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Preface

The Uniform Building Code is dedicated to the development of better building construction and greater safety to the public, through the elimination of needless red tape, favoritism and local politics by uniformity in building laws; to the granting of full justice to all building materials on the fair basis of the true merits of each material; and to the development of a sound economic basis for the future growth of cities through unbiased and equitable dealing with structural design and fire hazards.
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An ordinance regulating the erection, construction, enlargement, alteration, repair, moving, removal, conversion, demolition, occupancy, equipment, use, height, area, and maintenance of buildings or structures in the City of...........................................

..........................................................; providing for the issuance of permits and collection of fees therefor; declaring and establishing Fire Districts; providing penalties for the violation thereof, and repealing all ordinances and parts of ordinances in conflict therewith.

Be it ordained by the..........................................................of the City of.......................................................... as follows:
PART I

ADMINISTRATIVE

CHAPTER 1—TITLE AND SCOPE

Sec. 101. This Ordinance shall be known as the "Building Code," may be cited as such and will be referred to in this Ordinance as "this Code."

Wherever a section, chapter, or part is referred to in this Code by number it shall be understood to refer to a section, chapter or part of this Code.

Sec. 102. The purpose of this 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 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 structures.

The provisions of this Code shall be deemed to supplement any and all state laws of the State relating to buildings.

Sec. 103. New buildings and structures hereafter erected in the City and buildings and structures moved into the City shall conform to all requirements of this Code; and all requirements in this Code, unless otherwise specifically provided, shall apply to all such buildings and structures.

Additions, alterations, repairs and changes of use or occupancy in all buildings and structures shall comply with the requirements for new buildings and structures except as otherwise provided in Section 104 of this Code. (See Chapter 16).

Where, in any specific case, different sections of this Code specify different materials or methods of construction, the most restrictive requirement shall govern.

Sec. 104. The following specified requirements shall apply to existing buildings which for any reason whatsoever do not conform to the requirements of this Code for new buildings:

(a) Major Alterations and Repairs. Except as provided in Section 1602 when alterations and repairs in excess of 50 per cent of the value of an existing building are made to such building within any period of 12 months, the entire building shall be made to conform with the requirements given herein for new buildings. Any existing building which for any reason whatsoever, requires repairs, at any one time, in excess of 50 per cent of the value thereof, not deducting from such value any loss caused by fire or any other reason, shall be made to conform to the requirements of this Code or shall be demolished.

(b) Changed Use. If the existing use or occupancy of an existing building is changed to a use or occupancy which would not be permitted in a similar building hereafter erected, the entire building shall be made to conform with the requirements given herein for new buildings; provided, however, that if the use or occupancy of only a portion or portions of an existing building is changed and such portion or portions are segregated as specified in Section 503 of this Code then only such portion or
portions of the building need to be made to comply with said requirements; and provided, further, that the Building Inspector is hereby given authority to approve any change in the use or occupancy of any existing building within any one Group of Occupancy as specified in Part III, even though such building is not made to fully conform to the requirements of this Code, when it is obvious that such a change in the use or occupancy of the existing building will not extend or increase any existing non-conformity or hazard of the building.

(c) **Additions.** Any existing building not covered by the preceding paragraphs (a) and (b) which has its floor area or its number of stories increased or its use or occupancy changed in any way from its former or existing use or occupancy shall be provided with stairways, emergency exits and fire protection facilities as required in this Code for buildings hereafter erected for similar uses or occupancies.

(d) **Structural Alterations and Repairs.** Where any alteration or repair is made to the structural portion of any building or structure, the structural portion or any part thereof shall be made to conform to the requirements of this code for new buildings where deemed necessary by the Building Inspector.

(e) **Non-Structural Alterations and Repairs.** Minor non-structural alterations, repairs and changes may be made with the same materials of which the building is constructed; provided, that not more than 25 per cent of the roof covering of any building shall be replaced in any period of 12 months unless the new roof covering is made to conform to the requirements of this Code for new buildings.

**Maintenance**

Sec. 105. The requirements contained in this Code, covering the maintenance of buildings, shall apply to all buildings and structures now existing or hereafter erected. All buildings and structures and all parts thereof shall be maintained in a safe condition, and all devices or safeguards which are required by this Code at the erection, alteration or repair of any building shall be maintained in good working order.

This Section shall not be construed as permitting the removal or non-maintenance of any existing devices or safeguards unless authorized in writing by the Building Inspector.

The Chief of the Fire Department shall inspect periodically the storage of volatile or flammable liquids, exits, fire-prevention and fire-extinguishing apparatus and facilities in all buildings or structures, and shall report in writing to the Building Inspector any violations of the provisions of this Code applicable to any building or structure inspected.
CHAPTER 2 — GENERAL PROVISIONS

Sec. 201. No person shall erect or construct or proceed with the erection or construction of any building or structure, nor add to, enlarge, alter, repair, move, convert, extend or demolish any building or structure, or cause the same to be done, without first obtaining a building permit therefor from the Building Inspector.

Any person desiring a building permit as required by this Code shall file with the Building Inspector an application therefor in writing on a blank form to be furnished for that purpose.

Every such application for a permit shall describe the land upon which the proposed building or work is to be done, either by lot, block and tract, or similar description that will readily identify and definitely locate the proposed building or work.

Every such application shall show the use or occupancy of all parts of the building and such other reasonable information as may be required by the Building Inspector.

Copies of plans and specifications and a lot plan showing the location of the proposed building and of every existing building on the property, shall accompany every application for a permit, and shall be filed in duplicate with the Building Inspector; provided, however, that the Building Inspector may authorize the issuance of a permit without plans or specifications for small or unimportant work.

Plans shall be drawn to scale upon substantial paper or cloth and the essential parts shall be drawn to a scale of not less than one-eighth inch (\(\frac{1}{8}''\)) to one foot (1\').

Plans and specifications shall be of sufficient clarity to indicate the nature and character of the work proposed and to show that the law will be complied with. Computations, strain sheets, stress diagrams and other data necessary to show the correctness of the plans, shall accompany the plans and specifications when required by the Building Inspector.

Any specifications in which general expressions are used to the effect that "work shall be done in accordance with the Building Code" or "to the satisfaction of the Building Inspector" shall be deemed imperfect and incomplete and every reference to this Code shall be to the section or subsection applicable to the material to be used or to the method of construction proposed.

All plans shall bear the name of the Architect, Structural Engineer or person responsible therefor.

Sec. 202. (a) Issuance. The application, plans and specifications filed by an applicant for a permit shall be checked by the Building Inspector. Such plans may be reviewed by the Chief of the Fire Department with respect to the storage of volatile and flammable liquids as specified in Part III, and the installation of fire-prevention and fire-extinguishing apparatus and facilities as provided in this Code. When such plans and
specifications are found to be in conformity with the require-
ments of this Code and all other laws or ordinances applicable
thereto, the Building Inspector shall issue a permit for the
specified construction upon receipt of the required permit fee.

When the Building Inspector issues the permit, he shall endor-
se in writing or stamp on both sets of plans and specifications
"APPROVED."

One such approved set of plans and specifications shall be
retained by the Building Inspector as a public record, for a
period of not less than 90 days from date of completion of the
work covered therein, and one set of approved plans and speci-
fications shall be returned to the applicant, which set shall be
kept on such building or work at all times during which the
work authorized thereby is in progress and shall be open to
inspection by public officials. Such approved plans and specifi-
cations shall not be changed, modified or altered without author-
ization from the Building Inspector, and all work shall be done
in accordance with the approved plans.

(b) Validity. The issuance or granting of a permit or ap-
proval of plans and specifications shall not be deemed or con-
strued to be a permit for, or an approval of, any violation of
any of the provisions of this Code. No permit presuming to
give authority to violate or cancel the provisions of this Code
shall be valid, except in so far as the work or use which it
authorizes is lawful.

The issuance of a permit upon plans and specifications shall
not prevent the Building Inspector from thereafter requiring the
correction of errors in said plans and specifications or from
preventing building operations being carried on thereunder when
in violation of this Code or of any other ordinance of the City.

(c) Expiration. Every permit issued by the Building In-
spector under the provisions of this Code shall expire by limita-
tion and become null and void, if the building or work author-
ized by such permit is not commenced within 60 days from the
date of such permit, or if the building or work authorized by
such permit is suspended or abandoned at any time after the
work is commenced for a period of 60 days. Before such work
can be recommenced a new permit shall be first obtained so to
do, and the fee therefor shall be one-half the amount required
for a new permit, provided no changes have been made or will
be made in the original plans and specifications for such work;
and provided, further, that such suspension or abandonment has
not exceeded one year.

Sec. 203. Any person desiring a building permit shall, at
the time of filing an application therefor, as provided in Sec.
201 of this Code, pay to the Building Inspector a fee as required
in this Section.

For a total valuation of $50.00 or less no fee.
For a total valuation from $50.00 to $1,001 a $2.00 fee;
and an additional fee of $2.00 for each additional $1000 or
fraction thereof of total valuation to and including $15,000;
and an additional fee of $1.00 for each additional $1000 or
fraction thereof of total valuation to and including $50,000;
and an additional fee of 50c for each additional $1000 or frac-
tion thereof of total valuation exceeding $50,000.

The city, county, state, or the United States of America shall
be exempt from the paying of any fee for any building.
The Building Inspector shall determine the estimated valuation in all cases, and for such purpose he shall be guided by approved estimating practices.

Where work for which a permit is required by this Code is started or proceeded with prior to obtaining said permit, the fees above specified shall be doubled, but the payment of such double fee shall not relieve any persons from fully complying with the requirements of this Code in the execution of the work nor from any other penalties prescribed herein.

The Building Inspector shall keep a permanent, accurate account of all fees and other monies collected and received under this Code, the names of the persons upon whose account the same were paid, the date and amount thereof, together with the location of the building or premises to which they relate.

Sec. 204. (a) Inspections Required. The Building Inspector shall inspect or cause to be inspected at various intervals during the erection, construction, enlarging, alteration, repairing, moving, demolition, conversion, occupancy and underpinning all buildings or structures referred to in this Code and located in the City, and a final inspection shall be made of every building or structure hereafter erected prior to the issuance of the Certificate of Occupancy as required in Section 206.

No building construction, alteration, repair or demolition requiring a building permit shall be commenced until the permit holder or his agent shall have posted the building permit card in a conspicuous place on the front premises and in such position as to permit the Building Inspector to conveniently make the required entries thereon respecting inspection of the work. This permit card shall be maintained in such position by the permit holder until the Certificate of Occupancy has been issued by the Building Inspector.

The Building Inspector upon notification from the permit holder or his agent shall make the following inspections of Type V buildings 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.

Foundation Inspection: To be made after trenches are excavated and the necessary forms erected and when all materials for the foundation are delivered on the job. Where concrete from a central mixing plant (commonly termed “transit mixed”) is to be used, materials need not be on the job.

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.

Exterior Plastering Inspection: To be made after all lathing and backing is in place and all plastering materials are delivered on the job, but before any exterior plaster is applied.

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

No work shall be done on any part of the building and structure beyond the point indicated in each successive inspection without first obtaining the written approval of the Building Inspector. Such written approval shall be given only after an inspection shall have been made of each successive step in the construction as indicated by each of the above four inspections.
No reinforcing steel or structural framework of any part of any building or structure shall be covered or concealed in any manner whatsoever without first obtaining the approval of the Building Inspector.

In all buildings where plaster is used for fire protection purposes the permit holder or his agent shall notify the Building Inspector after all lathing and backing is in place and all plastering materials are delivered on the job and no plaster shall be applied until the approval of the Building Inspector has been received.

(b) Registered Inspector Required. In addition to the inspections to be made by the Building Inspector as specified in this Section, the owner or his agent shall employ a registered inspector for full-time inspection on the following types of work:

1. **Reinforced Concrete.** On reinforced concrete work when the design is based on an $f'_{c}$ in excess of 2,000 pounds.

2. **Masonry.** On masonry when the design is based on unit stresses in excess of 50 per cent of those allowed in Chapter 24.

3. **Welding.** On all structural welding.

The "registered inspector" shall be approved by, registered with, deputized by and assigned to a particular building or structure by the Building Inspector. Such "registered inspector" shall be thoroughly qualified by knowledge and experience in the design and construction of the structure to which he is assigned and he shall be thoroughly familiar with the requirements of this Code applying to that building or structure and with their practical application. The Building Inspector may authorize one such "registered inspector" to supervise the simultaneous construction of a limited number of buildings or structures, provided that his service shall extend over all the important details of framing, erection and assembly and that he is able to render full engineering inspection service on each building or structure under his supervision and control.

Before commencing his duties the "registered inspector" shall obtain a certificate of registration from the Building Inspector for which he shall pay the sum of $1.00. The "registered inspector" shall remain constantly upon the work during the process of construction, and his duties shall terminate only when a Certificate of Compliance is issued by the Building Inspector in approval and acceptance of the work on which he may be engaged as required in Section 205.

Each such "registered inspector" shall carefully inspect all materials entering into the construction of the structure and be responsible for obtaining full information regarding the strength of materials where new or untried materials are intended for any use involving structural safety. He shall report in writing, upon the special forms furnished by the building department, the true details regarding the progress of the work, the condition of same, deviation, defects, delays, general character of materials, working situations, weather conditions and all and any influencing factors that affect, in any manner, the structural safety and strength of the building. He shall be held directly responsible for the enforcement of this Code wherever same is applicable to the structure upon which he is
engaged. He shall notify the Building Inspector of any attempt to cover, conceal, patch or repair any defect in materials or workmanship before such materials have been examined by the Building Inspector or his duly authorized representative. He shall be held directly responsible for the infraction of any ruling of the Building Inspector and shall have the authority to compel the removal of defective materials or to suspend or stop work pending the rulings of the Building Inspector. He shall not be engaged in any other labor on the project upon which he is employed.

Sec. 205. The duties of the "registered inspector" shall terminate only when a Certificate of Compliance has been issued by the Building Inspector. Such Certificate of Compliance shall bear a statement signed by the "registered inspector" stating that the work upon the building or structure to which he has been assigned has been completed in a satisfactory manner and that the regulations of this Code affecting the structural features of such building or structure have been fully complied with. If there have been any infractions of this ordinance they shall be noted in this statement. The Building Inspector shall approve such Certificate of Compliance filed by the "registered inspector" if after inspection the structural features of such building or structure are found to be in accordance with the provisions of this Code. Each Certificate of Compliance shall bear the legal description of the property upon which such building or structure is located and an identifying description of the building. A duplicate of each Certificate of Compliance shall be kept on file permanently in the office of the Building Inspector.

Sec. 206. No building shall be occupied in any part thereof unless or until a Certificate of Occupancy has been issued by the Building Inspector. The Building Inspector shall, after an application therefor has been filed by the owner or his agent, issue a Certificate of Occupancy for such building, if after inspection it is found that such building complies with the provisions of this Code and all other requirements of law or ordinance applicable thereto. Such Certificate of Occupancy shall show the use to which the structure may be put and the maximum allowable floor loads for each floor thereof. A temporary Certificate of Occupancy may be issued by the Building Inspector for the temporary use of a portion of a building prior to the completion and occupancy of the entire building.

Sec. 207. The use or occupancy of any building shall not be changed until a Certificate of Occupancy permitting the new use or occupancy is issued by the Building Inspector when the new occupancy is such as to require alterations or repairs of the building, as specified in this Code. Where such changes involve storage of volatile or flammable liquids as specified in Part III, exits as specified in Chapter 33, or fire-prevention and fire-extinguishing apparatus as specified in Chapter 38, the Chief of the Fire Department, upon request of the Building Inspector, within two days shall certify his approval in writing to the Building Inspector when such changes are found to comply with the requirements of this Code. No such Certificate of Occupancy shall be issued unless the building shall comply with the requirements of this Code. (See Section 104.)
CHAPTER 3 — ENFORCEMENT

Sec. 301. The office of Building Inspector is hereby created and the Building Inspector is hereby authorized and directed to enforce all of the provisions of this Code and for such purpose he shall have the powers of a police officer.

The Building Inspector or his authorized representative may enter any building or premises for the purpose of inspection or to prevent violation of this Code, upon presentation of the proper credentials.

Whenever any building work is being done contrary to the provisions of this Code, or is being done in an unsafe or dangerous manner, the Building Inspector may order the work stopped by notice in writing served on any persons engaged in the doing or causing such work to be done, and any such persons shall forthwith stop such work until authorized by the Building Inspector to recommence and proceed with the work.

Whenever any building or portion thereof is being used or occupied contrary to the provisions of this Code the Building Inspector shall order such use or occupancy discontinued and the building or portion thereof vacated by notice served on any person using or causing such use or occupancy to be continued and such person shall vacate such building or portion thereof within ten days after receipt of such notice, or make the building or portion thereof comply with the requirements of this Code; provided however, that in the event of an emergency the following paragraph shall apply:

Any building or portion thereof, including buildings and structures in process of erection, if found to be dangerous to persons or property, or unsafe for the purpose for which it is being used, or in danger from fire due to defects in construction, or dangerous for use because of insufficient means of egress in case of fire, or which violates the provisions of this Code due to the removal, decay, deterioration or the falling off of any thing, appliance, device or requirement originally required by this Code, or which has become damaged by the elements or fire to an extent of 50 per cent of its value, may be condemned by the Building Inspector. The Building Inspector may order portions of the structural frame of a building or structure to be exposed for inspection when in his opinion they are in an unsafe condition. In any of the aforesaid cases the Building Inspector shall serve notice in writing on the owner, reputed owner or person in charge of such building or premises, setting forth what must be done to make such building safe. The person receiving such notice shall commence within 48 hours thereafter to make the changes, repairs or alterations set out in such notice and shall proceed diligently with such work or demolish the building. No such building shall be occupied or used for any purpose after the Building Inspector serves written notice of its unsafe or dangerous condition until the instructions of the Building Inspector have been complied with.

If, at the expiration of the time as specified in the first notice, the instructions, as stated, have not been complied with, a second notice shall be served personally upon the owner, his
agent, or the person in possession, charge or control of such building or structure or part thereof, stating therein such precautionary measures as may be necessary or advisable to place such building or structure or part thereof in a safe condition. Should the necessary changes not be made within 30 days after the service of such second notice the City Council may order the owner or agent of the building prosecuted as a violator of the provision of this Code and may order the Building Inspector to proceed with the work specified in such notice. A statement of the cost of such work shall be transmitted to the City Council, who shall cause the same to be paid and levied as a lien against the property. Proper service of either of such notices shall be personal service upon the owner of record, if he shall be found within the city limits. If he is not found within the city limits such service may be had upon any person accustomed to collect rents on the property in question who may be in the city and in the absence of such a person, upon the tenant of the premises. In the event such premises are vacant, and the owner is not found in the city, such service will be completed when the notice is sent by registered mail to the last known address of the said owner. Whenever the owner, agent or tenant is a corporation, service may be made upon the president, vice-president, secretary or treasurer, or in the absence of any of these, the local representatives of such corporation.

Sec. 302. The provisions of this Code are not intended to prevent the use of types of construction or materials offered as an alternate for the types of construction or materials required by this Code, but such alternate types of construction or materials to be given consideration shall be offered for approval as specified in this chapter. Corresponding materials or types of construction referred to in this Code, the use of which is the same as is intended for the new material or construction, and which has been approved, shall be considered as standards of quality and strength if no specification is provided.

Any person desiring to use types of construction or materials not specifically mentioned in this Code shall file with the Building Inspector authentic proof in support of claims that may be made regarding the sufficiency of such types of construction and materials and request approval and permission for their use.

The Building Inspector may approve such alternate types of construction or materials. If the evidence and proof are not sufficient, in the opinion of the Building Inspector, to justify approval, the applicant may refer the entire matter to the Board of Examiners and Appeals as specified in Section 303.

Sec. 303. Any person whose application for a building permit for the use of an alternate material or type of construction has been refused by the Building Inspector or who may consider that the provisions of this Code do not cover the point raised or that any particular provision would cause a manifest injury to be done may appeal to the Board of Examiners and Appeals by serving written notice on the Building Inspector in which it shall be stated that the applicant desiring to use the alternate materials or types of construction shall guarantee payment of

Alternate Materials and Types of Construction

Appeals
Sections 303-306

all expenses for necessary tests made or ordered by the Board of Examiners and Appeals. Such notice shall be at once transmitted to the Board, which Board shall arrange for a hearing on the particular point raised.

Such written notice shall be accompanied by the sum of $10.00 payable to the City. If the appeal is denied such fee shall be retained by the City, otherwise the fee shall be returned to the appellant.

Sec. 304. Whenever there is evidence that any material used or any construction does not conform to the requirements of this Code, the Building Inspector may require tests as proof of compliance to be made at the expense of the owner or his agent by a testing laboratory or other organization approved for the purpose by the Building Inspector. Copies of the results of all such tests shall be kept on file in the office of the Building Inspector for a period of not less than two years after the acceptance of the structure.

Sec. 305. In order to determine the suitability of alternate materials and types of construction and to provide for reasonable interpretations of the provisions of this Code, there shall be and is hereby created a Board of Examiners and Appeals, consisting of five members, who are qualified by experience and training to pass upon matters pertaining to building construction. One member shall be a practicing architect, one a competent builder, one a lawyer and two structural engineers, each of whom shall have had at least 10 years' experience as an architect, builder, lawyer or structural engineer. The Building Inspector shall be an ex-officio member and shall act as Secretary to the Board. The Board of Examiners and Appeals shall be appointed by the Mayor and shall hold office at his pleasure. The Board shall adopt reasonable rules and regulations for conducting its investigations and shall render all decisions and findings in writing to the Building Inspector with a duplicate copy to the appellant and may recommend to the City Council such new legislation as is consistent therewith.

The Board of Examiners and Appeals may interpret the provisions of this Code to cover a special case, if it appears that the provisions of this Code do not definitely cover the point raised or that a manifest injustice might be done, provided that every such decision shall be by unanimous vote of the Board of Examiners and Appeals. Decisions as to the use of alternate materials and types of construction shall be by majority vote and if not permitted by this Code shall become effective only when authorized by an amendment to this Code.

Sec. 306. It shall be unlawful for any person, firm or corporation to erect, construct, enlarge, alter, repair, move, remove, demolish, convert, equip, use or occupy or maintain any building and structure or any portion of any building or structure in the city, contrary to or in violation of any provision of this Code or to cause, permit or suffer the same to be done.

Any person, firm or corporation violating any of the pro-
visions of this Code shall be deemed guilty of a misdemeanor and each such person shall be deemed guilty of a separate offense for each and every day or portion thereof during which any violation of any of the provisions of this Code is committed, continued or permitted, and upon the conviction of any such violation such person shall be punishable by a fine of not more than $500, or by imprisonment in the city jail for not more than six months, or by both such fine and imprisonment.
PART II
DEFINITIONS AND ABBREVIATIONS
CHAPTER 4—DEFINITIONS AND ABBREVIATIONS

Sec. 401. For the purpose of this Code, certain abbreviations, terms, phrases, words and their derivatives shall be construed as set out in this Section. Words used in the singular include the plural and the plural the singular. Words used in the masculine gender include the feminine, and the feminine the masculine.

(a) **ALLEY** is any public space, public park or thoroughfare less than sixteen feet (16') but not less than ten feet (10') in width which has been dedicated or deeded to the public for public use.

**ALTER** or **ALTERATION** is any change, addition or modification in construction or occupancy.

**APARTMENT** is a room or suite of rooms which is occupied or which is intended or designed to be occupied by one family for living and sleeping purposes.

**APARTMENT HOUSE** is any building, or portion thereof, which is designed, built, rented, leased, let or hired out to be occupied, or which is occupied as the home or residence of three or more families living independently of each other and doing their own cooking in the said building, and shall include flats and apartments.

**APPROVED** as to materials and types of construction, refers to approval by the Building Inspector as the result of investigation and tests conducted by him, or by reason of accepted principles or tests by national authorities, technical or scientific organizations.

**AREA** (see "Floor Area").

A. S. A. is the American Standards Association.

A. S. T. M. is the American Society for Testing Materials.

**ASSEMBLY BUILDING** is a building used, in whole or in part, for the gathering together of persons for such purposes as deliberation, worship, entertainment, amusement, or awaiting transportation, except when used for school purposes.

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

(b) **BALCONY** is that portion of the seating space of an assembly room, the lowest part of which is raised four feet (4') or more above the level of the main floor.
BASEMENT is that portion of a building between floor and ceiling, which is partly below and partly above grade (as defined in this Section), but so located that the vertical distance from grade to the floor below is less than the vertical distance from grade to ceiling. (See "Story".)

BAY WINDOW is a rectangular, curved or polygonal window, supported on a foundation extending beyond the main wall of the building.

BUILDING is any structure built for the support, shelter, or enclosure of persons, animals, chattels, or property of any kind.

BUILDING—EXISTING BUILDING is a building erected prior to the adoption of this Code, or one for which a legal building permit has been issued.

BUILDING INSPECTOR is the Chief Building Inspector or any regularly authorized deputy.

(c) 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 is that portion of a building between floor and ceiling which is wholly or partly below grade (as defined in this Section) and so located that the vertical distance from grade to the floor below is equal to or greater than the vertical distance from grade to ceiling. (See "Story".)

CHIEF OF THE FIRE DEPARTMENT is the head of the Fire Department or any regularly authorized deputy.

COURT is an open, unoccupied space, bounded on two or more sides by the walls of the building. An inner court is a court entirely within the exterior walls of a building. All other courts are outer courts.

(d) DEAD LOAD in a building is the weight of the walls, permanent partitions, framing, floors, roofs and all other permanent, stationary construction forming a part of the building.

DWELLING is any building or any portion thereof, which is not an "Apartment House" or a "Hotel" as defined in this Code, which contains one or more "Apartments" or "Guest Rooms", used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or which are occupied for living purposes.

(e) EXISTING BUILDING—(See Building—Existing).

(f) FAMILY is one person living alone or a group of two or more persons living together, whether related to each other by birth or not.

FIRE RESISTANCE or FIRE-RESISTIVE CONSTRUCTION is construction to resist the spread of fire, details of which are specified in Chapters 42 or 43 of this Code.
Section 401

Definitions (Cont’d.)

**FLOOR AREA** is the area included within surrounding walls of a building (or portion thereof), exclusive of vent shafts and courts.

**FOOTING** or **FOUNDATION** is the spreading course at the base or bottom of a foundation wall, column or pier.

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

(g) **GALLERY** is that portion of the seating space of an assembly room having a seating capacity of more than 10 located above a balcony.

**GARAGE** is a building or portion thereof in which a motor vehicle containing gasoline, distillate or other volatile, flammable liquid in its tank, is stored, repaired or kept.

**GARAGE, PRIVATE**, is a building, or a portion of a building, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept, and with space for not more than 10 automobiles. (See Section 1509.)

**GARAGE, PUBLIC**, is any garage other than a private garage.

**GRADE (Ground Level)** is the average of the finished ground level at the center of all walls of a building. In case walls are parallel to and within five feet (5') of a sidewalk, the above ground level shall be measured at the sidewalk.

**GRADE (Lumber)** is 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.

**GUEST** is any person hiring or occupying a room for living or sleeping purposes.

(h) **HEIGHT OF BUILDING** is the vertical distance from the “Grade” to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitch or hip roof.

**HOTEL** is any building containing six or more 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.

(i) No definitions.

(j) No definitions.

(k) No definitions.

(1) **LINTEL** is the beam or girder placed over an opening in a wall, which supports the wall construction above.

**LIVE LOADS** are all imposed, fixed or transient loads other than “Dead Loads”.

(m) **MARQUEE** is a permanent roofed structure attached to and supported by the building. Marquees projecting over public property are regulated in Chapter 45.
MASTERY is 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 2405.)

MASTERY, SOLID, is masonry built without hollow spaces.

MEZZANINE or MEZZANINE FLOOR is an intermediate floor placed in any story or room. When the total area of any such “Mezzanine Floor” exceeds 33⅓ per cent of the total floor area in that room, it shall be considered as constituting an additional “Story”. The clear height above or below a “Mezzanine Floor” construction shall be not less than seven feet (7’).

(n) No definitions.

(o) OCCUPANCY is the purpose for which a building is used or intended to be used. Change of occupancy is not intended to include change of tenants or proprietors.

ORIEL WINDOW is a window which projects from the main line of an enclosing wall of a building and is carried on brackets or corbels.

(p) PERSON is a natural person, his heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

(q) No definitions.

(r) REPAIR is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. The word “Repair” or “Repairs” shall not apply to any change of construction.

ROOM CAPACITY. (See Seating Capacity).

(s) SEATING CAPACITY. The seating capacity of a theater, auditorium, or any room or place of public assemblage in which seats are not fixed, shall be determined on the basis of seven square feet (7 sq. ft.) of floor, balcony and gallery area per person, and in the case of fixed seats such as pews or benches the seating capacity shall be based on one person to each eighteen inches (18") of pew or bench length.

Exceptions: 1. The capacity of dance floors or the playing areas of gymnasiums when such areas or floors are not to be used for general assembly purposes shall be determined on the basis of fifteen square feet (15 sq. ft.) of floor area per person.

2. The capacity of school class rooms, individual rooms in public libraries and museums, when two thousand square feet (2000 sq. ft.) or less in floor area, shall be determined
on the basis of twenty square feet (20 sq. ft.) of floor area per person.

SHAFT is a vertical opening through a building for elevators, dumb-waiter, light, ventilation or similar purposes.

SHALL as used in this Code, is mandatory.

STAGE. (See Working Stage.)

STORY is that portion of a building included between the upper surface of any floor and the upper surface of the floor next above, except that the topmost story shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above. If the finished floor level directly above a basement or cellar is more than six feet (6') above grade such basement or cellar shall be considered a story.

STREET is any thoroughfare or public park not less than sixteen feet (16') in width which has been dedicated or deeded to the public for public use.

STRUCTURE is that which is built or constructed, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

T

(t) THEATER is a building or part thereof which contains an assembly hall, having a stage which may be equipped with curtains and permanent stage scenery or mechanical equipment adaptable to the showing of plays, operas, motion pictures, performances, spectacles and similar forms of entertainment.

(u) No definitions.

V

(v) VALUE or VALUATION of a building shall be the estimated cost to replace the building in kind.

VENEER is a facing of brick, stone, concrete, tile or similar material attached to a wall for the purpose of providing ornamentation, protection or insulation but not counted as adding strength to the wall.

W

(w) WALLS shall be defined as follows:

Bearing Wall is a wall which supports any load other than its own weight.

Curtain Wall is a non-bearing wall between columns or piers which is not supported by girders or beams.

Enclosure Wall is an exterior, non-bearing wall in skeleton construction, anchored to columns, piers or floors, but not necessarily built between columns or piers.
Faced Wall is a wall in which the masonry facing and backing are so bonded as to exert a common action under load.

Interior Wall is a wall entirely surrounded by the exterior walls of the building.

Non-Bearing Wall is a wall which supports no load other than its own weight.

Panel Wall is a non-bearing wall in skeleton construction built between columns or piers and wholly supported at each story.

Parapet Wall is that part of any wall entirely above the roof line.

Party Wall is a wall used or adapted for joint service between two buildings.

Retaining Wall is any wall used to resist the lateral displacement of any material.

WINDOW. (See Bay Window; See Oriel Window).

WORKING STAGE is a portion of an assembly building which is cut off from the audience section by a proscenium wall, provided with an opening, so arranged that curtains or drops may be lifted more than ten feet (10'), or so that their lower edges are higher than one-half of the height of the proscenium opening.

(x) No definitions.

(y) YARD is an open, unoccupied space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this Code, on the lot on which a building is situated.
PART III

REQUIREMENTS BASED ON OCCUPANCY

CHAPTER 5—CLASSIFICATION OF ALL BUILDINGS BY USE OR OCCUPANCY AND GENERAL REQUIREMENTS FOR ALL OCCUPANCIES

Sec. 501. Every building, whether existing or hereafter erected, shall be classified by the Building Inspector according to its use or the character of its occupancy, as a building of Group A, B, C, D, E, F, G, H, I or J, as defined in Chapters 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15 respectively. (See Tables No. 5-A and 5-B.)

When a building is used for more than one occupancy purpose it shall be classified in the occupancy group representing the greatest occupancy hazard. Group A Occupancy shall be considered the most hazardous and Group J the least hazardous. When portions of a building are separated from the remainder of a building by one or more unpierced continuous walls extending from the foundation of the building to and through the roof and affording four-hour fire-resistant protection, such portions may be considered as separate buildings.

Any occupancy not mentioned specifically or about which there is any question shall be classified by the Building Inspector and included in the Group which its use most nearly resembles based on the existing or proposed life and fire hazard.

Sec. 502. No change shall be made in the character of occupancy or use of any building which would place the building in a different Group of occupancy, unless such building is made to comply with the requirements of this Code for that Group.

Exception: The character of the occupancy of existing buildings may be changed subject to the approval of the Building Inspector, and the building may be occupied for purposes in other Groups without conforming to all the requirements of this Code for those Groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

No change in the character of occupancy of a building shall be made without a Certificate of Occupancy, as required in Section 207 of this Code.

Buildings in existence at the time of the passage of this Code, may have their existing use or occupancy continued, if such use or occupancy was legal at the time of the passage of this Code, provided such continued use is not dangerous to life.

Sec. 503. (a) General. When a building is used for more than one occupancy purpose each part of the building comprising a distinct "Occupancy," as described in Chapters 5 to 15, shall be separated from any other occupancy as specified in Section 503 (d).
(b) **Forms of Occupancy Separations.** Occupancy separations shall be vertical or horizontal or both or, when necessary, of such other form as may be required to afford a complete separation between the various occupancy divisions in the building.

(c) **Types of Occupancy Separation.** Occupancy separations shall be classed as "Absolute," "Special" and "Ordinary."

1. An "Absolute Occupancy Separation" shall have no openings therein and shall be of not less than four-hour fire-resistive construction.

2. A "Special Occupancy Separation" shall be of not less than three-hour fire-resistive construction. All openings in walls forming such separation shall be protected on each side thereof by self-closing one-hour fire-resistive doors and such doors shall be kept normally closed. The total width of all openings in any "Special Occupancy Separation" wall in any one story shall not exceed 25 per cent of the length of the wall in that story and no single opening shall have an area greater than one hundred and twenty square feet (120 sq. ft.).

   All openings in floors forming a "Special Occupancy Separation" shall be protected by vertical enclosures, extending above and below such openings. The walls of such vertical enclosures shall be of not less than two-hour fire-resistive construction and all openings therein shall be protected on one side thereof by self-closing one-hour fire-resistive doors and such doors shall be kept normally closed.

3. An "Ordinary Occupancy Separation" shall be of not less than one-hour fire-resistive construction. All openings in such separations shall be protected with self-closing fire-resistive doors and such doors shall be kept normally closed.

(d) **Fire Ratings for Occupancy Separations.** Occupancy separations shall be provided between the various groups and divisions of occupancies as set forth in Table No. 5-B, except that in no case need the separation be more fire-resistive than the exterior walls of the building in which the separation occurs, unless such walls are less than one-hour fire-resistive construction. Where any occupancy separation is required the minimum shall be an "Ordinary Occupancy Separation."

Sec. 504. The location of all buildings and the protection of certain openings shall conform to the requirements of the occupancy group in which such building is classified in this Code according to the use or character of the occupancy; provided, that exterior walls which form an angle of 75 degrees or more with the adjacent property line may have openings therein which are protected by not less than one-hour fire-resistive construction.

The specific requirements given in Sections 603, 703, 803, 903, 1003, 1103, 1203, 1303, 1403, and 1503, regulating the construction of exterior walls and the protection of openings therein with respect to adjacent property lines, shall apply to buildings erected on the same property, but with reference to an
### TABLE NO. 5-A—GROUPS OF OCCUPANCY

<table>
<thead>
<tr>
<th>Chapter Reference</th>
<th>Group</th>
<th>OCCUPANCY</th>
<th>DIVISION</th>
<th>Working Stage</th>
<th>Seating Capacity in Any One Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>A</td>
<td>Assembly Buildings</td>
<td>Yes</td>
<td>1000 or more</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>1—Assembly Buildings</td>
<td>Yes</td>
<td>Less than 1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2—Assembly Buildings</td>
<td>No</td>
<td>100 or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3—Assembly Buildings</td>
<td>No</td>
<td>Less than 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4—Stadiums, reviewing stands, and amusement park structures not included within Group A and Divisions 1, 2 and 3, of Group B.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>C</td>
<td>Any building used for school purposes, involving assemblage for instruction, education, or recreation...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>D</td>
<td>1—Jails, prisons, reformatories, houses of correction, and buildings where personal liberties of inmates are similarly restrained.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2—Hospitals, sanitariums, old peoples homes, orphanages, nurseries, and similar buildings (each accommodating more than six)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>E</td>
<td>Public garages, paint or petroleum storage, dry cleaning plants using flammable liquids, paint shops, and spray painting rooms and shops.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planing mills, box factories, woodworking and mattress factories...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage of hazardous and highly flammable or explosive materials and liquids...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>Wholesale and retail stores, office buildings, restaurants, undertaking parlors, printing plants, municipal police and fire stations...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gasoline filling and service stations, factories and workshops using materials not highly flammable or combustible.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage and sales rooms for combustible goods.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>G</td>
<td>Ice plants, power plants, pumping plants, cold storage, and creameries.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factories and workshops using incombustible and non-explosive materials.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage and sales rooms of incombustible and non-explosive materials.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>H</td>
<td>Hotels, apartment houses, dormitories, lodging houses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Convents and monasteries (each accommodating more than ten persons).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I</td>
<td>Dwellings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>J</td>
<td>1—Private garages, sheds and minor buildings used as accessories only when not over one thousand square feet (1000 sq. ft.) in area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2—Fences over six feet (6') high, tanks and towers.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE NO. 5-B—REQUIRED SEPARATIONS IN BUILDINGS OF MIXED OCCUPANCY

<table>
<thead>
<tr>
<th>Chapter Reference</th>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>A</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>N</td>
<td>N</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>8</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>A</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>9</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>N</td>
<td>N</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>E</td>
<td>N</td>
<td>O</td>
<td>O</td>
<td>S</td>
<td>S</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>N</td>
<td>N</td>
<td>O*</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>G</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>H</td>
<td>N</td>
<td>N</td>
<td>O</td>
<td></td>
<td></td>
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<td>14</td>
<td>I</td>
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<td>O**</td>
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<tr>
<td>15</td>
<td>J</td>
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</tr>
</tbody>
</table>


*No occupancy separations shall be required in Type I buildings.
**Provided that lath and plaster as approved for one-hour fire-resistant construction on the garage side and a self-closing, tight-fitting solid slab wood door one and three-eighths inches (1 3/8") in thickness, shall be permitted where the private garage space will accommodate not more than four automobiles.

imaginary property line located between such buildings and parallel to the face of either building; provided that in the case of Group J-1 occupancies which are accessory to Group I occupancies on the same property the requirements for Occupancy Separations between such occupancies as specified in Section 503 may be substituted in lieu thereof.

Sec. 505. The floor area of every building shall be determined by the character of the occupancy, the type of construction, and the location in a fire zone. Buildings one story in height shall adjoin a public space, yard, or street, and their areas shall not exceed the limits set forth in Table No. 5-C except as provided in Section 506, nor the limits specified in Chapter 16.

Buildings over one story in height shall adjoin a public space, yard, or street on not less than one side. The total area of all floors shall not exceed 200 per cent of the area allowed for one-story buildings, except as provided in Section 506, provided, however, that no single floor area shall exceed that permitted for one-story buildings.

For the purposes of this Chapter, a yard is an open, unoccupied space on the lot on which a building is located, permanently maintained as an integral part thereof, and free of all obstruction from the ground up.

See Chapters 6 to 16 inclusive for special occupancy provisions.
### TABLE NO. 5-C—BASIC ALLOWABLE FLOOR AREA FOR BUILDINGS ONE STORY IN HEIGHT (In Square Feet)

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>OCCUPANCY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>III</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>IV</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>V</td>
<td>Not Permitted</td>
</tr>
</tbody>
</table>

Note: For Group J Occupancy see Chapter 15.

### TABLE NO. 5-D—MAXIMUM STORIES OF BUILDINGS

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>OCCUPANCY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>III</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>IV</td>
<td>Not Permitted</td>
</tr>
<tr>
<td>V</td>
<td>Not Permitted</td>
</tr>
</tbody>
</table>

#### Allowable Area Increases

**Sec. 506. (a) General.** The increases of floor areas permitted in this Section may be additive when applicable, except that such increases for one-hour fire-resistive construction or for automatic sprinkler installations shall not apply when other provisions of this Code require such construction or sprinkler installation.

(b) **One-Hour Fire Resistance.** For buildings having at least one-hour fire-resistive construction the areas specified in Section 505 for Types III, IV, and V may be increased one-third.

(c) **Separation on Two Sides.** Where public space, streets, or yards, more than twenty feet (20') in width, extend along two sides of a building, the areas specified in Section 505 may be increased at a rate of 1⅓ per cent for each foot by which the minimum width exceeds twenty feet (20'), but the increase shall not exceed 50 per cent.

(d) **Separation on Three Sides.** Where public space, streets, or yards, more than twenty feet (20') in width, extend along three sides of a building, the areas specified in Section 505 may be increased at a rate of 2⅓ per cent for each foot by which
See Chapters 6 to 16 inclusive for special occupancy pro-

visions.

Under Section 506.1 (b) are used.

Sect. 506.1. The height of a building

The height of a building is measured from the average of the finished ground level to the highest point of the roof or to the highest point of any other part of the building, whichever is lower. The height of a building shall be determined by the character of the occup-

ation or use of the building. The height of a building shall be measured from the average of the finished ground level to the highest point of the roof or to the highest point of any other part of the building, whichever is lower.

Sect. 507. The maximum number of stories in buildings of Group A, B, C and D may be increased in accordance with the provisions of Section 506.1. The maximum number of stories in buildings of Group A, B, C and D may be increased in accordance with the provisions of Section 506.1.

Sect. 508. Buildings of Group A, B, C and D shall be designed and constructed so that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be designed and constructed so that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 509. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 510. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 511. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 512. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 513. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 514. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 515. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 516. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 517. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 518. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 519. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.

Sect. 520. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet. Buildings of Group A, B, C and D shall be so constructed that the minimum horizontal distance from the front, side and rear of the building to the nearest line of property shall be at least twenty-five feet.
CHAPTER 6—REQUIREMENTS FOR GROUP A OCCUPANCIES

Sec. 601. Group A Occupancies shall be:
Any assembly building with a working stage and a seating capacity of 1000 or more in any one room.

For occupancy separations see Table No. 5-B.

Sec. 602. (a) General. Buildings or parts of buildings classed in Group A because of the use or character of the occupancy shall be of Type I Construction and shall not be limited as to location in fire zones, seating capacity, height or area.

Platforms which are used in lieu of working stages shall be included in the floor area of the assembly rooms, when determining the seating capacity.

(b) Special Provisions. Working stages as defined in Section 401 shall be of Type I Construction, except as specified in Section 3905.

The slope of the main floor of the assembly room shall not exceed one in five. Ramps steeper than one in eight shall have non-slip floor surfaces.

Bleachers in a gymnasium over usable spaces shall be protected with lath and plaster as approved for one-hour fire-resistive construction.

Sec. 603. Buildings housing Group A occupancies shall front directly upon at least one public street not less than twenty feet (20') in width in which front shall be located the main entrance and exit of such building. The main assembly floor shall be located at or near the adjacent ground level.

Exterior walls or parts of walls, except on street fronts, which are less than five feet (5') from adjacent property lines shall have no openings therein. Openings in exterior walls, except on street fronts, which are less than ten feet (10') from adjacent property lines, shall be protected by doors or windows of one-hour fire-resistive protection.

For regulating adjacent buildings on the same property see Section 504.

Sec. 604. (a) Main Entrance and Exits. There shall be not less than one exit on each of three sides of the auditorium. Each of these exits shall be not less than five feet (5') in width and shall open directly upon a street or into an open exit court which shall be directly connected to a street as specified in Section 604 (b).

One such exit on a street front which shall serve as the main entrance shall be proportioned on the basis of two feet (2') of width for each 100 persons or major fraction thereof to and including 1000 persons, with an additional one foot (1') per 100 persons for each additional 100 persons or major fraction thereof to and including 2000 persons and an additional six inches (6") for each additional 100 persons or major fraction thereof,
clear width of the court when open.

10. The courts shall be by ramps with a slope of not more than one in eight.

by ramps with a slope of not more than one in eight. Exits.

Exit courts shall have a clear width of not less than twenty-four inches (24") or upon courts connected to an adjacent exit court, a clear width of not less than forty-eight inches (48") on each side of the exit court.
have a slope of not more than one in nine. Ramps, steps, or levels shall be constructed of materials not subject to slipping when wet, are not slippery when wet, and are at least 6 inches (152 mm) in height when measured at the point three feet (3') from the edge of the ramp or step. The surface of the ramp or step shall be not less than three feet (3') wide and there shall be no more than six seams between any two adjacent sections of the ramp or step. Where access to the church is provided for persons with disabilities, ramps, steps, or levels shall be constructed to accommodate the seating capacity of the church. Doors shall be not less than three feet (3') wide and not less than twenty-five inches (635 mm) high. Doors shall be so arranged that no portion of the church is accessible to persons with disabilities unless it is furnished with a ramp, steps, or levels.

Section 3080.

(b) ramps, steps, or levels shall be provided for persons with disabilities. Ramps, steps, or levels shall be constructed of materials not subject to slipping when wet, are not slippery when wet, and are at least 6 inches (152 mm) in height when measured at the point three feet (3') from the edge of the ramp or step. The surface of the ramp or step shall be not less than three feet (3') wide and there shall be no more than six seams between any two adjacent sections of the ramp or step. Where access to the church is provided for persons with disabilities, ramps, steps, or levels shall be constructed to accommodate the seating capacity of the church. Doors shall be not less than three feet (3') wide and not less than twenty-five inches (635 mm) high. Doors shall be so arranged that no portion of the church is accessible to persons with disabilities unless it is furnished with a ramp, steps, or levels.

Section 3080.

(c) ramps, steps, or levels shall be provided for persons with disabilities. Ramps, steps, or levels shall be constructed of materials not subject to slipping when wet, are not slippery when wet, and are at least 6 inches (152 mm) in height when measured at the point three feet (3') from the edge of the ramp or step. The surface of the ramp or step shall be not less than three feet (3') wide and there shall be no more than six seams between any two adjacent sections of the ramp or step. Where access to the church is provided for persons with disabilities, ramps, steps, or levels shall be constructed to accommodate the seating capacity of the church. Doors shall be not less than three feet (3') wide and not less than twenty-five inches (635 mm) high. Doors shall be so arranged that no portion of the church is accessible to persons with disabilities unless it is furnished with a ramp, steps, or levels.
one in eight shall have non-slip floor surfaces. Required exits shall have aisles or cross aisles leading thereto.

Aisles in balconies or galleries shall be located so that there are not more than six seats between any seat and an aisle.

Aisles in balconies and galleries shall have the same minimum width as for aisles on the first floor and shall have the same ratio of increase in width with the exception that the increase shall be in the direction of exit travel. There shall be provided in all balconies or galleries having more than 20 rows of seats a cross aisle not less than four feet (4') wide from the back of one chair to the edge of the seat when down in the next row. Such cross aisle shall lead directly to an entrance or to an emergency exit.

Risers shall be not more than seven and one-half inches (7½"") and shall be the full width of the aisle and no tread shall be less than ten inches (10""). When the slope of the aisle is not more than one in five it shall be ramped. All aisles shall lead directly to exits.

The floor between rows of seats shall be on the same level as the aisles where they intersect.

(g) Seats. Seats shall be spaced not less than thirty-three inches (33"") back to back.

Seats on the main floor and in balconies and galleries shall be fastened securely to the floor and shall be not less than eighteen inches (18"") in minimum width.

(b) Boxes. Boxes may be served by stairs not less than three feet (3') in width with a rise and tread as required for main stair exits. Boxes accommodating more than 25 persons shall be considered as balconies. Seats in boxes need not be fastened to the floor.

(i) Doors and Gates. All exit and entrance doors or gates shall swing in the direction of exit travel and if provided with latches such latches shall be of self-releasing type, such as panic bolts or similar devices, which will permit the door to open when pressed against. All doors shall be installed so as not to decrease the required width of any opening, passageway or corridor in any manner whatsoever. No single door shall be more than three feet six inches (3'-6") in width and every exit door on the exterior of such building shall be not less than one-hour fire-resistive construction as specified in Section 4304 except at the main entrance and exit. Doors opening from within the building into a stair or ramp enclosure may be metal-clad doors as specified in Section 4304.

(j) Exit Lights. All exits shall be marked with illuminated signs bearing the word “EXIT” in letters at least five inches (5") high. Each sign shall be provided with two separate electric light globes on separate circuits, one such circuit being separate from any other circuit in the building. All exit signs shall be illuminated at all times when the building is occupied.

(k) Smokeproof Tower. Where there is more than one balcony or gallery all balconies or galleries above the first shall be served by not less than one smokeproof tower located on each side of such balcony or gallery and constructed as specified in Chapter 33.
Sections 604-608

(1) General. No obstructions shall be placed in any aisle, exit, foyer, passageway or corridor.

No bars shall be placed upon any window or any other opening in any Group A occupancy except on the windows of a private office.

All doors shall have a clear height of not less than six feet eight inches (6'-8

Sec. 605. All portions of Group A occupancies customarily used by human beings and all dressing rooms shall be provided with light and ventilation by means of windows and skylights with an area not less than one-eighth of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically operated ventilating system shall supply at least thirty cubic feet (30 cu. ft.) of pure air per minute per seat in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied. If the velocity of the air at the register exceeds ten feet (10') per second the register shall be placed more than eight feet (8') above the floor directly beneath.

Lights in all parts of the building customarily used by human beings shall be on a separate circuit from that of the stage and shall be controlled from the box office. All lights in corridors, exit courts and exit passageways shall be protected by a wire cage.

All registers or vents supplying air backstage shall be equipped with automatic closing devices with fusible links. Such closing devices shall be located where the vents or ducts pass through the prosenium wall and shall be operated by fusible links located on both sides of the prosenium wall and both inside of and outside of the vent or duct.

There shall be provided in an approved location at least one lavatory for each two toilets for each sex, and at least one drinking fountain for each floor level.

Sec. 606. Main stair or ramp exits from the first or lower balcony or gallery need not be enclosed but all other stair exits shall be enclosed and the enclosure shall be as specified in Chapter 30. There shall be no openings into stair or ramp enclosures except necessary entrance and exit doors. All emergency stair or ramp enclosures shall lead directly to a public street, alley or exit court.

All elevator shafts, vent shafts and other vertical openings shall be enclosed and the enclosure shall be as specified in Section 1807.

Sec. 607. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 33.

Sec. 608. Stages shall be equipped with automatic ventilators as required in Section 3901.

Chimneys and heating apparatus shall conform to the requirements of Chapter 37.
Deviations

Exception

Running tracks constructed of wood or unprotected steel or iron.

Section 609, Gymnasiums and similar occupancies may have

with not less than an "Ordinary Occupancy Separation.

burns fuel shall be separated from the rest of the building.

Every boiler room or room containing a heating plant which

Building with a "Special Occupancy Separation."

burns fuel so that fuel shall be separated from the rest of the

Every boiler room or room containing a heating plant which

resilient protection shall be provided with one-hour fire-

story or if less than ten feet (10') from other doors or windows

tial heating equipment, if located below grade in another

Avoider openings in a boiler room or room containing a-

quately marked. The

convenient and conspicuous place outside the building and ade-

service shall be provided with an approved shut-off valve at a

Every service to the same service to the service of the building shall be

A occupancy.

No hangible liquids shall be placed or stored in any group

means of Chapter 40.

Motion picture machine booths shall conform to the require.
CHAPTER 7—REQUIREMENTS FOR GROUP B OCCUPANCIES

Section 701. Group B occupancies shall be:

Division 1. Any assembly building with a working stage and a seating capacity of less than 1000 in any one room.

Division 2. Any assembly building without a working stage and a seating capacity of 100 or more in any one room.

Division 3. Any assembly building without a working stage and a seating capacity of less than 100 in any one room.

Division 4. Stadiums, reviewing stands, and amusement park structures not included within Group A and Divisions 1, 2 and 3, Group B, occupancies.

For occupancy separations see Table No. 5-B.

Section 702. (a) General. Buildings or parts of buildings classed in Group B because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506, and 507.

Exception: Division 4 structures of open skeleton frame type shall not be limited in area or height.

Platforms which are used in place of working stages shall be included in the floor area of assembly rooms when determining seating capacity.

(b) Special Provisions. Working stages and platforms shall be constructed as specified in Chapter 39.

Divisions 1 and 2 occupancies shall be of not less than one-hour fire-resistive construction throughout. Division 2 occupancies with a seating capacity of 1000 or more shall be of Type I, II or III construction.

Exception: Gymnasiums which do not have more than two balconies, each with a seating capacity not to exceed 300, and which are not located over usable spaces need not have one-hour fire-resistive protection.

The assembly floor of Division 1 and 2 occupancies shall be located at or near the ground level, provided that Division 1 and 2 occupancies having a total seating capacity of not more than 1000 may be located in the basement or one story above ground level and stairs may be used as a means of ingress and egress, and provided further that assembly rooms with seating capacity exceeding 500 shall not be located above the second floor above grade.

For attic space partitions and draft stops see Section 3205.

(c) Division 4 Provisions. Erection and structural maintenance of structures housing Division 4 occupancies shall conform to the requirements of this Code, and where there are no such specific requirements, shall provide adequate safety for the loads to which they may be subjected. (See Appendix.)

Structures housing Division 4 occupancies, other than those of open skeleton frame type, when more than one story in height or two hundred square feet (200 sq. ft.) in area, shall
have exterior walls, bearing partitions and floors of not less than one-hour fire-resistive construction.

When the space under a Division 4 occupancy is used for any purpose, it shall be separated from all parts of such Division 4 occupancy, including exits, by walls, floors and ceilings of not less than one-hour fire-resistive construction.

The Building Inspector may cause all Division 4 structures to be re-inspected at least once every six months.

Sec. 703. All buildings housing Group B occupancies shall front directly upon at least one public street, not less than twenty feet (20') in width, in which front shall be located the main entrance and exit of such building or such building may be connected to the street by an entrance passageway as specified in Section 604 (a).

Exterior walls or parts of walls except on street fronts which are less than five feet (5') from adjacent property lines, shall have no openings therein, shall be of not less than four-hour fire-resistive construction, and shall be constructed as specified in Parts V, VI and VII of this Code. Walls five feet (5') or more but less than ten feet (10') from adjacent property lines, except street fronts, shall be of not less than two-hour fire-resistive construction.

Exception: When any portion of a Division 4 occupancy is less than ten feet (10') from adjacent property lines, such portion shall have exterior walls, including openings, of not less than one-hour fire-resistive construction.

Openings in exterior walls of Divisions 1, 2 and 3, except on street fronts, which are less than ten feet (10') from adjacent property lines, shall be provided with doors and windows of one-hour fire-resistive construction.

For regulating adjacent buildings on the same property, see Section 504.

Sec. 704. (a) General. Requirements in this Section for Division 1, 2 and 3 occupancies, shall be the same as for Group A occupancies, as specified in Section 604, except that:

1. A foyer shall not be required.
2. Ramps shall not be required.
3. The minimum width of exits may be three feet (3').
4. The minimum number of exits may be not less than two.

(b) Stadiums and Reviewing Stands. Stairs, exits, aisles and seating for Division 4 stadiums and reviewing stands shall be as follows:

1. STAIRS. Stairs shall have a rise of not more than seven and one-half inches (7½") and a tread of not less than ten inches (10').

2. EXITS. There shall be provided one exit not less than seven feet (7') wide for each 2000 persons or major fraction thereof, which the stadium or reviewing stand is designed to seat. Such exits shall be spaced not more than seventy-five feet (75') apart. Passageways serving such exits shall be not less than seven feet (7') in clear height nor less than seven feet (7') in clear width.
3. AISLES. Aisles not less than three feet six inches (3'6") wide shall be provided so that there are not more than 20 seats between any seat and an aisle.

4. SEATS. Where seats are not marked or spaced off, a distance of eighteen inches (18") along any bench or platform shall constitute one seat in computing the required aisles, stairs and exits.

Seats shall be spaced not less than twenty-six inches (26") back to back, except that where backs are provided they shall be spaced not less than thirty inches (30") back to back.

(c) Amusement Structures. Stairs and exits for Division 4 amusement structures shall be provided as specified in Chapter 33, subject to the approval of the Building Inspector. Stairs and ramps in such structures not exceeding two stories in height need not be enclosed. Exit lights shall be installed as specified in Section 3312 where required by the Building Inspector.

Sec. 705. All portions of Group B occupancies customarily used by human beings and all dressing rooms shall be provided with natural or artificial light, ventilation, and sanitary facilities as specified in Section 605.

Sec. 706. All vertical openings such as elevator shafts, stairs, ramps and vent shafts shall be enclosed and the enclosure shall be as specified in Chapter 30, provided, however, that stair or ramp exits serving only a Division 1, 2, or 3 occupancy on the second floor of a building need not be enclosed. There shall be no openings into stair or ramp enclosures except necessary entrance and exit doors.

Sec. 707. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 708. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Motion picture machine booths shall conform to the requirements of Chapter 40.

No flammable liquids shall be placed or stored in a Group B occupancy.

Every gas service shall be provided with an approved outside shut-off valve conspicuously marked.

Exterior openings in a boiler room or room containing central heating equipment, if located below openings in another story or if less than ten feet (10') from other doors or windows of the same building, shall be provided with one-hour fire-resistant protection.

Every boiler room or room containing a heating plant which burns liquid or solid fuel shall be separated from the rest of the building with a "Special Occupancy Separation." Every boiler room or room containing a heating plant which burns gas as fuel shall be separated from the rest of the building with not less than an "Ordinary Occupancy Separation."

Sec. 709. Gymnasiums and similar occupancies may have running tracks constructed of wood or unprotected steel or iron.

In gymnasiums one inch (1") nominal tight tongue and grooved wall covering may be used on the gymnasium side in lieu of fire-resistant plaster.
CHAPTER 8—REQUIREMENTS FOR GROUP C OCCUPANCIES

Sec. 801. Group C occupancies shall be:

Any building used for school purposes, involving assemblage for instruction, education or recreation.

For all occupancy separations, see Table No. 5-B.

Sec. 802. (a) General. Buildings or parts of buildings classed in Group C because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506, and 507.

Platforms which are used in place of working stages shall be included in the floor area of assembly rooms when determining room capacity.

(b) Special Provisions. Rooms having a seating capacity of more than 100 and rooms used for kindergarten, first or second grade pupils shall not be located above the first story above grade except in buildings of Type I construction.

Where there is usable space under the first floor of two-story Type IV and V buildings, the construction up to and including the first floor shall be of Type I construction, and the first floor shall be unpierced for human access.

Balconies and bleachers over usable space and all janitor closets shall be protected with lath and plaster approved for one-hour fire-resistive construction.

Stairs and corridors shall be of not less than one-hour fire-resistive construction.

All curtains, drops and drapes shall be flame-proofed. (See Section 3809.)

Any working stage shall be constructed as specified in Section 602 (b).

The provisions of Section 1813 shall not apply to openings in buildings not more than three stories high when such openings are not less than thirty feet (30') from adjacent property lines and not less than thirty feet (30') from buildings on the same property.

For attic space partitions and draft stops, see Section 3205.

Sec. 803. Group C occupancies shall front directly upon at least one public street, not less than twenty feet (20') in width, in which front shall be located at least one required exit.

Exterior walls or parts of walls, except on street fronts, which are less than three feet (3') from adjacent property lines shall have no openings therein and shall be of not less than four-hour fire-resistive construction. Walls which are three feet (3') or more but less than ten feet (10') from adjacent property lines, except street fronts, shall be of not less than two-hour fire-resistive construction. All openings in exterior walls, except on street fronts, which are less than ten feet (10') from adjacent property lines shall be provided with doors and windows of one-hour fire-resistive construction.

For regulating adjacent buildings on the same property, see Section 504.
Sec. 804. 1. For the purpose of area determination and defining required exit facilities, rooms in Group C occupancies shall be classified as follows:

Class 1 shall be lecture rooms, auditoriums, and similar rooms wherein seats are either fixed or movable and the capacity unit therefor shall be seven square feet (7 sq. ft.).

Class 2 shall be the main exercise rooms of gymnasiums and the capacity unit therefor shall be fifteen square feet (15 sq. ft.).

Class 3 shall be general class rooms, recreation rooms, and similar rooms and the capacity unit therefor shall be twenty square feet (20 sq. ft.).

Class 4 shall be museums, libraries, laboratories and similar rooms not having fixed seats and the capacity unit therefor shall be thirty square feet (30 sq. ft.).

Class 5 shall be the same as Class 4, but with fixed seats and the capacity unit therefor shall be forty square feet (40 sq. ft.).

Class 6 shall be all other rooms, such as shops, vocational and similar rooms and the capacity unit therefor shall be one hundred square feet (100 sq. ft.).

2. A capacity unit shall be the floor area required per person.

3. For the purpose of this Chapter the room capacity shall be determined by dividing the superficial area by the appropriate capacity unit.

4. An exit-width unit shall be twenty-two inches (22").

5. Total exit width in inches from rooms shall be determined by dividing the room capacity by 100 and multiplying by 22.

6. The basic number of exit-width units required for any corridor, hall, stair or exit door opening therefrom shall be determined by dividing by 100 the capacity of each room emptying into such corridor, hall or stair between exits therefrom and such individual basic numbers shall be added together.

7. One exit-width unit shall be added to the basic widths for all corridors and halls, provided that no such corridor shall be less than six feet (6') in width exclusive of rails.

8. A corridor or hall serving additional floors as a required means of egress shall have added to its required width one exit-width unit.

9. Rooms having required width of exits directly to the exterior need not be considered in determining the required width of corridors, halls or stairs.

10. Where Class 1 rooms other than those designed to be used simultaneously with other rooms exit into a corridor or hall that serves as a required means of egress from other rooms, the corridor, hall, stairs and exits to the exterior need provide only for the capacity of whichever requires the greater width.

11. Each floor above or below the ground floor shall have not less than two exit stairs and the required exit width shall be equally divided between such stairs, provided that no stair shall be less than five feet (5') in width exclusive of rails.
12. Each room shall have an exit door located not more than one hundred and twenty-five feet (125') distant from the nearest exit to the exterior or enclosed stairway, measured along the line of travel.

13. The width of exit doors from corridors, halls and stairs shall be not more than one exit-width unit less than the required width of such corridors, halls or stairs.

14. There shall be no dead end in any corridor or hall more than ten feet (10') beyond the exit stair or door.

15. Any room, the floor of which is below ground and which is used by pupils shall have at least one exit leading directly to the exterior of the building, and such exit shall be not less in width than one-half the required width of exits from such room.

16. Schoolrooms shall have at least two exits and the distance between exits shall be not less than the width of the room.

17. Exit doors from rooms shall be not less than three feet (3') wide.

18. Doors to exterior stairs shall open on a landing not less than eight feet (8') wide.

19. No stairs or steps shall be placed in any corridor or hall.

20. For all other requirements see Chapter 33.

Sec. 805. All portions of Group C occupancies shall be provided with light and ventilation, either natural or artificial, as specified in Section 605.

Toilets shall be provided on the basis of one toilet for each 25 persons, or major fraction thereof, based on the capacity of the building, for each sex, provided that there shall be at least one toilet for each sex.

Urinals may be substituted for two-thirds of the toilets required for males.

There shall be provided at least one lavatory for each two toilets or urinals for each sex and at least one drinking fountain on each floor.

Sec. 806. All vertical openings such as elevator shafts, stair wells and vent shafts which permit the passage of fire or smoke through more than one floor shall be enclosed and the enclosure shall be as specified in Chapter 30.

Sec. 807. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 808. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Motion picture machine booths shall conform to the requirements of Chapter 40.

Every gas service shall be provided with an approved outside shut-off valve conspicuously marked.

Exterior openings in a boiler room or room containing central heating equipment, if located below openings in another story or if less than ten feet (10') from other doors or windows of the same building, shall be provided with one-hour fire-resistant protection.

Every boiler room or room containing a central heating plant which burns liquid or solid fuel shall be separated from
the rest of the building with a “Special Occupancy Separation.” Every boiler room or room containing a heating plant which burns gas as fuel shall be separated from the rest of the building with not less than an “Ordinary Occupancy Separation.” Every such boiler room or room containing a heating plant shall have at least one door opening directly to the outside of the building.

No flammable liquids shall be placed, stored or used in any Group C occupancies, except in approved quantities as necessary in laboratories and approved utility rooms, and such liquids shall be kept in tight or sealed containers when not in actual use.

Sec. 809. Gymnasiums and similar buildings may have running tracks constructed of wood or unprotected steel or iron.

In gymnasiums, one-inch (1”) nominal tight tongue and grooved wall covering may be used on the gymnasium side in lieu of fire-resistive plaster.

Roof covering shall be a “fire retardant” roofing as specified in Section 4305.

Arcades connecting buildings and used exclusively as passageways need not be considered as adjacent buildings for the provisions of this Chapter, provided that the walls of the building adjoining the arcades are finished with the same construction as required for the exterior walls of the building with no communicating openings between the arcades and the building, except doors; and provided that the arcades are of not less than one-hour fire-resistive construction or entirely of incombustible materials, or of heavy timber construction with two-inch (2”) nominal sheathing.
CHAPTER 9—REQUIREMENTS FOR GROUP D OCCUPANCIES

Sec. 901. Group D occupancies shall be:

Division 1: Jails, prisons, reformatories, houses of correction, and buildings where personal liberties of inmates are similarly restrained.

Division 2. Hospitals, sanitariums, old people's homes, orphanages, nurseries and similar buildings (each accommodating more than six).

For occupancy separations see Table No. 5-B.

Sec. 902. (a) General. Buildings or parts of buildings classed in Group D because of the use or character of the occupancy shall not exceed, in area or height, the limit specified in Sections 505, 506, and 507.

(b) Special Provisions. 1. General: Division 1 occupancies shall be of Type I construction throughout. Division 2 occupancies shall be of not less than one-hour fire-resistive construction throughout, and when more than one story in height shall be of Type I construction.

2. Special Construction: One-story buildings with not less than two-hour fire-resistive floors, and divided into areas of not more than two thousand five hundred square feet (2,500 sq. ft.) by means of two-hour fire-resistive walls extending from the floor to the roof with no openings therein except in the corridor, may have the special exits provided in Section 904.

For attic space partitions and draft stops, see Section 3205.

Sec. 903. All exterior walls or parts of walls except on street fronts, of Group D occupancies, which are less than five feet (5') from adjacent property lines shall have no openings therein, shall be of not less than four-hour fire-resistive construction and shall be constructed as specified in Parts V, VI and VII of this Code. All openings in exterior walls except on street fronts, which are less than ten feet (10') from adjacent property lines, shall be provided with doors or windows of one-hour fire-resistive construction.

For regulating adjacent buildings on the same property see Section 504.

Sec. 904. Not less than two exits shall be provided from each floor in every Group D occupancy regardless of the height or area of the building, and additional exits shall be provided as required in Chapter 33.

In hospitals or sanitariums, ramps with a slope of not more than one in six, or horizontal exits, shall be installed instead of stairways or in addition thereto to serve all portions of the building where bedridden patients are or may be placed. These ramps shall land at the first or ground floor level at points giving the most direct access practicable to the outer air. The width of all ramps and corridors shall be not less than five feet (5') clear of all obstructions, except handrails.
In Division 2 occupancies, exit doors shall not be fastened against exit by any device other than a self-releasing latch, panic bolt, or similar device which can be opened readily from the inside at all times without the use of keys or any special knowledge or effort.

Exceptions: 1. In buildings housing less than 25, exit doors may be fastened against exit by latches operated by door knobs or similar devices, which can be opened readily from the inside at any time without the use of keys.

2. In buildings meeting the requirements of paragraph 2 of Subsection 902 (b), exterior doors may be fastened with locks. Room doors shall not be fastened from the corridor side by any device other than allowed for in Exception 1 for exterior doors.

Smokeproof towers shall be provided as and when required in Chapter 33.

Sec. 905. All portions of Group D occupancies customarily used by human beings shall be provided with light and ventilation by means of windows or skylights with an area equal to one-eighth of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty cubic feet (30 cu. ft.) of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation while the building is occupied.

Sec. 906. Elevator shafts, vent shafts and other vertical openings shall be enclosed and the enclosure shall be as specified under Types of Construction.

Sec. 907. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 908. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Motion picture machine booths shall conform to the requirements of Chapter 40.

No storage of volatile flammable liquids shall be allowed in Group D occupancies and the handling of such liquid shall not be permitted in any Group D occupancies in quantities of more than one gallon unless such handling complies with the suggested Fire Prevention Ordinance, Edition of 1943, recommended by the National Board of Fire Underwriters.

Any gas service to a Group D occupancy shall be provided with an approved outside shut-off valve conspicuously marked.

Every boiler room or room containing a heating plant which burns liquid or solid fuel shall be separated from the rest of the building with a “Special Occupancy Separation.” Every boiler room or room containing a heating plant which burns gas as fuel shall be separated from the rest of the building by not less than an “Ordinary Occupancy Separation.”
Sec. 909. No requirements of this Chapter shall be so con-strued as to prohibit the construction of cell blocks in jails or prevent the use of any locks or safety devices in buildings where it is necessary to forcibly restrain the inmates.
CHAPTER 10—REQUIREMENTS FOR
GROUP E OCCUPANCIES

Sec. 1001. Group E occupancies shall be:

Public garages, paint or petroleum storage, dry cleaning plants using flammable liquids, paint shops and spray painting rooms and shops.

Planing mills, box factories, woodworking and mattress factories.

Storage of hazardous and highly flammable or explosive materials and liquids.

For occupancy separations see Table No. 5-B.

Note:—Flammable liquids shall be deemed to be those with a flash point below 190 degrees Fahrenheit as determined by the closed cup tester.

Sec. 1002. (a) General. Buildings or parts of buildings classed in Group E because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506, and 507.

(b) Special Provisions. Public garages shall not be of Type V construction, and shall be not over six hundred square feet (600 sq. ft.) in area when of Type IV construction.

Public garage floors shall be of incombustible materials and if not placed directly on the ground shall conform to the requirements for floors of Type I construction, or the floors may be of Type II construction properly protected with incombustible materials against saturation by oil and grease.

For buildings over eighty-five feet (85') in height see Sections 1809 and 1910.

For attic space partitions and draft stops see Section 3205.

Sec. 1003. All exterior walls or parts of walls except on street fronts, of Group E occupancies, which are less than five feet (5') from adjacent property lines shall have no openings therein, shall be of not less than four-hour fire-resistive construction and shall be constructed as specified in Parts V, VI and VII of this Code. All openings in exterior walls except on street fronts, which are less than ten feet (10') from adjacent property lines, shall be provided with doors or windows of one-hour fire-resistive construction.

For regulating adjacent buildings on the same property see Section 504.

Sec. 1004. All Group E occupancies shall have not less than two means of egress from each story including basements or cellars unless such basements or cellars are used for heating apparatus only, in which case only one exit shall be required.

Stairs and exits shall be provided as and when required in Chapter 33.

Smokeproof towers shall be provided as and when required in Chapter 33.
Where ramps are used for the transfer of automobiles from one floor to another such ramps shall meet the ground floor level at a point not less than twenty feet (20') from the exit from such building.

Sec. 1005. All portions of Group E occupancies customarily used by human beings shall be provided with light and ventilation by means of windows or skylights with an area equal to one-eighth of the total floor area or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty cubic feet (30 cu. ft.) of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation while the building is occupied.

In all buildings used for the storing or handling of automobiles operated under their own power and in all buildings where flammable liquids are used exhaust ventilation shall be provided sufficient to produce one complete change of air every 15 minutes. Such exhaust ventilation shall be taken from a point at or near the floor level.

Every building or portion thereof where more than four persons are employed shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets located either in such building or conveniently in a building adjacent thereto.

Sec. 1006. Elevator shafts, vent shafts and other vertical openings shall be enclosed, and the enclosure shall be as specified under Types of Construction.

Doors which are part of an automobile ramp enclosure may be kept normally open but shall be equipped with fusible links and so arranged as to be self-closing when released.

Sec. 1007. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 1008. Chimneys and heating apparatus shall conform to the requirements of Chapter 37. In any room in which volatile flammable liquids are used or stored no device generating a glow or flame capable of igniting gasoline vapor shall be installed or used within twenty-four inches (24") of the floor.

The use, handling, storage and sale of gasoline, fuel oil and other flammable liquids shall not be permitted in any Group E occupancy unless such use, handling, storage and sale comply with the suggested Fire Prevention Ordinance, Edition of 1943, recommended by the National Board of Fire Underwriters.

Dry cleaning plants in which combustible solvents are used or stored shall be of Type I construction and shall not exceed one story in height. All partitions shall be of four-hour fire-resistant construction, except for the necessary openings for the vent ducts, piping and shafting. All openings in exterior
walls, except wall vents, shall be protected with one-hour fire-resistant doors or windows. Wall vents having an area of not less than sixteen square inches (16 sq. in.) each, shall be placed in the exterior walls near the floor line, not more than six feet (6') apart horizontally. Each building shall be provided with a power driven fan exhaust system of ventilation which shall be arranged and operated so as to produce a complete change of air in each room every three minutes.

Each machine in dry cleaning establishments which uses a volatile flammable liquid shall have an adequate steam line directly connected to it, so arranged as to have the steam automatically released to the inside of such machine should an explosion occur in the machine.

Laws of the State regulating the construction and maintenance of dry cleaning plants or other buildings containing any occupancy or special hazard covered by this Chapter, shall be deemed to be a part of this Code and such buildings shall conform to the provisions of such state laws.
CHAPTER 11—REQUIREMENTS FOR
GROUP F OCCUPANCIES

Sec. 1101. Group F occupancies shall be:

Wholesale and retail stores, office buildings, restaurants, undertaking parlors, printing plants, municipal police and fire stations.

Gasoline filling and service stations, factories and workshops using materials not highly flammable or combustible.

Storage and sales rooms for combustible goods.

For occupancy separations see Table No. 5-B.

Sec. 1102. (a) General. Buildings or parts of buildings classed in Group F because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506, and 507.

(b) Special Provisions. Gasoline filling stations of Type V construction shall have incombustible exterior wall covering. Canopies, including supports thereof, over pumps shall be of incombustible materials or not less than one-hour fire-resistive construction.

For attic space partitions and draft stops see Section 3205.

Sec. 1103. All exterior walls or parts of walls except on street fronts of Group F occupancies which are less than four feet (4') from adjacent property lines shall have no openings therein, shall be of not less than four-hour fire-resistive construction and shall be constructed as specified in Parts V, VI and VII of this Code. All openings in exterior walls, except on street fronts which are less than eight feet (8') from adjacent property lines, shall be provided with doors and windows of one-hour fire-resistive construction.

For regulating adjacent buildings on the same property see Section 504.

Sec. 1104. Stairs and exits shall be provided as and when required in Chapter 33.

No portion of a Group F occupancy shall be more than one hundred and fifty feet (150') from an exit to the outside. Passageways direct to outside exits, free of all incumbrances and at least seven feet (7') in width, clearly defined by floor markings and overhead signs shall be maintained permanently.

Smokeproof towers shall be provided as and when required in Chapter 33.

Sec. 1105. All portions of Group F occupancies customarily used by human beings shall be provided with light and ventilation by means of windows or skylights with an area not less than one-eighth of the total floor area or shall be provided with artificial light and a mechanically operated ventilating system. In no case shall less than four changes of air per hour be provided.
Every building or portion thereof where more than four persons are employed shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets located either in such building or conveniently in a building adjacent thereto.

Sec. 1106. Elevator shafts, vent shafts and other vertical openings shall be enclosed, and the enclosure shall be as specified under Types of Construction.

Sec. 1107. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 1108. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

No storage of volatile flammable liquids shall be allowed in Group F occupancies and the handling and use of gasoline, fuel oil and other flammable liquids shall not be permitted in any Group F occupancy unless such use and handling comply with the suggested Fire Prevention Ordinance, Edition of 1943, recommended by the National Board of Fire Underwriters.

In any room in which volatile flammable liquids are used or stored no device generating a glow or flame capable of igniting gasoline vapor shall be installed or used within twenty-four inches (24") of the floor.
CHAPTER 12—REQUIREMENTS FOR GROUP G OCCUPANCIES

Sec. 1201. Group G occupancies shall be:

Ice plants, power plants, pumping plants, cold storage, creameries.

Factories and workshops using incombustible and non-explosive materials.

Storage and sales rooms of incombustible and non-explosive materials.

For occupancy separations see Table No. 5-B.

Sec. 1202. (a) General. Buildings or parts of buildings classed in Group G because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506, and 507.

(b) Special Provisions. Fire protection of the under side of roof framing may be omitted in all Types of Construction.

For attic space partitions and draft stops see Section 3205.

Sec. 1203. All exterior walls or parts of walls, except on street fronts of Group G occupancies which are less than three feet (3') from adjacent property lines, shall have no openings therein, shall be of not less than one-hour fire-resistive construction, and shall be constructed as specified in Parts V, VI and VII of this Code.

For regulating adjacent buildings on the same property see Section 504.

Sec. 1204. Stairs and exits shall be provided as and when required in Chapter 33.

No portion of a Group G occupancy shall be more than one hundred and fifty feet (150') from an exit to the outside. Passageways direct to outside exits, free of all incumbrances and at least seven feet (7') in width, clearly defined by floor markings and overhead signs, shall be maintained permanently.

Smokeproof towers shall be provided as and when required in Chapter 33.

Sec. 1205. All portions of Group G occupancies customarily used by human beings shall be provided with light and ventilation.

Every building or portion thereof where more than four persons are employed shall be provided with at least one toilet. Every building and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets located either in such building or conveniently in a building adjacent thereto.

Sec. 1206. Except as required in Chapter 33, vertical openings are not required to be enclosed.

Sec. 1207. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.
Sec. 1208. Chimneys and heating apparatus shall conform to the requirements of Chapter 37. In any room in which volatile flammable liquids are used or stored, no device generating a glow or flame capable of igniting gasoline vapor shall be installed or used within twenty-four inches (24") of the floor.

The storage, use and handling of gasoline, fuel oil and other flammable liquids shall not be permitted in any Group G occupancy unless such storage and handling comply with the suggested Fire Prevention Ordinance, Edition of 1943, recommended by the National Board of Fire Underwriters.
CHAPTER 13—REQUIREMENTS FOR
GROUP H OCCUPANCIES

Sec. 1301. Group H occupancies shall be:
Hotels, apartment houses, dormitories, lodging houses.
Convents and monasteries (each accommodating 10 or more
persons).

For occupancy separations see Table No. 5-B.

Sec. 1302. Buildings or parts of buildings classed in Group
H because of the use or character of the occupancy shall not
exceed, in area or height, the limits specified in Sections 505,
506 and 507.

For attic space partitions and draft stops see Section 3205.

Sec. 1303. All exterior walls or parts of walls, except on
street fronts of Group H occupancies which are less than three
feet (3') from adjacent property lines, shall have no openings
therein, shall be of not less than one-hour fire-resistive
construction and shall be constructed as specified in Parts V, VI
and VII of this Code. Openings in exterior walls, except on
street fronts, which are less than five feet (5') from adjacent
property lines, shall be provided with doors or windows of one-
hour fire-resistive construction.

For regulating adjacent buildings on the same property see
Section 504.

Location of Group H occupancies on the property shall meet
the requirements of any State laws which are intended to regu-
late such location.

Sec. 1304. Stairs and exits shall be provided as and when
required in Chapter 33.

Smokeproof towers shall be provided as and when required
in Chapter 33.

All stairs and exits in Group H occupancies shall open di-
rectly upon a street or alley or upon a yard or court not less
than four feet (4') in width directly connected to a street or
alley by means of a passageway not less in width than the
stairway opening into such passageway and not less than seven
feet (7') in height.

Sec. 1305. All rooms of Group H occupancies used for eat-
ing, living or sleeping purposes shall be provided with light and
ventilation by means of windows with an area not less than
one-eighth of the total floor area of such room or rooms.

Every building shall be provided with at least one toilet. Every
building and each subdivision thereof where both sexes
are accommodated shall be provided with at least two toi-
ettes located in such building and one such toilet shall be conspicu-
ously marked "For Women" and the other conspicuously marked
"For Men." Not less than one toilet shall be provided for each
15 persons or major fraction thereof that such building is de-
signated to accommodate.

Light, ventilation and sanitation shall be provided as speci-
fied by any State laws intended to regulate such light, ventila-
tion and sanitation.
Sec. 1306. All elevator shafts, vent shafts, stairways and other vertical openings shall be enclosed, and the enclosure shall be as specified under Types of Construction, except stairways in buildings two stories in height.

Sec. 1307. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when required in Chapter 38.

Sec. 1308. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

The storage and handling of gasoline, fuel oil and other flammable liquids shall not be permitted in any Group H occupancy unless such storage and handling comply with the suggested Fire Prevention Ordinance, Edition of 1943, recommended by the National Board of Fire Underwriters.

All doors leading into rooms in which volatile flammable liquids are used or kept shall be of one-hour fire-resistant construction and shall be kept normally closed.

Every boiler room or room containing a central heating plant using solid or liquid fuel shall be separated from the rest of the building by a "Special Occupancy Separation."

Exceptions: 1. Such furnaces may be used without an "Occupancy Separation" in buildings not more than two stories in height.

2. In buildings of Type V construction an "Ordinary Occupancy Separation" may be used.
CHAPTER 14 — REQUIREMENTS FOR
GROUP I OCCUPANCIES

Sec. 1401. Group I occupancies shall be:

Dwellings.

For occupancy separations see Table No. 5-B.

Sec. 1402. Buildings or parts of buildings classed in Group I because of the use or character of the occupancy shall not exceed, in area or height, the limits specified in Sections 505, 506 and 507.

Sec. 1403. All exterior walls or parts of walls except on street fronts of Group I occupancies which are less than three feet (3') from adjacent property lines shall have no openings therein, shall be of not less than one-hour fire-resistive construction and shall be constructed as specified in Parts V, VI and VII of this Code.

For regulating adjacent buildings on the same property see Section 504.

Sec. 1404. Stairs and exits shall be provided as and when required in Chapter 33.

Sec. 1405. All rooms of Group I occupancies used for eating, living or sleeping purposes shall be provided with light and ventilation by means of windows with an area not less than one-eighth of the total floor area of such room or rooms.

Light, ventilation and sanitation shall be provided as required by any State laws which are intended to regulate such light, ventilation and sanitation.

Sec. 1406. Stairs in Group I occupancies need not be enclosed. Dumb-waiter shafts, clothes chutes and other similar vertical openings shall be protected as specified in Section 3003.

Sec. 1407. Fire-extinguishing apparatus when installed shall conform to the requirements of Chapter 38.

Sec. 1408. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Flammable liquids shall not be stored or used in Group I occupancies in quantities in excess of one gallon and all such flammable liquids shall be kept in tight or sealed containers when not in actual use.

Sec. 1409. Group I occupancies constructed on the roof of multiple story buildings shall be considered as an additional story in so far as the construction, location, exposure, stairs, exits and fire-extinguishing apparatus are concerned.
CHAPTER 15 — REQUIREMENTS FOR GROUP J OCCUPANCIES

Group J Occupancies Defined

Sec. 1501. Group J occupancies shall be:
Division 1—Private garages, sheds and minor buildings used as accessories only when not over one thousand square feet (1000 sq. ft.) in area.
Division 2—Fences over six feet (6') high, tanks and towers.
For occupancy separations see Table No. 5-B.

Construction, Height and Area Allowable

Sec. 1502. Buildings or parts of buildings classed in Group J because of the use or character of the occupancy shall be one of the Types of Construction as specified in Part V of this Code. The floor area shall not exceed one thousand square feet (1000 sq. ft.). The height shall not exceed one story.

When any building exceeds the limit specified in this Chapter it shall be classed in the occupancy group other than Group J that it most nearly resembles.

Location on Property

Sec. 1503. All exterior walls or parts of walls (including windows and doors), except on street fronts, of Division 1, Group J occupancies which are less than three feet (3') from adjacent property lines shall be of not less than one-hour fire-resistive construction.

For regulating adjacent buildings on the same property, see Section 504.

Exit Facilities

Sec. 1504. Stairs and Exits shall be provided as and when required in Chapter 33.

Light and Ventilation

Sec. 1505. Private garages which are constructed in conjunction with any Group H or I occupancies and which have openings into such buildings shall be equipped with fixed louvered or screened openings or exhaust ventilation with exhaust openings located within six inches (6") of the floor. The clear area of the louvered opening or of the openings into the exhaust ducts shall be not less than sixty square inches (60 sq. in.) per car stored in such private garage. Under no circumstances shall a private garage have any opening directly into a room used for sleeping purposes.

Enclosure of Vertical Openings

Sec. 1506. Enclosure of vertical openings shall not be required.

Fire-Extinguishing Apparatus

Sec. 1507. Fire-extinguishing apparatus shall be installed as and when required in Chapter 38.

Where more than three automobiles are stored in any private garage there shall be installed not less than one two-and-one-half gallon chemical extinguisher to each five cars or major fraction thereof.

Special Hazards

Sec. 1508. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Flammable liquids shall not be stored, handled or used in Group J occupancies unless such storage or handling shall comply with the suggested Fire Prevention Ordinance recommended by the National Board of Fire Underwriters, Edition of 1943.
Sec. 1509. When storage space termed in this Code a private garage is provided in any building of mixed occupancies, such storage space shall be limited to six hundred and fifty square feet (650 sq. ft.) of floor area unless such storage space is separated from other portions of the building as required for public garages.

Exceptions and Deviations
PART IV

REQUIREMENTS BASED ON LOCATION IN FIRE ZONES

CHAPTER 16—RESTRICTIONS IN FIRE ZONES

General

Sec. 1601. (a) Fire Zones Defined. For the purpose of this Code, the entire city is hereby declared to be and is hereby established a Fire District and said Fire District shall be known and designated as Fire Zones One, Two and Three, and shall include such territory or portions of said City as outlined in an ordinance of said City, entitled: “An Ordinance Creating and Establishing Fire Zones.” Whenever in such ordinance creating and establishing fire zones, reference is made to any fire zone, it shall be construed to mean one of the three fire zones designated and referred to in this Chapter.

(b) Buildings Located in More than One Fire Zone. A building or structure which is located partly in one fire zone and partly in another shall be considered to be in the more highly restricted fire zone when more than one-third of its total floor area is located in such zone.

(c) Moved Buildings. Any building or structure moved within or into any Fire Zone shall be made to comply with all the requirements for new buildings in that Fire Zone.

(d) Temporary Buildings. Temporary buildings such as reviewing stands and other miscellaneous structures conforming to the requirements of this Code, and sheds, canopies or fences used for the protection of the public around and in conjunction with construction work may be erected in Fire Zones Nos. 1 or 2 by special permit from the Building Inspector for a limited period of time, and such building or structure shall be completely removed upon the expiration of the time limit stated in such permit.

Restrictions in Fire Zone No. 1

Sec. 1602. (a) General. Buildings or structures hereafter erected, constructed, moved within or into Fire Zone No. 1 shall be only of Type I, II, III or IV construction and shall meet the requirements of this Section.

(b) Limitation of Types of Construction. 1. Type III. Buildings or structures of Type III construction hereafter erected shall have all walls and partitions and floors over usable spaces of not less than one-hour fire-resistive construction.

2. Type IV. No building of Type IV construction having an area greater than four hundred square feet (400 sq. ft) exclusive of canopies that are open on at least two sides, shall be erected, constructed in, or moved into or within Fire Zone No. 1.

(c) Openings. All openings in exterior walls within twenty feet (20') of adjacent property lines or other buildings on the same property or within fifty feet (50') of the opposite side of a street or public place or in courts which are less than twenty feet (20') in least dimension, shall be provided with doors or windows of one-hour fire-resistive construction.
For the purpose of this Subsection, the center line of an adjoining alley may be considered as the adjacent property line. All distances in this Subsection shall be measured at right angles to the plane of the wall in which the opening occurs.

(d) Alterations. Any building or structure which is enlarged, altered, raised, repaired or built upon to an extent exceeding an expenditure within any five-year period of 20 per cent of the value of the building or structure, shall be made to comply with all the requirements of a new building or structure erected in Fire Zone No. 1.

No building of Type IV construction in excess of four hundred square feet (400 sq. ft.) in floor area nor any building of Type V construction already erected in Fire Zone No. 1 shall hereafter be altered, raised, enlarged, added to or moved, except as follows:

1. Such Type IV building may be made to conform to all the provisions of subsections (b) and (c) of this Section.

2. Changes, alterations and repairs to the interior of such building or to the front thereof facing a public street may be made, provided such changes do not, in the opinion of the Building Inspector, increase the fire hazard of such building.

3. Roofs of such buildings may be covered only with a “Fire Retardant” roofing as specified in Section 4305. See Section 104 (e) for repairs.

4. Such building may be moved entirely outside the limits of Fire Zone No. 1.

5. Such building may be demolished.

(e) Occupancies Prohibited. No Group E occupancies except garages shall be permitted in Fire Zone No. 1.

Sec. 1603. (a) General. Buildings or structures hereafter erected, constructed, moved within or into Fire Zone No. 2 shall be one of the Types of Construction as defined in this Code and shall meet the requirements of this Section.

(b) Limitation of Types of Construction. 1. Type IV. Buildings or structures of Type IV construction having an area greater than seventy-five hundred square feet (7,500 sq. ft.) shall not be erected, constructed, moved within or into Fire Zone No. 2 and such buildings over one thousand square feet (1,000 sq. ft.) in area, erected, constructed, moved within or into Fire Zone No. 2 shall have all exterior walls of not less than one-hour fire-resistive construction; provided that when such exterior walls are less than three feet (3') from adjacent property lines or less than six feet (6') from buildings on the same property, the exterior walls shall be of not less than four-hour fire-resistive construction.

2. Type V. Buildings or structures of Type V construction erected, constructed, moved within or into Fire Zone No. 2 shall have all exterior walls of not less than one-hour fire-resistive construction and shall not exceed seventy-five hundred square feet (7,500 sq. ft.) in area; provided, that when such exterior walls are less than three feet (3') from adjacent property lines or less than six feet (6') from buildings on the same property the exterior walls shall be of not less than four-hour fire-re-
SISTIVE CONSTRUCTION. In all cases the roofs of such buildings shall be covered with a “Fire Retardant” roofing as specified in Section 4305.

(c) Alterations. No building of Type IV construction in excess of one thousand square feet (1,000 sq. ft.) in floor area nor any building of Type V construction except as specified in Subsection (b) already erected in Fire Zone No. 2, shall hereafter be altered, raised, enlarged, added to or moved except as follows:

1. Such building may be made to conform to the provisions of Subsection (b) of this Section.

2. Changes, alterations and repairs to the interior of such building or to the front thereof facing a public street may be made provided such changes do not, in the opinion of the Building Inspector, increase the fire hazard of such building.

3. Roofs of such buildings may be covered only with a “Fire Retardant” roofing as specified in Section 4305. See Section 104 (e) for repairs.

4. Such building may be moved entirely outside the limits of Fire Zone No. 2.

5. Such building may be demolished.

6. Combustible finish on the outside of walls may be replaced by, or covered with exterior plaster as specified in Chapter 47.

(d) Occupancies Prohibited. No Group E Occupancies except garages shall be permitted in Fire Zone No. 2.

Sec. 1604. (a) General. Any building or structure complying with the requirements of this Code may be erected, constructed, moved within or into Fire Zone No. 3.
PART V

REQUIREMENTS BASED ON TYPES OF CONSTRUCTION

CHAPTER 17 — CLASSIFICATION OF ALL BUILDINGS BY TYPES OF CONSTRUCTION AND GENERAL REQUIREMENTS

Sec. 1701. The requirements of Part V are the minimum requirements for the various Types of Construction. In order that a building may be classed in any specific Type of Construction, it shall comply with all of the requirements for that Type of Construction, as specified in this Code.

No building or portion thereof shall be required to conform to the details of a Type of Construction higher than that Type which meets the minimum requirements based on Occupancy (Part III) or Location in Fire Zone (Part IV) even though certain features of such building actually conform to a higher Type of Construction.

The various Types of Construction herein defined represent varying degrees of public safety and resistance to fire. Where specific materials, types of construction or fire-resistive protection are required, such requirements shall be the minimum requirements and any materials, types of construction or fire-resistive protection which will afford equal or greater public safety or resistance to fire, as specified in this Code, may be used.

Any system or method of construction to be used shall admit of a rational analysis in accordance with well established principles of mechanics.

Sec. 1702. All buildings shall be divided into the following Types of Construction based upon their resistance to fire, and Type I shall be deemed to be the most fire-resistive and Type V the least fire-resistive Type of Construction.

Type I—FIRE-RESISTIVE Construction.
Type II—HEAVY TIMBER Construction.
Type III—ORDINARY MASONRY Construction.
Type IV—LIGHT INCOMBUSTIBLE FRAME Construction.
Type V—WOOD FRAME Construction.

When two or more types of construction occur in the same building and are not separated by an unpierced wall of four-hour fire-resistive construction, the entire building shall be classed in the least fire-resistive type of construction and such buildings shall be subject to the restrictions of such type. Any building erected prior to the passage of this Code, which by its construction cannot be classified definitely as Type I, II, III, IV or V as defined herein, shall for the purpose of this Code be deemed to belong to the least fire-resistive class of the two.
types to which it most nearly conforms. Any building which cannot be classed as Type I, II, III or IV construction shall be considered to be of Type V construction.

Sec. 1703. Exterior walls enclosing the floor areas shall be constructed and maintained for all buildings hereafter erected wherever no openings are allowed in exterior walls and wherever any fire protection for openings in the exterior walls is required in this Code.
CHAPTER 18 — TYPE I BUILDINGS
(Fire-Resistive)

Sec. 1801. In "Type I Buildings," the structural frame shall be of structural steel or iron which shall be fire-protected, or shall be of reinforced concrete. The exterior walls, inner court walls, and walls enclosing vertical openings, shall be of fire-resistant construction. The roof construction and floors shall be of fire-resistant materials. Exterior doors and windows, except as specified in Section 1813 shall be of fire-resistant construction.

Sec. 1802. The height of Type I buildings shall not be limited.

Sec. 1803. The floor area of Type I buildings shall not be limited.

Sec. 1804. Footings shall be of solid masonry as specified in Chapter 24 or of reinforced concrete as specified in Chapter 26, and shall be designed as specified in Section 2311 and Chapter 28. Foundation walls shall be of masonry or reinforced concrete as specified in Chapter 29.

Sec. 1805. Exterior walls shall be of not less than four-hour fire-resistant construction, except that walls fronting on streets having a width of at least fifty feet (50') in Fire Zone No. 1 or thirty feet (30') in Fire Zones No. 2 and No. 3 may be of incombustible construction with all structural members fire-protected as required in Section 1809. Inner court walls shall be of not less than three-hour fire-resistant construction.

Sec. 1806. Interior partitions shall be constructed of incombustible materials and shall be of not less than one-hour fire-resistant construction.

Exceptions: Temporary partitions dividing portions of stores, offices or similar places occupied by one tenant only may be constructed of wood panels or similar light construction up to three-fourths the height of the room in which placed; when more than three-fourths the height of the room, such partitions shall have not less than the upper one-fourth of the partition constructed of plain glass set in sash.

Sec. 1807. Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings, when required because of occupancy in Part III shall be of not less than two-hour fire-resistant construction and all openings therein shall be protected by fire-resistant doors or windows. (See Chapter 30.)

A parapet wall or hand rail at least thirty inches (30") in height above the roof shall be provided around all open shaft enclosures extending through the roof.

Sec. 1808. Structural framework shall be of structural steel or iron as specified in Chapter 27 or shall be of reinforced concrete as specified in Chapter 26.

The structural frame shall be considered as the columns, and
all girders, beams, trusses or spandrels having rigid connections to the columns and all other members essential to the stability thereof. The members of floor or roof panels which have no connection to the columns, shall be considered secondary members. The structural frame and secondary members shall be designed and constructed to carry all dead, live and other loads to which they may be subjected both during erection and after completion of the structure. Unless otherwise provided for in the structural frame the floor and roof panel construction shall be designed and constructed to carry the horizontal forces to such parts of the structural frame as are designed to carry the horizontal forces to the foundations.

The entire structural frame and each member which is a part of such frame shall be so designed and constructed that the stresses may be satisfactorily determined by a rational analysis in accordance with well established principles of mechanics and sound engineering practice.

**Sec. 1809. (a) Structural Steel or Iron Members.** All structural steel or iron members, not including frames or structural members for elevators and elevator enclosures, shall be thoroughly fire-protected with not less than four-hour fire-resistive protection for columns, beams and girders and three-hour fire-resistive protection for floors, for all buildings more than eight stories or eighty-five feet (85') in height housing Group E occupancies; and with not less than three-hour fire-resistive protection for columns, beams and girders and two-hour fire-resistive protection for floors for all other buildings.

**Exceptions:**
1. The thickness of the fire-protection on the outer edge of lugs or brackets on columns may be reduced to not less than one inch (1').
2. The masonry over window openings may be supported by a steel plate, angle or similar member which is not fire-protected on the under side, provided the member is supported at proper intervals from a structural beam or girder which is fire-protected on all sides. For openings in masonry bearing walls not exceeding four feet (4') in width, an angle or similar member supported by masonry and not fire-protected on the under side may be used.
3. Where every part of the structural steel framework of the roof of a Group A, B or C occupancy is not less than twenty-five feet (25') above any floor, balcony or gallery, fire-protection of all members of the roof construction may be omitted.
4. Where every part of the structural steel framework of the roof of a Group A, B or C occupancy is more than eighteen feet (18') and less than twenty-five feet (25') above any floor, balcony or gallery, the roof construction shall be protected by a suspended ceiling of not less than one-hour fire-resistive construction, and such ceiling shall be not less than six inches (6") distant from any part of such roof construction.

(b) **Reinforced Concrete Members.** All reinforced concrete columns, beams and girders shall be thoroughly fire-protected
with not less than four-hour fire-resistive protection and all floors, joists and slabs shall be thoroughly fire-protected with not less than three-hour fire-resistive protection, for all buildings more than eight stories or eighty-five feet (85') in height housing Group E occupancies; and all reinforced concrete columns, beams and girders shall be thoroughly fire-protected with not less than three-hour fire-resistive protection and all floors, joists and slabs shall be thoroughly fire-protected with not less than two-hour fire-resistive protection for all other buildings.

Sec. 1810. Floor construction shall consist of any incombustible floor system of not less than three-hour fire-resistive construction for all buildings housing Group E occupancies more than eight stories or eighty-five feet (85') in height, and of not less than two-hour fire-resistant construction for all other buildings.

The type of floor construction used shall provide means to keep the beams and girders from spreading, by installing either ties or bridging, with no laterally unsupported length of joists being permitted to exceed eight feet (8') except as otherwise provided in Sections 3102 and 3103. The floor and roof panel construction shall be so designed and constructed as to transfer horizontal forces to such parts of the structural frame as are designed to carry the horizontal forces to the foundations, unless such forces are provided for otherwise.

Where wood sleepers are used for laying wood floors the space between the floor slab and the underside of the wood flooring shall be filled with incombustible material in such a manner that there will be no open spaces under the flooring which will exceed one hundred square feet (100 sq. ft.) in area and such space shall be filled solidly under all partitions so that there is no communication under the flooring between adjoining rooms.

Sec. 1811. Roofs shall be constructed of any materials or combination of materials as allowed for floors in Section 1810.

Exception: Roofs more than twenty-five feet (25') above any floor, balcony or gallery, may be of unprotected incombustible materials.

Roof Covering shall be a “Fire Retardant” roofing as specified in Section 4305.

Any drainage fill placed on a roof deck of any building shall be of incombustible material and such fill shall be considered as a part of the dead load in designing the roof framing.

Sec. 1812. Stairs and stair platforms shall be constructed of reinforced concrete, iron or steel with treads and risers of concrete, iron or steel. Brick, marble, tile or other hard incombustible materials may be used for the finish of such treads and risers.

All stairs shall be designed and constructed as specified in Chapter 33 and as required under Occupancy in Part III.

Sec. 1813. Doors, windows and other openings in the exterior walls shall be protected by one-hour fire-resistive construction.

Exceptions: 1. The provisions of this Section shall not apply to doors, windows and other openings which face
directly upon, and are not within fifty feet (50') in Fire Zone No. 1 or are not within thirty feet (30') in Fire Zones No. 2 and 3, of the opposite side of a public street or other public place, this distance to be measured at right angles to the plane of the wall in which such openings occur.

2. The provisions of the first paragraph of this Section shall not apply to openings in an outer court twenty feet (20') or more in width parallel to and facing upon a street or public place, provided such openings are not within twenty feet (20') of an adjacent property line.

Sec. 1814. Bays, oriel s and similar projections shall be constructed of incombustible materials with walls, floors and roofs as specified in this Chapter and as specified in Chapter 35.

Porches and exterior balconies shall be constructed of incombustible materials but structural steel or iron members need not be fire-protected; provided, that loading platforms for warehouses, freight depots and similar buildings may be of heavy timber construction with wood floors not less than one and five-eighths inches (1⅜") thick. Such wood construction shall not be carried through the exterior walls of any Type I building.

Cornices, marques and similar appendages which are a part of a Type I building shall be constructed of substantial incombustible materials and as required in Chapter 45.

Sec. 1815. Penthouses and other roof structures shall be constructed of masonry or reinforced concrete, and all doors, windows and other openings therein shall be of not less than one-hour fire-resistive construction. (See Chapter 36.)

Skylights shall be constructed of not less than one-hour fire-resistive materials. (See Chapter 34.)

Sec. 1816. Wood or unprotected steel or iron shall be permitted in the following places:

1. Mezzanine floors may be of wood or unprotected steel provided that there shall be not more than two such mezzanines in any room of any building and provided, further, that no such mezzanine floor or floors shall cover more than 33⅓ per cent of the area in the room where located. Such mezzanine floors constructed in Fire Zone No. 1 shall be of heavy timber construction as required for floor construction in Type II buildings or of incombustible material protected with lath and plaster approved for one-hour fire-resistive construction.

2. Show window frames and aprons, also show cases and other appurtenances on the first floors of stores or other similar buildings may be of wood with or without unprotected steel or iron.

3. Trim, picture molds, chair rails, wainscoting, baseboards, hand rails, show window backing, temporary partitions, floors, and sleepers may be of wood. Wood doors may be used except in stair, elevator or other shaft enclosures or where not specifically prohibited under Occupancy in Part III.

4. Roofs may be sheathed by wood planks of two and one-half inch (2½") nominal thickness when such sheathing is more than thirty feet (30') distant from any floor, balcony or gallery and when such plank sheathing is protected on the underside by a ceiling of not less than one-hour fire-resistive construction.
CHAPTER 19 — TYPE II BUILDINGS
(Heavy Timber Construction)

Sec. 1901. In "Type II Buildings" the structural frame shall be of structural steel or iron which shall be fire-protected, of reinforced concrete, of masonry or of heavy timbers, provided, that in buildings not exceeding one story and sixty-five feet (65') in height the structural steel or iron may have the fire-protection omitted. Exterior walls shall be of fire-resistive construction. Inner court walls shall be of incombustible materials or protected solid wood. Roof construction shall be of wood, or incombustible materials. Floors and non-bearing partitions shall be of wood or incombustible materials.

Sec. 1902. Type II buildings shall not exceed a height of seventy-five feet (75'); provided, that the height of a building erected on sloping ground may be not to exceed seventy-five feet (75') plus a vertical distance equal to the vertical change in slope along the length of any side of such building but in no case shall such height exceed eighty-five feet (85') above the adjacent finished ground level; provided, further, that no one-story building shall exceed a height of sixty-five feet (65').

Towers, spires and steeples erected as a part of the building and not used for habitation or storage may extend not to exceed twenty feet (20') above such height limit.

Sec. 1903. The floor area of Type II buildings shall be limited according to occupancy as required in Part III of this Code.

Sec. 1904. Footings shall be of solid masonry as specified in Chapter 24 or of reinforced concrete as specified in Chapter 26, and shall be designed as specified in Section 2311 and Chapter 28. Foundation walls shall be of masonry or reinforced concrete as specified in Chapter 29.

Sec. 1905. Exterior walls shall be of not less than four-hour fire-resistive construction, except that walls fronting on streets having a width of at least fifty feet (50') in Fire Zone No. 1 or thirty feet (30') in Fire Zones No. 2 and No. 3 may be of incombustible construction, with columns having not less than three-hour fire-resistive protection and beams and girders not less than two-hour fire-resistive protection.

All walls within five feet (5') of adjacent property lines (excepting property lines abutting a street or an alley) and all walls within ten feet (10') of other buildings on the same property shall be provided with a parapet wall at least thirty inches (30") high above the roof at all points, provided that parapet walls need not be constructed on buildings twenty feet (20') or less in height or where the roof slopes more than 20 degrees from the horizontal back from the exterior wall of such building.

Inner court walls shall be the same as exterior walls or shall be of not less than four-inch solid wood laminated construction protected on the weather side thereof by incombustible fire-resistive materials as provided in Section 4202.
Sections 1906-1909

Partitions

Sec. 1906. Interior partitions shall be of one-hour fire-resistive construction or may be of solid wood construction formed of two layers of one-inch (1") nominal matched boards or of solid wood laminated construction not less than three and five-eighths inches (3½") thick.

Where wood partitions abut or adjoin masonry walls they shall be tied as required in Section 2518.

Temporary partitions as specified in Section 1806 may be used.

Enclosure of Vertical Openings

Sec. 1907. Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings shall be of not less than two-hour fire-resistive construction, (see Chapter 30); provided, that in buildings not more than three stories in height which are completely sprinklered as specified in Chapter 38 such enclosure walls may be of any construction permitted for interior partitions.

A parapet wall or hand rail at least thirty inches (30") in height above the roof shall be provided around all open shaft enclosures extending through the roof.

Structural Framework

Sec. 1908. The structural frame shall be as specified in Chapter 26 for reinforced concrete, Chapter 27 for structural steel and Chapter 25 for solid wood.

All wood columns in such structural frame shall be directly superimposed, one above the other, (no girders or bolsters between columns) and shall be provided with steel or cast iron caps or pintles which shall be self-releasing wherever any horizontal members are framed into such columns. No wood column shall be less than eight inches (8") nominal in its least dimension; no beam, girder or joist shall be less than six inches (6") nominal in its least dimension, nor less than forty-eight square inches (48 sq. in.) nominal in cross-sectional area; and no wood roof truss or arch framing member shall be less than four inches (4") nominal in least dimension, except that top and bottom chords of truss may be built up of two or more elements of not less than three inches (3") nominal thickness when the space between such elements is either solidly filled or is lightly closed for the full length on the underside thereof with a wood cover plate of two-inch (2") nominal thickness.

Fire-Protection of Structural Members

Sec. 1909. (a) Structural Steel or Iron Members. All structural steel or iron members (not including frames and structural members for elevators and elevator enclosures) shall be thoroughly fire-protected. Such fire-protection shall be of three-hour fire-resistive protection for columns, and two-hour fire-resistive protection for beams, girders and floor systems, provided, that such fire-protection may be omitted when the building does not exceed a height of one story and sixty-five feet (65').

Exceptions: 1. The thickness of the fire-protection on the outer edge of lugs or brackets on columns may be reduced to not less than one inch (1").

2. The masonry over window openings may be supported by a steel plate, angle or similar member which is not fire-protected on the under side, provided the member is sup-
Section 1909.101. Roof construction shall be as required for Type I Wood Structural Members. All reinforced concrete members shall be protected. Wood Structural Members shall be protected. See 1909.101. Roof construction shall be as required for Type I Wood Structural Members. All reinforced concrete members shall be protected. See 1909.101. Roof construction shall be as required for Type I Wood Structural Members. All reinforced concrete members shall be protected.
or iron. No wood shall be used in the following places:

See 1916. No wood shall be used in wood trimming unless specified in Chapter 7.

1. Mezzanine floors may be of wood or unprotected steel.

2. Show-window frames, and sills, also show cases and

3. Window screens on the first floors of stores and other similar structures.

4. The re-entrant construction, specified in Chapter 36.

5. Penhouse roofs shall be of not less than two-hour fire-resistive con-

6. Skylights shall be of not less than one-hour fire-resistive con-

7. Penhouses shall be of not less than two-hour fire-resistive con-

8. Building from the exterior. The exterior of the building shall be fire-resistive and be protected by the above standards.

9. The exterior of the building shall be fire-resistive and be protected by the above standards.

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49. The exterior of the building shall be fire-resistive and be protected by the above standards.

50. The exterior of the building shall be fire-resistive and be protected by the above standards.
or where not specifically prohibited under Occupancy in Part II.

may be used, except in stair, elevator and other shaft enclosures.

and wainscoting or baseboards may be of wood. Wood doors

partitions as specified in Section 1906. Picture moldings, chair rails

9. Trim, hand rails, show window backing and temporary
CHAPTER 20 — TYPE III BUILDINGS
(Ordinary Masonry)

Definition

Sec. 2001. In "Type III Buildings," the interior load bearing construction may be masonry or reinforced concrete walls or a structural frame of steel, reinforced concrete or wood. Exterior walls shall be of fire-resistive materials. Partitions, floors and roof framing may be of wood.

Height Allowable

Sec. 2002. Type III buildings shall not exceed a height of fifty-five feet (55') provided, that the height of a building erected on sloping ground may be fifty-five feet (55') plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building, but in no case shall such height exceed sixty-five feet (65') above the adjacent finished ground level; and provided, further, that towers, spires and steeples erected as a part of such building and not used for habitation or storage may extend not to exceed fifteen feet (15') above such height limit.

Area Allowable

Sec. 2003. The floor area of Type III buildings shall be limited according to Occupancy as required in Part III.

Foundations

Sec. 2004. Footings shall be of solid masonry as specified in Chapter 24 or of reinforced concrete as specified in Chapter 26, and shall be designed as specified in Section 2311 and Chapter 28. Foundation walls shall be of masonry or reinforced concrete as specified in Chapter 29.

Exterior and Inner Court Walls

Sec. 2005. Exterior walls shall be not less than four-hour fire-resistive construction, except that walls fronting on streets having a width of at least fifty feet (50') in Fire Zone No. 1 or thirty feet (30') in Fire Zones No. 2 and No. 3 may be of incombustible construction with all structural members having not less than one-hour fire-resistive protection.

All walls within five feet (5') of adjacent property lines (except property lines abutting a street or alley) and all walls within ten feet (10') of other buildings on the same property shall be provided with parapet walls at least thirty inches (30") high above the roof at all points; provided, that parapet walls need not be constructed on buildings twenty feet (20') or less in height or where the roof slopes more than 20 degrees from the horizontal back from the exterior wall of such building.

Inner court walls and all other walls not forming the exterior walls of the building may be as required for Type I or Type II buildings, or shall be of not less than one-hour fire-resistive construction.

Partitions

Sec. 2006. Partitions of wood shall be constructed as required in Chapter 25. Bearing partitions, when constructed of wood, shall not support more than two stories and a roof.

Temporary partitions as specified in Section 1806 may be used.

Enclosure of Vertical Openings

Sec. 2007. Enclosures for elevator shafts, vent shafts, stair wells and other vertical openings when required because of Occupancy in Part III shall be of not less than one-hour fire-resistive construction. (See Chapter 30.)
A parapet wall or hand rail at least thirty inches (30") in height above the roof shall be provided around all open shaft enclosures extending through the roof.

Sec. 2008. Structural framework shall be of steel, iron, reinforced concrete, masonry or wood and shall be designed and erected as specified in Chapter 26 for reinforced concrete, Chapter 27 for steel and iron, Chapters 22 and 25 for wood and Chapters 24 and 29 for masonry.

Sec. 2009. Fire-protection of steel or iron structural members may be omitted unless otherwise provided, because of location as in Part IV or Occupancy as in Part III, or as required in this Chapter.

All members carrying masonry in buildings over one story in height shall be fire-protected with not less than one-hour fire-protection. Bottom flanges of exterior lintels need not be fire-protected.

Sec. 2010. Floors may be constructed as specified in Chapter 26 for reinforced concrete, Chapter 24 for masonry, Chapter 25 for wood, and Chapter 27 for steel or iron.

In all buildings having a usable space under the first floor, except Groups I and J occupancies, the underside of such floor construction when of metal or wood shall be protected by a ceiling of lath and plaster approved for one-hour fire-resistive construction.

Wood joists, beams and girders supported by masonry walls shall be anchored thereto as required in Section 2518. Ventilation shall be provided between the ground and a wood floor as required in Section 2527.

Sec. 2011. Roof construction shall be of any Type of Construction permitted for floors except where otherwise required because of Occupancy in Part III.

Roof covering shall be a “Fire-Retardant” roofing as specified in Section 4305.

Sec. 2012. Stairs may be of steel, iron, reinforced concrete, masonry or wood and shall be designed and constructed as specified in Chapter 33, and as required under Occupancy in Part III.

Sec. 2013. Doors, windows and other openings in exterior walls may be of wood or of plain glass and wood sash unless otherwise required under Occupancy in Part III or Location in Part IV.

Sec. 2014. Bays, oriels and similar projections shall be constructed of incombustible materials with walls, floors and roof as required in this Chapter and in Chapter 35.

Porches and exterior balconies shall be constructed of incombustible materials but structural steel or iron members need not be fire-protected; provided that loading platforms for warehouses, freight depots and similar buildings may be of heavy timber construction with wood floors not less than one and five-eighths inches (1 5/8") thick. Such wood construction shall not be carried through the exterior walls of any Type III building.
Sections 2014-2016

Cornices, marquees and similar appendages which are a part of a Type III building shall be constructed of substantial incombustible materials and as required in Chapter 45.

Penthouses and Skylights

Sec. 2015. Penthouses and other roof structures shall be of not less than one-hour fire-resistive construction. (See Chapter 36.)

Skylights shall be of not less than one-hour fire-resistive construction. (See Chapter 34.)

Combustible Materials Regulated

Sec. 2016. Wood shall be permitted in a building of Type III construction except where specifically prohibited under Occupancy in Part III or Location in Part IV.

Combustible insulating materials may be placed in the partition, floor or roof framing but shall in no way interfere with the fire blocking or fire separations required by this Code.
CHAPTER 21 — TYPE IV BUILDINGS
(Light Incombustible Frame)

Sec. 2101. In "Type IV Buildings" the structural framework shall be of steel, iron, masonry or reinforced concrete and exterior walls shall be of incombustible materials. Partitions, floors and roof construction shall be of incombustible materials except as specified in this Chapter. Foundations shall be of masonry or reinforced concrete.

Sec. 2102. Type IV buildings shall not exceed a height of forty-five feet (45') provided that the height of such building erected on sloping ground may be forty-five feet (45') plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building but in no case shall such height exceed fifty-five feet (55') above the adjacent finished ground level. Towers, spires and steeples erected as a part of such building and not used for habitation or storage may extend not to exceed ten feet (10') above such height limit except that the height of such towers on Group G occupancies shall not be limited.

Sec. 2103. The floor area of a Type IV building shall be limited as specified under Occupancy in Part III and Location in Part IV.

Sec. 2104. Footings shall be of solid masonry as specified in Chapter 24 or of reinforced concrete as specified in Chapter 26, and shall be designed as specified in Section 2311 and Chapter 28. Foundation walls shall be of masonry or reinforced concrete as specified in Chapter 29.

Sec. 2105. Exterior Walls. Exterior wall covering shall provide suitable protection from the elements and shall be of incombustible material of such thickness, strength and so anchored to the wall frame as to resist effectively wind and other forces that may be applied to it. Wall coverings may be considered a structural part of the structural frame if designed and constructed to act integrally therewith.

Studs or other similar vertical supports shall in no case be spaced more than four feet (4') on centers. All openings wider than the regular stud spacing in the wall shall be trussed or provided with lintels with proper end support, provided that where no studs are used the structural frame shall be designed in accordance with Chapter 24, Chapter 26 or Chapter 27. All walls shall be thoroughly and effectively braced; and effectively fire-stopped at all floor and ceiling levels with incombustible materials. All steel studs shall be designed in accordance with Chapter 27.

All roof and floor loads shall be transmitted to the steel studs or other supporting members, either directly or by means of a load distributing member. Maximum wall height between horizontal supports perpendicular to bearing walls shall not exceed forty-five (45) times the structural thickness of the wall.

Portland cement plaster not less than one and one-half inch (1½") in thickness reinforced in two directions with not less than three-tenths per cent of steel may be considered to act with the studs to resist bending and shear under horizontal forces when said reinforcement is anchored to the stud in such a man-
ner as to resist effectively the stresses developed. The unit stresses for such reinforced plaster shall not be more than 50 per cent of those allowed for concrete beams in Table No. 26-B, based on a compressive strength of such plaster of 1500 pounds per square inch.

Partitions

Sec. 2106. Bearing partitions shall be constructed as required for exterior walls. Interior non-bearing partitions shall be of incombustible materials.

Enclosure of Vertical Openings

Sec. 2107. Enclosures for elevator shafts, stair wells and other vertical openings when required because of Occupancy in Part III shall be of not less than one-hour incombustible fire-resistive construction. (See Chapter 30.)

A parapet wall or hand rail at least thirty inches (30") in height above a flat roof shall be provided around all open shaft enclosures extending through the roof.

Structural Framework

Sec. 2108. The structural framework shall be as specified in Chapter 27 for iron and steel, Chapters 24 and 29 for masonry and Chapter 26 for reinforced concrete.

Fire-Protection of Structural Members

Sec. 2109. Fire protection of structural members may be omitted unless otherwise provided, because of location as in Part IV or occupancy as in Part III, or as required in this Chapter.

All members carrying masonry in buildings over one story in height shall be fire-protected with not less than one-hour fire protection. Bottom flanges of exterior lintels need not be fire-protected.

Floor Construction

Sec. 2110. Floor construction shall be of incombustible material, provided, however, that wood flooring may be used.

Roof Construction

Sec. 2111. Roof construction may be of any type of construction permitted by this code.

Roof covering shall be a "Fire Retardant" roofing as specified in Section 4305.

Stair Construction

Sec. 2112. Stairs shall be of any type permitted by this Code and shall comply with the requirements of Chapter 33.

Doors and Windows

Sec. 2113. Doors, windows and other openings in exterior walls may be of any type permitted by this code, unless otherwise required under Occupancy in Part III, and Fire Zones in Part IV.

Projections from the Building

Sec. 2114. Porches, cornices, marqueses, canopies and all other similar projections from the building shall be of incombustible materials, except that a loading platform not including the roof or roof structure thereof, may be constructed of wood as specified in Section 1914.

Penthouses and Skylights

Sec. 2115. Penthouses and other roof structures shall be constructed as required for the main portion of the building. (See Chapter 36.) Skylights shall be constructed as required in Chapter 34.
CHAPTER 22 — TYPE V BUILDINGS
(Wood Frame)

Sec. 2201. In "Type V Buildings," enclosing walls, interior walls, partitions, floors and roofs shall be of wood as specified in Chapter 25 or of wood in combination with other materials except where prohibited as specified under Occupancy in Part III. Any building which cannot be classed as Type I, II, III or IV construction shall be considered to be of Type V.

Sec. 2202. Type V buildings shall not exceed a height of thirty-eight feet (38'); provided that the height of a building erected on sloping ground may be thirty-eight feet (38') plus a vertical distance equal to the vertical change in slope along and in the length of any side of such building but in no case shall such height exceed forty-five feet (45') above the adjacent finished ground level; provided, further, that spires, towers or steeples erected as a part of such building and not used for habitation or storage may extend not to exceed ten feet (10') above such height limit.

Sec. 2203. The maximum floor area allowable for a Type V building shall in no case exceed that specified under Occupancy in Part III or Location in Part IV.

Sec. 2204. All exterior walls and interior bearing walls of type V buildings shall be supported on continuous solid masonry or reinforced concrete footings which shall be of sufficient size to support safely the loads imposed as determined from the character of the soil. Masonry foundation walls shall extend at least six inches (6") above the finished grade adjacent to the wall at all points. Mudsills shall be bolted to the foundation or foundation wall with not less than one-half inch (½") bolts, embedded at least seven inches (7") into the masonry and spaced not more than six feet (6') apart. (See appendix for table of minimum foundation requirements for Type V buildings.)

Exceptions: 1. Interior bearing walls in one-story buildings may be supported on piers.

2. For Type V buildings, (except Group H and I occupancies) isolated piers of solid masonry or reinforced concrete may be used for post and girder construction.

3. A one-story building (except a Group I occupancy) which does not exceed four hundred square feet (400 sq. ft.) in area, including additions, may be constructed without a masonry or reinforced concrete foundation if the walls are supported on a wood mudsill.

All mudsills shall be all-heart cedar, all-heart cypress or Foundation Grade redwood, or any species of wood if treated under pressure with an approved preservative.

Foundations for all buildings where the surface of the ground slopes more than one foot (1') in ten feet (10') shall be level or shall be stepped so that both top and bottom of such foundation are level.

Foundations of Type V Buildings may be of piles, constructed as provided in Chapter 28.
Foundation walls and all other walls used as retaining walls in connection with Type V buildings shall be not less than eight inches (8") in thickness. All such walls shall be designed for the loads specified in Section 2310.

Sec. 2205. (a) Construction. Exterior walls of all Type V buildings having a floor area of four hundred square feet (400 sq. ft.) or more, including additions, shall be constructed with studding not less than two inches by four inches (2"x4") spaced not more than sixteen inches (16") on centers, or such walls may be constructed of not less than four inch by four inch (4"x4") posts spaced not more than five feet (5') on centers or of larger members designed as required in Chapter 25, or may be of post and beam framing with plank sheathing not less than one and one-half inches (1 1/2") thick or may be of laminated construction not less than four inches (4") nominal in thickness with the structural assembly properly designed to support all loads.

One-story buildings having a total floor area of not more than four hundred square feet (400 sq. ft.) may have exterior walls of vertical one-inch (1") boards and battens without studs.

Buildings two stories in height shall have walls constructed as specified above. Buildings three stories in height shall have the first story studs not less than two inches by six inches (2"x6") spaced not more than sixteen inches (16") on centers.

Underpinning shall be not less in size than the studding of the story above; provided, that all underpinning exceeding four feet (4') in height shall be not less in size than the studding required for an additional story. All such underpinning shall be effectively braced.

Where studs continue through more than one story, joists shall be nailed securely to the studs and shall be supported upon a one inch by four inch (1"x4") ribbon notched into the studs and securely nailed thereto, or by other means affording equivalent strength and rigidity. Where stories are framed separately, each tier of studding shall have top and bottom plates and the top plates shall be doubled and lapped at all corners and intersections. Laps in separate pieces of the top plate shall be staggered not less than four feet (4').

All exterior walls and partitions shall be thoroughly and effectively braced.

Maximum allowable height of two inch by four inch (2"x4") stud framing shall be fourteen feet (14') and of two inch by six inch (2"x6") stud framing shall be twenty feet (20') unless the wall is supported laterally by adequate framing in a horizontal direction, perpendicular to the direction of the stud wall.

All walls shall be fire-stopped effectively as required in Section 2526.

Ventilating openings under first floor joists shall be provided as required in Section 2527.

A wood mudsill, not less than two inches (2") thick and not less in width than the wall framing supported thereon, and of the quality required in Section 2204 shall be placed under all wood frame walls or partitions directly supported by masonry or reinforced concrete foundations.
(b) Sheathing. Sheathing where required for exterior walls shall be applied solidly over the wall surface and shall be one or more of the following materials:

Wood not less than five-eighths inch (\(\frac{5}{8}\)) thick.

Approved fiber board not less than seven-sixteenths inch (7/16") thick.

Approved gypsum sheathing not less than one-half inch (\(\frac{1}{2}\)) thick.

Approved plywood not less than five-sixteenths inch (5/16") thick.

All Type V buildings three stories in height shall have the exterior walls covered with a solid sheathing as set forth in this section.

(c) Wall Coverings. 1. General. Exterior walls shall be covered on the outside with the materials and in the manner specified in this Section.

2. Weatherboarding. Studs or sheathing shall be covered on the outside face with one layer of building paper as specified in Section 2217. Weatherboarding, when in place, shall have an average thickness of not less than five-eighths inch (\(\frac{5}{8}\)) and a minimum thickness of not less than three-eighths inch (\(\frac{3}{8}\)). Such weatherboarding shall be placed over the paper and shall be securely nailed to the studding with not less than two nails to each stud in each piece of such weatherboarding. Horizontal joints in the weatherboarding shall be tongued and grooved or shiplapped joints, or such weatherboarding shall be laid shingle fashion and lapped not less than one-half inch (\(\frac{1}{2}\)). Siding patterns known as rustic, drop siding or shiplap shall have an average thickness in place of not less than nineteen thirty-seconds inch (19/32") and a minimum thickness of not less than three-eighths inch (\(\frac{3}{8}\)). Bevel siding shall have a minimum thickness measured at the butt section of not less than twenty-one thirty-seconds inch (21/32") and a tip thickness of not less than one-quarter inch (\(\frac{1}{4}\)). Siding of lesser dimensions may be used, provided the outside face of the stud is first covered with sheathing as provided in this Section.

3. Plywood. Where plywood is used for covering the exterior of outside walls it shall be of the exterior type not less than three-eighths inch (\(\frac{3}{8}\)) thick. If three-ply is used without sheathing, it shall be placed so that the grain of the outside plies runs perpendicular to the supporting members. Joints shall be backed solid with nailing pieces not less than two inches (2") wide.

4. Shingles or Shakes. Shingles or shakes may be used for exterior wall covering provided the frame of the structure is covered with building paper as specified in Section 2217. The thickness of shingles or shakes between wood nailing boards shall be not less than three-eighths inch (\(\frac{3}{8}\)).

5. Exterior Plastering. See Chapter 47 for Exterior Plastering. (See also Section 2205 in the Appendix.)


7. Galvanized Iron. Galvanized iron not less than 28 gauge may be used on stud walls without sheathing. Walls shall be effectively braced and nailing strips shall be placed in such
manner as to permit the metal to be nailed at vertical intervals of not more than four feet (4').

Sec. 2206. Interior partitions may be of any material permitted for exterior walls in this Code. If of wood, interior partitions shall be constructed, framed and firestopped as required for exterior walls as specified in Chapter 25, except that interior non-bearing partitions may have a single top plate, and except that where non-bearing partitions are approximately parallel and not more than four feet (4') apart, two-inch by three-inch (2"x3") studs sixteen inches (16") on centers, may be used.

Sec. 2207. Enclosure walls for elevator shafts, vent shafts, stair wells and similar vertical openings through a building shall be of not less than one-hour fire-resistive construction when required under Occupancy in Part III, except that chutes and dumb-waiter shafts with a cross-sectional area of not more than nine square feet (9 sq. ft.) may be lined with approved non-combustible materials covered with not less than 26 U. S. gauge sheet metal with all joints in such sheet metal lock-lapped. (See Chapter 30.) All openings into any such vertical enclosures shall be protected by metal or metal-clad doors with either metal or metal-clad jambs, casings or frames.

Sec. 2208. Structural framework may be of any type of construction permitted in this Code.

Sec. 2209. Fire-protection of structural framework shall not be required except as provided under Occupancy in Part III.

Sec. 2210. Floors may be of any type of construction permitted in this Code.

Sec. 2211. Roof construction may be of any type of construction permitted in this code. When roof construction is of wood it shall conform to the requirements of Chapter 25.

Attic or roof spaces shall be divided into areas not exceeding twenty-five hundred square feet (2500 sq. ft.) as required in Section 3205.

Roof covering shall be a "Fire Retardant" roofing, except that for Groups H, I and J occupancies, an ordinary roofing may be used as specified in Section 4305. Wherever a composition roofing is used, the roof construction shall be solidsheathed with wood, sheathing to be not less than twenty-five thirty-seCONDS inch (25/32") thick.

Sec. 2212. Stair construction may be of any type permitted in this code and shall conform to the requirements of Chapter 33.

Sec. 2213. Doors and windows may be of any type permitted in this Code.

Sec. 2214. Any projections from the building shall conform to the requirements for exterior walls, and shall be as required in Chapter 45.

Sec. 2215. Penthouses and skylights may be of any material permitted in Chapters 34 and 36 of this Code.
Building paper may be omitted in the following cases:

1. When exterior covering is of sheet metal.
2. In back-pressured construction.
3. When there is no human occupancy.
4. When the building is of wood with first floor height not exceeding 17 feet and not exceeding 2 floors.

Building paper shall be fastened with rust-resisting metal or other approved material. Exterior openings exposed to the weather shall be flashed. Exterior openings shall be flashed with rust-resisting metal or other approved material. Exterior openings shall be flashed with rust-resisting metal or other approved material.

Section 2216-2217

Sections 2216-2217
PART VI

ENGINEERING REGULATIONS, QUALITY AND DESIGN OF THE MATERIALS OF CONSTRUCTION

CHAPTER 23—LIVE AND DEAD LOADS

Definitions

Sec. 2301. Dead Load. The dead load of a building shall include the weight of the walls, permanent partitions, framing, floors, roofs and all other permanent stationary construction entering into and becoming a part of a building. (See Appendix for weights of construction materials.)

Live Load. The live load includes all loads except dead and lateral loads.

Loads

Sec. 2302. (a) General. Buildings and all parts thereof shall be of sufficient strength to support the estimated or actual imposed dead and live loads in addition to their own proper dead load, without exceeding the stresses noted elsewhere in this Code, provided that no building or part thereof shall be designed for live loads less than those specified in the following sections. Impact shall be considered in the design of any structure where impact loads occur.

(b) Special. Provision shall be made in designing office floors for load of 2000 pounds placed upon any space two and one-half feet (2½') square wherever this load upon an otherwise unloaded floor would produce stresses greater than those caused by a uniformly distributed load of 50 pounds per square foot.

In designing floors to be used for industrial or commercial purposes the actual live load caused by the use to which the building or part of the building is to be put, shall be used in the design of such building or part thereof, and special provision shall be made for machine or apparatus loads when such machine or apparatus would cause a greater load than specified for such use in Section 2304.

Floors in office buildings and in other buildings, where partition locations are subject to change, shall be designed to support in addition to all other loads, a uniformly distributed load equal in pounds per square foot to one-twelfth of the weight of one linear foot of the partition.

Public garages and commercial or industrial buildings in which loaded trucks are placed, used or stored shall have the floor systems designed to support a concentrated rear wheel load of a loaded truck placed in any possible position.

Method of Design

Sec. 2303. Any system or method of construction to be used shall admit of a rational analysis in accordance with well established principles of mechanics.

Unit Live Loads

Sec. 2304. The following unit loads shall be taken as the minimum live loads in pounds per square foot to be used in the design of buildings for the occupancies listed, and loads at least equal shall be assumed for uses not listed in this Section but which create or accommodate similar loadings.
Apartments ........................................ 40
Armories ........................................ 150
Auditoriums—Fixed Seats ....................... 50
   Movable Seats .................................. 100
Balconies and Galleries—Fixed Seats ........... 50
   Movable Seats .................................. 100
Cornices ........................................... 60
Corridors, Public .................................. 100
Dance Halls ........................................ 100
Drill Rooms ........................................ 100
Dwellings .......................................... 40
Exterior Balconies ................................ 100
Fire Escapes ....................................... 100
Garages ............................................ 100
Gymnasiums ....................................... 100
Hospitals—Wards and Rooms ........................ 40
Hotels—Guest Rooms and Private Corridors ...... 40
Libraries—Reading Rooms .......................... 60
   Stack Rooms ..................................... 125
Loft Building ...................................... 100
Manufacturing — Light ............................ 75
   Heavy ............................................ 125
Marquees .......................................... 60
Offices ............................................ 50
Printing Plants—Press Rooms ..................... 150
   Composing and Linotype Rooms ................. 100
Public Rooms ...................................... 100
Rest Rooms ........................................ 50
Reviewing Stands and Bleachers .................. 100
Roof Loads ........................................ (See Section 2305)
Schools—Class Rooms .............................. 40
Sidewalks .......................................... 250
Skating Rinks ..................................... 100
Stairways .......................................... 100
Storage — Light .................................... 125
   Heavy (Load to be determined from proposed use or occupancy, but never less than) 250
Stores—Retail (Light Merchandise) ............... 75
   Wholesale (Light Merchandise) ................. 100

All ceiling joists shall be designed for not less than 10 pounds per square foot total load.

All balcony railings shall be designed to withstand a horizontal force of 20 pounds per lineal foot, applied at the top of the railing.

Sec. 2305. Roofs shall be designed for a vertical live load of 20 pounds per square foot of horizontal projection applied to any and all slopes, except as hereinafter provided.

   Where the rise exceeds twelve inches (12") per foot no vertical live loads need be assumed, but the roof shall be designed for the dead load and for a wind load of 15 pounds per square foot of vertical projection.

   Where snow loads occur, roofs shall be designed for the increase in loading.

Sec. 2306. The following reductions in assumed live loads shall be permitted in designing of columns, piers, walls, foundations, trusses and girders.
1. No reduction of the assumed live load shall be allowed in the design of any slabs, joists or beams.

2. A reduction of the total live load used in the design of girders based on a certain tributary floor area shall be permitted as noted in the following schedule. This reduction shall not be carried into the columns nor shall such reduction be used in design of buildings to be used or occupied as warehouses or for storage purposes.

<table>
<thead>
<tr>
<th>Reduction Allowed</th>
<th>Tributary Floor Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>100 sq. ft.</td>
</tr>
<tr>
<td>10%</td>
<td>200 sq. ft.</td>
</tr>
<tr>
<td>15%</td>
<td>300 sq. ft. or more</td>
</tr>
</tbody>
</table>

3. For determining the total live loads carried by columns the following reductions shall be permitted, the reductions being based on the assumed live loads applied to the entire tributary floor area:

**Allowable Reductions for Warehouses and Storage Buildings**

- Carrying the roof ................................. 0 per cent
- Carrying 1 floor and roof ....................... 0 per cent
- Carrying 2 floors and roof ..................... 5 per cent
- Carrying 3 floors and roof .................... 10 per cent
- Carrying 4 floors and roof ................... 15 per cent
- Carrying 5 or more floors and roof ........ 20 per cent

**Live Load Reductions for Manufacturing Buildings, Stores and Garages**

- Carrying the roof .................................. 0 per cent
- Carrying 1 floor and roof ....................... 0 per cent
- Carrying 2 floors and roof ..................... 10 per cent
- Carrying 3 floors and roof .................... 20 per cent
- Carrying 4 or more floors and roof .......... 30 per cent

**Allowable Live Load Reductions for All Other Buildings**

- Carrying the roof .................................. 0 per cent
- Carrying 1 floor and roof ....................... 0 per cent
- Carrying 2 floors and roof ..................... 10 per cent
- Carrying 3 floors and roof .................... 20 per cent
- Carrying 4 floors and roof ................... 30 per cent
- Carrying 5 floors and roof .................... 40 per cent
- Carrying 6 floors and roof ................... 45 per cent
- Carrying 7 or more floors and roof ........ 50 per cent

**Wind Pressure**

Sec. 2307. For purposes of design the wind pressure upon all vertical plane surfaces of all buildings and structures shall be taken at not less than 15 pounds per square foot for those portions of the building less than sixty feet (60') above ground and at not less than 20 pounds per square foot for those portions more than sixty feet (60') above ground.

The wind pressure upon sprinkler tanks, sky signs, or other similar exposed structures and their supports shall be taken as not less than 30 pounds per square foot of the gross area of the plane surface, acting in any direction. In calculating the wind pressure on circular tanks, towers or stacks this pressure shall be assumed to act on 6/10 of the projected area.

The overturning moment calculated from the wind pressure
shall in no case exceed two-thirds of the dead load resisting moment.

The weight of earth superimposed over footings may be used to calculate the dead load resisting moment.

For combined stresses due to wind and other loads the allowable unit stresses may be increased 33 1/3 per cent in excess of the values given in Chapters 24, 25, 26, and 27. For members carrying wind stresses only the allowable unit stresses may be increased 33 1/3 per cent. In no case shall the section be less than required if the wind stress be neglected.

Sec. 2308. The live loads for which each floor or part thereof of a commercial or industrial building is or has been designed, shall have such designed live loads conspicuously posted by the owner in that part of each story in which they apply, using durable metal signs, and it shall be unlawful to remove or deface such notices. The occupant of the building shall be responsible for keeping the actual load below the allowable limits.

The maximum seating capacity shall be conspicuously posted by the owner of the building by means of durable metal signs placed in each assembly room, auditorium or room used for a similar purpose where fixed seats are not installed, and it shall be unlawful to remove or deface such notice or to permit more than this legal number of persons within such space.

Sec. 2309. Plans for other than residential buildings filed with the Building Inspector 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 2308, 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 Inspector certifying that the floors are suitable for the loads characteristic of the proposed occupancy. (See Sections 206 and 207.)

Sec. 2310. When earth or water, or earth and water, cause or may cause a pressure on any building or structure, such total pressure created shall be calculated in accordance with the best accepted engineering practice, and such calculations and design shall take into account any possible surcharge due to moving or fixed loads.

Sec. 2311. The base area of the footings of all buildings shall be designed in the following manner: The area of the footing which has the largest percentage of live load to total load shall be determined by dividing the total load by the allowable soil load. From the area thus obtained the dead load soil pressure of such footing is determined and the areas of all other footings of the building shall be determined on the basis of their respective dead loads only and such dead load soil pressure. In no case shall the load per square foot under any portion of any footing, due to the combined dead, live, wind and/or any other loads, exceed the safe sustaining power of the soil upon which the footing rests. The total reduced live load occurring in the column immediately above the footing shall be the live load used in the above computation.

Sec. 2312. (See Appendix.)
CHAPTER 24—MASONRY

General

Sec. 2401. (a) Scope. Masonry shall conform to the regulations of this Chapter and shall be limited to the materials specified in this Chapter.

(b) Definitions and Symbols. For the purpose of this Chapter, certain terms are defined as follows:

GROSS CROSS-SECTIONAL AREA OF HOLLOW UNITS
is the total area including cells of a section perpendicular to the direction of loading. Re-entrant spaces are included in the gross area unless these spaces are to be occupied in masonry by portions of adjacent units.

MASONRY UNIT is any brick, tile, block, or natural stone conforming to the requirements of Section 2402.

(c) Use of Masonry Units. Walls may be constructed of approved mechanically interlocking masonry units laid without mortar if all vertical and horizontal loads are sustained by structural members, or studs formed by reinforcing bars in cells filled with concrete.

Every masonry unit used in a bearing wall or structural member shall have a surface capable of adhering to cement mortar with sufficient tenacity to resist a tensile stress of 50 pounds per square inch, after curing for 28 days.

Masonry units may be re-used when clean, whole and conforming to the other requirements of this Section appropriate to the type of unit.

(d) Facing. Facing shall be bonded with the backing as specified in this Chapter for the respective materials. No facing shall be considered in computing the bearing strength or thickness of the wall, unless such facing has a strength equal to that of the backing.

(e) Tests of Materials. Where tests of materials are made they shall be in accordance with the standard specifications of the A.S.T.M. or other specifications as given in this Chapter.

Materials

Sec. 2402. (a) Burned Clay or Shale Brick. Except for size all brick of burned clay or shale shall conform to the requirements for Grade "NW" or Grade "MW" brick given in A.S.T.M. "Tentative Specifications for Building Brick," (C62-41T).

(b) Concrete Brick. Except for size, concrete brick shall conform to the requirements for Grade "A" or Grade "B" brick, given in A.S.T.M. "Standard Specifications for Solid Load-Bearing Concrete Masonry Units," (C145-40), provided that the minimum compressive strength of Grade "B" brick shall be not less than 1,500 pounds per square inch.

(c) Hollow Clay Tile. Hollow clay tile used in exterior walls and bearing walls shall conform to the requirements for Grade "LB X" clay tile, given in A.S.T.M. "Standard Specifications for Structural Clay Load-Bearing Wall Tile," (C34-41).

Hollow clay tile used in non-bearing partitions, fire protection, and furring, shall conform to the requirements of A.S.T.M. "Standard Specifications for Structural Clay Non-Load-Bearing Tile," (C56-41).
(d) **Hollow Concrete Block or Tile.** Hollow concrete block or tile shall conform to the requirements of A.S.T.M. “Standard Specifications for Hollow Load-Bearing Concrete Masonry Units,” (C90-39).\(^1\)

(e) **Gypsum and Gypsum Block or Tile.** Gypsum shall conform to the requirements of A.S.T.M. “Standard Specifications for Gypsum,” (C22-41).

Gypsum block or tile shall conform to the requirements of A.S.T.M. “Standard Specifications for Gypsum Partition Tile or Block,” (C52-41).

(f) **Cast Building Stone.** Cast building stone with no dimension more than eighteen inches (18") shall conform to the requirements for Grade “A” brick, given in A.S.T.M. “Standard Specifications for Solid Load-Bearing Concrete Masonry Units,” (C145-40). Every concrete unit more than eighteen inches (18") in any dimension shall conform to the requirements for concrete in Chapter 26.

(g) **Reinforcing Steel.** Reinforcing steel shall conform to the physical and chemical requirements for metal reinforcement in concrete, as specified in Chapter 26.

(h) **Unburned Clay Brick.** Unburned clay brick shall conform to the requirements of Section 2411.

(i) **Cement.** Cement for mortar shall be Type I or Type II portland cement as specified in A.S.T.M. “Standard Specifications for Portland Cement,” (C150-42). Cement may contain approved amounts of plasticizers if such plasticizers have been approved in accordance with the requirements for approval of admixtures as specified in Chapter 26.

(j) **Hydrated Lime.** Hydrated lime shall conform to the requirements of A.S.T.M. “Standard Specifications for Hydrated Lime for Structural Purposes,” (C6-31)\(^1\), and before slaking shall contain at least 85 per cent, by weight, of calcium oxide.

(k) **Quicklime.** Quicklime shall conform to the requirements of A.S.T.M. “Standard Specifications for Quicklime for Structural Purposes,” (C5-26)\(^1\), and shall contain at least 85 per cent, by weight, of calcium oxide.

(l) **Lime Putty.** Lime putty shall be made from quicklime or hydrated lime. If made from quicklime, the lime shall be slaked and then screened through a 16-mesh sieve. After slaking, screening, and before using, it shall be stored and protected for not less than 10 days. The resulting lime putty shall weigh not less than 83 pounds per cubic foot.

**Exception:** Processed lime which will pass through a No. 60 mesh sieve need be stored for only 24 hours after slaking.

Lime putty that is made from hydrated lime shall be stored for 48 hours before using.

(m) **Sand.** Sand for mortar shall conform to A.S.T.M. “Tentative Specifications for Aggregate for Masonry Mortar,” (C144-42T), except that the sand shall be graded from coarse to fine within the limits set forth in Table No. 24-A. Ocean or beach sand shall not be used for mortar.

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\(^1\)See “Specification Documents”.

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TABLE NO. 24-A—GRADING LIMITS FOR SAND FOR MORTAR

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage (by weight) Passing through Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 8</td>
<td>95 - 100</td>
</tr>
<tr>
<td>No. 30</td>
<td>30 - 60</td>
</tr>
<tr>
<td>No. 50</td>
<td>10 - 30</td>
</tr>
<tr>
<td>No. 100</td>
<td>1 - 10</td>
</tr>
</tbody>
</table>

(n) Water. Water for mortar shall be clean and free from injurious amounts of deleterious materials.

(o) Gypsum Mortar. Gypsum mortar shall be composed, by weight, of one part of gypsum and not more than three parts of mortar sand.

(p) Cement-Lime Mortar. Cement-lime mortar shall be composed, by volume, of one part portland cement, one-half part lime putty, and not more than four and one-half parts of mortar sand.

(q) Cement Mortar. Cement mortar shall be composed, by volume, of one part portland cement, and not more than three and one-half parts of mortar sand. Lime putty may be added to the mix, not in excess of one-fourth part, by volume, of the cement content.

(r) Grout. Grout shall be cement mortar to which is added water to produce consistency for pouring without segregation of constituents of the mortar.

Plain Masonry

Sec. 2403. (a) General. At the time of laying all units used in plain masonry shall be clean and damp on the surface. Units laid in mortar shall be laid with full shoved mortar joints and all head, bed, and wall joints shall be solidly filled with mortar.

Masonry units laid in cement mortar shall be kept moist continuously for at least seven days after being laid.

(b) Materials. Plain masonry shall be of burned clay or shale brick, concrete brick, natural or cast stone, each laid up in cement-lime mortar or cement mortar.

(c) Allowable Stresses. Plain masonry shall be so constructed that the unit stresses do not exceed those set forth in Table No. 24-B.

(d) Bond. In plain masonry of brick all stretcher courses shall be bonded by making vertical joints over centers of stretchers. There shall be not less than one header in every fifty square inches (50 sq. in.) of wall surface. If the thickness of the wall is greater than the length of the headers, each header shall be covered with another header that breaks joints with the header below.

In plain masonry of stone, the bond stones shall be uniformly distributed throughout the wall and shall comprise not less than 20 per cent of the wall surface. There shall be at least one bond stone for every five stretchers and each bond stone shall extend through the wall.
### TABLE NO. 24-B—ALLOWABLE STRESSES IN UNREINFORCED MASONRY

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>ALLOWABLE STRESS IN POUNDS PER SQUARE INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COMPRESSION</td>
</tr>
<tr>
<td>Plain Masonry</td>
<td>100</td>
</tr>
<tr>
<td>Plain Concrete</td>
<td>(0.15'c)</td>
</tr>
<tr>
<td>Unreinforced Grouted Masonry</td>
<td></td>
</tr>
<tr>
<td>Lime-Cement Mortar</td>
<td>125</td>
</tr>
<tr>
<td>Cement-Mortar Grade MW or Grade A Brick</td>
<td>180</td>
</tr>
<tr>
<td>Masonry of Natural Stone or Hollow Units on Gross Section</td>
<td>70</td>
</tr>
<tr>
<td>Gypsum Masonry</td>
<td>20</td>
</tr>
<tr>
<td>Masonry of Unburned Clay Units</td>
<td>30</td>
</tr>
</tbody>
</table>

* Tension shall be allowed only in masonry built under the supervision of a registered inspector.
** Cold joints shall not be assumed to carry tension.

(e) **Strength.** Plain masonry shall have a minimum strength of 900 pounds per square inch.

**Sec. 2404. (a) General.** At the time of laying, all masonry units used in grouted masonry shall be damp and free of excess dust and dirt. When immersed in water for five minutes each unit shall absorb at least five per cent and not more than 10 per cent of the dry weight of the unit.

Masonry units laid in cement mortar shall be kept moist continuously for at least seven days after being laid.

(b) **Materials.** Grouted masonry shall be of burned clay or shale brick or concrete brick laid up as specified in Subsection (d) of this Section.

(c) **Allowable Stresses.** Unreinforced grouted masonry shall be so constructed that the unit stresses do not exceed those set forth in Table No. 24-B.

(d) **Construction.** All units in the two outer tiers shall be laid with full bed and head joints of cement mortar. All interior joints shall be filled with grout.

One face tier may be carried up three courses before grouting, but the other face tier shall be carried up not more than one course above the grouting.

All longitudinal vertical joints shall be not less than three-fourths inch (\(\frac{3}{4}\)”) in thickness.

Horizontal construction joints shall be formed by stopping the grout one and one-half inches (1\(\frac{1}{2}\)”) below the top of the face tiers.

(e) **Strength.** Grouted masonry shall have a minimum strength of 1,500 pounds per square inch when Grade “MW” burned clay or Grade “A” concrete brick are used with cement.
TABLE NO. 24-C—ALLOWABLE STRESSES IN REINFORCED GROUTED MASONRY

<table>
<thead>
<tr>
<th>KIND OF STRESS</th>
<th>ALLOWABLE WORKING UNIT STRESS IN POUNDS PER SQUARE INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GRADE &quot;MW&quot; BURNED CLAY BRICK OR GRADE &quot;A&quot; CONCRETE BRICK AND CEMENT MORTAR</td>
</tr>
<tr>
<td>Compression—Axial</td>
<td>225</td>
</tr>
<tr>
<td>Compression—Flexural</td>
<td>400</td>
</tr>
<tr>
<td>Shear—No Web Reinforcement</td>
<td>25</td>
</tr>
<tr>
<td>Shear—Web Reinforcement Taking 2/3 of the entire shear</td>
<td>50</td>
</tr>
<tr>
<td>Bond—Plain Bars</td>
<td>60</td>
</tr>
<tr>
<td>Bond—Deformed Bars</td>
<td>75</td>
</tr>
<tr>
<td>Bearing</td>
<td>300</td>
</tr>
<tr>
<td>Modulus of Elasticity</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Modulus of Rigidity</td>
<td>600,000</td>
</tr>
</tbody>
</table>

mortar. When cement-lime mortar is used or when Grade "NW" burned clay brick or Grade "B" concrete brick are used, the minimum strength shall be 900 pounds per square inch.

Sec. 2405. (a) **General.** Reinforced grouted masonry shall conform to all of the requirements for grouted masonry specified in Section 2404, except that the unit stresses shall not exceed those set forth in Table No. 24-C.

(b) **Reinforcement.** Reinforcement for reinforced grouted masonry shall be plain or deformed steel bars as specified in Section 2604. The unit stress in reinforcement shall not exceed that specified in Section 2613.

All reinforcement shall be tested as specified in Chapter 26 except that tests shall not be required when the working stresses used in design are not more than 50 per cent of those specified in Section 2613.

The width of any space containing reinforcement shall be at least three-fourths inch (¾") larger than the sum of the nominal sizes of all reinforcement contained therein.

(c) **Design.** The design of reinforced grouted masonry shall be based on the assumptions, limitations, and methods of stress determination specified for reinforced concrete in Chapter 26, and shall conform to the additional limitations of this Chapter.

Sec. 2406. (a) **General.** Hollow unit masonry shall conform to the general requirements for plain masonry specified in Subsection 2403 (a).
(b) **Materials.** Hollow unit masonry shall be of hollow clay tile, or hollow concrete block or tile, laid up in cement mortar or cement-lime mortar, except that interior non-bearing masonry of hollow units may be laid up in gypsum mortar.

(c) **Allowable Stresses.** Hollow unit masonry shall be so constructed that the unit stresses do not exceed those set forth in Table No. 24-B when computed on the gross cross-sectional area.

(d) **Bond.** Bond in hollow unit masonry shall be provided by placing the vertical joints of each course over the centers of the units of the course immediately below. Corners and intersections shall be bonded by overlapping units in alternate courses.

(e) **Method of Laying.** When the thickness of the walls of the units is one and one-quarter inches (1\(\frac{1}{4}\)") or more, the units may be placed in end construction with cells vertical. When the thickness of walls is less than one and one-quarter inches (1\(\frac{1}{4}\")), the units shall be placed in side construction with cells horizontal.

**Exception:** Hollow units used in non-bearing walls and partitions may be laid in either end or side construction regardless of the thickness of unit walls.

(f) **Filled Cell Construction.** Masonry of hollow units may be designed as reinforced concrete where cells are continuously filled with concrete in which reinforcement is embedded. The area of cell walls which are in contact with the concrete core may be included in the computation of the effective areas of the section. The allowable stresses shall be those allowed for concrete of the same strength as units.

Sec. 2407. (a) **General.** No gypsum masonry shall be used in any bearing wall, or in any location where the gypsum will be directly exposed to moisture or weathering.

(b) **Materials.** Gypsum masonry shall be gypsum block or tile laid up in gypsum mortar.

(c) **Allowable Stresses.** Gypsum masonry shall be so constructed that the unit compressive stresses do not exceed those set forth in Table No. 24-B.

(d) **Bond.** The bond in gypsum masonry shall conform to the requirements for bond in masonry or hollow units specified in Subsection 2406 (d).

(e) **Method of Laying.** All units in gypsum masonry shall be placed in side construction with cells horizontal. The entire bearing surface of every unit shall be covered with mortar spread in an even layer; and all joints shall be filled with mortar.

Sec. 2408. (a) **General.** Reinforced gypsum concrete shall conform to the requirements for gypsum masonry as specified in Subsection 2407 (a).

(b) **Allowable Stresses.** The allowable working stresses shall be those set forth in Table No. 24-D.
### TABLE NO. 24-D—ALLOWABLE UNIT STRESSES (GYPSUM)

<table>
<thead>
<tr>
<th>TYPE OF STRESS</th>
<th>NEAT GYPSUM</th>
<th>GYPSUM FIBER CONCRETE with not more than 3 per cent of wood chips, shavings or fiber</th>
<th>GYPSUM FIBER CONCRETE with not more than 12½ per cent of wood chips, shavings or fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme fiber stress in compression in flexure</td>
<td>350</td>
<td>220</td>
<td>125</td>
</tr>
<tr>
<td>Direct Compression or bearing</td>
<td>200</td>
<td>165</td>
<td>100</td>
</tr>
<tr>
<td>Bond between gypsum and reinforcing</td>
<td>40</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Shearing Stress</td>
<td>30</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>1,000,000</td>
<td>600,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Ratio of modulus of elasticity of steel to that of gypsum (n)</td>
<td>30</td>
<td>50</td>
<td>150</td>
</tr>
</tbody>
</table>

(c) **Design.** Except as specified in this Section the design of all precast or poured-in-place slabs or tiles of reinforced gypsum shall be based on the assumptions, limitations, and methods of stress determination specified for reinforced concrete in Chapter 26.

(d) **Suspension Systems.** Gypsum suspension systems shall be not less than three inches (3") in thickness, and shall be of such character as to be readily calculable by the use of accepted engineering formulas, in which the stress in the suspension wires or cables shall be determined by the formula:

\[
T = \frac{wL^2}{8d}
\]

**WHERE**

- \(L\) = clear span in feet.
- \(T\) = maximum tension in wires in pounds per foot width of slab.
- \(w\) = uniformly distributed load per foot length of beam.
- \(d\) = sag of wires in feet at center of span.

The wires or cables used shall be cold drawn steel in which the allowable working stress shall not exceed 20,000 pounds per square inch.
(e) **Strength.** Neat gypsum and gypsum fiber concrete used in floor and roof construction shall develop the following minimum ultimate compressive strengths in pounds per square inch when dried to constant weight:

- Neat gypsum (containing gypsum and water only)...........1,800
- Gypsum fiber concrete (containing not more than three per cent by weight of wood chips, shavings or fiber) .........................................................1,000
- Gypsum fiber concrete (containing not more than 12\(\frac{1}{2}\) per cent by weight of wood chips, shavings or fiber) .... 500

Compressive tests shall be made on cylinders six inches (6") in diameter and twelve inches (12") long. The average compressive strength shall be not less than noted above, and no one specimen shall test less than 75 per cent of the average of the lot tested, and not less than five samples from the lot shall be tested to determine the average.

**Sec. 2409. (a) General.** Plain concrete shall conform to all the requirements for reinforced concrete as specified in Chapter 26, except for reinforcement. Provisions shall be made to care for temperature and shrinkage stresses either by use of steel or by joints.

(b) **Allowable Stresses.** Plain concrete shall be so constructed that the unit stresses do not exceed those set forth in Table No. 24-B.

**Sec. 2410. (a) General.** Masonry of glass blocks may be used in any non-bearing wall if designed and constructed in conformity with this Section.

(b) **Horizontal Forces.** The blocks shall be restrained laterally by an approved mechanical device capable of resisting the horizontal forces specified in Chapter 23 (Loads) for bearing walls.

(c) **Maximum Size of Panels.** No panel of glass block masonry shall exceed thirteen feet (13') in any dimension or one hundred forty-four square feet (144 sq. ft.) in area.

(d) **Expansion Joints.** Every glass block panel shall be provided with one-half inch (\(\frac{1}{2}\") expansion joints between the edges of the panel and the supporting structural members.

**Sec. 2411. (a) Soil.** The soil used shall contain not more than 45 per cent of material passing a No. 200 mesh sieve. The soil shall contain sufficient clay to bind the particles together when an asphalt stabilizer is used but shall not contain more than 0.2 per cent of water soluble salts.

(b) **Stabilizer.** The stabilizing agent shall be emulsified asphalt, portland cement, or other approved material. The stabilizing agent shall be uniformly mixed with the soil in amounts sufficient to provide the required resistance to absorption.

(c) **Sampling.** Each of the tests prescribed in this Section shall be applied to five sample brick selected at random from each 5,000 brick to be used.
(d) Compressive Strength. The brick shall have an average compressive strength of 300 pounds per square inch when tested in accordance with A.S.T.M. "Standard Methods of Sampling and Testing Brick," (C67-41). One sample out of five may have a compressive strength not less than 250 pounds per square inch.

(e) Modulus of Rupture. Bricks shall average 50 pounds per square inch in modulus of rupture, when tested by applying a centrally located concentrated load at a uniform rate by the use of two-inch (2") cylinders to a unit having a test span of four inches (4") less than its length.

(f) Moisture Content. The moisture content of the brick shall be not more than four per cent, by weight.

(g) Absorption. A dried four-inch (4") cube cut from a sample brick shall absorb not more than 2½ per cent moisture, by weight, when placed upon a constantly water-saturated porous surface for seven days.

(h) Shrinkage Cracks. No brick shall contain more than three shrinkage cracks and no shrinkage crack shall exceed three inches (3") in length or one-eighth inch (1/8") in width.

(i) Mortar. Mortar used in masonry of unburned clay units shall be portland cement mortar as specified in Section 2402 (q), to which a stabilizer may be added in an approved amount.

(j) Weathering. A unit when exposed to water sprayed at 20 pounds pressure for two hours from a standard four-inch (4") shower head set seven inches (7") from its face shall not show an erosion of more than one-sixteenth inch (1/16") nor any appreciable pitting.

(k) Footings. Footing walls which support masonry of unburned clay units shall extend to an elevation not less than six inches (6") above the adjacent ground at all points and shall be of concrete, burned clay units, or solid concrete units.

(l) Laying. At the time of laying, units shall be free of foreign material. Joints shall be solidly filled with mortar. Bond shall be provided as required for masonry of hollow units in Section 2406 (d).

(m) Limitations. Masonry of unburned clay units shall not be used in any building more than one story in height.

No bearing wall of unburned clay units shall have a height of more than 10 times the thickness of such walls, and the thickness shall in no case be less than sixteen inches (16").

Fireplaces and chimneys of unburned clay units shall be lined with fire brick not less in thickness than four inches (4").

Sec. 2412. (a) General. Masonry bearing walls shall be constructed only of plain masonry, grouted masonry, reinforced masonry, masonry of hollow units or of unburned clay units.

Masonry bearing walls shall not exceed three stories in height.

(b) Height and Thickness. The thickness of masonry walls shall be not less, and the maximum height, number of stories, and distance between supports not more, than shown in Table No. 24-E.
TABLE NO. 24-E—REQUIREMENTS FOR MASONRY WALLS

<table>
<thead>
<tr>
<th>MAXIMUM HEIGHT IN FEET</th>
<th>STORY</th>
<th>LIMITING RATIO—DISTANCE BETWEEN SUPPORTS AND WALL THICKNESS</th>
<th>MINIMUM THICKNESS IN INCHES (NOMINAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLAIN AND HOLLOW MASONRY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>3</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Basement</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>REINFORCED MASONRY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>3</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Basement</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

Exception: The provisions of this Subsection may be waived when written evidence is submitted by a qualified person showing that the walls meet all the other requirements of this Code.

(c) Stresses. Unless designed as reinforced columns the axial stress in bearing walls, or portions thereof, shall not exceed the value set forth in Table No. 24-B or Table No. 24-C multiplied by the expression

\[ 1 - \left( \frac{h}{28t} \right)^3 \]

WHERE

\[ h = \text{the unsupported height of wall.} \]
\[ t = \text{thickness of wall.} \]

Exception: Bearing walls of hollow units with vertical cells reinforced and continuously filled with concrete may be designed in accordance with Section 2620 (k) (Concrete Bearing Walls). The effective area used in design shall be that of the filled cell plus the area of the cell walls in contact with the core. The stresses shall be those allowed for concrete, with a maximum of \( f'_c \) of 2,000 pounds per square inch.

(d) Minimum Reinforcement. Bearing walls of reinforced masonry shall be reinforced with both vertical and horizontal bars not more than twenty-six inches (26") center to center.

In reinforced masonry walls the minimum area of reinforcement in each direction shall be not less than 0.001 times the area of the wall. Other walls, if they are grouted, may be reinforced in lesser amounts to resist tensile stresses.

No required vertical reinforcement shall be less than three-eighths inch (\( \frac{3}{8} \)) in diameter.

If the wall is constructed of more than two tiers, the reinforcement shall be equally divided into two layers.
(e) Concentrated Loads. For calculating wall stresses, concentrated loads may be assumed to be distributed over a maximum length of wall not exceeding the center to center distance between loads nor five times the width of the bearing.

(f) Eccentricity. Due allowance shall be made for the effect of eccentric loads upon bearing walls.

(g) Piers. Every pier whose width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member.

(h) Chases and Recesses. Chases and recesses in masonry walls shall not be constructed so as to reduce the required strength, thickness, or required fire resistance of the wall.

(i) Pipes and Conduits. No pipe or conduit shall be embedded in any structural masonry or required fireproofing.

Exception: 1. Rigid electric conduits may be embedded in structural masonry when their location has been detailed on the approved plans.

2. Any pipe or conduit may pass through any wall or floor slab by means of a sleeve at least large enough to pass any hub or coupling on the pipe line. Such sleeves shall not be spaced closer than three diameters, center to center, and when not detailed on the approved plans shall not exceed five inches (5") in diameter.

(j) Anchorage. Masonry bearing walls shall be anchored at all lines of lateral support. Such anchorage shall be capable of resisting the horizontal forces with a minimum of 200 pounds per linear foot of wall.

(k) Arches andLintels. The heads of openings in masonry walls shall be formed only of lintels of incombustible materials or of masonry arches.

(l) Openings in Walls. In addition to the minimum required reinforcement, not less than a one-half inch (1/2") bar for each longitudinal joint shall be provided at all edges of every opening which exceeds twenty-four inches (24") in either dimension. The bars shall extend twenty-four inches (24") beyond the corners of the opening.

Sec. 2413. (a) General. Non-bearing walls may be constructed of any masonry as specified in this Chapter. Non-bearing masonry walls shall conform to the provisions of Subsections (h), (i), and (k) of Section 2412.

(b) Thickness. Every non-bearing masonry wall shall be so constructed and have a sufficient thickness to withstand all vertical and horizontal loads as specified in Chapter 23, but in no case shall the thickness of such wall be less than that set forth in Table No. 24-F.

**TABLE NO. 24-F—MINIMUM THICKNESS OF NON-BEARING WALLS**

<table>
<thead>
<tr>
<th></th>
<th>MINIMUM RATIO</th>
<th>MINIMUM THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THICKNESS TO</td>
<td>THICKNESS</td>
</tr>
<tr>
<td></td>
<td>UNSUPPORTED</td>
<td>(Inches)</td>
</tr>
<tr>
<td></td>
<td>HEIGHT</td>
<td></td>
</tr>
<tr>
<td>Exterior unreinforced walls</td>
<td>1/20</td>
<td>8</td>
</tr>
<tr>
<td>Exterior reinforced walls</td>
<td>1/30</td>
<td>6</td>
</tr>
<tr>
<td>Interior partitions</td>
<td>1/48</td>
<td>2</td>
</tr>
</tbody>
</table>
(c) **Use.** Non-bearing walls may be used to carry a superimposed ceiling load of not more than 100 pounds per linear foot of wall.

(d) **Wire Mesh Reinforcement.** Wire mesh reinforcement may be used to resist tensile stresses when embedded in plaster applied to the surface of any non-bearing wall. Wire mesh reinforcement shall be as specified in Chapter 26 and plaster shall be as specified in Chapter 47.

(e) **Anchorages.** Non-bearing partitions shall be anchored along the top edge to a structural member or a suspended ceiling, or shall be provided with equivalent anchorage along the sides. Such anchorage shall be capable of resisting a horizontal force of not less than 50 pounds per linear foot of wall.

Exterior non-bearing walls shall be anchored along all edges to structural members. Such anchorage shall be not less than three-eighths inch ($\frac{3}{8}"$) round bars twenty-six inches (26") center to center and shall develop the full strength of the bars.

**Sec. 2414. (a) General.** No column shall be constructed of **Columns** unreinforced masonry.

Every masonry column shall be designed and constructed as required for reinforced concrete columns by the provisions of Section 2620, and shall conform to the additional requirements of this Chapter.

(b) **Limiting Dimensions.** The least dimension of every masonry column shall be not less than twelve inches (12"). [See Piers, Section 2412 (f)].

No masonry column shall have an unsupported length greater than 12 times its least dimension.

(c) **Allowable Loads.** The axial compressive stress of a masonry column shall be based on the gross area and shall not exceed the value set forth in Table No. 24-C.

(d) **Ties.** Lateral ties shall be placed approximately two inches (2") from the surface of the column.

**TABLE NO. 24-G—ALLOWABLE SHEAR ON BOLTS**

<table>
<thead>
<tr>
<th>DIA. OF BOLT</th>
<th>CONCRETE AND PLAIN, GROUTED AND HOLLOW UNIT MASONRY</th>
<th>MASONRY OF UNBURNED CLAY UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Embedment (Inches)</td>
<td>Shear (Pounds)</td>
</tr>
<tr>
<td>¼&quot;</td>
<td>4</td>
<td>350</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>4</td>
<td>500</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>5</td>
<td>750</td>
</tr>
<tr>
<td>½&quot;</td>
<td>6</td>
<td>1000</td>
</tr>
<tr>
<td>1&quot;</td>
<td>7</td>
<td>1250</td>
</tr>
<tr>
<td>1½&quot;</td>
<td>8</td>
<td>1500</td>
</tr>
</tbody>
</table>

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Sections 2414-2416

(e) **Lap in Vertical Bars.** Deformed bars in masonry columns shall be lapped at least 40 bar diameters.

Plain bars in masonry columns shall be lapped at least 50 bar diameters.

**Flexural Members**

Sec. 2415. (a) **General.** Every masonry flexural member shall be designed and constructed as required for reinforced concrete flexural members by the provisions of Chapter 26 and shall conform to the additional requirements of this Chapter.

(b) **Distance Between Lateral Supports.** The clear distance between lateral supports of every masonry flexural member shall not exceed 24 times the least width of the compression flange.

**Bolts**

Sec. 2416. Bolts which are embedded in masonry shall be grouted in place and the connection shall be designed so that the shear on every bolt is not more than the values set forth in Table No. 24-G.
CHAPTER 25—WOOD
(Quality and Design)

Sec. 2501. The quality and design of all wood except finish and millwork, used in the construction of all buildings shall con-
form to the requirements of this Chapter.

All members shall be so framed, anchored, tied and braced together as to develop the strength and rigidity necessary for the purpose for which they are used. No member shall be stressed in excess of the strength of its details and connections.

In no case shall reinforced concrete or masonry, other than tile or concrete floor finishes not more than three inches (3") in thickness, be supported on wood construction, except wood piling as specified in Section 2803.

Sec. 2502. All wood structural members shall be of suf-
ficient size and strength to carry their imposed loads safely and without exceeding the allowable working stresses as speci-

ifed in Section 2503.

In determining the safe load which a member will sustain or in determining the required size of a member the following provisions shall govern:

(a) Rough Lumber. Where rough lumber is designated on the plans and in the specifications, the full nominal size of the member may be used for determining cross sectional area.

(b) Surfaced Lumber. Where surfaced lumber is designated on the plans and in the specifications, the minimum surfaced dressed sizes corresponding to nominal dimensions as indicated in regional lumber manufacturers' association grading rules as listed in Table No. 25-A shall be used unless actual dressed sizes are indicated on plans.

(c) Unspecified Lumber. Where nominal dimensions of lumber are indicated on plans and specifications, without reference to surfacing, the minimum surfaced sizes corresponding to such nominal dimensions shall be used for determining the cross sectional area.

Sec. 2503. (a) Classification of Lumber. For the purpose of assigning allowable unit stresses to lumber used where its strength is the controlling consideration, two general classes of lumber shall be recognized, namely, “Structural Lumber” and “Yard Lumber.”

(b) Structural Lumber. 1. Structural lumber is that con-
forming to the requirements for the several grades in speci-
fications or grading rules designated in Table No. 25-A which are based on the grading procedure of American Lumber Standards, as set forth in “Wood Handbook.” U. S. Department of Agri-
culture, September, 1935. The grade of structural lumber shall be determined by the Building Inspector upon evidence furnished him or shall be identified by the grade mark of, or certificate of inspection issued by, a lumber grading or inspec-
tion bureau or agency recognized as being competent.

2. For long-time loading conditions the maximum allowable stresses for lumber qualifying as “Structural Lumber” for
### TABLE NO. 25-A—ALLOWABLE UNIT STRESSES IN WOOD

Continuously Dry Locations—Long Time Loading

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMERCIAL GRADE</th>
<th>ALLOWABLE UNIT STRESSES, POUNDS PER SQ. INCH</th>
<th></th>
<th></th>
<th></th>
<th>Modulus of Elasticity</th>
<th>Rules under which Graded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SYMBOL:</td>
<td>c or p</td>
<td>q</td>
<td>f</td>
<td>H</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Tidewater Red Cypress</td>
<td>1400 # f Tidewater Red Cypress</td>
<td>300</td>
<td>1400</td>
<td>120</td>
<td>1,200,000</td>
<td>Southern Cypress Mfgrs. Asn., Jacksonville, Fla., dated Jan. 1, 1941</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100 # f Tidewater Red Cypress</td>
<td></td>
<td>1100</td>
<td>100</td>
<td>1,200,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200 # c Tidewater Red Cypress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 # c Tidewater Red Cypress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douglas Fir</td>
<td>Dense Select Structural—</td>
<td>1200</td>
<td>345</td>
<td>1800</td>
<td>120</td>
<td>1,600,000</td>
<td>West Coast Bureau of Lumber Grades and Inspection, Seattle, Wash. Standard Grading and Dressing Rules No. 12, dated March 1, 1943</td>
</tr>
<tr>
<td>(Coast Region)</td>
<td>210a, 214a, 218a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select Structural— 210f, 214, 218f</td>
<td>1100</td>
<td>325</td>
<td>1800</td>
<td>100</td>
<td>1,600,000</td>
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</tr>
<tr>
<td></td>
<td>No. 1 Timbers—200f</td>
<td>1100</td>
<td>380</td>
<td>1400</td>
<td>120</td>
<td>1,600,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1400f—215a or 219a</td>
<td>1000</td>
<td>325</td>
<td>1200</td>
<td>100</td>
<td>1,600,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200f—215 or 219f</td>
<td>900</td>
<td>350</td>
<td>900</td>
<td>90</td>
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<td></td>
<td>900f—216f</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>West Coast Hemlock</td>
<td>1200f—498, 500f</td>
<td>900</td>
<td>300</td>
<td>1200</td>
<td>85</td>
<td>1,400,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>900f—490f</td>
<td>700</td>
<td>300</td>
<td>900</td>
<td>75</td>
<td>1,400,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 1 Timbers—503f</td>
<td>900</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Douglas Fir</td>
<td>Select Structural Structural</td>
<td>1466</td>
<td>380</td>
<td>1800</td>
<td>120</td>
<td>1,600,000</td>
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<td>(Inland Empire)</td>
<td>Structural</td>
<td>1150</td>
<td>335</td>
<td>1600</td>
<td>85</td>
<td>1,500,000</td>
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<tr>
<td></td>
<td>Common Structural</td>
<td>1050</td>
<td>315</td>
<td>1200</td>
<td>80</td>
<td>1,500,000</td>
<td></td>
</tr>
<tr>
<td>Larch</td>
<td>Select Structural Structural</td>
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<td>380</td>
<td>1800</td>
<td>133</td>
<td>1,300,000</td>
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</tr>
<tr>
<td></td>
<td>Common Structural</td>
<td>1200</td>
<td>345</td>
<td>1600</td>
<td>100</td>
<td>1,300,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1100</td>
<td>325</td>
<td>1200</td>
<td>90</td>
<td>1,300,000</td>
<td></td>
</tr>
<tr>
<td>Eastern Hemlock</td>
<td>Select Structural</td>
<td>700</td>
<td>300</td>
<td>1100</td>
<td>70</td>
<td>1,100,000</td>
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<tr>
<td>----------------</td>
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</tr>
<tr>
<td>1000 SG Eastern Hemlock</td>
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<tr>
<td>900 SG Eastern Hemlock</td>
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<tr>
<td>800 SG Eastern Hemlock</td>
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<table>
<thead>
<tr>
<th>Oak</th>
<th></th>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>1800f Oak, Red and White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1800</td>
<td>120</td>
</tr>
<tr>
<td>1600f Oak, Red and White</td>
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<td></td>
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<td></td>
<td>1600</td>
<td>120</td>
</tr>
<tr>
<td>1400f Oak, Red and White</td>
<td></td>
<td></td>
<td></td>
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<td>1400</td>
<td>120</td>
</tr>
<tr>
<td>1200f Oak, Red and White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1200</td>
<td>120</td>
</tr>
<tr>
<td>1100e Oak, Red and White</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1100</td>
<td>100</td>
</tr>
<tr>
<td>1000c Oak, Red and White</td>
<td></td>
<td>500</td>
<td>1200</td>
<td>100</td>
<td>1,500,000</td>
<td></td>
</tr>
<tr>
<td>900c Oak, Red and White</td>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Longleaf So. Pine</th>
<th>Select Structural</th>
<th>1450</th>
<th></th>
<th>2000</th>
<th>100</th>
<th>1,600,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime Structural</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merchandable Structural</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural Sq. Edge and Sound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>No. 1 Structural</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>No. 1 L.L. Dimension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 2 L.L. 1050f Dimension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shortleaf So. Pine</th>
<th>Dense Select Structural</th>
<th>1450</th>
<th></th>
<th>2000</th>
<th>100</th>
<th>1,600,000</th>
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<tbody>
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<td>Dense Structural</td>
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<tr>
<td>Dense Str. Sq. Edge and Sound</td>
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<tr>
<td>No. 1 Structural</td>
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<tr>
<td>No. 1 Dimension</td>
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<tr>
<td>No. 2 Dense—1050f Dimension</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 2 Medium Grain-900f Dim.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Redwood</th>
<th>Dense Select All-heart Structural</th>
<th>1200</th>
<th>267</th>
<th>1400</th>
<th>80</th>
<th>1,200,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select All-heart Structural</td>
<td></td>
<td>1200</td>
<td></td>
<td>1200</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1This grade not intended to be used in bending.
2Numbers refer to paragraph numbers, W.C.B.L.G.I.—Standard Grading and Dressing Rules No. 12.
3With slope of grain not more than one inch (1") in ten inches (10").
5For other shear values see paragraphs 368 and 450 of S.P.I.B. grading rules.
the species listed in Table No. 25-A, shall not exceed the values therein given. For species and grades not given in Table No. 25-A, the working stresses therefor shall be established by the Building Inspector in accordance with the principles in the “Guide to the Grading of Structural Timbers and the Determination of Working Stresses” (Miscellaneous Publication No. 185 of the U. S. Department of Agriculture).

(c) **Yard Lumber.** Yard lumber, for the purpose of this Code, shall consist of grades not specifically designated as structural lumber and shall comply with Section 2502. The grade of yard lumber shall be determined in the same manner as is above provided for structural lumber.

(d) **Plywood.** The term “Plywood” as used in this Code shall mean a built-up board or piece of wood made of three or more plies of veneer joined with glue and so laid that the grain of adjoining plies is at right angles. An odd number of plies shall be used. For the purpose of this Code all plywood shall conform to the U. S. Commercial Standard CS 45-42.

(e) **Decrease of Unit Stresses for Various Conditions of Exposure.** The various allowable unit stresses named in this Section are assigned for lumber used in continuously dry locations. For the condition of occasionally wet and quickly dried, the allowable unit stresses of Table No. 25-A shall be multiplied by the following reduction factors expressed in percentages:

- Extreme fiber in bending.......................... 87.5 %
- Compression perpendicular to grain........ 70 %
- Compression parallel to grain.................. 92 %
- Horizontal Shear..................................100 %

For other conditions of exposure, allowable unit stresses of Table No. 25-A shall be reduced as may be required by the Building Inspector.

(f) **Unit Stresses—Intermittent Live Load.** For the case of members designed for a live load that will be intermittent, or of infrequent occurrence and duration of less than 24 hours insofar as maximum conditions are concerned, unit stresses may be increased 25 per cent. Such increase shall be applicable to roof rafters, roof joists and roof trusses. Such increase shall not be applicable where the dead load is greater than the live load, nor to the minimum required live loads on floors, nor shall it be applicable to columns. Allowable unit stresses may be used without allowance for impact up to impact of 100 per cent of live loads figured.

(g) **Supplementary Provisions.** For joists spiked to studding and supported on a ribbon board gained into the studding the allowable unit stress in compression perpendicular to the grain may be increased 50 per cent above that specified elsewhere in this Section, provided that the vertical load shall be considered to be transferred directly to the ribbon. For other conditions of bearing such unit stresses may be increased in accordance with the following factors for bearings less than six inches (6") in length and located three inches (3") or more from the end of the timber:
<table>
<thead>
<tr>
<th>Length of bearing (inches)</th>
<th>1/4</th>
<th>1</th>
<th>1 1/4</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>1.85</td>
<td>1.60</td>
<td>1.45</td>
<td>1.30</td>
<td>1.15</td>
<td>1.10</td>
<td>1.00</td>
</tr>
</tbody>
</table>

For stress under a washer or small plate the factor of increase may be taken as for a bearing the length of which equals the diameter of the washer.

(h) **Joint Details.** In designing joint details the maximum allowable unit horizontal shear stress values set forth in Table No. 25-A may be increased not to exceed 50 per cent.

Sec. 2504. The maximum allowable unit stress in horizontal shear in beams and other members in flexure shall be computed by use of the following formula:

\[
\frac{3R}{H} = \frac{2}{b} \frac{h}{H}
\]

**WHERE**

\(H\) = maximum unit horizontal shear, pounds per square inch

\(b\) = breadth of beam, inches

\(h\) = height of beam, inches

\(R\) = Reaction, pounds, under the following conditions:

1. Distribution of load to adjacent beams through flooring or other members shall be considered.

2. All loads uniform or concentrated, within a distance of the height of the beam from the nearest support shall be neglected.

3. All concentrated loads located at a distance from the support of one to three times the height of the beam shall be considered as placed at three times the height of the beam from the support.

Horizontal shear for notched members shall be computed in accordance with stress values given in Section 2521.

Sec. 2505. Columns, including struts and other members in compression parallel to grain, shall be designed structurally as follows:

(a) **Short Columns.** The safe load, in pounds per square inch of net cross sectional area, for columns and other members stressed in compression parallel to the grain, with a ratio of unsupported length to least dimension \(l/d\) not exceeding 11 (short columns), shall not exceed the allowable unit compression stress parallel to grain for short columns, as shown in Table No. 25-A, i.e.:

\[
\frac{P}{A} = c
\]

\(c\)

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(b) **Intermediate columns.** For columns with a ratio of unsupported length to least dimension greater than 11 (intermediate columns), the following formula shall be used until the reduction in allowable stress equals one-third the stress permitted for short columns:

\[
\frac{P}{A} = c \left[ 1 - \frac{1}{3} \left( \frac{l}{Kd} \right)^4 \right]
\]

(c) **Long Columns.** For columns with a ratio of unsupported length to least dimension greater than \(K\), (long columns), the safe unit load shall be determined by the following formula:

\[
\frac{P}{A} = \frac{\pi^4 E}{36 \left( \frac{l}{d} \right)^2 \left( \frac{l}{d} \right)^3} = \frac{0.274 E}{36 \left( \frac{l}{d} \right)^2 \left( \frac{l}{d} \right)^3}
\]

**WHERE**

- \(P\) = total load in pounds
- \(A\) = area in square inches of net cross-section
- \(\frac{P}{A}\) = working stress or maximum load per square inch
- \(c\) = allowable unit stress in compression parallel to grain for short columns (see Table No. 25-A).
- \(l\) = unsupported length of column in inches
- \(d\) = least dimension of column in inches
- \(E\) = modulus of elasticity
- \(K\) = the \(\frac{l}{d}\) at the point of tangency of the parabolic and Euler curves, at which point

\[
\frac{P}{A} = \frac{2c}{3} \quad \text{and} \quad K = \frac{\pi}{2} \sqrt{\frac{E}{6c}}
\]

Columns shall be limited in maximum length between points of lateral support to \(l = 50d\), except as provided in Section 2516.

(d) **Round Columns.** The safe load on a column of round cross-section shall not exceed that permitted for a square column of the same cross-sectional area.

**Combined Stresses**

**Sec. 2506.** Members subject to both axial and bending stresses shall be proportioned in accordance with the following formula:
\[ \frac{P}{A} + \frac{M}{S} \leq \text{c}_{1} + \text{f}_{1} \]

**WHERE**

\( P \) = total axial load (in pounds).

\( A \) = area (in square inches) of net cross-section.

\( c_{1} \) = allowable unit axial stress permitted for members acting solely as a column (see Table No. 25-A and Section 2505).

\( M \) = total bending moment in inch pounds resulting from load causing flexure.

\( S \) = section modulus (in inches cubed) for net cross section.

\( f_{1} \) = allowable unit fiber stress in bending permitted for member (see Table No. 25-A).

**Sec. 2507.** The unit stress normal to a plane inclined to the fiber of a wood member shall not exceed that determined from the formula:

\[ \frac{p q}{n} = \frac{p \sin^{2} \theta + q \cos^{2} \theta}{n} \]

**WHERE**

\( p \) = allowable compressive unit stress parallel to grain (see Table No. 25-A).

\( q \) = allowable compressive unit stress perpendicular to grain (see Table No. 25-A).

\( \theta \) = angle between the direction of the load and the direction of the grain in degrees.

**Sec. 2508.** (a) **Design of Bolted Joints.** Bolted joints wherein bolts are used to resist stresses in wood structures shall be designed in accordance with the principles set forth in the "Wood Handbook," U. S. Department of Agriculture, September, 1935, and in addition thereto shall comply with the requirements of this Section.

(b) **Safe Loads, Double Shear.** Safe loads, in pounds on bolts in seasoned lumber of the following species: cedar, eastern red; cypress, southern; Douglas fir (coast region); larch, western; pine, southern yellow; redwood and tamarack, in joints consisting of three members in which the side members are one-half the thickness of the main member, shall not exceed values set forth in Tables No. 25-B and 25-C.

(c) **Loads at Angle to Grain.** When a force is applied by means of a bolt at an angle with the fiber of a wood member,
The safe load shall be determined in accordance with the formula:

\[ n = \frac{p \cdot q}{p \cdot \sin^2 \theta + q \cdot \cos^2 \theta} \]

WHERE

- \( n \) = safe load in pounds on bolt.
- \( p \) = safe load on bolt parallel to grain as set forth in Table No. 25-B.
- \( q \) = safe load on bolt perpendicular to grain as set forth in Table No. 25-C.
- \( \theta \) = angle between direction of load and direction of member, in degrees.

### TABLE NO. 25-B—HOLDING POWER OF BOLTS

**Loads Parallel to Grain (p)**

<table>
<thead>
<tr>
<th>Length of Bolt in main member, in inches</th>
<th>Diameter of Bolt in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>½</td>
</tr>
<tr>
<td>2</td>
<td>960</td>
</tr>
<tr>
<td>3</td>
<td>1050</td>
</tr>
<tr>
<td>4</td>
<td>1050</td>
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<td>5</td>
<td>1050</td>
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<tr>
<td>6</td>
<td>1640</td>
</tr>
<tr>
<td>7</td>
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<tr>
<td>8</td>
<td>1640</td>
</tr>
<tr>
<td>10</td>
<td>1640</td>
</tr>
<tr>
<td>12</td>
<td>1640</td>
</tr>
</tbody>
</table>

* This assumes full size lumber, i.e., not dressed sizes. Safe loads on dressed sizes may be obtained by interpolation.

### TABLE NO. 25-C—HOLDING POWER OF BOLTS

**Loads Perpendicular to Grain (q)**

<table>
<thead>
<tr>
<th>Length of Bolt in main member, in inches</th>
<th>Diameter of Bolt in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>½</td>
</tr>
<tr>
<td>2</td>
<td>460</td>
</tr>
<tr>
<td>3</td>
<td>690</td>
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<tr>
<td>4</td>
<td>810</td>
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<tr>
<td>5</td>
<td>780</td>
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<tr>
<td>6</td>
<td>1110</td>
</tr>
<tr>
<td>7</td>
<td>1060</td>
</tr>
<tr>
<td>8</td>
<td>980</td>
</tr>
<tr>
<td>10</td>
<td>1800</td>
</tr>
<tr>
<td>12</td>
<td>2180</td>
</tr>
</tbody>
</table>

* This assumes full size lumber, i.e., not dressed sizes. Safe loads on dressed sizes may be obtained by interpolation.
(d) **Bolts in Other Species of Wood.** For species of wood other than those set forth in Tables No. 25-B and 25-C, bolt values shall be derived in accordance with the principles stated in "Wood Handbook," U. S. Department of Agriculture, September, 1935.

(e) **Joints Other than Double Shear.** When a joint consists of two members (single shear) of equal thickness, one-half the tabulated load for a piece twice the thickness of one of the members shall be used. When members of a two-member joint are of unequal thickness, one-half the tabulated load for a piece twice the thickness of the thinner member shall be used.

For multiple-member joints other than two or three members, the load for each shear plane shall be computed in the same manner as for a two-member joint.

(f) **Metal Side Plates.** When metal plates are used each side of a wood member, tabulated bolt values may be increased one-quarter for values parallel to the grain.

(g) **Joints in Wet Locations.** When the joint is to be used in a location "occasionally wet but quickly dried," tabulated bolt values shall be reduced one-quarter.

In locations "usually wet," tabulated bolt values shall be reduced one-third.

(h) **Definition of Seasoned Lumber.** "Seasoned lumber" for the purpose of this section, is defined as lumber which has been air-dried for at least 60 days, or which has at the time of installation in the structure reached a moisture content approximately equal to that which it will eventually contain in service.

Where green or recently cut lumber is used, tabulated bolt values shall be reduced one-third.

(i) **Bolt Holes.** Bolt holes in wood members shall be made the same diameter as the bolt, unless otherwise specified on plans. Bolt holes may be specified to be not more than one-sixteenth of an inch larger than the bolt, in which case allowable loads shall be reduced 10 per cent.

(j) **Bolt Hole Spacing.** "Row of Bolts" is defined as a number of bolts placed in a line parallel to the direction of load.

Minimum center-to-center spacing of bolts in any one row for full design loads shall be four times the bolt diameter. In no case shall the bolt bearing capacity of any member be exceeded.

Spacing center-to-center between rows of bolts for loads perpendicular to grain shall be not less than two and one-half times the bolt diameter for an \( l/d \) ratio of two, and not less than five times the bolt diameter for \( l/d \) ratios of six or more. Intermediate values shall be directly interpolated.

Spacing center-to-center between rows of bolts for loads parallel to grain shall be such that the net tension area remaining at a critical section shall be not less than 80 per cent for softwoods, and 100 per cent for hardwoods, of the total area in bearing under all bolts in the particular timber.

End margin is defined as the distance from the end of a bolted member to the center of the bolt hole nearest the end. This distance, for a member in tension, shall be not less than
seven times the bolt diameter for softwoods and five times for hardwoods. End margin, for members in compression, shall be not less than four times the bolt diameter.

Edge margin is defined as the distance from the edge of the timber to the center of the nearest bolt hole. For members loaded perpendicular to grain, edge margin nearest the edge toward which the load is acting shall be at least four times the bolt diameter. For members loaded parallel to grain, edge margin shall be at least one and one-half times the bolt diameter.

Sec. 2509. Joints wherein timber connectors are used with bolts to transmit stresses between structural or load-bearing members shall be designed in accordance with the principles and recommended safe loads set forth in "Wood Handbook" published by U. S. Department of Agriculture, September, 1935.

Safe loads and design practice for types of connectors not mentioned or fully covered by the above publication may be determined from other published recommendations, provided such recommendations are first approved by the Building Inspector. Allowable load values for timber connectors shall be based on empirical test data. Connector safe load values shall be determined from the combined resistance of the connector and its bolt.

Sec. 2510. In connections involving the use of tightly fitting cylindrical pins of iron, steel, heavy steel pipe or hardwood, the allowable load on a pin shall be determined in the same manner as for bolts as set forth in the "Wood Handbook," published by the U. S. Department of Agriculture, September, 1935.

Sec. 2511. (a) Penetration. Lag screws shall penetrate into the farther member not less than one and one-half times the thickness of the side member.

(b) Safe Lateral Strength. The safe lateral strength shall be equal to 75 per cent of the single shear value of a bolt of the same diameter in a main member of thickness equal to one and one-half times the thickness of the side member.

(c) Screws with Side Plates. Where lag screws are used with steel side plates the safe load shall be determined as for bolts in single shear with a wood side plate, considering the thickness of main member to be two-thirds of the penetration of lag screws into the timber member.

(d) Placing. All lag screws shall be screwed and not driven into place.

In placing lag screws in wood, a hole shall first be bored of the same diameter and depth as the shank, after which the hole shall be continued to a depth equal to the length of the lag screw with a diameter equal to the diameter of the screw at the root of the thread.

(e) Holes. Holes for lag screws in steel plates shall be drilled to a diameter one-thirty-second of an inch larger than the nominal diameter of the lag screw.

Sec. 2512. (a) Shear Connections. A wood screw used to fasten a metal plate to a wooden member or a wooden member to a wooden member shall not be subjected to a greater
TABLE NO. 25-D—SAFE LATERAL RESISTANCE
OF WOOD SCREWS
In Pounds Per Screw

<table>
<thead>
<tr>
<th>Kind of Wood</th>
<th>Gauge of Screw</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>159</td>
</tr>
<tr>
<td>Redwood</td>
<td>124</td>
</tr>
<tr>
<td>Other Species</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE NO. 25-E—SAFE RESISTANCE OF WOOD
SCREWS TO WITHDRAWAL
When Inserted Perpendicular to Grain of Wood in Pounds per
Linear Inch of Screw

<table>
<thead>
<tr>
<th>Kind of Wood</th>
<th>Gauge of Screw</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>125</td>
</tr>
<tr>
<td>Redwood</td>
<td>75</td>
</tr>
<tr>
<td>Other Species</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

load causing shear and bending than the safe lateral strength
of the wood screw as set forth in Table No. 25-D. Screws shall
have an embedment into the farther member of at least six-
tents of the length of the screw. The length of the screw shall
be not less than seven times the diameter of the screw.

(b) **Tension Connections.** A wood screw inserted perpendicu-
lar to the grain of the wood shall not be subjected to a greater
load tending to cause withdrawal than the safe resistance of
the screw to withdrawal as set forth in Table No. 25-E.

A wood screw inserted parallel to the grain of the wood shall
not be allowed for resisting computed tensile stresses.

**Sec. 2513. (a) Safe Lateral Strength.** A wire nail inserted
perpendicular to the grain of the wood when used to fasten
wooden members together, shall not be subjected to a greater
load causing shear and bending than the safe lateral strength
of the wire nail or spike as set forth in Table No. 25-F.

A wire nail inserted parallel to the grain of the wood shall
not be subjected to more than three-fourths of the lateral load
allowable when inserted perpendicular to the grain.

(b) **Safe Resistance to Withdrawal.** A wire nail inserted per-
pendicular to the grain of the wood shall not be subjected to a
greater load, tending to cause withdrawal, than the safe resis-
tance of the nail to withdrawal, as set forth in Table No. 25-G.

Nails inserted parallel to the grain of the wood shall not be
allowed for resisting computed tensile stresses.
TABLE NO. 25-F—SAFE LATERAL STRENGTH OF COMMON WIRE NAILS

Inserted Perpendicular to the Grain of the Wood, in Pounds Per Nail

<table>
<thead>
<tr>
<th>Kind of Wood</th>
<th>Size of Nail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6d 8d 10d 12d 16d 20d 30d 40d 50d 60d</td>
</tr>
<tr>
<td>Length of Nail</td>
<td>2&quot; 2½&quot; 3&quot; 3¼&quot; 3½&quot; 4&quot; 4½&quot; 5&quot; 5½&quot; 6&quot;</td>
</tr>
<tr>
<td>Douglas fir or</td>
<td>70 100 120 130 160 190 230 270 310 360</td>
</tr>
<tr>
<td>Southern Pine</td>
<td>58 82 98 106 123 155 188 220 250 295</td>
</tr>
<tr>
<td>Redwood</td>
<td>As determined by the building inspector.</td>
</tr>
<tr>
<td>Other Species</td>
<td></td>
</tr>
</tbody>
</table>

TABLE NO. 25-G—SAFE RESISTANCE TO WITHDRAWAL OF COMMON WIRE NAILS

Inserted Perpendicular to the Grain of the Wood, in Pounds Per Linear Inch of Penetration into the Main Member

<table>
<thead>
<tr>
<th>Kind of Wood</th>
<th>Size of Nail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6d 8d 10d 12d 16d 20d 30d 40d 50d 60d</td>
</tr>
<tr>
<td>Douglas Fir or</td>
<td>27 29 35 35 39 48 52 56 61 67</td>
</tr>
<tr>
<td>Southern Pine</td>
<td></td>
</tr>
<tr>
<td>or Redwood</td>
<td></td>
</tr>
<tr>
<td>Other Species</td>
<td>As determined by the building inspector.</td>
</tr>
</tbody>
</table>

(c) **Spacing and Penetration.** Nails shall not be driven closer together than one-half their length unless driven in bored holes nor closer to the edge of the timber than one-quarter their length. Holes for nails when necessary to prevent splitting, shall be bored of diameter smaller than that of the nails. Nails shall be of such length that, when joining one timber to another, the penetration of the nail into the second or farther timber shall be not less than one-half the length of the nail.

**Washers**

Sec. 2514. All bolts in direct tension shall be provided with steel plate washers under heads and nuts. The area of these washers must be such that the unit bearing stress on the wood shall not exceed the allowable unit stress. The washer shall be not less in thickness than one-tenth the diameter or the length of the longer side of the washer.

Bolts taking shear only shall have Standard O. G. malleable iron washers, or equivalent, under head and nuts.

**Columns or Posts**

Sec. 2515. For allowable unit stresses see Sections 2503, 2504 and 2505.

All wood columns and posts shall be framed to true end bearings; shall extend down to supports of such design as to
hold securely the column or post in position and to protect its base from deterioration; shall be supported in basements by footings projecting at least two inches above the finished floor and separated therefrom by a metal plate of not less than one-quarter inch (¼") thickness; shall not rest directly or indirectly on floor beams except in cases where there is no column below.

Preservatives shall be applied to column ends where necessary to protect against dampness.

Untreated wood columns in basements, when built into masonry partitions or walls, shall be exposed on at least two sides.

Wood posts, where used as foundations below ground and as piles, (except for minor structures), shall be pressure-treated with an approved preservative.

Sec. 2516. The compressive strength of built-up columns or compression members, when composed of two or more members spiked or bolted together, either with or without spacing blocks between members, shall be taken as the combined compressive strength of the individual pieces, each considered as an independent column; provided, however, that compression members which are fastened together by bolts and timber connectors, or otherwise used in such a manner as to approach fixed-end conditions, or which are laterally braced parallel to the least dimension of the individual members, may be calculated as having 80 per cent of the compressive strength of long columns having a slenderness ratio — based on the least overall dimension of the composite member.

Specially designed spaced compression members shall be based upon design principles acceptable to the Building Inspector.

Sec. 2517. Where joists enter stud walls, either exterior or interior, in which the studs are not cut off and capped underneath the joists thus giving bearing support thereto, such joists shall be connected to the studs in an approved manner or may be supported on a wooden ribbon not less than one inch by four inches (1”x4”) set snugly into the studs. In the latter case design shall be in accordance with Section 2503 (f).

Joists under bearing partitions and running parallel thereto shall be doubled and well spiked or separated by solid bridging not more than sixteen inches (16") on centers to permit the passage of pipes.

The bearing surfaces of masonry on which wooden structural members are to rest shall be finished to give true and even support. When less than three feet (3’) from the ground, the bearing surfaces of wooden joists, beams, girders, built-up girders, or rafters over six inches (6") in width of bearing, which would otherwise rest directly upon masonry or concrete shall be protected in an approved manner against damage by moisture or other injurious conditions.

Every wooden joist, rafter, beam or girder entering any masonry or reinforced concrete wall shall be separated from
any wood members entering the opposite side of said wall by at least four inches (4") of solid masonry.

Ends of wood members entering masonry or concrete walls shall be treated with approved preservative or shall be provided with metal wall boxes affording one-half inch (½") air space on each side or shall be provided with at least one inch (1") of air space at top and sides.

Header beams shall be placed not closer than twenty inches (20") from the face of a chimney. All spaces between chimneys and wood joists or beams shall be filled with loose incombustible materials placed in an incombustible support, or a metal collar connected to the chimney and fastened to the joists, beams or flooring to form an effective fire stop.

All joists shall have a minimum bearing of two inches (2") except when supported on a ribbon board and nailed securely to the adjoining stud.

Cutting of wood girders, beams or joists shall be limited to that permitted in Sections 2506 and 2521.

Sec. 2518. When timber construction is used in connection with masonry or reinforced concrete walls, the walls shall be tied to the interior timber construction at each floor and roof at horizontal intervals as required by design loads and stresses.

Where the joists, rafters or beams are supported by wooden girders, such girders shall be anchored to the walls so as to furnish resistance as required by the design loads and stresses.

Sec. 2519. Header joists over six feet (6') long and tail joists over twelve feet (12') long shall be hung in joist or beam hangers, or secured by other devices affording equivalent support.

Trimmers and header joists more than four feet (4') long shall be doubled.

Sec. 2520. Wooden cross bridging or metal cross bridging of equal strength shall be placed between joists if the span of the joists is greater than eight feet (8'). The distance between bridging or between bridging and bearing shall not exceed eight feet (8'). Each member of wood cross bridging shall be not less than two inches by three inches (2"x3") nominal.

Solid bridging shall be placed between joists at all points of support, except when resting on ribbons, and at the edges of openings where the flooring is not continued.

Sec. 2521. Girders, beams or joists, may be notched or bored in any part of the section within three times the beam depth from either support. Such notches or holes shall not exceed one-fifth of the depth of beam except at point of support and as hereinafter provided.

Where girders, beams or joists are notched at points of support they shall meet design requirements for net section in bending and also for shear. The unit shearing stress at such
point shall be calculated by the following formula and shall not exceed value set forth in Table No. 25-A:

\[
\frac{3V}{H} = \frac{h}{2bd} \times \frac{1}{d}
\]

WHERE

- \( V \) = vertical shear at section under consideration.
- \( b \) = width of beam.
- \( d \) = actual depth of beam at the notch.
- \( h \) = total depth of beam.
- \( H \) = allowable unit horizontal shear stress.

Where notches or holes are made in other portions of the beam, the net remaining depth of beam shall be used in determining the bending strength.

Sec. 2522. Floor joists supporting plastered ceilings shall be so proportioned that their deflection under full live load and dead load exclusive of weight of plaster, shall not exceed one three-hundred-and-sixtieth of the span length.

Sec. 2523. Every member of a solid or laminated floor, consisting of members set closely together on edge, shall be firmly nailed with two nails at each end and at intervals along its length not greater than eighteen inches (18’’). The nails used shall be of a length equal to two and one-half times the thickness of a single lamination. Devices of equivalent strength may be used in lieu of nails.

In the case of laminated floors in structures of more than one span, at least two-thirds of the members shall pass over the supports. In any three consecutive members, no two splices shall be nearer to each other than one-quarter of a span length. No member shall be spliced more than once in a distance equal to a span length.

In all single span laminated floors the members forming the floor shall be full length and free from joints.

When laminated floors bear on a masonry wall, suitable anchorage shall be provided capable of resisting the design forces. (See also Section 3104.)

Sec. 2524. (a) Placing. Studs in walls and partitions may be placed with the longest dimension parallel with the wall or partition, provided the studs are considered as columns and comply with the column formulas. Such walls shall have top and bottom plates except when framed as provided in Section 2517, first paragraph.

(b) Plates. In bearing partitions the top plate shall be doubled and lapped at each intersection with walls or partitions. Joints in the upper and lower members of the top plate shall be staggered not less than four feet (4’).

(c) Bridging. All stud partitions or walls over ten feet (10’) in height shall have herringbone bridging, not less than two inches (2’) in thickness and of the same width as the stud, fitted snugly and spiked into the studs at mid-height of stud, or other
(d) **Size and Height.** Exterior stud walls and bearing partitions of buildings of two stories or less shall consist of not less than two-inch by four-inch (2"x4") studs; for buildings of three stories, the studding shall be not less than three-inch by four-inch (3"x4") or two-inch by six-inch (2"x6") to the bottom of the second floor joists and two-inch by four-inch (2"x4") for the two upper stories. Maximum allowable height of two-inch by four-inch (2"x4") and three-inch by four-inch (3"x4") stud framing shall be fourteen feet (14') and of two-inch by six-inch (2"x6") stud framing shall be twenty feet (20') unless the wall is supported laterally by adequate framing. No studding shall be spaced more than sixteen inches (16") center, except that in lieu of this requirement the studs and plates may be designed as a system of columns and beams, provided structural grade material is used.

(e) **Base Plates.** Stud walls resting on masonry shall have base plates or sills of foundation grade redwood, cedar, cypress or wood treated with approved preservative. Such sills shall be bolted to the masonry at corners and between corners with bolts not less than one-half inch (1/2") in diameter, embedded not less than seven inches (7") into the masonry and spaced not more than six feet (6') apart, center to center. These sills shall be not less than the width of the studs nor less than two inches (2") thick.

(f) **Corners and Bracing.** Angles at corners where stud walls or partitions meet shall be framed solid so that no lath can extend from one room to another. All exterior and main cross stud partitions shall be effectively and thoroughly braced.

(g) **Pipes in Walls.** Stud partitions containing plumbing, heating or other pipes shall be so framed and the joists underneath so spaced as to give proper clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of such pipes and shall be bridged with solid bridging. Where plumbing, heating or other pipes are placed in or partly in a partition, necessitating the cutting of the soles or plates, a metal tie not less than one-eighth inch (1/8") thick and one-and one-half inches (1 1/2") wide shall be fastened to the plate across and to each side of the opening with not less than four 16d nails.

(h) **Chimney Space.** Wood lath, furring or framing shall be placed not less than two inches (2") from any chimney and not less than four inches (4") from the back of any fireplace.

(i) **Underpinning.** The underpinning of bearing stud walls shall be so constructed as to resist the design forces.

(j) **Headers.** All wall openings four feet (4') wide or less shall be provided with double headers not less than two inches (2") thick, placed on edge, securely fastened together, and such headers shall have two-inch (2") solid bearing to the floor or bottom plate. All openings more than four feet (4') wide shall
be trussed or provided with lintels which shall have not less than two-inch (2") solid bearing at each end to the floor or bottom plate.

Sec. 2525. The wooden framework of all buildings shall be connected together in a secure manner, and the connections between the various parts shall be such that all forces will be adequately resisted. The sheathing and the sub-flooring shall be fastened to the studs, rafters or joists with nails which shall be in length at least two and one-half times the nominal thickness of the sheathing or subflooring. The nailing shall have an average spacing not more than four inches (4") along each stud, rafter or joist.

Exception: For plywood sheathing or subflooring nails shall be not less than sixpenny and shall be spaced not more than six inches (6") along the edges of panels and twelve inches (12") along intermediate supports and shall be at least three-eighths inch (\(\frac{3}{8}\"\)) from the edge of panel.

Sec. 2526. Firestopping shall be provided to cut off all concealed draft openings (both vertical and horizontal), and form an effective fire barrier between stories, and between a top story and the roof space. It shall be used in specific locations, as follows:

1. In exterior or interior stud walls, at ceilings and floor levels.

2. In all stud walls and partitions, including furred spaces, so placed that the maximum dimension of any concealed space is not over seven feet (7').

3. In furred masonry walls.

4. Between stair stringers at least once in the middle portion of each run, at top and bottom, and between studs, along and in line with run of stair adjoining such partition.

5. Around top, bottom, sides and ends of sliding door pockets.

6. Spaces between chimneys and wood framing; these shall be solidly filled with mortar, loose cinders or other incombustible material placed in incombustible supports.

7. Any other locations not specifically mentioned above, such as holes for pipes, shafting, etc., which could afford a passage for flames.

Fire stops when of wood shall be two-inch (2") nominal thickness. If width of opening is such that more than one piece of lumber is necessary, there shall be two thicknesses of one-inch (1") material with joints broken.
Sec. 2527. The space between bottom of floor joists and the ground of any building (except such space as is occupied by a basement or cellar) shall be provided with a sufficient number of ventilating openings through foundation walls or exterior walls to insure ample ventilation, and such openings shall be covered with a corrosion-resistant wire mesh with openings in such mesh not greater than one-half inch (1⁄4") in any dimension. The minimum total area of ventilating openings shall be proportioned on the basis of two square feet (2 sq. ft.) for each twenty-five linear feet (25 lin. ft.) or major fraction thereof of exterior wall. Such openings need not be placed in the front of the building.

Minimum clearance between bottom of floor joists and the ground beneath shall be eighteen inches (18").

Sec. 2528. Wood diaphragms may be used to distribute horizontal forces to resisting elements such as walls or partitions, provided the maximum deflection in the plane of the diaphragm, as determined by tests or analogies drawn therefrom, does not exceed the permissible deflection of such wall or partition.

In determining the permissible deflection of walls or partitions, the actual elastic properties of the materials (modulus of elasticity, allowable extreme fiber stresses, etc.) may be determined by tests or other data acceptable to the Building Inspector, or the assigned values for such properties elsewhere herein provided shall be used.

In determining the maximum horizontal deflection of a proposed wood diaphragm under assumed design loads, data from actual tests of diaphragms corresponding to the type proposed may be used or an analogy may be drawn from data furnished in an article entitled “Tests Indicate Design Methods for Earthquake-Proof Timber Floors” appearing in Building Standards Monthly, June, 1943, or in “The Rigidity and Strength of Frame Walls” published by the U. S. Forest Products Laboratory.

Connections and anchorage of wood diaphragms to resisting elements shall be provided along all the margins of the diaphragm. Such connections shall be capable of resisting the design loads or forces elsewhere herein prescribed.

Sec. 2529. For additional termite and fungus precautions, see Appendix.
CHAPTER 26—REINFORCED CONCRETE
(Quality and Design)

Sec. 2601. The quality of the materials used in reinforced concrete and the quality of reinforced concrete shall conform to the physical and chemical properties as specified in Sections 2604, 2605 and 2606.

Sec. 2602. The design of reinforced concrete shall conform to the rules and principles specified in this Chapter.

Sec. 2603. The following definitions give the meaning of certain terms as used in this Chapter.

Aggregate—Inert material which is mixed with portland cement and water to produce concrete.

Column—An upright compression member the length of which exceeds three times its least lateral dimension.

Column Capital—An enlargement of the upper end of a reinforced concrete column designed and built to act as a unit with the column and flat slab.

Column Strip—A portion of a flat slab panel one-half panel in width occupying the two quarter-panel areas outside of the middle strip, and extending through the panel in the direction in which bending moments are being considered.

Combination Column—A column in which a structural steel section, designed to carry the principal part of the load, is wrapped with wire and encased in concrete of such quality that some additional load may be allowed.

Composite Column—A column in which a steel or cast-iron section is completely encased in concrete containing reinforcement of spiral reinforcement and longitudinal bars.

Concrete—A mixture of portland cement, fine aggregate, coarse aggregate and water.

Deformed Bar—Reinforcing bars with closely spaced shoulders, lugs or projections formed integrally with the bar during rolling so as to firmly engage the surrounding concrete. Wire mesh with welded intersections not farther apart than twelve inches (12") in the direction of the principal reinforcement and with cross wires not smaller than No. 10 W. & M. Gauge may be rated as a deformed bar.

Diagonal Band—A group of bars covering a width approximately 0.4 the average span, symmetrical with respect to the diagonal running from corner to corner of the panel of a flat slab.

Direct Band—A group of bars, covering a width approximately 0.4 l, symmetrical with respect to the center lines of the supporting columns of a flat slab.

Dropped Panel—The structural portion of a flat slab which is thickened throughout an area surrounding the column capital.

Effective Area of Concrete—The area of a section which lies between the centroid of the tensile reinforcement and the compression face of a slab or beam.
Effective Area of Reinforcement—The area obtained by multiplying the right cross-sectional area of the metal reinforcement by the cosine of the angle between its direction and that for which the effectiveness of the reinforcement is to be determined.

Flat Slab—A concrete slab reinforced in two or more directions, generally without beams or girders to transfer the loads to supporting columns.

Gunite—A mixture of portland cement and fine aggregate, mixed dry, passed through a cement gun, or other similar device, hydrated at the nozzle and deposited under pressure in its place of final repose. It shall be considered as concrete for particulars of design as specified in this Chapter.

Laitance—Extremely fine material of little or no hardness which may collect on the surface of freshly deposited concrete or mortar, resulting from the use of excess mixing water and usually recognized by its relatively light color.

Middle Strip—A portion of a flat slab panel one-half panel in width, symmetrical with respect to the panel center line and extending through the panel in the direction in which bending moments are being considered.

Mortar—A mixture of portland cement, fine aggregate and water.

Negative Reinforcement—Reinforcement so placed as to take tensile stress due to negative bending moment.

Panel Ceiling—The ceiling of a flat slab in which approximately that portion of the area enclosed within the intersection of the two middle strips is reduced in thickness.

Panel Length—The distance along a panel side from center to center of columns of a flat slab.

Pedestal—An upright compression member whose height does not exceed three times its least lateral dimension.

Plain Concrete—Concrete without metal reinforcement, or reinforced only for shrinkage or temperature changes.

Portland Cement—The product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalkined gypsum.

Positive Reinforcement—Reinforcement so placed as to take tensile stress due to positive bending moment.

Ratio of Reinforcement—The ratio of the effective area of the reinforcement cut by a section of a beam or slab to the effective area of the concrete at that section.

Reinforced Concrete—Concrete in which metal other than that provided for shrinkage or temperature changes is embedded in such a manner that the two materials act together in resisting forces.

Surface Water—The water carried by the aggregate except that held by absorption within the aggregate particles themselves.

(b) Concrete Aggregates. Concrete aggregates, except lightweight aggregates, shall conform to the A.S.T.M. "Standard Specifications for Concrete Aggregates," (C33-42) including the methods of sampling and testing.

Lightweight aggregates for concrete shall conform to the A.S.T.M. "Standard Specifications for Lightweight Aggregates for Concrete," (C130-42) including the methods of sampling and testing.

Aggregates that do not meet the above specifications and that have been shown by test or actual service to produce concrete of the required strength, durability, watertightness and wearing qualities, may be used under the provisions of Section 2606, Method 2, where authorized by the Building Inspector.

The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than three-fourths of the minimum clear spacing between reinforcing bars.

(c) Water. Water used in mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other harmful substances.

(d) Metal Reinforcement. Metal reinforcement shall conform to the requirements of the A.S.T.M. "Standard Specifications for Billet-Steel Bars for Concrete Reinforcement" (A15-39)¹ or the A.S.T.M. "Standard Specifications for Rail-Steel Bars for Concrete Reinforcement" (A16-35)¹ or the A.S.T.M. "Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement" (A82-34)¹; provided, that hard grade steel bars larger than three-fourths inch (¾") in diameter shall not be used where bending would be required; and provided, further, that the requirements in the above-mentioned specifications for machining of deformed bars shall be eliminated.

Deformed bars, to receive that rating which permits the use of bond stresses higher than those allowed for plain bars, shall show a bond strength 25 per cent greater than that shown by plain bars of equivalent cross-sectional area.

(e) Storage. Storage of cement and aggregates shall be in a manner to prevent deterioration or the intrusion of foreign matter. Any material which has been damaged shall be immediately and completely removed from the work.

Sec. 2605. On concrete or reinforced concrete work the Building Inspector shall have the right to require the owner or his agent to make tests of the concrete and other materials from time to time to determine whether the materials and methods

¹See "Specification Documents".
in use are such as to produce concrete or reinforced concrete of the quality specified and used in the design of the building or structure. The tests shall be made, when ordered by the Building Inspector, by the owner or his authorized representative and no responsibility for the expense of these tests shall attach to the Building Department. All such tests shall be made by competent persons approved by the Building Inspector and copies of the results shall be kept on file in the office of the Building Inspector for a period of not less than two years after the acceptance of the structure. Specimens for concrete cylinder tests shall be taken at the place where the concrete is being deposited and shall be taken, cured and tested in accordance with the A.S.T.M. "Standard Method of Making and Storing Specimens of Concrete in the Field," (C31-42).

**Load Tests**

The Building Inspector shall have the right to order the test under load of any portion of a completed structure, when the conditions have been such as to leave reasonable doubt as to the adequacy of the structure to serve the purpose for which it is intended.

When a load test is required, the member or portion of the structure under consideration shall be subject to a superimposed load equal to one and one-half times the live load plus one-half of the dead load. This load shall be left in position for a period of 24 hours before removal. If, during the test, or upon removal of the load, the member or portion of the structure shows evident failure, such changes or modifications as are necessary to make the structure adequate for the rated capacity shall be made; or, where lawful, a lower rating shall be established. The structure shall be considered to have passed the test if the maximum deflection at the end of the 24 hour period does not exceed the value of $D$ as given by the following:

$$D = \frac{0.001 L^4}{12t}\cdots\cd LTS\cdots\cd...
TABLE NO. 26-A—ASSUMED STRENGTH OF CONCRETE MIXTURES

<table>
<thead>
<tr>
<th>Water-Content U. S. Gallons Per 94-lb. Sack of Cement</th>
<th>Assumed Compressive Strength at 28 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Gallons</td>
<td>Cu. Ft.</td>
</tr>
<tr>
<td>7½</td>
<td>1.00</td>
</tr>
<tr>
<td>6⅔</td>
<td>.90</td>
</tr>
<tr>
<td>6</td>
<td>.80</td>
</tr>
<tr>
<td>5</td>
<td>.67</td>
</tr>
</tbody>
</table>

NOTE: In interpreting this table, surface water contained in the aggregate must be included as part of the mixing water in computing the water-content.

All concrete exposed to freezing and thawing weather shall have a minimum ultimate 28-day compressive strength of not less than 3000 pounds per square inch. All other concrete shall have a minimum compressive strength of 2000 pounds per square inch.

The determination of the proportions of cement, aggregate and water to attain the required strengths shall be made by one of the following methods:

Method 1—Concrete made from average materials—When no preliminary tests of the materials to be used are made, the water-content per sack of cement shall not exceed the values in Table No. 26-A. Method 2 shall be employed when artificial aggregates or admixtures are used.

Method 2—Controlled Concrete—Proportions of the materials and water-content, other than those shown in Table No. 1 may be used provided that the strength-quality of the materials proposed for use in the structure shall be established by tests which shall be made in advance of the beginning of operations, using the consistencies suitable for the work and in accordance with the A.S.T.M. “Standard Method of Tests for Compressive Strength of Concrete,” (C39-42). A curve representing the relation between the water-content and the average 28-day compressive strength or earlier strength at which the concrete is to receive its full working load, shall be established for a range of values including all the compressive strengths called for on the plans. The curve shall be established by at least four points, each point representing average values from at least four test specimens. The water-content used in the concrete for the structure as determined from the curve, shall correspond to a strength which is 20 per cent greater than that called for on the plans, for concrete of a compressive strength less than 2500 pounds per square inch and 15 per cent greater for concrete of a compressive strength of 2500 pounds per square inch or more. No substitutions shall be made in the materials used on the work without additional tests in accordance herewith to show that the quality of the concrete is satisfactory.
Sec. 2607. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The combined aggregates shall be of such composition of sizes that when separated on the No. 4 standard sieve, the weight passing the sieve (fine aggregate) shall be not less than 30 per cent nor greater than 50 per cent of the total unless otherwise required by the Building Inspector, except that these proportions do not necessarily apply to light-weight aggregates.


Admixtures of lime or finely pulverized inert materials may be added but not in excess of six per cent by volume of the cement used.

Sec. 2608. The methods of measuring concrete materials shall be such that the proportions of all materials can be accurately controlled during the progress of the work and easily checked at any time by the Building Inspector or his authorized representative. A tolerance of one-fourth gallon of water per sack of cement in any batch of concrete will be allowed provided that the average for any 10 consecutive batches does not show a water content greater than that shown in Table No. 26-A, and on plans as specified in Section 2606.

The method of delivering the aggregates to the work and of storing and handling shall be such that the moisture content of the aggregates as they come to the mixer shall not be subject to frequent or unnecessary changes.

Sec. 2609. (a) Mixing. The concrete shall be mixed until there is a uniform distribution of the materials and the mass is uniform in color and homogeneous. In machine mixing, only batch mixers shall be used. Each batch shall be mixed not less than one minute after all the materials are in the mixer and must be discharged completely before the mixer is recharged. Machine mixers shall have a peripheral speed of approximately two hundred feet (200') per minute.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the A.S.T.M. "Tentative Specifications for Ready Mixed Concrete," (C94-42T).

(b) Cleaning Forms and Equipment. Before concrete is placed all equipment for mixing and transporting the concrete shall be cleaned, all debris shall be removed from the spaces to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry that will be in contact with concrete shall be well drenched (except in freezing weather). Reinforcement shall be thoroughly cleaned and secured in position. Concrete shall not be placed until the forms and reinforcement have been inspected and approved by the Building Inspector.
(c) **Removal of Water From Excavations.** Water shall be removed from excavations before concrete is deposited, unless otherwise directed by the Building Inspector. Any flow of water into an excavation shall be diverted through proper side drains to a sump, or be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting or otherwise, after the concrete has hardened thoroughly.

(d) **Transporting Concrete.** Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited as nearly as practicable in its final position to avoid rehandling or flowing. Under no circumstances shall concrete that has attained its initial set be used.

Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end without separation of the materials.

(e) **Placing.** Concrete shall be thoroughly compacted with suitable tools. When necessary, openings shall be provided in the forms to permit the placing of concrete in such a manner as to avoid accumulations of hardened concrete on the forms or reinforcing bars. The concrete shall be thoroughly worked around the reinforcement.

(f) **Curing.** Exposed surfaces of concrete shall be kept moist for a period of at least seven days after being deposited for ordinary cement and three days for high early strength cement.

(g) **Depositing in Cold Weather.** Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near-freezing weather. No frozen materials or materials containing ice shall be used.

All concrete materials and all reinforcement, forms, fillers and ground with which the concrete is to come in contact, shall be free from frost. Whenever the temperature of the surrounding air is below 40 degrees Fahrenheit all concrete placed in the forms shall have a temperature of between 70 degrees Fahrenheit and 100 degrees Fahrenheit, and adequate means shall be provided for maintaining a temperature of 50 degrees Fahrenheit for not less than 72 hours after placing or for as much more time as is necessary to insure proper curing of the concrete. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Manure, when used for protection shall not be applied directly to concrete.

(h) **Bonding Fresh and Hardened Concrete.** Before new concrete is deposited on or against concrete which has set, the forms shall be re-tightened, the surface of the set concrete shall be roughened, cleaned of foreign matter and laitance and thoroughly wetted but not saturated. The cleaned and wetted surfaces of the hardened concrete, including vertical and inclined
surfaces, shall first be slushed with a coating of 1:2 cement mortar against which the new concrete shall be placed before the mortar has attained its initial set.

Forms and Details of Construction

Sec. 2610. (a) Design of Forms. Forms shall conform to the shape, lines and dimensions of the member as called for on the plans and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

Temporary openings shall be provided at the base of column and wall forms, and at other points where necessary, to facilitate cleaning and inspection.

(b) Removal of Forms. Forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal with safety. Shoring shall not be removed until the member has acquired sufficient strength to support safely its own weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to support both the member and construction loads in a manner that will protect the member from damage.

The Building Inspector may require forms to remain in place for a specified time.

(c) Cleaning and Bending Reinforcement. Metal reinforcement, at the time concrete is placed, shall be free from rust scale or other coatings that will destroy or reduce the bond. Bends for stirrups and ties shall be made around a pin having a diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar, except that for bars larger than one inch, the pin shall be not less than eight times the minimum thickness of the bar. All bars shall be bent cold.

(d) Placing Reinforcement. Metal reinforcement shall be accurately placed and secured and shall be supported by chairs, spacers, or hangers. The minimum clear distance between parallel bars shall be one and one-half times the diameter for round bars or one and one-half times the diagonal for square bars. The minimum clear distance between bars and forms shall be the diameter of round bars and the diagonal of square bars. If the ends of bars are anchored as specified in Section 2618, the clear spacing may be made equal to the diameter of round bars or to the diagonal of square bars, but in no case shall the spacing between bars be less than one inch (1\(\text{"}\)), nor less than one and one-third times the maximum size of the coarse aggregate. Bars shall be embedded a distance from any face of any member not less than the minimum distance as specified in Sec. 4301.

When wire or other reinforcement, not exceeding one-fourth inch (\(\frac{1}{4}\)") in diameter is used as reinforcement for slabs not exceeding ten feet (10') in span, the reinforcement may be curved from a point near the top of the slab over the support to a point near the bottom of the slab at mid-span; provided
such reinforcement is either continuous over, or securely anchored to the support.

(e) Splices and Offsets in Reinforcement. In slabs, beams and girders, splices of reinforcement shall not be made at points of maximum stress without the approval of the Building Inspector. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars by bond and shear. In such splices the bars shall be spaced at the minimum distance specified in paragraph (d) of this Section.

Where changes in the cross section of a column occur, the longitudinal bars shall be offset in a region where lateral support is afforded. Where offset, the slope of the inclined portion shall not be more than 1 in 6, and in the case of tied columns the ties shall be spaced not over three inches (3") on centers for a distance of one foot (1') below the actual point of offset.

(f) Protective Covering of Concrete. At the under side of footings metal reinforcement shall have a minimum covering of three inches (3") of concrete.

In fire-resistive construction, metal reinforcement shall be protected as specified in Section 4301.

Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion.

(g) Construction Joints. Joints not indicated on the plans shall be so made and located as least to impair the strength of the completed structure. Where a joint is to be made, any excess water and laitance shall be removed from the surface after concrete is deposited. Before depositing of concrete is resumed the hardened surface shall be treated as specified in paragraph (h) of Section 2609.

At least two hours must elapse after concrete is deposited in the columns or walls before depositing in beams, girders, or slabs supported thereon. Haunches and column capitals shall be considered as part of, and to act continuous with, the floor.

Construction joints in floors shall be located near the middle spans of slabs, beams or girders, unless a beam intersects a girder at this point, in which case the joints in the girders shall be offset a distance equal to twice the width of the beam. Provision shall be made for shear by use of reinforcement, inclined in both directions across the joint.

Pipes which will contain liquid, gas or vapor at other than room temperature shall not be embedded in concrete necessary for structural stability or fire protection. Drain pipes and pipes whose contents will be under pressure greater than atmospheric pressure by more than one pound per square inch shall not be embedded in structural concrete except in passing through from one side to the other of a floor, wall or beam. Electric conduits and other pipes whose embedment is allowed shall not, with their fittings, displace that concrete of a column on which stress is calculated or which is required for fire protection, to greater extent than four per cent of the area of the cross section. Sleeves or other pipes passing through floors, walls or beams shall not be of such size or in such location as unduly to impair the strength of the construction; such sleeves or pipes
may be considered as replacing structurally the displaced concrete, provided they are not exposed to rusting or other deterioration, are of uncoated iron or steel not thinner than standard wrought-iron pipe, have a nominal inside diameter not over two inches, and are spaced not less than three diameters on centers. Embedded pipes or conduits other than those merely passing through shall not be larger in outside diameter than one-third the thickness of the slab, wall or beam in which they are embedded; shall not be spaced closer than three diameters on centers, nor so located as unduly to impair the strength of the construction. Circular uncoated or galvanized electric conduit of iron or steel may be considered as replacing the displaced concrete.

Assumptions for Design

Sec. 2611. The design of reinforced concrete members shall be made with reference to working stresses and safe loads. The accepted theory of flexure as applied to reinforced concrete shall be applied to all members resisting bending. The following assumptions shall be made:

(1) The steel takes all the tensile stress.

(2) In determining the ratio \( n \) for design purposes, the modulus of elasticity for the concrete shall be taken as \( 1000/\varepsilon_c \) and that for steel as 30,000,000 pounds per square inch.

Symbols and Notations

Sec. 2612. The symbols and notations used in these regulations are defined as follows:

- \( a \) = Width of face of column or pedestal.
- \( \alpha \) = Angle between inclined web bars and axis of beam.
- \( A \) = Total area of top of pedestal, pier, or footing at the column base; the span length between opposite supports in one direction (floors with supports on four sides).
- \( A' \) = Loaded area of pedestal, pier, or footing at the column base.
- \( A_c \) = Area of core of a spirally-reinforced column measured to the outside diameter of the spiral; net area of concrete section of a composite column.
- \( A_t \) = The overall or gross area of spirally-reinforced or tied columns; the total area of the concrete encasement of combination columns.
- \( A_r \) = Area of the steel or cast iron core of a composite column; the area of the steel core in a combination column.
- \( A_s \) = Effective cross-sectional area of reinforcement in tension in beams or in compression in columns; the effective cross-sectional area of reinforcement which crosses any of the principal design sections of a flat slab.
- \( A_w \) = Total area of web reinforcement in tension within a distance of \( s \), or the total area of all bars bent up in any one plane.
- \( b \) = Width of rectangular beam or width of flange of T-beam.
- \( b' \) = Thickness of web in beams of I or T sections.
- \( b_1 \) = Dimension of the dropped panel of a flat slab in the direction parallel to \( l_1 \).
- \( B \) = Span at right angles to span \( A \) (floors with supports on four sides).
- \( c \) = Diameter, in feet, of column capital of a flat slab at the underside of the slab, or dropped panel. No portion of
the column capital shall be considered for structural purposes which lies outside of the largest 90° cone that can be included within the outlines of the column capital; distance from gravity axis to extreme fiber in compression (in a column).

\( d \) = Depth from compression face of beam or slab center to of longitudinal tensile reinforcement; the least lateral dimension of a concrete column; the diameter of a round bar or side of a square bar.

\( D \) = Deflection of a floor member under test load.

\( e \) = Eccentricity of the resultant load on a column, measured from the gravity axis.

\( e_{A} \) = Plate action factors for spans \( A \) and \( B \) respectively.

\( e_{B} \) = (Floors with supports on four sides.)

\( E_{c} \) = Modulus of elasticity of concrete in compression.

\( E_{s} \) = Modulus of elasticity of steel in tension or compression (30,000,000 lbs. per sq. in.).

\( c \) = Compressive unit stress in extreme fiber of concrete in flexure or axial compression in concrete columns.

\( f'_{c} \) = Ultimate compressive strength of concrete usually at age of 28 days. (See Section 2606).

\( f_{r} \) = Permissible unit stress in the metal core of a composite column.

\( f'_{r} \) = Permissible unit stress on unencased steel columns and pipe columns.

\( f_{i} \) = Tensile unit stress in longitudinal reinforcement; nominal working stress in vertical column reinforcement.

\( f'_{i} \) = Useful limit stress of spiral reinforcement.

\( f_{e} \) = Tensile unit stress in web reinforcement.

\( F_{A} \) = Ratio of the distance between assumed inflection points of the span \( A \) to span \( B \) in an isolated strip extending the entire width of the structure when a uniformly distributed load is applied to span \( A \) only (floors with supports on four sides).

\( F_{B} \) = Ratio as defined above, but applying to Span \( B \) (floors with supports on four sides).

\( F_{AA} \) = The distances, assumed for purposes of load distribution, between inflection points in spans \( A \) and \( B \) respectively (floors with supports on four sides).

\( F_{BB} \) =

\( h \) = Unsupported length of column.

\( I \) = Moment of inertia of a section about the neutral axis for bending.

\( j \) = Ratio of distance between centroid of compression and centroid of tension to the depth (\( d \)).

\( K \) = Least radius of gyration of a metal pipe section (in pipe columns); the stiffness factor, that is, the moment of inertia divided by the span (floors with supports on four sides.)

\( K_{A} \) = Stiffness factor \( \left( \frac{I}{A} \right) \) for span \( A \) of panel \( AB \) (floors with supports on four sides).

\( K_{B} \) = Stiffness factor \( \left( \frac{I}{B} \right) \) for span \( B \) of panel \( AB \) (floors with supports on four sides).

\( K_{AR} \) = Stiffness factor for spans to right and left respectively of span \( A \) (floors with supports on four sides).

\( K_{AL} \) =

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Symbols and Notations (Cont’d.)

$K_{BR}$ = Stiffness factor for spans to right and left respectively of span $B$ (floors with supports on four sides).

$K_{BL}$ = Span length of beam or slab; span length of flat slab (usually expressed in feet) center to center of columns in the direction in which moments are considered (see Section 2619).

$l_1$ = Span length of flat slab panel center to center of columns, perpendicular to the rectangular direction in which moments are considered.

$l'$ = Clear span for positive moment and the average of the two adjacent clear spans for negative moment (see Section 2614 [a]).

$L$ = Span of member under load test (see Section 2605).

$M$ = Bending moment or moment of resistance in general.

$M_o$ = Sum of positive and negative bending moments at the principal design sections of a panel of a flat slab.

$n$ = Ratio of modulus of elasticity of steel to that of concrete

$$n = \frac{E_s}{E_c}$$

$N$ = The sum of the lengths of those edges of panel $A\bar{B}$ supporting continuous adjacent spans (floors with supports on four sides).

$\Sigma_o$ = Sum of perimeters of bars in one set.

$p$ = Ratio of effective area of tensile reinforcement to effective area of concrete in beams.

$p_t$ = Ratio of effective cross-sectional area of vertical reinforcement to the gross area $A_t$ (see Section 2620).

$p'$ = Ratio of volume of spiral reinforcement to the volume of the concrete core (out to out of spirals) of a spirally reinforced concrete column.

$P$ = Total allowable axial load on a column whose length does not exceed 10 times its least cross-sectional dimension.

$P'$ = Total allowable axial load on along column.

$r_a$ = Permissible unit working stress in concrete over the loaded area of a pedestal, pier, or footing.

$r_A$ = Load distribution factors, that is, the proportion of total load ($w'AB$) carried in the directions $A$ and $B$ respectively (floors supported on four sides).

$R$ = Least radius of gyration of a section; ratio of gross area to core area of a spirally-reinforced concrete column,

$$\frac{A_F}{A_c}$$

$s$ = Spacing of stirrups or of bent bars in a direction parallel to that of the main reinforcement.

$t$ = Thickness of the flange of T-beams; the total thickness or depth of a member under load test.

$t_1$ = Thickness of flat slab without dropped panels; or the thickness of flat slabs, including dropped panels where such are used.

$t_2$ = Thickness of flat slabs with dropped panels at points outside the dropped panel.

$t_3$ = Total thickness of slab (floors supported on four sides).

$u$ = Bond stress per unit of surface area of bar.
\[ v = \text{Shearing unit stress.} \]
\[ v_s = \text{Unit shearing stress permitted on the concrete of the web.} \]
\[ V = \text{Total shear.} \]
\[ V' = \text{Excess of the total shear over that permitted on the concrete.} \]
\[ w = \text{Uniformly distributed load per unit of length of beam or slab.} \]
\[ w' = \text{Uniformly distributed dead and live load per unit of area of a floor or roof.} \]
\[ W = \text{Total dead and live load uniformly distributed over a single panel area.} \]

**Sec. 2613.** As specified in Section 2606, the structural drawings and plans shall show the ultimate strength of concrete for which the several parts of the structures were de-

**TABLE NO. 26-B—ALLOWABLE UNIT STRESSES IN CONCRETE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Allowable Unit Stresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Any Strength of Concrete as Fixed by Test in Accordance with Sec. 3606</td>
<td></td>
</tr>
<tr>
<td>( n = 25000 )</td>
<td></td>
</tr>
<tr>
<td>( f'_e )</td>
<td>When Strength of Concrete is Fixed by the Water-Content in Accordance with Sec. 3606</td>
</tr>
<tr>
<td>( n = 12 )</td>
<td>( f'_e = 2000 ) p. s. i.</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Flexure: ( f_e )</td>
<td>Extreme fiber stress in compression</td>
</tr>
<tr>
<td>Extreme fiber stress in compression adjacent to supports of continuous or fixed beams or of rigid frames</td>
<td>( f_e )</td>
</tr>
<tr>
<td>Shear: ( v )</td>
<td>Beams with no web reinforcement and without special anchorage of longitudinal steel</td>
</tr>
<tr>
<td>Beams with no web reinforcement, but with special anchorage of longitudinal steel</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement and with special anchorage of longitudinal steel</td>
<td>( v )</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement and with special anchorage of longitudinal steel</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement and with special anchorage of longitudinal steel</td>
<td>( v )</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement and with special anchorage of longitudinal steel</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Flat slabs at distance ( d ) from edge of column capital or dropped panel</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Footings where longitudinal bars have no special anchorage</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Footings where longitudinal bars have special anchorage</td>
<td>( v_s )</td>
</tr>
<tr>
<td>Bond: ( u )</td>
<td>In beams and slabs and one-way footings:</td>
</tr>
<tr>
<td>Plain bars or structural shapes</td>
<td>( u )</td>
</tr>
<tr>
<td>Deformed bars</td>
<td></td>
</tr>
<tr>
<td>In two-way footings:</td>
<td>( u )</td>
</tr>
<tr>
<td>Plain bars or structural shapes</td>
<td>( u )</td>
</tr>
<tr>
<td>Deformed bars</td>
<td></td>
</tr>
<tr>
<td>(Where special anchorage is provided (see Sec. 2615c), one and one-half times these values in bond may be used)</td>
<td></td>
</tr>
<tr>
<td>Bearing: ( f_b )</td>
<td>On full area</td>
</tr>
<tr>
<td>On one-third area*</td>
<td>( f_b )</td>
</tr>
<tr>
<td>Pedestals (see Sec. 2621c)</td>
<td>( f_b )</td>
</tr>
</tbody>
</table>

*The allowable bearing stress on an area greater than one-third but less than the full area shall be interpolated between the values given.
signed. The working stresses for the design of buildings or structures shall be based on the ultimate strength indicated on the drawings as specified in Section 2606 and shall be in the ratios specified in this Chapter. The ultimate strength ($f'_c$) shall be the average strength attained at 28 days, based on six-inch by twelve-inch (6"x12") or eight-inch by sixteen-inch (8"x16") cylinders made, cured and tested in accordance with the A.S.T.M. "Standard Methods of Making and Storing Specimens of Concrete in the Field," (C31-42) and A.S.T.M. "Standard Methods of Tests for Compressive Strength of Concrete," (C39-42). Gunite test cylinders shall be made in a manner that will permit the blast of air to compact firmly the materials and provide proper escapement of the air to eliminate possible back pressure, and such cylinders shall be cured and tested as specified above.

The unit stresses in pounds per square inch on concrete to be used in the design shall not exceed the values shown in Table No. 26-B where $f'_c$ equals the minimum ultimate compressive strength at 28 days.

### Allowable Unit Stresses in Reinforcement

The following unit stresses in reinforcing steel shall not be exceeded:

**Tension:**

- Intermediate grade billet steel.............. ($f_s$) = 20,000 p. s. i.
- Rail steel bars........................................ ($f_s$) = 20,000 p. s. i.
- Web reinforcement ................................ ($f_s$) = 20,000 p. s. i.
- Structural steel shape........................ ($f_s$) = 18,000 p. s. i.

Wire mesh or other steel reinforcement, not exceeding ¼ inch in diameter (used in one-way slabs), 50 per cent of the minimum yield point as established by the A. S. T. M. Standards for the particular grade of steel used; but not to exceed....................... ($f_s$) = 30,000 p. s. i.

**Compression**

- Structural steel section in composite columns .................. 16,000 p. s. i.
- Cast-iron section in composite columns .................. 10,000 p. s. i.

**Note:** If special conditions require the use of billet-steel concrete reinforcement bars of structural or hard grades, the allowable unit stress shall not exceed 18,000 p. s. i. for structural grade nor 20,000 p. s. i. for hard grade bars.

### Flexural Computations

Sec. 2614. All members shall be designed to resist at all sections the maximum bending moments and shears produced by dead load, live load and other loads, as determined by the principle of continuity. In the case of approximately equal spans with loads uniformly distributed, where the intensity of live load does not exceed three times the intensity of dead load, this is satisfied essentially by the following moments:
Negative moment at face of first interior support:

For beams and girders and for slabs exceeding 10 feet:

Two spans \( \frac{1}{8} \frac{wl'^3}{w} \)

More than two spans \( \frac{1}{10} \frac{wl'^3}{w} \)

For slabs not exceeding 10 feet in span

Two spans \( \frac{1}{10} \frac{wl'^3}{w} \)

More than two spans \( \frac{1}{12} \frac{wl'^3}{w} \)

Negative moment at face of other interior supports \( \frac{1}{12} \frac{wl'^3}{w} \)

Positive moment at center of span

End spans \( \frac{1}{10} \frac{wl'^3}{w} \)

Interior spans \( \frac{1}{12} \frac{wl'^3}{w} \)

Shear in end members at first interior support \( 1.20 \frac{wl'}{2} \)

Shear at other supports \( \frac{wl'}{2} \)

For the purpose of applying this method “approximately” shall be construed to mean that the longer of two adjacent spans shall not exceed the shorter by more than 20 per cent. In these expressions \( l' \) = the clear span for positive moments and the average of the two adjacent clear spans for negative moment.

(a) **Permissible Assumptions.** The span length of freely supported beams and slabs shall be the clear span plus the depth of beam or slab, but shall not exceed the distance between centers of the supports.

In the application of the principle of continuity, the following assumptions shall be permissible:

1. Consideration may be limited to combinations of dead load on all spans with full live load on two adjacent spans and with full live load on alternate spans.

2. Any reasonable and consistent assumption may be made as to the relative stiffness of the floor construction and columns. In computing the relative stiffness of floors to columns, the value \( I \) of the floor members may be based on the entire concrete section neglecting the reinforcement, and that of columns on the entire concrete section plus the transformed steel section. The moment of inertia assumed for the columns in computing bending moments must also be used in computing stresses.
3. The far ends of columns above and below the floor under consideration may be considered fixed.

4. When members are deepened near their ends by haunches they may be analyzed as members of constant section provided the minimum depth is used throughout in computing stresses due to bending; otherwise a complete analysis is required. Where members are widened near their supports the additional width may be neglected in computing moments but may be used in computing stresses.

Additional section at the end may in any case be utilized in resisting shear if properly reinforced.

5. Where slabs of uniform thickness are built integrally with their supports the span length may be taken equal to the clear span between faces of supports and the width of support otherwise neglected.

6. In the application of the principle of continuity, center to center distances may be used in the moment determination of all members.

    Moments prevailing at the faces of support may be used to proportion the members at these sections.

7. In slabs other than ribbed floor construction or flat slabs, the principal reinforcement shall not be spaced farther apart than three times the slab thickness.

8. All beams except cantilevers shall have positive reinforcement of not less than .005 $b'd$.

9. Not less than .005 $b'd$ of negative reinforcement shall be provided at the outer end of members built integrally with their supports.

10. Where analysis indicates negative reinforcement along the full length of a span, the reinforcement need not be extended beyond the point where the required amount is .0025 $b'd$ or less.

11. In slabs of uniform thickness the minimum amount of reinforcement in the direction of principal stress shall be

    For structural, intermediate and hard grades and rail steel................................................................. .0025 $bd$

    For steel having a minimum yield point of 56,000 lb.
    per sq. in................................................................. .002 $bd$

(b) Distance between Lateral Supports. The clear distance between lateral supports of a beam shall not exceed 32 times the least width of compression flange.

(c) Depth of Beam or Slab. The depth of the beam or slab shall be taken as the distance from the centroid of the tensile reinforcement to the compression face of the structural members. Any floor finish not placed monolithically with the floor slab shall not be included as a part of the structural member. When the finish is placed monolithically with the structural slab in buildings of the warehouse or industrial class, the over-all depth shall be at least one-half inch (\(\frac{1}{2}''\)) over that required by the design of the member.
(d) Requirements for T-Beams. 1. In T-beam construction the slab and beam shall be built integrally or otherwise effectively bonded together. The effective flange width to be used in the design of symmetrical T-beams shall not exceed one-fourth of the span length of the beam, and its overhanging width on either side of the web shall not exceed eight times the thickness of the slab nor one-half the clear distance to the next beam.

2. For beams having a flange on one side only, the effective overhanging flange width shall not exceed one-twelfth of the span length of the beam, nor six times the thickness of the slab, nor one-half the clear distance to the nearest beam.

3. Where the principal reinforcement in a slab which is considered as the flange of a T-beam (not a rib in ribbed floors) is parallel to the beam, transverse reinforcement shall be provided in the top of the slab. This reinforcement shall be designed to carry the load on the portion of the slab assumed as the flange of the T-beam. The spacing of the bars shall not exceed five times the thickness of the flange, nor in any case eighteen inches (18")

4. Provisions shall be made for the compressive stress at the support in continuous T-beam construction, care being taken that the provisions of Section 2610 relating to the spacing of bars, and Section 2609(e), relating to the placing of concrete shall be fully met.

5. The overhanging portion of the flange of the beam shall not be considered as effective in computing the shear and diagonal tension resistance of T-beams.

6. Isolated beams in which the T-form is used only for the purpose of providing additional compression area, shall have a flange thickness not less than one-half the width of the web and a total flange width not more than four times the web thickness.

(e) One-way Ribbed Floor Construction. 1. Ribbed floor construction consists of concrete ribs and slabs placed monolithically with or without burned clay or concrete tile fillers. The ribs shall not be farther apart than thirty inches (30") face to face. The ribs shall be straight, not less than four inches (4") wide, nor of a depth more than three times the width.

2. When burned clay or concrete tile fillers, of material having a unit compressive strength at least equal to that of the designed strength of the concrete in the ribs, are used, and the fillers are so placed that the joints in alternate rows are staggered, the shells of the fillers in contact with the ribs may be included in the calculations involving shear or negative bending moment. No other portion of the fillers may be included in the design calculations.

3. The concrete slab over the fillers shall be not less than one and one-half inches (11/8") in thickness, nor less in thickness than one-twelfth of the clear distance between ribs. Shrinkage reinforcement in the slab shall be provided as required in Section 2615.
4. Where removable forms or fillers not complying with (2) are used, the thickness of the concrete slab shall not be less than one-twelfth of the clear distance between ribs and in no case less than two inches (2") . Such slab shall be reinforced at right angles to the ribs with a minimum of .049 square inches of reinforcing steel per foot of width, and in slabs on which the prescribed live load does not exceed 50 pounds per square foot, no additional reinforcement will be required.

5. When the finish used as a wearing surface is placed monolithically with the structural slab in buildings of the warehouse or industrial class, the thickness of the concrete over the fillers shall be one-half inch (½") greater than the thickness used for design purposes.

6. Where the slab contains conduits or pipes, the thickness shall be not less than one inch (1") plus the total over-all depth of such conduits or pipes at any point. Such conduits or pipes shall be so located as not to impair the strength of the construction.

(f) Compression Steel in Flexural Members. Where it is necessary to introduce steel in compression in girders, beams, or slabs, such steel shall be thoroughly anchored by ties or stirrups not less than one-fourth inch (¼") in size which shall be spaced not more than eight inches (8") apart over the distance where the compression steel is required.

Sec. 2615. Reinforcement for shrinkage and temperature stresses normal to the principal reinforcement shall be provided in floor and roof slabs where the principal reinforcement extends in one direction only. Such reinforcement shall provide for the following minimum ratios of reinforcement area to concrete area (bd), but in no case shall such reinforcing bars be placed farther apart than five times the slab thickness nor more than eighteen inches (18").

- Floor slabs where plain bars are used.......................... 0.0025
- Floor slabs where deformed bars are used....................... 0.002
- Floor slabs where wire fabric is used, having welded intersections not farther apart in the direction of stress than 12 inches......................................................... 0.0018
- Roof slabs where plain bars are used............................ 0.003
- Roof slabs where deformed bars are used......................... 0.0025
- Roof slabs where wire fabric is used, having welded intersections not farther apart in the direction of stress than 12 inches......................................................... 0.0022

Sec. 2616. (a) General Provisions. This construction, consisting of floors reinforced in two directions and supported on four sides, includes solid reinforced concrete slabs; concrete ribs with burned clay or concrete tile fillers, with or without concrete top slabs; and concrete ribs with top slabs placed monolithically with the ribs. The supports for the floor slabs may be walls, reinforced concrete beams, or steel beams fully encased in concrete.

When burned clay or concrete tile fillers, of material having a unit compressive strength at least equal to that of the designed strength of the concrete in the ribs, are used, the shells in contact with the concrete ribs may be included in calculations.
involving resistance to shear and bending moment, and the top and bottom shells may be included in calculations involving resistance to bending moment.

When a concrete top slab, placed monolithically with the ribs is used, it shall be not less in thickness than one and one-half inches (1½") nor less than one-twelfth of the clear distance between ribs. It shall be reinforced for shrinkage as required in Section 2615.

Where removable forms or fillers not complying with this Subsection are used, the thickness of the concrete slab shall be not less than one-twelfth of the clear distance between ribs and in no case less than two inches (2"). Such slab shall be reinforced to provide sufficient strength to carry the imposed loads.

(b) Factors. The values of the factors to be used in computations are as follows:

1. For simple spans

\[ F_A = F_B = 1 \]

2. For end spans, continuous at one end only

\[ F_A = 1 - \left[ \frac{0.25}{1 + \frac{7}{8} \frac{K_A}{K_{AR}}} \right] \quad (2) \]

\[ F_B = 1 - \left[ \frac{0.25}{1 + \frac{7}{8} \frac{K_B}{K_{BR}}} \right] \quad (3) \]

3. For interior continuous spans

\[ F_A = \frac{1}{2} \sqrt{1 - U_{AR}} + \frac{1}{2} \sqrt{1 - U_{AL}} \quad (4) \]

\[ F_B = \frac{1}{2} \sqrt{1 - U_{BR}} + \frac{1}{2} \sqrt{1 - U_{BL}} \quad (5) \]

in which

\[ U_{AR} = \frac{1}{1.5 + \frac{7}{8} \frac{K_A}{K_{AR}}} \]

and

\[ U_{AL} = \frac{1}{1.5 + \frac{7}{8} \frac{K_A}{K_{AL}}} \]

4. For strips rigidly anchored to the supports

\[ e_A = \frac{2}{4 - D_B} \quad (\text{for span } A) \quad (6) \]

\[ e_B = \frac{2}{4 - D_A} \quad (\text{for span } B) \quad (6a) \]
Two-Way Slabs
(Cont'd.)

in which

\[ D_A = \frac{F_{AA}}{F_{BB}} \]
\[ D_B = \frac{F_{BB}}{F_{AA}} \]

5. For strips not rigidly anchored at one or both ends, and for ribbed construction without filler blocks

\[ e_A = 1.0 \text{ (for span } A) \]
\[ e_B = 1.0 \text{ (for span } B) \]

6. Load distribution factor

\[ r_A = \frac{1}{1 + D_A^2} \text{ (for span } A) \] \hspace{1cm} (7)
\[ r_B = 1 - r_A \text{ (for span } B) \] \hspace{1cm} (7a)

(c) Slab Thickness. The minimum thickness of the slab which shall not be less than 4 inches shall be computed by formula (8).

\[ t_3 = \frac{A + B - 0.10 N}{72} \sqrt[3]{\frac{2000}{f'c}} \] \hspace{1cm} (8)

(d) Bending Moments. The bending moments at any section of any strip one foot wide, extending the full length of the continuous slab, shall be determined on the basis of the recognized principles of mechanics relating to continuous beams for those conditions of loading which cause maximum moment at any section, using an equivalent uniform load of \( e_{AR}A_w \) in the A direction, and \( e_{BR}B_w \) in the B direction.

(e) Supporting Beams. (1) For span \( A \), the maximum bending moments in the supporting beams may be determined from an equivalent uniformly distributed load per linear foot equal to

\[ w = \frac{B}{2} \left( 1 - e_{AR} \right) \] \hspace{1cm} (9)

(2) For span \( A \), the maximum shear in the supporting beams may be determined by formula (10).

\[ w = \frac{BA}{4} \left( 1 - r_A \right) \] \hspace{1cm} (10)

(3) For the purpose of computing shear and bending moments at intermediate points for the supporting beams of span \( A \), the total load from a two-way panel \( AB \), carried on the beam of span \( A \) shall at least be equal to

Total Load = \( w \frac{BA}{2} \left( 1 - r_A \right) \), considered uniformly varying in intensity

from \( w \frac{B}{2} \left( 1 + 2r_A - 3e_{AR} \right) \) at the center \hspace{1cm} (11)

to \( w \frac{B}{2} \left( 1 - 4r_A + 3e_{AR} \right) \) at the supports \hspace{1cm} (11a)
(4) For span \( B \), in the foregoing formulas, replace \( A \) with \( B \), \( r_A \) with \( r_B \), and \( e_A \) with \( e_B \).

(f) Panels of Approximately Uniform Stiffness. When the ratio of the stiffness factor of the span under consideration to that of each adjacent span is at least \( \frac{3}{2} \) and at most \( 3/2 \), \( F_A \) or \( F_B \), may be taken as 0.76 for interior spans, 0.87 for end spans and 1.0 for simple spans.

(g) Shear in Slab. 1. For purposes of determining shear in the strip one foot wide carrying the maximum load, the total load for the length of span \( A \) shall be

\[
\text{Total Load} = r_A w A, \text{considered uniformly varying in intensity}
\]

from \( r_A w (3e_A - 2) \) at the center of the span............. (12)

to \( r_A w (4 - 3e_A) \) at the supports...................... (12a)

2. Similarly, the total load carried on a strip one foot (1') wide for the length of span \( B \) shall be

\[
\text{Total Load} = r_B w B, \text{considered uniformly varying in intensity}
\]

from \( r_B w (3e_B - 2) \) at the center of the span............. (13)

to \( r_B w (4 - 3e_B) \) at the supports...................... (13a)

(h) Arrangement of Reinforcement. 1. In any panel, the reinforcement per unit width in the long direction shall be at least one-third of that provided in the short direction.

2. The positive moment reinforcement adjacent to a continuous edge only and for a width not exceeding one-fourth of the shorter dimension of the panel may be reduced 25 per cent.

3. At a non-continuous edge negative moment reinforce-

ment per unit width in amount at least as great as one-half that required for maximum positive moment for the center half of the panel shall be provided across the entire width of the exterior support.

4. The spacing of the reinforcement shall be not more than three times the slab thickness and the ratio of reinforcement shall be at least 0.0025.

5. The amount of reinforcement in any one foot wide strip shall be at least 0.003 times the product of the width of strip by the effective depth.

Sec. 2617. (a) Shearing Unit Stress. The shearing unit stress \( (v) \) in reinforced concrete beams shall be computed by formula (14):

\[
v = \frac{V}{b'd} \text{..................................................}(14)
\]

For beams of I or T section \( b' \) shall be substituted for \( b \) in formula (14).

In ribbed construction, where burned clay or concrete tile are used, \( b' \) may be taken as a width equal to the thickness of the concrete web plus the thickness of the vertical shells of the concrete or burned clay tile in contact with the joist as specified in Sections 2614 and 2616.

Where the value of the shearing unit stress computed by formula (14) exceeds the shearing unit stress \( (v) \) permitted
The shearings unit stress permitted when special arrangement is provided shall be that determined by

\[ s = \frac{P}{\sqrt{2}A} \cdot \frac{\sin \theta + \alpha \cos \theta}{\sin \phi^f} \]

Where

\[ P = P_{eff} \]

\[ \alpha = \alpha_{eff} \]

\[ \theta = \theta_{eff} \]

\[ \phi^f = \phi^f_{eff} \]

\[ A = A_{eff} \]

The required area shall be determined by formula (17).

Where there is a series of parallel bars, the required


total reinforcement shall be considered effective as WEB reinforcement when the center line of the smallest of such bars shall not exceed 0.040 ft. in diameter.

In formula (16) (HB) shall not exceed 0.040 ft.

\[ V = \frac{pl^f}{s} \]

(c) Strips. The area of steel required in strips placed perpendicular to the longitudinal reinforcement shall be computed by formula (15).

\[ V = \frac{pl^f}{s_{eff}} \]

(d) Type of Web Reinforcement. In the case of unwebbed or unwebbed web reinforcement, the required area of the strip or strip shall be provided to carry the excess.

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comparative tests, to destruction, of specimens of the proposed
system and of similar specimens reinforced in conformity with
the provisions of this Code, the same factor of safety being
applied in both cases.

(e) Combined Web Reinforcement. Where more than one
type of reinforcement is used to reinforce the same portion of
the web, the total shearing resistance of this portion of the web
shall be assumed as the sum of the shearing resistances com-
puted for the various types separately. In such computations
the shearing resistance of the concrete shall be included only
once, and no one type of reinforcement shall be assumed to
resist more than \( 2 \frac{V'}{3} \).

(f) Spacing of Web Reinforcement. Where web reinforce-
ment is required it shall be so spaced that every 45 degree line
(representing a potential crack) extending from the mid-depth
of the beam to the longitudinal tension bars shall be crossed by
at least one line of web reinforcement. If a unit shearing stress
in excess of 0.06\(f'_c\) is used, every such line shall be crossed by at
least two such lines of web reinforcement.

(g) Shearing Stress in Flat Slabs. In flat slabs, the shear-
ing unit stress on a vertical section which lies at a distance
\( \ell_i - 1\frac{1}{2} \) inches beyond the edge of the column capital and par-
allel with it, shall not exceed the following values when computed
by formula (14) (in which \( d \) shall be taken as \( \ell_i - 1\frac{1}{2} \) inches):

1. 0.03 \( f'_c \), when at least 50 per cent of the total negative
reinforcement in the column strip passes directly over the
column capital.

2. 0.025 \( f'_c \), when 25 per cent of the total negative rein-
forcement in the column strip passes directly over the column
capital.

3. For intermediate percentages, intermediate values of
the shearing unit stress shall be used.

In flat slabs, the shearing unit stress on a vertical section
which lies at a distance of \( \ell_i - 1\frac{1}{2} \) inches beyond the edge of
the dropped panel and parallel with it shall not exceed 0.03 \( f'_c \) when
computed by formula (14) in which \( d \) shall be taken as \( \ell_i - 1\frac{1}{2} \) inches. At least 50 per cent of the cross-sectional area
of the negative reinforcement in the column strip must be within
the width of strip directly above the dropped panel.

(h) Shear and Diagonal Tension in Footings. The shearing
unit stress computed by formula (14) on the critical section
[see Section 2621 (d)], shall not exceed 0.02 \( f'_c \) for footings
with straight bars, nor 0.03 \( f'_c \) for footings in which the bars
are anchored at both ends by adequate hooks or as otherwise
specified in Section 2618.

Sec. 2618 (a) Computation of Bond Stress in Beams. In
flexural members in which the tensile reinforcement is parallel
to the compression face, the bond stress at any cross section
shall be computed by formula (18).

\[
u = \frac{V}{\Sigma j d} \tag{18}
\]
in which \( V \) is the shear at that section.
Adequate end anchorage shall be provided for the tensile reinforcement in all flexural members to which formula (18) does not apply, such as footings, brackets and other tapered or stepped beams in which the tensile reinforcement is not parallel to the compression face.

(b) Ordinary Anchorage Requirements. Tensile negative reinforcement in any span of a continuous, restrained, or cantilever beam, or in any member of a rigid frame shall be adequately anchored by bond, hooks or mechanical anchors in or through the supporting member. Within any such span every reinforcing bar shall be extended at least 12 diameters beyond the point at which it is no longer needed to resist stress. In cases where the length from the point of maximum tensile stress in the bar to the end of the bar is not sufficient to develop this maximum stress by bond, the bar shall extend into a region of compression and be anchored by means of a standard hook or it shall be bent across the web at an angle of not less than 15 degrees with the longitudinal portion of the bar and either made continuous with the positive reinforcement or anchored in a region of compression.

Of the positive reinforcement in continuous beams not less than one-fourth the area shall extend along the same face of the beam into the support a distance of 10 or more bar diameters, or shall be extended as far as possible into the support and terminated in standard hooks.

In simple beams, or at the outer ends of freely supported end spans of continuous beams, at least one-half the positive reinforcement shall extend along the same face of the beam into the support a distance of 10 or more bar diameters, or shall be extended as far as possible into the support and terminated in standard hooks.

(c) Special Anchorage Requirements. Where increased shearing or bond stresses are permitted because of the use of special anchorage (see Section 2613), every bar shall be terminated in a standard hook in a region of compression, or it shall be bent across the web at an angle of not less than 15 degrees with the longitudinal portion of the bar and made continuous with the negative or positive reinforcement.

(d) Anchorage of Web Reinforcement. Single separate bars used as web reinforcement shall be anchored at each end by one of the following methods:

1. Welding to longitudinal reinforcement.
2. Hooking tightly around the longitudinal reinforcement through 180 degrees.
3. Embedment in the compression area of the beam a distance sufficient to develop the allowable tensile stress specified in Section 2613 at a bond stress not exceeding 0.04$f'_{c}$ on plain bars nor 0.05$f'_{c}$ on deformed bars.
4. Standard hook plus embedment in the compression area of the beam, which embedment exclusive of the hook shall be sufficient to develop by bond a stress of not less than 10,000 pounds per square inch at a bond stress of not more than 0.04$f'_{c}$ on plain bars nor 0.05$f'_{c}$ on deformed bars.
The extreme ends of bars forming simple U or multiple stirrups shall be anchored by one of the methods of Subsection (d) or shall be bent through an angle of at least 90 degrees tightly around a longitudinal reinforcing bar not less in diameter than the stirrup bar, and shall project beyond the bend at least 12 diameters of the stirrup bar.

The loops or closed ends of such stirrups shall be anchored by bending around the longitudinal reinforcement through an angle of at least 90 degrees, or by being welded or otherwise rigidly attached thereto.

Hooking or bending stirrups or separate web reinforcement bars around the longitudinal reinforcement shall be considered effective only when these bars are perpendicular to the longitudinal reinforcement.

Longitudinal bars bent to act as web reinforcement shall, in a region of tension, be continuous with the longitudinal reinforcement. The tensile stress in each bar shall be fully developed in both the upper and the lower half of the beam by one of the following methods:

I. As specified in Subsection (d-3).

II. As specified in Subsection (d-4).

III. By bond, at unit bond stress not exceeding 0.04 f'c, on plain bars nor 0.05 f'c, on deformed bars, plus a bend of radius not less than two times the diameter of the bar, parallel to the upper or lower surface of the beam, plus an extension of the bar of not less than 12 diameters of the bar terminating in a standard hook. This short radius bend extension and hook shall together not be counted upon to develop a tensile unit stress in the bar of more than 10,000 pounds per square inch.

IV. By bond, at a unit bond stress not exceeding 0.04 f'c, on plain bars nor 0.05 f'c, on deformed bars, plus a bend of radius not less than two times the diameter of the bar, parallel to the upper or lower surface of the beam and continuous with the longitudinal reinforcement. The short radius bend and continuity shall together not be counted upon to develop a tensile unit stress in the bar of more than 10,000 pounds per square inch.

V. The tensile unit stress at the beginning of a bend may be increased from 10,000 pounds per square inch when the radius of bend is two bar diameters, at the rate of 1,000 pounds per square inch tension for each increase of one and one-half bar diameters in the radius of bend, provided that the length of the bar in the bend and extension is sufficient to develop this increased tensile stress by bond at the unit stresses given in Subsection (d-III).

In all cases web reinforcement shall be carried as close to the compression surface of the beam as fireproofing regulations and the proximity of other steel will permit.

(e) **Anchorage of Bars in Footing Slabs.** All bars in footing slabs, except the longitudinal reinforcement between loads in continuous slab footings, shall be anchored by means of
standard hooks. The outer faces of these hooks shall be not less than three inches (3") nor more than six inches (6") from the face of the footing.

(f) Hooks. The terms "hook" or "standard hook" as used herein shall mean a complete semicircular turn with a radius of bend on the axis of the bar of not less than three and not more than six bar diameters, plus an extension of at least four bar diameters at the free end of the bar. Hooks having a radius of bend of more than six bar diameters shall be considered merely as extensions to the bars, and shall be treated as in Subsection (d)-V.

In general, hooks shall not be permitted in the tension portion of any beam except at the ends of simple or cantilever beams or at the freely supported ends of continuous or restrained beams.

No hook shall be assumed to carry a load which would produce a tensile stress in the bar greater than 10,000 pounds per square inch.

Any mechanical device capable of developing the strength of the bar without damage to the concrete may be used in lieu of a hook. Tests must be presented to show the adequacy of such devices.

Flat Slabs

Sec. 2619. (a) Limitations. The term flat slabs as used in these regulations refers to concrete slabs, without beams or girders to carry the load to supporting members, reinforced with bars extending in two or four directions. Slabs with dropped panels or paneled ceilings shall be considered as flat slabs provided that they meet the requirements herein given for such construction.

The moment coefficients, moment distribution, and slab thicknesses specified herein are for a series of rectangular slabs of approximately uniform size arranged in three or more rows of panels in each direction, and in which the ratio of length to width of panel does not exceed 1.33.

For structures having a width of less than three rows of panels, or in which irregular panels are used, an analysis shall be made of the moments developed in both slabs and columns.* When so required, computations shall be submitted to the Building Inspector.

(b) Panel Strips and Principal Design Sections. A flat slab panel shall be considered as consisting of strips in each direction as follows:

A middle strip one-half panel in width, symmetrical about panel center line and extending through the panel in the direction in which moments are considered.

A column strip one-half panel in width occupying the two quarter-panel areas outside of the middle strip.

The critical sections for moment calculations are referred to as principal design sections and are located as follows:

---

*It is not the intention to prohibit flat slab construction for panels longer than 1.33 times the width, or for buildings less than three bays wide, provided the moment factors are properly adjusted.
null
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Units</th>
<th>General Case</th>
<th>Special Case For $c = 22 / f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_e$ or $t_a$</td>
<td>Feet</td>
<td>0.335</td>
<td>0.35a</td>
</tr>
<tr>
<td>$h_e$ or $h_a$</td>
<td>Feet</td>
<td>0.005$g_1 = \left(1 - \frac{2}{3}\right)^\frac{1}{n}$</td>
<td>0.005$g_2 = \left(1 - \frac{2}{3}\right)^\frac{1}{n}$</td>
</tr>
</tbody>
</table>

Maximum $f$ shall be used in thickness formula.

In these tables (a), (b), (c), and (d) are always expressed in feet while the units to which the column refers are shown in the column headed units.

**Table 26-C—Limitations For Slab Thicknesses**

**Table 26-D—Moments To Be Used In Design Of An Interior Panel Of Flat Slab**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Units</th>
<th>General Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_e$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
<tr>
<td>$M_a$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
<tr>
<td>$M_{e, a}$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Units</th>
<th>General Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_e$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
<tr>
<td>$N_a$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
<tr>
<td>$N_{e, a}$</td>
<td>ft. lb.</td>
<td>0.057</td>
</tr>
</tbody>
</table>

**Notes:**
- The tables are for design purposes and should be used in conjunction with other standards and codes.
- The symbols and units are standard in structural engineering and should be understood by the reader.
- The calculations are based on specific conditions and should be verified for the specific use case.

**Section 2019**

Flat Slabs (Cont'd.)
TABLE NO. 26-F—Moments to be Used in Design of Flat Stabs

<table>
<thead>
<tr>
<th>Panel</th>
<th>Symbol</th>
<th>Envelope Close</th>
<th>Envelope Open</th>
<th>Fw+</th>
<th>Fw-</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 211
(2) Length of Bars and Points of Beam. The positive no.
Panel Ioad, be designed as solid one or two-way slabs to carry the entire

26E by strips, and for convenience, also by beams.

Moments for the four-way system are shown in Table No. 26E. By Section 2613, the ratio of reinforcement for balanced reinforcement shall not exceed the value of calculated for balanced reinforcement. In any strip shall not

### Table 2619

<table>
<thead>
<tr>
<th>Moment, kips in strip</th>
<th>(c)</th>
<th>(d)</th>
<th>(e)</th>
<th>(f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10'</td>
<td>15'</td>
<td>20'</td>
<td>25'</td>
<td>30'</td>
</tr>
<tr>
<td>170</td>
<td>230</td>
<td>290</td>
<td>350</td>
<td>410</td>
</tr>
<tr>
<td>200</td>
<td>260</td>
<td>320</td>
<td>380</td>
<td>440</td>
</tr>
<tr>
<td>230</td>
<td>290</td>
<td>350</td>
<td>410</td>
<td>470</td>
</tr>
<tr>
<td>260</td>
<td>320</td>
<td>380</td>
<td>440</td>
<td>500</td>
</tr>
<tr>
<td>290</td>
<td>350</td>
<td>410</td>
<td>470</td>
<td>530</td>
</tr>
<tr>
<td>320</td>
<td>380</td>
<td>440</td>
<td>500</td>
<td>560</td>
</tr>
</tbody>
</table>

(1) Reinforced Bearing Walls
Panels with Marginal Beams or

TABLE NO. 26E—Moments to be used in Design of

(Cont.)
### TABLE NO. 26-G—LENGTH OF BARS AND POINTS OF BEND

<table>
<thead>
<tr>
<th></th>
<th>With Drop</th>
<th>Without Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Case</td>
<td>$c = .225l$</td>
</tr>
<tr>
<td>TWO-WAY FLAT SLAB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(COLUMN STRIP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of straight bars (not less than 4 total band steel)</td>
<td>$l - \frac{1}{2} + (2' or 40d)$</td>
<td>.65l + (2' or 40d)</td>
</tr>
<tr>
<td>Length of bent bars (not less than 4 total band steel)</td>
<td>1.5l + .6c</td>
<td>1.635l</td>
</tr>
<tr>
<td>Length of additional straight bars over column head (if required)</td>
<td>.5l + .6c</td>
<td>.635l</td>
</tr>
<tr>
<td>Point of top bend in bent bars (from column center)</td>
<td>.25l</td>
<td>.25l</td>
</tr>
<tr>
<td>MIDDLE STRIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of straight bars (not more than .5 total band steel)</td>
<td>.65l</td>
<td>.65l</td>
</tr>
<tr>
<td>Length of bent bars (not less than .5 total band steel)</td>
<td>1.5l</td>
<td>1.5l</td>
</tr>
<tr>
<td>Point of top bend in bent bars (from column centers)</td>
<td>.175l</td>
<td>.175l</td>
</tr>
<tr>
<td>FOUR-WAY FLAT SLAB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(COLUMN STRIP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of straight bars (not less than 4 total band steel)</td>
<td>$l - \frac{1}{2} + (2' or 40d)$</td>
<td>.65l + (2' or 40d)</td>
</tr>
<tr>
<td>Length of bent bars (not less than 4 total band steel)</td>
<td>1.5l + .6c</td>
<td>1.635l</td>
</tr>
<tr>
<td>Length of additional straight bars over column head (if required)</td>
<td>.5l + .6c</td>
<td>.635l</td>
</tr>
<tr>
<td>Point of bend for bent bars (from column centers)</td>
<td>.2l</td>
<td>.2l</td>
</tr>
<tr>
<td>DIAGONAL BAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of straight bars (not more than .5 total band steel area)</td>
<td>$l - \frac{1}{2} + (2' or 40d)$</td>
<td>.65l + (2' or 40d)</td>
</tr>
<tr>
<td>Length of bent bars (not less than 4 total band steel area)</td>
<td>2.21l</td>
<td>2.21l</td>
</tr>
<tr>
<td>Point of bend for bent bars (from column centers)</td>
<td>.33l</td>
<td>.33l</td>
</tr>
<tr>
<td>Length of additional straight bars over column head (if required)</td>
<td>.8l</td>
<td>.8l</td>
</tr>
<tr>
<td>Top band across middle of direct band (length of straight bars)</td>
<td>.5l</td>
<td>.5l</td>
</tr>
</tbody>
</table>

†Note: To these lengths proper allowance to be added for bends.

The value of $(c)$ where brackets are used is twice the distance from the center of the column to a point where the bracket is one and one-half inches (1 1/2") thick.

(j) Columns Without Capitals or Brackets. Brackets and column capitals may be omitted altogether, provided the slab thickness is sufficient to resist fully the moments and shears at the column head section.

The value of $(c)$ where brackets and column capitals are omitted is the width of the column in the direction in which moments are considered, except that, when a beam of greater depth than the thickness of the slab or dropped panel extends into the column in the direction in which moments are considered, the value of $(c)$ may be taken as the width of the column plus twice the projection of the beam below the slab or dropped panel.

(k) Openings in Flat Slabs. Openings of any size may be cut through the floor in the area common to two intersecting middle strips, provided the total positive and negative resisting moments be maintained as required in Subsection (d) and that these total positive and total negative moments be redistributed.
between the remaining principal design sections to meet the new conditions.

In any area common to two column strips, not more than one opening shall be allowed and the greatest dimension of such an opening shall not exceed .05 \( l \).

In any area common to one column strip and one middle strip, openings shall not interrupt more than one-quarter of the bars in either strip and the equivalent of the bars so interrupted shall be provided by extra steel on both sides of the opening.

Any opening larger than described above shall be completely framed on all sides with beams to carry the loads to the columns.

(1) Shearing Stresses in Flat Slabs. See Section 2617.

Sec. 2620. (a) Limiting Dimensions. The following sections on reinforced concrete and composite columns except Subsection (g) apply to a short column, for which the unsupported length is not greater than 10 times the least lateral dimension. When the unsupported length exceeds this value, the design shall be modified as shown in Subsection (g). Principal columns in buildings shall have a minimum diameter or thickness of ten inches (10") and a minimum gross area of one hundred and twenty square inches (120 sq. in.). Posts that are not continuous from story to story shall have a minimum diameter or thickness of six inches (6").

(b) Unsupported Length of Columns. For purposes of determining the limiting dimensions of columns, the unsupported length of reinforced concrete columns shall be taken as the clear distance between floor slabs.

**Exceptions:**
1. In flat slab construction, it shall be the clear distance between the floor and the lower extremity of the capital.
2. In beam and slab construction, it shall be the clear distance between the floor and the under side of the deeper beam framing into the column in each direction at the next higher floor level.
3. In columns restrained laterally by struts, it shall be the clear distance between consecutive struts in each vertical plane; provided that to be an adequate support, two such struts shall meet the column at approximately the same level, and the angle between vertical planes through the struts shall not vary more than 15 degrees from a right angle. Such struts shall be of adequate dimensions and anchorage to restrain the column against lateral deflection.
4. In columns restrained laterally by struts or beams, with brackets used at the junction, it shall be the clear distance between the floor and the lower edge of the bracket, provided that the bracket width equals that of the beam or strut and is at least half that of the column.

For rectangular columns, that length shall be considered which produces the greatest ratio of length to depth of section.
(c) **Spirally Reinforced Columns.** 1. Permissible Load—
The maximum permissible axial load, \( P \), on columns with closely
spaced spirals enclosing a circular concrete core reinforced
with longitudinal bars shall be that given by Formula (22).

\[
P = A_e \left( 0.225f'_c + f_y p_e \right)
\]

(22)

**WHERE**

- \( A_e \) = the gross area of the column.
- \( f'_c \) = compressive strength of the concrete.
- \( f_y \) = nominal working stress in vertical column rein-
  forcement, to be taken at 40 per cent of the mini-
  mum specification value of the yield point; viz.,
  16,000 pounds per square inch for intermediate
  grade steel and 20,000 pounds per square inch for
  rail or hard grade steel.*
- \( p_e \) = ratio of the effective cross-sectional area of verti-
  cal reinforcement to the gross area, \( A_e \).

2. Vertical Reinforcement—The ratio \( p_e \) shall not be less
than 0.01 nor more than 0.08. The minimum number of bars
shall be six, and the minimum diameter shall be five-eighths inch
\((\frac{5}{8}"")\). The center to center spacing of bars within the periphery
of the column core shall be not less than 2\( \frac{1}{2} \) times the diameter
for round bars or 3 times the side dimension for square bars. The
clear spacing between bars shall be not less than one and one-
half inches \((1\frac{1}{2}"")\), or one and one-half times the maximum size
of the coarse aggregate used. These spacing rules apply to
adjacent pairs of bars at a lapped splice.

3. Splices in Vertical Reinforcement—Where lapped splices
in the column verticals are used, the minimum amount of lap
shall be as follows:

**I** For deformed bars—with concrete having a strength of
3000 pounds per square inch or above, 24 diameters of
bar of intermediate grade steel and 30 diameters of bar
of rail steel. For bars of higher yield point, the amount
of lap shall be increased in proportion to the nominal
working stress. When the concrete strengths are less
than 3000 pounds per square inch, the amount of lap shall
be one-third greater than the values given above.

**II** For plain bars—the minimum amount of lap shall be 25
per cent greater than that specified for deformed bars.

**III** Welded splices or other positive connections may be used
instead of lapped splices. Welded splices shall preferably
be used in cases where the bar diameter exceeds one and
one-fourth inch \((1\frac{1}{4}"")\). An approved welded splice shall
be defined as one in which the bars are butted and welded
and that will develop in tension at least the yield point
stress of the reinforcing steel used.

**IV** Where changes in the cross section of a column occur,
the longitudinal bars shall be offset in a region where

---

*Nominal working stresses for reinforcement of higher yield point
may be established at 40 per cent of the yield point stress, but not more
than 30,000 pounds per square inch, when the properties of such rein-
forcing steels have been definitely specified by standards of A. S. T. M.
designation. If this is done, the lengths of splice required by Section
3620, Sub-section (c) paragraph (3) shall be increased accordingly.
lateral support is afforded by a concrete capital, floor slab or by metal ties or reinforcing spirals. Where bars are offset, the slope of the inclined portion from the axis of the column shall not exceed one in six and the bars above and below the offset shall be parallel to the axis of the column.

4. Spiral Reinforcement—The ratio of spiral reinforcement, \( p' \) shall be not less than the value given by Formula (23), nor shall it be less in any case than 0.0112 for hot rolled spirals of intermediate grade or 0.0075 for cold drawn wire spirals.

\[
p' = 0.45 \left( R - 1 \right) \frac{f'^*}{f'}, \quad \text{........... (23)}
\]

**WHERE**

\( p' \) = ratio of volume of spiral reinforcement to the volume of the concrete core (out to out of spirals).

\( R \) = ratio of gross area to core area of column, \( A_g/A_c \).

\( f'^* \) = useful limit stress of spiral reinforcement, to be taken as 40,000 pounds per square inch for hot rolled rods of intermediate grade (A.S.T.M. A15-39)\(^1\) and 60,000 pounds per square inch for cold drawn wire A.S.T.M. (A82-34)\(^1\).

The spiral reinforcement shall consist of evenly spaced continuous spirals held firmly in place and true to line by at least three vertical spacer bars. Anchorage of spiral reinforcement shall be provided by one and one-half extra turns of spiral rod or wire at each end of the spiral unit. Splices, when necessary, shall be made in spiral rod or wire by welding or by a lap of one and one-half turns. The center to center spacing of the spirals shall not exceed one-sixth of the core diameter. The clear spacing between spirals shall not exceed three inches (3") nor be less than one and three-eighths inches (1\(\frac{3}{8}\") or one and one-half times the maximum size of coarse aggregate used. The reinforcing spiral shall extend from the floor level in any story, or from the top of the footing in the basement, to the level of the lowest horizontal reinforcement in the slab, dropped panel or beam above. In a column with a capital, it shall extend to the plane at which the diameter or width of the capital is twice that of the column.

5. Protection of Reinforcement — The column reinforcement shall be protected everywhere by a covering of concrete cast monolithically with the core, for which the thickness shall not be less than one and one-half inches (1\(\frac{1}{2}\")) nor less than one and one-half times the maximum size of the coarse aggregate, nor shall it be less than required by the fire protection and weathering provisions of Section 2610 (f).

6. Limits of Column Section — For columns built monolithically with concrete walls or piers, the outer boundary of the column section shall be taken either as a circle one and one-half inches (1\(\frac{1}{2}\")) outside the column spiral or as a square or rectangle of which the sides are one and one-half inches

\(^1\)See “Specification Documents”.

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The reaming portion is that of Subsection (c).

To 10000 pounds per square inch for a cast-iron core.
16000 pounds per square inch for a steel core or a steel core, or a permissible unit stress in steel core, not to exceed 10,000 pounds per square inch for a steel core or a steel core.

Cross-sectional area of the steel or cast-iron core.

\[ f = \frac{V}{V_f + \frac{V}{\gamma f}} \]

Cross-sectional area of the steel or cast-iron core.

\[ V = V_f + \frac{V}{\gamma f} \]

WHERE

\[ \gamma = 0.225 \]

\[ d = 0 \]

Composite Columns, I, Permissible Load — The Per-composite column. (d)

Under consideration of the total area of the total area may be used in applying the provisions of Subsection (c). Therefore, a reduced section area of the composite column, reinforced with both longitudinal and transverse reinforcement, shall be used. This shall be provided so that every cross section of the reinforcing bars and straps, in transverse direction, shall be of a size not less than 0.75 in diameter and shall be spaced apart not over 12 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 12 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart 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and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter 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not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16 in. in diameter and shall be spaced apart not over 16
The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

Where

- \( V \) = total area of concrete section
- \( A \) = cross-sectional area of steel column
- \( p \) = permissible stress for unressed steel column

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

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\[ \frac{V}{A} = p \frac{f_y}{f_p} \]

The column shall be designed to develop a compressive strength, 

\[ \frac{V}{A} = p \frac{f_y}{f_p} \]
tire floor load at each floor level. The steel column shall be
designed to carry safely any construction or other loads to be
placed upon it prior to its encasement in concrete.

2. Pipe Columns. — The permissible load on columns con-
isting of steel pipe filled with concrete shall be determined by
Formula (26).

\[ P = 0.225 f'c A_e + f'c A_r \] \hspace{1cm} (26)

The value of \( f'c \) shall be that given by Formula (27).

\[ f'c = \left( \frac{18,000}{18,000 - 70 \frac{h}{K}} \right) F \] \hspace{1cm} (27)

WHERE

- \( f'c \) = average unit stress in metal core.
- \( h \) = unsupported length of column.
- \( K \) = least radius of gyration of metal core section.
- \( F \) = (yield point of pipe)
- \( F = \frac{45,000}{45,000} \)

If the yield point of the pipe is not known, the factor \( F \) shall
be taken as 0.5.

(g) Long Columns. The maximum permissible load \( P' \) on
axially loaded reinforced concrete or composite columns hav-
ing a length, \( h \), greater than 10 times the least lateral dimen-
sion, \( d \), shall be given by Formula (28).

\[ P' = P \left( 1.3 - 0.03 \frac{h}{d} \right) \] \hspace{1cm} (28)

where \( P \) is the permissible axial load on a short column as given
by Formulas (22) and (24).

The maximum permissible load \( P' \) on eccentrically loaded
columns in which \( \frac{h}{d} \) exceeds 10 shall also be given by Formula
(28), in which \( P \) is the permissible eccentrically applied load
on a short column as determined by the provisions of Subsec-
tions (i) and (j). In long columns subjected to definite bend-
ing stresses, as determined in Subsection (h), the ratio \( h/d \) shall
not exceed 20.

(h) Bending Moments in Columns. The bending moments
in the columns of all reinforced concrete structures shall be
determined on the basis of loading conditions and restraint and
shall be provided for in the design. When the stiffness and
strength of the columns are utilized to reduce moments in
beams, girders, or slabs, as in the case of rigid frames, or in
other forms of continuous construction wherein column mo-
ments are unavoidable, they shall be provided for in the de-
sign. In building frames, particular attention shall be given
to cases of unbalanced floor loads on both exterior and interior
columns and of eccentric loading due to other causes. Wall col-
umns shall be designed to resist moments produced by:
subjected to combined axial compression and flexural stress, the

percentile combined compression and flexural stresses, the

for spiral and led columns, eccentrically loaded or otherwise.

The term may be replaced by the value for rectangular

For round columns without appreciable error

The value of

This will result in a fairly accurate design if the eccentricity

\[
\frac{f}{0.003} = u
\]

WHERE

\[
\frac{rd}{d} = \frac{1}{\alpha} \left( \frac{d}{d} + 1 \right)
\]

Note: For preliminary designs, this will usually give satisfactory

stress

combined Axial and Bending Stress. In Reinforced-con-

live stiffness and conditions of restraint.

level above and below the "neutral" level, in proportion to their rela-

1. Loads on a single exterior bay at one floor level.

2. Loads on a single exterior bay at two adjacent floor levels.

Section 2620
maximum permissible compressive fiber stress, \( f_c \), is given by formula (30).

\[
f_c = f_s \left(1 + \frac{0.4f'c}{R^2}\right)\left(1 + c \frac{f'c}{R^2}\right)
\]

wherein \( f_s \) is the average permissible stress on an equivalent axially loaded concrete column, and \( C \) is the ratio of \( f_s \) to the permissible fiber stress for members in flexure. Thus

\[
f_c = \frac{0.225f'c + f_s p_z}{1 + (n - 1) p_z}
\]

for spiral columns, and 0.8 of this value for tied columns. In general \( C = f_s/0.4f'c \).

The permissible tensile stress in the longitudinal reinforcement may equal that specified for flexural members, provided however that splices in the tensile steel at or near the section of maximum column moment are capable of developing fully the yield point strength of the reinforcement.

(k) Walls. 1. Lateral and Eccentric Loads. Walls shall be designed for any lateral or other loads to which they are subjected. Proper provision shall be made for eccentric loads.

2. Height and Thickness. The thickness of reinforced concrete walls shall be not less, and the maximum height, number of stories, and distance between supports shall be not more, than shown in Table No. 26-H.

Exception: The provisions of this paragraph may be waived when written evidence is submitted by a qualified person showing that the walls meet all the other requirements of this Code.

3. Design. The maximum allowable compressive stress in reinforced concrete bearing walls with minimum reinforcement as required by this Subsection shall not exceed

\[
1 - \left(\frac{h}{30d}\right)3 \geq 0.2f'
\]

When the reinforcement in bearing walls is designed, placed, and anchored in position as for columns, the working stresses shall be on the basis of formulas for columns. For calculating

**TABLE NO. 26-H—REQUIREMENTS FOR REINFORCED CONCRETE WALLS**

<table>
<thead>
<tr>
<th>Maximum Height in Feet</th>
<th>Story</th>
<th>Limiting Ratio—Distance Between Supports to Wall Thickness</th>
<th>Minimum Thickness in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>3</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Basement</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>
wall stresses, concentrated loads may be assumed to be distributed over a maximum length of wall not exceeding the center to center distance between loads nor five times the width of the bearing.

Reinforced concrete walls shall be reinforced with an area of steel in each direction, both vertical and horizontal, at least equal to 0.0025 times the cross-sectional area of the wall. Walls more than eight inches (8") in thickness 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 reinforcement shall be placed not less than one and one-half inches (1½") 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 three-fourths inch (¾") and not more than one-third the thickness of the wall from the interior surface. Bars shall be not less than three-eighths inch (¾") round, nor shall they be spaced more than eighteen inches (18") on centers.

Reinforced concrete walls shall be anchored at all points of lateral support. Such anchorage shall be capable of resisting the horizontal forces with a minimum of 200 pounds per lineal foot.

1. Non-Bearing Partitions. Non-bearing partitions of reinforced concrete shall have a thickness of not less than one forty-eighth of the distance between their supports nor less than three inches (3").

Footings

Sec. 2621 (a) Loads. Footings resting directly on soil or on piles shall be proportioned as to soil bearing area or number of piles on the basis of the total column load plus the weight of the footing itself. For computations of moments and shears, an upward reaction per unit area or per pile shall be based on the total column load (not including the weight of the footing itself) divided by the area or by the number of piles.

(b) Sloped or Stepped Footings. Footings in which the thickness has been determined by the requirements for shear as specified in Section 2617, Subsection (h), may be sloped or stepped, provided that the shear on no section outside the critical section exceeds the value specified, and provided further that the thickness of the footing above the reinforcement at the edge shall not be less than six inches (6") for footings on soil, nor less than twelve inches (12") for footings on piles. Sloped or stepped footings shall be cast as a unit.

(c) Bending Moment in Footings. The critical section for bending moment in a concrete footing which supports a concrete column, pedestal or wall, shall be considered to be at the face of the column, pedestal or wall. For footings under masonry walls, the critical section shall be assumed as halfway between the middle and edge of the wall. For footings under metallic bases, the critical section shall be assumed as halfway between the face of the column or pedestal and the edge of the metallic base.

The bending moment at the critical section in a square footing, or in a rectangular footing having its side not greater than one and one-half times its width, shall be computed from the load on trapezoids bounded by the line of the critical section for moment, the corresponding outside edge of the footing, and the portions of the two diagonals. The load on the two corner tri-
angles of the trapezoid shall be considered as applied at a distance equal to six-tenths of the projection of the footing from the line of critical section for moment. The load on the rectangular portion of the trapezoid shall be considered as applied at its center of gravity.

For a round or octagonal concrete column or pedestal, the face of the column shall be taken as the side of a square of an area equal to the area enclosed within the perimeter of the column or pedestal.

(d) Shearing and Bond Stresses. The critical section for diagonal tension in footings on soil shall be assumed as a vertical section at a distance \(d\) from the face of the column or pedestal supported by the footing.

In footings on piles the critical section shall be assumed at a distance \(\frac{d}{2}\) from the face of the column or pedestal, and any piles whose centers are at or within the section shall be excluded in computing shear.

For shearing stresses see Section 2617, Subsection (h).

The critical sections for bond shall be assumed at the face of the column or pedestal; at vertical planes where changes occur, and near the end of the bending moment reinforcement.

For bond stresses see Section 2618, Subsections (a) to (e) inclusive.

(e) Transfer of Stress at Base of Column. The compressive stress in longitudinal reinforcement at the base of a column shall be transferred to the pedestal or footing by dowels. There shall be at least one dowel for each column bar, and the total sectional area of the dowels shall not be less than the sectional area of the longitudinal reinforcement in the columns. The dowels shall extend up into the column and down into the pedestal or footing the distance required for lap of longitudinal column bars [see Section 2620, Subsection (c)].

The permissible compressive unit stress on top of the pedestal or footing directly under the column shall not be greater than that determined by formula (32).

\[
\frac{A}{A'} = 0.25 \left( \frac{3}{f''_e} \right) \sqrt{\frac{A}{A'}} \tag{32}
\]

In sloped or stepped footings, \(A\) may be taken as the area of the top horizontal surface of the footing, or as the area of the lower base of the largest frustum of a pyramid or cone contained wholly within the footing and having for its upper base the loaded area \(A'\), and having side slopes of one vertical to two horizontal.

(f) Pedestals and Footings (Plain Concrete). The allowable compressive unit stress on the gross area of a concentrically loaded pedestal shall not exceed 0.25\(f''_e\). Where this stress is exceeded, reinforcement shall be provided and the member designed as a reinforced concrete column.

The depth and width of a pedestal or footing of plain concrete shall be such that the tension in the concrete shall not exceed 0.03\(f'_e\), and the average shearing stress shall not exceed 0.02\(f'_e\) taken on critical sections as determined for reinforced concrete footings.
Sec. 2622. The depth of precast concrete joists shall be not more than four times the width of the top or bottom flanges nor less than one twenty-fourth of the span length.

The thickness of the top slab shall be not less than one-twelfth of the clear span between joists nor less than two and one-half inches (2½") for floors nor less than two inches (2") for roofs and not less than one and one-half inches (1½") over the joists. The slab shall have not less than 0.2 per cent reinforcement at right angles to the span of joists. The reinforcement shall be spaced not farther apart than five times the slab thickness.

When the top slab is adequately reinforced and bonded to the joist, the construction may be considered as a T-beam.

Precast joists shall be bridged as provided in Section 3102.

Sec. 2623. The term "Composite Beam" shall apply to any rolled or fabricated steel floor beam entirely encased in poured concrete at least four inches (4") wider, at its narrowest point, than the flange of the beam, supporting a concrete slab on each side without openings adjacent to the beam; provided that the top of the beam is at least one and one-half inches (1½") below the top of the slab and at least two inches (2") above the bottom of the slab; provided that a good grade of stone or gravel concrete with portland cement, is used; and provided that the concrete has adequate mesh, or other reinforcing steel, throughout its whole depth and across the soffit.

Composite beams may be figured on the assumption that:

1. The steel beam carries unassisted all dead loads prior to the hardening of the concrete, with due regard for any temporary support provided.

2. The steel and concrete carry by joint action all loads, dead and live, applied after the hardening of the concrete.

The total tensile unit stress in the extreme fiber of the steel beam thus computed shall not exceed 20,000 pounds per square inch. (See Section 2702).

The maximum stresses in concrete, and the ratio of Young's moduli for steel and concrete, shall be as prescribed by the specifications governing the design of reinforced concrete for the structure.

The web and end connections of the steel beam shall be adequate to carry the total dead and live load without exceeding the unit stresses prescribed in this Code, except as this may be reduced by the provision for other proper support.

Sec. 2624. Bolts shall be solidly embedded in concrete and the connection shall be designed so that the shear on every bolt is not more than the values set forth in Table No. 24-G.
CHAPTER 27—STEEL AND IRON

(Quality and Design)

Sec. 2701. The quality and design of steel and iron used structurally in buildings or structures shall conform to the requirements specified in this Chapter.

Steel used structurally shall be of such quality as to conform to A.S.T.M. "Standard Specifications for Structural Steel for Bridges and Buildings," (A7-42).

Steel pipe for steel pipe columns shall be of such quality as to conform to A.S.T.M. "Standard Specifications for Welded and Seamless Steel Pipe," (A53-42), and shall be a medium carbon steel manufactured by the open hearth or electric furnace process.

Cast steel used in buildings or structures shall be of such quality as to conform to the A.S.T.M. "Standard Specifications for Carbon Steel Castings," (A27-42).

Cast iron used in buildings or structures shall be of such quality as to conform to the A.S.T.M. "Standard Specifications for Gray Iron Castings," (A48-41).

All structural steel, cast steel and cast iron shall be tested in accordance with the above specifications when deemed necessary by the Building Inspector and copies of such tests shall be filed in the office of the Building Inspector. No structural steel, cast steel and cast iron shall be used in any building or structure which does not comply with the above requirements or for which no test results have been filed with the Building Inspector. All such tests shall be made by competent testing laboratories at the expense of the owner.

The computation and design shall be properly made so that the unit working stresses specified in this chapter are not exceeded. The structure and its details shall possess the requisite strength and rigidity for proper stability and the design of structural members shall be such as to admit of a rational analysis according to well established principles of mechanics and sound engineering practice.

All structural steel sections shall be straight and true and any section so damaged as to affect its proper carrying capacity shall not be used in the construction of any building or structure.

Sec. 2702. All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per square inch shall not exceed those specified in this Section.

(a) Tension

<table>
<thead>
<tr>
<th></th>
<th>Allowable Unit Stresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Steel, net section</td>
<td>20,000</td>
</tr>
<tr>
<td>Cast Steel on net section</td>
<td>15,000</td>
</tr>
<tr>
<td>Cast Iron on net section</td>
<td>(not allowed)</td>
</tr>
<tr>
<td>Rivets, on area based on nominal diameter</td>
<td>15,000</td>
</tr>
<tr>
<td>Bolts, at root of thread</td>
<td>15,000</td>
</tr>
</tbody>
</table>
Allowable Compression
Unit Stresses (Cont'd.)

(b) Compression

Columns, gross section

For columns with values of $l/r$ not greater than 120

$$\frac{17,000 - 0.485 \frac{l^2}{r^2}}{18,000}$$

For columns with values of $l/r$

$$\frac{18,000}{1 + \frac{l}{18,000r^2}}\left\{1.6 - \frac{l}{200r}\right\}$$

Plate Girder Stiffeners, gross section.............. 20,000
Webs of Rolled Sections at toe of fillet............. 24,000

For main compression members, the ratio of $l/r$ shall not exceed 180 and for bracing, struts and similar members 200.

On cast iron columns, with square or fixed ends;

$$P = 9,000 - 40 \frac{l}{r}$$

with a minimum gross diameter of six inches (6") and with the ratio $l/r$ never in excess of 70.

In the foregoing formulas "P" equals the maximum unit working stress in pounds per square inch; $l$ equals the unsupported length of the column or compression member in inches; and $r$ equals the least radius of gyration of the column or compression member.

(c) Bending

Tension in extreme fibers of rolled sections, plate girders, and built-up members............ 20,000

Compression on extreme fibers of rolled sections, plate girders, and built-up members, for values of $l/b$ not greater than 22,500

$$\frac{1 + \frac{l^2}{1800 b^2}}{40}$$

with a maximum of 20,000 in which $l$ is the unsupported length of the member, and $b$ is the width of the compression flange, both in inches.

Girders, beams, lintels and similar members may be laterally braced by joists, tie rods or similar members anchored thereto so as to laterally stay such members in both directions. Two or more cast iron or steel separators rigidly joining such members together shall be considered as lateral support if the length of flanges between separators does not exceed 40b.

On extreme fibers of pins, when the forces are assumed as acting at the center of gravity of the pieces......................30,000

(d) Shearing

Rivets, pins, and turned bolts in reamed or drilled holes........................................ 15,000
Unfinished bolts........................................ 10,000
Webs of beams and plate girders, gross section 13,000
(e) **Bearing**

<table>
<thead>
<tr>
<th></th>
<th>Double Shear</th>
<th>Single Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivets, and turned bolts in reamed or drilled holes</td>
<td>40,000</td>
<td>32,000</td>
</tr>
<tr>
<td>Unfinished bolts</td>
<td>25,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Pins</td>
<td></td>
<td>32,000</td>
</tr>
<tr>
<td><strong>Contact Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milled Stiffeners and other Milled Surfaces</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Fitted Stiffeners</td>
<td></td>
<td>27,000</td>
</tr>
</tbody>
</table>

(f) **Combined Stresses.** Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

All members and their connections which are subject to stresses of both tension and compression due to the action of live loads shall be designed to sustain the stress giving the largest section, with 50 per cent of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

(g) **Members Carrying Wind Load Only.** (See Section 2307.)

(h) **Roller Loads.** The load in pounds per lineal inch on expansion rollers shall not exceed 600 times the diameter of the roller in inches.

(i) **Allowable Unit Stresses for Used Steel.** The allowable unit stresses assigned by the Building Inspector to any steel not complying with the requirements of Section 2701 shall in no case be more than 80 per cent of the stresses given in 2702. In designs where used steel is provided for, proper allowances shall be made for holes, reduction in section by rust or other defects.

(j) **Allowable Unit Stresses in Light Steel.** The allowable unit stresses in steel used in structural members of light steel construction and having an ultimate tensile strength of less than 60,000 pounds per square inch, shall be reduced in proportion to the ultimate tensile strength of such member.

**Sec. 2703.** Every member and combination of members shall be designed to provide for any stress due to an eccentric load or force, whenever the increase in stress due to eccentric load or force exceeds 10 per cent of the stress due to a direct load or force on the member or members; but a member framed directly to a central web of another member shall not be considered an eccentric load or force in case the resultant of the load or force acts parallel with the said central web.
Sections 2703-2704

Members subject to both axial and bending stresses shall be so proportioned that the quantity
\[
\frac{f_a}{F_a} + \frac{f_b}{F_b}
\]
shall not exceed unity

\(F_a\) = Axial unit stress that would be permitted by this Code if axial stresses only existed.

\(F_b\) = Bending unit stress that would be permitted by this Code if bending stresses only existed.

\(f_a\) = Unit axial stress (actual) that is, the total axial stress divided by the area of the member.

\(f_b\) = Unit bending stress (actual) that is, the bending moment divided by the section modulus of the member.

Sec. 2704. (a) **Riveted Plate Girders.** Riveted plate girders, cover-plated beams, and rolled beams shall in general be proportioned by the moment of inertia of the gross section. No deduction shall be made for standard shop or field rivet holes in either flange; (except that in special cases where the reduction of the area of either flange by such rivet holes, calculated in accordance with the provisions of Section 2707, exceeds 15 per cent of the gross flange area, the excess shall be deducted.) If such members contain other holes, as for bolts, pins, or countersunk rivets, the full deduction for such holes shall be made. The deductions thus applicable to either flange shall be made also for the opposite flange if the corresponding holes are there present. When two or more rolled beams or channels are used to form a girder, they shall be so connected to each other as to properly distribute the loads to be carried.

(b) **Plate Girder Webs.** Plate girder webs shall have a thickness of not less than 1/170 of the unsupported distance between flanges.

(c) **Web Splices in Plate Girders.** Web splices in plate girders shall be proportioned to transmit the full shearing and bending stresses in the web at the point of splice.

(d) **Stiffeners.** Stiffeners shall be placed on the webs of plate girders at the ends and at points of concentrated loads. They shall have a close bearing against the flanges, shall extend as closely as possible to the edges of the flange angles, and shall not be crimped. They shall be connected to the web by enough rivets to transmit the stress. Only that portion of the outstanding legs outside the fillets of the flange angles shall be considered effective in bearing.

Intermediate stiffeners shall be required at all points where
\[
\frac{h}{t} > \frac{8000}{\sqrt{\delta}}
\]

188
WHERE

\[ d = \frac{270,000 \ t}{s} \times \sqrt[3]{\frac{s \ t}{h}} \]

in which \( d \) equals the clear distance between stiffeners, in inches.

Plate girder stiffeners shall be in pairs, one on each side of the web, and shall be connected to the web by rivets spaced not more than eight times their nominal diameter apart.

Intermediate stiffeners may be crimped over the flange angles.

(e) Crane Runway Girders. Crane runway girders shall be proportioned to resist any lateral forces produced by loads carried by them. These lateral forces shall in no case be less than 20 per cent of the maximum wheel loads.

(f) Rivets Connecting Flanges to Web. Rivets connecting the flanges to the web shall be proportioned to resist the horizontal shear due to bending as well as any loads applied directly to the flange.

(g) Plate Girder Flanges. Cover plates of girders shall extend not more than six inches (6") nor more than 12 times the thickness of the thinnest plate beyond the outer row of rivets connecting them to the angles. When no cover plates are used the width of the outstanding leg of the compression flange shall not exceed 12 times its thickness.

(h) Cover Plates. Cover plates, when required, shall be of equal thickness or shall diminish in thickness from the flange angles outward. No plate shall be thicker than the flange angles.

(i) Flange Sections. The gross section of the compression flange of a plate girder shall be not less than the gross section of the tension flange.

(j) Rolled Beams. Rolled beams shall be so proportioned that the unit compression stresses at the web toe of the fillets resulting from concentrated loads shall not exceed 24,000 pounds. Such stresses shall be determined by the formulas:
For interior loads \( \frac{R}{t (A + 2N)} \), but not to exceed 24,000

For end bearing \( \frac{R}{t (A + N)} \), but not to exceed 24,000

WHERE
\( R \) = concentrated interior load or end reaction, in pounds.
\( t \) = thickness of web, in inches.
\( A \) = Length of bearing, in inches.
\( N \) = distance from outer face of flange to web toe of fillet, in inches.

(k) **Effective Span Length.** Beams, girders and trusses shall
ordinarily be designed on the basis of simple spans whose effective
length is equal to the distance between centers of gravity of
the members to which they deliver their end reactions.

If, on the assumption of end restraint, full or partial, based
on continuous or cantilever action, beams, girders, and trusses
are designed for a shorter effective span length than that specified
in the paragraph above, their sections, as well as the sections
of the members to which they connect, shall be designed
to carry the shears and moments so introduced, in addition to all
other forces without exceeding at any point the unit stresses
specified in Section 2702.

Sec. 2705. The minimum thickness of metal in structural
steel shapes shall be: for sections exposed to the weather
five-sixteenths inch (5/16") ; for interior construction one-quarter
inch (¼”) ; and shall be not less than one-half inch (½”) at
every point for any cast iron or cast steel member, except as
follows:

**Exceptions:** 1. The webs of channels and I-beams, the
edges of rolled steel sections, steel joists, signs, skylight bars,
non-bearing walls and partitions, suspended ceilings, cornice
brackets, steel studs, and similar steel shapes shall not be
limited to the above thickness requirements except as pro-
vided in Section 2715. (See also Section 3316 for outside
stairways.)

2. In steel trusses carrying roof loads only on buildings
not exceeding two stories in height, the minimum thickness
of metal shall be \( \frac{5}{16} \)”, provided that no projecting part of any
compression member shall be less in thickness than \( \frac{1}{4} \) of the
unsupported width of the outstanding leg or projecting part.

Sec. 2706. Compression members when faced for bearings
shall be spliced sufficiently to hold the connected members
accurately in place. Other joints in riveted work, whether in

tension or compression, shall be spliced so as to transfer the
stress to which the member is subject.

Sec. 2707. (a) **Riveted Holes.** In computing net area the
diameter of a rivet hole shall be taken as one-eighth inch (¼”)
greater than the nominal diameter of the rivet.

(b) **Pin Holes.** In pin connected tension members, the net
section across the pin hole, transverse to the axis of the mem-

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ber, shall be not less than 140 per cent and the net section beyond the pin hole, parallel with the axis of the member, not less than 100 per cent, of the net section of the body of the member.

In all pin connected riveted members the net width across the pin hole, transverse to the axis of the member, shall preferably not exceed 12 times the thickness of the member at the pin.

(c) Chain of Holes. In the case of a chain of holes extending across a part in any diagonal or zigzag line, the net width of the part shall be obtained by deducting from the gross width the sum of the diameters of all the holes in the chain, and adding to the section so obtained for each gauge space in the chain, the quantity $\frac{s^4}{4g}$

WHERE

\begin{align*}
  s &= \text{longitudinal pitch of any two successive holes} \\
  g &= \text{transverse gauge of the same two holes.}
\end{align*}

The critical net section of the part is obtained from the chain which gives the least net width.

(d) Gross Width of Angles. For angles, the gross width shall be the sum of the widths of the legs less their thickness. The gauge for the holes in opposite legs shall be the sum of the gauges from back of angle less the thickness.

(e) Splice Members. For splice members, the thickness shall be only that part of the thickness of the member which has been developed by rivets beyond the section considered.

(f) Designed Sections. Unless otherwise specified, tension members shall be designed on the basis of net section. Columns shall be designed on the basis of gross section. Beams and girders shall be designed in accordance with Section 2704.

Sec. 2708. (a) Minimum Number of Rivets. Connections carrying calculated stresses, except for lacing, sag bars and girts, shall have not fewer than two rivets.

(b) Eccentricity in Members. Members meeting at a joint shall have their gravity axis meet at a point if practicable; if not, provision shall be made for their eccentricity.

(c) Eccentricity in Rivets. The rivets at the ends of a member transmitting stresses into that member should have their centers of gravity on the line of the center of gravity of the member; if not, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

(d) Eccentricity in Angles. Where angles in tension are connected through but one leg and the eccentricity is not taken into account, only 80 per cent of the net section of the angle shall be considered as effective.

(e) Eccentricity in Members in Flexure. When beams, girders or trusses are designed on the basis of simple spans, their end connections may ordinarily be designed for the reaction
shears only. If, however, the eccentricity of the connection is excessive, provision shall be made for the resulting moment.

(f) Combined Shear and Moment. When beams, girders or trusses are subject both to reaction shear and end moment, due to full or partial end restraint, based on continuous or cantilever action, their connections shall be especially designed to carry both shear and moment without exceeding at any point the unit stresses prescribed in Section 2702. Ordinary end connections comprising only a pair of web angles, with not more than nominal seat and top angle, shall not be assumed to provide for this kind of end moment.

(g) Filler Plates. When rivets carrying computed stress pass through fillers, the fillers shall be extended beyond the connected member and the extension secured by sufficient rivets to develop the strength of the filler.

(h) Fillers Under Stiffeners. Fillers under plate girder stiffeners at end bearing or points of concentrated loads shall be secured by sufficient rivets to prevent excessive bending and bearing stresses.

(i) Riveted Joints. All joints in riveted work, whether in tension or compression, shall be so spliced as properly to transmit all stresses, except as provided in Section 2706. The minimum distance from the center of any rivet or bolt hole to any edge shall be that given in Table No. 27-A.

**TABLE NO. 27-A—MINIMUM EDGE DISTANCES**

<table>
<thead>
<tr>
<th>Rivet Diameter (Inches)</th>
<th>Minimum Edge Distance (Inches) for Punched Holes In</th>
<th>Rolled Edge of Plates &amp; Sections with Parallel Flanges</th>
<th>Rolled Edge of Sections with Sloping Flanges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sheared Edge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>1</td>
<td>7/8</td>
<td>3/4 *</td>
</tr>
<tr>
<td>9/16</td>
<td>1 1/8</td>
<td>1</td>
<td>7/8 *</td>
</tr>
<tr>
<td>5/8</td>
<td>1 1/4</td>
<td>1 1/8</td>
<td>1 *</td>
</tr>
<tr>
<td>7/8</td>
<td>1 1/2</td>
<td>1 1/4</td>
<td>1 3/4 *</td>
</tr>
<tr>
<td>1</td>
<td>1 1/2</td>
<td>1 3/4</td>
<td>1 3/4 *</td>
</tr>
<tr>
<td>1 1/8</td>
<td>2</td>
<td>1 3/4</td>
<td>1 3/4 *</td>
</tr>
<tr>
<td>1 1/4</td>
<td>2 1/4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*May be decreased 1/8 inch when holes are near end of beam.

**TABLE NO. 27-B—SPACING OF RIVET HOLES**

<table>
<thead>
<tr>
<th>Rivet Diameter (in Inches)</th>
<th>Center to Center Spacing (in Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4</td>
<td>4 1/2</td>
</tr>
<tr>
<td>1 1/8</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>3 1/2</td>
</tr>
<tr>
<td>7/8</td>
<td>3</td>
</tr>
<tr>
<td>5/8</td>
<td>2 1/2</td>
</tr>
<tr>
<td>3/8</td>
<td>2</td>
</tr>
<tr>
<td>1/2</td>
<td>1 1/4</td>
</tr>
</tbody>
</table>
The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall be not less than shown in Table No. 27-B.

The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thinnest outside plate or shape, or 20 times the thinnest enclosed plate or shape with a maximum of twelve inches (12") and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thinnest plate or shape. For angles in built sections with two gauge lines, with rivets staggered, the maximum pitch in the line of stress in each gauge line shall not exceed 24 times the thinnest plate with a maximum of eighteen inches (18").

In tension members composed of two angles, a pitch of three feet six inches (3'-6") will be allowed, and in compression members two feet (2'-0") but the ratio l/r for each angle between rivets shall be not more than three-fourths of that of the whole member.

The pitch of rivets at the ends of built-up compression members shall not exceed four diameters of the rivets for a length equal to one and one-half times the maximum width of the member.

The minimum distance between the center of any rivet under computed stress, and the end or other boundary of the connected member toward which the pressure of the rivet is directed, shall be not less than the shearing area of the rivet shank (single or double shear respectively) divided by the plate thickness. This end distance may however be decreased in such proportion as the stress per rivet is less than that permitted under Section 2702; and the requirement may be disregarded in case the rivet in question is one of three or more in a line parallel to the direction of the stress.

Sec. 2709. In proportioning rivets, the nominal diameter of the rivet shall be used.

Rivets carrying calculated stresses, whose grip exceeds five diameters, shall have their number increased one per cent for each additional one-sixteenth inch (1/16") in the rivet grip. Special care shall be used in heating and driving such rivets.

Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all structures such as purlins, girts, door and window framing, alignment bracing and secondary beams in floor.

The effective bearing area of pins, bolts, and rivets shall be the diameter multiplied by the length in bearing; except that for countersunk rivets, half the depth of the countersink shall be deducted.

Rivets shall be used in the following cases:

In all connections in structures over one hundred feet (100') in height when the height is more than two and one-half times the minimum horizontal dimension at the ground line.
In all connections in structures one hundred feet (100') or less in height where the height is more than four times the least horizontal dimension at the ground line.

In all connections of beams and girders to columns and of beams and girders bracing columns in buildings over one hundred feet (100') in height, and in column splices of buildings more than two hundred feet (200') in height.

In all connections for supports of machinery or other moving loads.

Unfinished bolts may be used for connections not mentioned in the preceding paragraphs.

Turned bolts in reamed holes may be used, in place of rivets, in either shop or field work where it is impracticable to obtain satisfactory power driven rivets, provided holes are as specified in Section 2717. The finished shank shall be long enough to provide a full grip for the nut, and washers shall be used under all nuts.

The end reaction stresses of trusses, girders, or beams, and the axial stresses of tension or compression members which are carried on rivets, shall have such stresses developed by the shearing and bearing values of the rivets or bolts.

Sec. 2710. Fusion welding may be used (in place of riveting or bolting) for connecting structural steel or wrought iron parts or members to one another, but in no case shall the stresses in such joints exceed the allowable unit working stresses given in the following table:

<table>
<thead>
<tr>
<th>Allowable Unit Working Stresses for Static Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension in weld metal (butt welds).............</td>
</tr>
<tr>
<td>Shear in weld metal (fillet welds)...............</td>
</tr>
<tr>
<td>Compression in weld metal........................</td>
</tr>
</tbody>
</table>

Maximum fiber stresses due to bending shall not exceed the values prescribed above for tension and compression, respectively. In designing welded joints adequate provision shall be made for bending stresses due to eccentricity, if any, in the disposition or section of base metal parts.

The same proportional increase in the above working stresses shall be allowed for the various given conditions as specified in Section 2702, Subsections (f) and (g).


Sec. 2711. Trusses shall be riveted structures and only when there is sufficient reason to justify, as where riveted field connections become unwieldy, may they be designed as pin-connected structures.

All joints in riveted work, whether in tension or compression, shall be spliced properly to transmit the stresses.

Bracing shall be sufficient to withstand safely wind and other forces when the building is in the process of erection as well as after completion.
When two or more plates are in contact they shall be stitch riveted with rivets not more than twelve inches (12") apart in either direction.

The ends of beams, channels, girders and trusses that bear on masonry or reinforced concrete shall be so framed that the allowable stresses for masonry or reinforced concrete shall not be exceeded, and anchors of ample size and strength shall be provided thoroughly embedded in the masonry or reinforced concrete construction.

The ends of all beams, channels, girders, girts, purlins and similar members, that meet on a beam, girder, truss, column or pier shall be connected to each other by a strap or through the carrying members with not less than two bolts or rivets each not less than five-eighths inch (5/8") in diameter in the end of each connecting member.

Tie rods shall be proportioned to resist their respective stresses, and holes for them shall be placed as near the spring of the arches as practicable.

Sec. 2712. (a) Compression Members. The open sides of compression members shall be provided with lacing having tie plates at each end and at intermediate points if the lacing is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones of not less than one-half of this distance. The thickness of tie plates shall be not less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the members, and the rivet pitch shall be not more than four diameters.

(b) Tension Members. Tie plates shall be used to secure the parts of tension members composed of shapes. They shall have a length not less than two-thirds of the length specified for tie plates in compression members. The thickness shall be not less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the member and they shall be connected to each segment by at least three rivets.

(c) Spacing of Lacing Bars. Lacing bars of compression members shall be so spaced that the ratio \( l/r \) of the flange included between their connections shall be not over three-fourths of that of the member as a whole.

(d) Proportioning of Lacing Bars. Lacing bars shall be proportioned to resist a shearing stress normal to the axis of the member equal to two per cent of the total compressive stress of the member. In determining the section required the compression formula shall be used, \( l \) being taken as the length of the bar between the outside rivets connecting it to the segment for single lacing and 70 per cent of that distance for double lacing. The ratio \( l/r \) shall not exceed 140 for single lacing and 200 for double lacing.

(e) Thickness of Lacing Bars. The thickness of lacing bars shall be not less than one-fortieth for single lacing and
one-sixtieth for double lacing of the distance between end rivets; their minimum width shall be three times the diameter of the rivets connecting them to the segments.

(f) **Inclination of Lacing Bars.** The inclination of lacing bars to the axis of the members shall preferably be not less than 45 degrees for double lacing and 60 degrees for single lacing. When the distance between rivet lines in the flanges is more than fifteen inches (15") the lacing shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

**Sec. 2713.** Pins shall be long enough to insure a full bearing of all parts connected upon the turned-down body of the pin. Members packed on pins shall be held against lateral movement.

Pin holes shall be reinforced by plates wherever necessary to give proper bearing. At least one plate shall be as wide as the projecting flanges will allow. Where angles are used this plate shall contain sufficient rivets to distribute their portion of the pin pressure to the full cross section of the member.

**Sec. 2714.** Provision shall be made to transfer the column loads to the footings and foundations.

Column bases shall be set level and to correct elevation with full bearing on the masonry.

Column bases shall be finished to accord with the following requirements:

1. Rolled steel bearing plates two inches (2") or less in thickness may be used without planing or straightening; rolled steel bearing plates over two inches (2") but less than four inches (4") in thickness may be straightened by pressing, or planed on all bearing surfaces if presses are not available; rolled steel bearing plates four inches (4") or over in thickness shall be planed on all bearing surfaces (except as noted under paragraph 3 of this Section).

2. Column bases other than rolled steel bearing plates shall be planed on all bearing surfaces (except as noted in paragraph 3).

3. The bottom surfaces of column bases which rest on masonry foundations and are grouted to insure full bearing contact need not be planed.

4. Anchor bolts shall be of sufficient size and number to develop the computed stresses.

**Sec. 2715.** (a) **General.** Steel studs and other supports used in the structural frame of light steel construction and steel joists shall be light weight rolled steel sections or sections formed from light gauge flat rolled steel sheets, or a combination of both used alone or in combination with other materials of construction, all of which shall be of a standard or commonly accepted type or shape; or such members may be of a determinate truss design built up of rolled structural steel sections effec-
tively arc or resistance welded together. For such steel studs the ratio \( l/r \) shall not exceed 180.

The effective width of flanges on such members having a channel section shall not exceed 20 times the thickness of the flange. The effective width of flanges on such members having an I-section shall not exceed 20 times the thickness of the flange on each side of the neutral axis. The effective width of steel sheets or plates constructed to act integrally with steel joists, studs, or other steel supporting members shall not extend more than 20 times the thickness of such sheet or plate on each side of the point or points of fixation to such members.

Open web or trussed members shall be so constructed that the lines of force of all connected members shall intersect at a point or proper allowance shall be made in the design for any resulting stress. The web elements shall be of sufficient strength to resist effectively the shearing stresses.

The following are the minimum thicknesses of metal permitted for various members of the structural frame of light steel construction:

- Bearing studs, floor and roof framing members—16 gauge
- Cellular steel walls, floor and roof panels—18 gauge
- Roof decks supported on ribs—20 gauge

All connections shall be riveted, bolted or welded. All steel work, including welds and connections, except where entirely encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well worked into the joints and open spaces.

(b) Stresses. Stresses in structural members of light steel construction shall not exceed those specified in Section 2702. No steel joist under its calculated load shall deflect more than 1/360 of the span, when plaster is supported. The actual spacing of floor joists, studs or other light steel wall supports shall be determined by their capacity to sustain the loads which they carry, but in no case shall such spacing exceed four feet (4').

(c) Construction Details. Steel studs or other steel supporting members used in the structural frame of light steel construction and steel joists shall be connected to the supporting beams, girders, foundations or other steel supporting members by arc or resistance welding, riveting, bolting or other approved methods. All such welds in light steel construction shall be made on two sides or two edges of each bearing in such a manner as to resist effectively the stresses developed. Resistance welding shall develop the full strength of the member welded.

Steel floor and roof members supported on masonry and reinforced concrete shall have end bearings at least four inches (4") in length and the ends of such members resting on masonry or reinforced concrete shall be provided with approved joist anchors thoroughly embedded therein.

Bearing plates, when required by design, shall be securely welded, bolted or riveted to such floor and roof members, studs or other supporting members.

Bearing studs or other vertical bearing members shall rest on a sole or plate having an effective width equal to the depth
of such member and having a thickness of not less than 14 gauge but in no case less than that of the vertical member resting thereon unless each such vertical bearing member is thoroughly embedded in the concrete foundation. Such soles or plates shall be effectively anchored to the foundation and all splices and intersections shall develop the full strength of the members connected.

When bearing studs or other vertical bearing members are spliced, the full strength of such members shall be developed in the splice.

Where studs do not continue full length from one story through the next story above, a cap plate or steel member shall be provided on top of the lower story studs or a sill plate on the upper story. Such cap plate or sill plate shall be of sufficient strength to distribute adequately the loads from the upper story studs to the lower story studs.

All horizontal or diagonal ties or bracing in exterior walls and bearing partitions shall be effectively arc welded, bolted or riveted to the structural frame or effectively anchored to supporting masonry.

Where plumbing, heating or other pipes or conduits are placed in or partly in an exterior wall or bearing partition necessitating the cutting of soles or plates, bracing or structural member in said wall, such members shall be reinforced so as to provide sufficient strength to resist the stresses imposed thereon or proper provisions shall be made to transfer such stresses to the points of support.

**Expansion**

Sec. 2716. Proper provision shall be made for expansion and contraction.

**Workmanship**

Sec. 2717. All workmanship shall be equal to the best practice in modern structural shops.

Drifting to enlarge unfair holes shall not be permitted. Holes that must be enlarged to admit the rivets shall be reamed. Poor matching of holes shall be cause for rejection.

All material shall be clean and straight. If straightening or flattening is necessary, it shall be done by a process that will not injure the material. Sharp kinks or bends shall be cause for rejection.

Rolled sections, except for minor details, shall preferably not be heated, or, if heated shall be annealed.

All steel castings shall be properly annealed.

Material may be punched one-sixteenth inch (\(\frac{1}{16}\)) larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus one-eighth inch (\(\frac{1}{8}\')). When the metal is thicker than the diameter of the rivet, plus one-eighth inch (\(\frac{1}{8}\')), the holes shall be drilled, or sub-punched and reamed.

Holes for shop turned bolts shall be sub-punched and reamed or drilled from the solid. Holes for field turned bolts shall be sub-punched in the shop and reamed in the field.

When sub-punching and reaming is required the die used for punching shall be one-sixteenth inch (\(\frac{1}{16}\)) smaller than the
The workman, where the removal of metal resulting from such flaws, if not explicable by slicing off the core, is required, shall not be permitted to replace the milling of surface specified elsewhere in this code.

4. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

5. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

6. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

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47. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

48. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

49. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.

50. Core cutting shall not be permitted to replace the milling of surface specified elsewhere in this code.
The same care as those driven in the shop.

Rails driven in the field shall be beveled and driven with heads and all aplanas of the shop coat, and so forth.

Field painting shall be considered a phase of maintenance.

Exceed 1 to 1000 of the total height of the column.

To elevate slabs of multiple-story buildings the error shall not exceed 1 to 500. For elevation columns and columns adjacent to slabs 1.5 times the slab error shall be considered, and 24" off level when the error does not exceed 1 to 1000 of the elevation.

In the setting or erection of steel, work the individual pieces shall be considered as if driven as the shop.

Any group of columns shall be done until the structure is complete.

No leveling or welding shall be done until the structure is complete.

Wherever piles of material, erection equipment, or other weights of any nature, erection equipment or other weights are carried during erection, proper provision shall be made to take care of the resulting stresses.

No loads are carried during erection. Proper provision shall be made to take care of all dead load, wind and erection stresses.

As erection progresses the work shall be securely held up.

Building Inspector.

As long as required for safety or deemed necessary by the Building Inspector.

Class iron columns shall not be painted until after acceptance.

Cast iron columns shall not be painted against concrete.

Machine finished surfaces shall be protected against corosion.

Metal finished surfaces shall be protected against corosion.

Metal projections well worked into the joints and open spaces shall be thoroughly cleaned and 24" off level when the error does not exceed 1 to 1000 of the elevation.

All steel work, except where electrically engaged in concrete, shall be thoroughly cleaned and 24" off level when the error does not exceed 1 to 1000 of the elevation.

Assemblies shall be properly protected by paint.

Painting.

Seams 2117-2119.
PART VII

DETAILED REGULATIONS

CHAPTER 28—EXCAVATIONS, FOOTINGS AND FOUNDATIONS

Sec. 2801. All excavations for buildings and excavations accessory thereto shall be protected and guarded against danger to life and property. All permanent excavations shall have retaining walls of masonry or reinforced concrete of sufficient strength to retain the embankment together with any surcharged loads. No excavation for any purpose shall extend within one foot (1') of the angle of repose or natural slope of the soil under any footing or foundation, unless such footing or foundation is first properly underpinned or protected against settlement.

Any person making or causing an excavation to be made to a depth of twelve feet (12'), or less, below the grade, shall protect the excavation so that the soil of adjoining property will not cave in or settle, but shall not be liable for the expense of underpinning or extending the foundation of buildings on adjoining properties where his excavation is not in excess of twelve feet (12') in depth. Before commencing the excavation the person making or causing the excavation to be made shall notify in writing the owners of adjoining buildings not less than 10 days before such excavation is to be made that the excavation is to be made and that the adjoining buildings should be protected. The owners of the adjoining properties shall be given access to the excavation for the purpose of protecting such adjoining buildings.

Any person making or causing an excavation to be made exceeding twelve feet (12') in depth below the grade, shall protect the excavation so that the adjoining soil will not cave in or settle, and shall extend the foundation of any adjoining buildings below the depth of twelve feet (12') below grade at his own expense. The owner of the adjoining buildings shall extend the foundations of his buildings to a depth of twelve feet (12') below grade at his own expense as provided in the preceding paragraph.

Footings and foundations, unless specifically provided, shall be constructed of masonry or reinforced concrete and shall in all cases extend below the frost line. Masonry units used in foundation walls and footings shall be laid up in portland cement mortar. The base areas of all footings and foundations shall be proportioned as specified in Section 2311.

Footings shall be so designed that the allowable bearing capacity of the soil in tons per square foot as given below shall not be exceeded unless the particular soil on which the building is to be placed shows a greater bearing capacity than that specified in this Section.
Rock........................................Not more than 20 per cent of the ultimate crushing strength of such rock.
Gravel or coarse sand, well cemented...................... 6 tons
Dry, hard clay or coarse firm sand (hardpan)............ 4 tons
Moderately dry clay or moderately dry sand and clay.. 3 tons
Ordinary clay and sand........................................ 2 tons
Soft clay, sandy loam or silt................................. 1 ton
Adobe.......................................................... ½ ton

Where the bearing capacity of the soil is not definitely known or is in question, the Building Inspector may require load tests or other adequate proof as to the permissible safe bearing capacity at that particular location. To determine the safe bearing capacity of soil it shall be tested by loading an area not less than two square feet (2 sq. ft.) to not less than twice the maximum bearing capacity desired for use. Such double load shall be sustained by the soil until no additional settlement takes place for a period of not less than 48 hours in order that such desired bearing capacity may be used. Examination of sub-soil conditions may be required when deemed necessary.

Foundations shall be built upon natural solid ground where possible. Loam or soil containing organic matter shall not be used to support buildings exceeding one story in height. Where solid natural ground does not occur at the foundation depth, such foundations shall be extended down to natural solid ground or piles shall be used, unless there is a practically level fill of good ground which has been in place a sufficient length of time to settle properly, when such fill may be used.

Sec. 2803. (a) General Requirements. All piles used to support any building or part thereof shall be driven to a reasonably solid bearing in such a manner as not to impair their strength. No pile or group of piles shall be loaded eccentrically.

(b) Wood Piles. Wood piles shall be of oak, Douglas fir, Southern pine, cedar, or other approved wood containing no evidences of decay. The piles shall be free from short kinks or reverse bends and shall have a uniform taper from butt to tip. A straight line drawn from the center of the butt to the tip shall lie wholly within the body of the pile. The diameter of wood piles at the point shall be not less than six inches (6") and at the butt shall be not less than ten inches (10") for piles twenty-five feet (25') or less in length, and not less than twelve inches (12") at the butt for piles more than twenty-five feet (25') in length. No piles with spiral grain which exceeds one complete turn in forty feet (40'), shall be used. All wood piles and capping shall be cut off and/or placed below mean low water level or below lowest ground water level, with the exception of creosoted piles as covered in this Section.

Creosoted piles of Douglas fir or Southern pine when treated with Grade 1 creosote under pressure with the full-cell creosote treatment complying with Specification No. 41-b or No. 39-a of the American Wood Preservers Association in such a manner as to provide a final retention of not less than 12 pounds per cubic foot in Douglas fir piling and not less than 15 pounds per cubic foot in Southern pine piling may be used as follows:
1. Where the upper portion of the creosoted piling is to be exposed and available for inspection the cut-off may be above ground level or above water level.

2. Where the upper part of the creosoted piling will not be readily available for inspection the cut-off shall be below ground level but may be above ground water level provided the tops of the cut-off piles are treated with three coats of hot creosote and capped with concrete so that no part of the pile will be exposed to the air.

No creosoted piling shall be used which has been so injured in handling or driving as to penetrate the creosoted shell, except in the case of bolt holes and unavoidable framing including the top cut-off, all of which shall be treated with three coats of hot creosote.

The allowable load on wood piles shall be in conformity with the requirements of Section 2803 (f).

(c) Concrete Piles. Concrete piles shall be of material complying with the requirements for portland cement, fine aggregate, coarse aggregate and reinforcement as specified in Chapter 26 and steel as specified in Chapter 27. The maximum allowable working stress on any concrete pile shall not exceed 20 per cent of the ultimate compressive strength of the concrete used in the piles, determined by tests as specified in Chapter 26. The maximum allowable load on any pile shall not exceed such working stress multiplied by the average cross sectional area of the pile.

Concrete piles cast in place shall be made in such a manner as to insure the exclusion of any foreign matter and to secure a full sized shaft. The length of such piles shall be limited to not more than 30 times the average diameter. The diameter of piles cast in place shall be not less than eight inches (8") at the point and shall have an average diameter of not less than eleven inches (11").

Precast concrete piles shall be sufficiently cured to attain the ultimate strength upon which their use is based, before driving. Such piles shall be reinforced and so handled as not to be fractured in any manner which will affect their durability or strength. Precast concrete piles shall have a diameter at the point of not less than six inches (6") and an average diameter of not less than ten inches (10"). The length of such piles when driven to rock shall be limited to 20 times the average diameter and shall not exceed 40 times the average diameter in any other case.

The allowable load on concrete piles shall be in conformity with the requirements of Section 2803 (f).

(d) Steel Piles. Rolled structural steel piles shall comply with the requirements for structural steel as specified in Chapter 27. The minimum thickness of metal shall be three-eighths inch (¾"). The allowable load on structural steel piles shall be in conformity with the requirements of Section 2803 (f).

(e) Concrete-Filled Steel Pipe Piles. Concrete-filled steel pipe piles shall have a nominal outside diameter of not less than
ten and three-quarters inches \(10\frac{3}{4}"\) and a nominal wall thickness of not less than five-sixteenths inch \(5/16"\), except that piles having a nominal outside diameter of fourteen inches \(14"\) or over shall have a nominal wall thickness of not less than three-eighths inch \(3/8"\). Concrete filling shall conform to the requirements of this Section for concrete piles. Splices shall develop at least one-third of the full bending strength of the steel section, except that where the piles are required to be designed as columns by the provisions of Section 2803 (f), splices shall develop the full bending strength of the steel section.

The allowable load on concrete-filled steel pipe piles shall be in conformity with the requirements of Section 2803 (f). In applying the formulas of that Section, the values of \(P\), \(L\), \(A\) and \(E\) which are used shall be those for the empty shell as driven. In no case shall the allowable load exceed 7500 pounds per square inch on the steel plus 25 per cent of the ultimate 28-day compressive strength on the concrete, except that where the length of the piles exceeds 40 times the nominal outside diameter, the unit load on the concrete shall not exceed 20 per cent of its 28-day compressive strength.

**Exception:** Where concrete-filled steel pipe piles are driven open-ended to refusal on sound bed rock which is not underlain by a softer stratum, the formula of Section 2803 (f) may be disregarded and the allowable load may be based upon the unit stresses prescribed above.

(f) **Safe Load.** The assumed safe load on a pile shall not exceed the value given by the following formula, unless such safe load is determined by test loading as provided in this Section:

\[
R = \frac{12 \times W h + 0.25P}{W + P} \frac{RL}{24,000} + \frac{S + AE}{E}
\]

**WHERE:**

- \(R\) = ultimate driving resistance, in tons
- \(W\) = weight of hammer, in tons
- \(P\) = weight of pile in tons
- \(S\) = permanent settlement of pile under the average of the last 10 blows, in inches
- \(h\) = height of fall of hammer, in feet
- \(L\) = length of pile, in feet
- \(A\) = average right cross-sectional area of pile, in square inches
- \(E\) = modulus of elasticity of pile, in pounds per square inch

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No wooden pile shall be loaded in excess of 500 pounds per square inch of the right section of the pile at mid-length.

The safe bearing value of a pile may be determined by a load test, upon due notice to the Building Inspector. The assumed safe load shall not exceed one-half of the load which shows no settlement for 24 hours, and a total settlement not to exceed 0.01 inch per ton of test load.

The supporting value of piles depending solely upon friction when driven in clusters or groups, shall be determined by multiplying the bearing value of a single pile by an efficiency factor as determined by the following formula:

\[ \text{Efficiency} = 1 - \theta \left( \frac{(n-1)m + (m-1)n}{90 mn} \right) \]

WHERE:
- \( n \) = number of piles in a row
- \( m \) = number of rows
- \( d \) = diameter of pile
- \( s \) = center to center spacing of piles

\( \tan \theta = d/s \), in which \( \theta \) is numerically equal to the angle expressed in degrees.

Piles standing free in water or very soft soil shall conform with the applicable column formula as stated in this Code. Piles driven into firm ground may be considered fixed at five feet (5') below the ground surface and in soft material at ten feet (10') below the ground surface.

When precast concrete piles frame into a concrete deck structure, the unsupported length may be taken as two-thirds the distance from the top of the pile to the point of fixity as stated in the foregoing paragraph.

Sec. 2804. (a) Caissons. The footings of any structure may be carried down to a firm foundation by isolated piers of reinforced concrete or by open or pneumatic caissons either with or without enlarged base or bell at the bottom. The safe carrying capacity of such shafts or caissons shall not exceed the allowable unit bearing capacity of the soil multiplied by the area of the base or bell at bottom.

(b) Caissons With Belled Footings. In the case of piers or caissons with belled footings, the slope of the sides of the bell shall not exceed one foot horizontally for each two feet vertically unless properly reinforced in accordance with Section 2621.
CHAPTER 29 — VENEERED WALLS

General

Sec. 2901. (a) Limitations. Veneer shall not be assumed to add to the strength of any wall.

(b) Height. Exterior veneer shall not be attached to wood at any point more than twenty feet (20′) above the adjacent ground elevation.

(c) Horizontal Forces. Veneer shall not be assumed to resist horizontal forces, except as specifically provided in Section 2902.

(d) Exceptions. The limitations in this Chapter shall not apply to interior veneer of units five-eighths inch (\(\frac{5}{8}\)) or less in thickness.

Veneer Composed of Masonry Units

Sec. 2902. (a) Scope. The provisions of this Section shall apply to all veneer which is constructed of masonry conforming to the requirements of Chapter 24.

(b) Vertical Loads. No veneer shall support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported upon lintels of incombustible material.

(c) Anchorage. Masonry veneer shall be attached to the supporting wall with corrosion-resistant metal ties capable of resisting a horizontal force equal to four times the weight of the attached veneer.

Veneer ties shall be not less in thickness than No. 6 W & M gauge wire. Veneer ties shall be spaced not more than twenty-four inches (24") apart horizontally and not more than twelve inches (12") apart vertically.

Veneer ties shall be attached to a continuous horizontal tie not less in thickness than No. 8 W & M gauge wire and embedded in a horizontal joint.

(d) Support. The weight of masonry veneer shall be supported upon footings or other incombustible structural supports spaced not over twelve feet (12′) vertically above a point twenty feet (20′) above the adjacent ground elevation.

Exception: The weight of masonry veneer attached to wood frame walls shall be supported entirely upon footings.

Veneer Composed of Non-Structural Units

Sec. 2903. (a) Scope. The provisions of this Section shall apply to all veneer of materials not regulated by the requirements of Chapter 24.

(b) Loads and Stresses. For the purpose of this Section, veneer of non-structural units shall not be assumed to support any superimposed loads.

(c) Anchorage. Non-structural material used as veneer shall be anchored to the supporting wall by corrosion-resistant metal ties not less in thickness than No. 9 W & M gauge wire, and spaced not more than twelve inches (12") apart both horizontally and vertically.

Exceptions: Approved units, or units of flat tile, stone or terra cotta which are manufactured with scored surface
may be cemented to a masonry or concrete wall or to ex-terior plaster with portland cement mortar, provided the mortar bond is sufficient to withstand a shearing stress of 50 pounds per square inch after curing for 28 days.

Sec. 2904. (a) General. In addition to the general requirements of this Chapter, all veneer of glass shall comply with the regulations in this Section.

Glass veneer shall not be attached to any exterior wall at a point more than thirty-five feet (35') above the adjoining ground elevation.

(b) Dimension. Glass veneer units shall be not less than one-eighth inch (\(\frac{1}{8}\)") in thickness. Units less than three-sixteenths inch (3/16") in thickness shall be not larger in area than one square foot (1 sq. ft.). Units not more than one-quarter inch (\(\frac{1}{4}\)") nor less than three-sixteenths inch (3/16") in thickness shall be not larger in area than four square feet (4 sq. ft.).

No unit shall be larger in area than ten square feet (10 sq. ft.) or more than four feet (4') in length.

(c) Attachment. Every glass veneer unit shall be attached to the backing by approved corrosion-resistant ties and shall be supported upon shelf angles.

Exceptions: 1. Below a point twenty-two feet (22') above the adjacent ground elevations, the ties may be omitted.

2. Below a point three feet (3') above the adjacent ground elevations, the ties and shelf angles may be omitted.

(d) Mastic. The mastic shall cover not less than one-half of the area of the unit after the unit has been set in place and shall be neither less than one-quarter inch (\(\frac{1}{4}\)"") nor more than one-half inch (\(\frac{1}{2}\)"") in thickness.

The mastic shall be insoluble in water and shall not lose its adhesive qualities when dry.

Absorbent surfaces shall be sealed by a bonding coat before mastic is applied. The bonding coat shall be cohesive with the mastic.

Glass veneer surfaces, to which mastic is applied, shall be clean and uncoated.

(e) Shelf Angles. Shelf angles shall be of corrosion-resistant material capable of supporting four times the weight of the supported veneer.

The shelf angles shall be spaced vertically in alternate horizontal joints but not more than three feet (3') apart.

The shelf angles shall be spaced not farther apart horizontally than the width of the supported units.

(f) Backing. Exterior glass veneer shall be applied only upon masonry, concrete, or exterior plaster.

(g) Expansion Joints. Glass veneer units shall be separated from each other and from adjoining materials by an expansion joint at least one thirty-second inch (1/32") in thickness. There shall be at least one sixty-fourth inch (1/64") clearance between bolts and the adjacent glass.
CHAPTER 30—ENCLOSURE OF VERTICAL OPENINGS

Sec. 3001. Vertical openings are required to be enclosed in certain buildings depending upon the occupancy of the building, height of building or the Type of Construction. The vertical openings required to be enclosed are specified under Occupancy in Part III, and for stairways and ramps are specifically included in Chapter 33.

Sec. 3002. When stairways or ramps are required to be enclosed such enclosures shall extend from the lowest point to the highest point required and shall also include a complete passageway not less in width at any point than the required width of such stairway or ramp and such enclosure. All doors opening into such enclosures shall be of metal or shall be metal-clad doors as set forth in Section 4304, and all windows shall be of wire glass and metal frames and sash; except that when such openings face directly on a street or court and are not within ten feet (10') of an adjacent lot line such protection may be omitted. All such doors shall be self-closing and be kept normally closed.

Walls and partitions enclosing stairways, ramps or elevators shall be of not less than the fire-resistive construction required under Types of Construction in Part V. Enclosing walls of elevator shafts may consist of wire glass set in metal frames on the entrance side only. Elevator shafts extending through more than two stories shall be equipped with an approved means of adequate ventilation to and through the main roof of the building.

Sec. 3003. All shafts, ducts, chutes and other vertical openings not covered in Section 3002 shall have enclosing walls conforming to the requirements specified under Type of Construction of the building in which they are located when they exceed nine square feet (9 sq. ft.) in area, and all other shafts shall be lined with sheet metal having lock jointed or riveted seams and joints. Combustible material of partitions and floors through which the ducts pass shall be kept at least three inches (3") from the metal lining or be protected by not less than three-eighths inch (⅜") of plaster or one-fourth inch (¼") of asbestos or plasterboard. Openings between any ducts and the floor construction through which they pass shall be filled with mortar or other incombustible material supported by wire baskets that prevent the passage of fire. All doors opening into such vertical shafts shall be of metal or shall be covered on the shaft side by not less than one-fourth inch (¼") of asbestos and not less than 26 U. S. gauge metal returned around all edges and well fastened to the door. Windows in such shafts shall be wire glass and metal frames and sash or such frame and sash may be of wood entirely clad with metal of not less than 26 U. S. gauge.
CHAPTER 31—FLOOR CONSTRUCTION

Sec. 3101. Floor construction shall be of materials and construction as specified under Occupancy in Part III and under Types of Construction in Part V.

All floors shall be so framed and tied into the framework and supporting walls as to form an integral part of the whole building. Fire-resistive standards of floor construction are specified in Section 4303.

The type of floor construction used shall provide means to keep the beams and girders from spreading by installing ties or bridging.

Sec. 3102. Concrete slab floors shall be not less than two inches (2") thick. Topping when poured monolithic with the slab may be included as a structural part of the slab. Sleepers for the nailing of a wood floor shall not decrease the required structural depth of the slab unless placed in the direction of span and then shall not be placed more than one-half inch (½") into the slab. Concrete joists shall be solidly bridged for lateral support as follows: One row of concrete bridging shall be placed in clear spans of fifteen feet (15') to twenty-four feet (24'); two rows of bridging shall be placed in all clear spans of twenty-four feet (24') or more. Bridging shall be reinforced continuously top and bottom with not less than one-half inch (½") round rod or the equivalent area in other shapes. Such bridging shall be the full depth and width of the joists.

Sec. 3103. Steel joisted floors shall consist of steel joists as specified in Section 2715. When used in Type I or Type II buildings they shall have a reinforced concrete or gypsum slab not less than two inches (2") thick placed on and secured to the top thereof, and a fire-resistive ceiling as specified in Section 4303 on the under side thereof, fully covering and protecting the joists; provided that when such joists are used in places where unprotected wood joists are permitted the steel joists need not be protected with fire-resistive materials as specified above. Fire-resistive ceilings as specified in Section 4303 shall, except in the case of one-hour fire-resistive construction, be designed and constructed to support a load of not less than 10 pounds per square foot in addition to its own weight.

The reinforced concrete or gypsum slab placed on and secured to the top of the steel joists shall be sufficiently reinforced to support all dead, live or other loads between joists. Joists shall be securely cross bridged at intervals not to exceed eight feet (8') along the joist length. The lateral unsupported length of the top chord of any steel joist shall not exceed 40 times the width of the compression flange.

Bridging shall be provided during the period of construction to adequately support the top chord or flange against lateral movement and such bridging shall be designed to hold each joist in a vertical plane. Sufficient permanent bridging shall be installed to laterally stay the joists and to transmit any horizontal forces in either direction perpendicular to the direction.
of the joists. Such bridging shall consist of solid concrete sections, structural steel shapes or plates, portal bridging, diagonal rods, or other bridging which will provide equal stiffness. Any row of bridging shall be capable of transferring 500 pounds from each joist to the adjoining joists.

**Sec. 3104.** Mill constructed floors shall be not less than three inches (3") nominal splayed or tongued and grooved plank covered with one inch (1") nominal flooring laid crosswise or

**TABLE NO. 31-A—ALLOWABLE SPANS FOR FLOOR JOISTS**

<table>
<thead>
<tr>
<th>Size of Joists (Inches)</th>
<th>Spacing of Joists, Center to Center (Inches)</th>
<th>Maximum Allowable Span (Feet and Inches)</th>
<th>Plastered Ceiling Below</th>
<th>Without Plastered Ceiling Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 6</td>
<td>12</td>
<td>10-0</td>
<td>12-0</td>
<td>10-0</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>9-1</td>
<td>10-0</td>
<td>8-7</td>
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<tr>
<td></td>
<td>24</td>
<td>8-0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 8</td>
<td>12</td>
<td>13-0</td>
<td>15-11</td>
<td>13-11</td>
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<td></td>
<td>16</td>
<td>12-1</td>
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<td>24</td>
<td>10-8</td>
<td>11-5</td>
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<tr>
<td>2 x 10</td>
<td>12</td>
<td>16-8</td>
<td>19-11</td>
<td>17-4</td>
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<td></td>
<td>16</td>
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<td>2 x 12</td>
<td>12</td>
<td>20-1</td>
<td>23-11</td>
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<td>16</td>
<td>18-5</td>
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<td>17-5</td>
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<td>23-1</td>
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<td>25-11</td>
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<td>18-9</td>
<td>21-8</td>
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<td>3 x 14</td>
<td>12</td>
<td>26-11</td>
<td>30-0</td>
<td>25-0</td>
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<td>24</td>
<td>22-1</td>
<td>25-2</td>
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</table>
diagonal. Top flooring shall not extend closer than one-half inch (½") to walls to allow for swelling in case the floor becomes wet. Such one-half inch space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinking movements of the floor. Corbeling of masonry walls under floor planks may be used in place of such molding.

If laminated floors are used, at least two laminations at the wall shall be omitted until after glazing and roofing has been completed.

See Section 2523 for detailed requirements.

Sec. 3105. Wood joisted floors shall be framed and constructed and anchored to supporting wood stud or masonry walls as specified in Chapter 25. Wood joisted floors need not be fire-protected on the under side except where specifically required under Occupancy in Part III, Location in Part IV, or Type of Construction in Part V.

Girders supporting first floor joists in residence buildings shall be not less than four inches by four inches (4" x 4") for spans of five feet (5') or less, or not less than four inches by six inches (4" x 6") (placed on edge) for spans not more than seven feet (7').

Table No. 31-A gives the maximum allowable spans for floor joists for Douglas fir and Southern pine using a 1200f grade, surfaced four sides to American Lumber Standard sizes and based on live load of 40 pounds per square foot uniformly distributed.

Joists of other grades, other woods and other sizes may be used, in which case they shall not be stressed to exceed the maximum allowable fiber stress as specified in Chapter 25.

Floor joists shall have a clearance of not less than eighteen inches (18") between the bottom of the joists and the surface of the ground underneath.

Joists under bearing partitions shall be installed as specified in Chapter 25. All joists, beams and girders shall be framed away at least two inches (2") from all flues and chimneys and at least four inches (4") from the back of any fireplace. All wood floor joists having a span of more than eight feet (8') shall have bridging as specified in Chapter 25.

Solid blocking not less than two inches (2") nominal in thickness and full depth of the joists shall be provided in the following places: over all bearing walls, bearing partitions and around all stairways or other vertical openings; and over all girders, except when joists are not ceiled on the underside thereof. Such solid blocking shall serve as the required bridging specified in Chapter 25.
CHAPTER 32—ROOF CONSTRUCTION AND COVERING

General

Sec. 3201. Roof covering shall be as required under Occupancy in Part III, Location in Part IV or Types of Construction in Part V. All roofs shall be so framed and tied into framework and supporting walls as to form an integral part of the whole building.

Construction

Sec. 3202. The general requirements for construction of floors as specified in Chapter 31 shall apply to roofs except that in Type II buildings the roof sheathing shall be not less than two and one-half inches (2$\frac{1}{2}$") nominal in thickness and except that concrete or gypsum roof slabs shall be not less than two inches (2") in thickness.

Roof trusses shall have all joints well fitted and shall have all tension members well tightened before any load is placed on the truss. Diagonal and sway bracing shall be used to brace all roof trusses. The allowable working stresses of materials in trusses shall be as specified in Chapters 25 and 27. The minimum net section of the members after framing shall be used in determining the strength of the truss at any point.

Design

Sec. 3203. The design of the roof construction shall be in accordance with engineering regulations for the materials used.

Table No. 32-A gives the maximum allowable spans for ceiling joists and roof rafters of Douglas fir and Southern pine

<table>
<thead>
<tr>
<th>Size of Joists (Inches)</th>
<th>Spacing of Joists, Center to Center (Inches)</th>
<th>Maximum Allowable Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For Ceiling Joists</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Feet and Inches)</td>
</tr>
<tr>
<td>2 x 4</td>
<td>12</td>
<td>11-0</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>10-0</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>8-11</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>7-10</td>
</tr>
<tr>
<td>2 x 6</td>
<td>12</td>
<td>16-7</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>15-4</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>13-8</td>
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<tr>
<td></td>
<td>32</td>
<td>12-0</td>
</tr>
<tr>
<td>2 x 8</td>
<td>12</td>
<td>21-8</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>20-2</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>18-0</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>15-10</td>
</tr>
<tr>
<td>2 x 10</td>
<td>12</td>
<td>26-10</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>25-0</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>22-6</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>19-6</td>
</tr>
</tbody>
</table>
using a 1200/ grade, surfaced four sides to American Lumber Standards sizes.

Joists or rafters of other grades, other woods and other sizes may be used, in which case they shall not be stressed to exceed the minimum allowable fiber stress as specified in Chapter 25.

The allowable span of roof rafters shall be measured from plate to ridge, except that where rafters are braced to ceiling joists and a complete truss is formed, the span shall be considered as the distance between intersecting points of trussing.

Roof framing and trussing shall be thoroughly and effectively angle braced. Roof joists when supported on a ribbon board shall be well nailed to the stud.

Sec. 3204. Roof covering shall be required over all combustible roof construction and shall be of one of the classes set forth in Section 4305 as required under Occupancy in Part III, Location in Part IV and Type of Construction in Part V.

Sec. 3205. All buildings shall have access provided to the attic space by means of a stairway or permanent ladder or a scuttle. The openings provided through the ceiling for such access into the attic space shall be not less than two feet by three feet (2'x3') and shall be located in the hallway or corridor of all Type III and V buildings three stories or more in height.

Type III or V buildings, one or two stories in height shall have scuttle holes into the attic space which are not less than eighteen inches (18") square.

In wood frame roof construction where ceilings occur the attic spaces or spaces between ceilings and the under side of roofs shall be divided into horizontal areas of not more than twenty-five hundred square feet (2500 sq. ft.) with tight one-inch (1") partitions of matched wood or of approved incombustible materials. All openings through these partitions shall be protected by self-closing doors of the same thickness and materials as the partition.

In buildings with no ceilings and having rooms with floor areas of over thirty thousand square feet (30,000 sq. ft.), tight draft stops shall be installed to prevent a free current of air under the roof. These draft stops in trussed roofs shall extend from the roof down to the bottom chord of the truss and shall divide the under roof or attic into sections not to exceed twenty thousand square feet (20,000 sq. ft.) in area.

Sec. 3206. Roofs of all buildings shall be sloped so that they will drain to gutters and downspouts which shall be connected with conductors to carry the water down from the roof underneath the sidewalk to and through the curb. Overflows shall be installed at each low point of the roof to which the water drains.
CHAPTER 33—STAIRS AND EXITS

Sec. 3301. All exits as required for buildings in this Code shall comply with the requirements specified in this Chapter for a stairway, ramp or smokeproof tower. Wherever stairways are mentioned, ramps may be substituted when constructed as specified in Section 3310. A smokeproof tower constructed as specified in Section 3315 shall be considered as a required stairway as specified in Section 3309. Such smokeproof towers may be substituted for stairways wherever the latter are required in this Code.

All stairways shall be constructed of materials permitted for floors as specified under Types of Construction in Part V for that type of building in which such stairways are located, except as specified in Sections 3315 and 3316. All stairways of wood construction shall be protected on the underside by not less than one-hour fire-resistive construction as specified in Chapter 43. Metal stairways entirely enclosed as specified in this Chapter shall not be required to be fire-protected as required for floors in Part V of this Code. The provisions of this Chapter shall not apply to Group I occupancies except as specifically stated in Sections 3302, 3307 and 3314.

Sec. 3302. All stairways and all platforms, landings and balconies forming a part of such stairway shall be designed to sustain an assumed live load of not less than 100 pounds per square foot.

There shall be no variation in the width of treads in any flight and the variation in heights of risers in any flight shall not exceed three-sixteenths inch (3/16”). All treads shall have a nosing of not less than one inch (1”).

The surface material of stair treads and landings shall be such as not to involve danger of slipping.

An arrangement of treads known as winders shall be permitted in Group I occupancies or for monumental stairways which are not serving as a required means of exit but in no case shall any tread have a width at any point less than eight inches (8”) exclusive of nosing.

Stairways and intermediate landings shall continue with no decrease in width along the direction of exit travel, except that when three or more stairways are required, one-half the required number of stairways may be combined at the second floor level with such combined width extending to the first floor level.

Sec. 3303. One-half of the required number of stairways shall be continued their full width to and through the roof by means of a penthouse in all buildings three stories or more in height; provided, that not more than one stairway shall be required to continue to and through the roof when the roof has a slope of more than six inches (6”) for each twelve inches (12”) of horizontal projection. In two-story buildings scuttles not less than two feet by three feet (2’ x 3’) shall be provided to and through the roof. Stairways leading to roofs of buildings shall have signs conspicuously placed with letters not less than four
inches (4") high indicating such access at the ground floor level.

All stairways shall lead to the street directly or by means of a yard, court or fire-resistive passageway having a width at least equal to the aggregate widths of all the exits discharging into it; provided, that not to exceed one-half of the required number of stairs may terminate at the second floor level provided they lead directly to a street or alley front of the building and are provided with a balcony on the exterior of the building not less than three feet (3') wide and five feet (5') long. Such balcony shall be constructed of incombustible materials and when the floor of such balcony is located more than twelve feet (12') above the sidewalk directly below, such balcony shall be equipped with an approved counterbalanced stairway or ladder.

Where stairways discharge through the fire-resistive passageways such passageways shall be not less than seven feet (7') in clear height and with a width at least equal to the stairway or stairways served by such passageways. All openings into such passageways shall be protected by one-hour fire-resistive doors.

All exits shall be so arranged as to make clear the direction of egress to the exterior of the building and shall be so located that they are readily accessible and visible. When not visible to all occupants, adequate signs shall be provided to indicate their location. For buildings with sleeping rooms, schools and places of detention, exits shall be so arranged that it is possible to go in either direction at any point in a corridor to an exit.

Stairways shall abut on not more than one side of an elevator enclosure.

No portion of any building shall be more than one hundred fifty feet (150') (along the line of travel) from the nearest exit, and no corridor exit door shall be more than one hundred feet (100') (measured along the line of travel) from the nearest exit. In Group D and H occupancies all doors providing egress from public hallways and all doors providing egress from the building shall open in the direction of exit travel, except sliding doors as provided in Section 3304.

**Sec. 3304.** Doors shall not open immediately on a flight of stairs but on a landing at least equal to the width of the door.

Doors giving access to stairways shall swing with the direction of exit travel but where swinging doors are not practicable sliding doors approved by the Building Inspector may be permitted. Vertical sliding doors and rolling shutters shall not be used. There shall be no obstructions on stairways or landings nor to the full swing of doors. Swinging doors in their swing shall not reduce the effective width of stairways or landings to less than thirty inches (30") nor when open interfere with the full use of the stairs.

All doors in exit enclosures or providing access to exterior stairways shall be self-closing and be kept normally closed and shall be of not less than one-hour fire-resistive construction, except that doors facing a street and at street level may be of unprotected wood. Doors shall be tight-fitting and constructed and installed in a workmanlike manner.
All doors used in connection with exits shall be so arranged as to be opened readily from the side from which egress is made or from both sides when the building is occupied. Locks if provided shall not require a key to operate from the inside.

Railings

Sec. 3305. All stairways shall have walls or well secured balustrades or guards on each side and handrails shall be placed on at least one side of every stairway and stairways exceeding forty-four inches (44") in width shall have handrails placed on each side. Stairways over seven feet (7') wide shall be provided with one or more continuous intermediate handrails substantially supported and the number and position of intermediate handrails shall be such that there is not more than sixty-six inches (66") between adjacent handrails.

Handrails and railings shall be placed thirty inches (30") above the nosing of treads and ends of handrails shall be returned to the wall.

Lighting

Sec. 3306. Every stairway or other means of exit into corridors and passageways appurtenant thereto shall be provided with an adequate system of lighting, either natural or artificial. Lights in the exit signs shall be kept burning at all times that the building served by such stairways or exits is being used or occupied.

Detailed Requirements

Sec. 3307. Stairways and landings, returns and passageways serving such stairways shall be not less than forty-four inches (44") wide; except, that for dwellings and when serving mezzanines or not more than one family or one apartment in buildings not exceeding two stories in height the required width may be reduced to not less than three feet (3'). All such widths shall be clear of all obstructions; except that handrails attached to walls may project within the required width not more than three and one-half inches (3½") at each side when the stairway is forty-four inches (44") or more in width and on one side when the stairway width is less than forty-four inches (44"). If newels project above tops of rails a minimum clear width of not less than that specified in this paragraph shall be provided between the face of the newel and the face of the wall or newel opposite.

The rise of stairway shall be not more than seven and one-half inches (7½") and the tread exclusive of the nosing not less than ten inches (10") (maximum pitch 37 degrees), and there shall be not more than 17 risers in any one run between landings; provided, that stairways in dwellings and stairways serving mezzanine floors may have a rise of not more than eight inches (8") and a tread exclusive of the nosing of not less than nine inches (9").

In Groups A, B, and C occupancies the walls at the outer corners of landings shall be curved on a radius of at least two feet (2'), or a 45 degree splay not less than twenty inches (20") wide shall be provided to eliminate right angle corners.

Every required stairway including stairways in Group I occupancies shall have a head room clearance of not less than six feet six inches (6' 6") measured vertically from the nearest nosing to the nearest soffit.
Sec. 3308. All required stairways and ramps in buildings three stories or more in height, including landings and parts of floors between stairways which lie in the path of travel shall be enclosed as specified under Occupancy in Part III, under Types of Construction in Part V, and in Chapter 30; except that monumental stairways leading only from the street floor level to the second floor or basement which do not constitute required means of exit in public buildings or stores shall be exempted from the enclosure requirements.

Exit enclosures shall not be used for storage in any manner whatsoever and shall not contain any material or equipment liable to cause fire, explosion or panic.

At the top of every stairway enclosure a ventilating skylight with a horizontal area of not less than eight square feet (8 sq. ft.) shall be installed as specified in Section 3402, or in lieu of such skylight an equivalent window opening glazed with plain glass may be provided in the penthouse walls. Fixed openings not less than five hundred square inches (500 sq. in.) in area shall be provided at the top of each stairway enclosure for ventilation.

Sec. 3309. The number of stairways provided for each use or occupancy shall be as required in Table No. 33-A for three-story buildings. For two-story buildings the allowable areas may be increased 50 per cent. For buildings four stories or more in height the allowable areas shall be decreased two per cent per floor for each floor above the third floor to and including the eighth floor and shall be decreased one per cent for each additional floor above the eighth floor; provided, that in no case shall there be less than two stairways serving each floor for each building three stories or more in height. Where the entire building is sprinklered in accordance with the provisions of Chapter 38 the allowable areas in Table No. 33-A may be increased 33-1/3 per cent.

**TABLE NO. 33-A—BASIC AREAS FOR COMPUTING REQUIRED NUMBER OF STAIRWAYS**

<table>
<thead>
<tr>
<th>Maximum Areas for Types I and II Buildings (Sq. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Up to 3,000</td>
</tr>
<tr>
<td>Up to 8,000</td>
</tr>
<tr>
<td>Up to 18,000</td>
</tr>
<tr>
<td>Up to 28,000</td>
</tr>
<tr>
<td>Up to 40,000</td>
</tr>
<tr>
<td>Up to 64,000</td>
</tr>
<tr>
<td>Up to 70,000</td>
</tr>
<tr>
<td>Up to 88,000</td>
</tr>
<tr>
<td>Up to 108,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Areas for Types III, IV and V Buildings (Sq. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3,000</td>
</tr>
<tr>
<td>Up to 8,000</td>
</tr>
<tr>
<td>Up to 18,000</td>
</tr>
<tr>
<td>Up to 24,000</td>
</tr>
<tr>
<td>Up to 35,000</td>
</tr>
<tr>
<td>Up to 49,000</td>
</tr>
<tr>
<td>Up to 65,000</td>
</tr>
<tr>
<td>Up to 80,000</td>
</tr>
</tbody>
</table>
The number of required stairways for Group A, B and C occupancies is specified in Chapters 6, 7 and 8, respectively.

Where a cellar or basement in a Group D, E, F, G and H occupancy is used for other than storage or furnace room purposes, exits, stairs or ramps shall be provided as for the same occupancies on the second floor, except that any basement used by the public or any basement to be used by more than 20 employees simultaneously shall have not less than two stairways.

Exceptions: 1. Group D occupancies shall be provided with not less than one smokeproof tower constructed as specified in Section 3315 when such building exceeds two stories in height.

2. Group E—In automobile storage garages, where a system of ramps continuous from the ground floor to the top floor is used to transport automobiles from floor to floor, the number of stairways required shall be not less than one-half that shown in Table No. 33-A.

3. Where one horizontal exit is provided, the allowable areas tabulated may be increased 15 per cent and where more than one such exit is provided, such areas may be increased not to exceed 25 per cent.

Ramps

Sec. 3310. Wherever stairways are required by this Code, ramps with a slope not greater than one foot (1') in eight feet (8') may be substituted.
Ramps shall comply with all the requirements for stairways as to construction, width, enclosures, landing, lighting and ventilation.
Ramps shall be surfaced with an approved non-slip material. Handrails shall not be required where the slope of the ramp is less than one foot (1') in ten feet (10').

Horizontal Exits

Sec. 3311. A horizontal exit shall consist of one or more protected openings through or around an exterior wall or occupancy separation or of one or more bridges connecting two buildings or parts of buildings entirely separated by occupancy separations.

Openings used in connection with horizontal exits shall be protected by one-hour fire-resistive doors as specified in Section 4304. If swinging doors are used there shall be adjacent openings with doors swinging in opposite directions, with signs on each side of the wall indicating the exit door which swings with the travel from that side.

Such doors shall be kept continuously unlocked whenever the building is occupied and be normally closed or be self-closing and equipped with fusible links.

Signs and Lighting

Sec. 3312. Signs having white letters not less than five inches (5") high on a green field indicating location of exits shall be provided not only at the exit but at other points in the building wherever necessary to clearly indicate the direction of egress. Lights shall be kept burning during all times that the building is used or occupied.

Passageways and Corridors

Sec. 3313. Safe and continuous passageways, aisles, or corridors leading to exits and so arranged as to provide convenient access to exits for every occupant shall be maintained at all
times on all floors and in all buildings. The minimum clear width of any passageway, aisle or corridor shall be three feet (3') at the narrowest point and doors swinging into such passageway shall not restrict the effective width at any point during their swing to less than the minimum width herein required.

Sec. 3314. Stairways in Group I occupancies, stairways serving only one apartment not above the second floor level, or stairways leading to mezzanine floors not exceeding one thousand square feet (1,000 sq. ft.) in area are exempted from the width, rise, tread and enclosure provisions in this Chapter but in no case shall such stairways have a rise of more than eight inches (8") and a tread exclusive of the nosing of less than nine inches (9").

Sec. 3315. (a) Where Required. A smokeproof tower consisting of a stairway with exterior access, entirely enclosed by masonry walls of not less than four-hour fire-resistive construction and floors and ceilings of not less than two-hour fire-resistive construction and constructed as specified in this Section shall be required in every building of Group D, E, F, G and H occupancies five stories or more in height. Smokeproof towers shall be installed in Group A, B and C occupancies as specified in Chapters 6, 7 and 8, respectively.

(b) Construction. The stairways, landings, platforms and balconies of smokeproof towers shall be constructed as required for stairways, except that they shall be of incombustible materials throughout, except for handrails which may be of wood. The enclosure shall extend from the street level to a penthouse on the roof of the building and shall be roofed over with incombustible materials. Light and ventilation shall be provided at the top of every such enclosure as required for stairways. Balustrades on the vestibules and balconies shall be not less than three feet six inches (3' 6") in height. Exit lights shall be provided as required in Section 3312.

(c) Access and Egress. Access to the smokeproof tower shall be provided from each story by means of vestibules open to the outside on an exterior wall or by means of balconies overhanging an exterior wall but not subject to severe fire exposure. Every such vestibule, balcony or landing shall have an unobstructed length not less than the combined required width of exit doors opening upon such balcony or landing and shall be directly open to a street, alley or yard or to an enclosed court open at the top and not less than fifteen feet (15') in width and six hundred square feet (600 sq. ft.) in area.

Access from the building to vestibules or balconies and to the enclosure shall be through doorways not less than thirty inches (30") wide nor less than seventy-five inches (75") in clear height. These openings shall be provided with self-closing fire doors of not less than one-hour fire-resistive construction as specified in Section 4302, swinging in the direction of exit travel; provided that clear wire glass not exceeding seven hundred and twenty square inches (720 sq. in.) in area shall be provided in all such doors giving access to the enclosure from the balcony or vestibule. Where locks or latches are provided they shall be of
an approved pressure-release type and shall be so designed as to provide access from the building at every floor and roof level.

Stairways of smokeproof towers shall provide continuous uniform egress from the roof and all stories to street grade. Egress shall be provided at the ground floor level either directly or through a passageway not less than forty-four inches (44") in clear width and eight feet (8') in clear height to a street, yard or alley not less than ten feet (10') in width. The walls of such passageway shall be of not less than four-hour fire-resistive construction and the ceiling and floor of not less than two-hour fire-resistive construction. The walls of any such passageway shall be unpierced throughout their entire length.

(d) Location. Every smokeproof tower required by this Code shall be located so as to furnish the best means of egress for the occupants of the building and access shall be provided thereto by means of a public room, public hall or passageway not less than thirty-six inches (36") in clear width and in no case shall access thereto be through another apartment, guest room, office or private room of any nature.

Sec. 3316. Outside stairways of the return platform or straight-run type may be used as a required means of exit for buildings not exceeding five stories or fifty-five feet (55') in height but in no case shall such stairways constitute more than 50 per cent of the required exit capacity. All outside stairways shall be located so as to lead directly to a street or alley or to a yard directly connected with a street or alley.

The stairways, landings, platforms and balconies shall be constructed as specified for stairways in this Chapter, except that they shall be of incombustible materials throughout; provided that stairways serving only the second floor may be constructed of combustible material. Structural metal shall be not less than one-quarter inch (¼") thick and shall be so framed as to permit ready access for inspection and painting. All windows and other openings adjacent to such stairways shall be provided with fixed metal covered sash and frames and wire glass or be provided with shutters or doors of one-hour fire-resistive construction.

No part of any such outside stairway shall be within ten feet (10') of a lot line which does not form the boundary of a street or alley.
CHAPTER 34—DOORS, WINDOWS
AND SKYLIGHTS

Sec. 3401. Fire doors where required shall be as specified in Section 4304. All such doors shall be self-closing and if not kept normally closed shall be arranged to close automatically with the fusing of an approved fusible link.

Windows required to have metal frames shall be constructed either of steel or wrought iron rolled shapes or of hollow galvanized sheet iron, as specified in Section 4304.

When wire glass is required, it shall mean glass the thickness of which at the thinnest point shall be not less than one-fourth inch (1/4") and in which a wire netting is embedded. Wire glass shall be set with putty and metal stops.

Sec. 3402. All skylights constructed with metal frames shall be substantially built with interlocking seams. Frames of skylights shall be designed to carry loads required for roofs as specified in Section 2305. All skylights, the glass of which is set at an angle of less than 45 degrees from the horizontal, if located above the first story, shall be set at least one foot (1') above the roof. The curbs on which the skylight rests shall be constructed as required for inner court walls or for masonry.

When wire glass is required for skylights the size shall not exceed seven hundred and twenty square inches (720 sq. in.) in area or forty-eight inches (48") in any dimension in any one panel. All glass in skylights shall be wire glass, except that skylights over vertical shafts extending through two or more stories shall be glazed with plain glass as specified in this Section; provided, that wire glass may be used if ventilation equal to not less than one-eighth the cross sectional area of the shaft but never less than four feet (4') is provided at the top of such shaft.

Any glass not wire glass shall be protected above and below with a screen constructed of wire not smaller than No. 12 B. and S. gauge with a mesh not larger than one inch (1"). The screen shall be substantially supported below the glass.

Skylights installed for the use of photographers may be constructed of metal frames and plate glass without wire netting.

Ordinary glass may be used in the roofs and skylights for greenhouses, provided the height of the greenhouse at the ridge does not exceed twenty feet (20') above the grade. The use of wood in the frames of skylights will be permitted in greenhouses outside of Fire Zones No. 1 and 2, if the height of the skylight does not exceed twenty feet (20') above the grade, but in other cases metal frames and metal sash bars shall be used.

Glass used for the transmission of light, if placed in floors or sidewalks, shall be supported by metal or reinforced concrete frames, and such glass shall be not less than one-half inch (1/2") in thickness. Any such glass over sixteen square inches (16 sq. in.) in area, shall have wire mesh embedded in the same or shall be provided with a wire screen underneath as specified for skylights in this Section. All portions of the floor lights or sidewalk lights shall be of the same strength as is required by this Code for floor or sidewalk construction, except in cases where the floor is surrounded by a railing not less than three feet six inches (3'6") in height, in which case the construction shall be calculated for not less than roof loads.
CHAPTER 35—BAYS AND BALCONIES

Construction

Sec. 3501. Construction of walls and floors in bay and oriel windows shall conform to the construction allowed for exterior walls and floors of the type of construction of the building to which they are attached. The roof covering of a bay or oriel window shall conform to the requirements for roofing of the main roof of the building.

All exterior balconies attached to or supported by masonry walls shall have brackets or beams constructed of wire, steel, concrete or other incombustible material. All railings for balconies or porches shall be not less than three feet (3') in height above the floor of such balcony or porch.
CHAPTER 36—PENTHOUSES AND ROOF STRUCTURES

Sec. 3601. No penthouse or other projection above the roof shall exceed twenty-eight feet (28') in height above the roof when used as an enclosure for tanks or for elevators which run to the roof and in all other cases shall not extend more than twelve feet (12') in height above the roof. The aggregate area of all penthouses and other roof structures shall not exceed 20 per cent of the area of the roof. No penthouse, bulkhead or any other similar projection above the roof shall be used for manufacturing, business, habitation, offices or storage, except that they may be permitted to be used for the making of blue prints, photographic prints, for scientific observation, for summer houses or for Group I occupancies.

Roof structures of Type I buildings shall be constructed with walls, floors and roof as required for the main portion of the building.

Walls of roof structures parallel to and within four feet (4') of the exterior walls of Type II or III buildings shall be constructed the same as the exterior wall of the story immediately below. Such wall shall project two feet (2') above the roof and two feet (2') beyond the sides of such roof structure, except that the side projection shall not be required when the adjoining side walls are of masonry. Walls other than those occurring within four feet (4') of an exterior wall on Type II or III buildings shall be of not less than one-hour fire-resistant construction. The restrictions of this paragraph shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

Sec. 3602. Towers or spires when enclosed shall have exterior walls as required for the building to which they are attached. Towers not enclosed and which extend more than seventy-five feet (75') above grade shall have their framework constructed of iron, steel or reinforced concrete. No tower or spire shall occupy more than one-fourth of the street frontage of any building to which it is attached and in no case shall the base area exceed sixteen hundred square feet (1,600 sq. ft.) unless it conforms entirely to the type of construction requirements of the building to which it is attached and is limited in height as a main part of the building. If the area of the tower or spire exceeds one hundred square feet (100 sq. ft.) at any horizontal cross section its supporting frame shall extend directly to the ground. The roof covering of spires shall be as required for the main roof of the rest of the structure.

Skeleton towers used as radio masts and placed on the roof of any building shall be constructed entirely of incombustible materials when more than twenty-five feet (25') in height and shall be directly supported on an incombustible framework to the ground. They shall be designed to withstand a wind load from any direction as specified in Section 2307 in addition to any other loads.
CHAPTER 37—CHIMNEYS AND HEATING APPARATUS

Sec. 3701. Chimneys shall be constructed in conformance with "A Standard Ordinance for Chimney Construction" recommended by the National Board of Fire Underwriters, Third Edition, revised 1927, except as specified in this Chapter.

The walls of all chimneys whether used for appliances using coal, coke, wood, or oil shall be built of brick, concrete, stone, hollow tile of clay or concrete or of concrete blocks; provided that a metal smokestack or a patent chimney as specified in Sections 3702 and 3704, respectively, may be used.

Flue linings shall be made of fire clay or of other suitable refractory clays adapted to withstand reasonably high temperatures and flue gases and shall have a softening point not lower than 1994 degrees Fahrenheit. Flue linings shall be not less than five-eighths inch (5/8") in thickness and shall be built in as the outer walls of the chimney are constructed. All joints and spaces between the masonry and lining shall be thoroughly slashed and grouted full as each course of masonry is laid. Cracked, broken or otherwise defective linings shall not be used. Flue linings shall start from a point not less than eight inches (8") below the center line of smoke pipe intakes or in the case of fireplaces from the apex of the smoke chamber and shall be continuous to a point not less than four inches (4") above the enclosing walls. Flue lining may be omitted in brick chimneys for Group I occupancies provided the walls of the chimneys are not less than eight inches (8") thick and that the inner course shall be of fire brick with a fire resistance equal to that required for flue linings.

The walls of brick chimneys shall be not less than three and three-fourths inches (3 3/4") thick and shall be lined except as provided above. All brick work shall be laid with full mortar joints, and shall be struck smooth where exposed to the weather. No mortar lining shall be permitted.

Concrete chimneys cast in place shall be suitably reinforced vertically and horizontally. The walls shall be not less than three and three-fourths inches (3 3/4") thick and shall have a flue lining as specified in this Section; provided, that flue linings may be omitted in reinforced concrete chimneys for Group I occupancies when the walls of such chimneys are not less than six inches (6") thick.

Hollow blocks or hollow tile of clay or concrete shall not be used for the walls of an independent chimney but may be used for chimneys built in connection with exterior or party walls of hollow units for buildings not exceeding three stories in height. The outer eight inches (8") of such a wall may serve as the outside wall of the chimney.

Chimneys shall extend at least three feet (3') above flat roofs and not less than two feet (2') above the ridge of gable and hip roofs or the high point of mansards irrespective of the distance of the chimney from such obstruction to draft.

Chimneys shall be built upon solid masonry or reinforced concrete foundations properly proportioned to carry the weight imposed without settlement or cracking. The chimney shall

1See "Specification Documents".
carry no load except its own weight and such load shall be
transmitted to the foundation in such manner as to prevent the
shearing or falling off of any part of the chimney. The footing
for an exterior chimney shall start below the frost line.

Flues shall be built as nearly vertical as possible and in no
case at an angle greater than 30 degrees from the vertical.

When any single flue has an effective area exceeding two
hundred square inches (200 sq. in.) the wall shall be not less
than eight inches (8") thick and shall have flue lining as speci-
fied in this Section, except that when flues become too large for
fire clay flue lining, such flues shall be lined with fire brick for a
distance of at least twenty-five feet (25') from the point of
intake.

There shall be but one connection to a flue irrespective of
whether the fuel used be coal, coke, wood, or oil. Ordinary and
low pressure heating devices burning solid fuels shall have a
minimum effective flue area of not less than the following, and
such area shall be provided by a flue having its short dimension
not less than two-thirds the long dimension.

Small special stoves and heaters.......................... 28 sq. in.
Stoves, ranges and room heaters.............................. 40 sq. in.
Fireplaces (at least 1/12 the fireplace opening)....... 50 sq. in.
Warm air furnaces, steam and hot water boilers..... 70 sq. in.

All flues to which large ranges, heating furnaces, boilers,
automatic gas water heaters or fireplaces are to be connected
shall be subjected to a smoke test before acceptance but the
test shall not be made until the mortar has thoroughly seasoned.
Such test shall be made in the presence of the Building Inspect-
or.

Sec. 3702. Steel or iron smokestacks may be used in place
of brick chimneys specified in Section 3701, in which case the
thickness of the metal shall be not less than one-fourth inch
(¼"). Such stacks when used for manufacturing, for high
pressure boilers, furnaces or other similar heating or manufac-
turing appliances shall be lined with fire brick for a distance
of not less than twenty-five feet (25') from the place where the
smoke pipe enters and shall be protected on the outside up to
and through the roof of the building with eight inches (8") of
masonry or a No. 18 U. S. gauge sheet-metal shield which pro-
vides an eight-inch (8") ventilated air space between such shield
and the steel or iron stack; provided, that a metal smokestack
when located inside of a vent shaft having masonry enclosing
walls not less than eight inches (8") thick and having a two-
inch (2") air space between the walls and the stack on all sides
may have such masonry or metal shield protection omitted. All
stacks shall be properly guyed when the height of the stack
exceeds 15 times its least diameter.

Smokestacks constructed of not less than No. 10 U. S.
Gauge steel, with either welded or riveted joints, may be
mounted directly upon industrial, heating or power boilers
which are designed to support the stack load. A clearance of
not less than six inches (6") shall be maintained at all times
around such smokestack and any flammable material within
twelve inches (12") of such smokestack shall be protected by
one-fourth inch (¼") of asbestos covered by sheet metal.
Sec. 3703. Gas furnaces, gas water heaters and other gas appliances which are required to be vented, may in lieu of the chimney required in Section 3701, be provided with a vent of unglazed fire clay or concrete tile pipe not less than one-half inch (1/2") in thickness and having a sleeve or flange not more than twenty-four inches (24") apart and at every joint in such vent pipe. Such sleeves or flanges shall project at least three-fourths inch (3/4") beyond the outer surface of the joint and shall securely join the sections of such vent and all joints shall be well cemented. The sleeves or flanges shall be securely attached to the portions of the building or structure adjoining such vents and act as a spacer to provide an air space around such vent, or such vent may be entirely enclosed in a galvanized iron pipe with such sleeves or flanges separating the outer pipe at least one-half inch (1/2") from the clay or concrete vent. The area of any flue or vent shall be not less than the area of the largest vent connection inlet plus 50 per cent of the areas of all other additional inlets, provided that no gas flue or vent shall have an area of less than twelve square inches (12 sq. in.), and shall be not less than two inches (2") in any internal dimension. No vent connection inlet shall be located at the bottom of any gas vent, and any two inlets must be offset or staggered so that it will be impossible for any horizontal plane to pass through any part of both inlets.

A single galvanized or copper bearing metal vent connection exposed to view in a room throughout its entire length may be used to connect the appliance to the vent. Such metal vent connection shall be not less in diameter than the connection on the appliance and shall be maintained not less than six inches (6") distant from any combustible portion of the building or the combustible material shall be protected by not less than one-hour fire-resistive construction. Every portion of a vent connection shall have a rise of not less than one inch (1") to the foot from the appliance to the chimney and the length of such connection shall be no greater than the height of the vent from the point at which the vent connection enters to the top of the vent.

Every vent shall extend in as nearly a vertical position as possible and be continuous from the gas appliance to the outside of the building and extend at least two feet (2') above any portion of the roof within fifteen feet (15') of said vent.

No vent connection connected to any gas appliance having pilot provision for automatic or remote control, shall be connected to any chimney flue which is used as a smoke flue for any stove, boiler, heater or other apparatus designed to burn wood, coal, oil or other fuel other than gas unless such pilot provision is so designed that the supply of gas to the main burners in connection therewith will be automatically shut off when combustion of gas is not taking place at the pilot.

Sec. 3704. Patent chimneys may be used, except for oil burners, when complying with the requirements of this Code.

All patent chimneys shall be constructed with a flue lining enclosed in a metal outer casing which is so arranged as to provide not less than a one inch (1") air space between the flue lining and the casing. The flue lining shall be made of fire clay or suitable refractory clays adapted to withstand reasonably
high temperatures and flue gases, shall have a softening point not lower than 1994 degrees Fahrenheit and shall be not less than one inch (1") in thickness. Such chimneys shall be built up from the floor level on which they are used and in no case shall a stove pipe enter the bottom of a patent chimney.

When such chimneys are erected on the outside of a building they shall be supported by a substantial iron bracket attached to the studs or framework of the building with through-bolts. When erected on the inside of a building such patent chimneys shall be provided with a smokeproof clean-out of approved design at or near the floor. The floor on which they are placed shall be protected by not less than eight inches (8") of masonry or terra cotta set on a one-fourth inch (¼") metal plate. Partitions enclosing patent chimneys shall have an opening opposite the clean-out on the chimney for the purpose of cleaning the flue.

When such chimneys are used with fireplaces, they shall be supported by a metal plate embedded in mortar at the throat of the fireplace. The metal plate shall provide a means of keeping the one inch (1") air space between flue lining and casing.

All patent chimneys shall be built plumb and without bends. All joints in such chimneys shall be made with cement mortar and the bands covering the joints shall be of not less than 24 U. S. Gauge galvanized iron. All patent chimneys shall be braced every six feet (6') in their height by not less than 16 gauge wire secured to the chimney by locks or collars and extending in at least three directions.

Not more than two inlets for smoke pipes will be permitted in any patent chimney. When only one inlet is provided the flue shall be not less than six inches (6") in diameter and shall be not less than eight inches (8") in diameter where two inlets are provided.

All galvanized iron used for the casing of patent chimneys shall be of 24 U. S. Gauge riveted together with rivets not more than three inches (3") apart or seamed and with such seams secured with rivets at the top and bottom of each section. There shall be not less than one inch (1") clearance between the chimney and the casing at all points and such casing shall be ventilated by not less than six one inch (1") holes punched near the top of the chimney above the roof and in each inlet to the chimney.

Sec. 3705. All smoke pipes shall be as short and straight as possible. Smoke pipes for furnaces, boilers or apparatus burning solid or liquid fuel shall be constructed of black iron of not less than 24 U. S. Gauge or masonry and shall fit tightly into the chimney. Galvanized iron shall not be used.

Smoke pipes shall enter the side of chimneys through a fire clay or metal thimble or a flue-ring of masonry. The top of smoke pipe intakes shall be set not less than eighteen inches (18") below sheet metal ceilings, wood lath and plaster or exposed wood framing. Neither the intake pipe nor the thimble shall project into the flue. No wood-work shall be placed within six inches (6") of the thimble. When a smoke pipe enters a chimney breast through a studded-off chimney partition the thimble shall be kept six inches (6") clear of all woodwork.
Sec. 3706. All fireplace walls shall be not less than eight inches (8") thick and if built of stone or hollow units shall be not less than twelve inches (12") thick. The faces of all such minimum thickness walls exposed to fire shall be lined with fire brick, soap stone, cast iron or other suitable fire-resistive material. When lined with four inches (4") of fire brick such lining may be included in the required minimum thickness. All fireplaces shall be connected to a regulation chimney as specified in Section 3701, or to a patent chimney as specified in Section 3704.

All fireplaces and chimney breasts shall have trimmer arches or other approved fire-resistive construction supporting hearths. The arches and hearths shall be not less than twenty inches (20") wide measured from the face of the chimney breast and not less than twelve inches (12") wider than the fireplace opening on each side. The arches shall be of brick, stone or hollow tile not less than four inches (4") thick. A flat stone or reinforced concrete slab may be used to carry the hearth instead of an arch if it be properly supported and a suitable fill provided between it and the hearth. Hearths shall be of brick, stone, tile or concrete. Wood centering under a trimmer arch shall be removed after the masonry has thoroughly set.

False fireplaces for gas or electrical heaters shall not be constructed in imitation of fireplaces unless complying with all the requirements for fireplaces. Gas and electrical space heaters may be installed in recesses not more than six inches (6") in depth, provided the entire recess is constructed of incombustible material. Such recesses shall be labeled by means of a metal plate bearing the words "For Gas and Electrical Appliances Only."

No heater burning solid or liquid fuel shall be placed in a fireplace which does not comply with the requirements of this Section. No such heaters shall be connected to a gas vent flue. No wood shall be placed within eight inches (8") of the jambs or within twelve inches (12") of the top or arch of any fireplace opening.

Sec. 3707. Warm air furnaces designed to burn solid or liquid fuel shall be encased in a double metal shield with an air space between and shall be protected with at least three inches (3") of sand on top and shall rest on masonry or concrete floors. No wood partitions shall be built within seven feet (7') of the front or four feet (4') of the sides of the outer shield of such furnaces, but the distance to the partitions at the side may be reduced to two feet (2') if they are covered with sheet metal or metal lath and plaster. The distance from the top shield of such furnace to any ceiling or framing of wood above shall be not less than twenty-four inches (24") unless such wood ceiling or framing is protected with not less than one-hour fire-resistive construction as specified in Section 4302.

Every furnace designed to burn solid or liquid fuel shall set upon a masonry floor or be placed on a bed of not less than four inches (4") of masonry and every portion thereof including the smoke pipe shall be at least two feet (2') from any combustible material or such combustible material shall be protected by a covering of No. 24 U. S. Gauge galvanized iron, furred with metal furring not less than one and one-half inches (1 1/2")
from such combustible construction or shall be entirely covered by one-hour fire-resistive construction. Any such furnace set in masonry shall be completely and tightly covered with at least four inches (4") of brick, concrete, tile, sand or a combination of such materials. Every such furnace shall be connected to a regulation chimney as specified in Section 3701.

Every gas furnace other than single pipe floor furnaces shall be set in a furnace room upon a masonry floor or shall be set upon not less than two inches (2") of masonry on asbestos board not less than one-half inch (½") in thickness covered with No. 20 U. S. Gauge galvanized iron or steel. The top of such furnace shall be not less than nine inches (9") from protected combustible material nor less than eighteen inches (18") from unprotected combustible material. Gas furnaces shall not be installed in any location inaccessible for inspection and repair. An opening or door not less than thirty by thirty-six inches (30"x36") shall be provided for access to the room or space in which any gas furnace is installed. Every such furnace shall be vented into a regulation chimney as specified in Section 3701 or as provided in Section 3703.

An air supply for combustion shall be provided for every warm air furnace. Such supply shall be from outside the building into the furnace space through one or more openings. Such openings shall have a net area of not less than four hundred square inches (400 sq. in.). No obstruction of any kind shall be placed over such openings except wire netting with openings not less than one-half inch (½") square. Air used for conveying heat and for ventilation may be taken from outside the building, from inside the building or from both sources. Where such air is taken from inside the building or from both inside and outside the building it shall be conducted to the furnace by means of ducts of incombustible material.

The furnace room or rooms shall be located in the basement or cellar of any building having a gravity system and the least horizontal dimension of such room shall be six feet (6'). The floor of the furnace room shall be not less than seven feet (7') in the clear below the bottom of the lowest joists of any floor under which lateral heat pipes from the furnace or furnaces are taken and such floor shall be constructed of incombustible materials.

Sec. 3708. Steam hot water heating plants, for not more than 15 pounds pressure, and hot water heaters using solid or liquid fuel, shall rest upon masonry or reinforced concrete floors and shall be protected on the outside by asbestos. The clearance of wooden partitions, ceilings, and other combustible materials shall be the same as given for warm air furnaces.

Sec. 3709. Large boilers for power or steam purposes or for generating high pressure steam shall be so located that no wood or other combustible material shall be less than five feet (5') from the top or sides or ten feet (10') from the front of such apparatus and all combustible material less than ten feet (10') from the top or sides or less than twenty feet (20') from the front shall be protected with at least four inches (4") of concrete, brick or other similar incombustible material and shall be well ventilated to prevent the temperature rising above 125 degrees Fahrenheit. Steel, cast iron or concrete columns ad-
Stoves

Sec. 3710. All stoves used for heating, cooking or laundry purposes using solid or liquid fuel shall have all combustible partitions in back of and extending not less than twelve inches (12") beyond each side of such stove protected by not less than one-hour fire-resistive construction. Such stoves shall be securely supported at least twelve inches (12") above any wood floors by metal supports and there shall be a metal and asbestos pad at least three-eighths inch (3/8") thick below such stove extending at least six inches (6") beyond each side and at least twelve inches (12") in front of such stove. Such stoves shall not be placed nearer than six inches (6") to any combustible partition.

All such stoves shall be connected by a smoke pipe conforming to the requirements of Section 3705 and to a chimney meeting the requirements of Section 3701.

Gas Ranges, Domestic Water Heaters, and Hot Plates

Sec. 3711. Gas ranges, domestic hot water heaters and hot plates shall be supported at least six inches (6") above any wood floor or other combustible material and where burners are not provided with a shield below, the wood or other combustible material shall be protected with a double metal shield with a one inch (1") air space between or with a one-half inch (1/2") pad of metal and asbestos. Combustible partitions or walls within six inches (6") of any gas range, hot plate or ordinary domestic hot water heater, and within three inches (3") of any approved domestic automatic storage hot water heater shall be protected by one-fourth inch (1/4") of asbestos, covered with a 26 U.S. gauge metal covering or shall have not less than a one-hour fire-resistive protection, provided that approved domestic gas ranges of the fully insulated type shall be exempt from the foregoing requirements. Wood ceiling or other combustible materials shall be at least three feet (3') above such installations. All water heaters shall be connected to a vent pipe meeting the requirements of Section 3703 or to a regulation chimney as specified in Section 3701.

In the kitchen of every building hereafter erected there shall be provided a chimney as provided in Section 3701, a vent as provided in Section 3703 or in lieu of such chimney or vent, when approved by the Building Inspector, there may be installed in the wall or ceiling approximately over the gas outlet, a ventilating opening with an area of not less than six inches by eight inches (6" x 8"), connected to a ventilating duct leading to the outside air, such duct for each kitchen to be not less than twenty-four square inches (24 sq. in.) in cross sectional area. An approved system of forced draft ventilation may be substituted for the natural draft ventilating system.

Gas Ranges for Restaurants and Hotels

Sec. 3712. Gas ranges for restaurants, bakeries or hotels shall be supported at least six inches (6") above any wood floor and if less than twelve inches (12") above the floor, the wood shall be protected by a metal shield or such ranges may rest on a steel and masonry support. Such ranges shall not be placed nearer to any wood partitions or other combustible material than six inches (6") and if nearer than twelve inches (12") such par-
tions shall be protected with a metal or asbestos shield. The
distance from any such range to any wood ceiling or other
combustible material above shall not be less than twelve inches
(12") and if less than three feet (3') the ceiling or combustible
material above shall be protected with a double metal shield
with one inch (1") air space between or with one inch (1") of
metal lath and portland cement plaster or one inch (1") of as-
bestos. Hood and ventilating flues from such ranges may be
of sheet metal or masonry and if of sheet metal shall be pro-
tected from all wood or other combustible materials by four
inches (4") of concrete, gypsum or terra cotta tile or an eight
inch (8") air space and a metal shield. Such ventilating flues
shall not be carried through wood floors or up combustible par-
titions unless protected by at least four inches (4") of masonry
or concrete.

Sec. 3713. Stoves, furnaces and other heating or power
apparatus in which oil burners are installed shall be constructed
and erected as required for similar apparatus using solid fuel.
Oil burning apparatus using commercial fuel oil, furnace
oil, diesel oil or other flammable liquids shall be constructed and
installed in compliance with the regulations of the National
Board of Fire Underwriters for the "Construction and Installa-
tion of Oil Burning Equipment and for the Storage and Use of
Oil Fuels in Connection Therewith" recommended by the Na-
tional Fire Protection Association, Edition of 1934, with amend-
ments of 1936.

Sec. 3714. Other sources of heat and flame not specific-
ally mentioned herein shall be constructed and so protected as
to prevent heating any wood or other combustible material used
in the construction of floors, ceilings, partitions or other parts
of a building to a temperature of over 125 degrees Fahrenheit,
when in full operation, and shall be so constructed as not to be
liable to undue corrosion or deterioration and not subject to
accidental overturn or other disarrangement conducive to dan-
gerous conditions.

Sec. 3715. For gravity systems no leader heat pipes shall
be over twenty feet (20') in length measured horizontally, except
where a booster fan is installed when such length shall not ex-
ceed forty feet (40'). All such pipes under first floor joists
shall have a uniform rise of at least one inch (1") per lineal
foot of horizontal run. Warm air pipes and appurtenances
serving first floor rooms shall have a minimum cross sectional
area in square inches of not less than the cubic foot capacity
of the room or rooms in which registers are located, divided by
40; provided, that no leader pipe shall have a net area less than
fifty square inches (50 sq. in.). Risers and appurtenances serving
floors above the first floor shall have a net area of not less than
two-thirds that required to serve the first floor.

Registers shall be located in or near the wall of the room
nearest the furnace. No register shall be located in outside walls
except in cases of absolute necessity. Where double registers
are supplied by one leader pipe each register shall have a
capacity of not less than two-thirds the area of the leader
pipe. When necessary to install appurtenances in an outside

1See "Specification Documents".
wall at least the weather side shall be covered with air-cell asbestos paper.

Ninety degree bends in round pipe shall be made by not less than four piece elbows. Sixty degree bends shall be made by means of not less than three piece elbows. All warm air pipes and fittings, cold air or recirculating pipes, ducts, boxes and fittings shall be made of bright tin or galvanized iron. All such appurtenances except leader heat pipes under the first floor shall be covered with two thicknesses of asbestos paper weighing at least eight pounds to one hundred square feet (100 sq. ft.) or with air-cell asbestos insulation, or shall be double walled with a one-fourth inch (¼") space between the inner and outer walls. Horizontal warm air pipes shall be kept at least three inches (3") from any combustible material or shall be protected with an asbestos shield and a one inch (1") air space. Air-cell asbestos paper not less than one-fourth inch (¼") in thickness shall be securely cemented around all leader pipes.

All riser pipes shall be braced or held in place by means of metal strips securely fastened to the pipe and shall in no case be held in place by nailing diagonally through the corners of such pipe. No joint shall depend wholly upon solder to make it tight. All leader pipes shall be securely fastened in place by means of wires or metal strips.

In the installation of Y runs or branch runs the cross sectional area of the warm air pipe at the furnace shall equal in square inches the cubic contents of all the rooms served by such warm air pipe divided by 40. Sizes of branch runs shall be determined in the same manner on the basis of the room or rooms served. Branches from trunk lines shall be taken off in a generally horizontal plane at an angle not more than 45 degrees from the line of the pipe. Fifteen degree Y branches may be permitted in forced draft systems. Riser pipes shall not be taken off the top of the first floor register boxes.

Where warm air pipes and appurtenances are to be installed in a building the joists and studs shall be so arranged as to provide not less than 14 inches (14") clear space in continuous horizontal runs and/or vertical risers from the furnace to the register served.

Incinerators

Sec. 3716. All incinerators which are built as an integral part of the building shall have the enclosing walls of the fire boxes or combustion chamber of solid masonry or reinforced concrete not less than eight inches (8") in thickness where the horizontal area does not exceed fifteen square feet (15 sq. ft.) and not less than twelve inches (12") in thickness where the combustion chamber is of greater area. The inner four inches (4") of such combustion chamber walls shall be of fire brick laid in fire clay or cement mortar, except that the walls surrounding the ash chamber below the fire grate need not be so lined. The inner walls of any combustion chamber shall not be offset in excess of one inch (1") for every three inches (3") of rise in the height of the wall unless supported by reinforced concrete or structural steel.

The chimney for every incinerator shall be constructed as specified in Section 3701, with an approved spark arrester placed over the top of the chimney.
CHAPTER 38—FIRE EXTINGUISHING APPARATUS

Sec. 3801. Standard automatic sprinklers shall be installed as specified in this Chapter in the following places:

1. In the cellar of every building.

2. In assembly buildings with a working stage: under the gridiron, under the stage floor, under all fly and tie galleries, in all dressing rooms, storerooms, property rooms, carpenter shops, paint shops, passageways and all places back of the proscenium wall. A line of sprinklers shall be installed on the stage side of, and immediately back of the proscenium curtain and not more than five feet (5') above the proscenium arch.

3. In all Group E occupancies occupied wholly or in part as a planing mill, box factory, wood working establishment where lumber is made into a finished product and in which more than two power operated wood working machines exclusive of saws are used.

4. In all Group E occupancies occupied wholly or in part as a mattress factory used to manufacture, assemble or renovate mattresses or stuffed furniture using cotton, silk floss, mohair or other like material for packing or stuffing.

5. In all Group E occupancies used as film exchanges.

6. In Group B and C occupancies in any enclosed occupied space below or over a stairway, except where the entire construction is as required for Type I buildings, and in all portions of basements or cellars used for storage or maintenance work rooms.

Exception: The above provisions shall not apply in the following places:

Automatic sprinklers shall not be required in the cellars of Group H and I occupancies having four or less apartments, nor in the cellars of Group C, D, E, F, G, and H occupancies when the ceiling of such cellar or basement is three feet (3') or more above grade, nor when such cellars or basements have an area of fifteen hundred square feet (1500 sq. ft.) or less.

Sec. 3802. Every automatic sprinkler system required by this Code shall comply in all respects with the regulations of the National Board of Fire Underwriters recommended by the National Fire Protection Association for the "Installation of Sprinkler Equipment" Edition of 1940.

Exceptions: A single water supply equal to the primary supply required by such regulations may be accepted as complying with the requirements of this Code. In no case where a connection to a city water main constitutes the source of supply shall such connection be less than four inches (4") in diameter.

Sprinklers required in paragraph 6, Section 3801, may be supplied from the domestic water system and need not comply with the provisions of this section except as to pipe sizes and spacing of heads, provided that where the domestic water supply has a pressure less than 15 pounds per square inch, an approved

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1See "Specification Documents".
automatic chemical extinguisher may be used in lieu of the sprinklers.

The alarm valve required for a standard automatic sprinkler system shall not be required in the cellars of Group B, C, D, E, F, G, and H occupancies where the area of such cellar is less than three thousand square feet (3000 sq. ft.).

Sec. 3803. Every building three or more stories in height shall be equipped with one or more dry standpipes.

Sec. 3804. (a) Construction. Dry standpipes shall be of wrought iron or galvanized steel and together with fittings and connections shall be of sufficient strength to withstand 300 pounds of water pressure to the square inch when ready for service, without leaking at the joints, valves or fittings.

Tests shall be conducted by the owner or contractor in the presence of a representative of the Fire Department whenever deemed necessary and ordered by the Building Inspector. The tests shall be applied at the top and bottom connections of such standpipes and the owner or contractor shall be responsible for any damage caused by breakage or faulty installation while such tests are being conducted. After such standpipes have been tested, the owner or contractor shall remove all water therefrom.

(b) Size. Dry standpipes shall be of such a size as to be capable of delivering 250 gallons per minute from each of any three outlets simultaneously under the pressure created by one fire engine or pumper, based on the existing city equipment available. No part of a dry standpipe system other than hose connections shall be less than three inches (3”) in diameter.

(c) Number Required. Every building three or more stories in height where the area of any floor above the second floor is ten thousand square feet (10,000 sq. ft.) or less shall be equipped with not less than one dry standpipe and an additional standpipe shall be installed for each additional ten thousand square feet (10,000 sq. ft.) or fraction thereof.

(d) Location. Standpipes shall be located within stairway enclosures or as near such stairways as possible or shall be on the outside of, embedded within, or immediately inside of an exterior wall and within one foot (1’) of an opening in a stairway enclosure or the balcony or vestibule of a smokeproof tower or an outside exit stairway.

(e) Siamese Connections. All four inch (4”) dry standpipes shall be equipped with a two-way Siamese fire department connection. All five inch (5”) dry standpipes shall be equipped with a three-way Siamese fire department connection and all six inch (6”) dry standpipes shall be equipped with a four-way Siamese fire department connection. All Siamese inlet connections shall be located on a street front of the building and not less than one foot (1’) nor more than four feet (4’) above the grade and shall be equipped with clapper-checks and substantial plugs. All Siamese inlet connections shall be recessed in the wall or otherwise substantially protected.
(f) Outlets. All dry standpipes shall extend from the ground floor to and over the roof and shall be equipped with a two and one-half inch (2½") outlet not more than four feet (4') above the floor level at each story. All dry standpipes shall be equipped with a two-way two and one-half inch (2½") outlet above the roof. All outlets shall be equipped with gate-valves with substantial chains.

(g) Threads. All hose threads in connection with such standpipe installations shall be uniform with that used by the local fire department.

(h) Signs. An iron or bronze sign with raised letters at least one inch (1") high shall be rigidly attached to the building adjacent to all Siamese connections and such sign shall read: "CONNECTION TO DRY STANDPIPE."

Sec. 3805. Every Group A, B and C occupancy of any height and every Group D, E, F, G and H occupancy three or more stories in height and every Group E and F occupancy over 20,000 square feet in area shall be equipped with one or more interior wet standpipes extending from the cellar or basement into the topmost story, provided that Group B and C buildings having no permanent stage and having a seating capacity of less than 500 need not be equipped with interior standpipes.

Sec. 3806. (a) Construction. Interior wet standpipes shall be constructed as required for dry standpipes.

(b) Size. Interior wet standpipes shall have an internal diameter sufficient to deliver 50 gallons of water per minute under 30 pounds per square inch pressure at the hose connection, based on the available water supply. Buildings of Groups A and B occupancies shall have wet standpipe systems capable of delivering the required quantity and pressure from any two outlets simultaneously, for all other occupancies only one outlet need be figured to be open at one time. In no case shall the internal diameter of a wet standpipe be less than two inches (2").

Any approved formula which determines pipe sizes on a pressure drop basis may be used to determine pipe sizes for wet standpipe systems. The Building Inspector may require delivery and pressure tests on completed wet standpipe systems before approving such systems.

(c) Number Required. Wet standpipes shall be so located that any portion of the building can be reached therefrom with a hose not exceeding seventy-five feet (75") in length.

(d) Location. In Groups A and B occupancies, outlets shall be located as follows:

On each side of the stage, on each side of the rear of the auditorium and on each side of the rear of the balconies. Where seating capacities are less than 500 the number of locations noted above may be reduced upon the approval of the Building Inspector. In Group C, D, E, F, G, and H occupancies the location of all interior wet standpipes shall be approved by the Building Inspector.

(e) Siamese Connections. All interior wet standpipes shall be equipped with a Siamese fire department inlet connection located
on the street front of the building and such connection shall have two inlets for buildings five stories or less in height, three inlets for buildings six to ten stories inclusive in height, and four inlets for buildings more than ten stories in height.

(f) Outlets. All interior wet standpipes shall be equipped with a one and one-half inch (1 1/2") straightway composition gate-valve in each story including the basement or cellar of the building and located not less than one foot (1') nor more than five feet (5') above the floor.

(g) Threads. All hose threads in connection with the installation of such standpipes, including valves and reducing fittings, shall be uniform with that used by the local fire department.

(h) Signs. An iron or bronze sign with raised letters at least one inch (1") high shall be rigidly attached to the building adjacent to all Siamese connections and shall read: “CONNECTION TO WET STANDPIPE.”

(i) Water Supplies. All interior wet standpipes shall be connected to a street water main of not less than four inches (4") in diameter or when the water pressure is insufficient to maintain 30 pounds pressure at the highest hose outlet such standpipe shall be connected to a pressure tank, gravity tank or fire pump. Such supply shall be sufficient to furnish at least 30 pounds pressure at the topmost standpipe outlet.

When more than one interior wet standpipe is required in the building, such standpipes shall be connected at their bases or at their tops by pipes of equal size.

(j) Pressure and Gravity Tanks. Tanks shall have a capacity sufficient to furnish at least 250 gallons per minute for a period of not less than 10 minutes. Such tanks shall be located so as to provide not less than 25 pounds pressure at the topmost hose outlet for its entire supply. Discharge pipes from pressure tanks shall extend two inches (2") into and above the bottom of such tanks. All tanks shall be equipped with a manhole, ladder and platform, drain pipe, water and pressure gauges. Every pressure tank shall be tested in place after installation and proved tight at a hydrostatic pressure 50 per cent in excess of the working pressure required. Where such tanks are used for domestic purposes the supply pipe for such purposes shall be located at or above the center line of such tanks. Incombustible supports shall be provided for all such supply tanks and not less than a three foot (3') clearance shall be maintained over the top and under the bottom of all pressure tanks.

(k) Fire Pumps. Fire pumps shall have a capacity of not less than 250 gallons per minute with a pressure of not less than 25 pounds at the topmost hose outlet. The source of supply for such pumps shall be a street water main of not less than four inch (4") diameter or a well or cistern containing a one-hour supply. Such pumps shall be supplied with an adequate source of power and shall be automatic in operation.

(l) Hose and Hose Reels. Each hose outlet of all interior wet standpipes shall be supplied with a hose not less than one and one-half inches (1 1/2") in diameter. Such hose shall be equipped
with a suitable brass or bronze nozzle and shall be not over seventy-five feet (75') in length. An approved standard form of wall hose reel or rack shall be provided for the hose and shall be located so as to make the hose readily accessible at all times and shall be recessed in the walls or protected by suitable cabinets.

Sec. 3807. Basement pipe inlets shall be installed in the first floor of every store, warehouse or factory where there are cellars or basements under same, except where in such cellars or basements there is installed an automatic sprinkler system as specified by this Code, or where the cellars or basements are used for banking purposes, safe deposit vaults or similar uses.

All basement pipe inlets shall be of cast iron, steel, brass or bronze with lids of cast brass or bronze and shall consist of a sleeve not less than eight inches (8") in diameter through the floor extending to and flush with the ceiling below and with a top flange, recessed with an inside shoulder, to receive the lid and flush with the finish floor surface. The lid shall be a solid casting and have a ring lift recessed in the top thereof, so as to be flush. The lid shall have the words "Fire Department Only, Do Not Cover Up," cast in the top thereof. The lid shall be installed in such a manner as to permit its removal readily from the inlet.

The location of such basement pipe inlets shall be approved by the Building Inspector and shall be kept readily accessible at all times to the Fire Department.

Sec. 3808. All fire extinguishing apparatus, including automatic sprinklers, wet and dry standpipes, automatic chemical extinguishers, basement pipe inlets and the appurtenances there-to shall meet the approval of the chief of the Fire Department as to installation and location and shall be subject to such periodic tests as he may require.

Sec. 3809. Where it is desired to require flame-protection of all stage scenery provisions will be found in the Appendix.
CHAPTER 39—STAGES AND PLATFORMS

Sec. 3901. There shall be one or more ventilators constructed of metal or other incombustible material near the center and above the highest part of any working stage raised above the stage roof and having a total ventilation area equal to at least five per cent of the floor area within the stage walls. The entire equipment shall conform to the following requirements or their equivalent:

1. Doors shall open by force of gravity sufficient to overcome the effects of neglect, rust, dirt, frost, snow or expansion by heat or warping of the framework.

2. Glass, if used in ventilators, must be protected against falling on the stage. A wire screen, if used under the glass, must be so placed that if clogged it cannot reduce the required ventilating area or interfere with the operating mechanism or obstruct the distribution of water from the automatic sprinklers.

3. The doors and other covers shall be arranged to open instantly after the outbreak of fire, by the use of approved automatic fusible links which will fuse and separate at not more than 160 degrees Fahrenheit. A manual control must also be provided by a cord running down to the stage at a point on each side of the stage designated by the Building Inspector.

4. The fusible link and the cord must hold the doors closed against a force of at least 30 pounds excess counter weight tending to open the door. The fusible links shall be placed in the ventilator above the roof line and in at least two other points in each controlling cord and so located as not to be affected by the sprinkler heads above. Each stage ventilator shall be operated to an open and closed position at least once before each performance.

Sec. 3902. Gridirons, fly galleries and pin-rails shall be constructed of incombustible materials and fire-protection of steel and iron may be omitted. Gridirons and fly galleries shall be designed to support not less than 75 pounds live load per square foot.

The main counter-weight sheave beam shall be designed to support a horizontal and vertical uniformly distributed live load equal to not less than five pounds per square foot over the area of the gridiron directly back of the proscenium opening.

Sec. 3903. In buildings having a working stage, the dressing room sections, workshops, and storerooms shall be located on the stage side of the proscenium wall and shall be separated from each other and from the stage by not less than a “Special Occupancy Separation.”

In buildings having any stage other than a working stage, the dressing room section, workshops and storerooms shall be separated from each other and from the rest of the building by not less than an “Ordinary Occupancy Separation.”

Sec. 3904. A working stage as defined in Section 401 shall be completely separated from the auditorium by a proscenium wall of not less than four-hour fire-resistive construction.
The proscenium wall shall extend not less than four feet (4') above the roof over the auditorium.

Proscenium walls may have, in addition to the main proscenium opening, one opening at the orchestra pit level and not more than two openings at the stage floor level, each of which shall be not more than twenty-five square feet (25 sq. ft.) in area.

Openings in the proscenium wall of a working stage shall be protected on each side by one-hour fire-resistive doors. The proscenium opening, which shall be the main opening for viewing performances, shall be provided with a self-closing fire-resistive curtain as provided in Chapter 41.

Sec. 3905. All parts of working stage floors shall be of Type I construction except the part of the stage extending back from and the full width of the proscenium opening, which may be constructed of steel or heavy timbers covered with a wood floor not less than two inches (2'') nominal thickness. No part of the combustible construction except the floor finish shall be carried through the proscenium opening. All parts of the stage door shall be designed to support not less than 125 pounds per square foot.

Openings through stage floors shall be equipped with tight-fitting trap doors of wood not less than two inches (2'') nominal thickness.

Sec. 3906. Walls and ceilings of a platform in an assembly room shall be protected on the platform side with lath and plaster as approved for one-hour fire-resistive construction.

Any usable space under a raised platform of an assembly room shall be of one-hour fire-resistive construction throughout.

Sec. 3907. At least one exit two feet and six inches (2' 6'') wide shall be provided from each side of the stage opening directly or by means of a passageway not less than three feet (3') in width to a street or exit court. An exit stair not less than two feet six inches (2' 6'') wide shall be provided for egress from each fly gallery. Each tier of dressing rooms shall be provided with at least two means of egress each not less than two feet six inches (2' 6'') wide and all such stairs shall be constructed as specified in Chapter 33. The stairs required in this Subsection need not be enclosed.

Sec. 3908. A protecting hood shall be provided over the full length of the stage switchboard.
CHAPTER 40—MOTION PICTURE MACHINE BOOTH

Sec. 4001. Every motion picture machine using flammable films, together with all electrical devices, rheostats, sewing machines and all such films present in any Group A, B or C occupancy, shall be enclosed in a booth large enough to permit the operator to walk freely on either side or in back of the machine and shall be not less than seven feet (7') high and have a floor area of not less than fifty square feet (50 sq. ft.) to each motion picture machine in such booth.

The floor of such booth shall be constructed of masonry or reinforced concrete or shall be covered with not less than two inches (2") of masonry. The walls and ceiling shall be of not less than one-hour fire-resistive construction.

The entrance to booth shall be equipped with a tight-fitting self-closing fire door of Types 4, 5 or 6 as specified in Section 4304. Such door shall open outwardly and shall not be equipped with any latch.

Machine and observation ports in machine booth walls shall be of three kinds; projection ports, observation ports, and combination observation and spot light ports. These ports shall be limited in size and number as follows: There shall be not more than one projection port for each machine head, including stereopticon machines. The area of each projection port shall be not more than one hundred twenty square inches (120 sq. in.). There shall be not more than one observation port for each projection port and their area shall not exceed one hundred fifty square inches (150 sq. in.) each. There shall be not more than three combination observation and spotlight ports and they shall not exceed thirty inches (30") by twenty-four inches (24"). Where the openings in the front wall of the projection booths are larger than the ports specified, they may be reduced to the required size by bolting No. 10 U. S. gauge steel plate over the opening on the booth side of the wall, in such a manner that they cannot be readily removed or moved on the slides. These steel plates shall have the openings of the required size cut in them. There shall be not less than one foot (1') of wall space between openings for combination ports. In no case shall the openings which are to be reduced in size by the steel plate be larger than thirty-six inches (36") square. Each port opening in the projection booth wall shall be completely covered with a single pane of plate glass. Each such opening together with any fresh air inlets, shall be provided with a shutter of not less than No. 10 U. S. gauge sheet metal large enough to overlap at least one inch (1") on all sides of such opening and arranged to slide without binding. These shutters shall be held normally open by means of small chains fastened to a 160 degree Fahrenheit fusible link, the whole so arranged that the shutters may be easily released and closed either by hand or automatically when released by the fusible link and shall be so designed as to effect a weight of not less than eight pounds on each fusible link. Pieces of film shall not be used in place of fusible links. The shutters shall be so hung that the operation of closing shall be
smooth and without noise. The closing of all shutters shall be effected in five seconds.

Every booth shall be equipped with a ventilating inlet not less than thirty square inches (30 sq. in.) in area placed near the floor on each of three sides, and protected by wire netting. At the top of every booth there shall be at least a ten inch (10") diameter vent for each motion picture machine. Such vent shall be constructed of sheet metal not less than No. 24 U. S. gauge and shall connect into a masonry flue or go directly through the roof and twelve inches (12") above, and shall be provided with an exhaust fan which will produce a complete change of air in the booth every 10 minutes. No wood or other combustible material shall be allowed to come within four inches (4") of the vent. There shall be not more than one elbow or change in direction of this metal vent in any attic space. No such vent shall pass through any occupied room unless encased in not less than four inches (4") of solid masonry.

All shelves, furniture and fixtures within the booth shall be constructed of metal or other incombustible material. Every motion picture machine shall be securely fastened to the floor to prevent overturning.

All films not in actual use shall be stored in metal cabinets or boxes constructed of galvanized iron or steel with metal partitions and shelves. Each such compartment shall have a capacity not in excess of 10 reels of film, and shall have tight self-closing doors of iron or steel. No solder shall be used in the construction of such metal boxes or cabinets.
CHAPTER 41—PROSCENIUM CURTAINS

Sec. 4101. Proscenium curtains when required shall be made of incombustible materials constructed and mounted so as to intercept hot gases, flames and smoke, and to prevent glow from a severe fire on the stage showing on the auditorium side within a period of five minutes. The curtain shall be raised and lowered each evening at the close of the performance. The closing of the curtain from the full open position shall be effected in less than thirty seconds, but the last five feet (5') of travel shall require not less than five seconds.

Sec. 4102. A proscenium curtain for stage openings over sixty feet (60') in width shall comply with the regulations contained in “Appendix P” of the building code recommended by the National Board of Fire Underwriters, Fifth Edition, revised reprint, 1934, or with the regulations contained in “Schedule for Rating Theaters and Motion Picture Halls” of the Board of Fire Underwriters of the Pacific, Revision of September 10, 1930. A proscenium curtain for stage openings sixty feet (60') or less in width, shall be constructed and installed as specified in this Chapter. The curtain shall be made of one thickness of asbestos cloth weighing not less than three and one-quarter pounds per square yard.

The asbestos cloth used in the construction of the curtain shall have incorporated into the yarn before weaving, either monel metal, nickle, brass or other metal or alloy having not less strength than these metals at temperatures up to 1700 degrees Fahrenheit and no less resistance to corrosion at ordinary temperatures. Asbestos cloth made of long fiber blue crocidolite asbestos may be used in place of crysotile asbestos cloth of the same weight. The wires used to reinforce the yarn shall be either single or double but the tensile strength of each wire shall be sufficient to support a load of not less than three pounds at ordinary temperatures, and the strength of two strands of yarn and one wire twisted together shall be sufficient to support a load of six pounds. The strength of the cloth in tension when tested by the strip method shall be not less than 160 pounds per inch of width of warp and 52 pounds per inch of filling.

The asbestos fiber of yarns may contain cotton or other combustible fiber not to exceed 20 per cent of the weight of the asbestos. The total carbon content of the cloth shall not exceed 10 per cent of the total weight of the fiber. When required by the Building Inspector, a sample of the cloth of sufficient size for testing shall be submitted.

In addition to any decoration, the curtain shall be painted on both sides with a mineral paint having a silicate of soda binder, which will completely fill the cloth. Filler paint shall have not less than four parts of casein in each 10 parts of silicate of soda. This paint shall be well brushed into the cloth so that no light or smoke can come through.

Sec. 4103. The curtain shall be made of continuous vertical strips of asbestos cloth. The widths of cloth shall overlap at the seams not less than one inch (1") and shall be sewed with a double row of stitching of asbestos thread.

The curtain shall be wide enough to extend into steel smoke grooves on each side of the proscenium opening at least eight

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Inches (8"") and shall overlap the top and sides of the proscenium opening at least twelve inches (12"").

Six-inch (6"") pockets shall be sewed in the top and the bottom of the curtain to hold the pipe battens; the sides shall be hemmed at least six inches deep. A two-inch pipe batten shall be placed at the top and a one and one-half inch (1½"") batten at the bottom. For stage openings over forty feet (40') in width the bottom batten shall be not less than two and one-half inches (2½"") in diameter. The battens shall be reinforced at the joints with twelve-inch (12"") sections of pipe housed and riveted.

The curtain shall be held to the steel guides in the smoke pockets with substantial roller grips riveted or bolted to the side hem, not more than eighteen inches (18"") on center. Each roller grip shall be fastened to the curtain with not less than three bolts or rivets.

No. 16 U. S. gauge galvanized metal shall be bent and placed vertically along each side hem of the curtain material, so that both faces of the hem are covered not less than six inches (6""). This metal edging shall be fastened to the side hem with rivets spaced not more than six inches (6"") on center.

The top of the curtain shall have a smoke stop fitted to make it as smoke-tight as practicable. The bottom of the curtain shall have a yielding pad of incombustible material not less than three inches (3"") thick to form a seal against the floor.

Sec. 4104. Smoke grooves which protect the sides of the curtain shall be of structural steel shapes and plates not less than one-quarter inch (¼"") thick. These grooves shall be not less than fourteen inches (14"") deep and six inches (6"") wide and shall be set back from the face of the arch at least six inches (6""). Grooves shall extend from the stage floor to a point three feet (3') above the top of the raised curtain, and shall be securely bolted to the proscenium wall. Details of the grooves shall be submitted to the Building Inspector and Fire Chief for approval.

Steel tracks shall be built into the smoke grooves upon which shall travel the roller curtain guides. This track must be so installed that it is held rigidly in place and so that roller guides will operate smoothly. Safe support and smooth operation are required with a wind load of one pound per square foot over the entire area of the curtain.

Support for the curtain shall be by means of one-quarter-inch (¼"") flexible steel cables for curtains forty feet (40') or less in width, and three-eighths-inch (⅜"") flexible steel cables for curtains over forty feet (40') in width. These cables shall be spaced not more than twelve feet (12') on centers, and the end overhang shall be not more than fifteen inches (15""). Supporting cables shall be tied to the top batten with a clove-hitch and the end secured with two iron rope clips. A substitute method of attachment will be allowed if approved by the Building Inspector.

The supporting cables shall pass through sheaves in the gridiron and over to the counter-weight guides and shall fasten to the counter-weight by means of three-eighth-inch (⅜"") turn-
buckles with clove-hitches and cable clips. Turnbuckles shall be locked to prevent backing out. Weight of the curtain shall be evenly divided on the cables.

There shall be safety stay chains of straight welded link fastened to the top curtain batten of sufficient strength to support safely the weight of the curtain. There shall be one more stay chain than the number of supporting cables and, except for the stay chains at the ends of the curtain, shall be centered between the supporting cables. Stay chains shall be securely attached to the top batten of the curtain and thence to the gridiron, if of steel construction, or shall be bolted through the proscenium wall with three-fourths-inch (¾") bolts. Safety chains shall be so adjusted that they support the curtain when it is lowered and the bottom batten is resting on the pad supported by the floor.

All cables shall be carried over head and loft blocks fitted with ball or roller bearings of ample capacity to accommodate the weight at the speeds required. Grooves in the blocks shall be machined properly to cradle and protect the cable. All blocks supporting the proscenium curtain shall be supported on the proscenium wall by means of steel brackets of suitable size safely to carry the weight, or shall be mounted on structural steel beams.

Blocks shall be installed so that the head-block is sufficiently higher than the loft blocks to prevent cables from fouling loft block housings.

Diameters of the blocks shall be a minimum of twelve inches (12") for three-line sets and sixteen inches (16") for all other sets.

The mechanism and devices for controlling the curtain shall be of simple design and shall be positive in operation. Opening of the curtain shall be by hydraulic or electric power. For curtains where the overbalance on the curtain side does not exceed 150 pounds, manual operation may be used. In this case, manual operation will be allowable only if a method is provided which allows the curtain and counterbalance to be approximately equal under normal conditions, but which adds the required over-weight on the curtain side automatically in case of an emergency.

Emergency release shall be by gravity obtained by over-balancing the curtain. The emergency control line shall be of cotton sash cord, fitted with not less than four fusible links, one on each side of the stage and two overhead in the gridiron, which when the links are fused or the sash cord burned will allow the curtain to lower itself automatically. This control line shall extend up both sides of the proscenium arch and across the gridiron, and shall be so arranged that when released it will also automatically open the stage ventilators.

On each side of the proscenium arch, at a location in plain view shall be located an easily read sign, bearing the inscription: "In case of fire, cut line to lower fire curtain," with an indicator pointing to the location of a knife for that purpose. The knives shall be attached to the wall by a chain sufficiently long to reach the release line.
For electric operation there shall be installed push buttons plainly marked: "Fire Curtain—stop; Fire Curtain—down." One set of control buttons shall be installed on each side of the proscenium opening. For hydraulic or manual operation the endless line shall be marked plainly with an arrow pointing the direction for closing.

For manual operation the operating hand line shall be not less than three-fourths inch (\(\frac{3}{4}\)"") diameter manila rope secured to the top and bottom of the counterweight arbor, and shall pass under a floor block, adjustable for tension, of not less than twelve-inch (12"") diameter.

The top and bottom counterweight sections of the arbor shall be of cast iron, sufficiently heavy to accommodate safely the loads. The top and bottom sections shall be connected with rods not less than three-fourths-inch (\(\frac{3}{4}\)"") diameter, with one tie-plate for every four feet (4') of rod. There shall be smooth grooves on the ends of the top and bottom weights which engage the steel guides. Intermediate weights shall be of cast iron, grooved to drop into place on top of the lower carrying weight. The turnbuckles connecting the supporting cables to the top weight shall be attached to eye-bolts passing through the top weight.

Counterweight guide tracks shall be structural "T's" or angles, properly tied together and securely anchored to the proscenium wall. All joints where the counterweight travels shall be ground smooth and a liberal coating of grease shall be applied to the tracks. These guides shall extend from the gridiron a length equivalent to the length of the arbor, plus the travel of the curtain, plus five feet (5'). The specified length shall be considered as the minimum. A structural steel stop shall be provided at the bottom of the arbor.

For proscenium curtains in which the overbalance is in excess of 150 pounds, an approved adjustable checking device shall be installed to check the speed of fall during the last five feet (5') of travel and an alarm shall be installed at the center of the top of the proscenium arch, which will sound when the curtain is descending through the emergency release.

Sec. 4105. The complete installation of every proscenium curtain shall be subjected to operating tests and any theater in which such proscenium curtain is placed shall not be opened to public performances until after the proscenium curtain has been accepted and approved by the Building Inspector.

Sec. 4106. Curtains of other designs and materials, when not obviously of greater fire resistance than specified in this Chapter, shall before acceptance be subjected to the standard fire test specified in Chapter 42, as applicable to non-bearing partitions, except that such tests shall be continued only for a period of five minutes unless failure shall have occurred previously. The unexposed face of the curtain shall not glow within a period of five minutes nor shall there be any passage of smoke or flame through the curtain.
PART VIII

FIRE-RESISTIVE STANDARDS FOR
FIRE PROTECTION

CHAPTER 42—GENERAL

Sec. 4201. Building materials, systems, units and forms of
construction as regulated by this Code shall be classified as
"four-hour fire-resistant construction," "three-hour fire-resistant
construction," "two-hour fire-resistant construction" and "one-
hour fire-resistant construction," for fire-resistant purposes and
protection. Materials, systems, units and forms of construction,
in order to be classed as four-hour, three-hour, two-hour or
one-hour fire-resistant construction shall meet the respective
requirements for such rating as specified in the A.S.T.M. "Standard
Specifications for Fire Tests of Building Construction and
Materials," (C19-41).

Any materials, systems, units or forms of construction which
meet the requirements of the aforesaid standard specifications
shall be accepted as fire-resistant construction of the degree
specified, if and when they shall be shown by an authoritative
test conducted in accordance with all of the provisions of such
aforesaid specifications, to possess such fire resistance.

Sec. 4202. The following materials, combinations of ma-
terials, systems and units shall be classed as fire-resistant ma-
terials:

Brick
Concrete brick, block or tile
Gypsum block or tile
Gypsum (plain or reinforced)
Gypsum plaster board (or lath) and plaster.
Hollow clay tile
Metal
Metal and asbestos
Metal lath and plaster
Portland cement concrete (plain or reinforced)
Sand-lime brick

Sec. 4203. All fire-resistant construction of burned clay,
concrete or gypsum units or other similar units shall be solidly
bedded and laid in gypsum mortar, lime-cement mortar or ce-
ment mortar; provided, that gypsum units shall be laid in
gypsum mortar only. All such units shall be thoroughly bonded
together by broken joints in alternate courses or by sufficient
metal ties or bonds.

All concrete, gunite, gypsum or similar protection for steel
or iron structural members which is cast, poured or similarly
applied shall be reinforced at the edges of such members in a
manner sufficient to prevent cracking and disintegrating of such protection. All such applied fire protection materials shall be reinforced by metal rods, wire or mesh to provide against cracking and disintegrating of the protecting material.

All plaster fire protection shall consist of gypsum mortar, portland cement mortar or other equally fire-resistive material. Gypsum plaster only shall be used for plastering on gypsum units. When plaster is used for fire protection purposes it shall be reinforced with a metal mesh or lath when the plaster is more than one inch (1") thick. Gunite applied to masonry need not be reinforced and when properly bonded shall be considered a part of the required thickness.

Gypsum lath as specified in Chapter 43 shall be three-eighths inch (\(\frac{3}{8}\)) in thickness and shall have perforations not less than three-quarters inch (\(\frac{3}{8}\)) in diameter, distributed over the face of the lath and comprising not less than two and three-quarters per cent of the area of the lath.
CHAPTER 43—FIRE-RESISTIVE STANDARDS

Sec. 4301. The thickness of fire-resistive materials for fire protection of structural parts shall be as shown in Table No. 43-A for the respective degree of fire protection shown. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space or spaces between the fire-protecting materials and the member protected. The thickness of plaster protection shall be measured from the face of the plaster to the plane of the back surface of the metal or wire lath where such lath is used and shall include two-thirds of the thickness of the gypsum plaster board (or lath) where such board (or lath) is used.

Grade A concrete shall mean concrete with a coarse aggregate of limestone, pumice, calcareous pebbles, trap rock, blast furnace slag, burnt clay, burnt shale or other coarse aggregates containing not more than 65 per cent of siliceous material, such as granite, sandstone, chert pebbles, flint, or quartz.

Grade B concrete shall mean concrete with a coarse aggregate other than that allowed in Grade A concrete.

Soffit tile protecting beam and girder flanges shall be tied to the flange with steel or iron ties.

If the structural part is of iron or steel the thickness given in Table No. 43-A shall be measured outside of the extreme edges of the structural shapes, except that projecting edges of lugs and brackets shall be given a minimum protection of one-inch (1") thickness. For reinforced concrete members, the thickness given in Table No. 43-A shall be outside of the reinforcement. For purposes of design the protection shall not be considered as carrying load except as permitted for columns in Section 2620.

Plaster protection of over one inch (1") in thickness shall have, in addition to the required mesh or lath, a layer of metal lath, wire or metal mesh embedded not more than three-fourths inch (3/4") from the surface and securely tied into the supporting members.

Wire of not less than No. 10 B. and S. gauge wound or tied around members at not more than a six-inch (6") pitch, or wire or expanded metal mesh shall be placed and well embedded in all concrete, poured gypsum and gunite protections.

Wire mesh or other forms of metal ties in concrete protections shall be held away from the structural members and embedded in the protection not less than three-fourths inch (3/4") from its outer surface at points of minimum thickness. Hollow tile or gypsum block protections shall have iron or steel ties embedded in each horizontal joint, or have outside iron or steel ties over each unit, the diameter of wire to be 0.18 inch, or of equivalent area in ties of other forms. Wire mesh, where used for tying protections, shall weigh not less than one and one-half pounds per square yard. Where metal lath or wire mesh is used as a plaster base or tie it shall weigh not less than two and two-tenths pounds per square yard, and shall have two and one-half or more meshes per inch or equivalent.

Sec. 4302. Fire-resistive bearing and non-bearing walls and partitions shall be of not less than the thicknesses and construction specified in this Chapter, to be classed for the respective degrees of protection indicated.
TABLE NO. 43-A — MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS INCOMBUSTIBLE INSULATING MATERIALS

<table>
<thead>
<tr>
<th>Structural Parts to Be Protected</th>
<th>Insulating Material Used</th>
<th>Minimum thickness of material in inches for the following fire resistant periods: 4 hr. 3 hr. 2 hr. 1 hr.</th>
</tr>
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<tbody>
<tr>
<td>Steel or Cast Iron Columns; Projecting Steel Beam or Girder Flanges; All Members of Primary Trusses</td>
<td>Grade A concrete</td>
<td>2  2  1½  1</td>
</tr>
<tr>
<td></td>
<td>Grade B concrete</td>
<td>3  2½  2  1½</td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Brick of clay, shale, concrete or sand-lime</td>
<td>3½  3½  2½  1½</td>
</tr>
<tr>
<td></td>
<td>Clay tile, clay tile and concrete or concrete block (see note 2)</td>
<td>4 or 4 or 2  2</td>
</tr>
<tr>
<td></td>
<td>Solid gypsum blocks</td>
<td>2 pl.  2 pl.</td>
</tr>
<tr>
<td></td>
<td>Hollow gypsum blocks</td>
<td>3 pl.  3  2  2</td>
</tr>
<tr>
<td></td>
<td>Poured gypsum</td>
<td>2  1½  1  1</td>
</tr>
<tr>
<td></td>
<td>Metal lath and gypsum or portland cement plaster</td>
<td>...  ...  2½  1</td>
</tr>
<tr>
<td>Webs of Steel Beams and Girders</td>
<td>Grade A concrete</td>
<td>2  1½  1  1</td>
</tr>
<tr>
<td></td>
<td>Grade B concrete</td>
<td>3  2½  1½  1</td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Brick of clay, shale, concrete or sand-lime</td>
<td>3½  2½  2½  2½</td>
</tr>
<tr>
<td></td>
<td>Clay tile, clay tile and concrete or concrete block</td>
<td>3 or 2  2  2</td>
</tr>
<tr>
<td></td>
<td>Solid gypsum block</td>
<td>2 pl.  2  2  2</td>
</tr>
<tr>
<td></td>
<td>Hollow gypsum block</td>
<td>3 pl.  2  2  2</td>
</tr>
<tr>
<td></td>
<td>Poured gypsum</td>
<td>2  1½  1  1</td>
</tr>
<tr>
<td></td>
<td>Metal lath and gypsum or portland cement plaster</td>
<td>...  ...  2  1</td>
</tr>
<tr>
<td>Reinforcing Steel in Reinforced Concrete Columns, Beams, Girders and Trusses</td>
<td>Grade A concrete</td>
<td>1½  1½  1½  1</td>
</tr>
<tr>
<td></td>
<td>Grade B concrete</td>
<td>2  1½  1½  1</td>
</tr>
<tr>
<td>Reinforcing Steel in Reinforced Concrete Joists</td>
<td>Grade A concrete</td>
<td>1½  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Grade B concrete</td>
<td>1½  1½  1  %</td>
</tr>
<tr>
<td>Ceiling Protection for Roof Members including Roof Trusses and Secondary Trusses</td>
<td>Metal or wire lath and gypsum or cement plaster, concrete, burned clay products or gypsum</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>1½  1  %  %</td>
</tr>
<tr>
<td>Reinforcing and Tie Rods in Floor and Roof Slabs</td>
<td>Grade A concrete</td>
<td>Thickness 1  1  %  %</td>
</tr>
<tr>
<td></td>
<td>Grade B concrete</td>
<td>includes gypsum or cement plaster 1  1  %  %</td>
</tr>
<tr>
<td></td>
<td>Gypsum</td>
<td>1  1  %  %</td>
</tr>
</tbody>
</table>

NOTE: (1) pl. in above table shall be not less than ½ in. gypsum or cement plaster.
(2) Reentrant parts of protected members shall be filled solid for 4 and 3 hour protections.
   • Two ½ in. layers with ¾ in. air space between.
The structural requirements of the masonry and reinforced concrete walls shown in Table No. 43-B are specified in Chapters 24 and 29 for the specific location or use of the walls and all walls shall comply with those structural requirements as well as the fire-resistive limitations as specified in this Chapter.

The tabulated thicknesses given in Table No. 43-B are minimum and shall not be broken into; provided that where combustible floor or partition members project into solid masonry or reinforced concrete walls or partitions the required effective thickness of wall shall be measured from two inches (2") back along the member from the end in the wall, to the opposite face of the wall. Where such members project into hollow walls and the space between the members and for not less than four inches (4") above and below them is filled solid with fire-resistive incombustible materials for the full thickness of the wall, or where such hollow walls are constructed of hollow units laid with cells horizontal (side construction) the required thickness shall be measured as specified for solid masonry walls in this paragraph. Where hollow units are laid with cells vertical (end construction) and the hollow spaces are not thus filled, the required effective thickness of walls shall be measured from the ends of members in walls to the opposite face of the wall.

Plaster, in order that it may be considered as adding to the fire resistance of walls and partitions shall be gypsum or portland cement plaster applied to an average thickness of not less than one-half inch (\(\frac{1}{2}\)""). Plaster over one inch (1") in thickness, as measured to the plaster base, shall have, in addition to the required mesh or lath, a layer of metal lath, wire or metal mesh embedded not more than three-fourths inch (\(\frac{3}{4}\)"") from the surface and securely tied into the supporting members.

Required fire-resistive plastering or stucco on the outside of exterior masonry walls may be omitted from inaccessible portions of the wall provided the inside plastering opposite the inaccessible portions is doubled in thickness.


Metal or wire lath shall weigh not less than two and two-tenths pounds per square yard. Metal or wire mesh where used as ties in concrete shall weigh not less than one and one-half pounds per square yard. Where used as ties for plaster it shall weigh not less than two and two-tenths pounds per square yard and have not less than two and one-half meshes per inch, or equivalent.

Wood studs for bearing partitions or walls shall be not less than the two inch by four inch (2"x4") nominal size and be spaced not more than sixteen inches (16") apart.

Sec. 4303. Fire-resistive floor construction shall be accepted for the following respective degrees of fire-resistive protection when constructed as specified in this Section. For the structural details of any floor construction, the particular details specified under Part VI of this Code shall govern.
### TABLE NO. 43-B—Rated Fire-Resistive Periods for Various Walls and Partitions

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>CONSTRUCTION</th>
<th>Minimum Finished Thickness face to face (including plaster where mentioned) in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4-hr.</td>
</tr>
<tr>
<td>Brick of Clay, Shale, Sand-Lime or Concrete, and Plain Concrete</td>
<td>Solid unplastered</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Solid plastered</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Hollow (rowlock) unplastered</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Hollow (rowlock) plastered</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>End or side construction. One cell in wall thickness. Plastered</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End or side construction. Two cells in 8-in. or less thickness. Unplastered</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>End or side construction. Two cells in 8-in. or less thickness. Plastered</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>End or side construction. Two cells in wall thickness. Unplastered</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End or side construction. Two cells in wall thickness. Plastered</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End or side construction. Three cells in 8-in. or less thickness. Unplastered</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End or side construction. Three cells in 8-in. or less thickness. Plastered one side</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End or side construction. Three cells in 8-in. or less thickness. Plastered</td>
<td></td>
</tr>
<tr>
<td>Combination of Brick and A. S. T. M. Load-Bearing Tile, or Hollow Concrete Block or Tile</td>
<td>4-in. brick and 4-in. tile plastered one side (tile side)</td>
<td>9</td>
</tr>
<tr>
<td>Concrete Block or Tile</td>
<td>Aggregate—Brick, Clay or Fire Brick</td>
<td>1(\frac{3}{4})-in. face Shells</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Expanded Slag, Burned Clay or Shale, Cinders</td>
<td>1(\frac{3}{4})-in. face Shells</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unplastered</td>
</tr>
<tr>
<td>Other Aggregates—</td>
<td></td>
<td>1(\frac{3}{4})-in. face Shells</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unplastered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plastered each side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unplastered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plastered each side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unplastered</td>
</tr>
<tr>
<td>Solid Concrete</td>
<td>Solid Gunit</td>
<td>Reinforcement not less than 0.2% in each direction</td>
</tr>
<tr>
<td>Hollow Gypsum Blocks</td>
<td></td>
<td>Reinforcement not less than 0.2% in each direction or 6</td>
</tr>
<tr>
<td></td>
<td>Plastered each side</td>
<td>6*</td>
</tr>
<tr>
<td>Hollow Wall of Reinforced Gunit</td>
<td>Outer shell 2-in. thick for 10-in. wall and 1(\frac{3}{4})-in. thick for 8-in. wall</td>
<td>10*</td>
</tr>
<tr>
<td>Solid Gypsum or Portland Cement Plaster</td>
<td>Incombustible stud with metal or wire lath</td>
<td>2*</td>
</tr>
<tr>
<td></td>
<td>Incombustible stud with metal or wire lath, neat wood fiber gypsum plaster</td>
<td>2*</td>
</tr>
<tr>
<td>Hollow Stud Partition with Gypsum or Portland Cement Plaster or Gunit on Each Side</td>
<td>Incombustible stud with metal or wire lath, 3(\frac{1}{4})-in. plaster on each side</td>
<td>3*</td>
</tr>
<tr>
<td></td>
<td>Incombustible stud with metal or wire lath, 1-in. plaster on each side</td>
<td>2* &amp; 4(\frac{1}{2})*</td>
</tr>
<tr>
<td></td>
<td>Wood studs with metal or wire lath, Fire-stopped, 3(\frac{1}{4})-in. plaster on each side</td>
<td>3* or 5</td>
</tr>
<tr>
<td></td>
<td>Wood studs with metal or wire lath, Fire-stopped, 1-in. neat wood fiber plaster each side</td>
<td>5*</td>
</tr>
<tr>
<td></td>
<td>Wood studs with 3(\frac{1}{4})-in. perforated gypsum lath, Fire-stopped, 3(\frac{1}{4})-in. gypsum plaster each side</td>
<td>3* or 5</td>
</tr>
</tbody>
</table>

* Shall be used for non-bearing purposes only.
** 8 in. for Expanded Slag.
† \(\frac{3}{4}\) in. Face Shells.
Four-hour, three-hour and two-hour fire-resistive floors as specified in this Section shall be constructed entirely of incombustible materials.

(a) **Four-Hour.** Four-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum or solid masonry slabs or arches not less than four inches (4") in thickness or shall consist of hollow masonry slabs or arches not less than four inches (4") in thickness with a top covering of not less than two inches (2") of solid masonry, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in Table No. 43-C. Except in the case of steel-joisted construction, all reinforcing, tie rods and supporting structural members in such floors shall be protected with not less than four-hour fire-resistive construction.

(b) **Three-Hour.** Three-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum or solid masonry slabs or arches not less than three inches (3") in thickness or shall consist of hollow masonry slabs or arches not less than four inches (4") in thickness with a top covering of solid masonry not less than one and one-half inches (1½") in thickness, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in Table No. 43-C. Except in the case of steel-joisted construction all reinforcing, tie rods and supporting structural members in such floor construction shall be protected with not less than three-hour fire-resistive construction.

(c) **Two-Hour.** Two-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum or solid masonry slabs or arches not less than two and one-half inches (2½") in thickness or shall consist of hollow masonry slabs or arches not less than three inches (3") in thickness with a top covering of not less than one inch (1") of solid masonry, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in Table No. 43-C. Except in the case of steel-joisted construction all reinforcing, tie rods and supporting structural members in such floor construction shall be protected with not less than two-hour fire-resistive construction.

(d) **One-Hour.** One-hour fire-resistive floor construction shall consist of one of the following:

1. Reinforced concrete, gypsum or solid masonry slabs or arches not less than two and one-half inches (2½") in thickness.

2. Hollow masonry slabs or arches not less than three inches (3") in thickness with all joints in such hollow unit construction thoroughly filled with cement or gypsum mortar.

3. Steel joists protected with fire-resistive materials as set forth in Table No. 43-C.

**Exceptions:**

1. The incombustible floor slab may be omitted where no usable space occurs above the joists.

2. Plaster ceiling may be omitted below the lowest floor joists over usable space.

4. Wood-joisted construction with a double floor on top [the
subfloor not less than three-fourths inch ($\frac{3}{4}''$) thick and a total thickness of the two layers of not less than one and one-fourth inch (1$\frac{1}{4}''$) and with a ceiling of three-fourths inch ($\frac{3}{4}''$) gypsum or portland cement plaster on metal or wire lath meeting requirements of Chapter 47, or gypsum plaster one-half inch ($\frac{1}{2}''$) thick on three-eighths inch ($\frac{3}{8}''$) perforated gypsum lath with joints reinforced with three-inch (3'') strips of metal lath. The ceiling shall be securely fastened to or suspended from the underside of such joists.

Exceptions: (1) The double flooring on top may be omitted where no usable space occurs above the joists.
(2) Plaster ceiling may be omitted below the lowest floor joists over unusable space.
(3) Five-eighths inch ($\frac{5}{8}''$) approved plywood subfloor may be used in lieu of three-fourths inch ($\frac{3}{4}''$) solid wood subfloor.

Except in the case of steel-joisted construction, all reinforcing, tie rods and supporting structural members shall be protected with not less than one-hour fire-resistive construction.

Where a ceiling of lath and plaster as approved for one-hour fire-resistive construction as specified in this Chapter is used below slabs or structural members not otherwise required to be protected by such a ceiling, the required thickness of slab and fireproofing of structural members may be reduced one-half inch ($\frac{1}{2}''$) but in no case shall the slab thickness be less than two inches (2'').

Sec. 4304. (a) Fire-Resistive Doors. One-hour fire-resistive doors shall be constructed as specified for one of the following types, 1, 2 or 3, or any door which will successfully pass the one-hour fire test specified in Section 4201, and all such doors to receive the one-hour rating, shall be hung in place as specified in this Section.

### TABLE NO. 43-C—MINIMUM PROTECTION FOR STEEL JOISTS
(Based on Time Periods for Various Insulating Materials)

<table>
<thead>
<tr>
<th>FIRE RESISTANCE PERIOD (in hours)</th>
<th>THICKNESS OF INCOMBUSTIBLE SLAB ABOVE JOISTS (in inches)</th>
<th>THICKNESS OF PROTECTION UNDER JOISTS (in inches)</th>
<th>CONCRETE, BURNED CLAY PRODUCTS OR GYPSUM (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plaster on Metal or Wire Lath (As specified in Chapter 47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>Next-Fibred Gypsum</td>
<td>Sanded Gypsum</td>
</tr>
<tr>
<td>4</td>
<td>2$\frac{1}{2}$</td>
<td>1$\frac{1}{2}$</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2$\frac{1}{4}$</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1$\frac{1}{4}$</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1$\frac{3}{4}$</td>
<td>2</td>
</tr>
</tbody>
</table>

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Fire-resistive doors used for openings in stairway enclosures, smokeproof towers, corridors and passageways, moving picture booths, room partitions, exterior walls facing streets or more than twenty-five feet (25') from adjacent property lines and for "Ordinary Occupancy Separations" as specified in Section 503, shall be constructed as specified for one of the following types: 1, 2, 3, 4, 5 or 6 or any door which will provide equivalent protection against fire when hung in place as specified in this Section.

1. Tin-clad wood-core doors with the core made of three plies of wood one inch (1") nominal in thickness and covered with sheet metal, the door to be constructed in accordance with the "Underwriters' Standard for Tin-Clad Fire Doors and Shutters," Edition of December, 1941.

2. Sheet metal doors constructed of two sheets of not less than No. 26 U. S. Gauge corrugated sheet metal, one sheet on each side of a structural steel frame, corrugations vertical on one side and horizontal on the other and having not less than one-sixteenth inch (\(\frac{1}{16}\)) of asbestos placed in between the two metal sheets.

3. Sheet metal doors constructed of two sheets of metal of not less than No. 26 U. S. Gauge fastened to a structural steel frame in such manner as to leave a one inch (1") space in the panels, which space shall be filled with asbestos and with a one-eighth inch (\(\frac{1}{8}\)) asbestos covering on the stiles and structural steel frame.

4. Tin-clad wood-core doors made of two plies of wood one inch (1") nominal in thickness and covered with sheet metal, the door to be constructed in accordance with the "Underwriters' Standard for Tin-Clad Fire Doors and Shutters," Edition of December, 1941.

5. Sheet metal doors as specified in paragraph 3 above, but with one-fourth inch (\(\frac{1}{4}\)) of asbestos placed between the metal sheets in the panels and with no asbestos required on the stiles and structural frame.

6. Metal-clad doors which shall be wood panel doors with frame not less than one and three-fourths inches (1\(\frac{3}{4}\)) in thickness and with wood panels not less than three-fourths inch (\(\frac{3}{4}\)) in thickness, the whole door covered with not less than No. 26 U. S. Gauge metal. The panels of such doors shall fit into the frame not less than three-fourths inch (\(\frac{3}{4}\)) and all joints of metal shall be lapped and nailed tightly to the wood frame.

In all cases metal shall be fastened to the wood or metal frame by nailing, bolting or riveting and no solder shall be used on any door except for filling of joints.

Glass panels of one-fourth inch (\(\frac{1}{4}\"\)) wire glass shall be permitted in any of the above doors except when such doors are used on all openings for the stage portion of any Group A occupancy or for openings in "Special Occupancy Separations" as specified in Section 503. Such glass panels shall be not more
than seven hundred and twenty square inches (720 sq. in.) in area, nor exceed fifty-four inches (54") in height or forty-eight inches (48") in width. Grooves not less than three-fourths inch (\(\frac{3}{4}\)") in depth and three-eighths inch (\(\frac{3}{8}\)"") in width providing not less than five-eighths inch (\(\frac{5}{8}\)"") of bearing for the glass shall be required.

Fire doors bearing the label of the Underwriters' Laboratories, Incorporated, shall be accepted as meeting the requirements of any of the above doors.

Hardware for sheet metal and tin-clad fire doors referred to in paragraphs No. 1, 2, 3 and 4, shall be made of good quality malleable iron not less than one-fourth inch (\(\frac{1}{4}\)"") thick or of flat rolled structural steel not less than three-eighths inch (\(\frac{3}{8}\)"") thick; provided, that tubular steel track made of at least one-eighth inch (\(\frac{1}{8}\)"") steel may be used. Sliding tracks shall be supported so that a wall fastening is directly opposite each door hanger when door is in a closed position. Hangers supporting doors shall be fastened to the door with not less than three one-half inch (\(\frac{3}{2}\)"") bolts extending through the door. Latches for fire doors shall be not less than two and one-half inches by three-eighths inch (2\(\frac{1}{2}\)"\(\times\)\(\frac{3}{8}\)"), and latch bars shall be not less than one and one-half inches by one-fourth inch (1\(\frac{1}{2}\)"\(\times\)\(\frac{1}{4}\)").

Hardware for swinging hollow metal and metal-clad doors as referred to in paragraphs 5 and 6 shall be made as follows:

**Hinges.** For doors not exceeding eight feet (8') in height the hinges shall be of steel or bronze. If made of steel they may be either full, half surfaced, or butt hinges four and one-half inches by four and one-half inches (4\(\frac{1}{2}\)"\(\times\)4\(\frac{1}{2}\)"") and not less than one-eighth inch (\(\frac{1}{8}\)"") in thickness. If made of bronze they shall be butt hinges four and one-half by four and one-half inches (4\(\frac{1}{2}\)"\(\times\)4\(\frac{1}{2}\)"") and not less than three-sixteenths inch (\(\frac{3}{16}\)"") in thickness. When bronze hinges are used a steel stud and socket shall be provided at each hinge. The studs shall be attached to the rear jamb and shall engage a socket at least three-fourths inch (\(\frac{3}{4}\)"") deep in the rear edge of the door.

**Locks.** Doors shall be provided with a mortise or unit lock which has a latch bolt with a throw of not less than three-fourths inch (\(\frac{3}{4}\)"").

When mounted in pairs the normally standing door shall have a push bolt at the top and at the bottom which has a throw of not less than three-fourths inch (\(\frac{3}{4}\)"").

Special locking devices shall be provided as required in Part III under Occupancy, and as provided in Sections 3304, 3311 and 3315.

**Astragals.** Swinging fire doors mounted in pairs shall be provided with at least one astragal attached to one door and overlapping the opposite door at least three-fourths inch (\(\frac{3}{4}\)""). The above provision need not apply when the doors meet on a mullion.

Fire doors required by this Code shall be installed in the manner prescribed in the "Regulations for the Protection of
Openings in Walls and Partitions Against Fire," of the National Board of Fire Underwriters, recommended by the National Fire Protection Association, Edition of January, 1939.1

All fire doors shall be so hung that when closed they will fit tightly into place against the wall or frame so as to prove an effective stop for fire and smoke. Space around fire doors necessary for their operation shall at all times be kept unobstructed and when deemed necessary by the Building Inspector a screen or railing protection shall be installed to insure no storing or placing of material against any fire door which would prevent its operation in case of emergency.

(b) Fire-Resistive Shutters. One-hour fire-resistive shutters shall be constructed as specified for any one of the types of fire-resistive doors specified in part (a) of this Section.

(c) One-Hour Fire-Resistive Windows. One-hour fire-resistive windows shall have frames and sash of solid metal bars or hollow metal forms fabricated by pressing, welding or crimping together but not by the use of solder or other fusible alloy. All glass used in fire-resistive windows shall be wire glass and shall be not less than one-fourth inch (¼”) in thickness and no one light shall exceed seven hundred and twenty square inches (720 sq. in.) in area. Grooves three-fourths inch (¾”) in depth shall be provided and glass so arranged as to have not less than five-eighths inch (5/8”) of bearing in hollow metal frames and with grooves not less than one-half inch (½”) and with glass provided with not less than three-eighths inch (5/8”) of bearing in windows of solid metal section. Continuous glazing angles shall be provided on the inside. Fire-resistive windows with hollow metal frames shall be limited to a maximum size of sixty square feet (60 sq. ft.) with a six-foot (6’) maximum width and a ten-foot (10’) maximum height for double hung and counterbalanced windows and to a maximum size of seventy square feet (70 sq. ft.) with a seven-foot (7’) maximum width and ten-foot (10’) maximum height for stationary windows. Solid metal section windows shall be limited to a maximum size of eighty-four square feet (84 sq. ft.) in area with a maximum dimension in either direction of twelve feet (12’). Multiple section windows of these above sizes may be used when hollow metal or solid section mullions are provided. Hollow metal mullions shall be limited to a maximum length of twelve feet (12’) and shall be used for non-bearing purposes only. Solid section mullions when used in lengths exceeding twelve feet (12’) shall be fire-protected as required in Section 4301 in accordance with the fire-resistive construction of the building in which they are placed. Where fire-resistive windows are required by this Code, wood sash and plain glass may be substituted when protected as specified in Subsections (a) and (b) of this Section.

Fire-resistive windows bearing the label of the Underwriters’ Laboratories, Incorporated, shall be accepted as one-hour fire-resistive windows.

Sec. 4305. (a) General. Roof coverings for all buildings shall be either "Fire Retardant" or "Ordinary" roofings as spe-

1See "Specification Documents".
specifically required either by Location in Part IV, or by Type of Construction in Part V. The roof covering shall be securely fastened to the supporting roof construction.

(b) Composition Roofing Materials. 1. Definitions. **FELT** is the dry or de-saturated product produced by "felting" vegetable or animal fibers or other suitable materials or by "felting" not less than 85 per cent by weight of asbestos fibers.

**ROOFING FELT** is felt saturated with a bituminous compound.

**ROLL ROOFING** is felt saturated with a bituminous saturant, then coated on both sides with a bituminous coating and then surfaced on both sides with powdered talc, mica or other suitable mineral matter; provided, that such roll roofing need not be coated nor surfaced if felt is produced from asbestos and two or more layers are used in combination.

**FELT MEMBRANE** is felt saturated with bituminous saturant, then coated on one or both sides with a bituminous coating.


3. Method of Laying. Where there is not a ceiling underneath, a layer of unsaturated building paper weighing not less than five pounds to each one hundred square feet (100 sq. ft.) of such paper shall be laid over wood decks before the laying of composition fire retardant roof covering, except asphalt shingles.

Built-up composition roofings shall be thoroughly mopped between layers with an approved bituminous compound so that no layer touches unmopped the layer next above.

Gravel top covering shall mean flowing a coat of an approved bituminous compound and completely covering with gravel, crushed rock, crushed brick, other crushed earthenware of similar mineral surfacing material, a sufficient quantity being embedded in the bituminous compound in accordance with good standard practice.

4. Tests. Test methods, used to determine the specific requirements for physical properties of roll roofing, roofing felt, or felt membrane given in this Section shall be those methods set forth in the A.S.T.M. "Tentative Methods of Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing," (D146-38T)\(^1\).

(c) **Fire Retardant Roofings.** "Fire Retardant" roofing shall be any roof covering which meets the requirements specified for any one of the following roofings, 1 to 7 inclusive, or shall be any roofing meeting the requirements of the Class A or B specifications of the Underwriters' Laboratories, Incorporated.

1. Any built up composition roofing consisting of layers of roofing felt, roll roofing, felt membrane or gravel, the sum of whose fire-retardant values as given in Table No. 43-D, equals

\(^1\)See "Specification Documents".
not less than 15 including a top covering selected from parts (b) or (c) of said Table.

2. Hydraulic compressed rigid shingles not less than one-eighth inch (\(1/8\)"") thick, composed of portland cement and asbestos fibers, laid over a layer of saturated felt weighing not less than 14 pounds to the one hundred square feet (100 sq. ft.) or hydraulic compressed rigid sheets not less than seven thirty-seCONDS inch (\(\frac{7}{32}\)"") thick, composed of portland cement and asbestos fibers. The aforesaid felt may be omitted when the compressed shingles are placed over an existing roof covering.

3. Asphalt-saturated mineral-surfaced prepared composition shingles laid so there are not less than two thicknesses at any point. The combined weight of such shingles shall be not less than 200 pounds to the one hundred square feet (100 sq. ft.) of completed roof area.

4. Concrete slab or concrete tile roofs, constructed as specified in Chapter 26 without additional roof covering.

5. Metal roof covering of corrugated, standing seam or flat type of not less than No. 26 U.S. gauge metal. All flat metal roof coverings shall be laid on solid sheathing. Corrugated or standing seam metal roof covering shall be designed to support the required live load between supporting members.

6. Slate shingles securely fastened with copper nails or with copper nails and No. 14 B. and S. gauge copper wire, with nails of such length as to provide not less than three-fourths inch (\(\frac{3}{4}\)"") of penetration into the nailing strips or sheathing. Under all such shingles there shall be placed at least one layer of asphalt saturated felt weighing not less than 30 pounds to 108 square feet.

7. Clay roof tile securely fastened with copper nails or copper wire; provided that for roofs not exceeding a rise of eight inches (8"") in twelve inches (12"") galvanized iron nails may be used, and provided further that tile with projection lugs need not be nailed or wired in place. Wire shall be not smaller than No. 14 B and S gauge. Nails shall penetrate the supporting roof construction not less than three-fourths inch (\(\frac{3}{4}\)"").

Roofing tile other than flat pan tile with or without flanges, or flat shingle tile, or flat decorative tile, shall satisfy the following strength requirements: When supported on the turned down edges at points six inches (6"") each side of the center of the tile, giving four points of support and a span of twelve inches (12"") and loaded with a concentration at the center, the average breaking load per tile for five representative tile tested shall be not less than 400 pounds and the breaking load for any individual tile tested shall be not less than 350 pounds.

Roof tile shall not absorb more than 15 per cent of the dry weight of the tile during a 48-hour immersion test.

Under all burned clay units, there shall be placed not less than two layers of asphalt saturated rag felt, each layer weighing not less than fourteen pounds (14 lbs.) to 100 sq. ft., solidly mopped between and surfaced with asphalt.

(d) Ordinary Roofings. "Ordinary" roofing shall be any roof covering which meets the requirements specified for any one of the following roofings, 8 to 11 inclusive, or shall be any
### Table 4-3-D

**Minimum Physical Properties and Fire-Resistant Value of Roofing Materials**

<table>
<thead>
<tr>
<th>Value</th>
<th>Reference</th>
<th>Type of Roofing</th>
<th>108 sq. ft.</th>
<th>108 sq. ft.</th>
<th>Perl w/ perl</th>
<th>Perl w/ perl</th>
<th>Perl w/ perl</th>
<th>Perl w/ perl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Crushed Hard Burned Ceramic Material</td>
<td>200</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gravel and Ceramic Material</td>
<td></td>
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<tr>
<td>20</td>
<td>40</td>
<td>No. 35 Roofing White Top (asbestos)</td>
<td>30</td>
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<tr>
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<td>No. 35 Roofing Black Top (asbestos)</td>
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<td>No. 4 Roofing Black Top (asbestos)</td>
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<td>No. 3 Roofing Black Top (asbestos)</td>
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<td>No. 0 Roofing Black Top (asbestos)</td>
<td>30</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** For Fire-Resistant Roofing top covering shall be selected from (p) or (c).

These figures shall not be less than 80% of the required value of the roof.
specified in parts 17 and A of this Code, less than six, unless otherwise required because of location as
a fire-retardant value as given in Table No. 43-D equal to not
group J Division 1 occupants. Any composition roofing having
Roofings for Group J Occupancies. On buildings housing

This Code, subject to meeting the requirements of

Wood shingles bearing the label of any recognized inspect-
into the supporting roof construction.

Each shingle shall be nailed with two nails driven substantially
Gaue and not less than one and one-fourth inch (1 1/4) long.
coated or commercially pure iron nails of at least 14 B. and S.
All wood shingle shall be nailed firmly with copper, zinc, zinc-

| Total Length of Shingle Permissible Exposed Length |
|----------------|------------------|
|                | 11 in.           |
| 1 9/16 in.     | 32 in.           |
| 7 1/8 in.      | 23 in.           |
| 5 7/8 in.      | 18 in.           |
| 5 in.          | 16 in.           |

Section 4560. (Contd.)
PART IX
REGULATIONS FOR USE OF PUBLIC STREETS AND PROJECTIONS OVER PUBLIC PROPERTY

CHAPTER 44—PROTECTION OF PEDESTRIANS DURING CONSTRUCTION OR DEMOLITION

Sec. 4401. No person shall place or store any material or equipment necessary for the work under a building permit on a street, alley or public sidewalk, nor shall any work be performed except in accordance with the provisions of this Chapter.

No person shall perform any work on any building or structure, if by so doing he endangers pedestrians on the street that abuts the property line, unless the pedestrians are protected as specified in this Chapter.

Sec. 4402. Material or equipment necessary for the work under a building permit may be placed or stored on public property in the following locations:

(a) In Front of the Building Site. In the one-third portion of the roadway of the street that is adjacent to the curb in front of the building site for which a permit has been issued; provided that no material or equipment shall be placed or stored within five feet (5') of any rail or any street railway track.

(b) In Front of the Adjoining Site. In the roadway of the street adjoining the building site for which a permit has been issued to the same extent and under the same restrictions as specified in Subsection (a) of this Section.

A due waiver of claim against the city for damages on account of such placement or storage must be obtained from the owner of such property and filed in the office of the Building Inspector before such materials or equipment may be placed or stored.

(c) In the Alley. In the alley adjoining the building site for which a permit has been issued, provided that a clear and unobstructed roadway not less than ten feet (10') in width is maintained through such alley along the building site.

(d) Public Sidewalk in Front of Building Site. On any portion of the public sidewalk in front of the building site for which a permit has been issued, except on the walkway required to be maintained.

Sec. 4403. Material and equipment necessary for work to be done under a permit shall not be placed or stored on public property so as to obstruct free and convenient approach to any fire hydrant, fire or police alarm box, any utility box or to any catch-basin or manhole, or so as to interfere with the free flow of water in any street or alley gutter.

Sec. 4404. The mixing of mortar or concrete on public property shall be done in a mechanical mixer or in a tight box in such a manner as to prevent dripping or splashing on the public property.

Sec. 4405. A substantial protective frame and boarding shall be built around and over every street lamp, utility box, fire or police alarm box, fire hydrant, and every catch basin and man-
### TABLE NO. 44-A—TYPE OF PROTECTION REQUIRED FOR PEDESTRIANS

<table>
<thead>
<tr>
<th>HEIGHT OF CONSTRUCTION</th>
<th>DISTANCE FROM CONSTRUCTION TO WALKWAY</th>
<th>PROTECTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight feet or less</td>
<td>Less than six feet</td>
<td>Railing</td>
</tr>
<tr>
<td></td>
<td>Six feet or more</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Less than six feet</td>
<td>Fence and Canopy</td>
</tr>
<tr>
<td>More than eight feet</td>
<td>Six feet or more and one-quarter height of construction or less</td>
<td>Fence and Canopy</td>
</tr>
<tr>
<td></td>
<td>Six feet or more and one-fourth to one-half height of construction</td>
<td>Fence</td>
</tr>
<tr>
<td></td>
<td>Six feet or more and at least one-half height of construction</td>
<td>None</td>
</tr>
</tbody>
</table>

hole that may be damaged by any work being done under the permit. This protection shall be maintained while such work is being done.

**Protection of Pedestrians on Public Property**

Sec. 4406. (a) **Walkway.** A walkway not less than four feet (4') wide with a railing on the street side shall be maintained on the sidewalk in front of the building site during construction, alterations or demolition.

(b) **Type of Protection Required.** Protection shall be provided for pedestrians as required in Table No. 44-A, and be constructed as specified in this Chapter.

Such protection shall be maintained in place and kept in good order for the entire length of time pedestrians on the street that abuts the property line may be endangered, and shall be completely removed as soon as such construction work permits.

(c) **Construction of Railings.** Railings shall be substantially built and not less than three feet (3') high.

(d) **Construction of Fences.** Fences shall be substantially built of tight boards eight feet (8') high above grade, placed on the side of the walkway nearest to the building site. Fences shall extend the entire length of the building site and each end shall be turned and extended to the building line.

Doorways may be cut in the fence if they are protected by doors and kept closed, except when opened to permit materials or persons to pass through.

(e) **Construction of Canopies.** The protective canopy shall have a clear height of ten feet (10') above the walkway. The roof shall be tightly boarded. Every canopy shall have a tight board fence built along its entire length, on the side thereof next to the building site. The fence shall be solid from the
sidewalk or walkway to the canopy roof and each end shall be
turned and extended solid to the building site.

The entire structure shall be designed to carry the loads to
be imposed on it, provided, the minimum live load to be used in
design shall be not less than 35 pounds per square foot, uni-
formly loaded.

If materials are stored or work is done on the roof of the
canopy, the street sides and ends of the canopy roof shall be
protected by a tight curb board not less than one foot (1') high
and a railing not less than three feet (3') high.

The space under the canopy over the walkway and the ap-
proaches thereto shall be kept well lighted with artificial light-
ing continuously between sunset and sunrise.

Sec. 4407. When the area or a portion thereof occupied by
a public sidewalk is to be excavated, the holder of the building
permit shall construct a substantial temporary walkway not
less than four feet (4') in width for pedestrian travel over the
areas to be excavated or around the same.

The walkway over the evacuated area shall be designed for
a uniform live load of 150 pounds per square foot. The walk-
way shall be provided with suitable ramps or stairs at each end
and with a handrail not less than three feet (3') high along each
side or with a railing on one side and a fence on the other, as
the case may require.

The walkway around the excavated area shall be as close to
the excavation on the street side as possible and constructed
with a railing not less than three feet (3') high and a fence on
the excavation side of the walkway.
CHAPTER 45—PERMANENT OCCUPANCY OF PUBLIC PROPERTY

General

Sec. 4501. No part of any structure or any appendage thereto, except signs, shall project beyond the property line of the building site, except as specified in this Chapter.

Structures or appendages regulated by this Code shall be constructed of materials as required in Sections 1814, 1914, 2014, 2114 and 2214 and Chapter 35.

The projection of any structure or appendage shall be the distance measured horizontally from the property line to the outermost point of the projection.

Projection Into Alleys

Sec. 4502. No part of any structure or any appendage thereto, except signs, shall project into any alley except that a curb or buffer block may project not more than nine inches (9") and not exceed a height of nine inches (9") above grade.

Space Below Sidewalk

Sec. 4503. The space adjoining a building below a sidewalk on public property may be used and occupied in connection with the building for any purpose not inconsistent with this Code or other laws or ordinances regulating the use and occupancy of such spaces on condition that the right to so use and occupy may be revoked by the city at any time and that the owner of the building will construct the necessary walls and footing to separate such space from the building and pay all costs and expenses attendant therewith.

Balconies and Appendages

Sec. 4504. Oriel windows, balconies, unroofed porches, cornices and belt courses and appendages such as watertables, sills, capitals, bases and other decorative features may project over the public property of the building site a distance as determined by the clearance of the lowest point of the projection above the grade immediately below, as follows:

Clearance above grade less than eight feet (8')—no projection is permitted.

Clearance above grade over eight feet (8')—one inch (1") of projection is permitted for each additional inch of clearance, provided that no such projection shall exceed a distance of four feet (4').

Marquees

Sec. 4505. (a) General. For the purpose of this Section a marquee shall include any object or decoration attached to or a part of said marquee.

(b) Projection and Clearance. No part of any marquee shall be less than two feet (2') from the curb line.

No part of any marquee extending more than two-thirds of the distance from the property line to the curb line shall be less than twelve feet (12') above the ground or pavement below.

No part of any marquee extending not more than two-thirds of the distance from the property line to the curb line shall be less than eight feet (8') above the ground or pavement below.

(c) Length. The length of a marquee which projects more than two-thirds the distance from the property line to curb shall not exceed twenty-five feet (25') along the direction of the street.
(d) **Thickness.** The maximum height or thickness of a marquee measured vertically from its lowest to its highest point shall not exceed three feet (3') when the marquee projects more than two-thirds of the distance from the property line to the curb line and shall not exceed nine feet (9') when the marquee is less than two-thirds of the distance from the property line to the curb line.

(e) **Construction.** A marquee shall be supported entirely from the building.

(f) **Roof Construction.** The roof or any part thereof may be a skylight provided wire glass is used not less than one-fourth inch (\(\frac{1}{4}\)”) thick with no single pane more than eighteen inches (18”) wide.

Every roof and skylight of a marquee shall be sloped to downspouts which shall conduct any drainage from the marquee under the sidewalk to the curb.

(g) **Location Prohibited.** Every marquee shall be so located as not to interfere with the operation of any exterior standpipe or to obstruct the clear passage of stairways or exits from the building or the installation or maintenance of electrolers.

**Sec. 4506.** Movable awnings or hoods may have combustible coverings supported on incumbustible frames attached to the building.

Such awning or hood may extend over the public property not more than two-thirds the distance from the property line to the nearest curb in front of the building site.

The lowest part of any movable awning or hood frame shall be not less than eight feet (8') above the ground immediately below, and the lowest part of any fringe attached to such awning or hood shall be not less than seven feet (7’) above the grade immediately below.

**Sec. 4507.** Doors in Fire Zones Nos. 1 and 2, either fully opened or when opening, shall not project more than one foot (1’) beyond the property line, except that in alleys no projection beyond property line is permitted. Doors in Fire Zone No. 3, that swing over the property line, shall be maintained normally closed.
PART X
CHAPTER 47—LATHING AND PLASTERING

General
Sec. 4701. Lathing and plastering 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 Chapters 42 and 43.
No plaster shall be applied until the lathing has been inspected and approved by the Building Inspector.
The Building Inspector may require that test holes be made in the wall for the purpose of determining the thickness of the plaster, provided the permit holder has been notified 24 hours in advance of the time of making such test.

Materials
Sec. 4702. (a) Sand. Sand shall be washed sand conforming to A.S.T.M. “Standard Specifications for Sand for Use in Plaster,” (C35-39); except that when used with portland cement for scratch coat plastering, the amount of sand retained on a No. 8 sieve shall be not less than 10 per cent or more than 30 per cent.


(c) Lime. Lime shall conform to the requirements of A.S.T.M. “Standard Specifications for Quicklime for Structural Purposes,” (C5-26), or the A.S.T.M. “Standard Specifications for Hydrated Lime for Structural Purposes,” (C6-31).
Lime putty shall be made from quicklime or hydrated lime, and shall be prepared in an approved manner, stored and protected for an approved period of time.


Approved types of plasticity agents may be added to portland cement, Types I or II, in the manufacturing process or when mixing the plaster, but in no case shall the amount of plasticity agent exceed 10 per cent of the volume of cement in the plaster mixture.


(g) Fiber Insulation. Fiber insulation lath shall be manufactured from wood or other vegetable fiber in accordance with “Federal Specifications for Insulating Fiberboard,” (F.S. LLL-F-321a).

(h) Gypsum Lath. Gypsum lath shall conform to A.S.T.M. “Standard Specifications for Gypsum Lath,” (C37-42), and shall be not less than five-sixteenths inch (5/16") in thickness.

Sec. 4703. (a) Distance Between Supports. For gypsum, wood, and fiber insulation laths, the distance between supports shall not exceed sixteen inches (16"").

Internal angles, external angles, coves, arches and junctures between wood, fiber insulation, gypsum lath and other plaster bases shall be reinforced with cornerite, except where metal or wire lath is carried around such intersections.

No interior lath shall be applied until all exterior framing is covered.

(b) Gypsum Lath. Gypsum lath shall be nailed to wood supports at intervals not to exceed four inches (4") with 13-gauge, one and one-eighth inch (1 1/8"), three-eighths inch (3/8") flathead, galvanized or blued nails and shall be secured to horizontal or vertical metal supports by means of approved special clips.

Joints between walls and ceilings shall be staggered. Lath shall be applied with joints broken in each course. The laths shall be spaced not more than one-quarter inch (1/4") apart.

(c) Wood Lath. Wood lath shall be spaced not less than one-quarter inch (1/4") or more than three-eighths inch (3/8") apart at edges, one-quarter inch (1/4") apart at ends, and shall be nailed with 3d fine, 16-gauge, blued nails, full driven. Joints shall be broken every seventh lath and above or below all openings.

Lath shall run approximately at right angles to the supporting members, and no lath shall extend through any wall.

Wood lath shall be thoroughly soaked before being nailed in place, and kept damp until plaster is applied.

(d) Fiber Insulation Lath. Fiber insulation lath shall be nailed to wood supports at intervals not to exceed four and one-half inches (4 1/2") with nails of the following sizes, placed not less than three-eighths inch (3/8") from the ends, and not less than one-half inch (1/2") from shiplapped, tongued and grooved, or interlocking edges:

For one-half inch (1/2") lath—One and one-eighth inch (1 1/8") fiberboard nails or 6d box nails.

For one-inch (1") lath—One and three-fourths inch (1 3/4") fiberboard nails or 4d box nails.

End joints, except in interlocking type lath, shall be not less than three-sixteenths inch (3/16") wide. Shiplapped, tongued and grooved, or interlocking edges shall be fitted to contact.

(e) Metal and Wire Lath. 1. The weight of metal and wire lath and the spacings of supports shall conform to the requirements set forth in Table No. 47-A.

2. Metal and wire lath shall be lapped at least one mesh at side and ends, but need not exceed one inch (1").

3. Metal and wire lath shall be attached to vertical wood supports at not to exceed six-inch (6") spacing with not less than 4d common nails driven to a penetration of at least three-quarters inch (3/4") and bent over to engage not less than three strands of lath. Metal and wire lath shall be attached to ceiling joists or other horizontal wood supports with not less than one and one-half inch (1 1/2"), 11 gauge, barbed nails with a head
TABLE NO. 47-A—WEIGHTS OF METAL AND WIRE LATH

<table>
<thead>
<tr>
<th>TYPES OF LATH</th>
<th>WEIGHT (lbs. per sq. yd.)</th>
<th>MAXIMUM SPACING OF SUPPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire Lath</td>
<td>2.48</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Flat Expanded</td>
<td>2.5</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Flat Expanded</td>
<td>3.4</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Flat Rib</td>
<td>2.75</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Flat Rib</td>
<td>3.4</td>
<td>24&quot;</td>
</tr>
<tr>
<td>¼&quot; Rib</td>
<td>3.0</td>
<td>24&quot;</td>
</tr>
<tr>
<td>Sheet Lath</td>
<td>4.5</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>

TABLE NO. 47-B—SIZES OF MAIN RUNNERS IN SUSPENDED AND FURRED CEILINGS

<table>
<thead>
<tr>
<th>DISTANCE CENTER TO CENTER OF HANGERS</th>
<th>SIZE</th>
<th>MAIN RUNNERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Hot Rolled</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Cold Rolled</strong></td>
</tr>
<tr>
<td>Up to 2 feet</td>
<td>⅜&quot;</td>
<td>300 lb./1000 ft. 16 ga. with ⅜&quot; flanges</td>
</tr>
<tr>
<td>Up to 3 feet</td>
<td>1&quot;</td>
<td>410 lb./1000 ft. 16 ga. with ⅜&quot; flanges</td>
</tr>
<tr>
<td>Up to 4 feet</td>
<td>1½&quot;</td>
<td>650 lb./1000 ft. 16 ga. with ⅜&quot; flanges</td>
</tr>
</tbody>
</table>

not less than seven-sixteenths inch (7/16") in diameter, or an equivalent approved attachment.

4. Metal and wire lath shall be attached to horizontal and vertical metal supports at not to exceed six-inch (6") spacing with not less than No. 18 W & M gauge, galvanized annealed wire, or an equivalent approved attachment.

Sec. 4704. Where reinforced plaster or gunite partitions are used they shall have vertical steel or iron channels with a depth of not less than one-third the thickness of the partition, made of not less than No. 16 U. S. gauge metal and spaced not more than twenty-four inches (24") on center. They shall be securely fastened and anchored to adjoining framing members.

Hollow non-bearing partitions of reinforced plaster or gunite shall have a shell thickness of not less than three-fourths inch (⅜").

Reinforcement shall be as set forth in Table No. 47-A. The minimum thickness of reinforced plaster or gunite partitions shall be not less than one and one-half inch (1½") nor one eighty-fourth of the distance between supports.

Sec. 4705. (a) General. Suspended or furred ceilings shall be designed to meet the requirements of this Section, or shall be designed for a live load of 10 pounds per square foot.

(b) Main Runners. Main runners shall be hot rolled or cold rolled steel channels, and shall be not less than the sizes and weights set forth in Table No. 47-B.
If monolithic concrete ceilings or walls shall be attached there to

three-eighths inch (3/8") of plaster to produce desired hinge or

suites, metal lath or wire lath shall be attached there to

as set forth in Table No. 4-17.

5) (b) Thickness. Gypsum panels shall be fastened to the

following thicknesses of plaster. From face of plaster base to

installation with or without lath.

In no case shall a plaster coat be accepted as a required coat

of cement plaster shall not be applied directly to their

interior surface unless permitted by fire regulations in the

building. Where lath or wythe wall is required by this Section

Chapter EC 4-17.

See 4-17. (a) Number of coats.

Coal work when applied over other plaster bases allowed in this

and be placed in the main part of the anchor.

bolts to secure spandrels or bent ties around numbers of

bears and where necessary shall be bonded with three-eighths

such

Tiebeams to join edges of beams.

be used to attach car-

or equivalent approved attachments shall be used to attach car-

be bonded with three-eighths

EI anchors. Hangers for suspended ceilings shall be not

Cross strings shall be securely attached to the main runnels

in Table No. 4-17.

(c) Cross Runnels. Cross Runnels for various spacings of

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/16&quot;</td>
<td>0&quot;</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>3/16&quot;</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>1/4&quot;</td>
</tr>
</tbody>
</table>

TABLE NO. 4-17—REQUIRED THICKNESS OF INTERIOR PLASTER

TABLE 4-17—SIZES OF CROSS RUNNELS IN SPAN.

SPACING | FRAMING | MAIN RUNNEL TO CENTER OF DISTANCE CENTER

SECTION 4-1705-4-1706
For interior Portland cement plaster may be:

3. Interior smooth finish shall be mixed in the proportion of:

3. Two parts of White Sand by volume, or a prepared gypsum cement.
2. One part of Portland cement.
2. One part of gypsum plaster. The base coats shall be mixed in the proportion of:

1. Portland cement plaster, the first coat.
2. Portland cement plaster, the second coat, and six pounds of water to one cubic yard.
3. Portland cement, and six pounds of water to one cubic yard.
4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.

and proportion in accordance with the following procedure:

Mixing Procedure:

1. Gypsum or Portland cement. The base coats shall be mixed in the proportion of:

2. Portland cement plaster. The base coats shall be mixed in the proportion of:

3. Portland cement plaster. The base coats shall be mixed in the proportion of:

4. Portland cement plaster. For three-coat work, the first coat shall be mixed in the proportion of:

1. Portland cement plaster. The first coat of Portland cement plaster to one part of gypsum or Portland cement.
2. Portland cement plaster. The second coat of Portland cement plaster to one part of gypsum or Portland cement.
3. Portland cement plaster. The base coats shall be mixed in the proportion of:

1. Two parts of sand by weight. 
2. One part of Portland cement.
2. Six parts of water.
1. As required for the third coat of exterior stucco.

2. A gauged cement plaster mixed in proportion of one part portland cement to not more than two and one-half parts of lime putty and not more than four parts of sand by volume.

3. Smooth white finish, mixed in the proportion of not less than one part gypsum gauging plaster or Keene's cement to three parts lime putty by volume.

4. Keene's cement finish, mixed in the proportions of three parts Keene's cement to one part lime putty, by volume.

5. Lime sand-float finish shall be mixed in the proportion of one part gypsum gauging plaster or Keene's cement, three parts of lime putty, and three parts of sand, by volume.

6. Interior stucco finish shall be mixed in the proportion of one part of Keene's cement, two parts of lime putty, and three parts of white sand by volume, or a prepared color finish.

**Exception:** When finishes No. 3, No. 4, No. 5, or No. 6 are used, portland cements having plasticity agents added in the manufacturing process shall not be used in the coat to which this finish is applied.

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**Sec. 4708. (a) Base Coats.** 1. **Gypsum Plaster.** The scratch coat shall be applied with sufficient material and pressure to form a full key or bond.

For two-coat work it shall be doubled back to bring the plaster out to grounds and straightened to a true surface and left rough to receive the finish coat. For three-coat work, the surface shall be scratched to provide a bond for the brown coat and shall have been in place at least 12 hours before the second or brown coat is applied. The second or brown coat shall be brought out to grounds, and straightened to a true surface and left rough, ready to receive the finish coat.

2. **Lime Plaster.** The first two coats shall be applied in the same manner as gypsum plaster, except that in three-coat work, the second or brown coat shall be applied over a dry base coat.

3. **Portland Cement Plaster.** The first two coats shall be as required for the first two coats of exterior work, except that the interval between the first and second coats shall be not less than 24 hours.

(b) **Finish Coats.** 1. Smooth white finish shall be applied over base coat which has set and is surface-dry. Thickness shall be from one-sixteenth inch (1/16”) to one-eighth inch (1/8”).

2. Sand-float finish shall be applied over set base coat which is not quite dry.

3. Keene's cement finish shall be applied over set base coat which is not quite dry. Thickness shall be from one-sixteenth inch (1/16”) to one-eighth inch (1/8”), unless finish coat is marked off or jointed, in which case the thickness may be increased as required by depth of marking or jointing.

4. The finish coat for interior portland cement plastering shall be applied in the same manner as required for the third coat of exterior stucco, except that other types of finish coat may be applied as specified in Section 4707 (c).
TABLE NO. 47-E—EXTERIOR PLASTER REINFORCEMENT

<table>
<thead>
<tr>
<th>TYPE OF REINFORCEMENT</th>
<th>MINIMUM DIMENSION OF OPENINGS</th>
<th>MAXIMUM DIMENSION OF VERTICAL OPENINGS</th>
<th>MINIMUM W &amp; M GAUGE</th>
<th>MINIMUM WEIGHT lbs./sq. yd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded metal</td>
<td></td>
<td></td>
<td></td>
<td>1.8</td>
</tr>
<tr>
<td>Metal lath</td>
<td></td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>18</td>
<td>1.6</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>1½&quot;</td>
<td>17</td>
<td>1.4</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>16</td>
<td>1.4</td>
</tr>
<tr>
<td>Welded netting</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>18</td>
<td>1.4</td>
</tr>
</tbody>
</table>

(c) **Plaster on Concrete.** Monolithic concrete surfaces shall be clean, free from efflorescence, damp and sufficiently rough to insure adequate bond.

Gypsum plaster applied to monolithic concrete ceilings shall be specially prepared bond plaster for use on concrete, to which water only shall be added. Gypsum plaster on monolithic walls and columns shall be applied over a scratch coat of bond plaster before it has set. The brown coat shall be brought out to grounds, straightened to a true surface and left rough, ready to receive finish coat.

Lime plaster applied to concrete walls shall be as specified in Section 4707.

Portland cement plaster applied to interior concrete walls or ceilings shall conform to requirements for application to exterior concrete walls as specified in Section 4711 (c).

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**Interior Plastering:**

**Staff.** Staff shall be soaked before sticking. Lugs shall be of pure fiber and plaster of paris. Rust-resistive fastenings of sufficient strength to anchor the staff to the support shall be not less than No. 14 B & S gauge copper wire.

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**Exterior Plastering:**

**Backing.** Except in back plastered construction, studs shall be sheathed or wire of not less than No. 18 W & M gauge shall be stretched taut horizontally at intervals not exceeding six inches (6") on centers vertically and securely fastened in place.

(b) **Weather Protection.** Weather protection shall be as specified in Section 2217.

(c) **Metal Reinforcement.** Exterior plaster, except when applied to concrete or masonry, shall be reinforced with one of the materials having a rust-resistive coating applied after fabrication as set forth in Table No. 47-E.

Metal reinforcement shall be furred out from the backing at least one-quarter inch (¼") with an approved furring device, and shall be nailed with galvanized nails or approved furring devices driven to at least three-quarters inch (¾") penetration which shall be spaced not more than six inches (6") apart vertically and sixteen inches (16") apart horizontally. Metal reinforcement shall be lapped at least one full mesh at all joints. When no sheathing is used, all vertical joints shall be made at
<table>
<thead>
<tr>
<th>Coat</th>
<th>Maximum Volume of Sand Per Volume of Cement</th>
<th>Minimum Thickness</th>
<th>Minimum Period Before Application of Succeeding Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td>First or scratch</td>
<td>3½</td>
<td>¾&quot;</td>
<td>48 hrs.</td>
</tr>
<tr>
<td>Second or brown</td>
<td>4½ (1st &amp; 2nd coats)</td>
<td>¾&quot;</td>
<td>48 hrs.</td>
</tr>
<tr>
<td>Third or finish</td>
<td>2**</td>
<td>¾&quot;</td>
<td>7 days</td>
</tr>
</tbody>
</table>

*Measured from back to crest of scored plaster.
**Approved prepared finish coats containing not less than 1/3 by weight of portland cement may be used.

the studs and horizontal joints where expanded metal or metal lath is used shall have at least one tie between studs, made with No. 18 W & M gauge galvanized annealed tie wire.

**Sec. 4711. (a) General.** Exterior cement plaster shall be portland cement plaster meeting the requirements of Table No. 47-F, except when applied over concrete or masonry.

(b) **Plasticity Agents.** Plasticity agents shall be of approved types and amounts, and if added to portland cement in the manufacturing process, no later additions shall be made.

(c) **Application.** 1. **General.** Except when applied to concrete or masonry, and except as otherwise provided for pneumatically applied plaster, exterior cement plastering materials shall be mixed by machine methods for not less than two minutes, and shall be applied in three coats as set forth in Table No. 47-F.

The first coat shall be forced through all openings in the reinforcement so as solidly to fill all spaces. It shall then be scored horizontally with a scratcher having one-eighth inch (¾") clipped teeth and grooves not more than one-half inch (¾") deep.

The second coat shall be rodded and water floated, with no variation greater than one-quarter inch (¼") in any direction under a five-foot (5') straightedge.

The third coat shall not be a brush coat.

2. **Plastering on Masonry or Concrete.** The masonry surface on which plaster is to be applied shall be clean, free of efflorescence, damp and sufficiently rough to insure proper bond. Mixtures specified for the second coat in this Section may be applied directly to masonry.

**Sec. 4712.** Pneumatically placed cement plaster shall be a mixture of portland cement and sand, mixed dry, conveyed by air through a pipe or flexible tube, hydrated at the nozzle at the end of the conveyor and deposited by air pressure in its final position.

Rebound material may be screened and re-used as sand in an amount not greater than 25 per cent of the total sand in any batch.
Section 4712

Pneumatically placed cement plaster shall consist of a mixture of one part cement to not more than five parts of sand. Plasticity agents may be used as specified in Section 4711 (b). 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 inch (\(\frac{7}{8}\))”. The first coat shall be rodded as specified in Section 4711(c) for the second coat. The curing period and time interval shall be as set forth in Table No. 47-F.
PART XI

SPECIAL SUBJECTS

CHAPTER 48—FILM STORAGE

Secs. 4801 and 4802. Where it is desired to regulate film storage complete provisions covering handling and storage of photographic and X-Ray nitrocellulose films may be found in Appendix Chapter 48, page 290.

CHAPTER 49—MECHANICAL REFRIGERATION

Secs. 4901 to 4908. Where it is desired to regulate the type and installation of mechanical refrigeration complete provisions may be found in Appendix Chapter 49, page 290.

PART XII

LEGISLATIVE

CHAPTER 60—LEGISLATIVE

Sec. 6001. If any section, subsection, sentence, clause or phrase of this Ordinance is, for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this Ordinance. The City Council hereby declares that it would have passed this Ordinance, and each section, subsection, clause or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses and phrases be declared unconstitutional.

Sec. 6002. The specifications, suggested ordinances and regulations which are mentioned by title and date of publication in various parts of this Ordinance are hereby declared to be a part of this Ordinance when not in conflict with a specific statement contained in the body of this Ordinance to the contrary. The following list includes all of the specifications, suggested ordinances and regulations referred to in this Code:

NATIONAL STANDARD SPECIFICATIONS REFERRED TO IN CHAPTERS 1 TO 49
Uniform Building Code

<table>
<thead>
<tr>
<th>Author</th>
<th>Organization's Designation</th>
<th>Subject</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Society of Refrigerating Engineers:</td>
<td></td>
<td>Safety Code for Mechanical Refrigeration, Approved by A.S.A.</td>
<td>4901</td>
</tr>
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</table>

277
### American Society for Testing Materials:

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Section</th>
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<tbody>
<tr>
<td>A7-42</td>
<td>Standard Specification for Steel for Bridges and Buildings.</td>
<td>2701</td>
</tr>
<tr>
<td>A15-39</td>
<td>Standard Specification for Billet-Steel Bars for Concrete Reinforcement.</td>
<td>2604(d)</td>
</tr>
<tr>
<td>A16-35</td>
<td>Standard Specification for Rail-Steel Bars for Concrete Reinforcement.</td>
<td>2604(d)</td>
</tr>
<tr>
<td>A27-42</td>
<td>Standard Specification for Carbon-Steel Castings for Miscellaneous Industrial Uses.</td>
<td>2701</td>
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<tr>
<td>A48-41</td>
<td>Standard Specification for Gray Iron Castings.</td>
<td>2701</td>
</tr>
<tr>
<td>A52-42</td>
<td>Standard Specification for Welded and Seamless Steel Pipe.</td>
<td>2701</td>
</tr>
<tr>
<td>A82-34</td>
<td>Standard Specification for Cold-Drawn Steel Wire for Concrete Reinforcement.</td>
<td>2604(d), 2620(c)</td>
</tr>
<tr>
<td>C5-26</td>
<td>Standard Specification for Quicklime for Structural Purposes</td>
<td>2402, 4702</td>
</tr>
<tr>
<td>C6-31</td>
<td>Standard Specification for Hydrated Lime for Structural Purposes.</td>
<td>2402, 4702</td>
</tr>
<tr>
<td>C19-41</td>
<td>Standard Methods of Fire Tests of Building Construction and Materials.</td>
<td>4201</td>
</tr>
<tr>
<td>C22-41</td>
<td>Standard Specification for Gypsum.</td>
<td>2402</td>
</tr>
<tr>
<td>C28-40</td>
<td>Standard Specification for Gypsum Plasters.</td>
<td>4702</td>
</tr>
<tr>
<td>C31-42</td>
<td>Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field.</td>
<td>2605, 2613</td>
</tr>
<tr>
<td>C33-42</td>
<td>Standard Specification for Concrete Aggregates.</td>
<td>2604(b)</td>
</tr>
<tr>
<td>C34-41</td>
<td>Standard Specification for Structural Clay Load-Bearing Wall Tile.</td>
<td>2402</td>
</tr>
<tr>
<td>C37-42</td>
<td>Standard Specification for Gypsum Lath.</td>
<td>4702</td>
</tr>
<tr>
<td>C39-42</td>
<td>Standard Method of Test for Compressive Strength of Concrete.</td>
<td>2606, 2613</td>
</tr>
<tr>
<td>C52-41</td>
<td>Standard Specification for Gypsum Partition Tile or Block.</td>
<td>2402</td>
</tr>
<tr>
<td>C56-41</td>
<td>Standard Specification for Structural Clay Non-Load-Bearing Tile.</td>
<td>2402</td>
</tr>
<tr>
<td>C61-40</td>
<td>Standard Specification for Keene's Cement.</td>
<td>4702</td>
</tr>
<tr>
<td>C62-41T</td>
<td>Tentative Specification for Building Brick.</td>
<td>2402</td>
</tr>
<tr>
<td>C67-41</td>
<td>Standard Methods of Sampling and Testing Brick.</td>
<td>2411(d)</td>
</tr>
<tr>
<td>C90-39</td>
<td>Standard Specification for Hollow Load-Bearing Concrete Masonry Units.</td>
<td>2402</td>
</tr>
<tr>
<td>C94-42T</td>
<td>Tentative Specification for Ready-Mixed Concrete.</td>
<td>2607, 2609</td>
</tr>
<tr>
<td>C130-42</td>
<td>Standard Specification for Lightweight Aggregates for Concrete.</td>
<td>2604(b)</td>
</tr>
<tr>
<td>C144-42T</td>
<td>Tentative Specification for Aggregates for Masonry Mortar.</td>
<td>2402</td>
</tr>
<tr>
<td>C145-40</td>
<td>Standard Specification for Solid Load-Bearing Concrete Masonry Units.</td>
<td>2402</td>
</tr>
<tr>
<td>C150-42</td>
<td>Standard Specification for Portland Cement.</td>
<td>2402, 2604(a), 4702</td>
</tr>
<tr>
<td>D146-38T</td>
<td>Tentative Methods of Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing.</td>
<td>4305(b)</td>
</tr>
</tbody>
</table>

### American Standards Association:

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>A42, 1-1938</td>
<td>Gypsum Plastering, including Requirements for Lathing and Furring.</td>
<td>4702</td>
</tr>
</tbody>
</table>

### American Welding Society:

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941</td>
<td>Code for Arc and Gas Welding in Building Construction, Sections 2, 3, 4.</td>
</tr>
</tbody>
</table>
Board of Fire Underwriters of the Pacific:  
Sept. 10, 1930 Schedule for Rating of Theaters and Motion  
Picture Halls.  

Building Standards Monthly:  
June, 1943 Tests Indicate Design Methods for Earth-  
quake-Proof Timber Floors.  

National Board of Fire Underwriters:  
1927 Standard Ordinance for Chimney  
Construction.  
July 15, 1930 Storage and Handling of Photographic  
and X-Ray Nitrocellulose Films.  
July 1, 1939 Regulations for Nitrocellulose Motion  
Picture Film.  
1934 Building Code, Appendix P,  
Fifth Edition Revised.  
April, 1941 Regulations for Oil-Burning Equipment.  
1943 Recommended Fire Prevention Ordinance.  
1008, 1108, 1208, 1308, 1508  

National Fire Protection Association:  
January, 1939 Protection of Openings in Walls and  
Partitions Against Fire.  

Underwriters' Laboratories, Inc.  
December, 1941 Roofs, Class C Coverings.  
December, 1941 Standard for Tin-Clad Fire Doors and  
Shutters.  

United States Department of Agriculture:  
Misc. Pub. No. 185 Guide to the (rading of Structural Timbers  
and Determination of Working Stresses.  

United States Department of Commerce, Bureau of Standards:  
CS31-42 Wood Shingles.  
CS45-42 Plywood.  

United States Federal Government:  
LJJ-F-321a Federal Specifications for Insulating  
Fiberboard.  

United States Forest Products Laboratory:  
October, 1929 Rigidity and Strength of Frame Walls.  

Sec. 6003. Ordinance No...and all ordinances amendatory thereto, and all ordinances or parts of ordinances in conflict with this Ordinance are hereby repealed.  

Sec. 6004. This Ordinance shall be, and is hereby declared to be in full force and effect, from and after 30 days from its date of final passage and approval.  

Ordinances Repealed  
Date Effective
APPENDIX

The Appendix, pages 280-290, contains suggested ordinances covering subjects which may not be desired in all cities, also other pertinent information designed to be of assistance to the Building Inspector.

Refer to Sec. 702(c). The following suggestions are given as a guide for the detailed design and construction of reviewing stands.

Every reviewing stand shall be constructed with four-inch by six-inch (4"x6") girders running parallel to the front of such stand, spaced not more than six feet (6') apart, and supported at distances not exceeding six feet (6') apart by posts of not less than four inches by six inches (4"x6"). These posts shall be braced diagonally with one-inch by six-inch (1"x6") bracing, forming a continuous herringbone bracing, the full length of such stand for each vertical six feet (6') of such posts. The girders at the top of the posts shall be braced with braces not less than four inches by four inches (4"x4") at right angles to the joists above the girders. Every post or brace shall be thoroughly secured to a foot plate, which shall be of sound wood not less than two inches by six inches (2"x6") in cross section laid solidly on the ground at right angles to the front of the stand and forming the base for each line of posts. There shall be joists resting on the girders of not less than two inches by eight inches (2"x8") cross section. Such joists shall be spaced not exceeding forty inches (40") apart and two-inch (2") plank shall be used for the seats and steps. Braces shall be provided whenever necessary to make a solid, substantial structure, which shall be safe under any possible emergency. All timbers forming the framing shall be thoroughly spiked together. There shall be a level stringer of two inches by six inches (2"x6") cross section at the bottom of each line of posts, parallel to the stand; also a horizontal piece of two inches by six inches (2"x6") cross section the full length of the stand and at right angles to same for every row of posts, and every six feet (6') of vertical height thereof. All timbers used in the construction of reviewing stands shall be sound (no second-hand or broken lumber permitted). Wherever the stand, or a portion thereof, extends over an excavation, the posts shall be extended to the bottom of said excavation and shall be braced with horizontal braces as hereinbefore provided.

Refer to Sec. 2204. Minimum foundation requirements shall be as set forth in Table No. 22-A of this Section.

<table>
<thead>
<tr>
<th>Number of Stories</th>
<th>Thickness of Foundation Wall in Inches</th>
<th>Width of Footing in Inches</th>
<th>Thickness of Footing in Inches</th>
<th>Depth of Foundation Below Natural Surface of Ground and Finish Grade in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>14</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>16</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>18</td>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>

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Sec. 2205. (c) Wall Coverings. 5. Exterior Plaster. (1) Lathing. Studs shall be sheathed, or wire of not less than 18 W & M gauge shall be stretched taut horizontally at intervals not exceeding six inches (6") on centers vertically and securely fastened in place. The frame shall be covered with building paper as required in Section 2217.

Plaster shall be reinforced with one of the materials having a rust-resistant coating applied after fabrication, as set forth in Table No. 22-B.

Metal reinforcement shall be furred out from the backing at least one-quarter inch (¼") with an approved furring device, and shall be nailed with galvanized nails or approved furring devices driven to at least three-quarters inch (¾") penetration which shall be spaced not more than six inches (6") apart vertically and sixteen inches (16") apart horizontally. Metal reinforcement shall be lapped at least one full mesh at all joints. When no sheathing is used, all vertical joints shall be made at the studs and horizontal joints where expanded metal or metal lath is used shall have at least one tie between studs, made with not less than No. 18 W & M gauge galvanized annealed anneal tie wire.

(2) Application. Exterior plaster shall be portland cement plaster meeting the requirements of Table No. 22-C.

### TABLE NO. 22-B—EXTERIOR PLASTER REINFORCEMENT

<table>
<thead>
<tr>
<th>TYPE OF REINFORCEMENT</th>
<th>MINIMUM DIMENSION OF OPENINGS</th>
<th>MAXIMUM DIMENSION OF VERTICAL OPENINGS</th>
<th>MINIMUM W &amp; M GAUGE</th>
<th>MINIMUM WEIGHT lbs./sq. yd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded metal</td>
<td></td>
<td></td>
<td>18</td>
<td>1.8</td>
</tr>
<tr>
<td>Metal lath</td>
<td></td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>18</td>
<td>1.6</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>1½&quot;</td>
<td>17</td>
<td>1.4</td>
</tr>
<tr>
<td>Woven netting</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>16</td>
<td>1.4</td>
</tr>
<tr>
<td>Welded netting</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>18</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### TABLE NO. 22-C—EXTERIOR PORTLAND CEMENT PLASTER

<table>
<thead>
<tr>
<th>COAT</th>
<th>MAXIMUM VOLUME OF SAND PER VOLUME OF CEMENT</th>
<th>MINIMUM THICKNESS</th>
<th>MINIMUM INTERVAL BEFORE APPLICATION OF SUCCEEDING COAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>First or scratch</td>
<td>3½</td>
<td>¾&quot;**</td>
<td>48 hrs.</td>
</tr>
<tr>
<td>Second or brown</td>
<td>4½</td>
<td>(1st &amp; 2nd coats)</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>Third or finish</td>
<td>2**</td>
<td>¾&quot;</td>
<td></td>
</tr>
</tbody>
</table>

*Measured from backing to crest of scored plaster.
**Approved prepared finish coats containing not less than 1/3 by weight of portland cement may be used.

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Exterior Plaster

Plasticity agents shall be of approved types and if added to portland cement in the manufacturing process, no later additions shall be made.

Except for pneumatically applied plaster, exterior cement plastering materials shall be mixed by machine for not less than two minutes and shall be applied in three coats as set forth in Table No. 22-C.

The first coat shall be forced through all openings in the reinforcement so as solidly to fill all spaces. It shall then be scored horizontally with a scratcher having one-eighth inch (⅛") clipped teeth and grooves not more than one-half inch (½") deep. The second coat shall be rodded and water floated with no variation greater than one-fourth inch (¼") in any direction under a five foot (5') straightedge. The third coat shall not be a brush coat.

(3) Pneumatically Placed Plaster. Pneumatically placed cement plaster shall be a mixture of one part portland cement to not more than five parts sand, mixed dry, conveyed by air through a pipe or flexible tube, hydrated at the nozzle at the end of the conveyor, and deposited by air pressure in its final position. Rebound material may be screened and re-used as sand in an amount not greater than 25 per cent of the total sand in any batch.

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 inch (7/8"). The first coat shall be rodded as specified in Subsection (2) for the second coat. The curing period and time interval shall be as set forth in Table No. 22-C.

Refer to Sec. 2301.

WEIGHTS OF BUILDING MATERIALS

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per Cu. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick, Pressed</td>
<td>150</td>
</tr>
<tr>
<td>Brick, Common</td>
<td>125</td>
</tr>
<tr>
<td>Brick, Common, laid ⅜&quot; joints</td>
<td>120</td>
</tr>
<tr>
<td>Brick, Soft, laid ⅜&quot; joints</td>
<td>100</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>450</td>
</tr>
<tr>
<td>Cinders, dry, bituminous, in bulk</td>
<td>45</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>Cinder, structural</td>
<td>110</td>
</tr>
<tr>
<td>Stone or gravel</td>
<td>144</td>
</tr>
<tr>
<td>Concrete Building Tile, 60% solid</td>
<td>87</td>
</tr>
<tr>
<td>Concrete Building Tile, 55% solid</td>
<td>79</td>
</tr>
<tr>
<td>Earth</td>
<td></td>
</tr>
<tr>
<td>Common loam, dry and loose</td>
<td>76</td>
</tr>
<tr>
<td>Clay and gravel, dry and loose</td>
<td>100</td>
</tr>
<tr>
<td>Common earth, dry and packed</td>
<td>100</td>
</tr>
<tr>
<td>Wet mud</td>
<td>120</td>
</tr>
<tr>
<td>Glass</td>
<td>157</td>
</tr>
<tr>
<td>Granite</td>
<td>170</td>
</tr>
<tr>
<td>Gravel, dry</td>
<td>120</td>
</tr>
<tr>
<td>Material</td>
<td>Lbs. Per Cu. Ft.</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Granite Masonry, dressed</td>
<td>165</td>
</tr>
<tr>
<td>Granite Masonry, rubble</td>
<td>155</td>
</tr>
<tr>
<td>Limestone Masonry, dressed</td>
<td>162</td>
</tr>
<tr>
<td>Marble Masonry, dressed</td>
<td>170</td>
</tr>
<tr>
<td>Mortar, hard, cement</td>
<td>135</td>
</tr>
<tr>
<td>Mortar, hard, lime</td>
<td>105</td>
</tr>
<tr>
<td>Slag (blast furnace)</td>
<td>130</td>
</tr>
<tr>
<td>Steel</td>
<td>490</td>
</tr>
<tr>
<td>Terra Cotta, filled with brickwork</td>
<td>120</td>
</tr>
<tr>
<td>Terra Cotta, Dennison interlock tile, laid</td>
<td>65</td>
</tr>
</tbody>
</table>

**Timber—**

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir, dry</td>
<td>32</td>
</tr>
<tr>
<td>Fir, wet</td>
<td>44</td>
</tr>
<tr>
<td>Oak</td>
<td>46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, fresh at 60 degrees Fahrenheit</td>
<td>62 1/2</td>
</tr>
<tr>
<td>Sand, dry</td>
<td>100</td>
</tr>
<tr>
<td>Sand, wet</td>
<td>120</td>
</tr>
</tbody>
</table>

**Ceilings—**

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood, lath and plaster</td>
<td>8</td>
</tr>
<tr>
<td>Metal lath and plaster suspended</td>
<td>10</td>
</tr>
</tbody>
</table>

**Partitions—**

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;x4&quot; studs, wood lath, 5/8&quot; plaster, both sides</td>
<td>16</td>
</tr>
<tr>
<td>2&quot;x4&quot; studs, plaster board, 5/8&quot; plaster, both sides</td>
<td>16</td>
</tr>
<tr>
<td>Channel studs, metal lath, cement plaster, solid 2&quot; thick</td>
<td>20</td>
</tr>
<tr>
<td>Plaster on hollow clay tile (one side)</td>
<td>5</td>
</tr>
<tr>
<td>2&quot; Hollow Clay Tile</td>
<td>13</td>
</tr>
<tr>
<td>3&quot; Hollow Clay Tile</td>
<td>16</td>
</tr>
<tr>
<td>4&quot; Hollow Clay Tile</td>
<td>18</td>
</tr>
<tr>
<td>5&quot; Hollow Clay Tile</td>
<td>20</td>
</tr>
<tr>
<td>6&quot; Hollow Clay Tile</td>
<td>25</td>
</tr>
<tr>
<td>8&quot; Hollow Clay Tile</td>
<td>30</td>
</tr>
<tr>
<td>12&quot; Hollow Clay Tile</td>
<td>45</td>
</tr>
<tr>
<td>Plaster on plaster block partitions (one side)</td>
<td>5</td>
</tr>
<tr>
<td>2&quot; Plaster Blocks</td>
<td>7</td>
</tr>
<tr>
<td>2 1/2&quot; Plaster Blocks</td>
<td>8.5</td>
</tr>
<tr>
<td>3&quot; Plaster Blocks</td>
<td>9.5</td>
</tr>
<tr>
<td>3 1/2&quot; Plaster Blocks</td>
<td>10.5</td>
</tr>
<tr>
<td>4&quot; Plaster Blocks</td>
<td>12</td>
</tr>
<tr>
<td>5&quot; Plaster Blocks</td>
<td>15</td>
</tr>
<tr>
<td>6&quot; Plaster Blocks</td>
<td>18</td>
</tr>
<tr>
<td>8&quot; Plaster Blocks</td>
<td>22</td>
</tr>
</tbody>
</table>

**Roofings—**

<table>
<thead>
<tr>
<th>Material</th>
<th>Lbs. Per</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood shingles</td>
<td>3</td>
</tr>
<tr>
<td>Slate 9/16&quot;</td>
<td>7</td>
</tr>
<tr>
<td>Slate 14&quot;</td>
<td>10</td>
</tr>
<tr>
<td>Tile and clay shingles</td>
<td>11 to 14</td>
</tr>
<tr>
<td>Roman tile, clay</td>
<td>12</td>
</tr>
<tr>
<td>Spanish tile, clay</td>
<td>19</td>
</tr>
</tbody>
</table>
Ludowici tile, Spanish ........................................ 10
Tile roof laid in mortar, add .................................. 10
Copper (if no weight is specified) .......................... 1½
Tin .................................................................. 1
Corrugated iron .................................................. 2
Tar and gravel .................................................... 6
Prepared composition .......................................... 1
Skylights, metal covered, wire glass ....................... 5

Refer to Sec. 2312. The following provisions are suggested for inclusion in the Code by cities located within an area subject to earthquake shocks. The design of buildings for earthquake shocks is a moot question but the following provisions will provide adequate additional strength when applied in the design of buildings or structures.

Sec. 2312. (a) General. Every building or structure and every portion thereof, except Type V buildings of Group I occupancy which are less than twenty-five feet (25') in height, and minor accessory buildings, shall be designed and constructed to resist stresses produced by lateral forces as provided in this Section. Stresses shall be calculated as the effect of a force applied horizontally at each floor or roof level above the foundation. Such force shall be proportional to the total dead plus one-half the vertical design live load, except for warehouses and tanks, in which case such force shall be proportional to the total dead plus the total vertical designed live load. The force shall be assumed to come from any horizontal direction.

All bracing systems both horizontal and vertical shall transmit all forces to the resisting members and shall be of sufficient extent and detail to resist the horizontal forces provided for in this Section and shall be located symmetrically about the center of mass of the building or the building shall be designed for the resulting rotational forces about the vertical axis.

Junctures between distinct parts of buildings, such as wings which extend more than twenty feet (20') from the main portion of the building, shall be designed at the juncture with other parts of the building for rotational forces, or the juncture may be made by means of sliding fragile joints having a minimum width of not less than eight inches (8”). The details of such joints shall be made satisfactory to the Building Inspector.

(b) Horizontal Force Formula. In determining the horizontal force to be resisted, the following formula shall be used:

\[
F = CW
\]

where "F" equals the horizontal force in pounds.

"W" equals the total dead load plus one-half the total vertical designed live load, at and above the point of elevation under consideration, except for warehouses and tanks, in which case "W" shall equal the total dead load plus the total vertical designed live load at and above the point or elevation under consideration. Machinery or other fixed concentrated loads shall be considered as part of the dead load.

"C" equals a numerical constant as shown in Table No. 23-A.
TABLE NO. 23-A—HORIZONTAL FORCE FACTORS

<table>
<thead>
<tr>
<th>Part or Portion</th>
<th>Value of “C”*</th>
<th>Direction of Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>The structure as a whole and every portion not itemized in this table**</td>
<td>.02 on soil, over 2000 lbs.</td>
<td>Any direction horizontally</td>
</tr>
<tr>
<td></td>
<td>.04 on soil up to 2000 lbs.</td>
<td></td>
</tr>
<tr>
<td>Bearing walls, non-bearing walls, partitions, curtain walls, enclosure walls,</td>
<td>.05</td>
<td>Normal to surface of wall</td>
</tr>
<tr>
<td>panel walls</td>
<td>With a minimum of five pounds per square foot.</td>
<td></td>
</tr>
<tr>
<td>Cantilever parapet and other cantilever walls, except retaining walls</td>
<td>.25</td>
<td>Normal to surface of wall</td>
</tr>
<tr>
<td>Exterior and Interior ornaments and appendages</td>
<td>.25</td>
<td>Any direction horizontally</td>
</tr>
<tr>
<td>Towers, tanks, towers and tanks plus contents, chimneys, smokestacks, and</td>
<td>.05</td>
<td>Any direction horizontally</td>
</tr>
<tr>
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*See map on page 286 for zones. The values given “C” are minimum and should be adopted in locations not subject to frequent seismic disturbances as shown in Zone 1. For locations in Zone 2, “C” should be doubled. For locations in Zone 3, “C” should be multiplied by four. **Where wind load as set forth in Section 2307 would produce higher stresses, this load should be used in lieu of the factor shown.

(c) Foundation Ties. In the design of buildings of Types I, II and III, where the foundations rest on piles or on soil having a safe bearing value of less than 2,000 pounds per square foot, the foundations shall be completely inter-connected in two directions approximately at right angles to each other. Each such inter-connecting member shall be capable of transmitting by both tension and compression at least 10 per cent of the total vertical load carried by the heavier only of the footings or foundations connected. The minimum gross size of each such member if of reinforced concrete shall be twelve inches by twelve inches (12”x12”) and shall be reinforced with not less than the minimum reinforcement specified in Section 2620. If the inter-connecting members are of structural steel, they shall be designed as provided in Section 2702, and encased in concrete. A reinforced concrete slab may be used in lieu of inter-connecting tie members, providing the slab thickness is not less than one forty-eighth of the clear distance between the connected foundations; also providing the thickness is not less than six inches (6”).

Inter-connecting slabs shall be reinforced with not less than eleven-hundredths square inch (.11 sq. in.) of steel per foot of slab in a longitudinal direction and the same amount of steel
Map of the 11 Western States

showing

Zones of Approximately Equal Seismic Probability
in a transverse direction. The bottom of such slab shall not be more than twelve inches (12") above the tops of at least 80 per cent of the piers or foundations. The footings and foundations shall be tied to the slab in such a manner as to be restrained in all horizontal directions.

(d) Plans and Design Data. With each set of plans filed, a brief statement of the following items shall be included:

1. A summation of the dead and live load of the building, floor by floor, which was used in figuring the shears for which the building is designed.

2. A brief description of the bracing system used, the manner in which the designer expects such system to act, and a clear statement of any assumptions used. Assumption as to location of all points of counter-flexure in members must be stated.

3. Sample calculation of a typical bent or equivalent.

(e) Stresses. Stresses in materials shall not exceed by more than 331/3 per cent the allowable working stresses permitted in this Code, except that rivets may be stressed the same in tension as is allowed in shear. The allowable shear in reinforced concrete walls, six inches (6") or more in thickness, shall not exceed five one-hundredths of the ultimate compressive strength of the concrete.

(f) Detailed Requirements. 1. Bonding and Tying. Cornices and ornamental details shall be bonded in the structure so as to form an integral part of it. This applies to the interior as well as to the exterior of the building.

2. Overturning Moment. In no case shall the calculated overturning moment of any building or structure due to the forces provided for in this Section exceed two-thirds of the moment of stability of such building or structure. Moment of stability shall be calculated using the same loads as used in calculating the overturning moment.

3. Additions. Every addition to an existing building or structure shall be designed and constructed to resist and withstand the forces provided for in this Section, and in any case where an existing building or structure is increased in height all portions thereof affected by such increased height shall be reconstructed to resist and withstand the forces provided for in this Section.

4. Alterations. No existing building or structure shall be altered or reconstructed in such a manner that the resistance to the forces provided for in this Section will be less than that before such alteration or reconstruction was made; provided, however, that this provision shall not apply to non-bearing partitions, and shall not apply to other minor alterations which are made in a manner satisfactory to the Building Department.

(g) Lime Mortars. Lime mortars shall not be used in any unit masonry construction forming a part of a building.

(h) Veneer Ties. Veneer ties provided in Section 2902(c) shall be of sufficient strength to support the full weight of the veneer in tension.

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Sections 2312 and 2529

(i) Intention or Interpretation of Lateral Force Provisions.

These lateral force requirements are intended to make buildings earthquake-resistive. The provisions of this Section apply to the buildings as a unit and also to all parts thereof, including the structural frame or walls, floor and roof systems, and other structural features.

The provisions incorporated in this Section are general and, in specific cases, may be interpreted or added to as to detail by rulings of the Building Inspector in order that the intent shall be fulfilled.

Refer to Sec. 2529. The following precautions are recommended for territories where foundation timber is subject to special hazard of decay and termite damage.

1. Before any new building is erected all stumps and roots shall be removed from the soil to a depth of at least twelve inches (12") below the surface of the ground in the area to be occupied by the building.

2. The exterior walls of, and all wood posts supporting girders in wood frame buildings over four hundred square feet (400 sq. ft.) in area shall be placed on masonry or concrete foundation walls or piers.

3. All masonry for foundation purposes shall be laid in portland cement mortar. Portland cement mortar shall be composed of one part of cement and three parts of sand by volume with an allowable addition of lime putty or hydrated lime of not more than 15 per cent by volume of the cement content.

4. The top of every masonry or concrete foundation wall or pier which supports and is in contact with wood construction of any kind shall be not less than six inches (6") above the final grade level or finished surface of any ground adjacent thereto (except as provided in the case of slabs). Masonry or concrete foundation walls shall in all cases extend at least as high as the top of any adjacent concrete or masonry slab which is supported by either natural ground or an earth fill.

5. Floor joists shall have a clearance of not less than eighteen inches (18") between the bottom of the joists and the surface of the ground underneath. The ground underneath floor joists shall be leveled or smoothed off so as to maintain a reasonably even surface under the entire area covered by the floor joists.

6. All wood sills, including mudsills and sole plates, which are placed directly on the ground or on masonry or concrete foundations, shall be of the grade and kind of lumber specified in paragraph No. (9).

7. Wood sleepers or similar floor supports when placed directly on masonry or concrete which is in contact with the ground shall be of the grade and kind of lumber specified in paragraph No. (9).

8. All wood members used to support permanently a load of any kind, in buildings over four hundred square feet (400 sq. ft.) in area, shall be of the grade and kind of lumber specified in paragraph (9) when any part of such member is placed within eighteen inches (18") of any earth, either natural ground or earth fill.
Sections 2529, 3809, and 4801
and additions to such existing systems, etc.

etc.

Scope

Definitions

and additions to such existing systems, except as otherwise provided elsewhere. All regulations of this chapter shall apply to all

etc.

etc.

General

Refer to Chapter 49: Where it is desired to regulate the installation of refrigeration systems, the following provisions are recommended for inclusion in the code:

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