEDING 15,000 GSF IN AREA)**

- (a) Building Energy Requirements
  - (1) The energy-consuming load shall consist of the sum of the peak (maximum normal) steady-state simultaneous loads imposed by the energy consuming items in the building and shall not exceed the values tabulated in Table V. All energy consuming items in the building shall be included except for those items using process related energy.
  - (2) Maximum allowable allotment for on-site fuel-fired equipment shall be selected on the basis of the gross output rating of the equipment.

**TABLE V**  
**MAXIMUM ALLOWABLE SIMULTANEOUS LOAD**  
**See 3202.9(a)**

Occupancy	Allotment	
	Watts/GSF	or BTU/GSF
R (Residential) [See 3202.1(a)]	8.5*	29*
B (Business)	7.1	24
M (Mercantile)	6.3	22
E (Educational)	7.5	26
I (Institutional)	8.3	28
A (Assembly)	5.7	19
F (Factory-Industrial)	6.4**	22**

\* This figure is intended for environmental systems only. *All other usage is excluded.*

\*\* Energy allotment is based on assumed 55°F indoor temperature.

## SECTION 3203 MATERIAL AND INSTALLATION REQUIREMENTS FOR FOAMED IN PLACE UREA-BASED THERMAL INSULATION

### 3203.1 – GENERAL

This Section applies to urea-based thermos-setting foam insulation for use in wall, partition and floor cavities in building construction. This material shall not be used in ceiling cavities.

### 3203.2 – MATERIAL CHARACTERISTICS

(a) The material shall be certified by the manufacturer to meet the following requirements when tested in accordance with the applicable sections of HUD Materials Bulletin No. 74.

(1) *Resin Properties*

Free aldehyde content – 1.0 percent maximum

(2) *Curing Properties*

Setting Time

Closed cavity – 20-60 seconds

Open cavity – 10-60 seconds

Volume Resistivity of Fresh Foam – 5000 ohms – centimeter minimum

Water Drainage – None

Shrinkage during curing – 4% maximum

Fungi Growth Inhibition – Maximum 10% of that in the content test frame

(3) *Dry Foam Properties*

Density – 0.70-0.9 pounds per cubic foot

Thermal Resistance – R-12 for 3 inches

Corrosiveness

Aluminum, copper & steel – No perforations

Galvanized steel – No pitting and maximum loss of mass of 0.01 ounce.

Water Absorption –

Floating Test – maximum 15% by volume

Droplet Test – minimum 1 hour

Surface Burning Characteristics – maximum 25 flame spread classification

(in accordance with ASTM E-84.)

Ash Content – Maximum 2% of original foam volume.

- (b) Effective Thermal Resistance – The effective thermal resistance values shall be certified as complying with the applicable section of HUD Materials Bulletin No. 74 and shall be supplied to the distributor and/or applicator by the manufacturer.

**3203.3 – INSTALLATION STANDARDS**

- (a) Manufacturers' Recommendations – Material shall be installed in strict accordance with the manufacturer's specific installation instructions. These instructions shall be provided to the distributor and/or applicator by the material manufacturer. Unless otherwise specified by the manufacturer, the materials entering the foaming gun shall be within the range of 59 to 86°F. During application and for a period of four (4) days after application the exterior surface of cavities to which foam is supplied shall be within the range of 23 to 86°F.
- (b) Qualified Applicators – The installation of this material shall be performed only by an applicator who has been trained by the foam manufacturer and carries a current certificate of qualification by the manufacturer and identification card issued by the manufacturer. Each manufacturer shall certify that all his **approved** applicators are properly trained, qualified and certified by him.
- (c) Quality Control – To assure quality control, the applicator shall use either resin shipped in a pre-mixed liquid state by the manufacturer or equipment having quality control devices which will insure proper mixing of the material at the job site.
- (d) Fire Protection – All material exposed to the interior of a structure shall be protected in accordance with Section 719 of this Code. No portion of the installed material shall be exposed after construction is completed. Special precautions shall be taken to prohibit prolonged exposure of the installed material to direct sunlight, temperatures above 100°F, oils, solvents and acid vapors.
- (e) Water Vapor – Water present in the installed material shall be permitted to escape from a wall while the material dries in the cavity. In cases where the interior and exterior wall surfaces may restrict water vapor transmission other provisions shall be provided to allow the water vapor to escape.



- (f) Vapor Barrier – Prior to or immediately after foaming exterior walls a vapor barrier equivalent to 6 mil polyethylene shall be installed on the inner side of the wall. The vapor barrier shall not be allowed to bulge and shall be lapped 3 to 6 inches at all corners and seams. Cuts and breaks in the vapor barrier at doors, windows or other areas shall be properly repaired. When material used on the cold side of the wall have a permeability rating or 8 perms or less, vent plugs, vent strips or other suitable means shall be provided to allow cavity moisture to vent to the atmosphere.

### **3203.4 – MATERIAL LABELING**

Each container of urea-based foaming materials shall bear labels listing the following minimum information:

- (1) Manufacturer's Name
- (2) Storage temperature and dates after which materials may not be used.
- (3) Statement that material is to be installed only by a licensed or qualified applicator.
- (4) Warning to avoid contact of material with eyes, nose and skin.
- (5) Flame spread classification.

### **3203.5 – MATERIAL STORAGE**

Unless specified otherwise by the manufacturer, urea-based foaming materials shall be stored in temperatures between 50 and 86°F.

## **SECTION 3204 NON-DEPLETABLE ENERGY**

### **3204.1 – GENERAL**

This Section applies to the use of non-depletable energy sources to reduce the use of depletable energy by new buildings complying with Sections 3201 or 3202.

### **3204.2 – DEFINITIONS**

- (a) Depletable Energy – Energy produced from fossil fuels or nuclear fuel. Fossil fuels are carbonaceous substances which may be oxidized to produce heat or chemically combined to produce electricity (e.g., fuel cell). Nuclear fuels are radioactive substances which, through the process of controlled fission, produce heat. Heat produced by fuels may be utilized directly or used to produce electricity.
- (b) Non-Depletable Energy – Energy derived from one or more of the following sources:
  - (1) Natural sun lighting and/or thermal, chemical, or electrical energy derived directly from conversion of incident solar radiation.
  - (2) Energy derived from wind, waves and tides, and lake or pond thermal differences.
  - (3) Energy derived from the internal heat of the earth.

**3204.3 – CREDIT FOR USE OF NON-DEPLETABLE ENERGY**

- (a) Analysis of annual energy usage shall be performed by a registered Professional Engineer to compare the design complying with Section 3201 or 3202 and the alternative design utilizing non-depletable energy. The depletable energy consumed by the alternative design shall be less than or equal to the design complying with Section 3201 or 3202.
- (b) The analysis of the annual energy usage of the standard and the proposed alternative building and system designs shall meet the following criteria:
  - (1) The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be of sufficient detail to permit the evaluation of effect of building data (such as orientation, size, shape, transfer characteristics of mass, air, moisture, and heat) and climatic data.
  - (2) The calculation procedure(s) used shall simulate the operation of the building and its service systems through a full year operating period and shall be of sufficient detail to permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage.

**APPENDIX "B"**  
**CHAPTER 32**

**THERMAL ENVELOPE CRITERIA FOR BUILDINGS UNDER 15,000 S.F.**

PROJECT TITLE \_\_\_\_\_  
\_\_\_\_\_

LOCATION \_\_\_\_\_  
\_\_\_\_\_

OWNER \_\_\_\_\_  
\_\_\_\_\_

DESIGNER \_\_\_\_\_  
\_\_\_\_\_

**PROJECT DATA:**

Occupancy Group \_\_\_\_\_ Thermal Zone \_\_\_\_\_

Building Gross Area \_\_\_\_\_ GSF [See 3202.2(f)]

No. of Stories \_\_\_\_\_

**LIG-HTING:**

Total Lights \_\_\_\_\_ W/GSF

**HEATING:** \_\_\_\_\_ BTU /HR /GSF

Building Heat Loss-including infiltration air \_\_\_\_\_

Total Installed Capacity \_\_\_\_\_

Table IV Allowance \_\_\_\_\_

**APPENDIX "B"**

**Thermal Envelope Criteria (continued)**

**TABULATION OF THERMAL VALUES USED TO  
CALCULATE BUILDING HEAT LOSS**

BUILDING SECTION	Area (S.F.)	U Value
Walls	_____ _____	_____ _____
Windows	_____ _____	_____ _____
Doors	_____ _____	_____ _____
Roof	_____ _____	_____ _____
Floor	_____ _____	_____ _____

**DESIGNER'S STATEMENT**

To the best of my knowledge and belief, the design of this building complies with the applicable requirements of Chapter 32 of the North Carolina State Building Code.

SIGNED \_\_\_\_\_

DATE \_\_\_\_\_

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

**APPENDIX "C"**  
**CHAPTER 32**  
**BUILDING ENERGY PERFORMANCE CRITERIA FOR**  
**BUILDINGS OVER 15,000 S.F.**

PROJECT TITLE \_\_\_\_\_

LOCATION \_\_\_\_\_

OWNER \_\_\_\_\_

DESIGNER \_\_\_\_\_

**PROJECT DATA:**

Occupancy Group \_\_\_\_\_ Thermal Zone \_\_\_\_\_

Building Gross Area \_\_\_\_\_ GSF

Number of Stories \_\_\_\_\_

**COOLING:**

**BTU/HR/GSF**

Building Heat Gain-including Outside Air \_\_\_\_\_

Total Installed Terminal Cooling Capacity (Coils) \_\_\_\_\_

Total Installed Primary Cooling Capacity (Compressors) \_\_\_\_\_

**HEATING:**

Building Heat Loss-including Outside Air \_\_\_\_\_

Total Installed Terminal Heating Capacity (Coils) \_\_\_\_\_

Total Installed Primary Heating Capacity (Boilers, etc.) \_\_\_\_\_

**LIGHTING:**

Total Lighting \_\_\_\_\_ W/GSF

<b>ENERGY SUMMARY</b>		
Description	Connected Load/GSF (W or BTU/HR)	Energy Consuming Load/GSF (W or BTU/HR)
Interior Lighting		
Decorative Exterior Lighting		
Domestic Water Heating		
Heating or Cooling		
HVAC Auxiliaries		
Swimming Pool Heating		
Humidification		
Elevators-Escalators		
Cooking and Sanitation		
Manufacturing Process		
Computers		
Sterilizers		
Gen. Purpose Receptacles		
TOTAL		
Allotment from Table V		

NOTE: Designer to list all connected energy loads in the building and show peak steady-state simultaneous loads imposed by energy consuming items deleting those items he considers process related energy from the energy consuming load tabulation. Final determination of process related energy loads shall rest with the authority having jurisdiction.

**DESIGNER'S STATEMENT:**

To the best of my knowledge and belief, the design of this building complies with the applicable requirements of Chapter 32 of the North Carolina State Building Code.

SIGNED \_\_\_\_\_

NAME \_\_\_\_\_

DATE \_\_\_\_\_ TITLE \_\_\_\_\_

**APPENDIX “D”**

<b>R VALUE CONVERSION CHART</b>	
<b>R VALUE</b>	<b>VALUE</b>
1	1.000
2	0.500
3	0.333
4	0.250
5	0.200
6	0.167
7	0.143
8	0.125
9	0.111
10	0.100
11	0.091
12	0.083
13	0,076
14	0.071
15	0.067
16	0.063
17	0.059
18	0.056
19	0.053
20	0.050
21	0.048
22	0.045
23	0.044
24	0.042
25	0.040
26	0.038
27	0.037
28	0.036
29	0.034
30	0.033

A-100 9-14-82 In Table Note #5 of Appendix N, make the following changes:  
 “Change the flame spread for Class B, C, and D to 26-75,76-200, and 201-500 respectively.”

## **CHAPTER 33**

### **PIERS, BULKHEADS AND WATERWAY STRUCTURES**

**Adopted September 11, 1979**

#### **SECTION 3301 GENERAL**

The intent of this Chapter is to provide minimum standards for the design, construction and maintenance of piers, bulkheads and waterway structures that are not covered by other existing codes or design standards. This Chapter exempts farm structures not on public waters, marine terminal or port facilities for berthing, mooring, docking and servicing ships, barges or tug boats which handle cargo of all types including bulks, liquids, fuels and passengers.

The design of piers, bulkheads and waterway structures is essential for the protection of life and property without causing adverse effects to the shoreline. These structures by their very nature result in some modification of physical environment and therefore require minimum design standards. The guidelines in this Chapter address minimum standards for foundations, design forces, structural integrity, material selection and utilization, and construction techniques.

#### **SECTION 3302 PERMITS AND APPROVALS**

The construction of any pier, bulkhead or waterway structure in the public waters of North Carolina or the placement of dredged materials in waters or wetlands, generally requires the owner to obtain a permit/permits prior to construction. A permit from the United States Army Corps of Engineers is generally required for all marine construction. In addition to the permit issued by the Corps of Engineers, additional permits may be required from municipal or county governments, local marine commissions, and the North Carolina Department of Natural Resources and Community Development. In cases of structures to be built on lakes operated by an electric utility for the generation of power, a permit from the operating utility is also required.

Permits and/or information may be obtained from:

1. Regulatory Functions Branch  
Wilmington District, Corps of Engineers  
Department of the Army  
Wilmington, North Carolina
2. Permit Section  
Division of Marine Fisheries  
N. C. Department of Natural Resources and Community Development
3. County Dune Protection Officers
4. Local Building Inspectors



## SECTION 3303 MINIMUM DESIGN LOADS

### 3303.1 – GENERAL

Every structure shall be of sufficient strength to support the imposed dead, live, wind and impact loads without exceeding the allowable stresses prescribed for the various materials elsewhere in this code. Adequate consideration shall be made for forces imposed by earth, water, docking and mooring.

### 3303.2 – DEAD LOADS

The weight of the component parts of a structure shall be used in the design when it will influence the strength of the structural elements.

### 3303.3 – LIVE LOADS

Design live loads shall be the greatest load that will probably be imposed on the structure including superimposed loads on retained material which exert horizontal loads on the structure. Where vehicles are allowed, use actual weight of vehicles and wheel loads as specified in the latest Edition of “Standard Specifications for Highway Bridges” of the American Association of State Highway and Transportation Officials. *The Design load shall be posted at the dock or pier approach where vehicles are allowed.* Minimum live loads are:

- A. FIXED PIERS, DOCKS, CATWALKS – 30 lbs. per sq. ft. or 300 lbs. concentrated load on any area 2 ft. square.
- B. FLOATING PIERS, DOCKS, FINGERS – 20 lbs. per sq. ft. or 300 lbs. concentrated load on any area 2 feet square.

Under dead load, floating piers shall have a minimum of 15 inches freeboard. The pier shall have not more than six degrees tilt from the horizontal under uniform live loading on one-half of the pier width or under concentrated load of 600 lbs. applied on any side.

- C. BULKHEADS, SEAWALLS, REVETMENTS

Design loads shall be the greatest combinations of loads exerted on the structure. Consideration shall be given to horizontal loads exerted by superimposed loads on the retained earth and by inclined surface slopes.

### 3303.4 – WIND LOADS

As prescribed in [Chapter 12](#).

### 3303.5 – IMPACT LOADS

As prescribed in [Chapter 12](#) but not less than the 1.25 times the kinetic energy exerted by a striking vessel or vehicle.

### 3303.6 – WATER LOADS

Hydrostatic horizontal pressures along with the equivalent fluid pressure of soil and any surcharge thereon shall be considered.

Provide sufficient anchorage against uplift between all components and between the structure and its support of not less than 1.5 times the uplift force.

Wave forces shall be determined from wave record where available. Where no wave records are available the design wave shall be determined from probable wind speed, direction, fetch and water depth which will yield a critical wave. Forces shall then be calculated using current coastal engineering practice.

### **3303.7 – EARTH LOADS**

Lateral earth pressures shall be determined by considering the specific soil properties and applying earth pressure theories generally accepted for soil mechanics in engineering practice. Except for simple and inexpensive structures this normally requires the services of specialists in soil mechanics and/or foundations design. Adequate consideration shall be given for the effect of probable varying levels of ground water, tide and flood water. Pressures exerted by the earth shall be checked for dry, saturated and submerged conditions as applicable.

### **3303.8 – EROSION**

The effects of reasonably predictable erosion and wave induced scour shall be given ample consideration.

## **SECTION 3304 ENGINEERED DESIGNS**

**3304.1 – DOCKS, PIERS AND CATWALKS** used by the Public or are intended for use by vehicles shall be designed by a Registered Professional Engineer or Registered [Architect](#).

**3304.2 – BULKHEADS AND OTHER TYPE RETAINING WALLS** used by the public having an exposed face above the ground or above mean low water of 5 ft or greater shall be designed by a Registered Professional Engineer or Registered [Architect](#).

**3304.3 – OCEAN FRONT RETAINING WALLS, BULKHEADS** and other-type retaining walls used by the public on the coastline of the Atlantic Ocean or adjacent inlets shall be designed by a Registered Professional Engineer or Registered [Architect](#).

## **SECTION 3305 MATERIALS**

### **3305.1 – GENERAL**

The quality of materials and fastenings used for load supporting purposes shall conform to good engineering practices. In areas subject to attack from wood borers such as termites, teredoes, or limnoria, the wood used shall be [approved](#) wood having natural resistance or shall be pressure treated with a preservative recommended by the American Wood Preservers Association for the specific application. Piling shall comply with applicable provisions of [Chapter 13](#). Wood components shall comply with applicable provisions of [Chapter 17](#). Concrete components shall comply with applicable provisions of [Chapter 16](#). Steel components shall comply with applicable provisions of [Chapter 15](#). In areas of severe corrosion such as salty or brackish waters, all metal components shall be protected by coating, cathodic protection or be oversized accordingly to allow for the specific exposure. Aluminum bulkhead sheets or aluminum bulkhead or dock components shall be of proper alloy to resist corrosive elements in the adjacent water and soil. Galvanized bulkhead components and dock components shall be coated by the “Hot Dip” process to sufficient cover to provide corrosion protection equal to the degree of exposure of corrosive elements. Masonry used in bulkheads and dock work shall comply with [Chapter 14](#).

In general, materials should be selected and adequately protected to afford a design life of at least 20 years for the facility.

No materials will be allowed except those specifically stated unless the design is sealed by a Registered Professional Engineer or Registered [Architect](#).

## **SECTION 3306 CONSTRUCTION OF PIERS, DOCKS, CATWALKS AND FLOATING DOCKS**

### **3306.1 – FIXED PIERS**

Fixed piers for coastal areas shall be supported by piling with tip penetration of not less than 8 feet dependent on the total applied load. Less penetration is [approved](#) only if other means of resisting flotation uplift is provided. Pier support by shallow piling, legs or columns with point bearing on rock shall have provisions for horizontal forces and overturn as well as flotation uplift.

Connections between piling or legs to cap beams, stringers, beams and deck shall have sufficient capacity to safely support all applied loads and provide transfer of load to adjoining members. Maximum spans for pier joists shall be in accordance with the Span Table for Joists and Rafters, 1970 as published by the National Forest Products Association or may be designed in accordance with accepted engineering practice.

### **3306.2 – METAL BARRELS FLOTATION UNITS**

The use of metal barrels not specifically designed for use as flotation devices is prohibited.

### **3306.3 – DECOMPOSABLE FLOTATION UNITS**

Floating docks or piers using exposed polystyrene billets (or other foam material) shall be designed for 125% of tabulated loads here to allow for deterioration from environmental effects.

### **3306.4 – ELECTRICAL SERVICE**

All electrical service to marine structures shall be in accordance with the current edition of the National Electrical Code as adopted by the N. C State Building Code Council.

### **3306.5 – FUEL DOCKS**

Fuel docks and other marine facilities handling flammable liquids shall comply with the National Fire Code, NFPA-30. All fuel installations shall be designed to prevent fuel spillage from entering the water. The fuel docks or floats shall be a separate structure from berths and shall be isolated to the extent that fire or explosion would have minimal opportunity to spread to or from the fuel dock to the berths. Storage tanks for public facilities shall be located a minimum distance of 50 feet from the dispenser with a shut-off valve at the tank.

### **3306.6 – HANDRAILS**

For walkways, access piers, steps or ramps, personnel handrails or other safety provisions shall be provided along the edges where the vertical drop to the mean low water level or mud line exceeds 6 (six) feet. Edges which have a primary function other than walks or access ways, such as docking frontage and swimming access shall not require railing. Railing shall be designed in accordance with [Chapter 12](#) for [balcony](#) railing.

### 3306.7 – MAINTENANCE OF PUBLIC STRUCTURES

The Building Inspector shall have the authority to condemn and close to the public any structure which is considered unsafe, and it shall not be used by the public until the deficiencies are corrected. Before the structure is reopened to the public, a certification by a Registered Professional Engineer or Registered [Architect](#) shall be required.

Each owner will be responsible for the proper and satisfactory maintenance of any public structure covered by this section. All such structures shall be subject to inspection at any time by the Building Inspector.

## SECTION 3307 CONSTRUCTION: BULKHEADS, SEAWALLS AND REVETMENTS

### 3307.1 – BULKHEADS

- (a) Bulkheads shall be constructed in a manner to be effective against erosion and provide for adequate bank stabilization. The bulkhead system may consist of either of the following combinations thereof: braced sheet pile walls with tie backs, king piles and horizontal panels, gravity walls, cantilever and counterfort retaining walls. Bulkhead walls shall be constructed to prevent passage of fine material through joints or cracks from the fill side to the stream side.
- (b) Local site conditions and performance of bulkheads in service should govern in selection of a system. The potential for erosion and scour at the mud line shall also be investigated, and appropriate compensating features shall be reflected in the construction. Bulkheads shall be terminated by either tying into adjoining structures or by extending the bulkhead line a minimum of 10 feet in a landward direction at an angle of not less than 45<sup>o</sup> to the shoreline in order to protect against end erosion or flanking by wave action. No structure shall be terminated without regard for end anchorage and stabilization. Sheet pile bulkheads with an exposed vertical height of 4 feet or greater shall be stabilized at the top by providing adequate anchorage, such as, the use of batter piles or tie backs. Anchor blocks for tie backs shall be located landward of the soil wedge formed by the wall and a line projected on an angle measured from the horizontal and passing upward from the berm surface on the outward face. The angle shall be the internal friction angle of the material being retained. The tie back anchor shall be located no closer than twice the height of the exposed vertical surface of the wall. Sheet pile embedment shall be determined by analysis and design, but shall not be less than the length of pile exposed above ground. Cantilever and gravity wall bulkheads shall be founded on a firm foundation with special construction given to undermining and progressive instability.
- (c) Where public walkways, steps or ramps run adjacent to bulkheads, personnel handrails or other safety provisions shall be provided along the top of the wall where the vertical drop to the mean low water line or mud line exceeds 6 (six) feet. Handrails shall be designed in accordance with [Chapter 12](#) for [Balcony Railings](#).
- (d) Wood members used for permanent features shall be not less than 2 inches in nominal thickness. All steel bolts, rods and other hardware shall be hot dipped galvanized or protected with an equivalent system. Bolts, rods and other metal materials shall be no smaller than ½ inch in diameter or thickness. Threaded fasteners shall not be tightened directly against wood surfaces but used only in conjunction with standard ogee or flat washers.

- (e) Concrete, steel and cement asbestos bulkheads shall be constructed in such a manner to assure adequate performance. Connections shall be designed to resist the full applied load. Adequate attention shall be given to material protection against corrosion and concrete cover for reinforcing steel. Concrete shall have a 28-day minimum compressive strength of 3,000 psi and shall be “air-entrained” type concrete.

### **3307.2 – SEAWALLS**

Seawalls may be constructed of concrete or stone rubble mound or other suitable materials. They shall be founded on a firm foundation and may require the use of piling or other suitable support. The face shall be shaped and supported to withstand the full force of the design wave. A provision shall be provided to prevent undermining and progressive instability by installing a sheet pile wall along the toe and/or by placing adequate stone rip rap protection.

### **3307.3 – REVETMENTS**

- (a) Rigid revetments shall be founded on a firm foundation to prevent against undermining and progressive instability. Provisions should be made to provide for adequate toe protection by extending the face a minimum of two feet below the mud line plus a depth to compensate for known or anticipated scour. Additional protection may be needed in active areas and may consist of sheet piling along the toe and/or stone rip rap. An adequate pattern of weep holes shall be provided in the face to relieve hydrostatic pressure behind the wall. Joints shall be sealed to prevent loss of fines from the protected slope.
- (b) Flexible revetments may be utilized where foundations will produce minor consolidation and settlement. Adequate provisions shall be made to prevent migration of fine materials through the wall. The face shall not be steeper than 1.0 horizontal to 1.0 vertical. Flatter slopes may be needed for stability depending on the construction materials and site conditions. The face may consist of stone rip rap or individual interlocking concrete units or poured concrete. Toe protection provisions shall be provided as discussed for the rigid type. Flexible revetments must be porous enough to allow for water passage and thereby relieve hydrostatic pressure behind the face.

## **SECTION 3308 CONSTRUCTION OF GROINS AND JETTIES**

### **3308.1 – GROINS**

- (a) Groins are designed and constructed for the purpose of building or maintaining a protective beach by trapping littoral drift (beach materials) or to retard the recession of an eroding shoreline. The planning and design of a groin/groin system shall be based on wave height, period and direction, characteristics of beach material and beach slope.
- (b) LOCATION  
Groins shall extend landward a sufficient distance to prevent flanking.
- (c) TYPES  
Groins shall be either (1) very low, impermeable and nonadjustable or (2) impermeable and adjustable.

## (d) GENERAL SPECIFICATIONS

Adjustable groins shall be maintained at elevations in accord with actual beach needs and development of desirable changes of the beach profile, and so as to avoid damage to adjacent beaches. In no case shall the top of such groins be set higher than 2 feet above the beach profile. Impermeable, nonadjustable groins shall not extend seaward beyond the mean low water line, and their top elevation shall not be higher than 6 inches above the beach profile. Considerations or the degree of beach protection to be provided by proposed groins, and the acceptability of such installations, will be based primarily on the following factors: direction and volume of littoral drift; wave force and direction; wind force and direction; land usage; type of bulkhead; type of groin; and spacing and lengths of groins. A complete coastal engineering study may be required before approval is given to the number, type, and length of groins. The design should account for the wave and current forces focused on the beach. The groin/groin system should not adversely modify the littoral drift, to the extent to cause severe erosion on the lee side of the structure.

**3308.2 – GROINS AND JETTIES**

There is no universal type of groin/groin system or jetty because of the wide variations in conditions at each location. It is incumbent on the owner of a groin or jetty type structure to recognize the legal implications of the coastal structure and to plan, design, construct and maintain the structure accordingly. It is thus prudent to seek the advice of a Registered Professional Engineer or Registered [Architect](#) with coastal engineering experience.

**SECTION 3309 DEFINITIONS**

**BASIN, BOAT** – A naturally or artificially enclosed or nearly enclosed harbor area for docking and securing small craft.

**BULKHEAD** – A vertical wall structure designed to retain shoreline material and prevent erosion due to wave activity.

**BULKHEAD LINE** – The line formed along the shore by the most seaward elements of the bulkhead.

**CATWALK** – A narrow footway platform extending along-side a structure.

**DATUM, PLANE** – The horizontal plane to which soundings, ground elevations or water surface elevations are referenced.

**DOCK** – A pier, wharf, or platform for the unloading of materials or living beings.

**FETCH** – The area in which waves are generated having a rather constant direction of speed.

**GANGWAY** – A narrow footway bridge extending from the shore usually to a floating structure.

**GROIN** – A shore protection structure built (usually perpendicular to the shoreline) to trap littoral drift or retard erosion of the shore.

**GROIN SYSTEM** – A series of groins that function to protect a section of shoreline.

**JETTY** – A structure designed to protect and/or stabilize a navigation entrance.

**KING PILE** – The primary structural member that supports horizontal panels to form a vertical wall sometimes used in bulkhead or groin construction.

**LITTORAL DRIFT** – The sedimentary material transported along the shore by waves and currents.

**LONGSHORE TRANSPORT** – The movement of littoral drift (material) running parallel to the shoreline.

**PIER** – An elevated deck structure, usually pile supported, extending out into the water from the shore.

**PIERHEAD LINE** – The limiting line to which any pier or dock structure can extend into the water.

**PILE** – A cylindrical timber, concrete or metal member embedded into the ground to support or brace a structure.

**PILE, SHEET** – A pile with a generally slender flat cross section to be embedded into the ground or seabed and meshed or interlocked with like members to form a diaphragm, wall or bulkhead.

**REVTMENT** – A flexible structure usually constructed of stone or concrete and placed on a bank slope to protect it against erosion by wave and current action.

**SEA WALL** – A massive structure built along and parallel to a shoreline for the purpose of protecting and stabilizing the shore against erosion resulting from heavy wave activity.

**WAVE, DESIGN** – A wave that is potentially most damaging to an economically feasible structure, or wave for which a structure is designed.

# CHAPTER 34

## COASTAL & FLOOD PLAINS CONSTRUCTION STANDARDS

Adopted September 11, 1979

### SECTION 3401 PURPOSE, APPLICATION, AND SCOPE

The requirements set forth in this section shall apply to all construction located within areas identified by governmental agency (state and federal) as coastal high hazard areas, ocean hazard areas, the regulatory flood plain areas, and all areas within the 120 MPH wind zone (Figure 12B and Table 12F). Mountain wind velocities listed in Table 12G.1 are not applicable to this section.

### SECTION 3402 DEFINITIONS

**MSL** – Mean sea level as defined by National Geodetic Vertical Datum.

**BASE FLOOD ELEVATION** – The peak water elevation in relation to MSL expected to be reached during a design flood which is established by the Building Code Council. It shall be based on a flood having a one percent chance of being equaled or exceeded in any given year.

**COSTAL HIGH HAZARD AREA** – An area subject to coastal flooding and high velocity waters including storm wave wash, as shown by Federal Emergency Management Agency maps and subject to approval by the Building Code Council.

**OCEAN HAZARD AREA** – An area as identified by North Carolina Coastal Resources Commission, and subject to approval by the Building Code Council, near the shoreline of the Atlantic Ocean which has been identified as subject to at least one of the following hazards: (A) Historical or predicted future trends of long term erosion, (B) erosion expected to occur during a coastal storm reaching the base flood elevation, or (C) shoreline fluctuations due to tidal inlets.

**FLOOD PLAIN** – Land below base flood elevation, which of record has in the past been flooded by storm water – surface runoffs, or tidal influx: and – as defined by the Corp of Engineers’ Maps, the Federal Emergency Management Agency Maps, or as approved by the Building Code Council.

**REGULATORY FLOOD PLAIN** – (Same as flood plain defined above).



**SECTION 3403 PILING STANDARDS**

**3403.1** – All buildings in areas identified as coastal high hazard areas or ocean hazard areas shall be constructed on a piling foundation.

**3403.2** – The foundation shall be designed (as required by Chapter 12 and Chapter 13) to withstand vertical and horizontal loads in combination with the loss of soil support due to erosion and shoreline change likely to occur.

- (a) All pilings shall have a minimum tip penetration of not less than 8 feet below the natural or finished grade of the lot, whichever is lower, and as required by Chapter 13.
- (b) All pilings within ocean hazard areas shall have a tip penetration of at least 5.0 feet below MSL or 16' below average original grade whichever is least. Structures within the Ocean Hazard Area which are placed upon site behind a line, 60 times the annual erosion rate away from the most seaward line of stable natural vegetation are exempt from this additional tip penetration requirement.

**SECTION 3404 ELEVATION STANDARDS**

**3404.1** – The lowest structural member excluding pilings and bracing supporting the lowest habitable floor in the coastal high hazard area and ocean hazard area, shall be elevated above the base flood elevation plus wave height addition.

**3404.2** – The wave height addition is determined by the flood water depth (D) under the building using the formula: (See Figure 1)

$$\text{wave height addition} = 0.55 \times D$$

Where D = Base Flood elevation minus lowest finish grade elevation

or

Other acceptable methods of wave height determination such as found in “Estimating Wave Heights” (FEMA TD-3) or Corp of Engineers “Shore Protection Manual” (SPM).

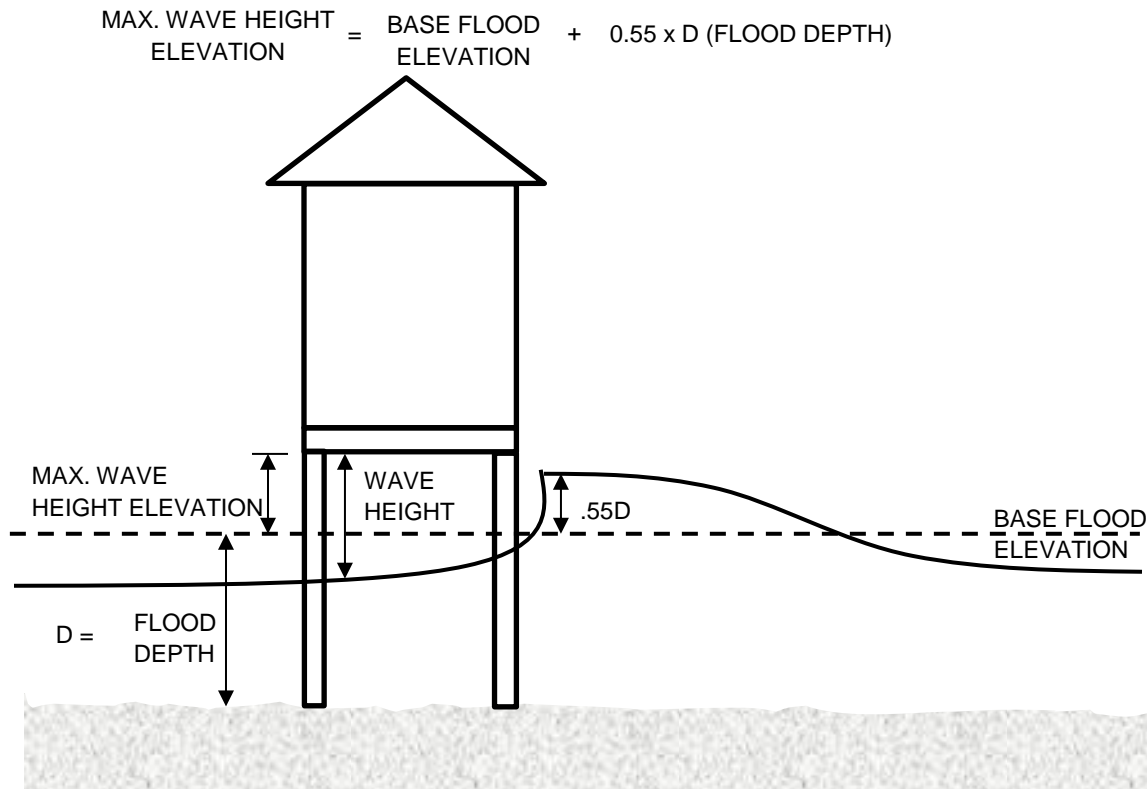


FIGURE 1: WAVE CONDITIONS ON A PILING SUPPORTED BUILDING.

**3404.3** – The elevation of the first habitable floor of all structures in the Regulatory Flood Plain except in the coastal high hazard and ocean hazard areas shall be above the base flood elevation except as provided for in [Paragraph 3406.2](#). This requirement does not apply to the addition, renovation or reconstruction to any building which was constructed prior to the initial Flood Insurance Study for that area if the addition, renovation or reconstruction does not exceed 50% of the present market value of the structure.

**3404.4** – Where walls are constructed below the base flood elevation, they shall be constructed in a manner to minimize wave forces on the structure.

### SECTION 3405 ANCHORING AND BRACING STANDARDS

**3405.1** – All construction shall be anchored and braced to resist uplift, floatation, collapse, or lateral movement of the structure.

**3405.2** – The building official may require plans sealed by a Registered Engineer or Licensed Architect certifying to the building complying with paragraph (a) above. (Reference Chapter 1, [Section 105.5\(c\)](#) of Volume I, N.C. State Building Code.)

### SECTION 3406 CONSTRUCTION, MATEIALS, AND METHODS STANDARDS

**3406.1** – All construction and equipment located below the Base Flood Elevation shall be resistant to flood damage.

**3406.2** – Other than in Coastal High Hazard and Ocean Hazard Areas, all habitable spaces and areas containing equipment located below the Base Flood Elevation shall meet the following:

- (a) Flood-proofing shall comply classification standard FPI1 and FP2 contained in the I.S. Army Corp of Engineers “Flood-Proofing Regulations” dated June 1972 or other approved methods.
- (b) A Registered Engineer or Licensed Architect shall certify that the flood-proofing has been designed to withstand the flood pressure, velocities, impact, and uplift forces.

**3406.3** – Connection Details: All construction shall be adequately anchored and connected to prevent floatation, collapse, lateral movement or overturning during design storm conditions. Special attention should be given to connection between major structural systems such as piling to floor beam, beam to floor joist, joist to exterior side wall diaphragms and side wall to roof joist. The Building Official may require plans signed by a Registered Engineer or Licensed Architect submitted on the connection, anchoring and support system documenting its ability to withstand combined storm wind and wave forces.

**3406.4** – In the Coastal High Hazard Area and the Ocean Hazard Area all metal connectors and fasteners outside of the conditioned spaces shall be hot dip galvanized steel after fabrication and meet ASTM A 153. Exposed metal connectors such as tie down straps on porches, decks, and areas under the structure shall be a minimum of 3/16” thick and shall be hot dip galvanized after fabrication and meet ASTM A 123 or ASTM A 153. Metal connectors of approved equivalent corrosion resistant material may be accepted. See [Table A](#).

**TABLE A: Corrosion Resistance (Applied Only to Structures Located in Coastal High Hazard Areas and Ocean Hazard Areas)**

	Exposure Level		
	OPEN (exteriors, porches, under house)	VENTED/ENCLOSED (attics, floor trusses, enclosed crawl spaces and stud cavity)	CONDITIONED (heated/cooled living areas)
Nails, staples, screws	Hot Dip galvanized	Hot Dip galvanized	---
Nuts, bolts, washers, tie rods	Hot Dip galvanized	Hot Dip galvanized	---
Steel connection plates & straps (3/16” minimum thickness)	Hot Dip galvanized after fabrication	Hot Dip galvanized	---
Sheet metal connectors, wind anchors, joist hangers, steel joists and beams	Stainless Steel or Hot Dip galvanized after fabrication	Hot Dip galvanized after fabrication	Hot Dip galvanized
Truss plates	Stainless Steel or Hot Dip galvanized after fabrication	Hot Dip galvanized after fabrication or stainless steel within 6’- 0” of a gable louver or soffit vent. Otherwise in accordance with TIP-78 of the Truss Plate Institute	Standard galvanized

### **SECTION 3407 STABILITY STANDARDS**

Calculations to determine overturning forces and moments on the foundation shall be made as set forth in [Section 1205.7](#) including appropriate consideration for increased moments and reduced piling penetration due to erosion.

### **SECTION 3408 RECORDS AND CERTIFICATIONS**

The building permit shall include the minimum elevation above MSL for the first habitable floor. The required elevation (MSL) shall be provided by the builder or contractor upon issuance of the permit. This certificate of elevation shall be provided by the contractor or builder at the time of inspection of the flooring prior to further vertical construction. The building official shall require that the actual elevation required by Section 3404 be certified by a registered land surveyor or professional engineer.

### **SECTION 3409 FIRE AND SAFETY STANDARDS FOR TYPES V AND VI CONSTRUCTION**

(Residential Occupancy)

**3409.1** – Section 3409 applies to all residential occupancy in areas identified as coastal high hazard areas or ocean hazard areas, or areas in 120 MPH wind zone (Fig. 12B and Table 12F).

**3409.2** – All roof covering shall be Class A or Class B, or Class Asphalt covering.

# APPENDICES

Appendices A-G were taken from the Basic Building Code, 1976 Edition, published by the Building Officials Conference of America. Inc., 1313 East 60th St., Chicago, Illinois 60637

## NOTE:

Appendices A-G are for informational and convenient reference purposes only. See Chapter II and Text of Code for Standards officially adopted.

[APPENDIX A](#) – AUTHORITATIVE STANDARDS AGENCIES

[APPENDIX B](#) – ENGINEERING PRACTICE STANDARDS

[APPENDIX C](#) – MATERIAL STANDARDS

[APPENDIX D](#) – STRUCTURAL UNIT TEST STANDARDS

[APPENDIX E](#) – STRUCTURAL ASSEMBLY TEST STANDARDS

[APPENDIX F](#) – DURABILITY TEST STANDARDS

[APPENDIX G](#) – FIRE TEST AND FLAME SPREAD TEST STANDARDS

[APPENDIX H](#) – FIRE PROTECTION STANDARDS

[APPENDIX I](#) – METRIC CONVERSION FACTORS

[APPENDIX J](#) – UNIT DESIGN DEAD LOADS FOR STRUCTURAL DESIGN PURPOSES

[APPENDIX K](#) – FIRE RESISTANCE RATINGS

[APPENDIX L](#) – EARTHQUAKE LOADS

[APPENDIX M](#) – SHAPE FACTORS

[APPENDIX N](#) – FLAMMABILITY OF CARPET AND UNDERLAYMENT

[APPENDIX O](#) – ATRIUMS

[APPENDIX P](#) – STATE FIRE PREVENTION CODE

## APPENDIX A

### AUTHORITATIVE STANDARDS AGENCIES

#### Concrete

American Concrete Institute  
 P.O. Box 19150  
 Detroit, Michigan 48219 ..... ACI

Concrete Reinforcing Steel Institute  
 180 North LaSalle Street  
 Chicago, Illinois 60601 ..... CRSI

Gypsum Association  
 1603 Orrington Avenue  
 Suite 1210  
 Evanston, Illinois 60201 ..... CA

National Concrete Masonry Association  
 P.O. Box 9185, Rosslyn Station  
 Arlington, Virginia 22209 ..... NCMA

National Lime Association  
 4000 Brandywine Street, NW  
 Washington, D.C. 20016 ..... NLA

Portland Cement Association  
 5420 Old Orchard Road  
 Skokie, Illinois 60076 ..... PCA

#### Electrical

Illuminating Engineers Society  
 345 East 47th Street  
 New York, New York 10017 ..... IES

Institute of Electrical and  
 Electronics Engineers, Inc.  
 345 East 47th Street  
 New York, New York 10017 ..... IEEE

International Association of  
 Electrical Inspectors  
 802 Busse Highway  
 Park Ridge, Illinois 60068 ..... IAEI

National Electrical Manufacturers  
 Association  
 155 East 44<sup>th</sup> Street  
 New York, New York 10017 ..... NEMA

National Electric Sign Association  
 10922 South Western Avenue  
 Chicago, Illinois 60642 ..... NESAA

#### Equipment

Air-Conditioning and Refrigeration Institute  
 1815 North Fort Myer Drive  
 Arlington, Virginia 22209 ..... ARI

American Gas Association  
 8501 East Pleasant Valley Road  
 Independence, Ohio 44131 ..... AGA

American Petroleum Institute  
 1625 K Street, NW  
 Washington, D. C. 20005 ..... API

American Society of Heating, Refrigerating  
 and Air-Conditioning Engineers  
 United Engineering Center  
 345 East 47th Street  
 New York, New York 10017 ..... ASHRAE

The American Society of Mechanical  
 Engineers  
 United Engineering Center  
 345 East 47th Street  
 New York, New York 10017 ..... ASME

**Equipment – continued**

Home Ventilating Institute  
230 North Michigan Avenue  
Chicago, Illinois 60601 ..... HVI

Incinerator Institute of America  
2425 Wilson Boulevard  
Arlington, Virginia 22201 ..... IIA

The Institute of Boiler and Radiator  
Manufacturers  
393 Seventh Avenue-10th Fl.  
New York, New York 10001 ..... 1-B-R

National Automatic Sprinkler and Fire  
Control Association, Inc.  
2 Holland Avenue  
White Plains, New York 10603 ... NASFCA

National Elevator Industry, Inc.  
600 Third Avenue  
New York, New York 10016 ..... NEI

**Government Agencies**

Department of Defense  
Office of Civil Defense  
Office of the Secretary of the Army  
Washington, D.C. 20390 ..... DOD- OCD

Federal Aviation Agency  
Systems Research and Development Service  
Washington, D. C. 20553 ..... FAA

Federal Specifications  
Superintendent of Documents  
Government Printing Office  
Washington, D. C. 20234 ..... FS

Forest Products Laboratory  
United States Department of Agriculture  
Madison, Wisconsin 53705 ..... FPL

Housing and Home Finance Agency  
Division of Housing Research  
Washington, D. C. 20410 ..... HHFA

National Environmental Systems  
Contractors Association  
221 North LaSalle Street  
Chicago, Illinois 60601 ..... NESCA

National LP-Gas Association  
79 West Monroe Street  
Chicago, Illinois 60603 ..... NLPGA

National Oil Fuel Institute, Inc.  
60 East 42nd Street  
New York, New York 10017 ..... NOFI

Uniform Boiler and Pressure Vessel Laws  
Society, Inc.  
57 Pratt Street  
Hartford, Connecticut 06103 ..... UBPVLS

Joint Army-Navy Specifications  
Bureau of Supplies and Accounts  
Navy Department  
Washington, D. C. 20225 ..... JAN

Air Material Command  
Wright-Patterson Air Force Base  
Dayton, Ohio 45433 ..... JAN

National Bureau of Standards  
(Department of Commerce)  
Washington, D.C. 20234 ..... NBS

National Research Council of Canada  
Division of Building Research  
Ottawa, Ontario, Canada  
KIA OR6 ..... NRCC

Naval Facilities Engineering Command  
(formerly Bureau of Yards & Docks)  
Navy Department  
Washington, D. C. 20390 ..... NFEC

**Government Agencies – continued**

Navy Specifications  
 Bureau of Supplies and Accounts  
 Navy Department  
 Washington, D. C. 20225 ..... NS  
 Product Standards Section  
 Office of Engineering Standards Services  
 National Bureau of Standards  
 Washington, D. C. 20234 ..... PS  
 Public Health Service  
 Department of Health, Education and  
 Welfare  
 Washington, D. C. 20201 ..... PHS

Superintendent of Documents  
 Government Printing Office  
 Washington, D. C. 20402 ..... GPO  
 United States Department of Agriculture  
 Washington, D. C. 20225 ..... USDA  
 United States Department of Commerce  
 Construction Division  
 Washington, D. C. 20225 ..... USDC  
 United States Forest Service  
 Madison, Wisconsin 53705 ..... USFS  
 United States Naval Supply Depot  
 5801 Tabor Avenue  
 Philadelphia, Pennsylvania 19120 .. USNSD

**Interior Finishes and Masonry**

Acoustical and Board Products Association  
 205 West Touhy Avenue  
 Park Ridge, Illinois 60068 ..... ABPA  
 American Hardboard Association  
 20 North Wacker Drive  
 Chicago, Illinois 60606 ..... AHA  
 Brick Institute of America  
 1750 Old Meadow Road  
 McLean, Virginia 22101 ..... BIA  
 Facing Tile Institute  
 333 North Michigan Avenue  
 Chicago, Illinois 60601 ..... FTI  
 Gypsum Association  
 1603 Orrington Avenue  
 Suite 1210  
 Evanston, Illinois 60201 ..... GA  
 Hardwood Plywood Manufacturers  
 Association  
 P.O. Box 6246  
 Arlington, Virginia 22206 ..... HPM  
 Indiana Limestone Institute of America, Inc.  
 400 East 7th Street-P.O. Box 489  
 Bloomington, Indiana 47401 ..... ILIA

Marble Institute of America, Inc.  
 Pennsylvania Building  
 Washington, D. C. 20004 ..... MIA  
 National Building Granite Quarries  
 Association, Inc.  
 P. O. Box 444  
 Concord, New Hampshire 03302 .. NBGQA  
 National Concrete Masonry Association  
 P.O. Box 9185  
 Arlington, Virginia 22209 ..... NCMA  
 National Lime Association  
 4000 Brandywine Street, NW  
 Washington, D. C. 20016 ..... NLA  
 National Particleboard Association  
 2306 Perkins Place  
 Silver Springs, Maryland 20910 ..... NPA  
 Perlite Institute, Inc.  
 45 West 45th Street  
 New York, New York 10036 ..... PI  
 Portland Cement Association  
 5120 Old Orchard Road  
 Skokie, Illinois 60076 ..... PCA



**Interior Finishes and Masonry – continued**

Resilient Tile Institute  
26 Washington Street  
East Orange, New Jersey 07017 ..... RTI

The Society of the Plastics Industry, Inc.  
250 Park Avenue  
New York, New York 10017 ..... SPI

**Metal and Steel**

Aluminum Association  
750 Third Avenue  
New York, New York 10017 ..... AA

American Institute of Steel Construction,  
Inc.  
1221 Avenue of the Americas  
Suite 1580  
New York, New York 10020 ..... AISC

American Iron and Steel Institute  
1000 Sixteenth Street, NW  
Washington, D. C. 20036 ..... AISI

American Welding Society  
2501 N. W. Seventh Street  
Miami, Florida 33125 ..... AWS

Architectural Aluminum Manufacturers  
Association  
35 East Wacker Drive  
Room 3200  
Chicago, Illinois 60601 ..... AAMA

Cast Iron Soil Pipe Institute  
2029 K Street, NW  
Washington, D. C. 20006 ..... CISPI

Concrete Reinforcing Steel Institute  
180 North LaSalle Street  
Chicago, Illinois 60601 ..... CRSI

Copper Development Association, Inc.  
405 Lexington Avenue  
New York, New York 10017 ..... CDA

Lead Industries Association, Inc.  
292 Madison Avenue  
New York, New York 10017 ..... LIA

Tile Council of America  
Research Center  
P.O. Box 326  
Princeton, New Jersey 08540 ..... TCA

Metal Building Manufacturers Association  
2130 Keith Building  
Cleveland, Ohio 44115 ..... MBMA

Metal Lath Association  
12703 Triskett  
Cleveland, Ohio 44111 ..... MLA

National Association of Architectural Metal  
Manufacturers  
1033 South Boulevard  
Oak Park, Illinois 60302 ..... NAAMM

Research Council on Riveted and Bolted  
Structural Joints of the Engineering  
Foundation

United Engineering Center  
345 East 47<sup>th</sup> Street  
New York, New York 10017 RCRBSJEF

Steel Bar Mills Association  
38 South Dearborn Street  
Chicago, Illinois 60603 ..... SBMA

Steel Deck Institute  
9836 West Roosevelt Road  
Westchester, Illinois 60153 ..... SDI

Steel Door Institute  
2130 Keith Building  
Cleveland, Ohio 44115 ..... SDI

Steel Joist Institute  
2001 Jefferson Davis Highway  
Suite 707  
Arlington, Virginia 22202 ..... SJI

Steel Scaffolding & Shoring Institute  
2130 Keith Building  
Cleveland, Ohio 44115 ..... SSSI

**Metal and Steel – continued**

Steel Window Institute  
 2130 Keith Building  
 Cleveland, Ohio 44115 ..... SWI

Wire Reinforcement Institute  
 5034 Wisconsin Avenue  
 Washington, D. C. 20016 ..... WRI

**General Standards and Testing Laboratories**

American Insurance Association  
 85 John Street  
 New York, New York 10038 ..... AIA

General Electric Company  
 3198 Chestnut Street  
 Philadelphia, Pennsylvania 19101 ..... GE

American National Standards Institute, Inc.  
 1430 Broadway  
 New York, New York 10038 ..... ANSA

National Fire Protection Association  
 470 Atlantic Avenue  
 Boston, Massachusetts 02110 ..... NFIPA

American Society for Testing and Materials  
 P.O. Box 7510  
 Philadelphia, Pennsylvania 19101 ... ASTM

National Sanitation Foundation Testing  
 Laboratories, Inc.  
 3475 Plymouth Road  
 P O. Box 1468

Factory Mutual Engineering Division  
 Standards-Laboratories Department  
 1151 Boston-Providence Turnpike  
 Norwood, Massachusetts 02062 ..... FMED

Ann Arbor, Michigan 48106 ..... NSFTL

Underwriter Laboratories, Inc.  
 207 East Ohio Street  
 Chicago, Illinois 60611 ..... ULI

**Fire Testing Laboratories (Floor, Walls, Roof and Similar Tests)**

National Bureau of Standards  
 (Department of Commerce)  
 Superintendent of Documents  
 Government Printing Office  
 Washington, D. C. 20234 ..... NBS

Underwriters' Laboratories, Inc.  
 333 Pfingsten Road  
 Northbrook, Illinois 60062 ..... ULI

The Ohio State University  
 Building Research Laboratory  
 2070 Neil Avenue  
 Columbus, Ohio 43210 ..... OSU

Underwriters' Laboratories, Inc.  
 1655 Scott Boulevard  
 Santa Clara, California 95050 ..... ULI

Underwriters' Laboratories, Inc.  
 207 East Ohio Street  
 Chicago, Illinois 60611 ..... ULI

University of California at Berkeley  
 College of Engineering  
 Berkeley, California 94720 ..... UCB

**Flame Spread Testing laboratories**

Southwest Research Institute  
 8500 Culebra Road  
 San Antonio, Texas 78228 ..... SWRI

Underwriters' Laboratories, Inc.  
 1655 Scott Boulevard  
 Santa Clara, California 95050 ..... ULI

Underwriters' Laboratories, Inc.  
 333 Pfingsten Road  
 Northbrook, Illinois 60062 ..... ULI

**Structural Testing Laboratories**

Brick Institute of America  
1750 Old Meadow Road  
McLean, Virginia 22101 ..... BIA

The Detroit Testing Laboratory, Inc.  
12800 Northend Avenue  
Detroit, Michigan 48237 ..... DTL

Forest Products Laboratory  
United States Department of Agriculture  
Madison, Wisconsin 53705 ..... FPL

General Electric Company  
3198 Chestnut Street  
Philadelphia, Pennsylvania 19101 ..... GE

Hardwood Plywood Manufacturers  
Association  
P.O. Box 6246  
Arlington, Virginia 22206 ..... HPM

H. C. Nutting Company  
4120 Airport Road  
Cincinnati, Ohio 45226 ..... HCN

IIT Research Institute  
10 West 35<sup>th</sup> Street  
Chicago, Illinois 60616 ..... IITRI

NAHB Research Foundation, Inc.  
Research Laboratory  
Rockville, Maryland 20850 ..... NAHB

The Ohio State University  
Building Research Laboratory  
2070 Neil Avenue  
Columbus, Ohio 43210 ..... OSU

The Pennsylvania State University  
Research Institute  
University Park, Pennsylvania 16802 ... PSU

Pittsburgh Testing Laboratory  
1330 Locust Street  
Pittsburgh, Pennsylvania 15219 ..... PTL

Robert W. Hunt Company  
810 South Clinton  
Chicago, Illinois 60607 ..... RWH

University of Detroit  
Research Institute  
Detroit, Michigan 48221 ..... UD

**Unclassified Miscellaneous**

The American Institute of Architects  
1735 New York Avenue, NW  
Washington, D. C. 20006 ..... AIA

American Public Health Association  
1790 Broadway  
New York, New York 10017 ..... APHA

American Society of Civil Engineers  
United Engineering Center  
345 East 47th Street  
New York, New York 10017 ..... ASCE

American Society of Sanitary Engineering  
960 Illuminating Building  
Cleveland, Ohio 44113 ..... ASSE

American Water Works Association  
6066 West Quincy Avenue  
Denver, Colorado 80235 ..... AWWA

Building Officials and Code Administrators  
International, Inc.  
1313 East 60th Street  
Chicago, Illinois 60637 ..... BOCA

Building Research Advisory Board Division  
of Engineering  
National Research Council  
2101 Constitution Avenue  
Washington, D. C. 20418 ..... BRAB

International Association of Plumbing &  
Mechanical Officials  
5032 Alhambra Avenue  
Los Angeles, California 90032 ..... IAPMO

International Conference of Building  
Officials  
5360 South Workman Mill Road  
Whittier, California 90601 ..... ICBO

**Unclassified Miscellaneous - continued**

Manufacturing Chemists' Association, Inc.  
 1825 Connecticut Avenue, NW  
 Washington, D C. 20006 ..... MCA

Mineral Fiber Products Bureau  
 509 Madison Avenue  
 New York, New York 10022 ..... MFPB

Mobile Homes Manufacturers Association  
 14650 Lee Road  
 Chantilly, Virginia 22021 ..... MHMA

National Association of Building  
 Manufacturers  
 1619 Massachusetts Avenue, N.W.  
 Washington, D. C. 20036 ..... NABM

National Association of Home Builders  
 15th and M Streets, NW  
 Washington, D. C. 20005 ..... NAHB

National Clay Pipe Institute  
 P.O. Box 310  
 350 West Terra Cotta Avenue  
 Crystal Lake, Illinois 60014 ..... NCPI

National Insulation Manufacturers  
 Association  
 441 Lexington Avenue  
 New York, New York 10017 ..... NIMA

**Wood and Wood Products**

Acoustical and Board Materials Association  
 205 West Touhy Avenue  
 Park Ridge, Illinois 60068 ..... AIMA

American Hardboard Association  
 20 North Wacker Drive  
 Chicago, Illinois 60606 ..... AHA

American Institute of Timber Construction  
 333 W. Hampden Avenue  
 Englewood, Colorado 80110 ..... AITC

American Plywood Association  
 1119 A Street  
 Tacoma, Washington 98401 .... APA-DFPA

National Mineral Wool Insulation  
 Association  
 382 Springfield Avenue  
 Suite 312  
 Summit, New Jersey 07901 ..... NMWIA

National Research Council of Canada  
 Ottawa, Ontario, Canada  
 K1A OR6 ..... NBCC

National Society of Professional Engineers  
 2029 K Street, NW  
 Washington, D. C. 20006 ..... NSPE

Sheet Metal and Air Conditioning  
 Contractor's National Association, Inc.  
 1611 North Kent Street  
 Arlington, Virginia 22209 ..... SMACNA

Southern Building Code Congress  
 International  
 3617 Eighth Avenue, South  
 Birmingham, Alabama 35222 ..... SBCC

Truss Plate Institute, Inc.  
 7100 Baltimore Avenue  
 Suite 200  
 College Park, Maryland 20740 ..... TPI

American Wood Preservers' Association  
 1625 I St., N.W.  
 Washington, D.C. 20006 ..... AWPA

American Wood Preservers Bureau  
 P.O. Box 6085  
 Arlington, Virginia 22206 ..... AWPB

American Wood Preservers Institute  
 1651 Old Meadow Road  
 McLean, Virginia 22101 ..... AWPI

Appalachian Hardwood Manufacturers, Inc.  
 1015 Mercantile Library Building  
 414 Walnut Street  
 Cincinnati, Ohio 45202 ..... AHM

**Wood and Wood Products – continued**

Association of Timber and Timber Treatment Inspection Agencies 729 Fisher Road Grosse Pointe, Michigan 48230 ... ATTTIA	Plywood Fabricator Service, Inc., an affiliate of the American Plywood Association 1119 A Street Tacoma, Washington 98401 ..... PFS
California Redwood Association 617 Montgomery Street San Francisco, California 94111 ..... CRA	Red Cedar Shingle and Handsplit Shake Bureau 5510 White Building Seattle, Washington 98101 ..... RCSHSB
Canadian Wood Council 761-170 Laurier Avenue W Ottawa, Ontario, Canada K1P 5V5 ..... CWC	Redwood Inspection Service 617 Montgomery Street San Francisco, California 94111 ..... RIS
Hardwood Plywood Manufacturers Association P.O. Box 6246 Arlington, Virginia 22206 ..... HPMMA	Southern Forest Products Association P.O. Box 52468 New Orleans, Louisiana 70150 ..... SFPA
National Forest Products Association 1619 Massachusetts Avenue, NW Washington, D. C. 20036 ..... NFoPA	Southern Hardwood Producers, Inc. 805 Sterick Building Memphis, Tennessee 38103 ..... SHP
National Particleboard Association 2306 Perkins Place Silver Springs, Maryland 20910 ..... NPA	Southern Pine Inspection Bureau P.O. Box 846 Pensacola, Florida 32594 ..... SPIB
National Woodwork Manufacturer's Association 400 West Madison Street Chicago, Illinois 60606 ..... NWMA	Timber Engineering Co. 5530 Wisconsin Ave., N.W. Washington, D. C. 20015 ..... TECO
Northeastern Lumber Manufacturers Association, Inc. 13 South Street Glen Falls, New York 12801 ..... NELMA	Truss Plate Institute, Inc. 7100 Baltimore Avenue Suite 200 College Park, Maryland 20740 ..... TPI
Northern Hardboard and Pine Manufacturers Association, Inc. 501 Northern Building Green Bay, Wisconsin 54301 ..... NHPMA	West Coast Lumber Inspection Bureau 6980 S.W. Varnes Road P.O. Box 23145 Portland, Oregon 97223 ..... WCLIB
	Western Wood Products Association 1500 Yeon Building Portland, Oregon 97204 ..... WWPA

## APPENDIX B

### ENGINEERING PRACTICE STANDARDS

*See also Appendices C, D, E, F and G for standards on specific materials or test of units or assemblies; some of which include engineering practice standards for specific applications.*

#### Concrete

Concrete Formwork – Recommended Practice for .....	ACI 347-68
Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction .....	ASTM E329-72
Manufacturing Reinforced Concrete Floor and Roof Units – Recommended Practice for .....	ACI 512-67
Reinforced Concrete – Building Code Requirements for .....	ACI 318-71
Accumulative Supplement to ACI 318-71 .....	ACI-1975
Reinforced Concrete Structures – Manual of Standard Practice for Detailing .....	ACI 315-74
Reinforced Steel Welding Code .....	AWS D12.1-75

#### Electrical Illumination

Daylighting – Recommended Practices of .....	IES RP5-1962
Design Criteria for Lighting Interior Living Spaces .....	IES RPII-196911
Electrical Code – National .....	NFiPA 70-1975
Industrial Lighting .....	ANSI A 11.1-1973
Lighting Handbook .....	IES-1972
Office Lighting – Recommended Practice .....	IES RP1-1973
School Lighting – Recommended Practice .....	IES RP3-1970

#### Energy Conservation

ASHRAE Handbook and Products Directories – Systems Volume .....	ASHRAE-1973
– Fundamentals Volume .....	ASHRAE-1972
Energy Conservation in New Building Design .....	ASHRAE 90-75

#### Equipment

Elevators and Lifts Construction, Care and Use of Automotive Lifts – Safety Requirements for .....	ANSI B153.1-1974
Elevators, Dumbwaiters, Escalators and Moving Walks – Safety Code for .....	ANSI A17.1-1971
– 1972 Supplement .....	ANSI A17.1a-1972
– 1973 Supplement .....	ANSI A17.1b-1973
– 1974 Supplement .....	ANSI A17.1c-1974
– 1975 Supplement .....	ANSI A17.1d,e,f-1975
Elevators, Escalators and Moving Walks – Practice for the Inspection of ..	ANSI A17.2- 1973
Manlifts – Safety Standard for .....	ANSI A90.1-1969
– 1972 Supplement .....	ANSI A90.1a-1972

## Heating

Boiler Code and Unfired Pressure Vessel Code ..... ASME-1974

## Fire Protection and Safety Practices

Life Safety Code ..... NFIPA 101-1977

NOTE: NFIPA 101-1977 is acceptable for matters of design of exits not provided for by the Codes. Finish and construction requirements incorporated therein are not applicable.

Aircraft Hangars – Standard on ..... NFIPA 409-1975

Cellulose Nitrate Motion Picture Film

– Standard for the Storage and Handling of ..... NFIPA 40-1974

Dry Cleaning Plants – Standard for ..... NFIPA 32-1974

Dust Explosions and Ignition, Standard for the Prevention of

– in Flour and Feed Mills and Allied Grain Storage Elevators ..... NFIPA 61C-1973

– in Grain Elevators, Bulk Handling Facilities ..... NFIPA 618-1973

– in Industrial Plants – Fundamental Principles for ..... NFIPA 63-1975

– in Starch Factories ..... NFIPA 61A-1973

Fire Tests for Flame Resistant Textiles and Films – Standard Methods of ..... NFIPA 701-1975

Garages

– Parking Structures – Standard for ..... NFIPA 88A-1973

– Repair Garages – Standard for ..... NFIPA 88B-1973

Gas Shielded Arch Welding – Recommended Safe Practice for ..... AWS A6.1-1966

Household Fire Warning Equipment – Standard for ..... NFIPA 74-1975

Incinerators and Rubbish Handling – Standard on ..... NFIPA 82-1972

Liquefied Petroleum Gases – Standard for the Storage and Handling of ..... NFIPA 58-1974

Liquefied Petroleum Gases at Utility Gas Plants

– Standard for the Storage and Handling of ..... NFIPA 59-1974

Liquids, Flammable and Combustible – Code for ..... NFIPA 30-1973

Oxygen-Fuel Gas Systems for Welding and Cutting

– Standard for the Installation and Operation of ..... NFIPA 51-1974

Piers and Wharves – Standard for the Construction and Protection of ..... NFIPA 87-1975

Pulverized Fuel Systems – Standard for the Installation and Operation of ..... NFIPA 60-1973

Pyroxylin Plastics – Code for Storage of ..... NFIPA 40E-1975

Safe Practices for Welding and Cutting Containers

That Have Held Combustibles ..... AWS A6.0-65

Safety in Welding and Cutting ..... ANSI Z49.1-1973

Smoke and Heat Venting Guide for ..... NFIPA 204-1968

Spray Finishing Using Flammable and Combustible Materials – Standard for ... NFIPA 33-1973

Tents, Grandstands and Air-Supported Structures

Used for Places of Assembly – Standard for ..... NFIPA 102-1972

## Glass

Safety Glazing Material Used in Buildings

– Performance Specifications and Methods of Test for ..... ANSI Z97.1-1972

## Interior Finishes

Application and Finishing of Gypsum Board – Specifications for (See Appendix M)..	GA 216-75
Gypsum Base for Veneer Plasters – Standard Specification for .....	ASTM C588-68
Gypsum Board Products, Gypsum Lath, Gypsum Partition Tile or Block, and Precast Reinforced Gypsum Slabs – Method of Physical Testing of .....	ASTM C473-74
Gypsum Lath – Standard Specification for .....	ASTM C37-69
Gypsum Plasters – Specification for .....	ASTM C28--3
Gypsum Plasters and Gypsum Concrete – Standard Methods for Physical Testing of .....	ASTM C472-73
Gypsum Veneer Plaster – Specifications for .....	ASTM C587-73
Gypsum Veneer Plaster – Specifications for Application .....	GA 150-1970
Gypsum Wallboard – Specification for .....	ASTM C36-75
Interior Lathing and Furring – Specifications for .....	ANSI A42.4-1967
Interior Marble – Specifications for .....	ANSI A94.1-1961
Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels – Standard Recommended Practice for Installation of .....	ASTM C636-69
Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings – Standard Specifications for .....	ASTM C635-69
Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior, Lathing and Furring for – Specifications for .....	ANSI A42.3-1971
Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior – Specifications for .....	ANSI A42.2-1971
Steel Framing Members to Receive Screw-Attached Gypsum Wallboard Backing Board, or Water-Resistant Backing Board – Specifications for .....	ASTM C754-74
Tile, Ceramic, Installed with – Chemical Resistant, Water Cleanable Tile-Setting Grouting Epoxy .....	ANSI A108.6-1969
– Dry-Set Portland Cement Mortar .....	ANSI A108.5-1972
– Water Resistant Organic Adhesives .....	ANSI A108.4-1972
Tile, Ceramic Mosaic, Installed with Portland Cement Mortar .....	ANSI A108.2-1972
Tile, Electrically Conductive Ceramic, Installed with Conductive Dry Set Portland Cement Mortar .....	ANSI A108.7-1972
Tile, Glazed Ceramic Wall, Installed with Portland Cement Mortar .....	ANSI A108.1-1972
Tile, Quarry and Paver, Installed with Portland Cement Mortar .....	ANSI A108.3-1972

## Masonry

Cold Weather Masonry Construction .....	BIA-1968
Design and Construction of Loadbearing Concrete Masonry – Specifications for ...	NCMA-1970
Engineered Brick Masonry – Requirements for .....	BIA-1969
NOTE: This standard (BIA-1969) is only applicable to brick masonry of solid masonry units made from clay or shale.	
Masonry – Building Code Requirements for .....	ANSI A41.1-1970
Reinforced Masonry – Building Code Requirements for .....	ANSI A41.2-1970



**Metal****Aluminum**

- Aluminum Construction Manual, Aluminum Formed  
Sheet Building Sheathing Design Guide ..... AA-ABS32-69
- Aluminum Construction Manual, Specifications for Aluminum Structures ... AA-SAS30-71
- Aluminum Construction Manual, Aluminum Sheet Metal Work  
in Building Construction ..... AA-ASM35-71

**Steel**

- Architecturally Exposed Structural Steel – Specification for ..... AISC-1960
- Design of Cold-Formed Steel Structural Members – Specification for ..... AISI-1968
- Design Fabrication and Erection of Structural Steel for Buildings  
– Specification for ..... AISC- S310-78
- Joist Girders – Standard Specifications for ..... SJI-78
- Design of Cold-Formed Stainless Steel Structural Members – Specification for ... AISI-1974
- Gas Systems for Welding and Cutting ..... (See Fire Protection  
and Safety Practice)
- Non-Load (Axial) Bearing Steel Studs, Runners (Track),  
and Rigid Furring Channels for Screw Application of  
Gypsum Board – Specification for ..... ASTM C645-75
- Longspan Steel Joist LH Series, and Deepspan Steel Joists DLH Series  
– Standard Specifications for ..... SJI/AISC-1978
- Metal Building Systems Manual ..... MBMA-1974
- Open Web Steel Joists, H-Series – Standard Specification for ..... SJI/AISC-1978
- Steel Drill Screw Application of Gypsum Sheet  
Material to Light Gage Steel Studs – Specification for ..... ASTM C646-72
- Structural Applications of Steel Cables for Building – Criteria for ..... AISI-1973
- Structural Joints Using ASTM A325 or A490 Bolts – Specification for ..... AISC-S314-78
- Welding Code, Structural ..... AWS D1.1-79
- Welding Sheet Steel in Structures ..... AWS 01.3-1978

**Wood and Wood Products**

- Adhesives for Field Gluing Plywood to Wood Framing  
– Performance Specification for ..... APA-AFG-01-1974
- APA Glued Floor System ..... APA-V405-1976
- Joists and Rafter  
Span Tables for ..... NFoPA-1973
- Working Stresses for ..... NFoPA-1974
- Pile Foundations Know How ..... AWPI-1970
- Pole Building Design ..... AWPI-1972
- Plywood Commercial/Industrial Construction Guide ..... APA-Y300-1976
- Plywood Design Specifications ..... APA-Y510-1976
- Plywood-Lumber Components – Design Specifications for  
(includes curved panels, beams, stressed-skin panels,  
sandwich panels, diaphragm construction and folded plates) ..... APA-V815-1976

APPENDIX B

Plywood-Lumber Components – Fabrication Specifications  
(includes curved panels, beams, stressed-skin panels,  
sandwich panels, diaphragm construction and folded plates) ..... APA-V820-1976  
Plywood Residential Construction Guide ..... APA-Y405-1976  
Stress Grade Lumber and Its Fastenings  
– National Design Specifications for ..... NFoPA-1973  
– Supplement, Table 1, Allowable Unit Stresses-Structural Lumber ..... NFoPA-1974  
Structural Design Data – Wood ..... NFoPA-1970  
Structural Design guide for Hardwood Plywood ..... HPMa-S6-71  
Timber Construction Manual ..... AITC-1974  
Timber Construction Standards (except AITC 117) ..... AITC-100-1972  
Timber Structural Glued Laminated – Inspection Manual for ..... AITC 200-73  
Trusses – Design Specifications for Light Metal Plate Connected Wood ..... TPI-1974  
Wood Handbook ..... USDA Handbook No. 72-1974

**Unclassified Miscellaneous**

Basic Housing – Property Maintenance Code ..... BOCA 1975  
Building Materials and Equipment – Coordination of Dimensions of ..... ANSI A62.1-1957  
Demolition – Safety Requirements for ..... ANSI A10.6-1969  
Fallout Shelters – Suggested Building Code Provisions for ..... DOD-OCdTR-36-1966  
Flood Proofing Regulations ..... U.S. Army-1972  
Floor and Wall Openings, Railings, and Toe Boards  
– Safety Requirements for ..... ANSI A12.1- 1973  
Installing Vitrified Clay Sewer Pipe – Recommended Practice for ..... ASTM C12-74  
Loads, Minimum Design in Buildings and Other Structures  
– Building Code Requirements for ..... ANSI A58.1-1972  
Mobile Homes, Body and Frame Design and Construction and  
Installation of Plumbing, Heating and Electrical Systems ..... NFIPA 501B-1974  
One- and Two-Family Dwelling Code ..... BOCA, AInA, SSBC, ICB0-1975  
1976 Supplement ..... BOCA, AInA, SSBC, ICB0-1976  
Safety Requirements for Shoring Concrete Formwork – Recommended ..... SSSI-1973  
Sign and Outdoor Display Structures – Building Code Requirements for ..... ANSI A60.1-1949  
Waterproofing and Drainage of Floors – Manual on..... NFIPA 92M-1972

## APPENDIX C

### MATERIAL STANDARDS

See also [Appendix D](#) for standards for tests of specific materials.

#### Concrete

Aggregates, Concrete – Specifications for .....	ASTM C33-74a
Aggregates, Lightweight, for Structural Concrete – Specifications for .....	ASTM C330-75a
Aggregates, Lightweight, for Concrete Masonry Units .....	(See Masonry)
Aggregates, Lightweight, for Insulating Concrete – Specifications for .....	ASTM C332-71
Forms for One-way Concrete Joist Construction – Types and Sizes of .....	USDC PS 16-69
Gypsum Concrete – Specifications for .....	ASTM C317-70
Manufacturing Reinforced Concrete Floor and Roof Units – Recommended Practice for .....	ACI 512-67
Masonry Units – Concrete .....	(See Masonry)
Natural Cement – Specifications for .....	ASTM C10-73
Portland Cement – Specifications for .....	ASTM C150-74
Ready Mix Concrete – Specifications for .....	ASTM C94-74a
Reinforcing .....	(See Metals)
Sheet Materials for Curing Concrete – Specifications for .....	ASTM C 171- 75
Vermiculite Concrete Roofs and Slabs on Grade – Specifications for .....	ANSI A122.1-1965

#### Interior Finishes

Adhesives, Organic, for Installation of Ceramic Tile Types I and II – Standard for .....	ANSI A136.1-72
Aggregates, Inorganic, for use in Gypsum Plaster – Specifications for .....	ASTM C35-70
Conductive Dry-Set Portland Cement Mortar, Standard Specification for (for Ceramic Tile) .....	ANSI A118.2-1972
Dry-Set Portland Cement Mortar – (for Ceramic Tile) .....	(See Masonry)
Epoxy, Chemical Resistant, Water Cleanable Tile-Setting and Grouting – Standard Specifications for .....	ANSI A118.3-1969
Gypsum and Gypsum Products, Chemical Analysis of – Standard Methods for ..	ASTM C471-75
Gypsum Base for Veneer Plaster – Specifications for .....	ASTM C588-68
Gypsum Board Products, Gypsum Lath, Gypsum Partition Tile or Block, and Precast Reinforced Gypsum Slabs – Method of Physical Testing of .....	ASTM C473-74
Gypsum Lath – Specifications for .....	ASTM C37-69
Gypsum Plasters – Specifications for .....	ASTM C28-73
Gypsum Plasters and Gypsum Concrete, Physical Testing of – Standard Methods for .....	ASTM C472-73
Gypsum Veneer Plaster – Specifications for .....	ASTM C587-73
Gypsum Wallboard – Specifications for .....	ASTM C36-75
Latex-Portland Cement Mortar, Standard Specification for (for Ceramic Tile) .....	ANSI A118.4-1973
Lime, Hydrated, Normal Finishing – Specifications for .....	ASTM C6-74
Lime, Hydrated, Special Finishing – Specifications for .....	ASTM C206-74

Quicklime and Hydrated Lime – Methods of Physical Testing of .....	ASTM C110-74
Quicklime for Structural Purposes – Specifications for .....	ASTM C5-74
Tile, Ceramic – Standard Specifications for .....	TCA 137.1-1976

## Masonry

Aggregate, Fine – Effect of Organic Impurities in, on Strength of Mortar .....	ASTM C87-75
Aggregates, Lightweight, for Concrete Masonry Units – Specifications for .....	ASTM C331-69
Aggregate for Masonry Grout – Specifications for .....	ASTM C404-75
Aggregate for Masonry Mortar – Specifications for .....	ASTM C144-75
Brick, Building (Solid Masonry Units Made from Clay or Shale) – Specifications for .....	ASTM C62-69
Brick, Concrete Building – Specifications for .....	ASTM C55-71
Brick, Face, Calcium Silicate (Sand Lime Brick) – Specifications for .....	ASTM C73-72
Brick Facing (Solid Masonry Units Made from Clay or Shale) – Specifications for .....	ASTM 55-71
Brick, Hollow (Hollow Masonry Units Made from Clay or Shale) – Specifications for .....	ASTM C652-75
Cement, Masonry – Specifications for .....	ASTM C91-71
Ceramic Tile (Veneers) .....	(See Interior Finishes)
Clay Facing Tile, Structural – Specifications for .....	ASTM C212-70
Clay Load-Bearing Wall Tile, Structural – Specifications for .....	ASTM C34-70
Clay Non-Load Bearing Screen Tile, Structural – Specifications for .....	ASTM C530-70
Clay Non-Load-Bearing Wall Tile, Structural – Specification for .....	ASTM C56-71
Concrete Masonry Units, Hollow Load Bearing – Specifications for .....	ASTM C90-70
Concrete Masonry Units, Hollow Non-Load Bearing – Specifications for .....	ASTM C129-73
Concrete Masonry Units, Solid Load Bearing – Specifications for .....	ASTM C145-71
Dry-Set Portland Cement Mortar – Standard Specifications for .....	ANSI A118.1-72
Glazed Units: Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units – Specifications for .....	ASTM C126-71
Gypsum Partition Tile and Block – Specifications for .....	ASTM C52-72
Lime, Hydrated for Masonry Purposes – Specifications for .....	ASTM C207-74
Limes .....	(See Interior Finishes)
Mortar and Grout for Reinforced Masonry – Specifications for .....	ASTM C476-71
Mortar for Unit Masonry – Specification for .....	ASTM C270-73
Portland Cement-Lime Mortar for Brick Masonry – Standard Specifications for .....	BIA M1-72
Portland Cement – Specifications for .....	(See Concrete)

## Metal

Alloy Steel Bolts, Quenched and Tempered, for Structural Steel Joints – Standard Specifications for .....	ASTM A490-76
Alloy Steel Sheets and Strip, Regular Quality Hot-Rolled and Cold-Rolled – Specification for .....	ASTM A506-73
Aluminum-Alloy Bars, Rods and Wire – Standard Specifications for .....	ASTM B211-74
Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes – Standard Specifications for .....	ASTM B221-74
Aluminum-Alloy Die and Hand Forging – Standard Specifications for .....	ASTM B247-74

Aluminum Alloy Seamless Pipe and Seamless Extruded Tubing	
– Standard Specifications for .....	ASTM B241-73
Aluminum Alloy Sheet and Plate – Standard Specifications for .....	ASTM B209-74
Aluminum-Alloy Standard Structural Shape, Rolled or Extruded	
– Standard Specifications for .....	ASTM B308-73
Aluminum-Alloy Drawn Seamless Tubes – Standard Specifications for .....	ASTM B210-74a
Aluminum Alloy Extruded Structural Pipe and Tube	
– Standard Specifications for .....	ASTM B249-73
Aluminum-Alloy Round Welded Tubes – Standard Specifications for .....	ASTM B313-73
Aluminum-Alloy Rivet and Cold Heading Wire and Rods	
– Standard Specifications for .....	ASTM B316-75
Aluminum Alloy Die Casting – Standard Specifications for .....	ASTM B85-73
Aluminum Alloy Permanent Mold Castings – Standard Specification for .....	ASTM B108-75
Aluminum Alloy Sand Castings – Standard Specifications for .....	ASTM B26-75
Aluminum Sliding Glass Doors – Specifications for .....	AAMA 402.8-72
Aluminum Windows – Specifications for .....	AAMA 302.8-72
Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding	
– Specifications for .....	AWS A5.17-76
Bolts, High Strength, for Structural Steel Joints Including	
Suitable Nuts and Plain Hardened Washers – Specifications for .....	ASTM A325-76a
Bolts and Studs, Quenched and Tempered Steel, Specifications for .....	ASTM A449-74
Carbon and Alloy Steel Nuts for Bolts for High-Pressure and	
High Temperature Service – Specifications for .....	ASTM A194-74
Carbon-Steel Castings Suitable for Fusion Welding for	
High Temperature Service – Specifications for .....	ASTM A216-75
Carbon Steel Nuts – Specifications for .....	ASTM A563-75
Carbon Steel Plates of Structural Quality, Low and	
Intermediate Tensile Strength – Specifications for .....	ASTM A283-75
Carbon Steel Strip, Cold-Rolled – Specifications for .....	ASTM A109-72
Castings, Mild-to-Medium Strength Carbon Steel for	
General Application – Specifications for .....	ASTM A27-73
Castings, Gray Iron – Specifications for .....	ASTM A48-74
Cold-Formed Welded and Seamless Carbon Steel Structural	
Tubing in Rounds and Squares – Specifications for .....	ASTM A500-74a
Steel Castings for Structural Purposes, High Strength – Specifications for .....	ASTM A148-73
Electrodes, Low Alloy Steel Covered Arc Welding – Specifications for .....	AWS A5.5-69
Electrodes, Mild Steel Arc Welding – Specifications for .....	AWS A5.1-69
High Strength, Low Alloy Structural Steel with 50,000 psi	
Minimum Yield Point to 4 inches Thick – Specifications for .....	ASTM A588-75
Hot-Formed Welded and Seamless Carbon Steel	
Structural Tubing – Specifications for .....	ASTM A501-74
Hot-Formed Welded and Seamless High-Strength	
Low-Alloy Structural Tubing – Specifications for .....	ASTM A618-74
Hot Rolled Carbon Steel Sheets and Strip, Structural Quality	
– Specifications for .....	ASTM A570-72

Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip  
 Process for Roofing, Specifications for ..... ASTM A361-71

Steel, Sheet, Cold Rolled, Long Term Coated, Specification for ..... ASTM 308-74

Low Carbon Steel, External and Internal Threaded, Standard Fasteners  
 – Specifications for ..... ASTM A307-74

Mild Steel Electrodes for Flux-Cored Arc Welding – Specifications for ..... AWS A5.20-69

Mild Steel Electrodes for Gas Metal-Arc Welding – Specifications for ..... AWS A5.18-69

Piles, Welded and Seamless Steel Pipe – Specifications for ..... ASTM A252-75

Pipe, Metal ..... (See Plumbing and Piping)

Reinforcement, Axle-Steel Deformed and Plain Bars for Concrete  
 – Specifications for ..... ASTM 617-75

Reinforcement, Deformed and Plain Billet-Steel Bars for Concrete  
 – Specifications for ..... ASTM 615-75

Reinforcement, Deformed Steel Wire for Concrete – Specifications for ..... ASTM A496-72

Reinforcement, Rail-Steel Deformed and Plain Bars for Concrete  
 – Specifications for ..... ASTM A616-75

Reinforcement, Steel Wire, Cold-Drawn, for Concrete – Specifications for ..... ASTM A82-72

Reinforcement, Steel Wire, Welded Fabric for Concrete – Specifications for .... ASTM A185-73

Reinforcement, Welded Deformed Steel Wire Fabric for Concrete  
 – Specifications for ..... ASTM 497-72

Seven-Wire Stress-Relieved Strand, Uncoated, for Prestressed Concrete  
 – Specifications for ..... ASTM A416-74

Steel Drill Screw Application of Gypsum Sheet Material to  
 Light Gauge Steel Stud ..... ASTM C646-76

Sheet Piling Steel – Specifications for ..... ASTM A328-75a

Steel, Carbon and High-Strength, Low-Alloy Hot-Rolled Sheet,  
 Hot-Rolled Strip and Cold-Rolled Sheet, General Requirements  
 – Standards for ..... ASTM A568-74

Steel, Cold-Rolled Sheet, Carbon Structural – Specifications for ..... ASTM A611-72

Steel Forgings, Carbon and Alloy for General Industrial Use  
 – Specifications for .....ASTM A668-72

Steel, Hot-Rolled and Cold-Rolled Sheet and Strip, High Strength,  
 Low-Alloy Columbium and/or Vanadium – Specifications for ..... ASTM A607-75

Steel, Hot-Rolled and Cold-Rolled Sheet and Strip, High-Strength,  
 Low-Alloy with Improved Corrosion Resistance – Specifications for ..... ASTM A606-75

Stainless and Heat-Resisting Chromium Steel Plate, Sheet and Strip  
 – Standard for ..... ASTM A176-75

Stainless and Heat-Resisting Chromium-Nickel Steel Plate,  
 Sheet, and Strip – Standard for ..... ASTM A167-74

Steel Structural Rivets – Specifications for ..... ASTM A502-75

Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring  
 Channels for Screw Application of Gypsum Board – Specification for ..... ASTM C645-76

Structural Steel – Specifications for ..... ASTM A36-75

Structural Steel, High Strength – Specifications for ..... ASTM A440-75

Structural Steel, High Strength Low Alloy – Specifications for ..... ASTM A242-75

Structural Steel, High Strength Low Alloy Columbiun Vanadium – Specifications for .....	ASTM A572-75
Structural Steel, High Strength Low Alloy Manganese Vanadium – Specifications for .....	ASTM A441-75
Structural Steel, High Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding – Specifications for .....	ASTM A514-75
Structural Steel with 42,000 psi Minimum Yield Point (½ in. Maximum Thickness) – Specification for .....	ASTM A529-75
Uncoated Stress-Relieved Wire for Prestressed Concrete – Specifications for ....	ASTM A421-74

## Plumbing and Piping

Asbestos-Cement Non-Pressure Sewer Pipe – Specifications for .....	ASTM C428-74
Asbestos-Cement Pressure Pipe – Specifications for .....	ASTM C296-73b
Brass Pipe, Seamless Red Brass – Specification for .....	ASTM B43-75
Cast Iron and Ductile Iron Pressure Pipe – Specifications for .....	ASTM A377-73
Cast Iron Soil Pipe and Fittings – Specifications for .....	ASTM A74-72
Clay Pipe – Compression Joints for Vitrified Clay Bell and Spigot Pipe .....	ASTM C425-74
– Drain Tile – Specifications for .....	ASTM C4-70
– Extra Strength and Standard Strength Clay Pipe and Perforated Clay Pipe – Specifications for .....	ASTM C700-74
Concrete Pipe – Culvert Storm Drain and Sewer, Reinforced – Specifications for .....	ASTM C76-74
– Sewer – Specifications for .....	ASTM- C14-74
Copper Drainage Tube (DWV) – Specification for .....	ASTM B306-74b
Copper Pipe, Seamless, Standard Sizes – Specifications for .....	ASTM B42-75
Steel Pipe – Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses – Specifications for .....	ASTM A120-73
– Steel or Iron, Spiral-Welded – Specifications for .....	ASTM A211-73
– Welded and Seamless – Specifications for .....	ASTM A53-73
Tile, Clay Drain .....	(See Clay Pipe)
Tube and Tubing – Brass, Seamless – Specifications for .....	ASTM B135-74
– Copper, Seamless – Specifications for .....	ASTM B75-74b
– Copper, Seamless, Water – Specifications for .....	ASTM B88-75
– Copper Brazed Steel Tubing – Specifications for .....	ASTM A254-70
Welded and Seamless Wrought Steel Pipe .....	ANSI B36.10-75
Valves, Flanges and Pipe Fittings, Gray Iron Castings – Specifications for .....	ASTM A126-73

### *Polybutylene Piping and Tubing*

<i>Pipe &amp; Tubing – Hot &amp; Cold</i>	ANSI/ASME D31.9-1982
<i>Water Distribution</i>	ASTM D-3300-81
<i>Pipe – Hot &amp; Cold Water</i>	ASTM D-3000-73
<i>Pipe – Cold Water Only</i>	ASTM D-2662-78
<i>Tubing – Cold Water Only</i>	ASTM D-2666-75

## Roofing and Siding

Asphalt for Dampproofing and Waterproofing – Specifications for .....	ASTM D449-73
Asphalt for Use in Constructing Built-Up Roof Coverings	
– Specifications for .....	ASTM D312-71
Asphalt Roll Roofing Surfaced with Mineral Granules – Specifications .....	ASTM D249-73
Asphalt Roll Roofing Surfaced with Powdered Talc or Mica	
– Specifications for .....	ASTM D224-68
Asphalt Shingles Surfaced with Mineral Granules – Specifications for .....	ASTM D225-70
Asphalt Siding Surfaced with Mineral Granules – Specifications for .....	ASTM D699-70
Fiberboard Nail-Base Sheathing – Standard Specification for .....	ASTM D2277-72
Fiber Insulation Board, Structural and Decorative	
– Recommended Product and Application Specification	
½ Inch Fiberboard Nail-Base Sheathing .....	ABPA-IB Spec. No. 2-75
– Recommended Product and Application Specification	
Structural Insulating Roof Deck .....	ABPA-IB Spec. No. 1-75
– Method of Testing (Made from Cellulosic fiber) .....	ASTM C209-72
– Specifications for (Made from Cellulosic fiber) .....	ASTM C208-72
Foamboard, Structural Insulating (Made from Cellulosic Fibers)	
– Specifications for .....	ASTM C532-66
Grading Rules for CertiGrade Red Cedar Shingles .....	RCSHSSB-1975
Gypsum Sheathing Board – Specifications for .....	ASTM C79-67

## Wood and Wood Products

American Softwood Lumber Standard .....	USDC PS20-70
Fire Retardant Pressure Treatment, Plywood .....	AWPA C27-74
Fire Retardant Pressure Treatment, Structural Lumber .....	AWPA C20-74
Flooring, Laminated Block – Interim Industry Standard for .....	HPMA LF-71
Glued Laminated Structural Lumber Standards	
– Structural Glued Laminated Members and Laminations	
Before Gluing of Southern Pine, Pacific Coast Douglas Fir	
and Western Hemlock by Pressure Process .....	AWPA C28-75
– Structural Glued Laminated Southern Pine .....	SPIB-1974
– Structural Glued Laminated Timber .....	USDC PS 56-73
– Structural Glued Laminated Timber of Douglas Fir, Western Larch,	
Southern Pine and California Redwood .....	AITC 117-1974
Hardboard – Commercial Standard for .....	USDC PS 58-73
Hardboard Siding, Voluntary Product Standard for .....	USDC PS 60-73
Methods for Establishing Structural Grades and Related	
Allowable Properties for Visually Graded Lumber .....	ASTM D245-74
Methods of Test for Durability of Fire Retardant Treatment of Wood .....	ASTM D-2898-72
Particleboard – Commercial Standard for .....	USDC CS 236-66
Piles, Round Timber – Establishing Design Stresses for .....	ASTM D2899-74
Piles, Timber, Round – Specifications for .....	ASTM D25--3



## Plywood

- Construction and Industrial – Product Standard for ..... USDC PS I-74
- Hardwood and Decorative – Product Standard for ..... USDC PSSI- 71
- Preservative Treatment for Pressure Process ..... AWWA C9-75

## Preservative Treatment

- of Lumber, Timber, Bridge Ties, and Mine Ties (All Species)
  - Standards for ..... AWWA C2-75
- of Piles by Pressure Process – Standards for ..... AWWA C3-75
- of Poles by Pressure Process – Standards for ..... AWWA C4-75
- by Pressure Process – All Timber Products – Standards for ..... AWWA C1-75

## Quality Control Standards for Pressure – Treated

## Lumber, Softwood Lumber, Timber and Plywood

- With Water-Borne Preservatives (For Above Ground Use) ..... AWPB LP2-80
- With Waterborne Preservatives (For Ground Contact Use) ..... AWPB LP 22-80
- With Light Hydrocarbon Solvent-Penta Solution (For Above Ground Use)... AWPB LP 3-78
- With Volatile Hydrocarbon Solvent-Penta Solution  
(For Above Ground Use) ..... AWPB LP 4-78
- With Volatile Hydrocarbon Solvent-Penta Solution  
(For Ground Contact Use) ..... AWPB LP 44-78
- With Creosote or Creosote Coal-Tar Solutions (For Above Ground Use) .... AWPB LP 5-78
- With Creosote or Creosote Coal-Tar Solution (For Ground Contact Use) ... AWPB LP 55-78
- With Heavy Hydrocarbon Solvent-Penta Solution  
(For Above Ground Use) ..... AWPB LP 7-78
- Softwood Lumber, Timber and Plywood Solution  
(For Ground Contact Use) ..... AWPB LP 77-78

Shingles ..... (See Roofing and Siding)

**Unclassified Miscellaneous**

- Felt – Methods of Testing ..... ASTM D461-72
- Flammability of Flexible Plastic – Method of Test for ..... ASTM D568-74
- Flammability of Self-supporting Plastics – Method of Test for ..... ASTM D635-74
- Formboard, Gypsum – Specification for ..... ASTM C318-73
- Insulated Metal Roof Deck Standard ..... FMRC Standard 4450-1971
- Laboratory Measurement of Airborne Sound Transmission Loss  
of Building Partitions, Standard Recommended Practice for ..... ASTM E90-70
- Laboratory Measurement of Impact Sound Transmission Through Floor-  
Ceiling Assemblies Using the Tapping Machine, Tentative Method of ..... ASTM E492-73T
- Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
  - Federal Specifications for, with Amendment 3-1974 ..... FF-N-105B-1971
- Nails for the Application of Gypsum Wallboard – Standard Specifications for ... ASTM C514-72
- Perlite Loose Fill Insulation – Standard Specifications for ..... ASTM C549-73
- Plastics – Definition of Terms Relating to ..... ASTM D883-76
- Plastics, Deformation of, Under Load – Method of Test for ..... ASTM D621-64
- Plastics, Density of Smoke from Burning or Decomposition
  - Method of Test for .....ASTM D2843-70
- Plastics, Ignition Properties of – -Method of Test for ..... ASTM D1929-68

APPENDIX C

Preservatives for Wood

– Creosote – Standards for .....	AWPA P 1-65
– Creosote and Creosote Solutions .....	AWPA P 2-75
– Oil-Borne Preservatives – Standards for .....	AWPA P 8-74
– Oil-Borne Solvents – Standards for .....	AWPA P 9-75
– Water-Borne Preservatives – Standards for .....	AWPA P 5-75
Thickness of Solid Electrical Insulation – Method of Test for .....	ASTM D374-74
Vermiculite Loose Fill Insulation – Standard Specifications for .....	ASTM C516-75

## APPENDIX D

### STRUCTURAL UNIT TEST STANDARDS

*See also Appendices B and C for engineering practice standards and material standards which contain unit test methods.*

#### Concrete

Coarse Aggregates, Resistance to Abrasion of Small Size, by use of the Los Angeles Abrasion Machine – Test for .....	ASTM C131-75
Fine and Coarse Aggregates, Sieve or Screen Analysis of – Test for .....	ASTM C136-71
Concrete, Obtaining and Testing Drilled Cores and Sawed Beams of .....	ASTM C42-74
Concrete Test Specimens in the Laboratory – Making and Curing .....	ASTM C192-69
Concrete, Molded Cylinders – Test for Compressive Strength of .....	ASTM C39-72
Lightweight Insulating Concrete, Compressive Strength – Test for .....	ASTM C495-69
Concrete Masonry Units – Sampling and Testing .....	ASTM C140-70
Concrete Masonry Units, Hollow Load Bearing – Specifications for .....	ASTM C90-70
Concrete Masonry Units, Solid Load Bearing – Specifications for .....	ASTM C145-71
Concrete, Hardened Portland Cement – Test for Cement Content of .....	ASTM C85-73
Concrete, Ready Milled – Specifications for .....	ASTM C94-74a
Sands for Concrete – Test for Organic Impurities in .....	ASTM C40-73

#### Interior Finishes

Gypsum and Gypsum Products, Chemical Analysis of – Standard Methods of ...	ASTM C471-75
Gypsum Board Products, Gypsum Lath, Gypsum Partition Tile or Block, and Precast Reinforced Gypsum Slabs – Method of Physical Testing of .....	ASTM C473-74
Gypsum Concrete – Specifications for .....	ASTM C317-70
Gypsum Formboard – Specifications for .....	ASTM C318-73
Gypsum Lath- – Specifications for .....	ASTM C37-69
Gypsum Plasters – Specifications for .....	ASTM C28-73
Gypsum Plasters and Gypsum Concrete, Physical Testing of – Standard Methods for .....	ASTM C472-73
Gypsum Sheathing Board – Specifications for .....	ASTM C79-73
Gypsum Wallboard – Specifications for .....	ASTM C36-75
Insulating Board (Made from Cellulosic Fiber), Structural and Decorative – Methods of Testing .....	ASTM C209-72
– Specifications for .....	ASTM C208-72
Lime .....	(See Masonry)

#### Masonry

Aggregate for Masonry Mortar – Specifications for .....	ASTM C144-75
Brick, Concrete Building – Specifications for .....	ASTM C55-71
Brick and Structural Clay Tile – Sampling and Testing .....	ASTM C67-73
Cement, Masonry – Specifications or .....	ASTM C91-71
Ceramic Tile (Veneers) .....	(See Interior Finishes)
Chemical Analysis of Limestone, Quicklime and Hydrated Lime .....	ASTM C25-72

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Concrete Masonry Units ..... (See Concrete)  
Diagonal Tension (Shear) in Masonry Assemblages – Method of Test for ..... ASTM E519-74  
Flexural Bond Strength of Masonry – Methods of Test for ..... ASTM E518-74  
Glazed Units – Ceramic Glazed Structural Clay Facing Tile,  
Facing Bricks, and Solid Masonry Units-Specifications for ..... ASTM C 126-71  
Lime and Limestone Products – Methods of Sampling,  
Inspection, Packing and Marking of ..... ASTM C50-74  
Lime, Hydrated and Quick – Methods of Physical Testing of ..... ASTM C110-71  
Lime, Hydraulic Hydrated for Structural Purposes – Specifications for ..... ASTM C 141-72  
Mortars, Hydraulic Cement – Method of Testing for  
Compressive Strength of (Using 2 in. Cube Specimens) ..... ASTM C 109-73  
Mortars, Hydraulic Cement – Method of Test for Tensile Strength of ..... ASTM C190-72  
Stone, Natural Building – Methods of Test for  
Absorption and Bulk Specific Gravity of ..... ASTM C97-70  
Stone, Natural Building – Method of Test for Compressive Strength of ..... ASTM C170-70  
Stone, Natural Building – Methods of Test for Modulus of Ruptures of ..... ASTM C99-70  
Water Permeance of Masonry – Method of Test for ..... ASTM E51--74

**Metals**

Cast Iron – Method of Testing Compression of ..... ASTM A256-76  
Metallic Materials – Methods of Tension Testing of ..... ASTM E8-96

**Unclassified Miscellaneous**

Cement, Hydraulic – Methods, of Sampling ..... ASTM C 183-76  
Cement, Natural – Specifications for ..... ASTM C10-73  
Clay Pipe, Testing ..... ASTM C301-72  
Plastics Under Load – Method of Test for Deformation of ..... ASTM D261- 64  
Tile, Clay Drain – Specification for ..... ASTM C4-70

**Wood and Wood Products**

Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials ... ASTM D1037-72a  
Timber, Small Clear Specimens – Method of Testing ..... ASTM D143-72  
Timbers in Structural Sizes – Methods of Static Tests of ..... ASTM D198-74  
Veneer, Plywood and Other Glued Veneer Construction  
– Methods of Testing ..... ASTM D805-72

## APPENDIX E

### STRUCTURAL ASSEMBLY TEST STANDARDS

See also [Appendix D](#) for standards for tests of unit materials.

Metal Fasteners in Wood, Testing of .....	ASTM D1761-74
Heavy Truss Assemblies, Testing .....	ASTM E73-74
Panels for Building Construction-Methods of Conducting Strength Test of .....	ASTM E72-74a
Rate of Leakage Through Exterior Windows, Curtain Walls and Doors, Standard Method of Test for .....	ASTM E283-73

## APPENDIX F

### DURABILITY TEST STANDARDS

*See also Appendices C, D and E for tests of individual materials or unit assemblies.*

#### Concrete and Concrete Aggregate

Concrete, Aggregate – Method of Tests for Voids in .....	ASTM C30-70
Concrete, Air Content of Freshly Mixed, by the Pressure Method – Method of Test for .....	ASTM C231-75
Unit Weight, Yield and Air Content (Gravimetric) of Concrete – Test for .....	ASTM C138-75
Organic Impurities in Sand for Concrete – Method of Test for .....	ASTM C40-73

#### Masonry and Masonry Products

Ceramic Glazed Structural Clay Facing Tile, Facing Brick and Solid Masonry Units – Specifications for .....	ASTM C126-71
Freezing and Thawing Tests (see specifications for material) – Brick and Structural Clay Tile – Sampling and Testing .....	ASTM C67-73
– Clay Drain Tile – Specifications for .....	ASTM C4-70

#### Plastics

Water Absorption of Plastic – Methods of Test for .....	ASTM D570-72
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#### Roofing and Siding

Asphalt Roll Roofing, Cap Sheets, and Shingles – Methods of Testing .....	ASTM D228-69
Bituminous Materials, Accelerated Test of Weathering – Recommended Practice for .....	ASTM D529-73
Felted and Woven Fabrics Saturated with Bituminous Substance for Use in Waterproofing and Roofing – Methods of Sampling and Testing ....	ASTM D146-72

#### Unclassified Miscellaneous

Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials – Specifications for .....	ASTM D1037-72a
Gypsum and Gypsum Products, Chemical Analysis of – Standard Methods for .....	ASTM C471-72
Gypsum Board Products, Gypsum Lath, Gypsum Partition Tile or Block, and Precast Reinforced Gypsum Slabs – Method of Physical Testing of .....	ASTM C473-74
Gypsum Plasters and Gypsum Concrete, Physical Testing of – Standard Methods for .....	ASTM C472-73

## APPENDIX G

### FIRE TEST AND FLAME SPREAD TEST STANDARDS

#### Combustible or Noncombustible Properties

Fire-Retardant Treatments of Building Materials .....	NFiPA 703-1961
Noncombustibility of Elementary Materials	
– Method of Test for Determining .....	ASTM E136-73

#### Fireresistance Properties

Building Construction and Materials – Methods of Fire Test of .....	ASTM E119-73
Ceiling Construction .....	(See Building Construction)
Door Assemblies – Methods of Fire Tests of .....	ASTM E152-73
Fire Dampers .....	ULI 555-1973
Fire Tests for Flame-Resistant Textiles and Films – Standard Methods of .....	NFiPA 701-1975
Roof Coverings – Methods of Fire Test of .....	ASTM E108-70
Tents, Grandstands and Air-Supported Structure	
Used for Places of Assembly – Standard for .....	NFiPA 102-1972

#### Flame Spread Properties

Sound Controlling Blocks and Boards (Acoustical Tiles and Panels, Prefabricated) with amendment No. 3-1972 .....	Fed. Spec. SS-II8a 1967
Surface Burning Characteristics of Building Materials – Method of Test for .....	ASTM E84-70

#### Flash Point

Flash Point by Pensky-Masters Closed Tester Method of test for .....	ASTM D93-73
Flash Point by Tag Closed Tester – Method of Test for .....	ASTM D56-70
Flash and Fire Points by Cleveland Open Cup – Method of Test for .....	ASTM D92-72

## APPENDIX H

### FIRE PROTECTION STANDARDS

(Compliance with these standards deemed good practice)

(Available from National Fire Protection Association  
60 Batterymarch Street – Boston, Mass. 02110)

### NATIONAL FIRE CODES – CONTENTS 1977

#### VOLUME I

- 10 Portable Fire Extinguishers, '75
- 11 Foam Extinguishing Systems, '76
- 11A High Expansion Foam Systems, '76
- 11B Synthetic Foam and Combined Agent Systems, '74
- 12 Carbon Dioxide Systems, '73
- 12A Halon 1301 Systems, '73
- 12B Halon 1211 Systems, '73
- 13 Sprinkler Systems, Installation, '76

#### VOLUME 2

- 13D Sprinkler Systems, Dwellings, '75
- 14 Standpipe & Hose Systems, '76
- 15 Water Spray Fixed Systems, '73
- 16 Foam-Water Sprinkler & Spray Systems, '74
- 17 Dry Chemical Systems, '76
- 18 Wetting Agents, '72
- 19B Respiratory Protective Equipment for Fire Fighters, '71
- 194 Fire Hose Connections, '74
- 196 Fire Hose, '74
- 197 Initial Fire Attack, Training Standard on, '66
- 20 Centrifugal Fire Pumps, '76
- 22 Water Tanks, '76
- 24 Outside Protection, '73

#### VOLUME 3

- 30 Flammable and Combustible Liquids Code, '76
- 31 Oil Burning Equipment, '74
- 32 Dry Cleaning Plants, '74
- 321 Classification of Flammable Liquids, '76
- 327 Cleaning Small Tanks, '75
- 33 Spray Application, '73
- 34 Dip Tanks, '74
- 35 Manufacture of Organic Coatings, '76
- 36 Solvent Extraction Plants, '74
- 37 Sta. Combustion Engines & Gas Turbines, '75
- 385 Tank Vehicles for Flammable & Combustible Liquids, '74
- 386 Portable Shipping Tanks, '74
- 395 Flammable & Combustible Liquids on Farms and Isolated Construction Projects, '72

- 40 Cellulose Nitrate Motion Picture Film, '74
- 40E Storage of Pyroxylin Plastic, '75
- 43A Liquid and Solid Oxidizing Materials, '75
- 43C Storage of Gaseous Oxidizing Materials, '75
- 43D Storage of Pesticides in Portable Containers, '75
- 44A Fireworks, Manufacturing, Transportation and Storage, '74
- 45 Fire Protection for Laboratories Using Chemicals, '75
- 48 Magnesium, Storage, Handling, '74

#### VOLUME 4

- 481 Titanium, Storage, Handling, '74
- 490 Ammonium Nitrate Storage, '75
- 493 Intrinsically Safe Apparatus, '75
- 495 Explosive Materials, '73
- 496 Purged Enclosures for Electrical Equipment, '74
- 49 Explosives, Motor Vehicle Terminals, '76
- 50 Bulk Oxygen Systems, '74
- 50A Gaseous Hydrogen Systems, '73
- 50B Liquefied Hydrogen Systems, '73
- 51 Welding Cutting, Oxygen-Fuel Gas Systems for, '74
- 51A Acetylene Cylinder Charging Plants, '74
- 51B Cutting & Welding Processes, '76
- 54 National Fuel Gas Code, '74
- 56A Inhalation Anesthetics, '73
- 56B Respiratory Therapy, '76
- 56C Laboratories in Health-Related Institutions, '73
- 56D Hyperbaric Facilities, '76
- 56E Hypobaric Facilities, '72
- 56F Nonflammable Medical Gas Systems, '74
- 56G Inhalation Anesthetics in Ambulatory Care Facilities, '75
- 57 Fumigation, '73

#### VOLUME 5

- 58 Liquefied Petroleum Gases, Storage and Handling, '76



- 59 Liquefied Petroleum Gases at Utility Gas Plants, '76
- 59A Liquefied Natural Gas, Storage and Handling, '75
- 60 Pulverized Fuel Systems, '73
- 61A Manufacturing and Handling Starch, '73
- 61B Grain Elevators, Bulk Handling Facilities, '73
- 61C Feed Mills, Dust Hazards, '73
- 61D Agricultural Commodities for Human Consumption, '73
- 63 Industrial Plants, Dust Explosions, '75
- 65 Aluminum Processing and Finishing, '75
- 651 Aluminum or Magnesium Powder, '74
- 653 Coal Preparation Plants, Dust Hazards, '71
- 654 Plastics Industry Dust Hazards, '75
- 655 Sulfur Fires, Explosions, Prevention, '71
- 656 Spice Grinding Plants, Dust Hazards, '71
- 66 Pneumatic Conveying Systems, '73
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- 70A Electrical Code for One- and Two-Family Dwellings, '75

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8 Effects of Fire on Operations, Management Responsibility for, '74  
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10L Model Enabling Act, Portable Fire Extinguishers, '75  
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13E Fire Department Operations in Properties Protected by Sprinkler, Standpipe Systems, '73  
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901 Uniform Coding for Fire Protection, '76

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1904 Fire Department Aerial Ladders and Elevating  
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## APPENDIX I

### METRIC CONVERSION FACTORS FOR THE MOST COMMON UNITS USED IN BUILDING DESIGN AND CONSTRUCTION

Conversion factors are taken to *six* significant figures, where appropriate. *Underlined* values denote *exact* conversions.

METRIC TO CUSOMARY			CUSTOMARY TO METRIC		
<b>LENGTH</b>					
1 km	= 0.621 371 = 49.7096	mile (international) chain	1 mile (international)	= <u>1.609 344</u> = 20.1168	km m
1 m	= 1.093 61 = 3.280 84	yd ft	1 yd 1 ft	= <u>0.9144</u> = <u>0.3048</u> = <u>304.8</u>	m m mm
1 mm	= 0.039 370 1	in	1 in (1 US survey foot	= <u>25.4</u> = 0.304 800 6	mm m)
 <b>AREA</b>					
1 km <sup>2</sup>	= 0.386 101	mile <sup>2</sup> (US survey)	1 mile <sup>2</sup> (US survey)	= 2.590 00	km <sup>2</sup>
1 ha	= 2.471 04	acre (US survey)	1 acre (US survey)	= 0.404 687 = 4046.87	ha m <sup>2</sup>
1 m <sup>2</sup>	= 1.195 99 = 10.7639	yd <sup>2</sup> ft <sup>2</sup>	1 yd <sup>2</sup> 1 ft <sup>2</sup>	= 0.836 127 = 0.092 903	m <sup>2</sup> m <sup>2</sup>
1 mm <sup>2</sup>	= 0.001 550	in <sup>2</sup>	1 in <sup>2</sup>	= <u>645.16</u>	mm <sup>2</sup>
 <b>VOLUME, MODULUS OF SECTION</b>					
1 m <sup>3</sup>	= 0.810 709 x 10 <sup>-3</sup> = 1.307 95 = 35.3147	acre feet yd <sup>3</sup> ft <sup>3</sup>	1 acre ft 1 yd <sup>3</sup> 1 ft <sup>3</sup>	= 1233.49 = 0.764 555 = 0.028 316 8 = 28.3168	m <sup>3</sup> m <sup>3</sup> m <sup>3</sup> L(dm <sup>3</sup> )
1 mm <sup>3</sup>	= 423.776 = 61.0237 x 10 <sup>-6</sup>	board ft in <sup>3</sup>	100 board ft 1 in <sup>3</sup>	= 0.235 974 = 16,387.1 = 16.3871	m <sup>3</sup> mm <sup>3</sup> mL (cm <sup>3</sup> )
 <b>(FLUID) CAPACITY</b>					
1 L	= 0.035 314 7 = 0.264 172 = 1.056 69	ft <sup>3</sup> gal (US) qt (US)	1 gal (US liquid)* 1 qt (US liquid) 1 pt (US liquid)	= 3.785 41 = 946.353 = 473.177	L mL mL
1 mL	= 0.061 023 7 = 0.033 814	in <sup>3</sup> fl oz (US)	1 fl oz (US)	= 29.5735	mL
 <b>SECOND MOMENT OF AREA</b>					
1 mm <sup>4</sup>	= 2.402 51 x 10 <sup>-6</sup>	in <sup>4</sup>	1 in <sup>4</sup>	= 416 231 = 0.416 231 x 10 <sup>-6</sup>	mm <sup>4</sup> m <sup>4</sup>

**METRIC TO CUSOMARY****CUSTOMARY TO METRIC****PLANE ANGLE**

1 rad	= 57° 17' 45"	(degree)	1° (degree)	= 0.017 453 3	rad
	= 57.29958°	(degree)		= 17.4533	mrad
	= 3437.75'	(minute)	1' (minute)	= 290.888	µrad
	= 206 265"	(second)	1" (second)	= 4.848 14	µrad

**VELOCITY, SPEED**

1 m/s	= 3.280 84	ft/s	1 ft/s	= <u>0.3048</u>	m/s
	= 2.236 94	mile/h	1 mile/h	= <u>0.447 04</u>	m/s
1 km/h	= 0.621 371	mile/h		= <u>1.609 344</u>	km/h

**ACCELERATION**

1 m/s <sup>2</sup>	= 3.280 84	ft/s <sup>2</sup>	1 ft/s <sup>2</sup>	= <u>0.3048</u>	m/s <sup>2</sup>
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**VOLUME RATE OF FLOW**

1 m <sup>3</sup> /s	= 35.3147	ft <sup>3</sup> /s	1 ft <sup>3</sup> /s	= 0.028 316 8	m <sup>3</sup> /s
	= 22.8245	million gal/d	1 million gal/d	= 43.8126	L/s
	= 0.810 709 x 10 <sup>-3</sup>	acre ft/s	1 acre ft/s	= 1233.49	m <sup>3</sup> /s
1 L/s	= 2.118 88	ft <sup>3</sup> /min	1 ft <sup>3</sup> /min	= 0.471 947	L/s
	= 15.850 3	gal/min	1 gal/min	= 0.063 090 2	L/s
	= 951.022	gal/h	1 gal/h	= 1.051 50	mL/s

**FORCE PER UNIT LENGTH**

1 N/m	= 0.068 521 8	lbf/ft	1 lbf/ft	= 14.5939	N/m
			1 lbf/in	= 175.127	N/m
1 kN/m	= 0.034 260 9	tonf/ft	1 tonf/ft	= 29.187 8	kN/m

**PRESSURE, STRESS, MODULUS OF ELASTICITY (FORCE PER UNIT AREA)**(1 Pa = 1 N/m<sup>2</sup>)

1 MPa	= 0.072 518 8	tonf/in <sup>2</sup>	1 ton/in <sup>2</sup>	= 13.7895	MPa
	= 10.4427	tonf/ft <sup>2</sup>	1 tonf/ft <sup>2</sup>	= 95.7605	kPa
	= 145.038	lbf/in <sup>2</sup>	1 kip/in <sup>2</sup>	= 6.894 76	MPa
1 kPa	= 20.8854	lbf/ft <sup>2</sup>	1 lbf/in <sup>2</sup>	= 6.894 76	kPa
			1 lbf/ft <sup>2</sup>	= 47.8803	Pa

**WORK, ENERGY, HEAT (1 J – 1 N•M = 1 W•s)**

1 MJ	= 0.277 778	kWh	1 kWh (550 ft•lbf/s)	= <u>3.6</u>	MJ
1 kJ	= 0.947 817	Btu	1 Btu (Int. Table)	= 1.055 06	kJ
				= 1055.06	J
1 J	= 0.737 562	ft•lbf	1 ft•lbf	= 1.355 82	J

**METRIC TO CUSOMARY****CUSTOMARY TO METRIC****POWER, HEAT FLOW RATE**

1 kW	= 1.341 02	hp (horsepower)	1 hp	= 0.745 700	kW
			1 hp	= 745.700	W
1 W	= 3.412 14	Btu/h	1 Btu/h	= 0.293 071	W
	= 0.737 562	ft•lbf/s	1 ft•lbf/s	= 1.355 82	W

**HEAT FLUX DENSITY**

1 w/M2	= 0.316 998	Btu/(ft <sup>2</sup> •h)	1 Btu/(ft <sup>2</sup> •h)	= 3.154 59	W/m <sup>2</sup>
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**COEFFICIENT OF HEAT TRANSFER**

1 W/(m <sup>2</sup> •K)	= 0.176 110	Btu/(ft <sup>2</sup> •h•°F)	1 Btu/(ft <sup>2</sup> •h•°F)	= 5.678 26	W/(m <sup>2</sup> •K)
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**THERMAL CONDUCTIVITY**

1 W/(m•K)	= 0.577 789	Btu/(ft•h•°F)	1 Btu/(ft•h•°F)	= 1.730 73	W/(m•K)
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**CALORIFIC VALUE (Mass and Volume Basis)**

1 kJ/kg	=			= <u>2.326</u>	kJ/kg
(1 J/g)	= 0.429 923	Btu/lb	1 Btu/lb	= <u>2.326</u>	(J/g)
1 kJ/m <sup>3</sup>	= 0.026 839 2	Btu/ft <sup>3</sup>	1 Btu/ft <sup>3</sup>	= 37.2589	kJ/m <sup>3</sup>

**THERMAL CAPACITY (Mass and Volume Basis)**

1 kJ/(kg•K)	= 0.238 846	Btu/(lb•°F)	1 Btu/(lb•°F)	= <u>4.1868</u>	kJ/(kg•K)
1 kJ/(m <sup>3</sup> •K)	= 0.014 910 7	Btu/(ft <sup>3</sup> •°F)	1 Btu/(ft <sup>3</sup> •°F)	= 67.0661	kJ/(m <sup>3</sup> •K)

**ILLUMINANCE**

1 lx (lux)	= 0.092 903	lm/ft <sup>2</sup> (footcandle)	1 lm/ft <sup>2</sup> (footcandle)	= 10.7639	lx (lux)
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**LUMINANCE**

1 cd/m <sup>2</sup>	= 0.092 903	cd/ft <sup>2</sup>	1 cd/ft <sup>2</sup>	= 10.7639	cd/m <sup>2</sup>
	= 0.291 864	footlambert	1 footlambert	= 3.426 26	cd/m <sup>2</sup>
1 kcd/m <sup>2</sup>	= 314 159	lambert	1 lambert	= 3.183 01	kcd/m <sup>2</sup>

**TEMBERATURE INTERVAL**

1°C	= <u>1 K</u> = <u>1.8</u> °F		1°F	= 0.555 556	°C or K
				= 5/9°C = 5/9K	

**EQUIVALENT TEMPERATURE VALUE (T °C = T<sub>K</sub> - 273.25)**

t°C	= 5/9 (t <sub>F</sub> - 32)		t <sub>F</sub>	= 9/5 t°C + 32	
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**METRIC TO CUSOMARY****CUSTOMARY TO METRIC****MASS**

1 kg	= 2.204 62	lb (avoirdupois)			
	= 35.2740	oz (avoirdupois)			
1 metric ton	= 1.102 31	ton (short, 2000 lb)	1 ton (short)**	= 0.907 185	metric ton
				= 907.185	kg
	= 2204.62	lb	1 lb	= 0.453 592	kg
1 g	= 0.035 274	oz	1 oz	= 28.3495	g
	= 0.643 015	pennyweight	1 pennyweight	= 1.555 17	g
			** (1 long ton (2240 lb))	= 1016.05	kg)

**MASS PER UNIT LENGTH**

1 kg/m	= 0.671 969	lb/ft	1 lb/ft	= 1.488 16	kg/m
1 g/m	= 3.547 99	lb/mile	1 lb/mile	= 0.281 849	g/m

**MASS PER UNIT AREA**

1 kg/m <sup>2</sup>	= 0.204 816	lb/ft <sup>2</sup>	1 lb/ft <sup>2</sup>	= 4.882 43	kg/m <sup>2</sup>
1 g/m <sup>2</sup>	= 0.029 494	oz/yd <sup>2</sup>	1 oz/yd <sup>2</sup>	= 33.9057	g/m <sup>2</sup>
	= 3.277 06 x 10 <sup>-3</sup>	oz/ft <sup>2</sup>	1 oz/ft <sup>2</sup>	= 305.152	g/m <sup>2</sup>

**DENSITY (MASS PER UNIT VOLUME)**

1 kg/m <sup>3</sup>	= 0.062 428	lb/ft <sup>3</sup>	1 lb/ft <sup>3</sup>	= 16.0185	kg/m <sup>3</sup>
	= 1.685 56	lb/yd <sup>3</sup>	1 lb/yd <sup>3</sup>	= 0.593 276	kg/m <sup>3</sup>
1 t/m <sup>3</sup>	= 0.842 778	ton/yd <sup>3</sup>	1 ton/yd <sup>3</sup>	= 1.186 55	t/m <sup>3</sup>

**MOMENT OF INERTIA**

1 kg•m <sup>2</sup>	= 23.7304	lb•ft <sup>2</sup>	1 lb•ft <sup>2</sup>	= 0.042 1401	kg•m <sup>2</sup>
	= 3417.17	lb•in <sup>2</sup>	1 lb•in <sup>2</sup>	= 292/640	kg•mm <sup>2</sup>

**MASS PER UNIT TIME**

1 kg/s	= 2.204 62	lb/s	1 lb/s	= 0.453 592	kg/s
1 t/h	= 0.984 207	ton/h	1 ton/h	= 1.016 05	t/h

**FORCE**

1 MN	= 112.404	tonf (ton-force)	1 tonf (ton-force)	= 8.896 44	kN
1 kN	= 0.112 404	tonf	1 kip (1000 lbf)	= 4.448 22	kN
	= 224 809	lbf (pound-force)			
1 N	= 0.224 809	lbf	1 lbf (pound-force)	= 4.448 22	N

**MOMENT OF FORCE TORQUE**

1 N•m	= 0.737 562	lbf•ft	1 lbf•ft	= 1.355 82	N•m
	= 8.850 75	lbf•in	1 lbf•in	= 0.112 985	N•m
1 kN•m	= 0.368 781	tonf•ft	1 tonf•ft	= 2.711 64k	kN•m
	= 0.737 562	kip•ft	1 kip•ft	= 1.355 82	kN•m

## APPENDIX J

### UNIT DEAD LOADS FOR DESIGN PURPOSES

The intent of this appendix is to assist the designer and building official in establishing the minimum weights for materials commonly used in building construction. Some material assemblies have a range in weight. A typical figure is indicated, but when there is reason to suspect a considerable deviation, the actual weight should be determined.

#### Note on use of Appendix J tables

When making calculations based on the tables in Appendix J, the weights of masonry include mortar but not plaster. For plaster, add 5 pounds per square foot (psf) for each face plastered. Values given represent averages. In some cases there is a considerable range of weight for the same construction.

**Table J-1**  
**UNIT DESIGN DEAD LOADS FOR CONCRETE SLABS**

Concrete slabs	Pounds per square foot
Concrete, reinforced-stone, per inch of thickness	12½
Concrete, reinforced-lightweight sand, per inch of thickness	9½
Concrete, reinforced, lightweight, per inch of thickness	9
Concrete, plain stone, per inch of thickness	12
Concrete, plain, lightweight, per inch of thickness	8½



**Table J-2  
UNIT DESIGN DEAD LOADS FOR RIBBED SLABS**

Ribbed slabs Depth, in inches (rib depth plus slab thickness)*	Pounds per square foot					
	Width of rib, in inches					
	4	5	6	7	8	9
<b>12 inch clay-tile fillers (normal weight concrete):</b>						
4 plus 2	49	51	52	54	---	---
6 plus 2	60	63	65	67	---	---
8 plus 2½	79	82	85	87	---	---
10 plus 3	96	100	103	106	---	---
12 plus 3	108	112	116	120	---	---
<b>20 inch wide forms:</b>						
6 plus 2½	45	48	50	50	---	---
8 plus 2½	51	54	57	60	---	---
10 plus 2½	57	60	64	68	---	---
12 plus 2½	63	67	72	76	---	---
14 plus 2½	---	74	79	84	---	---
16 plus 2½	---	---	88	93	98	---
20 plus 2½	---	---	---	111	118	---
<b>30 inch wide forms:</b>						
6 plus 2½	41	43	45	47	---	---
8 plus 2½	45	47	50	53	---	---
10 plus 2½	49	52	55	58	---	---
12 plus 2½	53	57	60	64	---	---
14 plus 2½	---	62	66	70	---	---
16 plus 2½	---	---	72	76	80	---
20 plus 2½	---	---	---	90	95	101
<b>2-way clay-tile fillers (12 X 12):</b>						
4 plus 2	61	62	64	---	---	---
6 plus 2	87	89	90	---	---	---
8 plus 2½	100	103	107	---	---	---
10 plus 3	121	126	131	---	---	---
12 plus 3	136	141	146	---	---	---

\* Make appropriate allowances for tapered ends.

**Table J-3**  
**UNIT DESIGN DEAD LOADS FOR WAFFLE SLABS**

Waffle slabs Depth, in inches (Rib depth plus slab thickness)	Pounds per square foot
<b>19 X 19, 5 @ 24</b>	
6 plus 2½	66
8 plus 2½	78
10 plus 2½	85
12 plus 2½	101
<b>30 X 30, 6 @ 36</b>	
8 plus 3	73
10 plus 3	83
12 plus 3	95
14 plus 3	106
16 plus 3	114
20 plus 3	135

**Table J-4  
UNIT DESIGN DEAD LOADS FOR FLOOR FINISH**

Floor finish	Pounds per square foot
Double 7/8 inch wood on sleepers, light-concrete fill	19
Double 7/8 inch wood on sleepers, stone-concrete fill	28
Single 7/8 inch wood on sleepers, light-concrete fill	16
Single 7/8 inch wood on sleepers, stone-concrete fill	25
3 inch wood block on mastic, no fill	10
1 inch cement finish on stone-concrete fill	32
1 inch terrazzo on stone-concrete fill	32
Marble and mortar on stone-concrete fill	33
Linoleum on stone-concrete fill	32
Linoleum on light-concrete fill	22
1½ inch asphalt mastic flooring	18
3 inch wood block on ½ inch mortar base	16
Solid flat tile on 1 inch mortar base	23
2 inch asphalt block, ½ inch mortar	30
1 inch terrazzo, 2 inch stone concrete	32
Floor finish tile per inch depth	12
Cement finish per inch depth	12
Gypsum slabs per inch depth	4
Precast concrete plank per inch depth	(as determined by test)
Hardwood flooring per inch depth	4
Underflooring per inch depth	3
Linoleum	2
Asphalt tile	2

**Table J-5  
UNIT DESIGN DEAD LOADS FOR WATERPROOFING**

Waterproofing	Pounds per square foot
Five-ply membrane	5

**Table J-6  
UNIT DESIGN DEAD LOADS FOR FLOOR FILL**

Floor fill	Pounds per square foot
Cinder fill, per inch	5
Cinder concrete, per inch	9
Lightweight concrete, per inch	7
Sand, per inch	8
Stone concrete, per inch	12

**Table J-7  
UNIT DESIGN DEAD LOADS FOR WOOD-JOIST FLOORS**

Wood-joist floors (no plaster) – double wood floor joist sizes in inches:	Pounds per square foot	
	12-in spacing	16-in spacing
2 X 6	6	5
2 X 8	6	6
2 X 10	7	6
2 X 12	8	7
3 X 6	7	6
3 X 8	8	7
3 X 10	9	8
3 X 12	11	9
3 X 14	12	10

**Table J-8  
UNIT DESIGN DEAD LOADS FOR MATERIALS**

Materials	Pounds per cubic foot
Cast-stone masonry (cement, stone, sand)	144
Cinder fill	57
Concrete, plain:	
Cinder	108
Expanded-slag aggregate	100
Haydite (burned-clay aggregate)	90
Slag	132
Stone (including gravel)	144
Vermiculite and perlite aggregate, nonload-bearing	25-50
Other light aggregate, load-bearing	70-105
Concrete, reinforced:	
Cinder	111
Slag	138
Stone (including gravel)	150
Earth (dry)	96
Earth (damp)	108
Earth (wet)	120
Cork	15
Masonry, ashlar:	
Granite	168
Limestone, crystalline	168
Limestone, oolitic	135
Marble	173
Sandstone	144
Masonry, rubber mortar:	
Granite	153
Limestone, crystalline	147
Limestone, oolitic	138
Marble	156
Sandstone	137
Rubber stone masonry	156

**Table J-8 (cont'd)**  
**UNIT DESIGN DEAD LOADS FOR MATERIALS**

Materials	Pounds per cubic foot
Terra cotta, architectural:	
Voids filled	120
Voids unfilled	72
Timber, seasoned:	
Ash, commercial white	41
Cypress, southern	32
Fir, Douglas, coast region	34
Oak, commercial reds and whites	45
Redwood	28
Spruce, red, white, and Sitka	28
Southern pine, short leaf	39
Southern pine, long leaf	48
Timber, hemlock	30

**Table J-9**  
**UNIT DESIGN DEAD LOADS FOR ROOF AND WALL COVERINGS**

Roof and wall coverings	Pounds per square foot
Asphalt shingles	2
Cement asbestos shingles	4
Cement tile	16
Clay tile (for mortar add 10 lb):	
2 inch book tile	12
3 inch book tile	20
Roman	12
Spanish	19
Ludowici	10
Composition:	
Three-ply ready roofing	1
Four-ply felt and gravel	5½
Five-ply felt and gravel	6
Copper or tin	1
Corrugated asbestos-cement roofing	4
Corrugated iron	2
Fiberboard, ½ inch	¾
Formed steel decking	(see manufacturer)
Gypsum sheathing, ½ inch	2
Rigid insulation, ½ inch	¾
Sheet lead	3
Skylight, metal frame, 3/8 inch wire glass	8
Slate, 3/16 inch	7
Slate, ¼ inch	10
Spanish tile	2-
Wood sheathing, per inch thickness	3
Wood shingles	3

**Table J-10  
UNIT DESIGN DEAD LOADS FOR SUSPENDED CEILINGS**

Suspended ceilings	Pounds per square foot
Cement on wood lath	12
Cement on metal lath	15
Gypsum on wood or metal lath	10
Plaster on tile or concrete	5
Suspended metal lath and gypsum plaster	10
Suspended metal lath and cement plaster	15
Plaster on wood lath	8

**Table J-11  
UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
4 inch clay brick, high absorption	34
4 inch clay brick, medium absorption	39
4 inch clay brick, low absorption	46
4 inch sand-lime brick	38
4 inch concrete brick, heavy aggregate	46
4 inch concrete brick, light aggregate	33
8 inch clay brick, high absorption	69
8 inch clay brick, medium absorption	79
8 inch clay brick, low absorption	89
8 inch sand-lime brick	74
8 inch concrete brick, heavy aggregate	89
8 inch concrete brick, light aggregate	68
12 inch common brick	120
12 inch pressed brick	130
12 inch sand-lime brick	105
12½ inch concrete brick, heavy aggregate	130
12½ inch concrete brick, light aggregate	98
17 inch clay brick, high absorption	134
17 inch clay brick, medium absorption	155
17 inch clay brick, low absorption	173
17 inch sand-lime brick	138



**Table J-11 (cont'd)**  
**UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
17 inch concrete brick, heavy aggregate	174
17 inch concrete brick, light aggregate	130
22 inch clay brick, high absorption	168
22 inch clay brick, medium absorption	194
22 inch clay brick, low absorption	216
22 inch sand-lime brick	173
22 inch concrete brick, heavy aggregate	216
22 inch concrete brick, light aggregate	160
4 inch brick, 4 inch load-bearing structural clay tile backing	60
4 inch brick, 8 inch load-bearing structural clay tile backing	75
8 inch brick, 4 inch load-bearing structural clay tile backing	102
8 inch combination brick and concrete block	72
12 inch combination brick and concrete block	90
8 inch load-bearing structural clay tile	42
12 inch load-bearing structural clay tile	58
8 inch concrete block, heavy aggregate	55
12 inch concrete block, heavy aggregate	85
8 inch concrete block, light aggregate	38
12 inch concrete block, light aggregate	55
2 inch furring tile, one side of masonry wall, add to above figures	12
4 inch hollow concrete block – stone aggregate	30
lightweight	20
6 inch hollow concrete block – stone aggregate	42
lightweight	30
8 inch hollow concrete block – stone aggregate	55
lightweight	38
10 inch hollow concrete block – stone aggregate	62
lightweight	46
12 inch hollow concrete block – stone aggregate	85
lightweight	55
4 inch solid concrete block – stone aggregate	45
lightweight	34

**Table J-11 (cont'd)**  
**UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
6 inch solid concrete block – stone aggregate	50
lightweight	37
8 inch solid concrete block – stone aggregate	67
lightweight	48
10 inch solid concrete block – stone aggregate	84
lightweight	62
12 inch solid concrete block – stone aggregate	108
lightweight	72
4 inch load-bearing clay tile	24
6 inch load-bearing clay tile	36
2 inch non-load-bearing clay tile	11
3 inch non-load-bearing clay tile	18
4 inch non-load-bearing clay tile	20
6 inch non-load-bearing clay tile	30
8 inch non-load-bearing clay tile	36
10 inch non-load-bearing clay tile	40
4 inch non-load-bearing hollow concrete block	20
6 inch non-load-bearing hollow concrete block	30
8 inch non-load-bearing hollow concrete block	40
T.C. 1½ inch split terra cotta furring	8
2 inch split terra cotta furring	10
3 inch split terra cotta furring	12
2 inch hollow gypsum block	9½
3 inch hollow gypsum block	10
4 inch hollow gypsum block	15
5 inch hollow gypsum block	18
6 inch hollow gypsum block	24
2 inch solid gypsum block	12
3 inch solid gypsum block	18
4 inch solid gypsum block	24
2 inch facing tile	15
4 inch facing tile	25

**Table J-11 (cont'd)**  
**UNIT DESIGN DEAD LOADS FOR UNPLASTERED WALLS AND PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
6 inch facing tile	38
2 inch solid plaster	20
4 inch solid plaster	32
4 inch hollow plaster	22
Wood studs 2 X 4, unplastered	4
Wood studs 2 X 4, plastered one side	12
Wood studs 2 X 4, plastered two sides	20
4 inch glass block	18

**Table J-12**  
**UNIT DESIGN DEAD LOADS FOR LATH AND PLASTER PARTITIONS**

Walls and partitions (unplastered)	Pounds per square foot
2 inch solid cement on metal lath	25
2 inch solid gypsum on metal lath	18
2 inch solid gypsum on gypsum lath	18
2 inch metal stud gypsum and metal lath both sides	18
3 inch metal stud gypsum and metal lath both sides	19
4 inch metal stud gypsum and metal lath both sides	20
6 inch wood studs plaster and wood lath, both sides	18
6 inch wood studs plaster and metal lath, both sides	18
6 inch wood studs plaster and plaster boards, both sides	18
6 inch wood studs unplaster gypsum board, both sides (dry wall)	10

**Table J-13**  
**UNIT DESIGN DEAD LOADS FOR PLASTER WORK**

Walls and partitions (unplastered)	Pounds per square foot
Gypsum (one side)	5
Cement (one side)	10
Gypsum on wood lath	8
Gypsum on metal lath	8
Gypsum on plaster board or fiber board	8
Cement on wood lath	10
Cement on metal lath	10

**Table J-14  
MISCELLANEOUS**

	Pounds per square foot
<b>FLOORING</b>	
7/8" hardwood floor on sleepers clipped to concrete without fill	5
1½" terrazzo floor finish directly on slab	19
1½" terrazzo floor finish on 1" mortar bed	30
¾" ceramic or quarry tile on ½" mortar bed	16
¾" ceramic or quarry tile on 1" mortar bed	22
¼" linoleum or asphalt tile directly on concrete	1
¼" linoleum or asphalt tile on 1" mortar bed	12
¾" mastic floor	9
Asphaltic concrete, 1½" thick	18
<b>CEILINGS</b>	
½" gypsum board	2
5/8" gypsum board	2½
¾" plaster on metal lath furring	8
Suspended ceilings, Add	2
Acoustical tile	1
Acoustical tile on wood furring strips	3
<b>ROOFS</b>	
Gypsum, per inch of thickness	4
Insulating concrete, per inch	3
Metal Deck (22 gauge)	2
<b>WALLS</b>	
Windows, glass, frame and sash	8
4" stone	55
Steel or wood studs, lath, ¾" plaster each side	18
Steel or wood studs, 5/8" gypsum board each side	6
Steel or wood studs, 2 layers ½" gypsum board each side	9

## **APPENDIX K**

### **FIRE RESISTANCE RATINGS**

#### **TECHNICAL INFORMATION ON FIRE RESISTANCE RATINGS**

The following tables present for the information of building inspectors and other public officials, [architects](#), engineers and others interested in fire safety in buildings, types of construction which provide fire resistance ratings of 1, 1½, 2, 2½, 3 and 4 hours, as may be required by codes or regulations. The data cover,

- Beam, girder and truss protections
- Ceiling constructions
- Column protections
- Floor and ceiling constructions
- Walls and partitions.

The tables are set up in terms of minimum requirements (type of protection material, details of construction and thickness of materials) for the specified fire resistance, and in such form as to fit the fire resistance required by this Code. Some constructions, such as brick walls and certain floor constructions and column protections, have obtained test ratings higher than required by building codes, and hence higher than indicated in the tables. For further data the original references, shown by numbers in parenthesis, should be consulted.

The fire resistance rating of a wall or partition or floor and ceiling construction is essentially the time in hours the construction will remain in place and prevent temperatures on the unexposed side from exceeding a certain amount when the construction is exposed to the standard test fire. The fire resistance rating of a column is the time in hours the column will stay in place and carry its load. The usefulness of the assembly after the fire exposure is not taken into account, and damage to the assembly is not necessarily a factor in the rating.

Ratings are based on Standard Fire Tests made substantially in accord with the "Standard Methods of Fire Tests of Building Construction and Materials," ASTM E119, NFPA 251, U.L. 263 unless identified as estimated ratings.

In addition to ratings based on standard tests are estimated ratings of certain forms of construction based on certain standard tests or which have been commonly recognized and used for many years but for which standard test data have not been available. Such ratings have been included to fill some of the important gaps in the tables of ratings based on standard tests, so that building inspectors and other users of these tables would have some information to go by pending the time when more adequate test data become available.

The data given under estimated ratings do not include details on attachment, but it is assumed that the protection will be securely attached in such a way that it will remain in place during fire exposure.

Attention is called to the fact that with ratings based on currently published listings by Underwriters' Laboratories, Inc., and Underwriters Laboratories of Canada there is reasonable assurance that the listed materials will conform in weight, dimension, and quality to those which developed the original test rating, but that with other ratings the materials currently available may not necessarily be the same weight, dimensions and quality as those which were originally tested and rated.

Where an assembly is specified to be of noncombustible materials, care must be exercised in selecting from the tables only assemblies which are made of noncombustible materials.

**Analyzing Test Data.** In judging and interpreting test results it is necessary to analyze carefully the test data if ratings therefrom are to be on a comparable basis.

With many of the older fire tests the fire exposure differed to a considerable extent from the present standard fire exposure, and with many of the early floor fire tests top surface temperatures were not observed.

Many of the tests on columns were made prior to 1925 with column loads somewhat lower than permitted today. In certain cases this necessitates consideration of the effect of greater allowable loads on the fire resistance rating.

Many tests have been made on samples smaller than the minimum size specified in the standard fire test. Such tests cannot be considered the equivalent of tests made on samples of standard size. In some cases they may be satisfactory in determining heat transmission characteristics, from which fairly reliable estimates of the fire resistance rating may be made, provided other characteristics affecting performance of the assembly in the standard fire test have been established, but such estimates may be made with considerable caution.

The above factors have been taken into account in arriving at the ratings shown in the following tables.

**Applying Test Results to Modified Forms of Construction.** Because small differences in quality of materials, forms of construction and dimensions of parts, in some cases, make large differences in the fire resistance, care must be exercised in applying test ratings to constructions which differ from those actually tested. Some of the factors which need to be considered are the following.

**CONCRETE.** The fire resistance of concrete depends to a considerable extent on the kind and quality of coarse aggregate used. Siliceous gravel aggregates which contain a large percentage of chert or flint give lower ratings than limestone, trap rock, slag and a number of other aggregates. Where expanded shale aggregate is called for it is of the rotary kiln type unless otherwise noted.

The relation between kind of aggregate and fire resistance ratings is well illustrated in the ratings given for concrete protections for steel columns.

**PLASTER.** In constructions where plaster coatings provide an important part of the fire resistance, it is important to note the kind of plaster, its thickness, the type and proportions of the ingredients, and the type and method of fastening the lath. Gypsum plaster is superior to portland cement or lime plaster in resisting heat transmission. Unless asbestos or other fiber is added to portland cement plaster, its fire resistance is further limited by cracking and spalling.

The richness of the plaster mix has a considerable effect on the fire resistance, particularly with gypsum plaster, and if the listed ratings are to be obtained the mix must be as specified.

The increase in fire resistance obtained by addition of a plaster coating is shown in the tables for certain constructions. In general, a facing of 3/4-inch portland cement or gypsum plaster will usually increase the fire resistance of a 1-hour assembly by 1/2-hour. On 2-, 3- and 4-hour assemblies the increase for the same kind and thickness of plaster will be progressively greater, amounting usually to about 1 hour on a 4-hour assembly. If applied to two sides of a masonry partition the effectiveness is double that of plaster on one side. Plaster coatings, to be effective in adding to the fire resistance periods when combustible structural members are framed in, must be on the exposed faces of the walls opposite to the faces in which the combustible members are inserted.

The use of perlite or vermiculite aggregate in place of sand in plaster, increases its resistance to fire.

**ACOUSTICAL TILE.** The type of acoustical tile suspension system specified in the tables is important. Exposed or lay-in tile steel suspension systems result in a more rapid heat build-up in the concealed ceiling space than do concealed tile suspension systems that support tile in a recessed groove (kerf) in tile edge. Tile hold down clips are included in all assemblies incorporating exposed tile suspension systems.

**PRESTRESSED CONCRETE.** The high-tensile steel wires or cables imbedded in but not necessarily bonded to the concrete may be pretensioned or post-tensioned. Factors such as cell configuration in hollow slabs, effect of moisture trapped in grouted cable ducts of post-tensioned members, the effect of end supports or end connections and the point of temperature failure of high-tensile steel will influence the fire resistance rating. Most fire tests of prestressed concrete have been conducted with ends and edges of the test assembly restrained. If field erection is not as tested, performance under fire conditions may not give the rating in the tables.

**SPRAYED FIBER.** Performance of fire proofing materials such as sprayed fiber applied directly to steel or other surfaces depends on the condition of the surface receiving the sprayed fiber. The surface should be free of oil, rust or other foreign matter. Many fiber protections first require a special adhesive or water application on the surface to receive the fiber. Where required the fiber should be tamped to the required thickness.

**WALLBOARD.** Special gypsum wallboard or coreboard with a specially formulated core affords greater fire resistance than does the conventional or regular gypsum wallboard or coreboard of the same thickness. If the wallboard or coreboard in the description is "U.L. Listed," then wallboard or coreboard having an attached Underwriters' Laboratories, Inc. label stating the same type of construction and design number as that given in the description must be used. Constructions incorporating a special wallboard or coreboard are so noted under details of construction.

**HOLLOW UNITS.** It should be noted that with hollow constructions and with constructions composed of hollow units the thickness of the hollow space is a relatively minor factor in the fire resistance. Comparative tests have indicated that it is the total thickness of solid material in the unit rather than the total thickness of the unit which is the principal factor. Therefore, with constructions involving hollow block or tile, use of thicker unit of the same material will increase the rating only if and as the thickness of solid material in the unit is increased. An increase in rating may be obtained by filling the cores.



**CRITICAL FEATURES IN FIRE RESISTANCE RATINGS.** With masonry walls and partitions the critical feature in determining the fire resistance rating under the standard fire test is usually the temperature rise on the unexposed surface or in other words its resistance to heat transmission. However, with some constructions, the critical feature may be the load carrying ability under fire exposure or the resistance to hose stream penetration.

With columns, beams and girders the critical feature is usually the ability to carry the load under fire exposure, which in turn is usually dependent on the heat insulating value of the protective covering and its ability to stay in place during the fire exposure.

With noncombustible floor constructions the critical feature has usually been the temperature rise on the top (unexposed) surface in view of adequate protection provided on the underside, but ceiling protection is important and if deficient the critical feature becomes the load carrying ability under fire exposure which is dependent on the ceiling protection. Where the ceiling protection consists chiefly of plaster on some form of lath the method of attachment of the lath and the security with which it and the plaster are held in place during the fire exposure are often critical features. Falling of any considerable portion of the plaster and lath during the fire exposure period makes the possible collapse of such floors under load (whether of combustible or noncombustible construction) a critical feature in the test results. This has been the case in a number of floor tests.

It should be noted that ratings of plaster facings on walls and partitions are not applicable to similar finishes on ceilings, for under fire exposure plaster may fall from a ceiling considerably before it will fall from a vertical surface, even though it be applied to the same plaster base in both cases.

**Fire Walls.** Fire resistance ratings as determined by the standard fire test do not provide an adequate basis for specifying minimum thickness of fire walls of buildings. In brief general terms, the standard fire test is made on a sample wall about 10 feet square and to be rated as a 4-hour wall, for example, the sample must stand up under the standard exposure fire and bear its rated load, if of load bearing construction, for a period of 4 hours without attaining a temperature on its unexposed face higher than 250 F. above the starting temperature. The hose stream test which is also specified is made on a like sample exposed to only a 1-hour fire so that this test is not a critical factor in such walls.

It is obvious that a fire test as described will not measure the ability of a wall many times the size of the test panel to stand up against fire exposure extending over more or less its entire area. Walls expand when heated and in severe building fires it is common to see them curl and fall as the result of such expansion on the heated side. Ability to withstand the impact from collapsing floors and falling objects is also important.

When a wall is called upon to stop a spreading fire that is reaching or has attained conflagration proportions it must have stability against collapse or overturning far in excess of that presented by certain types of construction which develop a 4-hour resistance in the standard fire test, if it is to serve its purpose.

Therefore until tests have been developed that will measure the kind of performance required in fire walls of buildings, it is necessary to a considerable extent, as in this Code, to specify thickness and required mass and stability of walls on the basis of experience and their performance in actual fires.

## GENERAL NOTES

### Materials and Forma of Construction

All ratings are based on use of materials and forms of construction in full conformity with requirements of this Code, and in compliance with any applicable material specifications of the American Society for Testing and Materials.

The thickness of walls, partitions and floor slabs specified in the tables are based on fire resistance only and are not to be construed as permitting such thicknesses where other considerations require greater thicknesses. See for example the Code provisions regarding height and thickness of masonry walls in this Code.

### Ceiling Constructions

Ceiling constructions described under Floor and Ceiling Constructions cannot be used interchangeably with other floor constructions to obtain the fire resistance rating of the floor and ceiling construction from which the ceiling construction was taken.

Openings in a fire resisting ceiling for pipes, ducts and other service equipment should only be permitted on the basis of fire tests of fire resisting ceilings with such openings, except that one electrical outlet box not exceeding 16 square inches in area may be installed in such ceilings in each 90 square feet of ceiling area.

Firestopping of concealed spaces formed by a fire resisting ceiling and floor above should be provided in accordance with building code provisions.

### Plaster

Plaster mixes are designated as follows: "1:2, 1:3 gypsum and sand plaster" which indicates two coats of plaster, the first or scratch coat made of 1 part gypsum to 2 parts sand, and the second or brown coat of 1 part gypsum to 3 parts sand.

Plaster proportions are by weight unless otherwise indicated.

Plaster of cement and sand may be richer in cement content than specified for a given rating unless otherwise indicated.

Plaster of gypsum and sand may be richer in gypsum content than specified for a given rating unless otherwise indicated.

Plasters with vermiculite or perlite aggregate must be of the proportions as specified for a given rating.

Thickness of plaster is measured from the face of the plaster base, except that with metal lath it is measured from the back of the lath unless otherwise stated. The usual 1/16 in. white or finish coat of plaster may be included in the required plaster thickness.

Ceilings of plaster on metal lath, unless otherwise specified in individual ratings, may be in contact, furred, or suspended.

### **Explanatory Notes and References**

The abbreviation “Comb.” appearing in the tables under Rating means the assembly is rated as combustible according to the Standard Methods of Fire Tests of Building Construction and Materials, NFPA Standard No. 251, U.L. 263. An assembly is rated as combustible when it involves materials which do not classify as noncombustible as defined in this Code.

When an assembly is designated as combustible it does not necessarily mean that all the materials in the construction are combustible but that there is a significant amount of combustible material in it.

Letters appearing in the tables as superscripts refer to explanatory notes given at the end of the tables.

Numbers in parenthesis given in the tables under details of construction or details of protection refer to references to sources of data listed at the end of the tables, after the notes.

U.L. refers to Underwriters’ Laboratories, Inc.

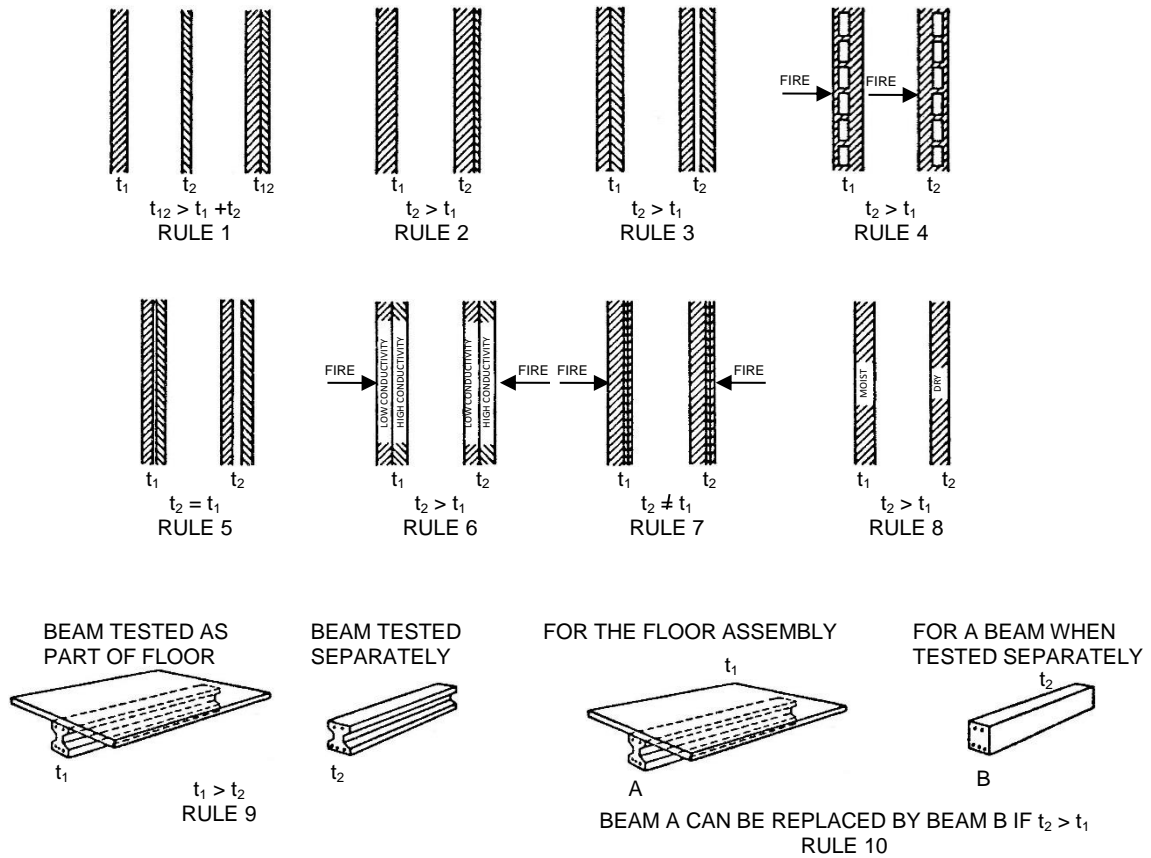
### **RULES OF FIRE ENDURANCE RATING**

1. The “thermal” fire endurance of a construction consisting of a number of parallel layers is greater than the sum of the “thermal” fire endurances characteristic of the individual layers when exposed separately to fire.
2. The fire endurance of a construction does not decrease with the addition of further layers.
3. The fire endurance of constructions containing continuous air gaps or cavities is greater than the fire endurance of similar constructions of the same weight, but containing no air gaps or cavities.
4. The farther an air gap or cavity is located from the exposed surface, the more beneficial is its effect on the fire endurance.
5. The fire endurance of a construction cannot be increased by increasing the thickness of a completely enclosed air layer.
6. Layers of materials of low thermal conductivity are better utilized on that side of the construction on which fire is more likely to happen.
7. The fire endurance of asymmetrical constructions depends on the direction of heat flow.
8. The presence of moisture, if it does not result in explosive spalling, increases the fire endurance.
9. Load-supporting elements, such as beams, girders, and joists, yield higher fire endurances when subjected to fire endurance tests as parts of floor, roof, or ceiling assemblies than they would when tested separately.
10. The load-supporting elements (beams, girders, joists, etc.) of a floor, roof, or ceiling assembly can be replaced by such other load-supporting elements which, when tested separately, yielded fire endurances not less than that of the assembly.

NOTE: Permission has been granted to use this copyrighted material on “Rules of Fire Endurance.”

APPENDIX K

Shown below is a diagrammatic illustration of the rules. Although these rules do not eliminate the need for accurate and elaborate design methods, they may give some assistance in solving many problems encountered in everyday practice.



Diagrammatic illustration of ten rules.

**t = fire endurance**

**BEAM, GIRDER AND TRUSS PROTECTIONS – Continued****Estimated Ratings****Reinforced Concrete Beams, Girders and Trusses (Estimated)**

Protection Type	Details of Protection	Rating
<b>Concrete</b>	1 in. <sup>1</sup> concrete	1 hr.

**Steel Beams, Girders and Trusses – Individually Protected (Estimated)**

<b>Plaster and Metal Lath</b>	Two ¾ in. layers of 1:3 gypsum and sand plaster on metal lath, with ¾ in. air space between.	2½ hrs.			
	Two 7/8 in. layers 1:2½ portland cement and sand plaster on metal lath, with ¾ in. air space between.	2 hrs.			
	¾ in. 1:3 gypsum and sand plaster on metal lath.	1 hr.			
	1 in. 1:2½ portland cement and sand plaster on metal lath.	1 hr.			
Protection Type	Details of Protection	Minimum Thickness <sup>1</sup> Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Clay tile, Concrete, Brick, or Gypsum</b>	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster.	---	---	2	2
	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster; all spaces between member and tile or block filled solid.	---	2	2	2
	Clay tile or concrete block; unplastered.	---	---	---	2
	Clay tile or concrete block; unplastered; all spaces between member and tile or block filled solid.	---	---	2	2
	Concrete, Group 1 course aggregate <sup>k</sup> ; metal ties bent around beam flanges and other projecting parts.	2	2	1½	1
	Concrete, Group 2 course aggregate <sup>k</sup> ; with 3 in. or finer metal mesh placed 1 in. from the finished surface.	2½	2½	2	1½
	Brick, hollow or solid (clay, concrete or sand-lime).	3¾	3¾	2¼	2¼
	Gypsum blocks, hollow; plastered with ½ in. gypsum plaster.	3	3	2	2
	Gypsum blocks, hollow; unplastered; joints grouted.	---	3	2	2
	Gypsum blocks, solid; plastered with ½ in. gypsum plaster.	2	2	2	2
	Gypsum blocks, solid; unplastered; joints grouted.	---	---	2	2
	Gypsum poured; plastered with ½ in. gypsum plaster.	1½	1½	1	½
	Gypsum poured; unplastered.	2	2	1½	1

Letter superscripts refer to notes, page 641.

Add provisions for the proper ASTM E119 fire tests to provide for the protection of large steel trusses, as follows:

*TRUSSES*

Where trusses are required to be fire protected, such protection may be provided by one or more of the following methods:

1. Fire resistive materials of the thickness specified and applied to each of the members of the truss.
2. Fire resistive materials enclosing the entire truss on all sides for its entire length and height.
3. Fire resistive floor and ceiling assemblies enclosing trusses provided there are no combustible materials in the enclosed truss space.

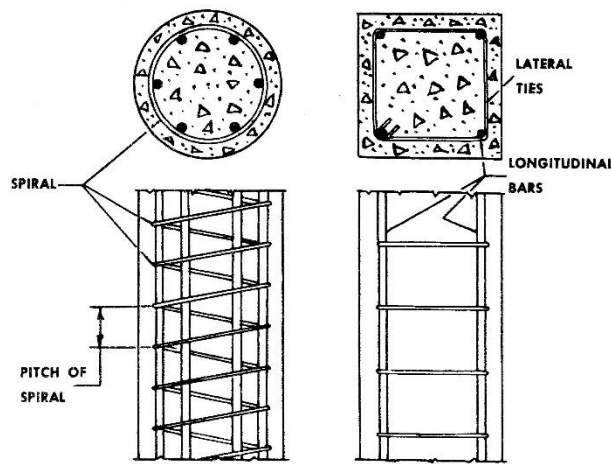
The required thickness and construction of fire resistive assemblies enclosing trusses shall be based upon the results of full-scale fire tests, or combinations of fire tests on selected representative truss components which, in the judgement of the building official, will provide the required fire resistance for the assembly.

**COLUMN PROTECTIONS**

*Cast Iron Columns – 7 in. diam., min.<sup>m</sup>*

Protection Type	Details of Protection	Rating
<b>Clay Tile</b>	2 in. <sup>l</sup> hollow clay tile with outside wire ties <sup>q</sup> ; ¾ in. mortar between tile and column; no fill (9, 26)	3 hrs.
<b>Concrete</b>	2 in., aggregate cinders <sup>o</sup> , 1:2:5 mix; no fill. (9, 26)	2½ hrs.
<b>Plaster on Metal Lath</b>	1½ in. portland cement plaster on ¾ in. rib metal lath, with plaster pushed through sufficiently to leave not over ½ in. air space; Plaster mix (by volume): 1:1/10:2½ portland cement, lime and sand; no fill. (9, 26)	3 hrs.

*Reinforced Concrete<sup>y</sup> Columns*



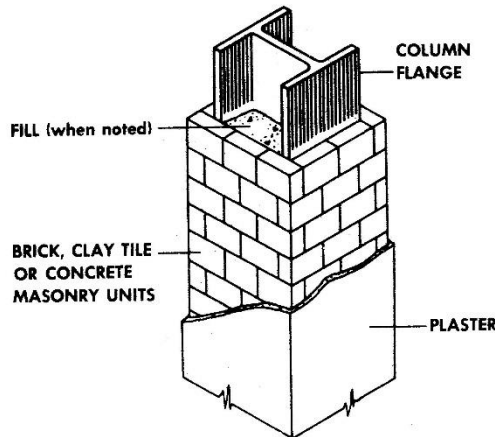
Protection Type	Details of Protection	Rating
<b>Concrete</b>	1½ in. <sup>l</sup> concrete, coarse aggregate limestone, calcareous <sup>n</sup> gravel, trap rock or blast furnace slag; 12 in. or larger round or square columns. <sup>m</sup> (27)	4 hrs.
	2½ in. <sup>l</sup> concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>s</sup> ; 16 in. or larger round or square columns. <sup>m</sup> (27)	4 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>s</sup> ; light 2 in. mesh expanded metal centrally located in the protective covering. 14 in. or larger round or square columns. <sup>m</sup> (27)	4 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>s</sup> ; light 2 in. mesh expanded metal centrally located in the protective covering. 12 in. or larger round or square columns. <sup>m</sup> (27)	3 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>s</sup> ; 16 in. or larger round or square columns. <sup>m</sup> (27)	3 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>s</sup> ; 12 in. or larger round or square columns. <sup>m</sup> (27)	2 hrs.

Letter superscripts refer to notes, page 641.

**COLUMN PROTECTIONS**

Protection Type	Details of Protection	Rating
<b>Concrete and Plaster</b>	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel <sup>g</sup> ; covered with 1 in. 1:2½ (by volume) portland cement and sand or gypsum and sand plaster, with admixture of not over ½ part lime; surface of column hacked or column cast in metal lath form, 16 in. or larger round or square columns. <sup>m</sup> (27)	4 hrs.

*Steel Columns*

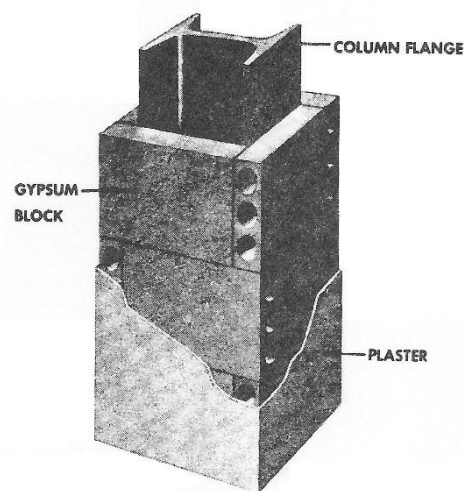


Protection Type	Details of Protection	Rating
<b>Brick</b>	3¾ in. solid clay brick; brick fill. (26)	4 hrs.
	2¼ in. solid clay brick; brick fill. (26)	1 hr.
<b>Clay Tile, Spaced out from Column</b>	4 in. hollow clay tile, two 2 in. layers; ½ in. mortar between tile and column; 3/8 in. metal mesh in horizontal joints; hollow clay tile fill. (26)	4 hrs.
	2 in. hollow clay tile plastered with ¾ in. 1:3 (by volume) gypsum and sand plaster; ¾ in. mortar between tile and column, 3/8 in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	4 in. hollow clay tile plastered with 5/8 in. 1:2½ (by volume) gypsum and sand plaster; 1 1/8 in. mortar between tile and column, 3/8 in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	2 in. hollow clay tile with outside wire ties <sup>q</sup> , or with 3/8 in. metal mesh in horizontal joints; limestone or trap rock concrete fill, extending 1 in. outside column on all sides, (26)	3 hrs.
	2 in. hollow clay tile with outside wire ties <sup>q</sup> , with or without ¾ in. mortar between tile and column. (26)	1 hr.
<b>Concrete Masonry Units</b>	3 in. concrete block, hollow, cinder; fill of cinder concrete slabs and mortar with 1¼ in. mortar between column and block <sup>r</sup> . (29)	4 hrs.
	4 in. concrete masonry units, solid, expanded clay or shale (rotary kiln); 1½ in. space between column and masonry units. No fill (113)	4 hrs.

Letter superscripts refer to notes, page 641.



## COLUMN PROTECTIONS – Continued

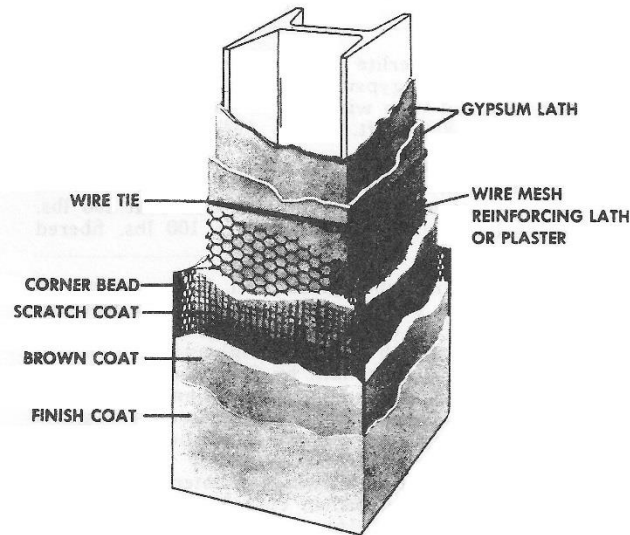
*Steel Columns (continued)*

Protection Type	Details of Protection	Rating
<b>Gypsum block, hollow or solid</b>	4 in. gypsum block, solid; corrugated metal ties or 3/8 in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; 3/4 in. gypsum mortar between column and block. (26)	4 hrs.
	2 in. gypsum block, solid; plastered with 1/2 in. gypsum and sand plaster; 7/8 in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of the same course together; no fill. (28)	4 hrs.
	2 in. gypsum block, solid; wire lath strips laid in horizontal joints; fill of gypsum block and mortar with 1/2 in. mortar between column and blocks and with 1/2 in. gypsum and sand plaster on outside. (28)	4 hrs.
	3 in. gypsum block, solid; plastered with 1/2 in. gypsum and sand plaster; 7/8 in. 12 gauge metal cramps linking adjacent blocks of the same course; 1/4 in. mortar between column flange and block; no fill (28)	4 hrs.
	2 in. gypsum block, solid; unplastered; 7/8 in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of the same course together; no fill. (28)	2 hrs.
	2 in. gypsum block, solid; corrugated metal ties or 3/8 in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; 3/4 in. gypsum mortar between column and block. (26)	2 hrs.
	2 in. gypsum block, hollow; unplastered; 7/8 in. 12 gauge metal cramps linking adjacent blocks of the same course; no fill. (28)	2 hrs.
<b>Gypsum Wallboard</b>	Three layers 1/2 in. gypsum wallboard. Inner two layers cemented and clinch nailed together, cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1 1/2 hrs.
	Two layers 1/2 in. gypsum wallboard. Inner layer cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1 hr.

Letter superscripts refer to notes, page 641.

**COLUMN PROTECTIONS – Continued**

*Steel Columns (continued)*



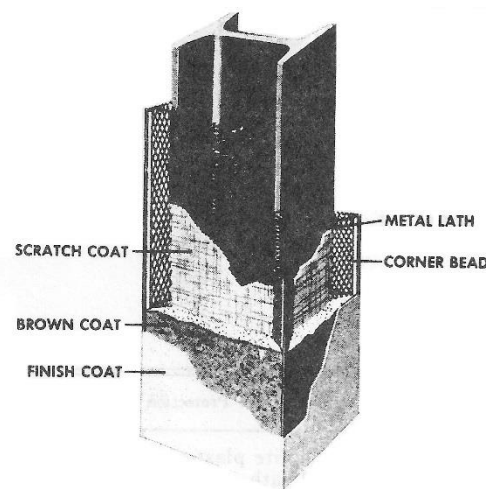
Protection Type	Details of Protection	Rating
<b>Plaster on Gypsum Lath (two layers)</b>	1½ in. gypsum-vermiculite plaster on two layers of ½ in. gypsum boxed around column, fastened with wire ties and reinforced with 1 in. wire mesh. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. gypsum. (92)	4 hrs.
<b>Plaster on Gypsum Lath (one layer)</b>	1½ in. gypsum-perlite plaster on two layers of ½ in. gypsum lath boxed around column, fastened with wire ties and reinforced with 1 in. wire mesh. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	4 hrs.
	1 in. gypsum-perlite plaster on two layers of ½ in. gypsum lath boxed around column, fastened with wire ties and reinforced with 1 in. wire mesh. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs.
	1 3/8 in. gypsum-perlite plaster, on two layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	3 hrs.
	1½ in. gypsum-perlite plaster reinforced with wire mesh, on ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs.
	2 in. gypsum and sand plaster on 3/8 in. perforated gypsum lath boxed a round column and fastened with wire ties. Plaster mix: scratch coat 200 lbs. and brown coat 300 lbs. sand to 100 lbs. fibered gypsum. (90)	3 hrs.

Letter superscripts refer to notes, page 641.

## COLUMN PROTECTIONS – Continued

### *Steel Columns (continued)*

Protection Type	Details of Protection	Rating
<b>Plaster on Gypsum Lath (one layer)</b>	1 3/8 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath boxed a round column and fastened with wire ties. Corner bead wings not in contact with gypsum lath for full height of column but attached to gypsum lath by 2 in. long extensions spaced 12 in. on centers. Extensions formed by cutting metal wings of corner beads on a diagonal every 12 in. to such a depth that when the resulting loose flaps are folded over they produce 2 in. extension to the metal wings. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (116)	3 hrs.
	1 1/2 in. gypsum-perlite plaster, on 3/8 in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	2 1/2 hrs.
	1 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2 1/2 cu. ft. perlite. (92)	2 hrs.
	1/2 in. 1:2 1/2 gypsum and sand plaster on 3/8 in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1 hr.
	5/8 in. 1:2 1/2 gypsum and sand plaster on 3/8 in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1 1/2 hrs.



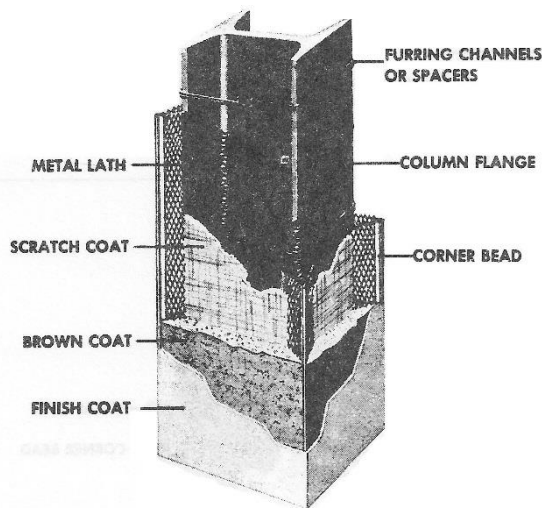
Protection Type	Details of Protection	Rating
<b>Plaster on Metal Lath</b>	3/4 in. 1:3 gypsum and sand plaster or 1 in. 1:2 1/2 portland cement and sand plaster, on metal lath. (9)	1 hr.
	1 in. plaster, 1:1/10:2 1/2 (by volume) portland cement, lime and sand on metal lath; no fill. (26)	1 hr.

Letter superscripts refer to notes, page 641.

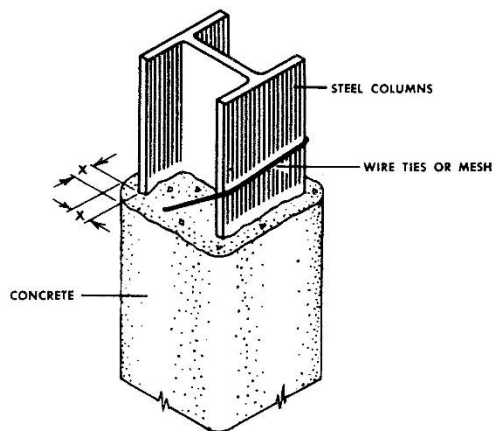
**COLUMN PROTECTIONS – Continued**

*Steel Columns (continued)*

Protection Type	Details of Protection	Rating
<b>Plaster on Metal Lath, Space Between Two Layers of Plaster</b>	Two ¾ in. layers of 1:3 gypsum and sand plaster or two 1 in. layers of 1:2½ portland cement and sand plaster, on metal lath, with ¾ in. air space between the two layers; no fill (9)	2½ hrs.
	2½ in. plaster, two 7/8 in. layers 1:1/10:2½ (by volume) portland cement, lime and sand on metal lath; ¾ in. air space between layers; no fill. (26)	2 hrs.



Protection Type	Details of Protection	Rating
<b>Plaster on Metal Lath spaced from column</b>	1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath spaced 1 in. from column. Plaster mix: 4:1 by weight of approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. Loose vermiculite fill. (32)	4 hrs.



Letter superscripts refer to notes, page 641.

## COLUMN PROTECTIONS – Continued

### *Steel Columns (continued)*

Protection Type	Details of Protection	Minimum Thickness <sup>1</sup> Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Portland Cement or Gypsum Concrete</b>	Concrete, coarse aggregate calcareous <sup>n</sup> or limestone; fill of same material. (9, 26)				
	6 x 6 in. or larger <sup>m</sup>	2	1½	1	1
	8 x 8 in. or larger	1½	1	1	1
	12 x 12 in. or larger	1	1	1	1
	Concrete, coarse aggregate trap rock; fill of same material; steel wire ties <sup>p</sup> . (9, 26)				
	6 x 6 in. or larger <sup>m</sup>	2½	1	1½	1
	8 x 8 in. or larger	2	1½	1	1
	12 x 12 in. or larger	1½	1	1	1
	Concrete, coarse aggregate granite, sandstone, siliceous <sup>x</sup> gravel or cinders <sup>o</sup> ; fill of same material; steel wire ties <sup>aa</sup> . (95)				
	6 x 6 in. or larger <sup>m</sup>	3	2	1½	1
	8 x 8 in. or larger	2½	2	1	1
	12 x 12 in. or larger	2	1	1	1
	Gypsum concrete, poured; fill of same material; 4 x 4 in. wire mesh reinforcement wrapped around column <sup>t</sup> . (28)	2	---	---	---

### *Timber Columns – Long Leaf Pine or Douglas Fir. Minimum Area 120 sq. in.*

Protection Type	Details of Protection	Rating
<b>Gypsum Wallboard</b>	3/8 in. gypsum wallboard on column and covering cast iron or steel cap. (9, 26)	1 hr.
<b>Plaster on Metal Lath</b>	1 in. 1:2½ portland cement and sand plaster on metal lath spaced ¾ in. from column. Plaster protecting cast iron or steel cap. (9, 26)	2 hrs. comb.

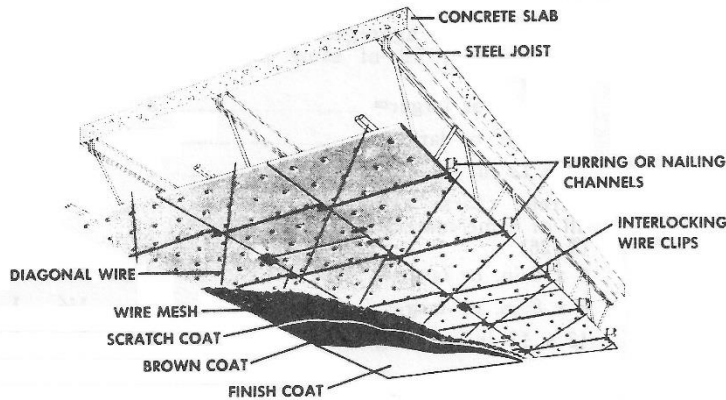
### *Steel Column*

Protection Type	Details of Protection	Rating
<b>Plaster on Gypsum Lath</b>	1 3/8 in. 1:2, 1:3 gypsum and sand plaster on 3/8 in. perforated gypsum lath wire tied to column. Additional wire ties around column through portions of corner beads reinforcing plaster.	2 hrs.

Letter superscripts refer to notes, page 641.

**FLOOR AND CEILING CONSTRUCTION – Continued**

*Steel Joists or Beams<sup>u</sup> (Continued)*



Ceiling Type	Details of Construction	Rating
<b>Plaster on Gypsum Lath</b>	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 1 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to 3/4 in. furring channels spaced 12 in. on centers with interlocking wire clips giving continuous support to lath. Plaster reinforced with 20 ga. wire mesh. Wire mesh attached to furring channels at joints in lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	4 hrs.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 1/2 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to 3/4 in. furring channels spaced 16 in. on centers, with special wire clips giving continuous support to lath. Plaster reinforced with 20 gauge wire mesh. Wire mesh attached to furring channels at joints in lath. Plaster mix: 2 1/2 cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 5/8 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to 3/4 in. furring channels spaced 12 in. on centers with interlocking wire clips giving continuous support to lath. Plaster reinforced with 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 5/8 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to 3/4 in. furring channels spaced 12 in. on centers with special wire clips at edges of lath and third points of lath width at each channel. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 1/2 in. gypsum-perlite plaster applied to 3/8 in. perforated gypsum lath secured to 3/4 in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster Mix: 2 1/2 cu. ft. perlite to 100 lbs. gypsum. (65)	2 1/2

Letter superscripts refer to notes, page 641.

## FLOOR AND CEILING CONSTRUCTION – Continued

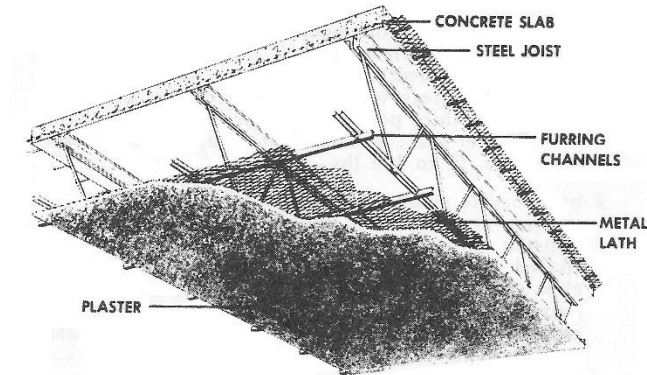
### *Steel Joists or Beams<sup>u</sup> (Continued)*

Ceiling Type	Details of Construction	Rating
<b>Plaster on Gypsum Lath</b>	2½ in. floor slab consisting of 2 in. reinforced gypsum concrete on ½ in. gypsum form boards. Ceiling of 5/8 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (88)	2 hrs.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 1 in. gypsum-perlite plaster, applied to 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1½ hrs.
	2 in. floor slab, consisting of 1½ in. reinforced gypsum concrete on ½ in. gypsum form boards. Ceiling of 1 1/8 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath, attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1½ hrs.
	2 in. concrete floor slab <sup>v</sup> on metal lath. Ceiling of ½ in. gypsum-perlite plaster, on 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 16 in. on centers, with special wire clips at edges of lath and midpoint of lath width at each channel. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	1 hr.
	2 in. concrete slab <sup>v</sup> on metal lath. Ceiling of 5/8 in. gypsum-perlite plaster, applied to 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	1 hr.

Letter superscripts refer to notes, page 641.

**FLOOR AND CEILING CONSTRUCTION – Continued**

*Steel Joists or Beams<sup>u</sup> (Continued)*



Ceiling Type	Details of Construction	Rating
<b>Plaster on Metal Lath</b>	2½ in. concrete slab <sup>v</sup> on metal lath, or 2 in. reinforced gypsum slabs covered with ½ in. mortar, on joists. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lbs. gypsum, on metal lath. (9)	4 hrs.
	2½ in. concrete on steel plate deck. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lbs. gypsum on metal lath. (9)	4 hrs.
	2½ in. concrete on steel plate deck. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lbs. gypsum, on metal lath. (9)	3 hrs.
	2½ in. cinder concrete plus ½ in. cement mortar finish, on steel plate deck. Ceiling of 1 1/8 in. 1:1 gypsum and sand plaster on metal lath. (9)	3 hrs.
	2 in. concrete floor slab <sup>v</sup> on metal lath, or 2 in. reinforced portland cement concrete plank with joints thoroughly grouted, on joists. Ceiling of 1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath. Plaster mix: 4:1 by weight or approximately 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. (32)	3 hrs.
	2½ in. concrete floor slab <sup>v</sup> on metal lath, or 2 in. reinforced gypsum tile covered with ½ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lbs. gypsum, on metal lath. (9)	3 hrs.
	2 5/8 in. reinforced gypsum concrete on 3/8 in. gypsum plaster board supported by joists of which the lower 2/3 is encased in precast gypsum and the upper extends into the floor slab; 1 in. minimum fireproofing on joists. Ceiling of ¾ in. 1:1 gypsum and sand plaster on metal lath. (22)	3 hrs.

Letter superscripts refer to notes, page 641.



**FLOOR AND CEILING CONSTRUCTION – Continued****Steel Joists or Beams<sup>u</sup> (Continued)**

Ceiling Type	Details of Construction	Rating
<b>Plaster on Metal Lath</b>	2 in. concrete floor slab <sup>v</sup> on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lbs. gypsum, on metal lath. (9)	2½ hrs.
	2½ in. concrete on steel plate deck. Ceiling of 1 in. 1:2 gypsum and sand plaster on metal lath. (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of 1 1/8 in. 1:1 gypsum-sand plaster, on metal lath; or 1½ in. 1:2 gypsum-sand plaster on ribbed metal lath (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster, or 1 in. 1:2, 1:2½ portland cement and sand plaster with 10 lbs. hydrated lime added per bag cement, on metal lath. (9)	2 hrs.
	2¼ in. concrete floor slab <sup>v</sup> on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar finish, on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	2 hrs.
	2½ in. concrete slab on ½ in. x 2¼ in. corrugated steel form unit. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath attached to ¾ in. furring channels with single strand of No. 18 SWG hanger wire every 6 in. along channels. Furring channels attached to bottom chord of steel joists with double strands of No. 18 SWG wire at each intersection. (118)	2 hrs.
	2 in. concrete floor slab <sup>v</sup> on metal lath, or 2 in. reinforced gypsum tile, on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster, or ¾ in. 1:2, 1:3 portland cement and sand plaster with 3 lbs. asbestos fiber and 15 lbs. hydrated lime per bag cement, on metal lath. (9)	1½ hrs.
	1½ in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1½ hrs.
	1 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (33)	1 hr.
	7/8 in. wood flooring nailed to wood sleepers on covering of asbestos paper weighing 14 lbs. per 100 sq. ft. cemented on sheet steel deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1 hr. comb.
<b>Reinforced Gypsum Tile and Plaster</b>	2 in. concrete slab <sup>v</sup> on metal lath, or 2 in. precast reinforced portland cement concrete or, gypsum slabs, on joists, the precast slabs to be finished with top coating of ¼ in. mortar. Ceiling of 2 in. reinforced gypsum tile anchored to joists with metal ties and covered with ½ in. 1:3 gypsum and sand plaster. (9)	4 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. reinforced gypsum tile with ½ in. 1:3 gypsum and sand plaster. Tile clipped to channels which are clipped to joists. (9)	4 hrs.

Letter superscripts refer to notes, page 641.

**FLOOR AND CEILING CONSTRUCTION – Continued*****Steel Joists or Beams<sup>u</sup> (Continued)***

Ceiling Type	Details of Construction	Rating
<b>Reinforced Gypsum Tile and Plaster</b>	2½ in. reinforced gypsum concrete on 3/8 in. gypsum plaster board on joists, or 2½ in. cinder concrete on metal floor lath on joists. Ceiling of 2 in. precast, reinforced gypsum ceiling tile suspended ½ in. below 1 in. furring channels in turn suspended ½ in. below joists; gypsum ceiling tile corrugated on under surface for effective plaster bond; all joints grouted with gypsum; ceiling finished with ½ in. 1:1 gypsum and sand plaster. (17)	3 hrs.
	2 in. precast, reinforced gypsum slabs on joists; joints grouted with gypsum. Ceiling of 2 in. precast, reinforced gypsum attached to bottoms of joists; joints grouted with gypsum; plastered with ¾ in. gypsum and sand plaster. (20)	3 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. interlocking unreinforced gypsum tile supported on upper face of lower beam flange, with ½ in. 1:3 gypsum and sand plaster. (9)	2 hrs.

***Wood Joists<sup>m</sup>, 2 x 10 in. or Larger. Not More Than 16 in. O.C.***

Ceiling Type	Details of Construction	Rating
	Two layers ½ in. gypsum wallboard. First layer applied perpendicular to joists with end joints on joists and staggered; wallboard attached to joists with 5d nails, 15/8 in. long, 0.072 in. shank diameter, 7/32 in. head diameter, spaced 18 in. O.C. 20 gauge steel wire fabric, 1 in. hexagonal mesh, applied perpendicular to joists and attached to joists over first layer of wallboard with 8d nails, 2 3/8 in. long, 0.099 in. shank diameter, 17/64 in. head diameter, spaced 5 in. O.C. and twisted in wire fabric. Second layer of wallboard applied perpendicular to joists over first layer and wire fabric; wallboard attached to joists with 8d nails, 2 3/8 in. long, 0.099 in. shank diameter, 17/64 in. head diameter, spaced 5 in. O.C. Paper tape embedded in joint compound over joints. Exposed nailheads covered with joint compound. (53)	1 hr. comb.

Letter superscripts refer to notes, page 641.

### FLOOR-CEILING ASSEMBLIES – Continued

#### *Wood Joists<sup>mn</sup>, 2 x 10 in. or Larger. Not More Than 16 in. O.C.*

Ceiling Type	Details of Construction	Rating
<b>Plaster and Gypsum Lath</b>	½ in. gypsum-perlite plaster on 3/8 in. gypsum lath. Lath applied perpendicular to joists and attached to joists with blued, plasterboard nails, 1¾ in. long, 0.0915 in. shank diameter, 3/8 in. head diameter, spaced 4 in. O.C. Plaster reinforced with 20 gauge steel wire fabric. 1 in. hexagonal mesh, applied perpendicular to joists over lath and attached with 8d cement-coated nails, 2 3/8 in. long, 0.099 in. shank diameter, 17/64 in. head diameter, spaced 6 in. O.C. Wire of fabric wrapped around shank of each nail. Plaster mix: scratch and brown coats, 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (51)	1½ hrs. comb.
	½ in. gypsum-sand plaster on 3/8 in. perforated gypsum lath. Lath applied perpendicular to joists and attached to joists with blued, plasterboard nails, 1 1/8 in. long, 0.0915 in. shank diameter, 3/8 in. head diameter, spaced 4 in. O.C. Plaster reinforced with 3 in. wide strips of expanded metal lath applied over joints of gypsum lath and attached to joists through lath with roofing nails, 1¾ in. long, 0.1205 in. shank diameter, ½ in. head diameter, spaced 5 in. O.C. for strips parallel to joists and two nails per joist for strips perpendicular to joists. Plaster mix: 1:2 fibered gypsum to sand. (9)	1 hr. comb.
	Floor consisting of 1 in. (nominal) subfloor and tongue and groove finish floor with asbestos paper weighing 12 to 14 lbs. per 100 sq. ft. between. Ceiling of ½ in. gypsum-sand plaster on 3/8 in. perforated gypsum lath. Lath applied perpendicular to joists and attached to joists with blued, plasterboard nails, 1 1/8 in. long, 0.0915 in. shank diameter, 3/8 in. head diameter, spaced 4 in. O.C. Plaster reinforced with 3 in. wide strips of expanded metal lath applied over joints of gypsum lath and attached to joists through lath with roofing nails, 1¾ in. long, 0.1205 in. shank diameter. ½ in. head diameter, spaced 5 in. O.C. for strips parallel to joists and two nails per joist for strips perpendicular to joists. Plaster mix: 1:2 fibered gypsum to sand. (9)	1 hr. comb.
	½ in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath. Lath applied perpendicular to joists and attached to joists with blued, plasterboard nails, 1¼ in. long, 0.0915 in. shank diameter, 19/64 in. head diameter, spaced 5 in. O.C. Plaster mix: scratch and brown coats, 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (52)	1 hr. comb.
<b>Plaster and Metal Lath</b>	¾ in. gypsum-perlite on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 1 in. long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 4 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft., and brown coat 3 cu. ft., perlite to 100 lbs. fibered gypsum. (57)	1½ hrs. comb.

Letter superscripts refer to notes, page 641.

### FLOOR-CEILING ASSEMBLIES – Continued

#### *Wood Joists<sup>mn</sup>, 2 x 10 in. or Larger. Not More Than 16 in. O.C. (Continued)*

Ceiling Type	Details of Construction	Rating
<b>Plaster and Metal Lath</b>	$\frac{3}{4}$ in. gypsum-vermiculite plaster on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 10 in. long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 4 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft., and brown coat 3 cu. ft., vermiculite to 100 lbs. fibered gypsum. (58)	1½ hrs. comb.
	$\frac{3}{4}$ in. gypsum-sand plaster on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 1½ in long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 6 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: 1:2 and 1:3, fibered gypsum to sand, for scratch and brown coats, respectively. (9)	1 hr. comb.
	Floor consisting of 1 in. (nominal) subfloor and tongue and groove finish floor with asbestos paper weighing 12 to 14 lbs. per 100 sq. ft. between. Ceiling of $\frac{3}{4}$ in. gypsum-sand plaster on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 1½ in. long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 6 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: 1:2 and 1:3, fibered gypsum to sand, for scratch and brown coats, respectively. (9)	1 hr. comb.
	$\frac{3}{4}$ in. portland cement-sand plaster on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 1½ in. long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 6 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: 1:2 and 1:3, portland cement to sand, for scratch and brown coats, respectively, with 3 lbs. asbestos fiber and 15 lbs. hydrated lime added per 94-lb. bag of cement. (9)	1 hr. comb.
	Floor consisting of 1 in. (nominal) subfloor and tongue and groove finish floor with two layers of kraft paper having tar between layers and weighing 5.6 lbs. per 100 sq. ft. between sub and finish floor. Ceiling of $\frac{3}{4}$ in. portland cement-sand plaster on diamond mesh, expanded metal lath weighing 3.4 lbs. per sq. yd. Metal lath attached to joists with barbed roofing nails, 1½ in. long, 0.1205 in. shank diameter, 7/16 in. head diameter, spaced 6 in. O.C. Scratch coat applied with sufficient pressure to form large keys on back of lath. Plaster mix: 1:2 and 1:3, portland cement to sand, for scratch and brown coats, respectively, with 3 lbs. asbestos fiber and 15 lbs. hydrated lime added per 94-lb. bag of cement. (9)	1 hr. comb.

Letter superscripts refer to notes, page 641.

## FLOOR-CEILING ASSEMBLIES – Continued

### *Heavy Timber*

Ceiling Type	Details of Construction	Rating
<b>None</b>	2x6 in., minimum No. 2 grade, lumber laid in horizontal position to form a 6 in. subfloor. Pieces fastened together with two rows of 16d nails, 3½ in. long, 0.162 in. shank diameter, 11/32 in. head diameter. One row near top and other row near bottom of lumber. Nails spaced, in staggered pattern, 12 in. O.C. in each row. (31)	1 hr. comb.

## WALLS AND PARTITIONS

### *Brick, Hollow Tile and Hollow Tile Brick faced*

Types	Details of Construction	Combustible Members Framed in Walls <sup>a</sup>				Members Framed in Wall: None or Noncombustible			
		Minimum Thickness <sup>b</sup> , Inches for Ratings of				Minimum Thickness <sup>b</sup> , Inches for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.	4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Brick</b> (clay, shale, concrete or sand-lime)	Solid walls plastered one side or unplastered. (1, 2, 3, 93)	12	12	8	8	8	8	8	4
	Solid walls plastered each side with ½ in. 1:3 gypsum and sand or portland cement and sand plaster, or 5/8 in. 1:2½ portland cement and sand or lime and sand plaster. (1, 2, 3, 93)	12	8	8	8	8	8	4	4
	Hollow "Cavity" type walls; ¼ in. round metal ties spaced 2 ft. horizontally every 6 <sup>th</sup> course. (9, 93)	---	---	--- <sup>d</sup>	10	10	10	10	10
<b>Hollow Tile<sup>e</sup></b> (clay or shale) Load Bearing	U = units	C = cells		See Note g					
	Unplastered. (4)	16 <sub>4C</sub> <sup>2U</sup>	16 <sub>4C</sub> <sup>2U</sup>	12 <sub>3C</sub>	12 <sub>3C</sub> <sup>h</sup>	12 <sub>4C</sub> <sup>2U</sup>	12 <sub>3C</sub> <sup>2U</sup>	12 <sub>3C</sub>	8 <sub>2C</sub>
	Plastered one side <sup>i</sup> with 5/8 in. 1:3 gypsum sand plaster. (4)	16 <sub>4C</sub> <sup>2U</sup>	12 <sub>3C</sub>	12 <sub>2C</sub> <sup>h</sup>	8 <sub>2C</sub>	12 <sub>3C</sub> <sup>2U</sup>	12 <sub>3C</sub>	8 <sub>3C</sub>	8 <sub>2C</sub>
	Plaster each side as above. (4)	16 <sub>4C</sub> <sup>2U</sup>	12 <sub>3C</sub>	12 <sub>2C</sub> <sup>h</sup>	8 <sub>2C</sub>	12 <sub>3C</sub>	8 <sub>2C</sub>	8 <sub>2C</sub>	8 <sub>2C</sub>
<b>Hollow Tile, Brick Faced</b>	Hollow clay (or shale) load-bearing tile of thickness shown, bonded to 4 in. brick facing, unplastered. (9)	---	---	8	4	8	4	4	4
	Sane as above with tile side plastered with 5/8 in. 1:3 gypsum and sand plaster. (4, 9)	---	12	8	4	4	4	4	4

### *Brick*

Type	Details of Construction	Rating
<b>Cored</b>	6 in. units 76% solid, unplastered; with noncombustible or no members framed into the wall. (91)	2½ hrs.
	4 in. units 83% solid, unplastered; with noncombustible or no members framed into the wall. (139)	1 hr.

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued****Brick**

Type	Details of Construction	Rating
<b>Cored</b>	8 in. units 71% solid, plaster on both sides with 5/8 in. 1:3 gypsum and sand plaster: (64)	
	With noncombustible or no members framed into wall.	4 hrs.
	With combustible framed <sup>a</sup> in members fully embedded in mortar.	3 hrs.
	With unembedded combustible members framed <sup>a</sup> into wall.	2 hrs.
	8 in. units 71% solid, unplastered: (64)	
	With noncombustible or no members framed into wall.	3 hrs.
	With combustible framed <sup>a</sup> in members fully embedded in mortar.	2 hrs.
	With unembedded combustible members framed <sup>a</sup> into wall.	1½ hrs.

**Clay Tile**

Type	Details of Construction	Rating
<b>Hollow</b>	8 in. wall units 43% solid, 3 cells in wall thickness: (4)	
	Noncombustible or no members framed into the wall.	
	Unplastered	2 hrs.
	Plastered one side	3 hrs.
	Plastered both sides	4 hrs.
	Combustible members framed in.	
	Plaster one side	1 hr.
	8 in. wall units 49% solid, 2 cells in wall thickness: (4)	
	Noncombustible or no members framed into the wall.	
	Unplastered	2 hrs.
	Plastered one side	3 hrs.
	Plastered both sides	4 hrs.
	Combustible members framed in.	
	Unplastered	1 hr.
Plaster one side	2 hrs.	
<b>Solid and Hollow</b>	6 3/8 in. partition with two units in wall thickness, one unit 3 7/8 in., other 1 3/4 in. thick, with 3/4 in. joint between filled mortar. Position of units reversed on alternating courses. Tile cored not to exceed 25% in 4 in. unit, and not to exceed 15% in 1 3/4 in. unit. (13)	3 hrs.*
	6 in. partition consisting of 4 in. tile cored not to exceed 41%, faced on fire exposed side with 1 3/4 in. tile cored not to exceed 15% with 3/8 in. mortar filled joint between, and plastered on opposite side with 3/4 in. 1:3 gypsum and sand plaster. (12)	3 hrs.*
	6 in. partition consisting of 4 in. tile cored not to exceed 40.5%, faced on fire exposed side with 1 3/4 in. tile cored not to exceed 22.5% with 1/4 in. mortar fill between. (117)	2 hrs.*

\* Nonbearing

Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

### Clay Tile

Type	Details of Construction	Rating
<b>Solid and Hollow</b>	4 in. facing tile cored not to exceed 25%, plastered on back side with ¾ in. 1:3 gypsum and sand plaster (14)	2 hrs.*
	4 in. facing tile cored not to exceed 30%, plastered on back side with ¾ in. gypsum-vermiculite plaster composed of 3½ cu. ft. vermiculite to 100 lbs. gypsum. (16)	2 hrs.*
	4 in. hollow tile of medium burned clay, not less than 60% solid, two cells in thickness; both sides plastered with 5/8 in. 1:3 gypsum and sand plaster. (9, 59)	2 hrs.*
	6 in. hollow tile of medium burned clay, not less than 45% solid, two cells in thickness; both sides plastered with 5/8 in. 1:3 gypsum and sand plaster. (9, 59)	2 hrs.*
	6 in. hollow tile (stretcher) with cored shells, glazed one face, not less than 71% solid, three horizontal cells in thickness, unplastered. (112)	2 hrs.*
	6 in. hollow tile of medium burned clay, not less than 30% solid; plastered on both sides with 5/8 in. 1:3 gypsum and sand plaster. (9, 59)	1½ hrs.*
	4 in. hollow tile (stretcher) with surface and through perforations on one face, not less than 72% solid, two horizontal cells in thickness, 1 in. thick fibrous glass pad in ¾ in. thick cell on perforated side, unplastered. Through perforations into cell not more than 9% of face area, additional surface perforations not more than 2% of face area. (111)	1 hr.*
	3 in. hollow tile not less than 50% solid, or 4 in. hollow tile not less than 40% solid, of medium burned clay; plastered on both sides with 5/8 in. 1:3 gypsum and sand plaster (9, 59)	1 hr.*
	4 in facing tile cored not to exceed 47%, plastered on back side with ¾ in. 1:3 gypsum and sand plaster (30)	1 hr.*
	4 in. hollow tile plastered each side with ¾ in. 1:3 gypsum and sand plaster. (5)	1 hr.*
	6 in. hollow tile plastered each side with 5/8 in. 1:3 gypsum and sand plaster. (9)	1 hr.*
	4 in hollow tile having 2 cells in wall thickness plastered each side with 5/8 in. 1:3 gypsum and sand plaster (9)	1 hr.*

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued****Composite Units**

Type	Details of Construction	Rating
<b>With Brick Veneer</b>	9½ in. partition consisting of 3 in. thick portland cement coated wood fiber units having a minimum density of 30 pounds per cubic foot spaced 2¼, in. from brick wythe 3¾ in. thick. Two wythes bonded together by ¼ in. diameter "Z" shaped zinc alloy rods spaced 18½ in. vertically and 24 in. horizontally. Composite units plastered on outer face with ½ in. 1:2 gypsum and sand plaster. (104)	4 hrs.*

**Stone Masonry**

Type	Details of Construction	Rating
<b>Limestone</b>	4 in wall of Indiana limestone panels. Joints have ½ in. diameter steel dowel pins 2 in. minimum length, spaced 30 in. on centers and mortar consisting of 1 part Type II masonry cement to 3 parts sand. (143)	1 hrs.*

**Estimated Ratings**

Type	Details of Protection	Minimum Thickness, Inches, for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Stone Masonry</b>	Solid walls	12	12	12	8

**Concrete**

Type	Details of Construction	Rating
<b>Cellular Concrete</b>	8 in. monolithic cellular concrete wall reinforced with two layers of 4 in. X 4 in., 6 ga. X 6 ga. welded wire fabric placed 1 in. from outer faces and supported by cellular concrete spacers 16 in. on centers in rows 16 in. apart. Cellular concrete produced by mixing 94 lb. portland cement with 5 gal. of water and foaming agents expanding 130 ± 30 percent of original pour volume when set, and having a density of 45 ± 5 lb. per cu. ft. and a compressive strength averaging 300 ± 100 psi at 28 days. (144)	4 hrs.**

\* Nonbearing

\*\* Rated as load bearing with noncombustible, or no members, framed in wall.

Letter superscripts refer to notes, page 641.



## WALLS AND PARTITIONS - Continued

### Concrete (Continued)

Type	Details of Construction	Rating
<b>Precast</b>	8 in. hollow units of expanded slag concrete, 52% solid, minimum wall and web thickness 1½ in., unplastered. Units laid vertically on lintel with flange of ring anchors in center groove of units at the joints on the lintel. 3 in. paper tubing set on top of ring anchors and pressed into joint. Joints grouted to paper tubing. 3/8 in. horizontal reinforcing rod inserted through the exposed section of ring anchors and tied in place. Floor strap anchors tied to reinforcing rod. All steel covered with concrete. (98)	4 hrs.
	6 in. hollow panels of pumice concrete; core holes 3 5/8 in. to 3 7/8 in., face shell thickness 1 in. to 1¼ in. Panels held in alignment and secured together by removing top 5 in. of webs in each panel, and core holes, joints and top 5 in. filled with 1:5.33 cement sand grout. Joints and top of panels reinforced with ½ in. reinforcing bar. (101)	4 hrs.*
	2 in. precast concrete slabs of expanded shale aggregate, 16 in. by 8 ft. laid horizontally and attached each side of 8 in. steel columns spaced on 8 ft. centers. Horizontal joints shiplap type, sealed with mastic. Vertical joints butt type centered over columns and calked with asbestos wicking and sealed with mastic. (77)	2½ hrs.*

### Estimated Ratings

Type	Details of Protection	Minimum Thickness <sup>b</sup> , Inches, for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Plain</b>	Solid walls, unplastered:				
	Group 1 Aggregates <sup>k</sup> , ¾ in. maximum size. (11)	6½	6	5	3½
	Group 2 Aggregates <sup>k</sup> , ¾ in. maximum size. (11, 33)	7½	6½	5½	4*
	Solid walls plastered each side with ¾ in. portland cement stucco or portland cement or gypsum plaster:				
	Group 1 Aggregates <sup>k</sup> , ¾ in. maximum size. (11)	5	4	3*	3*
	Group 2 Aggregates <sup>k</sup> , ¾ in. maximum size. (11)	6	5	4	3*

\* Nonbearing

Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

### Concrete Masonry Units (Continued)

Aggregate Type	Details of Construction	Rating
<b>Expanded Shale, Brick-faced</b>	6 in. units 61% solid; unplastered; faced with 2¼ in. brick. (9, 60)	4 hrs. **
<b>Expanded Slag, Brick-faced</b>	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with ¾ in. brick. (9, 60)	4 hrs. **
<b>Cinder Brick-faced</b>	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with ¾ in. brick. (9, 60)	4 hrs. **
	6 in. unplastered units, 61% solid; faced with 2¼ in. brick. (60)	4 hrs. **
<b>Expanded Shale, Clay and Slate</b>	10 in. units 60% solid; unplastered. (9, 60)	4 hrs. **
	6 in. units 89.1% solid; unplastered. (142)	4 hrs. *
	8 in. units, minimum face shell thickness 1½ in., minimum end shell thickness 1-5/16 in. and minimum interior web thickness 3-1/16 in. unplastered. Concrete studs built into wall on 2 ft. centers by filling every third cell along the length of the wall. Each stud reinforced with ½ in. round bar. (74)	2 hrs.*
	4 in. units 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (60)	2 hrs.*
	6 in units 68.8% solid, 3.59 in. equivalent thickness <sup>kk</sup> , unplastered. (138)	2 hrs.*
	4 in. units 100% solid, 3.40 in. equivalent thickness <sup>kk</sup> , unplastered. (139)	2 hrs.*
	6 in. units 61% solid; unplastered. (9.60)	1½ hrs.*
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9.60)	1½ hrs.*
<b>Expanded Slag</b>	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9.60)	4 hrs. **
	6 in. units 76% solid; unplastered. (9.60)	3 hrs. **
	6 in. units 61% solid; unplastered. (9.60)	2 hrs. *
	6 in. units, 50% solid; plastered on one side with ½ in. 1:3gypsum and sand plaster. (9.60)	2 hrs. *
	4 in. units. 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9. 60)	2 hrs. *
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9. 60)	2 hrs. *
	4 in. units, 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9. 60)	1½ hrs.*
	4 in. units 63% solid; unplastered. (9. 60)	1 hr.*

\* Nonbearing

\*\* Rated as load bearing with noncombustible, or no members, framed in wall.

\*\*\* With combustible members framed<sup>a</sup> into the wall, the rating is 2 hrs.

Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

## Concrete Masonry Units (Continued)

Aggregate Type	Details of Construction		Rating							
<b>Pumice</b>	10 in. units 60% solid; unplastered. (60)		4 hrs.**							
	4 in. units 63% solid; unplastered. (9, 60)		1 hr.*							
<b>Calceous Gravel</b>	8 in. unplastered units, 78% solid. (61)		3 hrs.**							
	8 in. unplastered units, 57% solid. (61)		2 hrs.**							
	4 in. units 63% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 61)		1½ hrs.*							
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 61)		1 hr.*							
<b>Cinder</b>	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 60)		3 hrs.***							
	6 in. units 61% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60)		2 hrs.*							
	6 in. units 50% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60)		2 hrs.*							
	6 in. units unplastered, 61% solid. (9, 60)		1½ hrs.*							
<b>Siliceous Gravel</b>	12 in unplastered wall, consisting of 8 in. units 57% solid and 4 in. units 67% solid. (9, 61)		4 hrs.***							
	12 in. units 58% solid; plastered both sides with ½ in. 1:3 gypsum and sand plaster. (61)		4 hrs.§							
	4 in. units 74% solid; plastered on both sides with ½ in 1:3 gypsum and sand plaster. (9, 61)		1 hr.*							
Type	Type of Aggregate	Minimum Equivalent Thickness <sup>kk</sup> and Approximate Face Shell and Web Thicknesses, Inches								
		2 hrs.**			3 hrs.**			4 hrs.**		
		Face Shell	Web	Equiva-lent Thick-ness	Face Shell	Web	Equiva-lent Thick-ness	Face Shell	Web	Equiva-lent Thick-ness
<b>8 or 12 in. Units<sup>hh</sup></b>	Natural, by-product, and processed, except those listed below. (96)	1¼	1	---	1½	1	---	2 1/8	1½	---
	Expanded clay, shale, or slate, rotary kiln process (96)	1 1/8	1	---	1 3/8	1	---	---	---	---
	Expanded clay, shale, or slate, rotary kiln process (96)	1¼	---	3.95 <sup>ll</sup>	1½	---	4.50 <sup>zz</sup>	1¾	---	5.35
	Expanded clay, shale, or slate, sintering process. (96)	1¼	---	4.20	1½	---	4.75	1¾	---	5.35
	Expanded slag. (96)	1 1/8	1	---	1 3/8	1	---	1 5/8	1	---
	Expanded slag. (140)	1¼	---	4.13 <sup>mmm</sup>	1½	---	4.78 <sup>mmm</sup>	1¾	---	5.30
	Pumis. (96)	---	---	---	---	---	---	1¼	1	---

\* Nonbearing

\*\* Rated as load bearing with noncombustible, or no members, framed in wall.

\*\*\* With combustible members framed<sup>a</sup> into the wall, the rating is 2 hrs.§ With combustible members framed<sup>a</sup> into the wall, the rating is 2½ hrs.

Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

### Concrete Masonry Units (Continued)

Type	Details of Construction	Members Framed in Wall: None or Noncombustible <sup>f</sup>			
		Minimum Equivalent Thickness <sup>e</sup> Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
<b>Unlisted Units</b>	Coarse aggregate, expanded slag, or pumice. (43)	4.7	4.0	3.2	2.1
	Coarse aggregate, expanded shale, clay, or slate (43)	5.1	4.4	3.6	2.6
	Coarse aggregate, limestone, cinders or unexpanded slag. (43)	5.9	5.0	4.0	2.7
	Coarse aggregate, calcareous gravel. (43)	6.2	5.3	4.2	2.8
	Coarse aggregate, siliceous gravel. (43)	6.7	5.7	4.5	3.0

### Gypsum Block

Type	Details of Construction	Rating
<b>Gypsum Block**</b>	4 in. hollow blocks plastered each side with ½ in. 1:3 gypsum and sand plaster. (6, 83)	4 hrs.*
	3 in. hollow blocks plastered each side as above. (6, 82)	3 hrs.*
	3 in. solid blocks, unplastered. (6)	3 hrs.*
	4 in. hollow blocks plastered on either side with ½ in. 1:3 gypsum and sand plaster. (45, 89)	3 hrs.*
	3 in. hollow blocks plastered on one side with ½ in. 1:3 gypsum and sand plaster. (44)	1½ hrs.*
	2 in. solid blocks, unplastered. (6, 9)	1 hrs.*
	3 in. hollow blocks, unplastered. (9)	1 hrs.*

\* Nonbearing

\*\* Hollow gypsum blocks – Minimum 70% solid.

Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

### *Gypsum Wallboard Partitions – Hollow (Continued)*

Type	Details of Construction	Rating
<b>Unlisted</b>	3-1/8 in. thick wall consisting of 1/2 in. gypsum wallboard laminated to 1 in. gypsum coreboard with joint finish compound and 2 in. screws not more than 2 ft. 3 in. on centers vertically. Each face set in No. 22 gauge angles anchored 2 ft. on centers providing 1-1/8 in. space between coreboard. (130)	1 hr.*
<b>Gypsum Wallboard, Lath, or Backing Board</b>	4-1/8 in. partition consisting of 1/2 in. gypsum wallboard, and 1 in. gypsum coreboard with V-shaped tongue and groove edges, attached to 22 gauge steel angles at floor, ceiling and edges to provide 1-1/8 in. space between coreboard layers. Coreboard, with vertical joints offset 12 in. from joints of opposite coreboard, attached with two No.8 by 1 1/4 in. self-tapping screws to both floor and ceiling runners, one screw per corner spaced 4 in. from vertical edge of each sheet and to angles at edges with screws spaced 24 in. on centers. Wallboard, with vertical joints staggered from joints of coreboard, laminated to coreboard with joint compound adhesive and No.7 by 1 1/4 in. steel screws spaced 27 in. on centers along vertical centerlines and edges of sheets and attached to both floor and ceiling angles with four No. 10 by 2 in. self-tapping screws for each 48 in. or width. Joints covered with tape and joint compound adhesive. (130)	2 hrs.*

### *Gypsum Wallboard Partitions – Solid, Without Steel Framing (Continued)*

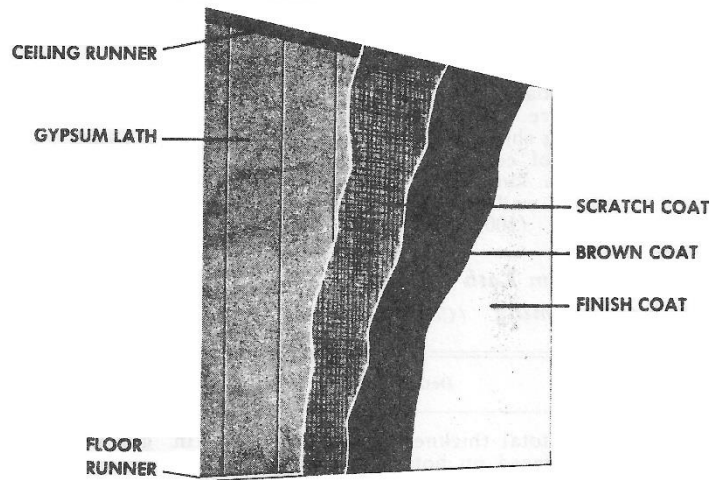
Type	Details of Construction	Rating
<b>Gypsum Wallboard, Lath, or Backing Board</b>	2 in. partition of panels fabricated of 2 layers of 5/8 in. gypsum wallboard and 1 in. gypsum coreboard supported by 18 gauge, two-piece floor, ceiling and edge runners. The panels fabricated by laminating the face layers of gypsum wallboard to the coreboard with joint compound adhesive to form a 1 1/2 in. tongue and a groove edge. Strip of 2 1/4 by 1/2 in. gypsum wallboard placed in floor runner and in one edge runner. Panels secured in runners by closure plates with No. 6 by 1/2 in. sheet metal screws spaced 17 1/2 in. on centers. Joints and screw heads covered with joint compound adhesive. (124)	

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

***Plaster and Gypsum Lath Partitions – Solid, Without Steel Framing***



Plaster Type	Details of Construction	Rating
<b>Gypsum and Perlite</b>	2 in. total thickness consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum-perlite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. gypsum. (63)	1½ hrs.*
<b>Gypsum and Sand</b>	2 in. total thickness, consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum and sand plaster. Top of lath attached to steel ceiling runner, and bottom engaged in groove of a wooden floor runner impregnated with fire retardant chemicals. Plaster mix for scratch coat 1:1 and brown coat 1:2 gypsum and sand. (54)	1½ hr.* comb
	2 in total thickness of 13/16 in. 1:1, 1:2 gypsum and sand plaster each side 3/8 in. gypsum lath inserted at top and bottom in steel runners. (37)	1 hr.*
	2 in. total thickness of ¾ in. 1:1, 1:2 gypsum and sand plaster each side ½ in. gypsum lath inserted at top and bottom in steel runners. (41)	1 hr.*
	2 in. total thickness consisting of 1in. laminated core made up of two layers of ½ in. plain gypsum lath faced on both sides with ½ in. 1:2½ gypsum and sand plaster. Gypsum lath joined together by means of 8d common nails driven at angle through shiplap joints of lath. Top of lath wire tied to No. 24 gauge steel ceiling runner strip and bottom of lath placed in metal base clips. (109)	1 hr.*

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued*****Metal Partition Panel Units***

Core Type	Details of Construction	Rating
<b>Gypsum Wallboard</b>	5 in. wall consisting of four layers of ½ in. gypsum wallboard applied so that joints in adjacent layers are staggered. 1½ in. 18 gauge fluted metal facing sheets with tongue and groove, applied each side of core, and bolted together with ¼ in. by 2¾ in. long bolts. Wall secured to steel angles at floor, wall and ceiling with ¼ in. by 2¾ in. long bolts. (100)	2½ hrs.*

***Plaster and Gypsum Lath Partitions – Solid, Without Steel Framing (Continued)***

Plaster Type	Details of Construction	Rating
<b>Gypsum and Vermiculite</b>	2½ in. total thickness consisting of ½ in gypsum lath, faced on both sides with 1 in. gypsum-vermiculite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. fibered gypsum. (79)	2 hrs.*

***Plaster and Gypsum Lath Partitions – Solid, Steel Framing Embedded in Plaster***

<b>Gypsum and Sand</b>	2-1/8 in. total thickness of 7/8 in. 1:1 gypsum and sand plaster each side of 3/8 in. gypsum lath; steel stud supports. (15)	1 hrs.*
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***Plaster and Metal Lath Partitions – Hollow, Exterior Walls, Finished Each Side as Noted***

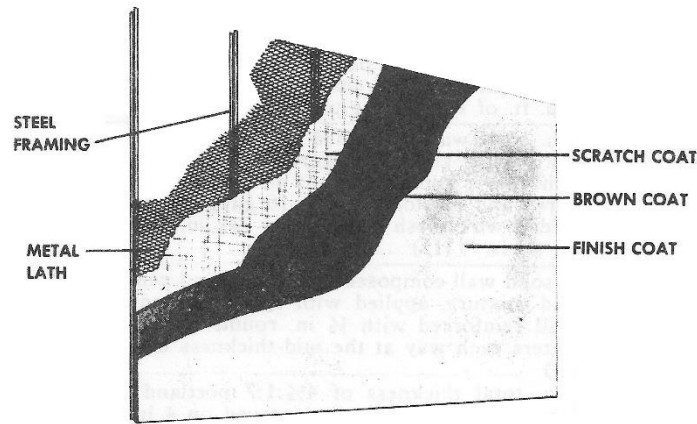
<b>Gypsum and Sand</b>	5-3/8 in. wall consisting of ¾ in. 1:2, 1:2 gypsum and sand plaster on interior side and 1 in. 1:3½, 1:3½ portland cement and sand on exterior side, plaster applied to 3-5/8 in. metal lath corrugated core sections (24 in. wide) covered with metal lath backed with paper mounted on aluminum foil with asphalt. 3-5/8 in. No. 16 gauge steel "Z" framing spaced 48 in. on centers and secured to overlapping metal lath with wire ties 12 in. on centers. Intermediate joints having metal lath overlap and wire tied 12 in. on centers. Wall wire tied 12 in. on centers to steel floor and ceiling channels. (122)	1½ hrs.*
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\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

*Plaster and Metal Lath Partitions – Solid, Steel Framing or Reinforcing Embedded in Plaster*



Plaster Type	Details of Construction	Rating
<b>Gypsum Neat</b>	2½ in. total thickness of neat gypsum plaster on metal lath attached to ¾ in. or 1 in. steel channels. (9)	2½ hrs.*
<b>Gypsum and Perlite</b>	1½ in. gypsum-perlite plaster on metal lath attached to ¾ in. steel channels. Plaster mix: for scratch and brown coats 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (66)	1 hr.*
<b>Gypsum and Sand</b>	2½ in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath on steel studs. (9)	2 hrs.*
	2 in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath attached to ¾ in. or 1 in. steel channels. (9)	1½ hrs.*
	2½ in. total thickness of 1:2, 1:3 gypsum and sand plaster on metal lath on steel studs. (7, 9)	1 hr.*
	2¼ in. total thickness of ¾ in. plaster of 86 parts gypsum, 12 parts sawdust and 2 parts asbestos fiber each side ¾ in. asbestos lath (medium), with sheet-steel “H” supports. (7)	1 hr.*
	2 in. total thickness of 1:1 gypsum and sand plaster on metal lath on steel studs. (9)	1 hr.*
	2 in. total thickness of 1:2, 1:2 gypsum and sand plaster on metal lath on steel studs. (40)	1 hr.*
<b>Gypsum (unsanded)</b>	2 in. total thickness of unsanded, wood-fibered gypsum plaster on metal lath on steel studs. (94)	2 hrs.*
<b>Gypsum and Vermiculite</b>	2½ in. total thickness of gypsum-vermiculite plaster on metal lath attached to ¾ in. steel channels. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of vermiculite to 100 lbs. gypsum. (79)	2 hrs.*
<b>Portland Cement and Perlite</b>	6-1/8 in. solid wall composed of 1:4 portland cement and perlite concrete aggregate mixture, applied with spray gun equipment to paper-backed wire fabric, and reinforced with 16 gauge 2 in. x 2 in. welded wire mesh fastened to 3-5/8 in. steel channel studs. (115)	4 hrs.*

\* Nonbearing

Letter superscripts refer to notes, page 641.



## WALLS AND PARTITIONS - Continued

### *Plaster and Metal Lath Partitions – Solid, Steel Framing or Reinforcing Embedded in Plaster*

Plaster Type	Details of Construction	Rating
<b>Portland Cement and Sand</b>	6 in. solid wall composed of 1:4 portland cement and sand mixture, applied with spray gun equipment. Wall reinforced with ½ in. round bars on 12 in. centers each way at the mid-thickness of the wall (72)	3 hrs.*
	2½ in. total thickness of 4½:1:7 portland cement, sawdust and sand mortar sprayed on 4 in. x 4 in. welded wire fabric on steel studs. (9)	1 hr.*

### *Plaster and Metal Lath Partitions – Solid, Without Steel Framing*

<b>Gypsum and Sand</b>	2 in. total thickness of 1:2 gypsum and sand plaster, applied equally each side of metal lath attached top and bottom to steel runners. (67)	1 hrs.*
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### *Steel Stud – Brick Veneered*

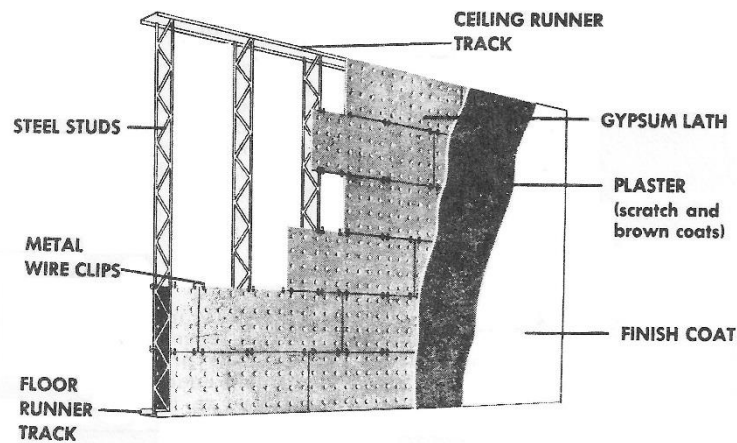
Ceiling Type	Details of Construction	Rating
<b>Gypsum Plaster on Interior</b>	One side sheathed with paper-backed wire lath and 3¾ in. brick veneer secured by filling 1 in. space between brick and lath with mortar. Other side faced with 1 in. paper-backed mineral-wool blanket weighing 0.6 lb. per sq. ft. attached to studs; metal lath laid over blanket and attached to studs, covered with ¾ in. 1:2, 1:3 gypsum and sand plaster. (9)	4 hrs. <sup>z</sup>
	One side with ½ in. gypsum sheathing nailed to 2-5/16 in. studs, and 3¾ in. brick veneer secured with metal ties to studs every fifth course. Other side ½ in. 1:2 gypsum and sand plaster on ½ in. perforated gypsum lath. (78)	2 hrs. <sup>z</sup>
	One side sheathed with ½ in. wood fiber board sheathing next to studs; ¾ in. air space formed with ¾ in. x 1-5/8 in. wood strips placed over the fiber board and secured to the studs; paper-backed wire lath nailed to these strips, 3¾ in. brick veneer held in place by filling ¾ in. space between brick and paper-backed lath with mortar. Inside facing of ¾ in. neat gypsum plaster on metal lath attached to 5/16 in. wood strips secured to edges of the studs. (9)	1½ hrs. <sup>z</sup> comb.

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

*Steel Stud – Hollow Partitions, Plaster on Gypsum Lath, Finished Each Side as Noted*



Finish Type	Details of Construction	Rating
<b>Gypsum and Perlite</b>	1 in. gypsum plaster on 3/8 in. perforated gypsum lath secured to 2½ in. studs by wire clips. Studs attached to No. 22 gauge steel floor and ceiling track. Plaster mix: scratch and brown coats 2 cu. ft. perlite to 100 lbs. of gypsum. (127)	2½ hrs.*
	¾ in gypsum-perlite plaster on 3/8 in. perforated gypsum lath secured to 2½ in. studs by wire clips. Studs attached to No. 22 gauge steel floor and ceiling track. Plaster mix: scratch and brown coats 2 cu. ft. perlite to 100 lbs. extra fibered gypsum. (126)	2 hrs.*
	½ in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached securely to 2½ or 4 in. studs by metal clips and with abutting ends of lath secured to each other with metal finger clips. Plaster mix for scratch and brown coats, 100 lbs. gypsum to 2½ cu. ft. perlite. (48, 110, 114)	1 hr.*
	½ in gypsum-perlite plaster on 3/8 in. plain gypsum lath attached securely to 2½ in. studs by 1-1/8 in. annular nails having 3/8 in. diameter heads spaced 6 in. on centers and with abutting ends of lath secured to each other with metal finger clips. ¾ in. channel bracing placed horizontally through studs at mid-height. Plaster mix: scratch and brown coats, 100 lbs. extra fibered gypsum to 2 cu. ft. perlite (68)	1 hr.*
<b>Gypsum and Sand</b>	½ in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath, attached securely to 2½ or 3/4 in. studs by special metal clips across lath. Abutting ends of lath secured to each other with metal wire clips. Studs pressed into ceiling track and fastened with two double strands of tie-wires; attached to floor track with a double strand of wire ties each side of track. (84, 102, 103)	1½ hrs.*

\* Nonbearing

Letter superscripts refer to notes, page 641.

### WALLS AND PARTITIONS - Continued

*Steel Stud – Hollow Partitions, Plaster on Gypsum Lath, Finished Each Side as Noted*

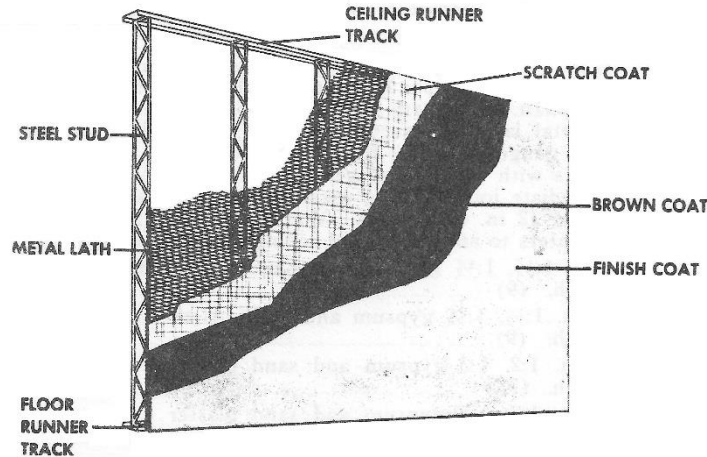
Finish Type	Details of Construction	Rating
<b>Gypsum and Sand</b>	½ in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath, attached securely by special wire clips to ¼ in. rods secured to 1-5/8 in. studs by wire clips. Abutting ends of lath secured to each other with metal wire clips. Studs pressed into ceiling track and fastened with two double strands of No. 18 SWG tie wires attached to floor track. (131)	1½ hrs.*
	¾ in. wall (total thickness) consisting of ¾ in. gypsum and sand plaster on ½ in. gypsum lath attached tightly to ¾ in. channel frame by wire ties. ¾ in. channels spaced 30 in. on centers horizontally and 5 ft. on centers vertically; tied at intersections. Channel frame attached to ¾ in. runner channels at ceiling, floor and wall edge. Plaster mix: scratch coat 100 lbs., brown coat 200 lbs. sand to 100 lbs. fibered gypsum. (107)	1 hr.*
	½ in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath attached securely to 2½ in. nailable studs with 1-1/8 in. long nails having 3/8 in. diameter heads spaced 6 in. on centers. Metal finger clips at intersection of lath joints. ¾ in. channel bracing placed horizontally through studs at mid-height. (135)	1 hr.*
	½ in. 1:1 gypsum and sand plaster on 3/8 in. gypsum lath on steel studs providing 1¼ in. central air space. (15)	1 hr.*
	½ in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath, attached securely to 3¼ in. studs by metal clips, abutting ends of lath secured to each other with metal finger clips. (46)	1 hr.*
	½ in. 1:2½ gypsum and sand plaster on 3/8 in. perforated gypsum lath attached securely to 1-5/8 in. or 2½ in. studs by metal finger clips and abutting ends of lath secured to each other with metal finger clips. (133, 134)	1 hr.*

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

*Steel Stud – Hollow Partitions, Plaster on Metal Lath, Finished Each Side as Noted*



Finish Type	Details of Construction	Rating
<b>Gypsum (unsanded)</b>	1 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.**
	7/8 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.*
	3/4 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	1½ hr.*
<b>Gypsum and Perlite</b>	1-1/8 in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1-5/8 in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.7 cu. ft. perlite. (70)	2 hrs.*
	1-1/8 in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1½ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 4 cu. ft. perlite. (71)	2 hrs.*
	1 in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1-3/8 in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.75 cu. ft. perlite. (73)	2 hrs.*
	1 in. (measured from face of lath) gypsum-perlite plaster, on metal lath attached to 4 in. studs. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. fibered gypsum. (55)	2 hrs.*
<b>Gypsum and Sand</b>	3/4 in. 1:2, 1:2 gypsum and sand plaster on metal lath backed with paper laminated to aluminum foil with asphalt. Metal lath attached to 3-5/8 in. corrugated metal lath core sections (24 in.) secured to No. 16 gauge steel "Z" framing spaced 48 in. on centers with wire ties spaced 12 in. on centers. Intermediate joints having metal lath overlap and wire tied 12 in. on centers. Wall wire tied 12 in. on centers to steel floor and ceiling channels. (123)	2 hrs. comb.
	1 in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	2 hrs.*
	7/8 in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	1½ hrs.*

\* Nonbearing

\*\*Rated as load bearing with noncombustible, or no members, framed into wall.

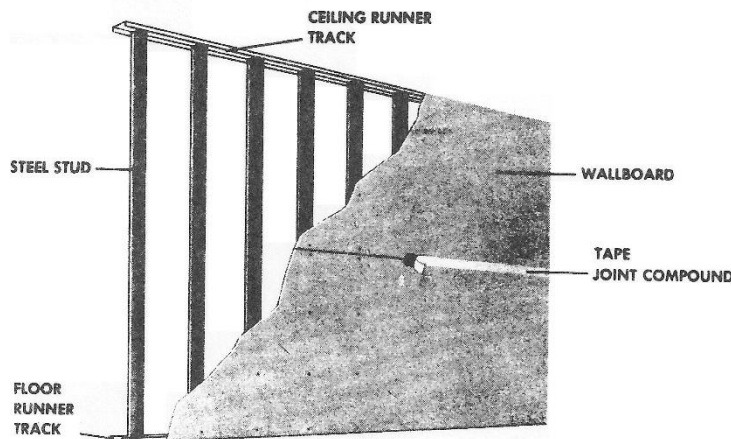
Letter superscripts refer to notes, page 641.

## WALLS AND PARTITIONS - Continued

### *Steel Stud – Hollow Partitions, Plaster on Metal Lath, Finished Each Side as Noted*

Finish Type	Details of Construction	Rating
<b>Gypsum and Sand</b>	7/8 in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	3/4 in. 1:2, 1:2 gypsum and sand plaster on metal lath (7, 9)	1 hr.
	5/8 in. (measured from face of lath) 1:2 gypsum and sand plaster on metal lath attached securely to 2½ in. studs by 3/4 in. annular nails having 3/8 in. diameter heads spaced 6 in. on centers. Lath lapped 1 in. and wire tied 6 in. on centers. 3/4 in. channel bracing placed horizontally through studs at mid-height. (145)	1 hr.*
<b>Portland Cement and Sand</b>	7/8 in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (9)	1 hr.*
	3/4 in. 1:2 portland cement and sand plaster in the scratch coat, 1:3 gypsum and sand plaster in the brown coat, on metal lath. (7)	1 hr.*

### *Steel Stud – Hollow Partitions Without Plaster, Finished Each Side as Noted*



Finish Type	Details of Construction	Rating
<b>Cement Asbestos Board</b>	½ in. cement-asbestos board on 3 in. steel studs; interior space filled with mineral wool under air pressure. (21)	1 hr.*
	3-7/8 in. wall composed of 7/16 in. thick pigmented asbestos board weighing 2.2 to 2.4 lbs. per sq. ft., on open web 20 gauge steel box studs. Space between studs packed solid with mineral wool batts. (85)	1 hr.*
<b>Gypsum Wallboard</b>	5/8 in. gypsum wallboard attached to 3-5/8 in. steel studs, with 2 in. cement coated nails spaced about 7 in. on centers. Joints covered with fiber tape and compound. (87)	1 hr.

\* Nonbearing

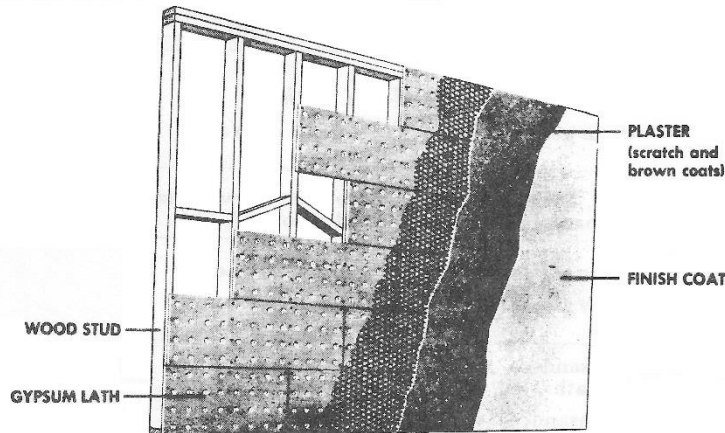
Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

**Wood Stud Partitions – Exterior Walls Only, Studs 2 x 4 in. or larger, Finished Each Side as Noted**

Finish Type	Details of Construction	Rating
<b>Gypsum Board and Cement Asbestos Board</b>	5/32 in. cement-asbestos shingles laid over 14 lbs. per 100 sq. ft. asbestos felt over 3/4 in. wood sheathing on one side; 4 in. strips of 1/2 in. gypsum board over edges of studs under facing of 3/16 in. cement asbestos board on other side; filling of mineral wool batts. (9)	1 hr. comb.
<b>Gypsum and Sand</b>	One side sheathed with 1/2 in. gypsum sheathing covered with wood drop siding; other side faced with 1/2 in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath. (39)	1 hr. comb.

**Wood Stud Partitions, Plaster on Gypsum Lath, Studs 2 x 4 in. or larger, Finished Each Side as Noted**



Finish Type	Details of Construction	Rating
<b>Gypsum (unsanded)</b>	1/2 in. unsanded, wood-fibered gypsum plaster on 3/8 in. plain gypsum lath. (9)	1 hr. comb.
<b>Gypsum and Perlite</b>	1 in. 1:2½, 1:2½ by volume gypsum-perlite plaster on 3/8 in. perforated gypsum lath. Plaster reinforced with 1 in. hexagonal mesh. (105)	<sup>bb</sup> 2 hr. comb.
	1/2 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath; plaster mix: 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (49)	1 hr. comb. or 1 ½ hrs.* comb.
	1/2 in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath, securely attached by metal clips. Plaster mix: 2 cu. ft. or 2½ cu. ft. perlite to 100 lbs. gypsum. (47, 132)	1 hr. comb.
<b>Gypsum and Sand</b>	1/2 in. 1:2 gypsum and sand plaster on 3/8 in. perforated gypsum lath. (7, 9)	1 hr. comb.

\* Nonbearing

Letter superscripts refer to notes, page 641.

### WALLS AND PARTITIONS - Continued

***Wood Stud Partitions, Plaster on Gypsum Lath, Studs 2 x 4 in. or larger,  
Finished Each Side as Noted (Continued)***

Finish Type	Details of Construction	Rating
<b>Gypsum and Sand</b>	½ in. 1:2, 1:2 gypsum and sand plaster on 3/8 in. plain gypsum lath attached by nails fitted with 1½ in. metal lath pads folded over heads, spaced 8 in. vertically, 16 in. horizontally. (7, 9)	1 hr. comb.
	½ in. 4:1 gypsum and sand plaster on 3/8 in. plain gypsum lath; 3 in. strips of metal lath over all joints. (8)	1 hr. comb.
	½ in. 1:2, 1:2 fibered gypsum and sand plaster on 3/8 in. gypsum lath plain or with pin type indentations on paper surfacing. (121, 125)	1 hr.
<b>Gypsum and Vermiculite</b>	½ in. gypsum-vermiculite plaster on 3/8 in. perforated gypsum lath. Plaster mix: 2½ cu. ft. vermiculite to 100 lbs. fibered gypsum. (50)	1 hr. comb. or 1½ hrs.* comb.

***Wood Stud Partitions, Plaster on Wood Lath, Studs 2 x 4 in. or larger,  
Finished Each Side as Noted***

<b>Gypsum and Sand</b>	½ in. 1:2, 1:3 gypsum and sand plaster on wood lath; stud spaces filled with mineral wool. (7, 9)	1 hr. comb.
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***Wood Stud Partitions, Plaster on Metal or Wire Lath, Studs 2 x 4 in. or larger,  
Finished Each Side as Noted***

<b>Gypsum (unsanded)</b>	1 in. unsanded, wood-fibered gypsum plaster on metal lath. (9)	<sup>bb</sup> 2hrs.* comb.
	¾ in. unsanded, wood-fibered gypsum plaster on metal lath (7, 9)	1½ hrs. comb.
<b>Gypsum and Pumice</b>	7/8 in. plaster, on metal lath attached to studs. Plaster mix for scratch and brown coats, 1:2 fibered gypsum plaster and pumice aggregate containing air entraining agent. (76)	1 hr. comb.
<b>Gypsum and Sand</b>	7/8 in. 1:2, 1:3 gypsum and sand plaster on metal lath; stud spaces filled with mineral wool. (9)	1½ hrs. comb.
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath, stud spaces filled with mineral wool. (7, 9)	1½ hrs. comb.
	7/8 in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr. comb.
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath. (7, 9)	1 hrs. comb.
	3/4 in. 1:2 gypsum and sand plaster on U.L. listed wire lath (paper-backed fabric) as specified in U.L. listing <sup>e</sup> , under Walls and Partitions – Design No. 1-1 HR.	1 hr. comb.

\* Nonbearing

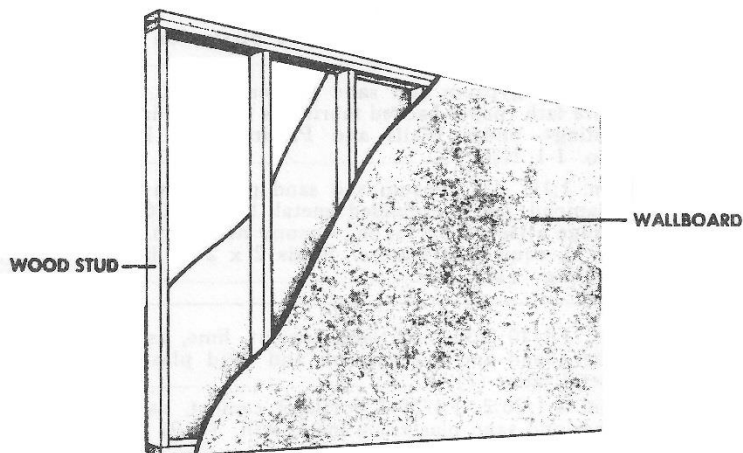
Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued**

**Wood Stud Partitions, Plaster on Metal or Wire Lath, Studs 2 x 4 in. or larger, Finished Each Side as Noted (Continued)**

Finish Type	Details of Construction	Rating
<b>Gypsum and Sand</b>	3/4 in. 1:1½, 1:3 gypsum and sand plaster on 3/8 in. diamond mesh expanded metal lath of 26 U.S. gauge attached by 1½ in. 4-penny nails 6 in. apart or by equivalent staples. Studs 2 x 2 in. if nonbearing. (10)	1 hr. comb.
<b>Gypsum, Portland Cement and Sand</b>	7/8 in. 1:1/10:1/30:2 portland cement, lime, asbestos fiber, sand and 1:3 gypsum and sand plaster on metal lath. (7)	1 hr. comb.
	7/8 in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (7, 9)	1 hr. comb.

**Wood Stud Partitions, Without Plaster, Studs 2 x 4 in. or larger, 16 in. O.C., Finished Each Side as Noted**



Finish Type	Details of Construction	Rating
<b>Gypsum Wallboard</b>	Two layers of ½ in. gypsum wallboard. Layers applied horizontally. Inner layer attached to studs and plates with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 7/32 in. head diameter, spaced 6 in. O.C.; outer layer attached to studs and plates over inner layer with 8d cement-coated nails, 2-3/8 in. long, 0.113 in. shank diameter, 17/64 in. head diameter, spaced 6 in. O.C. All vertical joints on studs. Paper tape embedded in joint compound over outer layer joints. Exposed nailheads covered with joint compound. (56)	1½ hr. comb.

\* Nonbearing

Letter superscripts refer to notes, page 641.



### WALLS AND PARTITIONS - Continued

*Wood Stud Partitions, Without Plaster, Studs 2 x 4 in. or larger, 16 in. O.C., Finished Each Side as Noted (Continued)*

Finish Type	Details of Construction	Rating
<b>Gypsum Wallboard</b>	Two layers ½ in. gypsum wallboard. Inner layer attached to studs and plates with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 7/32 in. head diameter, spaced 7 in. O.C.; outer layer attached to studs and plates over inner layer with 6d cement-coated nails, 1-7/8 in. long, 0.086 in. shank diameter, ¼ in. head diameter, spaced 7 in. O.C. All vertical joints on studs. Paper tape embedded in joint compound over outer layer joints. Exposed or nailheads covered with joint compound. (38)	1 hr. comb. or 1½ hrs.* comb.
	Two layers ½ in. gypsum wallboard. Inner layer applied vertically with vertical joints off studs; attached to studs and plates with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 7/32 in. head diameter, spaced 7 in. O.C.; outer layer applied horizontally over inner layer with vertical joints on studs, attached to studs and plates with 8d cement-coated nails, 2-3/8 in. long, 0.113 in. shank diameter, 17/64 in. head diameter, spaced 7 in. O.C. Paper tape embedded in joint compound over outer layer joints. Exposed nailheads covered with joint compound. (75)	1 hr. comb. or 1½ hrs.* comb
	Two layers 3/8 in. gypsum wallboard. Inner layer applied vertically and attached to studs and plates with 4d cement-coated nails, 1-3/8 in. long, 0.080 in. shank diameter, 7/32 in. head diameter, spaced 8 in. O.C.; vertical joints on studs; outer layer applied horizontally over inner layer with laminating compound and attached to studs and plates with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 15/64 in. head diameter, spaced 8 in. O.C.; vertical joints on studs and staggered with vertical joints of inner layer. Fiber tape embedded in joint compound over joints. Exposed nailheads covered with joint compound. (97)	1 hr. comb.
	½ in. gypsum wallboard. Applied vertically and attached to studs and plates with 5d cement-coated nails, 1¾ in. long, 0.099 in. shank diameter, ¼ in. head diameter, spaced 4 in. O.C.; vertical joints on studs. Stud cavities filled with either 0.6 lb. per sq. ft. glass fiber or 1.2 lb. per sq. ft. mineral wool batts or blankets, 2¾ to 3½ in. thick, nailed or stapled in place, 12 in. O.C. (7, 9)	1 hr.* comb.
<b>Gypsum Wallboard and Asbestos-Cement Board**</b>	3/16 in. asbestos-cement board and ½ in. gypsum wallboard. Wallboard applied vertically and attached to studs and plates with 6d cement-coated nails, 1-7/8 in. long, 0.0915 in. shank diameter, ¼ in. head diameter, spaced 7 in. O.C. Asbestos-cement board applied vertically over wallboard and attached to studs and plates with 6d nails, 2 in. long, 0.115 in. shank diameter, 13/64 in. head diameter, through predrilled, countersunk. 1/8 in. holes. 6 in. O.C. along edges of board and 16 in. O.C. at intermediate studs. (9, 80)	1 hr. comb. or 1½ hrs.* comb

\* Nonbearing

Letter superscripts refer to notes, page 641.

**WALLS AND PARTITIONS - Continued****Wood Stud Partitions, Without Plaster, Studs 2 x 4 in. or larger, 16 in. O.C., Finished Each Side as Noted (Continued)**

Finish Type	Details of Construction	Rating
<b>Gypsum Wallboard and Asbestos-Cement Board**</b>	3/16 in. asbestos-cement board and 3/8 in. gypsum wallboard. Wallboard applied vertically and attached to studs and plates with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 15/64 in. head diameter, spaced 7 in. O.C. Asbestos-cement board applied vertically over wallboard and attached to studs and plates with 6d nails, 2 in. long, 0.115 in. shank diameter, 13/64 in. head diameter, through predrilled, countersunk, 1/8 in. holes, 6 in. O.C. along edges of board and 16 in. O.C. at intermediate studs. All vertical joints of wallboard and asbestos-cement board on studs. (9, 80)	1 hr. comb.
	3/16 in. asbestos-cement board. 4 in. wide strips of 3/8 in. gypsum wallboard over edges of studs and plates attached with 5d cement-coated nails, 1-5/8 in. long, 0.086 in. shank diameter, 1/4 in. head diameter, spaced 7 in. O.C. Asbestos-cement board applied vertically over wallboard strips and attached to studs and plates with 6d nails, 2 in. long, 0.115 in. shank diameter, 13/64 in. head diameter, through predrilled, countersunk, 1/8 in. holes, 6 in. O.C. along edges of board and 16 in. O.C. at intermediate studs. All vertical joints on studs. Stud cavities filled with 2 lb. per sq. ft. mineral wool batts. (9, 80)	1 hr. comb.

**Wood Partitions – Solid**

<b>Laminated</b>	2x6 in., No. 1 grade. Douglas fir lumber laid in horizontal position to form 6 in. partition. Pieces fastened together with 16d nails, 3½ in. long, 0.162 in. shank diameter, 11/32 in. head diameter, spaced 12 in. O.C. Nails staggered from side to side. (36)	2 hrs.* comb.
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**FLOOR AND CEILING CONSTRUCTION - Continued****Reinforced Concrete<sup>u</sup>, Poured in Place**

Ceiling Type	Details of Construction	Rating
<b>Cementitious Mixture Applied Directly to Slab</b>	2½ in. slab with siliceous aggregate. ¾ in. protection to steel reinforcement. Ceiling of 7/8 in. U.L. listed cementitious mixture applied directly to underside of concrete slab. Other details as specified in U. L. listing <sup>c</sup> , under Floor or Roof, and Ceiling Constructions and Beam Protection – Design No. 99-2 HR.	2 hrs.
<b>Plaster on Metal Lath</b>	5 in. slab with limestone aggregate, with electrical raceways and junction boxes <sup>dd</sup> , Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)	4 hrs.

\* Nonbearing

Letter superscripts refer to notes, page 641.

## FLOOR AND CEILING CONSTRUCTION - Continued

### *Reinforced Concrete<sup>u</sup>, Poured in Place (Continued)*

Ceiling Type	Details of Construction	Rating
<b>Plaster on Metal Lath</b>	3 in. slab with limestone aggregate. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)	4 hrs.
	4 in. slab with limestone aggregate, with electrical raceways and junction boxes <sup>ec</sup> . Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 11½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)	3 hrs.
	2 in. slab with limestone aggregate. Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 13½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U. L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)	3 hrs.
<b>None</b>	4½ in. slab with expanded slag aggregate. ¾ in. protection to steel reinforcement. (62-A)	4 hrs.
	5¼ in. slab with expanded shale aggregate (rotary kiln) ¾ in. protection to steel reinforcement. (128)	4 hrs.
	6 in. slab with air-cooled slag aggregate. 1 in. protection to steel reinforcement. (62-J)	4 hrs.
	6 in. slab with traprock calcareous or siliceous aggregate. 1 in. protection to steel reinforcement. (62-C,D,L,P)	3 hrs.
	6 in. slab with crushed limestone aggregate, with electrical raceways and junction boxes. 1 in. protection to steel reinforcement. (62-B,O)	3 hrs. <sup>ii</sup>
	4¾ in. slab with air-cooled slag aggregate. ¾ in. protection to steel reinforcement. (62-M)	2½ hrs.
	4¾ in. slab with traprock or siliceous gravel aggregate. <sup>s</sup> ¾ in. protection to steel reinforcement. (62-E,H)	2 hrs.
	4¾ in. slab with calcareous gravel or crushed limestone aggregate. 1 in. protection to steel reinforcement. (62-F,G)	2 hrs.
	4 in. slab with siliceous gravel aggregate. ¾ in. protection to steel reinforcement. (33)	1 hr.
	3 in. slab with limestone aggregate. ¾ in. protection to steel reinforcement. (62-Q)	1 hr.

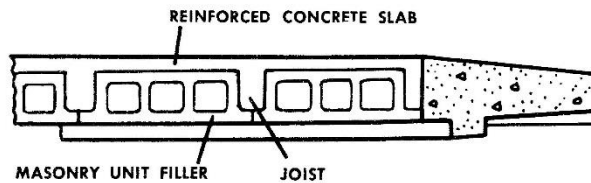
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**FLOOR AND CEILING CONSTRUCTION - Continued**

**Reinforced Concrete – Precast**

Ceiling Type	Details of Construction	Rating
<b>None</b>	6 in. thick floor consisting of 3½ in. thick U.L. listed precast concrete units with 2½ in. concrete topping. Electrical raceways and Junction boxes in concrete topping not more than 1 junction box in each 90 sq. ft. of floor area. Raceway not to exceed 2 in. in width and 1 in. in depth. Placing of precast concrete units and location of electrical raceways and junction boxes and other details as specified in U.L. listing <sup>c</sup> , under Floor or Roof, and Ceiling Constructions and Beam Protection – Design No. 30-4 HR.	4 hrs.
<b>Fiber, Sprayed-Applied Directly to Concrete</b>	1¾ in. concrete with expanded clay or shale aggregate (rotary kiln) on top of 4 in. U.L. listed precast concrete units. Ceiling of 3/8 in. U.L. listed sprayed fiber applied directly to adhesive coated precast concrete units. Other details as specified in U.L. listing <sup>c</sup> , under Floor or Roof, and Ceiling Constructions and Beam Protection – Design No. 35-3 HR.	3 hrs.

**Reinforced Concrete – Masonry or Wood Fiber Fillers<sup>u</sup>**



Filler Type	Details of Construction	Rating
<b>Clay Tile</b>	6 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between rows and concrete cast around and over tile to a depth of 2 in. Ceiling plastered with 5/8 in. 1:3 gypsum and sand plaster. (33)	2 hrs.
	4 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around and over tile to a depth of 1½ in. Ceiling plastered with 5/8 in. 1:3 gypsum and sand plaster. (33)	1½ hrs.
	4 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around and over tile to a depth of 1½ in. (33)	1 hr.
<b>Concrete Block</b>	2½ in. slab with limestone aggregate. ¾ in. protection to steel reinforcement. Space between concrete joists filled with 3-5/8 in. by 7-5/8 in. by 15-9/16 in. concrete masonry units with expanded shale aggregate and having a minimum equivalent thickness <sup>c</sup> of 2.72 in. (62-N)	3 hrs.

Letter superscripts refer to notes, page 641.

**FLOOR AND CEILING CONSTRUCTION - Continued*****Reinforced Concrete – Masonry or Wood Fiber Fillers<sup>u</sup>***

Filler Type	Details of Construction	Rating
<b>Building Units</b>	2½ in. slab and 8 in. deep joists having minimum width of 5 in. Slab and joist formed with 2 in. minimum thick U.L. listed building units. 1 in. concrete protection to slab steel reinforcing and ¾ in. concrete protection to joist steel reinforcing. Other details as specified in U.L. listing <sup>c</sup> , under Floor or Roof, and Ceiling Constructions and Beam Protection – Design No. 35-4 HR.	4 hrs.

***Reinforced Concrete Joists, Precast – Masonry Unit Fillers***

<b>None</b>	7¼ in. thick floor consisting of 2 in. limestone concrete on cinder concrete masonry units 5¼ in. thick x 7-5/8 in. x 26 in. supported on 8 in. reinforced concrete joists having 5 in. wide by 2¾ in. deep bottom flange providing 1¼ in. minimum bearing on concrete flange. 15/16 in. concrete protection to joist steel reinforcement. Masonry units 62% solid with 1-1/16 in. minimum face shell thickness. (120)	3 hrs.
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Letter superscripts refer to notes, page 641.

**NOTES**

- a The ratings for walls with combustible members framed into the wall, apply for members framed in not over 4 inches.
- b Thicknesses given do not include the thickness of plaster where plaster is specified.
- c See “Fire Resistance Index” and Supplements published by Underwriters’ Laboratories, Inc. or “List of Equipment and Materials,” Vol. II, and Supplements published by Underwriters’ Laboratories of Canada. The use of materials identified by U.L.I. Classification Marks or U.L.C. Labels or Listed Markings provides reasonable assurance that the materials described as “classified” or “listed” comply with the requirements for these materials established by the Laboratories in connection with the Classification or Listing.
- d A 10-inch wall may be used for this rating if hollow spaces near combustible members are filled with fire resistive material for the full thickness of the wall and for 4 inches or more above, below and between the combustible members.
- e Equivalent thickness is the average thickness of the solid material in the wall. It may be found by taking the total volume of a wall unit, subtracting the volume of core spaces, dividing this by the area of the face of the unit. Where walls are plastered or faced with brick the thickness of plaster or brick may be included in determining the equivalent thickness.
- f Where combustible members are framed into the wall, the wall must be of such thickness or be so constructed that the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, will be not less than 93% of the thickness shown in the table.

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- g The ratings of load bearing hollow clay tile depend in certain cases on the number of cells and units in the wall thickness. These are shown in the table along with the total thickness (in inches) of the wall, "2U" represents for example, two units and "4C" representing four cells in the wall thickness.
- h An 8-inch tile wall may be used for this rating if hollow spaces are filled as in Note<sup>d</sup>.
- i With combustible structural members framed into the wall, plaster is effective in increasing the fire resistance (over that for a similar wall or partition unplastered) only when applied on the side opposite that on which the structural members are framed in, and only with respect to fire exposure from the plastered side.
- j Ratings given are applicable where there is no combustible material or construction in the enclosed ceiling space. Ceiling to be at such a level that the beams, girders or trusses to be considered as protected by the ceiling, will not extend below the level of the ceiling more than 6 in. (as illustrated below), unless otherwise specified. This depth at any point, to be considered as the average depth on the two sides. Ratings are for protection only from fire beneath the ceiling.



- k Group 1 and group 2 aggregates are defined in the "Standard Specification for Concrete and Reinforced Concrete" of the 1940 "Joint Committee Report" as follows:  
 "Group 1. Blast-furnace slag, limestone, calcareous gravel, trap rock, [expanded] clay, or shale [or slate], cinders containing not more than 25% of combustible material and not more than 5% of volatile material, and other materials meeting the requirements of these specifications and containing not more than 30% quartz, chert, flint, and similar materials.  
 Group 2. Granite, quartzite, siliceous gravel, sandstone, gneiss, cinders containing more than 25%, but not more than 40% of combustible material and not more than 5% of volatile material and other materials meeting the requirements of these specifications, and containing more than 30% of quartz, chert, flint, and similar materials."
- l Thicknesses given are of the protection around the outside of the steel column, beam, girder or truss, or cast iron column, and outside of the reinforcing steel in reinforced concrete columns, beams, girders and trusses. They do not include thickness of plaster except where the protection consists only of metal lath and plaster.
- m The fire resistance of columns varies with the area of solid material in the cross section of the column – the larger the column the greater the fire resistance, for a given thickness of protection around the structural or reinforcing steel. The column dimensions given are the outer cross sectional dimensions of the steel or cast iron columns and the outside cross sectional dimensions of reinforced concrete columns. Columns smaller than those listed may require greater thicknesses of protection for the same degree of fire resistance. For columns which are not square the protection should correspond to that for the square column having the same or next smaller cross sectional area.
- n Calcareous aggregate containing a combined total of not more than 10% quartz, chert and flint for the coarse aggregate.
- o Cinders contained not over 10% unburned coal and not over 5% ash.
- p Wire ties consisted of No. 5 B. & S. gauge (0.18 in. diam.) steel wire wound spirally around the steel column on a pitch of 8 in.
- q Outside wire ties consisted of No. 12 B. & S. gauge (0.08 in. diam.) steel wire tied around the outside of each course of the tile at the middle.

- r Rating of 7 hours obtained in test with additional layer of  $\frac{3}{4}$  in. gypsum-sand plaster.
- s The aggregate used contained 60% or more of quartz, chert, or granite.
- t Rating of 6 hours obtained in test with additional layer of  $\frac{1}{2}$  in. gypsum-sand plaster.
- u The “Standard Methods of Fire Tests of Building Construction and Materials” fix a temperature limit for wood members such as sleepers set into the top slab of a floor construction. Except where test data are available to show that wood members may be embedded in the top slab a certain depth without developing temperatures higher than the standard specifies, or except as otherwise specifically indicated, the rating of floor and ceiling constructions are based on the assumption that no wood sleepers or other combustible members will be embedded in the specified top covering of concrete or gypsum. Such members may rest on top of the specified thickness of concrete or gypsum with additional concrete or gypsum fill between sleepers.
- v The thickness of concrete floor slab given is the minimum thickness over the joists. Between joist, the thickness will be greater due to sagging of the metal lath. Tests at the National Bureau of Standards have indicated that this additional thickness between joists is necessary if the specified fire resistance is to be assured. If the normal sag of  $\frac{1}{2}$  in. between joists is not present the average thickness, of slab should be  $\frac{1}{4}$  in. greater. Concrete plank may be used for the top slab if joints are thoroughly grouted and the plank is at least  $\frac{1}{4}$  in. thicker than the specified thickness for the top slab.
- w Metal lath of [approved](#) weight serving as form for poured top slab may be considered as reinforcement.
- x Siliceous gravel contained 100% clear quartz.
- y These ratings apply to columns with standard ties or spirals, and to columns without spirals if designed on the basis that the protective concrete covering carries no load. If the design load is based on the gross column area and the column does not have adequate ties or spirals the actual fire resistance will be considerably lower.
- z Ratings given are for fire exposures from the plastered side. Somewhat higher ratings were obtained with brick face exposed to fire.
- aa Wire ties of No. 8 SWG (0.16 in. diam.) steel wire wound spirally around steel column on a pitch of 8 in.
- bb This construction is not acceptable for use where a 2-hour construction is required to be of noncombustible materials, as is specified for all two-hour partitions in the National Building Code.
- cc Without concrete topping, floors and roofs of such U.L. classified units may be assigned a fire resistance rating of 2 hours.
- dd Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 3 in. concrete slab.
- ee Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 2 in. concrete slab.
- ff Unless otherwise noted the units have a minimum bearing of 3 inches at edges. The concrete topping is not considered as a structural element of the assembly.
- gg Where wood ceiling, floor and wall runner strips are used in place of metal runner strips, the construction is considered as combustible.
- hh Requirements as to cement-aggregate proportions, dry-rodded weight, strength, and other pertinent matters are specified in the applicable reference (reference 96 or 140).
- ii Rating is  $2\frac{1}{2}$  hours when marker screws are installed in raceway outlets.

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jj Deleted.

kk Equivalent thickness is the average thickness of solid material in the wall and may be calculated by the formula:

$$T_e = \frac{V_n}{L \times H}$$

where:

- T<sub>e</sub> = Equivalent thickness in inches,
- V<sub>n</sub> = Net volume in cubic inches,
- L = Actual length of unit in inches,
- H = Actual height of unit in inches.

The net volume (V<sub>n</sub>) of the units is to be determined by a water displacement method conducted on a number of units. The units are to be immersed in water for 24 hours, removed from the vat, surface water removed, and then immersed in water and the displacement determined.

Additional details of this method are described in the U.L.I. publication, "Procedure for Determining Equivalent Thickness," dated November 12, 1958.

ll A fire resistance rating of 4 hours may be assigned to the wall if the cells are filled with loose expanded shale aggregate, rotary kiln process.

mm A fire resistance rating of 4 hours may be assigned to the wall if the cells are filled with loose expanded slag aggregate.

nn Unless otherwise noted, wood flooring is 1 in. (nominal) tongue and groove sub and finish flooring with building paper between and no ceiling openings permitted.

As an alternate, the floor in the following Floor-Ceiling Designs may be composed of: Finish floor of 5/8 in. plywood, minimum grade to be "underlayment," with tongue and groove edges. Subfloor of 1/2 in. plywood, minimum grade to be "standard with exterior glue." Plywood to conform with PS1-66, laid with face grain perpendicular to joists and joints staggered.

No. L001	No. L204	No. L210	No. L514
L002	L205	L501	L515
L003	L206	L502	L519
L004	L207	L503	L521
L201	L208	L512	L522
L202	L209	L513	

In addition, the following Floor-Ceiling Designs may utilize an alternate floor composed of a finish floor of floor topping (a mixture of U.L. classified floor topping mixture, and, asphalt emulsion and water) over building paper or asphalt-saturated felt vapor barrier and a subfloor of 1 in. (nominal) tongue and groove flooring or 1/2 in plywood (minimum grade to be "standard," exterior glue, conforming with PS1-66) laid with face grain perpendicular to joists and joints staggered; details of floor topping, use of vapor barrier or building paper, and type of subfloor are set forth in individual designs as described in U.L. Fire Resistance Index:

No. L003	No. L501	No. L503	No. L512
L206	L502	L505	L514

oo Rating applies if the construction is restrained in accordance with the conditions of the test report.



- pp See U.L. classification, under Floor-Ceiling Design, for details of alternate method of ceiling attachment to underside of joists.
- qq Concrete protection held in position by suitably designed interior steel anchors hooked securely around flanges or angles of members, at intervals not exceeding 8 in.; anchors to be not less than 1/8 in. thick if flat, or 1/10 in. in diameter if wire, and located not less than 3/4 in., nor more than 1 in. from outside surface. When flange width of steel members exceeds 6 in., wire used for anchoring concrete protection to be not less than 1/8 in. in diameter. Provision shall be made to prevent displacement of anchors while concrete is being placed.

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| 62-B – RJ390-5 | 62-H – R3390-8  | 62-N – R3390-16 |
| 62-C – R3390   | 62-I – R3390-11 | 62-O – RJ390-17 |
| 62-D – R3390-6 | 62-J – R3390-12 | 62-P – R3J90-18 |
| 62-E – R3390-9 | 62-K – R3390-13 | 62-Q – R3390-19 |
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## **APPENDIX L**

### **EARTHQUAKE LOADS**

It is recognized that this State is subject to some risk from earthquake. It is further recognized that the design of typical structures to resist required wind loads results in some resistance in earthquake type loads. In view of the foregoing, and in view of the low probability of earthquake incidence in North Carolina, this Code does not require typical structures to be designed for earthquake loads. However, it is recommended that the design of structures, buildings, and elements thereof, which may be especially susceptible to earthquake damage, be reviewed to consider the resistance to earthquake loads as defined in the American National Standard A58.1-1972, paragraph 8 – Earthquake Loads.

## **APPENDIX M**

### **SHAPE FACTORS**

The following standards may be used for shape factors in lieu of shape factor given in Section [1205](#) of the Code for primary systems only. Wind velocities and velocity pressures are as per Tables 12F and 12G respectively.

Wind forces on Structures by American Society of Civil Engineers Paper No 3269

Wind Load by National Building Code of Canada, 1970 Commentary No. 1 to Supplement No.4

Building Code Requirements for Minimum Design Load in Building and Other Structures

ANSI A58.1-1972

## APPENDIX N

### FLAMMABILITY OF CARPET AND UNDERLAYMENT

Historically, building codes have not regulated flame spread ratings or the flammability of floor finishes in buildings because until recently, most floor finishes have had low flammability and even with the increase usage of all types of carpet and underlayments which have varying degrees of flammability, there has not been a sufficient number of fires with large loss of life which was directly attributed to the high flammability of carpet. As of October 24, 1980, there have only been three fires in the nation which several deaths were directly attributed to high flammability of the carpet used and no large loss of life fires have been directly attributed to the high flammability of carpet.

Code regulations recognize that a high degree of regulation on a particular item is not usually imposed until a series of catastrophes causing a large loss of life occur attributed to the item.

All carpet marketed in the United States is required by federal regulations to pass a “pill test” DOC FF 1-70 (which was a test developed by the National Bureau of Standards and is enforced by the Consumer Product Safety Commission.)

In order to provide for better self-regulation by the manufacturers of carpet which, if strictly adhered to, may preclude the necessity of legal regulation by the North Carolina Building Code, the following table is suggested as a guide to control the flammability of carpet and backing or underlayment in various locations:

LOCATION	NFPA <sup>14</sup> 253	UL <sup>12</sup> 992	ASTM <sup>13</sup> E-84
Exit stairways, vestibules to exit stairs, exit corridors and exit access corridors in institutional, assembly, educational, residential and hazardous occupancies.	.45	0-4	B <sup>5</sup>
Exit stairways, vestibules to exit stairs, exit corridors and exit access corridors in business occupancies	.22	0-8	C <sup>5</sup>
Elevator cars and Assembly Rooms	6	0-4	B <sup>5</sup>

**TABLE NOTES:**

- <sup>1</sup> If carpet is to be used with underlayment or backing, the carpet and underlayment or backing shall be tested together and meet the requirements set forth in the table. (According to representatives of the Carpet and Rug Institute and the Carpet Cushion Council, no manufacturers of carpet can presently meet the requirements of .45 Critical Rated Flux of NFPA 253 if backing is attached or if any kind of underlayment is used and only certain kinds of nylon carpet can meet this requirement without backing or underlayment.)
- <sup>2</sup> Carpet and Underlayment materials “listed” by Underwriters Laboratories in accordance with UL 992 (with “Flame Propagation Index” shown) will meet these requirements. Flame Propagation Index 0-8 may be used in locations where 0-4 is specified in buildings equipped with a complete automatic sprinkler system.
- <sup>3</sup> Carpet and underlayment materials listed (with these flame spread ratings) in accordance with ASTM E-84 will meet these requirements. Class C may be used in any location where Class B is specified and Class D may be used in locations where Class C is specified in buildings equipped with a complete automatic sprinkler system.
- <sup>4</sup> Carpet and underlayment materials “listed” (with critical radiant flux shown) by a nationally recognized testing laboratory in accordance with NFPA 253-1979 Method of Test of Surface Burning Characteristics of Building Materials (Radiant Panel Test) and [approved](#) by the local building official will meet these requirements. Critical Radiant Flux of .22 may be used where .45 is specified in buildings equipped with a complete automatic sprinkler system.

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- <sup>5</sup> Class A Interior Finish – Flame Spread 0-25  
Class B Interior Finish – Flame Spread 26-75  
Class C Interior Finish – Flame Spread 76-200  
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- <sup>6</sup> NFPA 253 Test not suitable (See Appendix E of NFPA 253 for proper application and interpretation of experimental results from use of this test.

GENERAL NOTE: Upon request, manufacturers will furnish a copy of their latest test report indicating whether the carpet was tested with or without underlayment and backing and either a certification by the manufacturer that the materials (carpet and underlayment or backing if the test was made with same) currently manufactured meet the same specifications as when the test was made; or hang tag on each roll of carpet can be furnished by the manufacturer or supplier giving this same information.

## **APPENDIX O**

### **ATRIUMS**

It is recommended that designers and inspection departments utilize the 1981 Edition of NFPA Life Safety Code 101, Article 6.2.2.3.1 exception #2(b) and the appendix referring to this section plus any more stringent requirements contained in recent amendments on atriums adopted by the Southern Building Code Congress International Inc. as the criteria for designing and approving atriums until the Council adopts a special section on enclosure of atriums.

## APPENDIX P

### STATE FIRE PREVENTION CODE

North Carolina General Statute 153-235 requires that any fire prevention code adopted by a county ordinance must be submitted to and [approved](#) by the North Carolina Building Code Council. To promote statewide uniformity in this area the State Building Code Council grants its approval of the Fire Prevention Code of the National Fire Protection (NFPA-1), 1982 Edition for adoption by any local county government.

The requirements of the Fire Prevention Code are designed to be used to maintain the life safety requirements of the State Building Code. They shall not be construed as additional requirements to those in the Building Code and where a conflict exists between these two codes, the requirements of the State Building Code shall prevail. In accordance with GS 143-140 and 143-141 only those decisions and interpretations of local enforcement agencies relating to the provisions of the North Carolina State Building Code may be appealed to the North Carolina Building Code Council.

In granting this approval the Building Code Council recognizes that the proper enforcement of the State Building Code by Building Officials and the maintenance of its life safety provision through the proper enforcement of the Fire Prevention Code by the Fire Marshall will regulate conditions which could cause a fire or explosion.

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