OFFICIAL
BUILDING CODE
CITY AND COUNTY OF DENVER
CITY AND COUNTY OF DENVER

Ordinance No. 32, Series 1941

SERIES OF 1941. COUNCILMAN’S BILL NO. 45. INTRODUCED BY COUNCILMAN BLAKLEY.

A BILL


BE IT ENACTED BY THE COUNCIL OF THE CITY AND COUNTY OF DENVER:

Section 1: That Section 1102 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto a new paragraph which shall read as follows:

"Provided, however, that the area restrictions on one story buildings in Fire Zones 2, 3 and 4 may be increased 100%.”

Section 2: That Section 1202 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto a new paragraph which shall read as follows:

"Provided, however, that the area restrictions on one story buildings in Fire Zones 2, 3 and 4 may be increased 100%.”

Section 3: That Section 1302 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto a new paragraph which shall read as follows:

"Provided, however, that the maximum allowable area on any one floor located in Fire Zones 2, 3 and 4 may be increased 50%.”

Section 4: That Section 1305 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:
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Section 5: That Section 1909 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto a new paragraph which shall read as follows:

"Fireproofing of steel may be omitted in one story buildings of Group 'F' and 'G' occupancies when the entire areas of the buildings are protected by an approved automatic sprinkler system as specified in Chapter 38."

Section 6: That paragraph (1) of Section 1910 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"(1) Floor construction shall be tongued and grooved or splined lumber not less than two (2) inches nominal in thickness with a top layer of flooring of one (1) inch nominal thickness laid thereon."

Section 7: That Section 1911 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Section 1911: The minimum allowable thickness of roof sheathing shall be two (2) inches nominal, the timbers and planking shall be self-releasing at end supports on walls, and no planking or timber shall extend across or through fire, party or division walls. Wood joists, beams, girders and rafters supported by masonry walls shall be anchored thereto as provided in Section 2508.

"Roof covering shall be a 'Fire-Retardant' roofing as specified in Section 4305 and shall be required over all combustible roof construction."

Section 8: That Section 2701 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto two new paragraphs which shall read as follows:

"When approved by the Chief Building Inspector, the 'Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings' of the American Institute of Steel Construction may be used.

"The allowable unit stresses for used steel and iron shall be assigned by the Chief Building Inspector, but in no case more than eighty percent (80%) of the stresses permitted for new steel and iron shall be used."
Section 9: That Section 2903 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Section 2903: (a) The thickness of solid masonry walls shall be sufficient at all points to keep the combined stresses due to live, dead and other loads for which the building is designed, within the limits specified in Section 2409 and Section 2410.

"The minimum thickness in inches of solid masonry exterior bearing or party walls, except panel and enclosure walls and walls of dwellings, shall not be less in thickness than specified in the following Table No. 1; provided, that in no case shall the uppermost fourteen (14) feet of such wall be less than eight (8) inches in thickness and each successive thirty-five (35) feet or fraction thereof shall be increased not less than four (4) inches in thickness.

**TABLE NO. 1**

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<td>Stories</td>
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"Exception: Exterior walls for Group I buildings shall be as specified in part (c) of this section.

"(b) Exterior non-bearing walls and interior bearing walls of solid masonry, except panel and enclosure walls and walls of dwellings shall be not less in thickness than specified in the following Table No. 2; provided that in no case shall the uppermost fourteen (14) feet of such wall be less than eight (8) inches thick and that each successive fifty (50) feet or fraction thereof shall be increased not less than four (4) inches in thickness.

**TABLE NO. 2**

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"Exception: Solid masonry non-bearing walls for Group I buildings, not over three (3) stories high shall be as specified in part (c) of this Section. Eight (8) inch interior bearing and non-bearing walls when supported laterally as provided in Section 2901 may be two (2) stories.'

"(c) Solid masonry walls, either bearing or non-bearing, for Group I buildings not over three (3) stories in height shall be not less in thickness than specified in Table No. 3, provided that eight (8) inch walls shall not exceed a height of twenty (20) feet, except in gables where such height shall be limited to thirty (30) feet, subject to the requirements for lateral support as provided in Section 2901.

"Twelve (12) inch walls shall be limited in height to fifty (50) feet, subject to the requirements for lateral support as provided in Section 2901.

TABLE NO. 3

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<td>Basement</td>
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<td>Stories</td>
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"(d) Pilasters and cross walls used as lateral support for walls shall be spaced not farther apart than provided in Section 2901. No cross wall less than eight (8) inches thick shall be considered as providing lateral support. Pilasters required for lateral support shall have a width of not less than one-eighth the clear distance between them, and the projecting thickness of the pilaster shall be not less than one twenty-fourth (1/24th) of the height of the wall.

"In one story buildings having walls not over sixteen (16) feet high to the under side of girders, joists or trusses and pilastered or supported by cross walls as specified in paragraph (d) of this section may have a total height of twenty (20) feet."

Section 10: That Section 2904 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Section 2904: In all solid unit masonry walls at least every sixth course on both sides of the wall shall be bonded and there shall be at least one (1) full header in every 144 square inches of each wall surface. In walls more than twelve (12) inches thick, the inner joints or header courses shall be covered with another header course which shall break joints with the course below."
Section 11: That Section 2905 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Section 2905: The unsupported height of isolated piers shall not exceed ten (10) times their least dimension unless properly reinforced. Piers of solid unit masonry shall be laid up in cement mortar.

"Walls in which the openings are of such an extent as to leave narrow sections two (2) feet or less in width, shall have such narrow sections computed and constructed as for isolated piers.

"Piers, columns or pilasters shall be provided as may be required under points of concentrated loads."

Section 12. That Section 2909 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Exterior bearing and party walls of hollow clay tile and concrete block or tile, hollow walls of solid masonry units and hollow monolithic concrete walls shall be not less in thickness in inches than as specified in the following Table No. 4; provided that in no case shall the uppermost twelve (12) feet of such walls be less than eight (8) inches in thickness, and each successive twenty-five (25) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness

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"Private garages and residences may have bearing and non-bearing walls of hollow tile, concrete block or tile, hollow walls of brick or hollow monolithic plain concrete of the thickness specified in Table No. 3, and height as specified in Section 2903 (c)."

Section 13: That Section 2912 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Hollow tile or concrete block or tile shall not be used for isolated piers or pilasters. Walls in which the openings are of such an extent as to leave narrow sections two (2) feet or less in width shall have such narrow sections computed and constructed as for isolated piers."
"Piers, columns or pilasters shall be provided as may be required under points of concentrated loads."

Section 14: That Section 2927 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Veneer on masonry walls other than panel or enclosure walls, shall not exceed forty (40) feet in height above foundations or other definite and secure supports.

"Exception: In Group I buildings, one and two stories in height, metal ties approved by the Chief Building Inspector may be used in place of brick bond as required in Section 2904, in top story only, and the height of such walls shall not exceed ten (10) feet, or twenty (20) feet, including gables. Piers, columns or pilasters shall be provided as may be required under points of concentrated loads."

Section 15: That Section 3102 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Concrete slab floors shall be not less than two and one-half (2 1/2) inches thick. Topping, when poured monolithic with slab, may be included as a structural part of the slab. Sleepers for the nailing of wood floors 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 (1/2) inch into the slab. Concrete joists shall be solidly bridged for lateral support as follows: One (1) row of concrete bridging shall be placed in clear spans of fifteen (15) feet to twenty-four (24) feet; two (2) rows of bridging shall be placed in all clear spans of twenty-four (24) feet or more. Bridging shall be reinforced continuously top and bottom with not less than one-half (1/2) inch round rod or the equivalent area in other shapes. Such bridging shall be the full depth and width of the joists.

"Clay tile and joist construction shall have a minimum coverage of two (2) inches of concrete where such slabs carry calculated stress. Joist and pan construction shall have a minimum coverage of two and one-half (2 1/2) inches over the pans."

Section 16: That Section 3104 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Mill constructed floors shall be not less than two (2) inches nominal splined or tongued and grooved plank covered with one (1) inch nominal flooring land crosswise or diagonal. Top flooring shall not extend closer than one-half (1/2) inch to walls to allow for swelling in case the floor becomes wet. Such one-half (1/2) inch
space shall be covered by a moulding fastened to the wall and so arranged that it will not obstruct the swelling or shrinking movement of the floor. Corbeling of masonry walls under floor planks may be used in place of such moulding.

"If laminated floors are used, at least two laminations at the wall shall be omitted until after glazing and roofing has been completed.

"Laminated floors consisting of planks not less than four (4) inches nominal width set on edge close together and spiked at about eighteen (18) inch intervals shall have the joints broken in such manner that no continuous line will occur across the floor and such flooring shall not be spiked to the supporting girders. Joints shall be made only at the supports and at the quarter points, with no more than two-thirds (2/3) of such joints away from support. Joints between the planks of a laminated floor shall be made and kept tight.

"The framing, fire cutting and anchoring of supporting timbers shall comply with the requirements of Chapter 25.

"Floor timbers shall be not less than six (6) inches nominal in either cross sectional dimension."

Section 17. That Section 3105 of Ordinance No. 32, Series of 1935, be and the same is hereby amended by adding thereto a new paragraph which shall read as follows:

"Floor joists shall have a clearance of not less than eighteen (18) inches from the ground."

Section 18: That Section 3202 of Ordinance No. 32, Series of 1935, be and the same is hereby amended and re-enacted to read as follows:

"Section 3202: The general requirements for construction of floors as specified in Chapter 31 shall also apply to roofs, except that in Type II buildings the roof sheathing shall be not less than two (2) inches nominal in thickness and concrete or gypsum roof slabs shall be not less than two (2) inches 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. Wood roof trusses shall not be used where exposed to weather. 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."
Section 19. If any section, sub-section, 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 Council of the City and County of Denver hereby declares that it would have passed this ordinance, and each section, sub-section, clause or phrase thereof, irrespective of the fact that any one or more sections, sub-sections, sentences, clauses or phrases be declared unconstitutional.

Section 20: All ordinances, or parts of ordinances, in conflict herewith are hereby repealed.

Section 21: In the opinion of the Council this Ordinance is necessary for the immediate protection and preservation of the public health, safety, convenience and general welfare, and it is enacted for that purpose and shall be in full force and effect immediately after its passage and final publication.

Passed by the Council and signed by its President this 21st day of April, A. D. 1941.

HAROLD M. WEBSTER, President.

Signed and approved by me this 23rd day of April, A. D. 1941.

BEN F. STAPLETON, Mayor.

Attested by the undersigned with the corporate seal of the City and County of Denver.

GEORGE F. ROCK,
Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver.

By SIEWERS FINCHER, Deputy Clerk.

Published in The Rocky Mountain News.
First publication April 19, 1941.
Last Publication April 24, 1941.
ORDINANCE No. 27

Series of 1944—Councilman’s Bill No. 36—Introduced by Entire Council.

A BILL

For an Ordinance in regard to buildings used or intended to be used for human habitation which are or are likely to become public nuisances or dangerous to the health, morals, safety or general welfare or which might tend to constitute a fire menace; providing procedures in relation thereto and penalties for violation of this ordinance.

WHEREAS, in the City and County of Denver there are, or in the future may be, buildings used or intended to be used for human habitation which are or are likely to become public nuisances or dangerous to the health, morals, safety or general welfare, or which might tend to constitute a fire menace; and,

WHEREAS, the regulation of such buildings falls within the police power of the City and County of Denver;

NOW, THEREFORE, BE IT ENACTED BY THE COUNCIL OF THE CITY AND COUNTY OF DENVER:

Section 1. This ordinance shall be known and referred to as the Housing Code of the City and County of Denver.

Section 2.—Definitions. When used in this Ordinance, the following definitions shall apply unless the context clearly indicates otherwise:

(a) Approved, for the purpose of this ordinance, shall be deemed to mean materials or installations as required by the Building, Plumbing, Electrical, or other existing ordinances of the City and County of Denver.

(b) The term Dwelling Unit means any place or structure or part thereof used for human habitation by a family, and having facilities for the preparation and consumption of food.

(c) The term Family means one person living alone, or a domestic household consisting of any two or more persons living in the same place or structure, related by adoption, marriage or blood, or joined by previously existing ties of friendship or common interest, and including not more than two lodgers.

(d) The term Room means any enclosed division of a dwelling unit containing over seventy square feet of floor space and commonly used for living purposes, not including lobbies, halls, closets, storage space, bathrooms, utility rooms and unfinished attics, cellars or basements.
(e) The term When Available as applied to water, means that such water is now in or will be installed without charge in a street bounding the premises, provided that not over 150 feet of service pipe need be laid to bring said water from the street main to the dwelling unit.

(f) The term Building and the term Structure, each mean any facility erected or used for a dwelling unit or units.

(g) A Substandard Dwelling Unit means:

A. Any dwelling unit or the premises on which the same is located, in which any of the following conditions exist to an extent that endangers the health, morals, safety or public welfare, or constitutes a public nuisance or a fire menace:

1. Structural unsoundness.
2. Defective chimneys, flues or heating apparatus.
3. Defective wiring.
4. Weakened or insufficient foundations, defective flooring or flooring supports.
5. Crumbling, loose or falling plaster.
6. Cracked, bulging, settling, or separated walls or partitions.
7. Interior or exterior walls or other vertical structural members that list, lean or buckle to such an extent that a plumb line passing through the center of gravity falls outside of the middle third of its base.
8. Defective ceilings or supports.
9. Defective roof or supports thereof.
10. Roof or walls of insufficient strength to resist snow and wind loads.
11. Broken windows or doors.
12. Not being adequately weatherproof.
13. Not capable of being adequately and safely heated.
14. Defective, dark, cramped, obstructed or otherwise dangerous passageways or stairways or insufficient exits.
15. Any dwelling unit, the premises on which same is located, or any other structure on such premises, having any condition dangerous to the occupants thereof, passersby, adjoining property or occupants thereof, or to the public generally.
16. Any dwelling unit, the premises on which same is located, or any other structure on such premises, being
insanitary, infested by insects or rodents, or being a health hazard for any reason.

17. Being in a dilapidated condition.

18. Being a life or fire hazard in itself, or because of its location or surroundings.

19. Having damp or wet rooms used for living purposes.

B. Any dwelling unit, or the premises on which the same is located, which fails to have:

1. When available, City running water piped into each dwelling unit, with sink and all plumbing installed in an approved manner, and in addition available to each dwelling unit, without entering any other dwelling unit, and located within the building, a toilet fit for use, water flushed, and installed in an approved manner, with at least one such toilet to not over three dwelling units and at least one such toilet to a total of not over twelve persons.

2. If the City running water is not available, a well as a source of water supply, providing such water is approved in writing by the Denver Health Department at least once every twelve months.

3. Available to each dwelling unit, some form of approved heating facility, in usable and safe condition, furnished by owner or tenant, including a chimney or other approved vent, and capable of adequately heating said unit.

4. Available to each dwelling unit, and furnished by owner or tenant, approved facilities and approved vents for cooking which are not used by the occupants of any other dwelling unit.

5. For every room, at least one glazed window opening directly to the outside air, having an area at least equal to 8% of the floor area of such room and capable of being opened for ventilation to an extent of at least 4% of said floor area; provided that in the case of two or more rooms connected with openings not less that five feet in width without doors, the combined window area provided in such rooms may be used in computing the amount available for the combined floor area.

6. In every toilet room or bathroom not provided with a window or skylight which can be opened, a vent, as now provided for in the Building Code and Plumbing Code of the City and County of Denver.

7. Separate access to such dwelling unit without passing through any room of any other dwelling unit.

Section 3. No building structure or place herein declared to be substandard shall be used as a dwelling unit.
Section 4. No dwelling unit shall be occupied by more than one family.

Section 5. Not more than two persons per room shall occupy any dwelling unit, except, for the purpose of this section, a child under six years of age shall not be counted as a person.

Section 6. This ordinance shall not apply to hotels or rooming houses licensed under the Municipal Code, except that dwelling units with provision of any kind for preparation and consumption of food in a structure that would otherwise be considered as a hotel or rooming house shall come under this ordinance.

Section 7. It shall be the duty of the Chief Building Inspector or to enforce this ordinance, and for this purpose, he shall appoint, with the approval of the Mayor, a special deputy or deputies.

Section 8. In the event that the Building Inspector has reason to believe that conditions prohibited by this ordinance exist, on any premises, he shall inspect such premises and all structures thereon containing dwelling units, and in the event he is denied access to such premises or dwelling units for any reason, he shall, in the manner provided in Sec. 431, Ch. 48, C.S.A. 1935, obtain an appropriate court order permitting him and his deputies to have access to such premises and dwelling units for the purpose of inspecting the same. If after such inspection, the Building Inspector shall determine that there is a violation of this ordinance, he shall forthwith notify the record owner of the property or the agent for the owner, and the occupant of the same, if a different person, and the mortgagee, if any, either by written notice personally served, or in the event personal service is not obtained, by a notice sent to the occupant by registered mail addressed to the premises, and to the owner by registered mail at such address as is shown to be the address of the owner on the tax records and to the holder of the mortgage or trust deed at address shown in mortgage or deed of trust, or in case such person cannot be found, by posting notice upon the premises in the manner provided for service of justice court summons and complaint in forcible entry and detainer cases. Said notice shall set forth in what respects the dwelling unit, building or property is substandard, and give the owner and the occupant not less than thirty days from the date of the notice to make such repairs or changes necessary to correct the substandard condition.

Section 9. The Building Inspector shall have the authority to demolish any structure so found to be substandard, or to prohibit the further use of said structure or premises, or any portion thereof, with or without consent of the owner, occupant or any person claiming an interest in the ownership, and for said purpose shall have the right to enter upon the building or premises of such owner or an adjoining owner from time to time, as may be necessary, and neither the owner nor the occupant nor other person having an interest in said property shall be entitled to any compensation or damages for any act of said Building Inspector.
performed pursuant to the provisions hereof. If any owner refuses or neglects to comply with any order of the Building Inspector, he may cause to be done whatever is necessary to comply with the order and shall pay the costs and expenses thereof out of the Emergency or other available fund, upon his order and the approval of the Mayor. He shall forthwith serve notice by registered mail upon the owner and lien holder, as hereinabove provided, of the amount of such costs and expenses, and that he will, at a time and place specified in the notice, hold a hearing, when and where the owner will be required to show cause why said amount should not be paid, and a lien placed upon the premises as hereinafter provided.

In event said owner fails to pay said amount, or fails to show cause as above provided, the Building Inspector shall thereupon certify a statement thereof to the Manager of Revenue, who in turn, shall assess and charge the same against the real estate upon which the building was or is situate, and the same shall become a lien upon real estate whereupon said building was or is situate. The assessment hereby created shall bear interest at the prevailing delinquent tax rate from the date thereof until paid, and shall be collected as general taxes are collected in the City and County of Denver. The lien hereby created shall be superior and prior lien to all liens except for general and special taxes.

In performing any act pursuant to the provisions of this ordinance, the Building Inspector and his deputies, and the Manager of Revenue shall not be personally liable for damages.

Section 10. All orders and decisions of the Building Inspector shall be final and conclusive, unless application for review be filed with the Board of Review, as hereinafter provided.

Section 11. There shall be, and hereby is created, a Board of Review which shall consist of five members appointed by the Mayor. Not more than one member of said Board shall hold any other public office or position within the City and County of Denver. The first members of said Board of Review shall be appointed for terms of one, two, three, four, and five years, respectively, as designated by the Mayor; and as their terms respectively expire, new members shall be appointed for a full term of four years. Vacancies shall be filled by the Mayor for the unexpired term of any member whose office becomes vacant. Members of said Board shall be removable by the Mayor.

Section 12. The Board of Review shall meet upon call of the chairman or vice-chairman and shall keep minutes of its meetings and make an annual report to the Mayor and to the City Council. Permanent quarters and adequate secretarial and clerical services and supplies shall be furnished to the Board of Review by the City and County of Denver. The quarters and service shall not in any way be related to any department having administration of this Code.

Section 13. The Board shall adopt rules to carry out the provisions hereof, and to regulate the proceedings before said Board.
Official

BUILDING CODE

CITY AND COUNTY

of Denver

Price $1.50

MCMXXXV
Preface

In this age of science and invention, all things man made, including our laws, must inevitably become obsolete. Such has been the history of building codes throughout the country. Laws adopted during the 19th Century or the early years of this century do not apply to building methods or materials of today, nor have they kept pace with the advancement of engineering practices. Investigations of the Building Code Committee of the United States Department of Commerce revealed such wide variance of requirements in different localities as to render a standardization of construction materials or methods a physical impossibility.

These facts have been apparent to Denver's building industry for many years, and in the fall of 1932 a delegation called the matter to the attention of Mayor Begole and the City Council. On October 31st, 1932, the Council adopted a resolution requesting the Chief Building Inspector to select a committee of five to draft a new Building Ordinance for submission to the Council. The committee selected consisted of:

Mr. G. Meredith Musick, Architect
Mr. Jay W. McCullough, Consulting Engineer
Mr. L. A. Barley, Chief Engineer, Mountain States Inspection Bureau
Mr. Francis J. Kirchhof, General Contractor
Mr. Wendell T. Hedgcock, Chief Building Inspector
Mrs. Alida K. Chamberlin, Secretary

We wish to acknowledge with gratitude the untiring efforts and ability which this committee has devoted to this work. We also express our appreciation to the following individuals and subcommittees who have aided in their specialized lines in the preparation of this code:

Denver Real Estate Exchange—
Mr. Aksel Nielsen
Mr. Cyrus Hackstaff
Mr. S. T. Steinmetz

Residential Sub-Committee—
Mr. Arthur A. Fisher
Mr. Donald Weese
Mr. M. M. Herres
Mr. Armond Thompson

Council Committee on Fire, Police and Excise—
Mr. Harry Rosenthal
Mr. Harry W. Risley
Mr. Eugene Veraldi
Fire Department Officials—
   Chief John F. Healy
   Deputy Chief, P. J. Boyne

Deputy City Attorneys—
   Mr. Robert Kirschwing
   Mrs. Mary Seach

Consulting Engineer—
   Mr. Karl Burghardt

To the Pacific Coast Building Officials Conference we are
indebted for the general outline of the Code, and for much of
the material contained herein. The following publications have
also been of material help in the work:

   The New England Building Officials Conference
   The National Board of Fire Underwriters
   Bulletins of the United States Department of Commerce
   The American Society for Testing Materials
   Joint Committee on Reinforced Concrete

The A. B. Hirschfeld Press, Denver, has made it possible to
publish the work in book form for convenient reference.

It is not to be supposed that this Code will be of fixed and
unflexible nature. A Board of Examiners and Appeals has been
created with authority to review decisions of the Building In-
spector and to pass upon the merits of new materials and
methods of construction. Changing local conditions and advance-
ments in architectural and engineering standards may require
modification and revisions from time to time. However, the Code
has attempted to set up standards of performance rather than
to specify certain materials, thus leaving to the discretion of the
Board the question as to whether or not a new material will
comply with these standards, and rendering the necessity of fre-
quently Code revisions unnecessary.

We dedicate this Code to the citizens of Denver in the hope
and expectation that the enforcement of its provisions will prove
beneficial to the majority, and that Denver’s construction needs
may be filled with the greatest economy consistent with public
safety and a high standard of construction.
such portion or portions are segregated as specified in Section 503 of this Code, then only such portion or portions of the building need 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 or 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) 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 specified in this Code for buildings hereafter erected for similar uses or occupancies.

No existing building shall have its floor area or its number of stories increased beyond the limits which would be allowed for new buildings under similar conditions.

The Chief Building Inspector may issue a permit for an addition to a present non-conforming building of Type I or J occupancy, said addition to be of similar construction to the existing building, when in his opinion such addition will not increase the fire hazard.

(d) Every alteration or repair to any structural part or portion of an existing building shall, when deemed necessary in the opinion of the Building Inspector, be made to conform to the requirements of this Code for new buildings. Minor alterations, repairs and changes not covered by the preceding paragraphs (a), (b) and (c), may be made with the same materials of which the building is constructed; provided, that not more than twenty-five (25) per cent of the roof covering of any building shall be replaced in any period of twelve (12) months unless the entire roof covering is made to conform with the requirements of this Code for new buildings.

Sec. 105. The requirements contained in this Code, covering the maintenance of buildings, shall apply to all buildings and/or structures now existing or hereafter erected. All buildings and/or 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.
CHAPTER 2 — GENERAL PROVISIONS

Sec. 201. No person shall erect or construct any building or structure, nor add to, enlarge, move, improve, repair, alter, 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/or tract, or similar general 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 thereon, 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 (\(\frac{1}{8}\)) inch to one foot.

Plans and specifications shall be of sufficient clarity to indicate the nature and character of the work proposed and to show that the building and zoning laws 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 sub-section 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 Designer.

No permit shall be issued for a building of a public or semi-public nature, such as office buildings, apartment houses, churches, schools, museums, libraries, art galleries, theatres, assembly halls, including City and County and State buildings, or for any building exceeding two stories in height, unless the plans
Sec. 205. 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 and/or structures referred to in this Code and located in the City and County of Denver, and a final inspection shall be made of every building and/or structure hereafter erected prior to the issuance of the Certificate of Occupancy as specified in Sec. 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 in a conspicuous place on the 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 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 24 hours' notification, not including Sundays or holidays, from the permit holder or his agent, shall make the following inspections of Type II, III, IV and V buildings, as defined in Chapter 5, and shall notify the permit holder or his agent wherein the same fails to comply with the law. No oversight or dereliction on the part of the Chief Building Inspector or any of his deputies shall be construed as waiving any of the requirements of the Code or approving any work in violation thereof.

Footing Inspection: To be made after trenches are excavated and before any footings are poured.

Foundation Inspection: Foundation inspection to be made after all foundations are poured and forms removed.

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.

Plaster Inspection: To be made after all lathing and backing is in place, and before any stucco or 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/or 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 no plaster shall be applied until the approval of the Building Inspector has been received.
Sec. 206. No building shall be occupied or 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. No such Certificate of Occupancy shall be issued unless the building shall comply with the requirements of this Code as specified in Section 104.

Sec. 208. In demolishing any structure or part thereof, story after story consecutively shall be completely removed. No material shall be placed upon a floor of any building in the course of demolition; the brick, timbers and other parts of such story shall be lowered to the ground immediately upon displacement. The materials to be removed shall be properly wet to lay any dust incident to their removal. A substantial shed, to be approved by the Chief Building Inspector, covering thoroughfares, shall be provided when demolishing buildings over twenty-five feet (25') in height. When any building has been wrecked, the person, firm or corporation who has wrecked the same shall immediately clear the property and adjacent streets and alleys of all rubbish, refuse and loose material resulting from such wrecking.

The wrecking contractor shall fill all excavations level with the adjoining grade. Plaster, brick and other incombustible materials may be used to fill such excavations, provided the top one (1) foot of fill shall be clean earth. The filling of such excavation shall not be required when a building permit has been issued for a new building on the site, and the construction started within ninety (90) days of the completion of wrecking operations. Such excavation shall, however, be provided with a substantial fence, not less than 3'6" in height, protecting the excavation on all sides.

Sec. 209. (a) Contractor Defined. A contractor, within the meaning of this ordinance, is a person, firm, co-partnership, corporation, association, or any combination thereof:

1. Who undertakes with or for another to build, construct, alter, repair, add to, move, or wreck any building or structure or any portion thereof, within the City and County of Denver for which a permit is required under the provisions of this ordinance for a fixed sum, price, fee, percentage or other compensation other than wages.
2. Who builds, constructs, alters, adds to, moves or wrecks any building or structure either on his own or other property for purposes of speculation, except Group I buildings and buildings or structures accessory thereto, intended for his own personal use and permanent occupancy.

(b) Exceptions. The provisions of this section shall not apply to:

1. Sub-contractors working for and under the supervision of a general contractor.
2. Plumbers, electricians, or other specialized trades for which special licenses are required.
3. Owners or their authorized agents making ordinary repairs to any building, which repairs do not involve the structure of the building, and on which a contractor is not employed.

(c) Issuance of Licenses. The issuance of all contractors' licenses, all hearings for suspension or revocation of licenses, or other matters pertaining thereto, shall be by "The Board of Examiners and Appeals" (See Sec. 302). Applications for contractors' licenses shall be on such forms and shall furnish such information as the Board may prescribe, and shall be accompanied by an examination fee of Ten Dollars ($10.00). If in the opinion of a majority of the Board the applicant is qualified by training or experience and is financially and morally responsible to fulfill the obligations of contractor, it shall direct the Chief Building Inspector to issue the applicant a license upon payment of the annual license fee herein prescribed, of which the examination fee shall be a part.

(d) The Board shall issue licenses for the following classes of contractors and the annual license fees shall be as prescribed for each class. All license fees shall be payable annually on or before the first day of May of each year. Licenses which are one year or more in arrears may be renewed by the Chief Building Inspector without re-examination, upon payment of the fees for the current year plus one year's annual fees as penalty, providing the license has not been suspended or revoked by action of the Board.

Class 1 and 2 licenses shall also entitle the holder thereof to the privileges and duties of cement contractors' license as provided in Article VII. Chapter LXV of the Municipal Code of 1927, or as may be amended, providing the required bond shall be posted as required by said ordinance.

1. General Contractors' License, Unlimited, shall entitle the holder thereof to contract for the building, construction, alteration or repairing of any type or size of structure permitted by this Code. The annual fee shall be $100.00.

2. General Contractors' License, Limited, shall entitle the holder thereof to contract for the building, construction, alteration or repairing of buildings in which the total value of all labor and materials entering the work, does not exceed Fifteen Thousand Dollars ($15,000). The annual license fee shall be twenty-five dollars ($25.00).

3. Special Contractors' License shall be issued by the Board to those engaged in contracting for labor or for labor and mate-
rial involving only one trade, such as brick contractor, plastering contractor and elevator contractor. This license shall also be issued to contractors specializing in one particular kind of work for which it has been issued and shall not be extended to cover other than the class of work for which issued. The annual license fee shall be Ten Dollars ($10.00).

The annual license fee for wrecking contractors shall be fifty dollars ($50.00). This license shall entitle the holder thereof, to deal in second hand building materials. No wrecking shall be done except by a licensed wrecking contractor, except that a licensed general contractor may remove portions of a building where such wrecking is a portion of a program of alteration or remodeling. A general contractor may use excess salvaged materials in other work constructed by him, or may dispose of same to a licensed wrecking contractor, but may not sell or offer for sale to the public.

(e) License Required. No building permits shall be issued to any contractor who has not first obtained a license or who is delinquent in payment of his annual license fees, or whose license has been suspended by action of the Board.

(f) Duties and Responsibilities of a Contractor. A contractor shall be responsible for all work included in his contract, whether or not such work is done by him directly or by sub-contractor. He shall be responsible for all funds or property received by him for prosecution or completion of a specific contract or for a specific purpose.

The Chief Building Inspector may, upon his own motion, and shall upon the verified complaint in writing of any person, require any contractor to appear before the Board for hearing upon five (5) days' notice in writing, mailed to his last known post office address, and the Board shall have the power to temporarily suspend or permanently revoke a license if the holder thereof is found guilty of or commits any one or more of the following acts or omissions:

1. Abandonment of any contract without legal cause.
2. Diversion of funds or property received for performance or completion of a specific contract, or for a specified purpose in the performance or completion of any contract, and their application or use for any other contract, obligation or purpose, or the failure, neglect or refusal to use such funds or property for the performance or completion of said contract.
3. Fraudulent departure from or disregard of, plans or specifications in any material respect, without consent of the owner or his duly authorized representative.
4. Wilful and deliberate disregard and violation of the building code of the City and County of Denver, or failure to comply with any lawful order of the Chief Building Inspector.
5. Failure to keep records showing all receipts and disbursements of the licensee in all of his transactions as a contractor as the term is defined in this ordinance, and to produce the same for examination by the Board when so required.
6. Misrepresentation of a material fact by applicant in obtaining a license.
7. The doing of any wilful, fraudulent act by the licensee as a contractor in consequence of which another is substantially injured.

8. Fraudulent use of license to obtain building permits for another.

9. Carelessness or negligence in providing reasonable safety measures for the protection of workmen and the public.

10. Failure to obtain permit as required in Chapter 2 hereof.

(g) Penalties for Violation. In addition to the suspension or revocation of license by the Board as provided in Section 209 hereof, any person, firm or corporation violating any of the provisions of this section shall be subject to the punishment as provided in Section 306 hereof.

Sec. 210. All state laws and municipal ordinances dealing with measures for the safety of workmen and of the public, shall be observed in addition to any requirements contained herein.

The machinery of all hoists located on the exterior of a structure shall be inclosed in a shed for protection against the weather and falling debris. Such shed shall be of ample size for the safe and convenient operation of the machinery. When located closer than fifteen (15) feet to the building wall, the roof shall be of plank not less than one and five-eighths (1 5/8) inches thick.
CHAPTER 3 — ENFORCEMENT

Sec. 301. There shall be appointed by the Mayor, a Chief Building Inspector, who shall be an architect or a qualified construction engineer of not less than five years' experience. It shall be the duty of the Chief Building Inspector to inspect, or cause to be inspected by a deputy having proper qualifications, all buildings in process of construction or repair, and he shall have power to inspect all other buildings to ascertain if the ordinances in regard to buildings are being complied with. He shall keep a record of such inspections and in cases where the ordinances are not being complied with, he shall make a report thereof to the Mayor. The Chief Building Inspector is hereby authorized and empowered, and it shall be his duty to enforce all the provisions of this ordinance and to report monthly to the Mayor on all matters pertaining thereto. It shall be his duty to make and enter in court, all complaints charging violations of the building or zoning ordinances. No oversight, neglect or dereliction on the part of the Chief Building Inspector or his authorized deputies or assistants shall authorize or legalize the violation of any of the provisions of this ordinance.

The inspectors of the electrical, plumbing and heating, boiler and elevator and smoke departments shall make reports to the Chief Building Inspector and such reports shall be entered of record in his office. It shall be the duty of all the members of the fire department to make prompt report to the Chief Building Inspector in every case where they may find any building or structure in an unsafe or defective condition. Such report shall be entered of record in his office.

Said Chief Building Inspector shall have the power, with the approval of the Mayor, to appoint such assistant inspectors and clerks who must be qualified for the positions and who shall hold their offices for the same term as that of the Chief Building Inspector, unless removed by the said Chief Building Inspector with the approval of the Mayor.

Sec. 302. There is hereby created a “Board of Examiners and Appeals” which shall consist of one licensed architect, one licensed engineer, one contractor, and the Chief Building Inspector who shall act as secretary of the board, and the Chief of the Fire Prevention Bureau. The first three above named members shall be appointed by the Mayor to serve in the first instance for terms of one, two and three years respectively, and thereafter for terms of three years each. These three members shall receive compensation from the City in the amount of five dollars ($5.00) for each meeting attended, but in no case more than two hundred fifty dollars ($250.00) per year. The two members last named above shall serve without compensation.

The Board shall make and publish such rules as it sees fit for the conduct of its business.
Sec. 303. The Board of Appeals shall hear appeals from the decision of the Building Inspector upon payment to the Manager of Revenue of a fee of ten dollars ($10.00) by the appellant. If the decision of the Building Inspector is reversed, this fee shall be returned to the appellant. The Building Inspector shall not vote on appeals except in case of a tie vote.

Sec. 304. The Board of Appeals shall pass upon new materials or methods of construction, and accept or reject same, complying or not complying with the requirements of this Code. Application for approval of materials or methods shall be in such form as the Board may prescribe, shall be accompanied by a fee of ten dollars ($10.00), payable to the Manager of Revenue, and by such evidence as can be produced which would have bearing on the subject. The applicant shall, if required by the Board, make such tests as the Board may prescribe, the cost of such tests to be paid by the applicant.

Structures or elements of structures not specifically approved by the Building Code shall be permitted if tests made in laboratory or under actual working conditions show them equal to structures or elements of structures approved by the Building Code for similar locations and uses.

Sec. 305. CONDEMNATION OF DANGEROUS BUILDINGS AND STRUCTURES AND DECLARING WHAT ANNUISANCES AND PROVIDING FOR THE ABATEMENT THEREOF.

A. Definitions: Words used in the present tense include the future; the singular number includes the plural and the plural the singular.

Whenever the following words are used in this ordinance the same shall have the following meaning unless expressly stated otherwise, to-wit:

Building. Any construction in the process of construction, completely built or used, for the shelter or enclosure of persons, animals, chattels, or any part of such construction.

Structure. Shall include buildings, outhouses, barns, sheds, staging, scaffolds, ashpits, fences, billboards, signs, sidewalks, wagons, junk piles, rubbish, excavations, walls or any object or thing used or maintained above or below the ground, or any part of such structure.

Person. The word person shall be construed as if followed by the words, “persons, firm or corporations, co-partner ships, associations, joint and several owners, individuals, trusts, and their agents, heirs, successors or assigns.”

Repair. The renewal or replacement of any existing part or parts of a building or structure for maintenance purpose only in keeping with its existing type of construction and use.

B. Dangerous Buildings and Structures: (a) That if in the City and County of Denver any building or structure shall from any cause be found or reported unsafe as being dangerous to public life, health, safety or property, or in such a dilapidated
and/or insanitary condition as to be unfit for use, or in the opinion of the Chief Building Inspector, with the concurrence of the Chief of the Fire Department, any building or structure shall be or become a fire menace to the public, community or adjacent property, the Chief Building Inspector shall have the authority and it shall be his duty to examine or cause an examination to be made of such building or structure, and if, in his opinion, the same be deemed unsafe, or a menace to public life, health, safety or property, or in such a dilapidated and/or insanitary condition as to be unfit for use, or a fire menace to the public, community or adjacent property, he shall immediately notify the owner, agent, or person of record having an interest in said building or structure, to cause the same to be made safe and secure, or that the same be shored up, repaired, removed, wrecked, filled or demolished, as the circumstances may require, and in conformity with the approval of the chief building inspector. Said notice shall state a reasonable time, having regard to the circumstances, within which such orders as set forth in said notice, shall be executed and complied with.

(b) If the public life, health, safety or property is in danger and immediate action is required by reason of a special emergency to preserve the public life, health and safety, the Chief Building Inspector is hereby authorized and it is his duty to enter, or he may authorize another person to enter, upon the premises and into any building or structure at any time with such workmen and assistance as may be necessary and cause said dangerous building or structure to be shored up, repaired, removed, wrecked, demolished, or filled, or otherwise made safe or secure, without delay, and a proper fence or barricade to be put up for the protection of the public and of passers-by, with proper notice on said building or structure, warning the public as to its dangerous character. This being an emergency because of the imminent peril to the public safety, life, health, and property, no previous notice is required to the owner, agent, or person of record having an interest in said building or structure. However, after said special emergency has been attended to by the Chief Building Inspector, as aforesaid, the Chief Building Inspector shall thereafter give notice as provided for in Section D hereof, to said owner, agent or person of record interested in said building or structure.

C. Discontinuance of Occupancy. (a) That if in said City and County of Denver, in the opinion of the Chief Building Inspector any building or structure is, or shall become, dangerous or unsafe, or in such a dilapidated or insanitary condition as to be unfit for occupancy, or a fire menace to the public, community, or adjacent property, the Chief Building Inspector has the authority and it is his duty to order the vacation of said building or structure, by serving on the occupants thereof an order of vacation in writing, stating the reason for the order of vacation and directing that the tenant vacate the said building or structure within a specified time, according to the circumstances.

(b) It shall be unlawful for any person to occupy or use any building or structure, or any part thereof, or to enter same until said building or structure is placed in a safe condition within the
meaning and intent of this Code, and until the written consent and approval of the Chief Building Inspector is first obtained.

D. Notice. (a) The notice herein referred to and to be served by the Chief Building Inspector upon the owner, agent, or person of record interested in said building or structure, as aforesaid, shall be served as follows, to wit: If the addresses or whereabouts of said owner, agent, or person of record interested in said building or structure, is known to the Chief Building Inspector, he shall cause said notice to be served upon said owner, agent or person of record interested in said building or structure, said service to be made either by personally serving said parties or by mailing a copy of said notice by registered mail, or service may be made by the sheriff of the county wherein said parties reside; and, in the event that the addresses and whereabouts of said owner, agent, or person of record interested therein, are unknown, then a copy of said notice shall be mailed to the last known address, if any, by registered mail, and if no last-known address is had then by publication of said notice in a public newspaper published in said City and County. Such publication shall be at least once each week for two successive weeks. Service shall be complete and all parties shall conclusively be presumed to have been served at the expiration of ten days from the date of the last publication and the affidavit of the publisher shall be evidence of such service. In addition to the foregoing manner of service of said notice the Chief Building Inspector shall cause a copy of said notice to be placed or posted upon such building or structure at or near its principal entrances, or at any other place he deems advisable.

(b) It shall be unlawful for any person to deface, interfere with, or to detach said notice placed or posted upon any building or structure, as aforesaid, without the consent of the Chief Building Inspector.

E. Owner to Pay Costs and Expenses. (a) The owner of said building or structure shall bear and pay the expenses and costs of shoring up, repairing, removing, wrecking, or demolishing, said building or structure, provided, that if said owner refuses or neglects to pay said costs and expenses after notice that they shall become a lien upon the real estate wherein said building or structure is situate and collected in the same manner as general taxes, said Chief Building Inspector shall pay the costs and expenses out of the Emergency Fund upon his order and approval of the Mayor.

(b) In the event that the Chief Building Inspector pays said costs and expenses as aforesaid, he shall certify a statement thereof to the Manager of Revenue, who in turn shall assess and charge the same against the real estate upon which said building or structure is or was situate and upon which the Chief Building Inspector has done or caused to be done the shoring up, repairing, removing, wrecking, demolishing, or filling, as aforesaid, and unless said assessment is paid within ninety (90) days after and from the date of notice thereof, the same shall become a lien upon the real estate wherein said building or structure is or was situate, said assessment to bear interest at the rate of 8 per cent per annum from the date of such assessment until paid, and
shall be collected as general taxes are collected in the City and County of Denver.

F. (a) Any building or structure within the corporate limits of the City and County of Denver, which by reason of fire, natural decay, defective structure; or having defective flues or heating apparatus, cracked foundations, crumbling plaster, cracked and separated walls and partitions, weakened floors due to deficient support and wear; confined or cramped stairways, insufficient exits, narrow or dark passageways, broken windows and doors admitting strong winds and rains, adding to the danger of collapse by reason of vibration and causing the building or structure to lean to one side; or being in a very dilapidated or insanitary condition; or having a defective roof or roof structure; or being in such a weakened state that a load of snow or heavy rain would cause said building or structure to collapse; or by reason of any or all of the above and foregoing conditions is beyond repair to make it fit for the use for which said building or structure was intended; or being in such a condition dangerous to the occupants thereof, passers-by, adjoining property and the owners or occupants of adjoining property, or to the public general, or to the community; or by reason of any or all of the above and foregoing conditions is a menace to the public health, or either a fire or health hazard, said building or structure shall be and it is hereby declared to be a nuisance and to be abated as such.

(b) Whenever the Chief Building Inspector of the City and County of Denver is satisfied that legal proceedings are necessary for the abatement of a building or structure hereinabove declared to be a nuisance, he shall apply to the Attorney for the City and County of Denver and the Attorney for the said City and County is hereby directed to institute and prosecute to final determination such legal proceedings as in his judgment may seem proper for the abatement of said building or structure herein declared to be a nuisance.

(c) Nothing in this section and no action taken thereunder shall be held to exclude such proceedings as may be authorized by this Code or any part thereof, or by or under any other ordinance or part of any ordinance, in force in said City and County, or any proceedings under the laws of the State of Colorado.

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/or structure or any portion of any building and/or structure in the City and County of Denver, 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 provisions of this ordinance or any lawful rule or regulation of the Board of Examiners, and Appeals, or any lawful order of the Chief Building Inspector shall be deemed guilty of a violation of this ordinance 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 three hundred dollars ($300.00), or by imprison-
ment in the County Jail for not more than ninety (90) days, or by both such fine and imprisonment in the discretion of the Court.

The issuance or granting of a permit or approval of plans and/or specifications shall not be deemed or construed to be a permit for, or an approval of, any violation of any of the pro-
visions of this Code. No permit presuming to give authority to violate or cancel the provisions of this Code shall be valid, except insofar 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 pre-
venting building operations being carried on thereunder when in violation of this Code or of any other ordinance of the City and County of Denver.

Every permit issued by the Building Inspector under the pro-
visions of this Code shall expire by limitation and become null and void, if the building or work authorized by such permit is not commenced within sixty 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 sixty days. Before such work can be re-commenced, a new permit shall be first obtained for the unfinished portion of such work.
PART II.

Definitions

CHAPTER 4

Sec. 401. For the purpose of this Code, certain terms, phrases and 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. Whenever 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.

"ALLEY." Any public space, or thoroughfare less than twenty (20) feet in width which has been deeded to the public for public use.

"ALTERATION." Alter or alteration means any change, addition or modification in construction.

"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.

"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.

"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" or "FIRE AREA" (See "Floor Area").

"ATTIC" or "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.

"BASEMENT" is that portion of a building between floor and ceiling, which is partly below and partly above grade, the ceiling in which is not less than 4' above the grade.

"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 and enclosure of persons, animals, chattels or movable property of any kind; and when separated by an "Absolute Fire Separa-
tion” each portion of such building so separated shall be deemed a separate building.

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

“CELLAR” is that portion of a building between floor and ceiling which is partly below and partly above grade, the ceiling in which is less than 4’ above grade.

“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.

“DEAD LOAD” in a building includes 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 used, built, rented, leased, let or hired out to be occupied, or which are occupied for living purposes.

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

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

“FLOOR AREA” is the area included within exterior walls or within exterior walls and fire walls of a building exclusive of courts.

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

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

“FOUNDATION” means a wall or pier below first floor serving as support for a wall, pier, column, or other structural parts of a building.

“GARAGE”—

“PRIVATE GARAGE” is a building or portion of a building in which not more than three motor vehicles are stored or kept, and in which no business or industry connected directly or indirectly with motor vehicles is carried on.

“PUBLIC GARAGE.” All buildings used for the storage, care or repair of motor vehicles, not included within the term of “Private Garage.”

“GRADE” (1) For buildings adjoining one street only, the elevation of the sidewalk at the center of that wall adjoining the street.

(2) For buildings adjoining more than one street, the average of the elevations of the sidewalk at centers of all walls adjoining streets.
(3) For buildings having no wall adjoining the street, the average level of the ground (finished surface) adjacent to the exterior walls of the building. All walls approximately parallel to and not more than five (5) feet from a street line are to be considered as adjoining a street.

"GUEST" means any person hiring and occupying a room for living and sleeping purposes.

"GUEST ROOM" means a room in a building occupied, or intended and designed to be occupied, let or hired out to "Guests."

"HEIGHT OF BUILDING" is the vertical distance from the "Grade" to the highest point 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 ten (10) 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.

"INCOMBUSTIBLE." An incombustible building material is one which will not oxidize within the temperature limits of a standard fire resisting test of not less than two hours' duration. Materials or assemblies involving combustibles in sufficient quantity or so arranged as to continue burning after removal from the test flame shall not be classed as incombustible.

"LINTEL" is the beam or girder placed over an opening in a wall, and which supports the wall construction above.

"LIVE LOADS" are all imposed, fixed or transient loads other than "Dead Loads."

"MASONRY" is that form of construction composed of stone, brick, concrete, gypsum, hollow clay tile, concrete blocks 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.)

"SOLID MASONRY" means masonry built without hollow spaces.

"HOLLOW WALL." A hollow wall is a wall built of solid masonry units laid in and so constructed as to provide an air space within the wall. When hollow walls are built in two (2) or more vertical separated withes, these withes shall be bonded together by the same masonry units used in the construction of the wall so as to exert common action under load.

"MEZZANINE" or "MEZZANINE FLOOR" is an intermediate floor placed in any story or room. When the total area of any such "Mezzanine Floor" exceeds thirty-three and one-third (33%\%) percent of the total floor area in that room or story in which said "Mezzanine Floor" occurs, 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 (7) feet.

"OCCUPANCY" as used in this Code pertains to and 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 that projects from the main line of an enclosing wall of a building and is carried on brackets or corbels.

"PERSON" means 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.

"PORCH." A roofed structure projecting from a building and separated from the building by the walls thereof.

"An Open Porch" shall have no enclosing features (except screen) higher than forty-two inches (42") above the floor except the roof and roof supports.

"An Enclosed Porch" shall have at least fifty percent (50%) of the horizontal section of the exterior walls in glass.

"REPAIR" means 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.

"SEATING CAPACITY." The seating capacity of a theatre auditorium, or any room or place of public assemblage in which seats are not fixed, shall be determined on the basis of seven (7) square feet of floor, balcony and/or 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 eighteen (18) inches of pew or bench length.

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

"SHALL," as used in this Code is mandatory.

"STORY" means 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. When the ceiling of the lower story of any building is four (4) feet or more above grade line, or when the attic story or space immediately under the roof of any building can be used for any purpose except service equipment pertaining to the building, such lower story or attic story shall be a story for the purpose of this Code.

"STREET" is any thoroughfare or public park not less than twenty (20) feet 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.

"VALUE" of a building shall be the estimated cost to replace the building in kind.
"VENEER" is the outer facing of brick, stone, concrete or tile attached to an enclosing wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

"WALLS"

"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.

"FIRE DIVISION WALL" is a wall of masonry or reinforced concrete which subdivides a building to restrict the spread of fire, but is not necessarily continuous through all stories nor extended through the roof.

"FIRE WALL" is a wall of masonry or reinforced concrete which subdivides a building to prevent the spread of fire by starting at the foundation and extending continuously through all stories to and above the roof.

"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.

"YARD" is an open, unoccupied space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this Code, and 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 for the purpose of this Code 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 Chart in Section 503.)

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.

The Types of Construction referred to in Chapters 6 to 15
inclusive, are:

Type I — Fire-Resistive Construction,
Type II — Heavy Timber Construction,
Type III — Ordinary Masonry Construction,
Type IV — Metal Frame Construction,
Type V — Wood Frame Construction,
and are defined in Chapters 18, 19, 20, 21 and 22 respectively.

Sec. 502. No change shall be made in the character of occu-
pancy or use of any building or portion of 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.

EXCEPTIONS:

The character of the occupancy of existing buildings may,
subject to the approval of the Building Inspector, be changed
and occupied for purposes in other Groups without conform-
ing to all the requirements of the 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 Sec-
tion 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) When the occupancy of a building is such that different portions of the building are placed in different occupancy Groups, a “Fire Separation” as specified in this Section shall be provided so that each Group is entirely segregated. Such “Fire Separation” shall provide either a complete vertical or horizontal separation, or a combination of both. Each portion of a building so segregated shall be considered, for the purpose of this Code, to be a separate building and as such shall conform to the specific requirements applying to that use or occupancy; provided, however, that “Fire Separations” shall not affect, or alter the requirements for fire walls when and where required because of area as specified in Part III, except when such “Fire Separation” provides the necessary complete vertical separation as specified in Section 2932.

(b) “Fire Separations” may be vertical and/or horizontal, depending upon the locations of the portions of the building to be segregated and shall consist of a system of walls, partitions and/or floors of materials and construction so arranged as to provide, during the period specified, a complete, secure and continuous fire-break between the buildings or portions thereof as required. “Fire Separations” are, for the purpose of this Code, classified as “Absolute,” “Special,” and “Ordinary” and shall not be less than as specified in the following paragraphs.

(1) An “Absolute Fire Separation” shall provide an effective resistance to the passage of fire for not less than four hours as specified in Chapter 42 and 43. No openings shall be allowed through an “Absolute Fire Separation.”

(2) A “Special Fire Separation” shall provide an effective resistance to the passage of fire for not less than three hours as specified in Chapters 42 and 43, except that all openings in walls forming such separation shall be protected on each side thereof by self-closing one hour fire-resistive doors as specified in Section 4304(a). Such doors shall be kept normally closed. The total width of all openings in any vertical “Special Fire Separation” shall not exceed in any one story twenty-five (25) percent of the length of the wall in that story and no single openings shall have an area greater than one hundred twenty (120) square feet.

Enclosure walls of vertical or horizontal enclosures passing through a “Special Fire Separation” shall be of not less than two hour fire-resistive construction as specified in Section 4304.

(3) An “Ordinary Fire Separation” shall provide an effective resistance to the passage of fire for not less than one hour as specified in Chapters 42 and 43. Openings in “Ordinary Fire Separations” shall be protected by self-closing metal clad doors as provided in Section 4304 and such doors shall be kept normally closed.

(c) “Fire Separations” shall be provided between the various Groups and Divisions of occupancies as specified in the tabulation which follows, except that in no case need the separation be more fire-resistive than the exterior walls of the building in
which the separation occurs; provided, however, that where any fire separation is required the minimum shall be a one hour "Fire Separation."

**FIRE SEPARATIONS** REQUIRED FOR MIXED OCCUPANCY

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>OCCUPANCY</th>
<th>GROUPS AND DIVISIONS OF OCCUPANCY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>A 1—Major theatres (with stage equipment) 2—Moving Picture theatres (seating 1000 or more) 3—Places of public assembly (other than theatres or moving picture theatres) having a seating capacity of 1000 or more in any one room</td>
<td>NNN</td>
</tr>
<tr>
<td></td>
<td>B 1—Theatres and Moving Picture Theatres (without stage equipment) seating less than 1000. 2—Same as Group A, Division 3, but having a seating capacity of less than 1000 in any one room.</td>
<td>NNN</td>
</tr>
<tr>
<td>8</td>
<td>C Public and Parochial Schools</td>
<td>A</td>
</tr>
<tr>
<td>9</td>
<td>D 1—Jails, prisons, reformatories, asylums, similar buildings. 2—Hospitals, sanitariums, orphanages, nurseries and similar buildings (n—accommodating more than 6 patients)</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NASA</td>
</tr>
<tr>
<td>10</td>
<td>E 1—Public garages, gasoline service stations, spray paint shop. 2—Planing mills, box factories, woodworking and mattress factories. 3—Storage of highly inflammable or explosive materials</td>
<td>SSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>11</td>
<td>F 1—Wholesale and retail stores, office buildings, restaurants, undertakers, parlor, printing plants, municipal police and fire stations. 2—Factories and workshops using materials not highly inflammable or explosive 3—Storage and sales rooms for combustible goods.</td>
<td>NNN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NNN</td>
</tr>
<tr>
<td>12</td>
<td>G 1—Ice plants, power plants, pumping plants, cold storage, creameries. 2—Factories and workshops using combustible or non-explosive materials 3—Storage and sales rooms of combustible or non-explosive goods.</td>
<td>NN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NN</td>
</tr>
<tr>
<td>13</td>
<td>H 1—Hotels, apartment houses, dormitories, lodging houses 2—Convents, monasteries (accommodating 10 or more).</td>
<td>NN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NN</td>
</tr>
<tr>
<td>14</td>
<td>I 1—Dwellings</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>J 1—Private garages 2—Accessory buildings and structures such as sheds, fences, water tanks, towers. 3—Stadiums, reviewing stands, amusement park structures</td>
<td>NNO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NNO</td>
</tr>
</tbody>
</table>

Note: *Refer to Chapters 6 to 15 inclusive for more complete listing of occupancies and definitions.
*Provided that 1/4 of an inch of metal lath and plaster on the garage side and a self-closing, tight fitting one and three-eighths (1-3/8) inch solid slab wood door shall be permitted where the private garage space will accommodate not more than three (3) automobiles.
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 seventy-five (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 as specified in Section 4304.

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 imaginary property line located between such buildings and parallel to the face of either building.
CHAPTER 6 — REQUIREMENTS FOR GROUP A BUILDINGS

Sec. 601. Each Group A occupancy shall be considered as a separate building and the Group shall include:

Division 1: All major theatres having a permanent stage equipped or which may be equipped with fly galleries or rigging loft for the handling of permanent or transient stage scenery and theatrical apparatus.

Division 2: All theatres and motion picture theatres having a stage as noted above and/or having a seating capacity of one thousand (1000) or more.

Division 3: All auditoriums, schools, churches, lodges, clubs, museums, dance halls, armories, libraries, gymnasiums, passenger stations, administration buildings of the city, county or state and similar buildings, having a total seating capacity of more than one thousand (1000) in any one room.

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

(b) Special Construction. The stage portion of the building shall be of Type I Construction except as specified in Section 609.

In buildings of Group A occupancy which are provided with a permanent stage, which stage is equipped or which may be equipped with fly galleries or a rigging loft for the handling of permanent or transient stage scenery or theatrical equipment, the stage shall be completely separated from the auditorium by a wall extending not less than four (4) feet above the roof over the stage and designated a proscenium wall of four (4) hour fire-resistant construction as specified in Section 4302. Such wall may have in addition to the main proscenium opening, other openings as required, each of which shall be not more than twenty-five (25) square feet in area, and shall be protected on the stage side thereof by a one hour fire-resistant automatic or self-closing door as specified in Section 4304. The main proscenium opening shall be equipped with a self-closing curtain as specified in Chapter 41. Other openings through the proscenium wall shall be protected as required above. The proscenium wall and/or curtain may be omitted in buildings of Division 3 occupancy, upon the approval of the Chief Building Inspector, when the intended use of the stage is such that no special fire hazard is involved.

The dressing room section, workshops and store rooms shall not be located under or on the stage nor in the auditorium, but shall be separated from each other and from the stage by a
Sections 602-604

“Special Fire Separation” as specified in Section 503.

Exceptions: Dressing rooms, workshops and store rooms may be placed under the stage; provided that the floors and partitions around such rooms, also the stage floor above, are of two hour fire-resistive construction throughout.

The slope of the main floor of the auditorium shall not exceed one (1) in five (5). Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces.

Location on Property

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

All openings in exterior walls shall be protected by fire doors and fire windows when required by location in Chapter 16, or Types of Construction, Chapter 18.

Stairs and Exits

Sec. 604. (a) Main Entrance and Exits. In every Group A building there shall not be less than one (1) exit on each of three sides of the auditorium and one from each side of every balcony or gallery. Each of these exits shall be not less than five feet (5′0″) in width and shall open directly upon a street or into an open exit court or alley which shall be directly connected to a street as specified in paragraph (b) of this Section.

One such exit on a street front which shall serve as the main entrance shall be proportioned on the basis of two (2) feet of width for each one hundred (100) persons or major fraction thereof to and including one thousand (1000) persons, with an additional one (1) foot per hundred persons for each additional one hundred (100) persons or major fraction thereof to and including two thousand (2000) persons and an additional six (6) inches for each additional one hundred (100) persons or major fraction thereof, all based upon the total seating capacity of the building served by such entrance and/or exit.

At the main entrance of each Group A building there shall be a foyer having an area of one (1) square foot to each seat in such building having access to such foyer. The foyer shall be at the same level as the back of the auditorium and all changes in elevation between the foyer and the public street adjacent thereto shall be by ramps with a slope of not more than one (1) in ten (10): Provided, that in buildings of Division 3 occupancy, no foyer shall be required.

The foyer if not abutting directly upon a public street shall communicate thereto by a straight and unobstructed corridor or passageway equal in width to that required for the main entrance which shall be used only as an exit or entrance; provided, however, that not to exceed ten (10) per cent of such required width may be used for the placing of a ticket booth. The required width of the foyer at any point shall be the combined width of the aisles, passageways and stairways at that point but need not exceed the required width of the entrance.

(b) Exit Courts. Along each side and long enough to accommodate all side exits of the auditorium not fronting directly upon a street or alley (not including that side bounded by the
stage), shall be an open court, or a passageway of Type I construction, not less than five (5) feet in width when the total seating capacity is one thousand (1000) or less, and such width shall be increased by one (1) foot for each additional five hundred (500) persons or major fraction thereof. These are required widths and shall not be reduced in any way.

The courts shall extend full width to a street or shall be connected to the street by a passageway of the same required width, with a height of not less than seven (7) feet and such passageway shall not exceed a length of fifty (50) feet. The court or passageway shall meet the street level and all changes in elevation shall be by ramps with a slope of not more than one (1) in eight (8).

All doors opening into such open courts or passageways of Type I construction shall be arranged so as not to decrease the clear width of the court when open.

(c) Main Floor Auditorium Exits. Exits, located on each side of and not less than one-half the length of the auditorium from the foyer, shall be provided on the main floor of each Group A building. These exits shall be proportioned on the basis of not less than twenty-two (22) inches of combined width to each one hundred fifty (150) seats or major fraction thereof on the main floor of the auditorium, and this exit width shall be equally divided to each side of the auditorium, and shall have a cross aisle not less than four (4) feet in width from the back of one chair to the edge of the seat when down in the next row leading directly to all first floor exits. All such exits shall open directly upon a street or exit court or may be connected thereto by corridors having a width not less than the exit opening into same. There shall be no openings in such corridors other than the exit openings, and the exit doors shall be hung so as not to decrease the required width. Egress from the main floor of the auditorium to the street shall be by means of ramps having a slope of not more than one (1) in eight (8), except as specified in part (a) of this Section.

Where fixed seats are not provided the exits shall be proportioned on the seating capacity as defined in Section 401.

(d) Balcony and Gallery Exits. Exits shall be provided from each side of each balcony or gallery, leading to a street or exit court. These exits shall have a combined width of not less than twenty-two (22) inches for every seventy-five (75) seats or major fraction thereof in such balcony or gallery and such exits shall be equally divided to each side. No exit shall be less than three feet and six inches (3‘6”) in width and shall be served by stairs or ramps completely enclosed, except as noted in Section 606, and constructed as specified in Chapter 33. All such exits shall be located as far apart as is practicable and all combined exits shall continue the full combined width to the street. No stair exit shall be continued to or communicate with a basement.

Where fixed seats are not provided the exits shall be proportioned on the seating capacity as defined in Section 401.

A handrail shall be provided on each side of every stair four (4) feet or more in width, and on one side of each stairway less
than four (4) feet in width. Stairs eight feet (8') or more in width shall have intermediate rails.

Stairs emptying into exit courts shall meet the court floor at not less than the stair width from the near side of any main floor exit opening into such exit court.

(e) Stage Exits. Not less than 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 (3) feet in width to a street, alley or exit court. An exit stair not less than two feet and 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, one leading directly out of the building, 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.

(f) Aisles. Aisles on the main floor shall be located so that there are not more than six (6) seats between any seat and an aisle. Every aisle shall be not less than three feet (3') wide if having seats on only one side and not less than three feet and six inches (3'6") wide if having seats on both sides. Such minimum width shall be measured at the end farthest from the foyer and shall be increased by one and one-half inches (1½") for each five (5) feet in length toward the foyer. There shall be no steps or obstructions of any kind in any aisles, and aisles may have a slope of not more than one (1) in five (5). Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces.

Aisles in balconies or galleries shall be located so that there are not more than six (6) 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 twenty (20) rows of seats a cross aisle not less than four (4) feet 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 (7½) inches and shall be the full width of the aisle and no tread shall be less than ten (10) inches. When the slope of the aisle is not more than one (1) in five (5) it shall be ramped. Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces. All aisles shall lead directly to exits.

(g) Seats. Seats shall be spaced not less than thirty-three (33) inches back to back. All seats in buildings of Divisions 1 and 2 of Group A and in buildings of Division 3 when used for assembly purposes on the main floor and in balconies and galleries shall be fastened securely to the floor and shall be not less than eighteen (18) inches in minimum width.

(h) Boxes. Boxes may be served by stairs not less than three (3) feet in width with a rise and tread as required for main stair exits. Boxes accommodating more than twenty-five (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, except that door mullions not over four inches (4") in width shall not be considered as decreasing required width. No single door shall be more than three feet and six inches (3'6") in width and every exit door on the exterior of such building shall be of not less than one hour fire-resistance 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 four (4) inches high. All exit signs shall be illuminated during any time the building is occupied. (See Electrical Ordinance.)

(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.

**Sec. 605.** All portions of Group A buildings customarily used by human beings and all dressing rooms shall be provided with light and ventilation by means of windows and/or skylights with an area not less than one-eighth (1/8) 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 (30) cubic feet of pure air per minute for each occupant thereof 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 (10) feet per second the register must be placed more than eight (8) feet 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 registers or vents supplying air back stage shall be equipped with automatic closing devices with fusible links.

**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 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 or alley or exit court.

All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.
Sections 606-609

Openings through stage floors shall be equipped with tight-fitting trap doors of wood not less than one and five-eighths (1\%) inches thick.

Fire Extinguishing Apparatus

Sec. 607. Major stages when equipped with gridiron, basements, property rooms, dressing rooms and all portions of the stage and rooms under the stage and back of the proscenium wall shall be equipped with automatic sprinklers as specified in Chapter 38.

A one and one-half (1\½) inch standpipe outlet shall be provided on each side of the stage, and such standpipes shall be constructed and equipped as specified in Chapter 38.

In the roof of every stage there shall be an automatic ventilator having a free ventilating area of not less than one-tenth (1/10) the area of the stage, constructed as specified in Section 3901.

Special Hazards

Sec. 608. Where any of the special hazards mentioned below are present the detailed regulations applying to such hazards as specified in the chapters indicated shall be complied with:

Moving picture booths, Chapter 40.
Chimney and heating apparatus, Chapter 37.

No inflammable liquids shall be placed, stored or used in a Group A building; except, that in paint-shops and work-shops inflammable liquids of Class III, as defined in Section 1008, may be used and stored in quantities of not to exceed a total of one hundred (100) gallons, and that liquids of Classes I and II may be used and stored in quantities not to exceed a total of one (1) gallon provided that all such liquids not in actual use shall be kept in tight or sealed containers.

Each gas service shall be provided with a shut-off valve at a convenient and conspicuous place outside the building and adequately marked.

Every boiler room or room containing a heating plant shall be separated from the rest of the building with a “Special Fire Separation” as specified in Section 503.

Exceptions and Deviations

Sec. 609. Gridirons, fly-galleries and pin-rails shall be constructed of incombustible materials and fireproofing of steel and iron may be omitted. Gridirons and fly-galleries shall be designed to support not less than seventy-five (75) pounds per square foot.

All parts of the stage which are not movable shall be of incombustible construction except that part of the stage extending back from and the full width of the proscenium opening which if not of fire-resistive construction shall be constructed of steel or heavy timbers covered with a wood floor not less than one and five-eighths (1\%) inches thick. No part of the combustible construction shall be carried through the proscenium wall. All parts of the stage floor shall be designed to support not less than one hundred and twenty-five (125) pounds per square foot.

A protecting hood shall be provided over and the full length of the stage switchboard.
Gymnasiums and similar buildings may have running tracks constructed of wood or unprotected steel or iron.

(Note: Existing buildings of Group A occupancy which do not comply with the requirements of this Code, shall make such alterations or changes as are deemed necessary by the Chief Building Inspector for the protection of the public.)

Sec. 610. Separation of Group A occupancies from all other occupancies shall be provided as specified in Section 503.
CHAPTER 7 — REQUIREMENTS FOR GROUP B BUILDINGS

**Sec. 701.** Each Group B occupancy shall be considered as a separate building, and the Group shall include:

Division 1: All theatres and motion picture theatres having a seating capacity of less than one thousand (1000), and having no permanent stage which is or may be equipped with fly galleries or a rigging loft for the handling of permanent or transient stage scenery and theatrical apparatus.

Division 2: Auditoriums, churches, lodges, clubs, museums, dance halls, armories, gymnasiums, libraries, passenger stations, administration buildings of city, county or state, and similar buildings having a total seating capacity in any one room of less than one thousand (1000).

**Sec. 702.** (a) General. Buildings or parts of buildings classed in Group B because of use or the character of the occupancy shall conform to the following specific requirements:

Maximum Allowable Areas on Any One Floor as Determined by Height of Building, Street Frontage and Type of Construction.

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>Maximum Height for Corresponding Areas</th>
<th>Maximum Floor Areas (Sq. Ft.)</th>
<th>Increase for Complete Sprinkling*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Stories</td>
<td>Building Fronting on</td>
</tr>
<tr>
<td>Type I</td>
<td>NO RESTRICTIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>65 ft.</td>
<td>5 stories</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>65 ft.</td>
<td>1 story</td>
<td>12,500</td>
</tr>
<tr>
<td>Type III</td>
<td>45 ft.</td>
<td>3 stories</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>35 ft.</td>
<td>1 story</td>
<td>7,500</td>
</tr>
<tr>
<td>Type IV</td>
<td>No restrictions</td>
<td>1 story</td>
<td>16,000</td>
</tr>
</tbody>
</table>

*Note:* Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.
Seating capacity may be increased except for Division 1, Group B occupancies, not to exceed fifty (50) per cent when no balconies or galleries are constructed as a part of such building and when the auditorium floor is located at or near ground floor level, in which case all exits shall be at street level or shall meet street level by means of ramps.

For buildings of intermediate height the allowable floor area shall be interpolated.

(b) Special Construction. When a permanent stage is provided, it shall be completely separated from the auditorium by a wall designated the proscenium wall, of not less than one-hour fire-resistive construction as provided in Section 4302. All openings, except the proscenium opening, in such wall shall be not more than twenty-five (25) square feet in area and shall be protected by metal-clad doors constructed as specified in Section 4304. The proscenium opening shall be equipped with a self-closing curtain as required in Chapter 41. The proscenium wall and/or curtain may be omitted in buildings of Division 2 occupancy, upon the approval of the Chief Building Inspector, when the intended use of the stage is such that no special fire hazard is involved.

Sec. 703. All Group B buildings shall front directly upon at least one public street not less than twenty (20) feet 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 704. The main floor of each Group B occupancy shall be located at or near the ground floor level, provided that occupancies in Division 2 of Group B buildings may be located above the ground floor, and stairs may be used as a means of ingress and egress.

All exterior walls or parts of walls, except on street fronts, of Group B buildings which are less than five (5) feet from adjacent property lines shall have no openings therein. All openings in exterior walls shall be protected by fire doors and windows when required by location: Chapter 16, or Type of Construction, Chapter 18, 19, and 20.

Sec. 704. (a) Main Entrance and Exits. In every Group B building there shall be not less than three exits, each not less than five feet (5') in width, leading directly to streets, to alleys or to courts or other open spaces on the same property which lead directly to streets or alleys, and two such exits shall be located at or near the end of the auditorium opposite from the main entrance. One such exit shall open directly upon or be connected by means of a straight passageway to a street not less than twenty (20) feet in width, and such main entrance and passageway shall be proportioned on the basis of two (2) feet of width for each one hundred (100) persons or major fraction thereof to and including one thousand (1000) persons, with an additional one (1) foot for each additional one hundred (100) persons or major fraction thereof to and including fifteen hundred (1500) persons. The required width of the foyer at any point shall be the combined width of the aisles, passageways and stairways at that point, but need not exceed the required width of the entrance.
Each balcony and gallery shall have not less than one exit not less than three feet and six inches (3'6") wide on each side thereof.

All changes in elevation along any exits, aisles or passages ways of all Division 1 Group B buildings shall be by ramps with a slope of not more than one (1) in five (5), except that the main entrance shall be sloped not more than one (1) in eight (8). Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces.

(b) Main Floor Auditorium Exits. Exits located at the end of the auditorium opposite from the main entrance shall be proportioned on the basis of twenty-two (22) inches of combined width to each one hundred fifty (150) seats or major fraction thereof on the main floor of the auditorium, and this exit width should be equally divided to each side of the auditorium. When more than two five (5) foot exits are required, the remaining required exits shall be placed on the sides of the auditorium, but not less than one-half (½) the length of the auditorium from the main entrance. Cross aisles not less than four (4) feet wide shall connect to all side exits.

If any exit court is provided, the width shall be the same as for Group A buildings. (See Section 604, paragraph (b).)

When fixed seats are not provided, the exits shall be proportioned on the seating capacity as defined in Section 401.

(c) Balcony and Gallery Exits. Exits shall be provided from each side of each balcony or gallery leading to a street or alley or to a court or open space on the same property leading directly to a street or alley. These balcony exits shall have a combined width of not less than twenty-two (22) inches to every seventy-five (75) seats or major fraction thereof in such balcony or gallery, and such exits shall be equally divided to each side.

All stairs serving as exits from Group B buildings shall be constructed as specified in Chapter 33, except as specified in part (k) of this Section.

(d) Stage Exits. Each stage shall have not less than one exit two feet and six inches (2'6") wide opening directly or by means of a passageway not less than three (3) feet in width to a street or alley. Each dressing room shall be provided with at least two means of egress, one leading directly out of the building, each not less than two feet and six inches (2'6") wide. Stairs required in this Sub-section (d) shall have a rise and tread as specified in Chapter 33, but such stairs need not be enclosed.

(e) Aisles. Aisles shall be located so that there are not more than six (6) seats between any seat and an aisle. Every aisle shall be not less than three feet (3') wide if having seats on only one side, and not less than three feet six inches (3'6") wide if having seats on both sides. Such minimum width shall be measured at the end farthest from the foyer and shall be increased by one and one-half (1½) inches for each five feet (5') in length toward the foyer. There shall be no steps or obstructions of any kind in the aisles, and aisles may have a slope of not more than one (1) in five (5). Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces.

There shall be provided in all balconies or galleries having
more than twenty (20) rows of seats a cross aisle not less than
four (4) feet wide from the back of one chair to the edge of the
seat when down in the next row. Such cross aisle shall lead di-
rectly to an entrance or to an emergency exit.

Risers shall be not more than seven and one-half (71/2) inches
and shall be the full width of the aisle, and no tread shall be less
than ten (10) inches. When the slope of the aisle is not more
than one (1) in five (5) it shall be ramped. Ramps steeper than
one (1) in eight (8) shall have non-slip floor surfaces. All aisles
shall lead directly to exits.

(f) Seats. Seats shall be spaced not less than thirty-three
(33) inches back to back, and there shall be not more than six
(6) seats between any seat and an aisle.

In all buildings of Division 1 of Group B and in buildings of
Division 2 used for public assemblage all seats on the main floor
and in balconies and galleries shall be fastened securely to the
floor and shall be not less than eighteen (18) inches in minimum
width.

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

(h) 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 a 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 cor-
rider in any manner whatsoever, except that door mullions not
over four inches (4") in width shall not be considered as decreas-
ing the required width. No single door shall be more than three
feet and six inches (3'6") in width, and every exit door on the
exterior of such building shall be of not less than one-hour fire
resistance as specified in Section 4304, except on street fronts.
Doors opening from within the building into a stair or ramp en-
closure shall be constructed as specified in Section 4304.

(i) Exit Lights. All exits shall be marked with illuminated
signs bearing the word "EXIT" in letters at least four (4) inches
high. All exit signs shall be illuminated during any time that the
building is occupied. (See Electrical Code.)

(j) Smokeproof Tower. Where there is more than one bal-
cony or gallery, all balconies or galleries above the first shall
be served by not less than one (1) smokeproof tower located on
each side of the balcony or gallery and constructed as specified
in Chapter 33. Not less than one smokeproof tower constructed
as specified in Chapter 33 shall be installed to serve as direct
exit from each Group B occupancy placed above the third floor
of any building, and one additional such exit shall be installed
for each additional twenty thousand (20,000) square feet or
major fraction thereof in excess of fifteen thousand (15,000)
square feet. Such exits shall be placed as far apart as possible.

(k) General. No obstructions of any kind, either permanent
or movable, shall be placed in any aisle, exit, passageway or
corridor, and all dimensions given shall refer to the clear width. This shall be construed as prohibiting radiators, chairs, stools, stands, slot machines, easels and similar objects from being placed in any exit, aisle, passageway or corridor. No furniture or fixtures of any kind shall be placed in the foyer in such a manner as to diminish the required width.

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

All stairs and ramps serving as entrances or exits for any Group B occupancy shall be designed and constructed as specified in Chapter 38, provided that when such Group B occupancy is located on the second floor of a two-story building or when leading to and serving such occupancy only, such stairs or ramps need not be enclosed when stairs lead directly to the outer air or are connected thereto by direct passages with unperforated walls and ceilings. All emergency stairs and ramps shall lead directly to a public street or alley or to a court or space not less than five (5) feet in clear width connected directly to a street or alley.

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

Sec. 706. All vertical openings such as elevator shafts, stairs, ramps and vent shafts shall be enclosed as specified in Chapter 30; provided, however, that stair or ramp exits serving only a Group B 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 specified 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 inflammable liquids shall be placed, stored or used in a Group B building.

Any gas service to a Group B building shall be provided with an outside shut-off conspicuously marked.

Every boiler room or room containing a heating plant shall be separated from the rest of the building with a "Special Fire Separation" as specified in Section 503.

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

All partitions and floors in Group B buildings and all bearing partitions and floors below a Group B occupancy when such occupancy is placed or is to be placed above the first floor of a building or structure shall be of not less than one-hour fire-resistant construction as specified in Chapter 43.

Type V Construction shall not be permitted for use of Group B occupancies.

Sec. 710. Separation of Group B occupancies from any other occupancies shall be provided as specified in Section 503.
CHAPTER 8 — REQUIREMENTS FOR GROUP C BUILDINGS

Sec. 801. Each Group C occupancy shall be considered as a separate building and the Group shall include:

All public and parochial schools except as provided in Chapter 6, over one (1) story in height and/or containing more than four (4) class rooms.

Sec. 802. (a) General. Buildings or parts of buildings classed in Group C because of use or the character of the occupancy shall be of Type I construction throughout.

Exceptions: 1. Gymnasiums and auditoriums may omit the fireproofing from the structural members of the roof.

2. One (1) story schools of not more than four (4) class rooms for temporary use, may be of any type of construction permitted by this Code except when located in Fire District No. 1.

3. Private schools accommodating not more than twenty-five (25) students, may be of any type of construction permitted by this Code for the Fire Zone in which it is located, providing suitable exit facilities are provided as may be directed by the Chief Building Inspector.

(b) Special Construction. When a permanent stage is provided, it shall be completely separated from the auditorium by a wall designated the proscenium wall, of not less than one hour fire-resistive construction as provided in Section 4302. All openings, except the proscenium opening, in such wall shall be not more than twenty-five (25) square feet in area and shall be protected by metal-clad doors constructed as specified in Section 4304. The proscenium opening, which shall be the main opening for viewing performances, shall be provided with an asbestos curtain as specified in Chapter 41. The proscenium wall and/or curtain may be omitted upon the approval of the Chief Building Inspector when the intended use of the stage is such that no special fire hazard is involved.

Sec. 803. All Group C buildings shall front directly upon at least one public street not less than twenty (20) feet in width, in which front shall be located the main entrance and exit to such buildings.

All openings in exterior walls shall be protected by fire doors and windows when required by location in Chapter 16, or Type of Construction in Chapters 18, 19 and 20.

Sec. 804. (a) Main Entrance and Exits. In every Group C building there shall be not less than two exits, each not less than five feet (5') in width leading directly to streets, to alleys or to courts or other open spaces on the same property which lead
directly to streets or alleys. One such exit shall open directly upon or be connected by means of a straight passageway to a street not less than twenty (20) feet in width and such main entrance and passageway shall be proportioned on the basis of two (2) feet of width for each one hundred (100) persons or major fraction thereof to and including one thousand (1000) persons, with an additional one (1) foot for each additional one hundred (100) persons or major fraction thereof to and including fifteen hundred (1500) persons. Exits shall be located as close as practicable to stairway and all stairways shall lead directly to a separate exit.

Each balcony and gallery shall have not less than one exit not less than three feet six inches (3'6'') wide on each side thereof.

(b) Main Floor Auditorium Exits. Exits located at the end of the auditorium opposite from the main entrance shall be proportioned on the basis of twenty-two (22) inches of combined width to each one hundred fifty (150) seats or major fraction thereof on the main floor of the auditorium, and this exit width should be equally divided to each side of the auditorium. When more than two five (5) foot exits are required, the remaining required exits shall be placed on the sides of the auditorium but not less than one-half (1\(\frac{1}{2}\)) the length of the auditorium from the main entrance. Cross aisles not less than four (4) feet wide shall connect to all side exits.

If any exit court is provided, the width shall be the same as for Group A buildings. (See Section 604, paragraph (b).)

When fixed seats are not provided, the exits shall be proportioned on the seating capacity as defined in Section 401.

(c) Balcony and Gallery Exits. Exits shall be provided from each side of each balcony or gallery leading to a street or alley or to a court or open space on the same property leading directly to a street or alley. These balcony exits shall have a combined width of not less than twenty-two (22) inches to every seventy-five (75) seats or major fraction thereof in such balcony or gallery and such exits shall be equally divided to each side.

All stairs serving as exits from Group C buildings shall be constructed as specified in Chapter 33, except as specified in part (k) of this Section.

(d) Stage Exits. Each stage shall have not less than one exit two feet six inches (2'6'') wide opening directly or by means of a passageway not less than three (3) feet in width to a street or alley. Each dressing room shall be provided with at least two means of egress, one leading directly out of the building, each not less than two feet and six inches (2'6'') wide. Stairs required in this sub-section (d) shall have a rise and tread as specified in Chapter 33, but such stairs need not be enclosed.

(e) Aisles. Aisles shall be located so that there are not more than six (6) seats between any seat and an aisle. Every aisle shall be not less than three feet (3') wide if having seats on only one side and not less than three feet six inches (3'6'') wide if having seats on both sides. Such minimum width shall be measured at the end farthest from the foyer and shall be increased by one and one-half (1\(\frac{1}{2}\)) inches for each five (5) feet in
length toward the foyer. There shall be no steps or obstructions of any kind in the aisles, and aisles may have a slope of not more than one (1) in five (5). Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces.

There shall be provided in all balconies or galleries having more than twenty (20) rows of seats a cross aisle not less than four (4) feet 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 (7 1/2) inches and shall be the full width of the aisle and no tread shall be less than ten (10) inches. When the slope of the aisle is not more than one (1) in five (5) it shall be ramped. Ramps steeper than one (1) in eight (8) shall have non-slip floor surfaces. All aisles shall lead directly to exits.

(f) Seats. Seats shall be spaced not less than thirty-three (33) inches back to back and there shall be not more than six (6) seats between any seat and an aisle.
In all rooms of buildings of Group C occupancy used for public assembly, all seats on the main floor and in balconies and galleries, shall be fastened securely to the floor and shall be not less than eighteen (18) inches in minimum width.

(g) 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 a 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, except that door mullions not over four inches (4") in width shall not be considered as decreasing the required width. No single door shall be more than three feet and six inches (3’6") in width and every exit door on the exterior of such building shall be of not less than one hour fire-resistance as specified in Section 4304, except on street fronts. Doors opening from within the building into a stair or ramp enclosure shall be constructed as specified in Section 4304.

(h) Exit Lights. All exits shall be marked with illuminated signs bearing the word "EXIT" in letters at least four (4) inches high. All exit signs shall be illuminated during any time that the building is occupied. (See Electrical Code.)

(i) 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 (1) smokeproof tower located on each side of such balcony or gallery and constructed as specified in Chapter 33. Such exits shall be placed as far apart as possible.

(j) General. No obstructions of any kind, either permanent or movable, shall be placed in any aisle, exit, passageway or corridor and all dimensions given shall refer to the clear width. This shall be construed as prohibiting radiators, chairs, stools, stands, slot machines, easels and similar objects from being placed in any exit, aisle, passageway or corridor. No furniture
or fixtures of any kind shall be placed in the foyer in such a manner as to diminish the required width.

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

All stairs and ramps serving as entrances or exits for any Group C occupancy shall be designed and constructed as specified in Chapter 33. All emergency stairs and ramps shall lead directly to a public street or alley or to a court or space not less than five (5) feet in clear width connected directly to a street or alley.

Sec. 805. All portions of Group C buildings customarily used by human beings and all dressing rooms shall be provided with light and ventilation, either natural or artificial, as specified in Section 605.

Sec. 806. All vertical openings such as elevator shafts, stairs, ramps and vent shafts shall be enclosed as specified in Chapter 30. There shall be no openings into stair or ramp enclosures except necessary entrance and exit doors.

Sec. 807. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified 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.

No inflammable liquids shall be placed, stored or used in a Group C building.

Any gas service to a Group C building shall be provided with an outside shut-off conspicuously marked.

Every boiler room or room containing a heating plant shall be separated from the rest of the building with a "Special Fire Separation" as specified in Section 503.

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

Sec. 810. Separation of Group C occupancies from any other occupancies shall be by an "Absolute Fire Protection."
CHAPTER 9 — REQUIREMENTS FOR GROUP D BUILDINGS

Sec. 901. Each Group D occupancy shall be considered a separate building and the Group shall include:

Division 1: Jails, prisons, reformatories, houses of correction, asylums for the insane or feeble-minded, and similar buildings.

Division 2: Hospitals, sanitariums, orphanages, nurseries, old people’s homes, and similar buildings accommodating more than six (6) persons.

Sec. 902. Buildings or parts of buildings classified in Group D because of use or the character of the occupancy shall be of Type I Construction and shall not be limited as to height or floor area.

Sec. 903. All exterior walls or parts of walls, except on street fronts, of Group D buildings, shall be protected by fire doors and/or fire windows, when required by location in Chapter 16 or by type of construction in Chapter 18. See Section 504 for regulating adjacent buildings on the same property.

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

Ramps. In lieu of ramps, horizontal exits may be provided as specified in Section 3311. Hospitals and sanitariums shall be sub-divided by a “Special Fire Separation” as specified in Section 503, into fire areas not exceeding ten thousand (10,000) square feet.

In hospitals or sanitariums, ramps with a slope of not more than one (1) in six (6) shall be installed instead of stairways or in addition thereto to serve all portions of the building where bed-ridden 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.

Except in places of detention, exit doors shall not be fastened against exit by any device except self-releasing latches, panic bolts or similar devices which can readily be opened from the inside at all times without the use of keys or any special knowledge or effort.

Smokeproof towers shall be provided as specified in Chapter 33.
Sec. 905. All portions of Group D buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area equal to one-eighth ($\frac{1}{8}$) 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 (30) cubic feet of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied.

Sec. 906. All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

Sec. 907. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified 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 inflammable liquids shall be allowed in Group D buildings. The handling of volatile inflammable liquids shall comply with the requirements of the Fire Department.

Any gas service to Group D buildings shall be provided with an accessible outside shut-off conspicuously marked.

Every boiler room or room containing heating apparatus shall be separated from the rest of the building with a “Special Fire Separation” as specified in Section 503.

Sec. 909. No requirements of this Chapter shall be construed 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.

Sec. 910. Separation of Group D occupancies from other occupancies shall be provided as specified in Section 503.
CHAPTER 10 — REQUIREMENTS FOR GROUP E BUILDINGS

Sec. 1001. Each Group E occupancy shall be considered as a separate building and the Group shall include all industrial or commercial buildings in which the nature of the occupancy creates a serious fire or life hazard, such as:

Division 1: Public garages, gasoline service stations, spray paint shops.
Division 2: Planing mills, box factories, woodworking and mattress factories.
Division 3: Storage or handling of hazardous and/or highly inflammable or explosive materials and/or liquids, such as nitrocellulose products, gasoline, naphtha, carbide, paint or petroleum storage (except in sealed containers for retail trade), paint manufacture or dry cleaning plants.

Note:—Inflammable 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 use or the character of the occupancy shall be of Types I, II, III, or IV Construction and the maximum height and floor area shall not exceed those specified in the following table:

<table>
<thead>
<tr>
<th>Maximum Allowable Areas on Any One Floor as Determined by Height of Building, Street Frontage and Type of Construction</th>
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<tbody>
<tr>
<td>Types of Construction</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Type I</td>
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<td>Type II</td>
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<td>Type III</td>
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<tr>
<td>Type III</td>
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<tr>
<td>Type IV</td>
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</tbody>
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Note:—*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.
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For buildings of intermediate height, the allowable floor areas shall be interpolated.

In buildings having rooms with floor areas of over thirty thousand (30,000) square feet, 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 space into sections not to exceed twenty thousand (20,000) square feet in area.

(b) All buildings of Group E, Division 3, occupancy shall be of Type I construction throughout.

Location on Property

Sec. 1003. All exterior walls or parts of walls except on street fronts of Group E buildings which are less than ten (10) feet from adjacent property lines shall be of masonry or reinforced concrete.

All openings in exterior walls, except on street fronts which are less than twenty (20) feet from adjacent property lines, shall be protected by doors and windows of one hour fire-resistive construction as specified in Section 4304. See also Chapter 16 for requirements based on location and Sections 1813, 1913, 2013, and 2113 for Types of Construction.

Stairs and Exits

Sec. 1004. All Group E buildings 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 latter case only one exit shall be required.

All stairs and exits shall comply with the requirements specified in Chapter 33.

Smokeproof towers shall be installed as and when specified in Chapter 33.

Light, Ventilation and Sanitation

Sec. 1005. All portions of Group E buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area equal to one-eighth (1/8) of the total floor area or shall be provided with artificial light and mechanically operated ventilating system. The mechanically driven ventilating system shall supply at least thirty (30) cubic feet of pure air per minute for each occupant thereof in all portions of the building and such system shall be kept continuously in operation during such time as the building is occupied.

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

In rooms used for the application of flammable finishes by spraying, an exhaust system of ventilation shall be installed to provide a complete change of air every three minutes. All equipment shall comply with the requirements of the National Board
of Fire Underwriters for equipment in explosive atmospheres. Motors shall not be located in spray room or in exhaust ducts. Each spray room shall be provided with separate exhaust ducts, which shall be made readily accessible for cleaning and shall be kept clear of any inflammable material. Exhaust ducts shall be so arranged as to not discharge in the direction of other buildings, or in any way to create a fire hazard or a nuisance. Entrance to exhaust ducts shall be near the floor level of the spray room.

All buildings where more than four (4) persons are employed shall be provided with at least one toilet. All buildings and each subdivision thereof where both sexes are employed shall be provided with access to at least two toilets either located in such building or conveniently located in a building adjacent thereto.

Sec. 1006. All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

Exceptions: Ramps used for the transfer of automobiles need not be enclosed providing the building is of Type I construction throughout.

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

Sec. 1008. Chimneys and heating apparatus shall conform to the requirements of Chapter 37, except that no open flame nor any heater with an enclosed flame shall be installed or maintained in any garage, dry cleaning rooms or place of storage of inflammable liquids. For special requirements for heating apparatus, see Section 1009, 1011, and 1012.

In garages forced circulation warm air furnaces may be used when the return air is taken from a point not less than six (6) feet above the floor, and the warm air is delivered by means of overhead ducts. In buildings of Group E, Division 3, occupancy, the heating plant shall be separated from the remainder of the building by an "Absolute Fire Separation."

Sec. 1009. (a) Cleaning Plant. For the purpose of this ordinance, the term “cleaning plant” shall mean and include all buildings for the actual operations of cleaning and dyeing with inflammable liquids, and in particular for the washing, scrubbing, brushing, dyeing, or other application or treatment, of fabric, cloths, clothing, or other materials, with inflammable liquids in quantities exceeding one gallon, as a cleaner, solvent or base, the extracting by mechanical process or evaporation of inflammable liquids from such fabrics, cloths, clothing or other materials, and the distilling, re-distilling, reclaiming, clarifying or settling of inflammable liquids which have been used as aforesaid. It shall not include laundries nor plants not using inflammable liquids in quantities exceeding one gallon.

(b) Permit. All applications for permits to construct a cleaning plant shall, before action is taken thereon by the Chief
Building Inspector be referred to the Chief of the Fire Department for investigation and report. No such building permit shall be granted for any cleaning plant, the plans of which do not comply in all respects with the requirements of this ordinance.

(c) **Construction.** Cleaning plants constructed under the provisions of this ordinance shall be of fire-resistive construction throughout without basement, cellar or open space below the ground, and cleaning section shall be not more than one story in height. The floors shall not be lower than grade. If a cleaning plant is constructed as a part of the same building with the premises destined for other uses, the cleaning plant shall be separated from the other parts of the building by an “Absolute Fire Separation” as defined in Section 504.

(d) **Location.** No cleaning room shall be constructed within ten (10) feet of any adjoining property line except street or alley lines, nor within ten (10) feet of any other building, unless such wall is without openings; and shall be operated and maintained in accordance with the following provisions: No cleaning or dyeing shall be carried on except at the cleaning plant designated in the license of the cleaner or dyer performing the work.

(e) **Exclusive Use of Premises.** Only activities incidental to cleaning or dyeing shall be conducted at the cleaning building.

(f) **Machines.** All cleaning, washing, extracting and redistilling shall be carried on in closed machines which shall be fluid tight. All washers shall have hinged doors and shall be arranged so that in case of an explosion the door will automatically close.

(g) **Scrubbing and Brushing.** Scrubbing and brushing may be performed in the cleaning room, but not more than five gallons of inflammable fluid shall be used in any one container. All inflammable liquids shall be returned to the settling or storage tanks as soon as the brushing or cleaning operation has been completed.

(h) **Use of Extractor Required.** All goods removed from washer shall be placed in tight metal pans; and no goods shall be taken from the room in which they have been washed or scrubbed until the inflammable liquid has been removed by an extractor. All goods shall be removed from the extractor at the close of operations.

(i) **Electric Groundings.** All piping and metallic parts of each machine shall be properly grounded by at least number ten insulated wire to a water pipe or other grounding device.

(j) **Metallic Belt Lacings Forbidden.** No high speed belts used in the driving of machinery in the cleaning plant shall have metallic lacings or fastenings.

(k) **Asbestos Blanket.** An asbestos blanket shall be kept in each room in the cleaning plant.

(l) **Disposal of Inflammable Materials.** No inflammable liquid shall be wasted, thrown out, or drained away, except on some vacant plot of ground at least one hundred (100) yards distant from the nearest building. All unnecessary inflammables
shall be removed from the premises and no smoking to be permitted in cleaning room.

(m) Inspection of Plants. The Chief of the Fire Department shall inspect, or cause to be inspected, each cleaning and dyeing establishment at least once each year and file a written report with the Manager of Safety and Excise.

(n) Separate Washing, Drying and Distillation Rooms. Washing rooms, drying rooms and distillation rooms shall be separated from the other rooms of the cleaning plant by a “Special Fire Separation” as defined in Section 504.

(o) Ventilation. An outside vent opening of at least twenty (20) square inches area shall be provided at the floor level in each washing room and in each drying room in the cleaning plant. Such vent openings shall be connected with a flue operated by a sparkless exhaust fan. There shall be sufficient outside vent openings in such rooms to completely change the air volume of the rooms every five minutes while the plant is in operation. All exhaust fans shall be provided with means of remote control whereby they may be shut down in emergency.

(p) Exits. Every room in the cleaning section shall be provided with at least two exits, which shall be remote from each other.

(q) Doors and Windows. All doors and windows in the cleaning plant shall be approved fire windows and approved fire doors. Wherever glass is used, it shall be wired glass in metal frames. All skylights and windows must be provided with fusible link connection to an automatic closing device. All doors leading to exterior shall be equipped with panic bolts.

(r) Lighting. See Electrical Code.

(s) Heaters. No gas or gasoline engine, steam generator, furnace or heating device shall be located, maintained or operated inside of the cleaning section. All heating of the cleaning section shall be secured only by the use of steam or hot water.

(t) Storage Tanks. Storage tanks for the storage of inflammable liquids shall be installed in accordance with the rules and regulations of the Fire Department.

(u) Settling Tanks. No inflammable liquid shall be settled in any open or unprotected vessel or tank. All settling tanks shall be constructed, located and vented essentially as provided for storage tanks. At the close of each day’s operations, all liquid contained in washers, extractors, stills or otherwise shall be returned to the stock or settling tanks.

(v) Service Pipes. All storage tanks shall be connected with service pipes, attached to the tops of such tanks and provided with a controlling valve and so constructed as to insure the return by gravity to the storage tanks of all volatile substances remaining in the service pipes when delivery is shut off.

(w) Distillation. Construction of clarifier or distiller shall be such that no exposed liquid shall issue therefrom, but this shall not prohibit properly guarded glass in sight feed.
(x) **Steam Supply Pipes.** Each room in the cleaning section shall be equipped with steam pipes of a diameter of at least one and one-quarter (1¼”) inches, inside measurement, located near the ceiling, and having not less than two openings. Said pipes shall be connected with a steam boiler, of capacity sufficient to completely fill every room in the cleaning section in less than one minute, and so arranged that the steam supply may be continually available for service while the plant is in operation. Valves to release the steam into each room shall be accessible for operation from some point outside of the room. In lieu of such steam system for extinguishing fires, a fire-deterrent gas or chemical system, automatic in operation, of recognized standards and approved by the Chief Building Inspector and the Chief of the Fire Department, may be installed.

(y) **Sewer Connections.** There shall be no piping or connection in any dry cleaning section by which volatile liquids might be allowed to flow into any public or private sewer, catchbasin or pit.

(z) **Hand Fire Extinguishers.** Each four hundred square feet of floor space in the cleaning plant shall be equipped with hand chemical fire extinguishers especially efficient for such condition, and approved by the Chief of the Fire Department of the City and County of Denver as to kind and type and to be maintained at all times in good working order.

(a-1) **Application to Future Construction.** The provisions of this ordinance shall not require the alteration, rebuilding or reconstruction of premises in actual operation as cleaning plants at the time of the passage of this ordinance, and which shall continue (without consecutive non-use for a period of a year or more) to be used for such purposes, nor prohibit the continued use of such premises in their existing condition as cleaning plants. Provided, however, that all new construction of premises for cleaning plants and all future construction or rebuilding of premises now in operation as such shall, as concerns such new construction, be in strict conformity with the provisions of this ordinance.

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**Paint Spray Rooms**

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**Sec. 1010. (a) General.** Wherever paints, varnishes, lacquers, enamels, stains or other flammable finishes are applied by means of spraying, a special room or booth shall be provided for the application of such finishes, and no spraying operations shall be carried on except in the space provided. General arrangements and minor details shall meet with the approval of the Chief Building Inspector.

(b) **Construction of Booths.** 1. Spray booths shall be constructed of not less than twenty-four (24) gauge U. S. Standard metal with heavy metal angle frames, or of other approved incombustible materials. The use of wire glass panels in part is satisfactory. The booth should be as smooth as possible inside to promote cleanliness. If combustible, the floor within the booth and for a distance of three (3) feet in every direction outside, shall be protected with zinc or other metal (preferably not steel) so that sparks may be avoided. There shall be a curtain not less than two and one-half inches (2½”), and not more than five (5)
inches deep along the outer and upper edges of all booths. On small booths the metal frame may be omitted if necessary rigidity can be obtained by heavy sheet metal.

2. All booths shall be completely enclosed on three (3) sides. Where desired, masonry walls may be utilized if given a smooth coat of waterproof plaster to permit cleaning and washing.

3. Floors of small booths or booths of such size as not to permit persons to enter, shall be of the same construction as the booth. Booths of such size as to permit persons to enter, shall have floors of concrete, or as prescribed above.

(c) Construction of Rooms and Tunnel Areas. In lieu of the above described booth construction, it shall be permissible to have a room or section of a building constructed and cut off from the remaining portions of the building, by an "Ordinary Fire Separation." (See Sec. 504.) The interior walls and ceilings of such room shall be finished with smooth plaster or other approved finish which can be easily cleaned.

(d) Ventilation. Ventilation for spray booths and spray rooms, shall be provided as required in Section 1005.

(e) Electrical Equipment. All electric apparatus shall be in strict accordance with the Electrical Code of the City and County of Denver, governing such apparatus in hazardous places. Only incandescent or mercury vapor lamps shall be used for lighting. Lamps in the vicinity of spray booths shall be protected by vapor proof globes or shall be double glazed, but no lamps shall be permitted inside ducts. No spark-producing cutouts, switches, detachable plugs, or portable lamps, shall be used within booths or in immediate vicinity of same. The use of extension cords is absolutely prohibited.

(f) Sprinklers. 1. Each booth, room and tunnel area shall be equipped with an approved system of automatic sprinklers, which may be supplied from the regular sprinkler system, when available, or in unsprinklered rooms, from the nearest convenient adequate water supply.

   Sprinkler should be kept clean. A curtain not less than two and one-half (2½) inches nor more than five (5) inches deep, shall be installed along the upper edge of the booth opening to serve as a deflector to confine most of the discharge in the booth and retain heat.

   2. Vent tubes and stacks, unless very short or small, shall be equipped with one or more approved automatic sprinklers so located that the entire interior of the tube will be protected.

   3. Booths of unusual design, shape, size or hazard require specially planned sprinkler protection. The Chief of the Fire Department shall be consulted as to the required protection in such cases.

   4. Automatic sprinklers within booths, vent tubes, and stacks, shall be controlled by one or more approved valves located in a readily accessible place not seriously exposed to a fire in the booth.
5. A standard equipment of First Aid Fire Apparatus shall be provided.

Note:—Foam type extinguishers are particularly effective to protect open containers of flammable liquids. For the general protection of spray booths and their exhaust systems, particularly where pyroxylin lacquers are used, a standard equipment of small hose or of soda-acid extinguishers should be installed. Where the spraying hazard is extensive or severe a forty (40) gallon chemical engine should be provided.

Sec. 1011. (a) Permit Required—Application For. It shall be unlawful for any person, firm or corporation to keep or store more than five thousand (5,000) feet of Nitro Cellulose motion picture films in any building or place, unless such person, firm or corporation shall have first obtained a permit in writing therefor from the Chief Building Inspector of the City and County of Denver. Before any such permit is granted, such person, firm or corporation shall file a written application therefor, setting forth the name, residence and location of the applicant if an individual, and if a corporation, its name, principal place of business and the names and residences of its officers. Each such application shall set forth the location at which it is desired or intended to keep or store such motion picture films. Upon receipt of any such application, said Chief Building Inspector shall make an investigation for the purpose of ascertaining whether or not the building or place at which it is desired or intended to keep, store or use motion picture films is so situated that the keeping, storing or using of motion picture films therein would not be dangerous; and also whether the conditions under which said motion picture films are kept or stored or are to be kept or stored, comply with the provisions of this ordinance.

(b) Provisions for Storage. It shall be unlawful for any person, firm or corporation possessing any Nitro-Cellulose motion picture films within the City and County of Denver, to keep or store the same in any other manner than as provided in this ordinance, or fail, neglect or refuse to comply with the following provisions:

1. All Nitro-Cellulose motion picture films in excess of five (5) standard reels stored at one time in motion picture exchanges or other occupancies shall be kept in approved vaults or cabinets.

2. Two hundred reels (1,000 lbs.) or less may be stored in approved cabinets, but not over one hundred reels may be placed in any one cabinet. Any storage in excess of two hundred (200) reels shall be in properly vented and sprinkled film vaults.

3. No film vault shall exceed seven hundred fifty (750) cubic feet in actual storage capacity, including aisles.

4. A cabinet shall have a minimum volume of one cubic foot for each nineteen pounds of film capacity, and shall in no case have a volume exceeding thirty (30) cubic feet.

5. The floors, walls and ceilings, of every film vault shall be of not less than three (3) hour fire-resistive construction as defined in Chapter 43.
6. Film vaults shall not be provided with skylights or glass windows other than as specified under vents.

7. Proximity to boilers, stacks or other sources of heat shall be avoided. Where heating is necessary to prevent freezing, coils shall be provided at the ceiling over aisle space and shall be protected by a wire screen twelve (12) inches below the pipes. Only hot water or steam heating shall be allowed with automatic control limiting temperature to not in excess of fifty (50) degrees.

8. An approved fire door shall be provided on each face of the wall on door openings. The interior door shall be automatic. The outer door shall be of the swinging type and close into a rabbot, or otherwise be made tight to prevent passage of flame around edges; it shall be self-closing and if fastened open shall be arranged to close automatically in case of fire originating in or out of vault.

9. Racks in film vaults shall be built of metal or other incombustible material and arranged to prevent film containers being placed in other position than on edge in a vertical position. Vertical incombustible partitions, equivalent in heat insulation and durability to three-eighths of an inch (\(\frac{3}{8}\)) hard asbestos and extending from floor to ceiling, shall be provided to divide racks into sections such that the amount of film protected by any sprinkler shall not exceed eight hundred thirty (830) pounds; partitions shall be substantial and have exposed edges protected. Means shall be provided to keep the containers on each side of such partition an inch away from same. Racks shall not obstruct any vent openings. Racks shall be so arranged that film cannot be placed under or between containers in the vertical position. Film shall not be stored or kept on the floor, unless in shipping containers approved by the Interstate Commerce Commission.

10. All lights in film vaults shall be at the ceiling and shall be of the fixed marine type, with vaporproof globes and conduit wiring. All switches shall be outside the vault and shall be arranged with a small pilot light to indicate on outside of vault whether vault lights are on or off.

11. Each film vault, and each compartment of a cabinet when the cabinet contains more than fifty (50) pounds of film, shall be separately vented to the outer air, with a vent having a minimum effective sectional area of seventy (70) square inches for each one hundred (100) reels (equivalent to 140 square inches per one thousand (1,000) pounds of film) capacity. For a standard vault of seven hundred and fifty (750) cubic feet, the vent opening shall be fourteen hundred (1400) square inches.

12. The outlet of each vent shall be above roof or made to face street, court or other clear space giving a distance of at least fifty (50) feet to doors, windows or other openings. Openings in walls of a building in the same plane or parallel planes and facing in the same direction as that in which the vent is situated, shall not be considered as coming within the intent of the rule. No vent outlet shall be within twenty-five (25) feet, measured horizontally, of any exterior fire escape, nor shall it be below any such fire escape which is within this distance.
13. All horizontal or vertical vents from vaults shall be constructed as required for chimneys in Chapter 37. When located entirely outside of the building walls, vents may be constructed as required for metal stacks in Chapter 37.

14. Each vent opening directly through an exterior wall shall be protected against the weather by single thickness glass (1/16 inch thick) painted a dark color or by other combustible fragile material, in a sash arranged to open automatically in case of fire by the use of an approved releasing device inside the film vault. The area of the glass shall be the effective sectional area of the vent opening. No pane of glass shall be smaller than two hundred (200) square inches. Any protection equivalent to the above may be accepted in lieu thereof.

15. A light wire screen not coarser than one-eighth (1/8) of an inch mesh shall also be placed over each vent, so arranged as not to interfere with the automatic operation of the sash. Bars or screen designed to prevent burglary or injury to contents, shall not have a mesh of less than four (4) inches, and shall be located inside the light wire screen.

16. A permanent guard shall be installed to prevent films from being forced against the vent openings of small containers.

17. Cabinets shall be of approved construction. Cabinets containing in excess of fifty (50) reels of film shall be divided into at least two distinct compartments, each compartment provided with an independent door; the separating partition should be practically air tight and of substantial construction.

Note:—In general, cabinet should be of a design and so insulated as to stand at least a five (5) minute fire test conducted in accordance with the Standard Time-Temperature Test, and also insulated to prevent the contents of one compartment being involved by a fire in the other.

(d) Classification of Building. 1. All buildings used for film exchange purposes shall have approved automatic sprinklers installed in film vaults, inspection rooms, rewinding rooms and shipping rooms.

2. Inspection rooms and shipping rooms shall be separated from the remainder of the building by a “Special Fire Separation” but no portion of any building shall be occupied as a film exchange where any portion of the building is occupied for living or sleeping quarters, except by a caretaker or a janitor.

Sec. 1012. (a) Unexposed Film. Unexposed film exceeding five hundred (500) cubic feet in aggregate amount, shall be stored in rooms completely equipped with automatic sprinkler system.

In portrait and commercial studios, the storage of unexposed film shall be in unopened Interstate Commerce Commission containers, or in cabinets or filing drawers, on shelves located at least two (2) feet above the floor, or in vented storage vaults. Where storage exceeds fifty (50) cubic feet, the room shall be equipped with automatic sprinklers. Where the aggregate stor-
age exceeds one hundred (100) cubic feet the storage shall be
in vented storage vaults as required for exposed film or in I.C.C.
shipping containers.

In hospitals, sanitariums, doctors' offices and X-ray laboratories, the storage of unexposed film shall be in unopened I.C.C.
shipping containers or in approved cabinets vented to the outside
air, or in vented storage vaults. Where the aggregate storage
exceeds fifty (50) cubic feet the storage shall be in a vented
storage vault as required for exposed film.

(b) Exposed Film. No exposed film shall be stored in any
basement. In portrait or commercial studios, exposed film shall
be stored in approved vented cabinets or storage vaults. Not
more than two hundred fifty (250) pounds shall be stored in any
single cabinet. Where the aggregate film storage exceeds one
thousand (1,000) pounds, it shall be stored in approved vented
vaults.

In hospitals, sanitariums, doctors' offices and X-ray laboratories, all exposed film shall be stored in approved vented cabinets
or in outside or roof storage houses. The aggregate storage
in cabinets shall be limited to five hundred (500) pounds.

(c) Storage Cabinets. Storage cabinets shall not exceed ten
(10) cubic feet capacity, and not over two hundred fifty (250)
pounds of film shall be stored in any one cabinet. All cabinets
shall be of approved insulated construction. Each cabinet shall be
provided with a separate vent to the outside of the building with
an area of five (5) square inches, for each cubic foot volume.
All such vents shall extend above the roof and at least twenty-
five (25) feet from doors, windows, fire escapes and other open-
ings, and shall be constructed as required for chimneys or of
riveted sheet metal not less than eighteen (18) gauge, insulated
with one (1) inch of incombustible insulating materials and shall
be kept at least nine (9) inches away from any combustible
material.

(d) Storage Vaults and Rooms. Storage vaults shall be
constructed as required for motion picture films. (See Section
1011.)

Outside storage houses shall be located on a roof or as far as
practicable from other buildings. Walls shall be of three (3)
hour fire-resistive construction.

Buildings shall not exceed seven hundred fifty (750) cubic
feet capacity, or shall be divided into sections with unpierced
walls of not over seven hundred fifty (750) cubic feet capacity
each.

Ventilation shall be provided as required for storage vaults.
(See Section 1011.)

If located on a building roof, automatic sprinkler shall be
provided as required for storage vaults. (See Section 1011.)

All wiring in storage vaults or rooms, shall comply with the
requirements of the electrical code of the City and County of
Denver, and as required for storage vaults in Section 1011.
Sections 1013-1015

Gasoline Filling Station and Greasing Pits

Sec. 1013. The installation of all tanks, pumps and other devices for the storage and for the sale of gasoline or other inflammable liquids shall be made in accordance with Ordinance Number 15, Series of 1933, and the rules and regulations of the Fire Department. No such installation shall be made without first obtaining a permit therefor from the Chief of the Fire Department.

It shall be unlawful for any person, firm or corporation to install or maintain, or permit to be installed or maintained, any type of gasoline pump, dispensing or vending apparatus, on any street area, but the same shall be placed at such distance from property lines adjoining street area that no part of any vehicle receiving gasoline from such pump or apparatus may stand on any part of the street area.

Greasing pits or lifts, unless inside of a building, shall not be less than twenty (20) feet from street, alley or sidewalk lines.

Exceptions and Deviations

Sec. 1014. All 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.

In public garages of Types II or III Construction, fireproofing may be omitted on the roof framing.

Mixed Occupancies

Sec. 1015. Separation of Group E occupancies from all other occupancies shall be provided as specified in Section 503.
CHAPTER 11 — REQUIREMENTS FOR GROUP F BUILDINGS

Sec. 1101. Each Group F occupancy shall be considered as a separate building and the Group shall include all moderately hazardous industrial and commercial occupancies, such as:

Division 1: Wholesale and retail stores, office buildings, restaurants, undertaking parlors, printing plants, municipal police and fire stations.

Division 2: Factories and workshops using materials not highly inflammable or combustible.

Division 3: Storage and sales rooms for combustible goods.

Sec. 1102. Buildings or parts of buildings classed in Group F because of use or the character of the occupancy shall be of Types I, II, III, IV Construction, and the maximum height and floor areas shall not exceed those specified in the following table.

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>Maximum Height for Corresponding Areas</th>
<th>Maximum Floor Areas (Sq. Ft.)</th>
<th>Increase for Complete Sprinkling*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Stories</td>
<td>1 Street</td>
</tr>
<tr>
<td>Type I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>65 ft.</td>
<td>5 stories</td>
<td>6,500</td>
</tr>
<tr>
<td>Type II</td>
<td>65 ft.</td>
<td>1 story</td>
<td>12,500</td>
</tr>
<tr>
<td>Type III</td>
<td>45 ft.</td>
<td>3 stories</td>
<td>5,000</td>
</tr>
<tr>
<td>Type III</td>
<td>35 ft.</td>
<td>1 story</td>
<td>7,500</td>
</tr>
<tr>
<td>Type IV</td>
<td>No restrictions</td>
<td>1 story</td>
<td>16,000</td>
</tr>
</tbody>
</table>

Note:—*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.
Sections 1102-1109

For buildings of intermediate height the allowable floor areas shall be interpolated.

Except in Fire Districts 1 and 2, sheds for the storage of lumber or similar materials may be of Type V Construction when having one side open. Such sheds shall not exceed 7500 square feet in area, and shall be not closer than ten (10) feet to side lot lines.

Location on Property

Sec. 1103. All exterior walls or parts of walls, except on street fronts, of Group F buildings which are less than four (4) feet from adjacent property lines, shall be of masonry or reinforced concrete. All openings in exterior walls, except on street fronts, which are less than eight (8) feet from adjacent property lines shall be protected by doors or windows of one hour fire-resistive construction as specified in Section 4304. See Section 504 for regulating adjacent buildings on the same property. See Chapters 16, 18, 19, 20 and 21, for location in Fire Districts and for Types of Construction.

Stairs and Exits

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

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

Light, Ventilation and Sanitation

Sec. 1105. All portions of Group F buildings customarily used by human beings shall be provided with light and ventilation by means of windows and/or skylights with an area not less than one-eighth (1/8) 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 either located in such building or conveniently located in a building adjacent thereto.

Enclosure of Vertical Openings

Sec. 1106. All elevator shafts, vent shafts and other vertical openings shall be enclosed as specified under Types of Construction.

Fire Extinguishing Apparatus

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

Special Hazards

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

No storage of inflammable liquids shall be allowed in Group F buildings, and the handling and use of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group F building unless such use and handling complies with the rules and regulations of the Fire Department.

Mixed Occupancies

Sec. 1109. Separation of Group F occupancies from all other occupancies shall be provided as specified in Section 503
CHAPTER 12 — REQUIREMENTS FOR GROUP G BUILDINGS

Sec. 1201. Each Group G occupancy shall be considered as a separate building and the Group shall include non-hazardous industrial and commercial occupancies which create a low fire and life hazard, such as:

Division 1: Ice plants, power plants, pumping plants, cold storage, creameries.

Division 2: Factories and workshops using combustible and/or non-explosive materials.

Division 3: Storage and sales rooms of combustible and/or non-explosive materials.

Sec. 1202. Buildings or parts of buildings classed in Group G because of use or the character of the occupancy shall be of Types I, II, III, or IV Construction and the maximum height and floor areas shall not exceed those specified in the following table:

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>Maximum Height for Corresponding Areas</th>
<th>Maximum Floor Areas (Sq. Ft.)</th>
<th>Increase for Complete Sprinkling*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>NO RESTRICTIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>65 ft. 5 stories</td>
<td>6,500 9,500 12,500</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>65 ft. 1 story</td>
<td>12,500 16,000 20,000</td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td>45 ft. 3 stories</td>
<td>5,000 6,500 9,500</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>35 ft. 1 story</td>
<td>7,500 9,500 12,500</td>
<td></td>
</tr>
<tr>
<td>Type IV</td>
<td>NO RESTRICTIONS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: — *Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

79
Sections 1202-1208

Storage sheds for incombustible and for non-explosive materials may be built of wood frame, metal covered, when not over 7500 square feet in area and located outside of Fire Zones I and II.

For buildings of intermediate height the allowable floor areas shall be interpolated.

Sec. 1203. Stairs and exits shall be provided as specified in Chapter 33.

Sec. 1204. Smokeproof towers shall be provided as and when required in Chapter 33.

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

Sec. 1206. 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, either located in such building or conveniently located in a building adjacent thereto.

Sec. 1207. Except as specified in Chapter 33, vertical openings are not required to be enclosed.

Sec. 1208. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

Sec. 1209. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

The storage, use and handling of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group G building unless such storage and handling complies with the rules and regulations of the Fire Department.

Sec. 1210. Separation of Group G occupancies from other occupancies shall be provided as specified in Section 503.
CHAPTER 13 — REQUIREMENTS FOR GROUP H BUILDINGS

Sec. 1301. Each Group H occupancy shall be considered as a separate building and the Group shall include:

Division 1: Hotels, apartment houses, dormitories, lodging houses.
Division 2: Convents, monasteries (accommodating ten or more persons).

Sec. 1302. Buildings or parts of buildings classed in Group H because of use or the character of the occupancy shall be of Types I, II, III or IV Construction, and the maximum height and floor areas shall not exceed those specified in the following table.

Maximum Allowable Areas on Any One Floor as Determined by Height of Building, Street Frontage and Type of Construction

<table>
<thead>
<tr>
<th>Types of Construction</th>
<th>Maximum Height for Corresponding Areas</th>
<th>Maximum Floor Areas (Sq. Ft.)</th>
<th>Increase for Complete Sprinkling*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Stories</td>
<td>1 Street</td>
</tr>
<tr>
<td>Type I</td>
<td>NO RESTRICTIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td>65 ft.</td>
<td>5 stories</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>65 ft.</td>
<td>1 story</td>
<td>12,500</td>
</tr>
<tr>
<td>Type III</td>
<td>45 ft.</td>
<td>3 stories</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>35 ft.</td>
<td>1 story</td>
<td>7,500</td>
</tr>
<tr>
<td>Type IV</td>
<td>45 ft.</td>
<td>1 story</td>
<td>16,000</td>
</tr>
</tbody>
</table>

Note:—*Increase shall not be permitted unless the area is entirely protected by an automatic sprinkler installation as specified in Chapter 38.

For buildings of intermediate height the allowable floor areas shall be interpolated.

Sec. 1303. Stairs and exits shall be provided as specified in Chapter 23.
Smokeproof towers shall be provided as and when specified in Chapter 33.

All stairs and exits in Group H buildings shall open directly upon a street or alley or upon a yard or court not less than four (4) feet 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 (7) feet in height.

Sec. 1304. All rooms of Group H buildings used for eating, living and/or sleeping purposes shall be provided with light and ventilation by means of windows with an area not less than one-eighth (1/8) of the total floor area of such room or rooms.

Interior kitchens for apartments shall have mechanical ventilation systems designed to provide a change of air not less than every ten minutes. Each interior bath shall have separate metal vent duct not less than forty (40) square inches in area, which may connect into a trunk duct in the attic. All vent ducts shall be of sheet metal and shall continue through the roof.

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 toilets located in such building and one such toilet shall be conspicuously marked “For Women” and the other conspicuously marked “For Men.” Not less than one toilet shall be provided for each fifteen (15) persons or major fraction thereof that such building is designed to accommodate.

Sec. 1305. All elevator shafts, vent shafts, stairways and other vertical openings shall be enclosed as specified under Types of Construction except stairways in buildings two (2) stories in height.

Sec. 1306. Automatic sprinklers, standpipes and basement pipe inlets shall be installed as and when specified in Chapter 38.

Sec. 1307. Chimneys and heating apparatus shall conform to the requirements of Chapter 37.

Every boiler room or room containing a central heating plant shall be separated from the rest of the building by a “Special Fire Separation” as specified in Section 503.

The storage and handling of gasoline, fuel oil and other inflammable liquids shall not be permitted in any Group H building unless such storage and handling complies with the rules and regulations of the Fire Department. All doors leading into rooms in which volatile inflammable liquids are used or kept, shall be of one hour fire-resistive construction as specified in Section 4304 and shall be kept normally closed.

Sec. 1308. Separations between Group H occupancies and all other occupancies shall be provided as specified in Section 503.
CHAPTER 14 — REQUIREMENTS FOR GROUP I BUILDINGS

Sec. 1401. Each Group I occupancy shall be considered as a separate building and the Group shall include any building or parts of buildings used as dwellings.

Sec. 1402. Buildings or parts of buildings classed in Group I because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction.

Sec. 1403. (See Zoning Ordinance.)

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

Sec. 1405. All rooms of Group I buildings used for cooking, eating, living and/or sleeping purposes shall be provided with light and ventilation by means of windows with an area not less than one-eighth (1/8) of the total floor area of such room or rooms.

Each interior bath shall have separate metal vent duct not less than forty (40) square inches in area which may connect into a trunk duct in the attic. All vent ducts shall be of sheet metal and shall continue through the roof.

Sec. 1406. Stairs in Group I buildings need not be enclosed. Dumbwaiter 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.

Inflammmable liquids shall not be stored or used in Group I buildings unless such storage or use conforms to the rules and regulations of the Fire Department.

Sec. 1409. Dwellings constructed on the roof of multiple storied buildings shall be considered as an additional story.

Sec. 1410. Separation of Group I occupancies from all other occupancies shall be provided as specified in Section 503.
CHAPTER 15—REQUIREMENTS FOR GROUP J BUILDINGS

Sec. 1501. Each Group J building or occupancy shall be considered as a separate building, and the Group shall include:

Division 1: Private garages.
Division 2: Accessory buildings and structures such as sheds, fences, water tanks and towers.
Division 3: Stadiums, reviewing stands and amusement park structures.

Sec. 1502. Buildings or parts of buildings classed in Group J because of use or the character of the occupancy shall be of Types I, II, III, IV or V Construction as regulated by the requirements of Chapter 16. The floor area of Types I and II construction shall not be limited, the floor area of Types III and IV shall be limited to ten thousand (10,000) square feet, and buildings of Type V construction shall not exceed one thousand (1000) square feet in area, except that such restriction of Type V construction shall not apply to amusement park structures of the open skeleton-framed type or to stadiums or reviewing stands for temporary use only.

Reviewing stands and amusement park structures shall be designed and constructed in a substantial manner so as to fully withstand all impact loads in addition to the static loads specified in Chapter 28.

Sec. 1503. (a) Classification.

1. Masonry walls.
2. Ornamental iron.
3. Woven wire.
4. Wood picket (more than 50% open)
5. Solid fences (wood or metal less than 50% open).
6. Hedges.

(b) In residence and business districts (see Zoning Map) or in any district, fences enclosing plots used for dwelling purposes shall conform to the following requirements:

1. Fences erected in front of the front building line shall be of Class 2, 3, 4 or 6, and shall not exceed a height of three feet six inches (3'6").
2. Side yard fences back of the front building line shall be of any class, but shall not exceed a height of three feet six inches (3'6") to the rear of the neighboring dwelling, provided that not
less than the rear twenty-five (25) feet of the lot may be fenced to a height of six (6) feet.

3. Rear yard fences may be of any class, but shall not exceed a height of six (6) feet except that if of Type V, the height shall not exceed a height of four (4) feet.

4. For buildings located on corner lots the restrictions for fences in the yard facing on the side street shall be the same as in paragraph 1, for front yard fences.

5. No barbed wire or other sharp pointed fence, and no electrically charged fence, shall be erected or maintained.

6. In case of a fence erected on top of a retaining wall, the height shall be measured from the grade of the low side; provided that in any case a fence of Types 2, 3, 4 or 6 may be erected on top of a retaining wall to a height not to exceed three feet six inches (3'6") above the grade of the high side.

7. On corner lots no fence, retaining wall, shrub, tree or thing shall be erected or maintained which obstructs the traffic vision.

8. Fences shall be in keeping with the general condition of the neighborhood in which they are erected, and any dilapidated, unsightly or dangerous fence shall be removed when so ordered by the Chief Building Inspector.

9. Retaining walls shall be adequately designed and drained so as to resist all lateral pressure to which they may be subject. Retaining walls shall not be erected in any front yard when, in the opinion of the Chief Building Inspector, such retaining wall would be unsightly or detrimental to adjoining property.

10. When, in his judgment, the public health, safety and welfare will be substantially served and the neighboring property will not be materially damaged, or in case of an agreement between neighboring property owners, a certified copy of which shall be filed with the Chief Building Inspector, he may, at his discretion, vary the requirements herein.

(c) In Commercial and Industrial Zones (see Zoning Map) no fence erected in the front yard space required by the zoning ordinance shall exceed a height of three feet six inches (3'6") and such fence shall be of Types 2, 3, 4 or 6 construction. Except in such required front yards, fences may be of any type of construction and height. Barbed wire or similar materials may be used at a height of not less than six (6) feet above grade. No electrically charged fence shall be erected or maintained. Fences shall be kept in repair, and any dilapidated, dangerous or unsightly fence shall be removed or repaired when so ordered by the Chief Building Inspector.

Sec. 1504. (a) Stairs and exits for amusement park devices shall be provided as specified in Chapter 33, except that stairs and ramps in buildings not exceeding two stories in height need not be enclosed.

(b) Stairs, exits, aisles and seating for stadiums and reviewing stands shall be as follows:
1. **Stairs.** All stairs shall have a rise of not more than seven and one-half (7\(\frac{1}{2}\)) inches and a tread of not less than ten (10) inches, not including the nosing.

2. **Exits.** There shall be provided one exit not less than seven (7) feet wide for each two thousand (2000) persons or major fractions thereof which the stadium or reviewing stand is designed to seat. Such exits shall be spaced not more than seventy-five (75) feet apart. Passageways serving such exits shall be not less than seven (7) feet in clear height nor less than seven (7) feet in clear width.

3. **Aisles.** Aisles not less than three feet six inches (3'6") in width shall be provided so that there are not more than twenty (20) seats between any seat and an aisle.

4. **Seats.** Where seats are not spaced or marked off in any stadium or reviewing stand, a distance of eighteen (18) inches 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 (26) inches back to back and where backs are provided for the seats, they shall be spaced thirty (30) inches back to back.

Where the space under the stadium or reviewing stand is used for any purpose whatsoever, exits passing through this space shall be separated therefrom by walls, floors and ceilings of not less than one-hour fire-resistive construction.

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**Light and Ventilation**

Sec. 1505. Private garages which are constructed in conjunction with any Group H or I buildings 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 (6) inches of the floor. The clear area of the louvered openings or of the openings into the exhaust ducts shall be not less than sixty (60) square inches per car stored in such private garage. Under no circumstances shall a private garage have any opening into a living or sleeping room.

Amusement park structures which have enclosed spaces open to and used by the public shall be provided with light and ventilation, either natural or artificial, sufficient for safe and healthful conditions.

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**Enclosure of Vertical Openings**

Sec. 1506. Elevator shafts, vent shafts, stair-wells and similar vertical openings shall be enclosed as specified in Chapter 30 when extending through three or more stories.

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**Fire Extinguishing Apparatus**

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

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**Special Hazards**

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

Inflammable liquids shall not be stored, handled or used in Group J buildings unless such storage or handling shall comply with the rules and regulations of the Fire Department.
Sec. 1509. When storage space, termed by this Code a private garage, is designed and provided in any building for the storage of more than three (3) automobiles, such storage space shall be deemed to be a public garage.

Amusement park structures into which the public is admitted, other than those of the open frame type of construction, when more than one story or two hundred (200) square feet in area shall have the exterior walls, bearing partitions and floors of not less than one-hour fire-resistive construction as specified in Chapter 43.

Sec. 1510. Separation of Group J occupancies from any other occupancies shall be provided as specified in Section 503 and in Section 1509.
PART IV.

Requirements Based on Location
In Fire Zones

CHAPTER 16—RESTRICTIONS IN FIRE ZONES

Sec. 1601. For the purpose of this Code, the entire City and County of Denver is hereby declared to be and is hereby established a Fire District, and said Fire District shall be known and designated as Fire Zones Nos. 1, 2, 3, and 4. Wherever reference is made to any fire zone, it shall be construed to mean one of the four fire zones described as follows:

Fire Zones. Where streets, alleys or rights-of-way are referred to in this section, it shall be taken to mean the center lines of said streets, alleys or rights-of-way.

Fire Zone No. 1. Fire Zone No. 1 shall include all the area lying within the following described boundaries:

Starting at the intersection of E. 14th Avenue and Grant Street, thence north on Grant Street to E. Colfax Avenue, thence west on E. Colfax Avenue to Lincoln Street, thence north on Lincoln Street to E. 20th Avenue, thence northeast on Glenarm Street to 20th Street, thence northwest on 20th Street to Champa, thence southwest on Champa Street to 19th Street, thence northwest on 19th Street to Wewatta Street, thence southwest on Wewatta Street to Cherry Creek; thence southeasterly on Cherry Creek to 13th Street, thence southeast on 13th Street to Delaware Street, thence south on Delaware Street to W. 14th Avenue, thence east on W. 14th Avenue to Grant.

Fire Zone No. 2. Fire Zone No. 2 shall include all of the area lying within the following described boundaries, except that which is included in Fire Zone No. 1.

Starting at W. 14th Avenue and Sheridan Boulevard, thence east on 14th Avenue to Federal Boulevard, thence south on Federal Boulevard to the Morrison Road, thence northeasterly on Morrison Road to W. Howard Place, thence east on W. Howard Place to the Platte River, thence north on the center line of the Platte River to W. 14th Avenue, thence east on W. 14th Avenue to Cherry Creek, thence southeasterly on the Center line of Cherry Creek to Delaware Street, thence south on Delaware to W. 6th Avenue, thence east on W. 6th Avenue to Acoma Street, thence south on Acoma Street to W. Ellsworth, thence west on W. Ellsworth to S. Bannock Street, thence south on S. Bannock
Street to W. Kentucky Avenue, thence east on W. Kentucky to S. Acoma, thence south on S. Acoma to Yale Avenue, thence east on Yale to the center line of the alley between Lincoln Street and Sherman Street, thence north on said alley to E. Warren Avenue, thence west on E. Warren Avenue to Lincoln Street, thence north on Lincoln Street to E. 4th Avenue, thence east on E. 4th Avenue to Grant Street, thence north on Grant Street to E. 10th Avenue, thence east on E. 10th Avenue to Washington Street, thence north on Washington Street to E. 14th Avenue, thence east on 14th Avenue to Dahlia Street, thence north on Dahlia Street to E. 16th Avenue, thence west on 16th Avenue to Washington Street, thence north on Washington Street to 23rd Street, thence northwest on 23rd Street to the center line of Broadway, thence north on Broadway to Lawrence Street, thence northeast on Lawrence to 29th Street, thence northwest on 29th Street to the center line of the Platte River, thence southwesterly on the center line of the Platte River to W. 16th Avenue, thence west on W. 16th Avenue to Federal Boulevard, thence south on Federal Boulevard to W. Conejos Place, thence west on W. Conejos Place to Tennyson Street, thence north on Tennyson to W. 16th Avenue, thence west on 16th Avenue to the center line of Sheridan Boulevard, thence south on Sheridan Boulevard to the point of beginning.

Fire Zone No. 3. Fire Zone No. 3 shall include all of the area lying within the following described boundaries, except that portion which is included in Fire Zones No. 1 and No. 2.

Starting at the center line of E. Alameda and Yosemite Street, thence north on Yosemite Street to E. 10th Avenue, thence west on E. 10th Avenue to Quince Street, thence north on Quince Street to E. 13th Avenue, thence east on E. 13th Avenue to Trenton Street, thence north on Trenton Street to E. 14th Avenue, thence east on E. 14th Avenue to Yosemite Street, thence north on Yosemite Street to E. 17th Avenue, thence west on E. 17th Avenue to the alley between Roslyn and Rosemary Streets, thence north on said alley to E. 26th Avenue, thence west on E. 26th Avenue to the alley between Monaco Parkway and Magnolia, thence north on said alley to E. 35th Avenue, thence west on E. 35th Avenue to the alley between Colorado Boulevard and Albion Street, thence north on said alley to E. 38th Avenue, thence west on E. 38th Avenue to Columbine Street, thence north on Columbine Street to E. 40th Avenue, thence west on E. 40th Avenue to the center line of the Union Pacific right-of-way, thence southwest on said right-of-way to 29th Street, thence northwest on 29th Street to the center line of the Platte River, thence southwesterly on the Platte River to the alley east of Lipan Street, thence north on said alley to W. 44th Avenue, thence west on W. 44th Avenue to the alley between Wyandot and Zuni, thence north on said alley to W. 46th Avenue, thence west on W. 46th Avenue to the alley between Eliot Street and Federal Boulevard, thence north on the alley between Eliot Street and Federal Boulevard to W. 52nd Avenue, thence west on W. 52nd Avenue to the alley between Federal Boulevard and Green Court, thence south on said alley to W. 49th Avenue, thence west on W. 49th Avenue to Grove Street, thence south on Grove to W. 46th Avenue, thence west on W. 46th Avenue
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to Lowell Boulevard, thence south on Lowell Boulevard to W. 41st Avenue, thence on W. 41st Avenue to Tennyson Street, thence south on Tennyson to W. 38th Avenue, thence west on W. 38th Avenue to Sheridan Boulevard, thence south on Sheridan Boulevard to W. 13th Avenue, thence east on W. 13th Avenue to Federal Boulevard, thence north on Federal Boulevard to the center line of the Morrison Road; thence northeasterly on the Morrison Road to W. Howard Place, thence east on W. Howard Place to the center line of the Platte River, thence north on the Platte River to W. 14th Avenue, thence east on W. 14th Avenue to the center line of the Denver & Rio Grande right-of-way, thence south and southeasterly on said right-of-way to W. Kentucky Avenue, thence east on W. Kentucky Avenue to Acoma Street, thence south on Acoma Street to Yale Avenue, thence east on Yale Avenue to the alley between Lincoln and Sherman Street, thence north on said alley to Warren Avenue, thence east on Warren Avenue to Downing Street, thence north on Downing Street to Evans Avenue, thence west on Evans Avenue to the alley between Ogden and Corona, thence north on said alley to the center line of the C. & S. right-of-way, thence southeasterly on said right-of-way to S. Race Street, thence south on S. Race Street to Asbury, thence west on Asbury to the alley between High and Williams, thence south on said alley to Iliff, thence east on Iliff to the alley between York and University, thence south on said alley to Yale Avenue, thence east on Yale to the alley between University and Josephine, thence north on said alley to Wesley, thence east on Wesley to Cook Street, thence north on Cook Street to Iliff Avenue, thence east on Iliff to Colorado Boulevard, thence north on Colorado Boulevard to Jewell, thence west on Jewell to the alley between Columbine and Josephine, thence north on said alley to E. Arkansas, thence east on Arkansas to S. Steele Street, thence north on S. Steele Street to Mississippi, thence east on Mississippi to Colorado Boulevard, thence north on Colorado Boulevard to the center line of Cherry Creek, thence northwesterly on the center line of Cherry Creek to Steele Street, thence north on Steele Street to 1st Avenue, thence east on 1st Avenue to Harrison Street, thence south on Harrison to Alameda, then east on Alameda to the point of beginning.

Fire Zone No. 4. Fire Zone No. 4 shall include all of the area of the City and County of Denver except that which is included in Fire Zones No. 1, No. 2 and No. 3.

Sec. 1602. (a) No building or structure of Type V construction shall be erected or constructed in or moved into Fire Zone No. 1.

(b) No building or structure of Type III or Type IV construction, having an area greater than four hundred (400) square feet, nor more than one (1) story or twenty (20) feet in height, shall be erected, constructed, enlarged or moved into Fire Zone No. 1.

(c) Any existing building or structure in Fire Zone No. 1, which is enlarged, raised or built upon to an extent exceeding
Sections 1604-1605

are covered with a veneer of masonry or stucco as provided in Section 2205, and that only one accessory building of like nature shall be allowed on any one building plot.

2. Existing dwellings of Type V construction may have additions built of similar construction, not to exceed 20% of the area existing at the time of passage of this ordinance.

(b) Any building or structure moved into Fire Zone No. 3 shall comply with all of the requirements for new buildings in Fire Zone No. 3.

Restrictions in Fire Zone No. 4

Sec. 1605. Any building complying with the requirements specified in this Code may be erected or moved into or within Fire Zone No. 4.
PART V.

Requirements Based on Types of Construction

CHAPTER 17—CLASSIFICATION OF ALL BUILDINGS
BY TYPES OF CONSTRUCTION

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 is necessary that all of the requirements for that type of construction be complied with.

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 specified 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 for the purpose of this Code shall be divided into the following types of construction based upon their resistance to fire, and for the purpose of this Code 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—METAL FRAME Construction.
Type V —WOOD FRAME Construction.

General
Classification by Types of Construction
Section 1702

When two or more types of construction occur in the same building and are not separated by an "Absolute Fire Separation" as specified in Section 503, the entire building shall be classed in the least fire-resistive type of construction, and such building 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 definitely classified 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.
CHAPTER 18 — TYPE I BUILDINGS
(Fire-Resistive)

Sec. 1801. “Type I” or “Type I Buildings.” The structural frame of Type I buildings shall be of structural steel or iron which shall be fireproofed, or shall be of masonry or of reinforced concrete. The foundation, exterior walls and inner court walls shall be of masonry or reinforced concrete. The roof construction and floors shall be of fire-resistive materials, except as permitted in Sections 1810 and 1811. Exterior doors and windows, except as specified in Section 1813, shall be of fire-resistive construction. (Note: Fire-resistive materials and fire-resistive construction have a specific meaning in this Code, as specified in Chapters 42 and 43.)

Sec. 1802. The height of Type I buildings shall not be limited, except as limited by Zoning or other ordinances.

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

Sec. 1804. Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be designed as specified in Sections 2306 and 2802.

Sec. 1805. All exterior bearing walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29, and shall be of not less than four-hour fire-resistive construction as specified in Section 4302.

Other exterior walls and inner court walls shall be of masonry or reinforced concrete of not less than three-hour fire-resistive construction as specified in Section 4302.

Parapet walls same as Section 1905.

Sec. 1806. Interior partitions shall be constructed of incombustible materials and shall be of not less than one-hour fire-resistive construction as specified in Section 4302.

Exceptions: 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 (¾) the height of the room in which placed; when more than three-fourths (¾) the height of the room, such partitions shall have not less than one-fourth (¼) of the height of the partition constructed of 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 two-hour fire-resistive construction, and all openings therein shall be protected by fire-resistive doors or windows as specified in Chapters 30 and 43.

A parapet wall or hand rail at least thirty (30) inches 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. 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) All structural steel or iron members, not including forms or structural members for elevators and elevator enclosures, or erection beams, shall be thoroughly fire-proofed 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 (8) stories or eighty-five (85) feet in height, and with three-hour fire-resistive protection for columns, beams and girders and two-hour fire-resistive protection for floors for all buildings which are eight (8) stories or eighty-five (85) feet or less in height, and all such fire-resistive protection shall be as specified in Chapter 43.

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

(2) The masonry over window openings may be supported by a steel plate, angle or similar member which is not fireproofed on the under side, provided the member is supported at proper intervals from a structural beam or girder which is fireproofed on all sides. For openings in masonry bearing walls not exceeding four (4) feet in width, an angle or similar member supported by masonry and not fireproofed 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 building is not less than twenty-five (25) feet above any part of any floor or balcony, fireproofing 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 building is less than twenty-five (25) feet above any floor or balcony, the roof construction shall be protected by a suspended ceiling of incombustible materials of not less than one-hour fire-resistive construction as specified in Chapter 43, and such ceiling shall be not less than six (6) inches distant from any part of such roof construction.

(b) All reinforced concrete columns, beams and girders shall be thoroughly fireproofed with four-hour fire-resistive protection, and all floors, joists and slabs shall be thoroughly fireproofed with not less than three-hour fire-resistive protection for all buildings more than eight (8) stories or eighty-five (85) feet in height; and all reinforced concrete columns, beams and girders shall be thoroughly fireproofed with not less than three-hour fire-resistive protection, and all floors, joists and slabs shall be thoroughly fireproofed with not less than two-hour fire-resistive protection for all buildings eight (8) stories or eighty-five (85) feet or less in height; and all such fire-resistive protection shall be as specified in Chapter 43.

Sec. 1810. Floors shall be constructed of reinforced concrete, brick or hollow tile arches, reinforced gypsum or may be composite floors of those materials in combination with structural steel or iron or reinforced concrete or such floor panel construction shall consist of any floor system providing not less than two-hour fire-resistive construction as specified in Section 4303 for buildings which are eight (8) stories or eighty-five (85) feet or less in height, and providing not less than three-hour fire-resistive construction as specified in Section 4303 for all buildings more than eight (8) stories or eighty-five (85) feet in height.

The type of floor construction used shall provide means to keep the beams and girders from spreading, either by installing ties or bridging, with no laterally unsupported length of joists being permitted to exceed eight (8) feet, 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.

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 (100) square feet in area, and such space shall be filled solidly under all partitions so that there is no communication under the flooring between adjoining rooms.
Sections 1811-1814

Roof Construction

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

Exceptions: Roof construction on buildings of any height will be permitted of incombustible materials not fireproofed, if separated from the top story by a self-supporting ceiling of a three (3) hour rating.

Roof construction may be of non-fire-resistive materials on buildings not over sixty-five (65) feet in height, if separated from the top story below by a self-supporting ceiling of not less than two (2) hour rating.

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

Stairs

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. Stair nosings of combustible material may be used if wholly embedded in fire-resistive materials.

All stairs shall be designed and constructed as specified in Chapter 38 and as specified under Occupancy in Part III.

Doors and Windows

Sec. 1813. Doors, windows and other openings in the exterior walls shall be protected by one-hour fire-resistive construction as specified in Section 4304.

Exceptions: (1) The provisions of this section shall not apply to doors, windows and other openings which face directly upon, and are not within forty (40) feet in Fire Zone No. 1 or are not within twenty (20) feet in Fire Zones Nos. 2, 3 and 4, 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 this section shall not apply to openings forty (40) feet or more from buildings on the same property, or forty (40) feet or more from adjacent property lines other than street fronts, in Fire Zone No. 1, or to openings twenty (20) feet or more on the same property or twenty (20) feet or more from adjacent property lines other than street fronts, in Fire Zones Nos. 2, 3, and 4, as regulated by the first exception.

Projections From the Building

Sec. 1814. Bays, oriel 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 fireproofed.

Cornices, marquises and similar appendages which are a part of a Type I building shall be constructed of substantial incombustible materials and as specified 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 protected by one-hour fire-resistive construction, when required under Section 1813.

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

(1) Mezzanine or balcony construction may be of unprotected steel provided that there shall be not more than two such mezzanines or balconies in any room of any building and provided, further, that no such mezzanine or balcony floor or floors shall cover more than thirty-three and one-third (33 1/3) per cent of the area in the room where located.

(2) Show window frames, 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, wainscotting, baseboards, hand rails, show window backing, floors and sleepers may be of wood. Wood doors may be used except in stair, elevator or other shaft enclosures or where specifically prohibited under Occupancy in Part III.

(4) Combustible insulation, if used, shall be in board form and shall be backed solidly with walls or ceilings of not less than one (1) hour fire-resistive construction. Such insulation shall not be furred out from walls or ceilings. No combustible insulating material shall be used in attic or concealed spaces.
CHAPTER 19 — TYPE II BUILDINGS
(Heavy Timber Construction)

Definition
Sec. 1901. Type "II" or "Type II Buildings." The structural frame shall be of structural steel or iron which shall be fire-proofed, or reinforced concrete, or masonry, or of heavy timbers. Foundations and exterior walls shall be of masonry or reinforced concrete. Roof construction shall be of wood, or incombustible materials. Floors and non-bearing partitions shall be of wood or incombustible materials.

Height Allowable
Sec. 1902. Type II buildings shall not exceed a height of sixty-five (65) feet.

Area Allowable
Sec. 1903. The floor area of Type II building shall be limited according to Occupancy as specified in Part III of this Code.

Foundations
Sec. 1904. Foundation walls and footings shall be of solid masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be designed as specified in Sections 2306 and 2802.

Exterior and Inner Court Walls
Sec. 1905. All exterior bearing walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29 and shall be of not less than four-hour fire-resistant construction as specified in Section 4302.

All walls within five (5) feet of adjacent property lines (excepting property lines abutting a street or an alley) and all walls within ten (10) feet of other buildings on the same property shall be provided with a parapet wall at least thirty (30) inches high above the roof at all points.

Inner court walls shall be constructed the same as exterior walls.

Partitions
Sec. 1906. Interior partitions shall be of one-hour fire-resistant construction as specified in Section 4302 or may be of solid wood construction formed of two layers of one-inch nominal matched boards or of two-inch nominal tongued and grooved wood planking or of solid wood laminated construction not less than three and five-eighths (3 5/8) inches thick.

Where wood partitions abutt or adjoin masonry walls they shall be tied as specified in Section 2507.

Other 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 two-hour fire-resistant construction as specified in Chapters 30 and 43; provided
that in buildings not more than three (3) stories in height which are completely sprinkled as specified in Chapter 38, such enclosure walls may be of any construction permitted for interior partitions.

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

Sec. 1908. The structural frame shall be of reinforced concrete, as provided in Chapter 26, structural steel as provided in Chapter 27, or of solid wood construction as specified in Chapter 25.

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 (8) inches nominal in its least dimension and no beam, girder or joist shall be less than six (6) inches nominal in its least dimension nor less than forty-eight (48) square inches nominal in cross-sectional area. In no case shall masonry or reinforced concrete be supported on wood construction, except tile or concrete floor finishes not more than three (3) inches in thickness.

Sec. 1909. (a) All structural steel or iron members (not including frames and structural members for elevators and elevator enclosures) shall be thoroughly fireproofed. Such fireproofing shall be of three-hour fire-resistive protection for columns, and two-hour fire-resistive protection for beams, girders, and floor systems, and all fireproofing shall be determined as specified in Chapter 43.

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

(2) The masonry over window openings may be supported by a steel plate, angle or similar member which is not fireproofed on the under side, provided the member is supported at proper intervals from a structural beam or girder which is fire-proofed on all sides. For openings in masonry bearing walls not exceeding four (4) feet in width, an angle or similar member supported by masonry and not fire-proofed on the under side may be used.

(3) Where the structural steel framework of the roof of a Group A, B or C building is not less than twenty-five (25) feet above any floor or balcony, fireproofing of all members of the roof construction may be omitted.

(4) Where the structural steel framework of the roof of a Group A, B or C building is less than twenty-five (25) feet above any floor or balcony, the roof construction shall be protected by a suspended ceiling of not less than two-hour fire-
resistive construction as specified in Chapter 48, and such ceiling shall be not less than six (6) inches distant from any part of such roof construction.

(b) Wood structural members shall not be required to be fire-proofed.

(c) All reinforced concrete columns shall be thoroughly fire-proofed with not less than three-hour fire-resistive protection and all joists, beams, girders and slabs shall be thoroughly fire-proofed with not less than two-hour fire-resistive protection outside of all steel reinforcing as specified in Section 4301.

Floor Construction

Sec. 1910. Floor construction shall be as specified for Type I buildings or shall be of one of the types noted below:

(1) Floor construction shall be tongued and grooved or splined lumber not less than three (3) inches nominal in thickness with a top layer of flooring of one (1) inch nominal thickness laid thereon.

(2) Construction of solid lumber placed on edge and securely spiked together to make a floor not less than four (4) inches nominal in thickness.

If such floor is six (6) inches nominal or more in thickness, the lumber shall be air seasoned or kiln dried.

A space of one-half (½) inch shall be required between all floor construction and the wall which it adjoins, to allow for swelling in case the floor becomes wet. This space shall be properly covered by a molding so arranged that it will not interfere with the swelling and shrinking movements of the flooring.

Wood joists, beams and girders supported by masonry walls shall be anchored thereto as specified in Section 2506.

The timbers and planking shall be self-releasing at end support on walls and no planking or timber shall extend through or across any fire, party or division walls.

Roof Construction

Sec. 1911. Roof construction shall be as specified for floor construction in Section 1910 except that the minimum allowable thickness shall be two and one-half (2½) inches nominal, the timbers and planking shall be self-releasing at end support on walls and no planking or timber shall extend across or through fire, party or division walls. Wood joists, beams, girders and rafters supported by masonry walls shall be anchored thereto as provided in Section 2508.

Roof covering shall be a “Fire-Retardant” roofing as specified in Section 4305 and shall be required over all combustible roof construction.

Stair Construction

Sec. 1912. Stair construction may be of wood in buildings not exceeding three (3) stories in height.

In buildings four (4) or more stories in height all stairs and stair construction shall be as required for Type I buildings.
All stairs and exits shall be designed and constructed as specified in Chapter 33 and as specified under Occupancy in Part III.

Sec. 1913. (a) Doors, windows and other openings in the exterior walls shall be protected by one-hour fire-resistive construction as specified in Section 4304.

Exceptions: (1) The provisions of this Section shall not apply to doors, windows and other openings which face directly upon, and are not within forty (40) feet in Fire Zone No. 1 or are not within twenty (20) feet in Fire Zones Nos. 2, 3 and 4, 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 this Section shall not apply to openings forty (40) feet or more from buildings on the same property, or forty (40) feet or more from adjacent property lines other than street fronts, in Fire Zone No. 1, or to openings twenty (20) feet or more on the same property or twenty (20) feet or more from adjacent property lines other than street fronts, in Fire Zones Nos. 2, 3 and 4, as regulated by the first exception.

Sec. 1914. Bays, oriel's and similar projections shall be constructed of incombustible materials with walls, floors and roof as specified 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 fireproofed; provided, that loading platforms for warehouses, freight depots and other similar buildings may be of heavy timber construction with wood floors not less than one and five-eighths (1%) inches thick, the space beneath to be enclosed on all sides. Such wood construction shall not be carried through the exterior walls of any Type II building.

Cornices, marquises and similar appendages which are a part of a Type II building shall be constructed of substantial incombustible materials and as specified in Chapter 45.

Sec. 1915. Penthouses shall be as required for Type I construction or shall be constructed with two-hour fire-resistive construction as specified in Chapters 36 and 43.

Skylights shall be of one-hour fire-resistive construction as specified in Chapters 34 and 43.

Sec. 1916. No wood lath or wood furring shall be allowed in any building of Type II construction, but unprotected steel or iron or wood will be allowed 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 thirty-three and one-third (33 1/3%) per cent of the area in the room where located.
Section 1916

(2) Show window frames, show cases and other appurtenances of stores and other similar buildings may be of wood, with or without unprotected steel or iron.

(3) Trim, handrails, show window backing and temporary partitions as specified in Section 1906, picture molds, chair rails and wainscoting or base boards may be of wood. Wood doors may be used, except in stair, elevator and other shaft enclosures, or where specifically prohibited under Occupancy in Part III.

(4) Combustible insulation, if used, shall be in board form and shall be backed solidly with walls or ceilings of not less than one-hour fire-resistant construction, or may be applied directly to the underside of wood floors or to roof sheathing in such a manner that no concealed spaces will be formed. No combustible insulating material shall be used in attic or concealed spaces.
CHAPTER 20 — TYPE III BUILDINGS
(Ordinary Masonry)

Sec. 2001. "Type III" or "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. Foundations and exterior walls shall be of masonry or reinforced concrete. Partitions, floors and roof framing may be of wood.

Sec. 2002. Type III buildings shall not exceed a height of forty-five (45) feet, in which height there shall be not more than three (3) stories.

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

Sec. 2004. Foundation walls and footings shall be of masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be designed as specified in Sections 2306 and 2802.

Sec. 2005. All exterior walls, inner court walls, fire walls and fire division walls shall be of masonry or reinforced concrete as specified in Chapter 29 and shall be of not less than four-hour fire-resistive construction as specified in Section 4302.

Exceptions: Gables of buildings of Groups I and J Occupancy may be of Type IV or Type V construction above the plate line except in Fire Zones 1 and 2.

All walls within five (5) feet of adjacent property lines (except property lines abutting a street or alley), and all walls within ten (10) feet of other buildings on the same property, shall be provided with parapet walls at least thirty (30) inches high above the roof at all points; except that parapet walls may be omitted on Type "I" or "J" buildings.

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 (2) floors and a roof, and shall be one (1) hour fire-resistive construction except in Group I or J buildings. All partitions between tenants shall be of one-hour fire-resistive construction as specified in Section 4302.

Exceptions: 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 (¾) of the height of the room in which placed; when more than three-fourths (¾) the height of the room, such partition shall have not less than one-fourth (¼) of the height of the partition constructed of glass set in sash.

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 one-hour fire-resistive construction as specified in Chapters 30 and 43.

A parapet wall or hand rail at least thirty (30) inches 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. Fireproofing of steel, iron or wood structural members may be omitted unless otherwise provided because of Location as in Part IV or Occupancy as in Part III, or as specified in Section 2010.

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

Wood joists, beams and/or girders supported by masonry walls shall be anchored thereto as specified in Section 2506.

Except in buildings of Groups I and J Occupancy, all floors, if ceiled below, shall be of one-hour fire-resistive construction as specified in Chapter 43.

Sec. 2011. Roof construction shall be of any Type of Construction permitted for floors as specified in Section 2010 and except where otherwise required because of Occupancy in Part III.

Wood rafters, joists, purlins, beams and girders supported by masonry walls shall be anchored thereto as specified in Section 2508.

Attic or roof spaces shall be divided into areas not exceeding twenty-five hundred (2500) square feet as specified in Section 2510.

Roof covering shall be a “Fire-Retardant” roofing as specified in Section 4305, when located in Fire Zone 1 or 2. Any roof covering complying with this Code may be used in Fire Zones 3 and 4.

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

Sec. 2014. Bays, oriel and similar projections shall be constructed of incombustible materials with walls, floors and roof as specified in this Chapter and in Chapter 35, except that buildings of Group H, Division 1, Occupancy, and Groups I and J buildings, may have such projections of Types IV and V construction.

Porches and exterior balconies shall be constructed of incombustible materials, but structural steel or iron members need not be fire-proofed, 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 (1 5/8”) inches thick, the space beneath to be entirely enclosed on all sides. Such wood construction shall not be carried through the exterior walls of any Type III building. Open porches and exterior balconies on buildings of Groups I or J Occupancy, not over two stories in height, may be of Type IV or Type V construction. Enclosed porches may be of Type IV or Type V construction if not over one (1) story in height. A second floor enclosed porch may be of Type IV or V construction provided the first story is of Type I, II or III construction.

Cornices and similar appendages, which are a part of a Type III building, shall be constructed of substantial incombustible material and as specified in Chapter 45, except that such appendages on buildings of Group H, Division 1, Group I or Group J Occupancy may have such appendages of wood construction when such appendage does not project into any public street or alley.

Sec. 2015. Penthouses and other roof structures shall be of not less than one-hour fire-resistive construction as specified in Chapters 36 and 43. Dormer windows on buildings of Groups I and J Occupancy may be of Types IV or V construction.

Skylights shall be of not less than one-hour fire-resistive construction as specified in Chapters 34 and 43.

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

No enclosed air space in any vertical wood framing shall have a dimension greater than eight (8) feet.

Combustible insulating materials may be placed in partition, floor or roof framing, but shall in no way interfere with the
fire blocking or fire separations required by this Code. Provided, further, that no non-rigid combustible insulating materials shall be used in any building unless all wiring is in rigid conduit. Provided, further, that where loose combustible insulating material is installed between studs, roof or ceiling joists, fire stops shall be installed between roof rafters at intersection with partitions and in walls or partitions not more than eight (8) feet apart in any direction.

Fire stop shall consist of solid wood blocking the same depth as the joists or studs, and not less than two (2) inch nominal in thickness, or of mortar, plaster or other combustible material poured the full depth of the joists and not less than two (2) inches in thickness.

Loose combustible insulating material shall be mixed with incombustible materials or chemically treated in such a manner as to render them slow-burning and vermin-proof.

No insulating material shall be installed until a permit shall have been issued for same by the Chief Building Inspector. No insulating materials shall be offered for sale or sold in the City and County of Denver until such materials have been submitted to such tests as may be prescribed by the Chief Building Inspector and approved by him.
CHAPTER 21 — TYPE IV BUILDINGS

(Metal Frame)

Sec. 2101. “Type IV” or “Type IV Buildings.” The structural framework shall be of steel, iron, masonry or reinforced concrete and the exterior walls and roof shall be of metal or other incombustible materials. Foundations shall be of masonry or reinforced concrete. Partitions and floor construction shall be as specified in this Chapter.

Sec. 2102. Type IV buildings shall not exceed a height of one (1) story and a mezzanine floor, except that buildings of Group I Occupancy may be two (2) stories in height.

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. Foundation walls and footings shall be of masonry as specified in Chapter 29 or of reinforced concrete as specified in Chapters 26 and 29, and shall be designed as specified in Sections 2306 and 2802.

Sec. 2105. Exterior walls shall be of galvanized iron or other non-corrodible metal of not less than twenty-six (26) gauge or shall be of incombustible materials.

Sec. 2106. Interior partitions shall be of metal or other incombustible materials.

Sec. 2107. No restrictions.

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

Sec. 2109. Fireproofing of structural members shall not be required.

Sec. 2110. The floors shall be of incombustible construction or may be of wood planks or blocks laid directly on the earth. In buildings of Types I and J Occupancy floors may be of wood on metal joists.
Sections 2111-2116

Roof Construction

Sec. 2111. Roof construction shall be entirely of metal or other incombustible materials provided that wood purlins not less than four (4) inches nominal in least dimension may be used to support metal roof covering. In buildings of Types I and J Occupancy wood sheathing may be used on metal rafters.

Roof covering shall be of a non-corrodible metal or may be a "Fire-Retardant" roofing as specified in Section 4305. In buildings of Type I and J Occupancy ordinary roof covering may be used except in Fire Districts 1 and 2.

Stair Construction

Sec. 2112. Stairs shall be of steel, iron, reinforced concrete masonry or wood and shall comply with the requirements of Chapter 33.

Doors and Windows

Sec. 2113. Openings in exterior walls shall be protected by doors, windows or shutters of metal or of metal frame, metal sash and wire glass; provided that such protection may be omitted when such openings are sixteen (16) feet or more from the opposite side of any street, alley or public place, or from an adjoining building or from adjacent property lines. Such protection shall not be required in buildings of Groups I and J occupancy.

Projections From the Building

Sec. 2114. Porches, cornices, marquises, canopies and all other similar projections from the building shall be of metal or incombustible materials, except that a loading platform may be constructed of wood.

Penthouses and Skylights

Sec. 2115. Penthouses and other roof structures shall be constructed entirely of incombustible materials except that roofs of such structures may be constructed as specified in Section 2111.

Skylights shall be of one-hour fire-resistive construction as specified in Chapters 34 and 43.

Combustible Materials Regulated

Sec. 2116. The inner side of walls and under side of roof shall not be ceiled with wood or wood lath and plaster, or any combustible material, except that in buildings of Groups I and J Occupancy, a combustible insulating material in board form may be used.

Combustible insulating materials shall not be used in buildings of Type IV construction, except as provided in this Section.
CHAPTER 22 — TYPE V BUILDINGS
(Wood Frame)

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

Sec. 2202. Type V buildings shall not exceed a height of twenty-five (25) feet in which height there shall be not more than two (2) stories.

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 of Type V buildings shall be supported on continuous masonry or reinforced concrete walls or footings and shall be of sufficient size to safely support the loads imposed as determined from the character of the soil. (See Section 2802.)

Exception: For Type V buildings (except Group I buildings) of post and girder construction continuous walls or footings shall not be required.

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

Sec. 2205. Exterior walls of all Type V buildings having a floor area of four hundred (400) square feet or more shall be constructed with studding not less than two (2) inches by four (4) inches spaced not more than sixteen (16) inches 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 (5) feet on centers or of larger members designed as specified in Chapter 25, or may be of post and beam framing with plank sheathing, or may be of laminated construction not less than four (4) inches nominal in thickness with the structural assembly properly designed to support all loads.

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

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

All exterior walls shall be covered on the outside with weatherboarding, shingles, stucco, masonry veneer or galvanized metal as specified in this section or by other similar approved materials, provided that one-story buildings having a total floor area of not more than four hundred (400) square feet may have exterior walls of vertical one (1) inch boards and battens without studs.

The minimum requirements for wall coverings for Type V buildings are as specified in parts (a), (b), (c), (d) and (e) of this Section.

(a) **Weatherboarding.** Studs shall be covered on the outside face with one layer of two-ply water-proofed building paper applied and tacked shingle fashion with joints horizontal. Horizontal joints of the paper shall be lapped at least two (2) inches and perpendicular joints at least six (6) inches. Weatherboarding, when in place, shall have an average thickness of not less than five-eighths (5/8) of an inch, and a minimum thickness of not less than three-eighths (3/8) of an inch. 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 tongues and grooves or shiplapped joints, or such weatherboarding shall be laid shingle fashion and lapped not less than one-half (1/2) inch. Building paper may be omitted where the interior face of the studs is not covered or where there is no human occupancy.

Siding patterns known as rustic, drop siding, or shiplap, shall have an average thickness in place of not less than nineteen thirty-seconds (19/32) of an inch and a minimum thickness of not less than three-eighths (3/8) of an inch. Bevel siding shall have a minimum thickness measured at the butt section of not less than twenty-one thirty-seconds (21/32) of an inch and a tip thickness of not less than one-fourth (1/4) of an inch. Siding of lesser dimension may be used, provided the outside face of the studs is first sheathed solid with boards not less than five-eighths (5/8) of an inch in thickness.

(b) **Shingles or Shakes.** Shingles or shakes may be used for the exterior wall covering when applied as follows: The outside face of the studs shall be first sheathed with board of uniform thickness not less than twenty-five thirty-seconds (25/32) of an inch thick and such sheathing shall be securely nailed to the studding with not less than two (2) eight (8) penny common nails to each stud in each piece of sheathing eight (8) inches or less in width and not less than three (3) such nails when such sheathing boards exceed eight (8) inches in width.

In all cases, except where the building is not intended for human occupancy or where the interior face of the studs is not covered, a substantial waterproofed building paper shall be applied directly over the outer face of the sheathing in the same manner as specified in sub-section (a) of this Section. Shingles
or shakes shall be nailed securely to the wall sheathing with at least two (2) non-corroding nails in each piece.

All shingles shall be nailed firmly with copper, zinc, zinc-coated or commercially pure iron nails of at least fourteen and one-half (14½) gauge and not less than one and one-fourth (1¼) inches long—two (2) nails to each shingle.

(c) Stucco. Stucco may be applied with or without sheathing or similar backing.

In all cases except in back plastered construction, a substantial waterproof paper or asphalt saturated felt weighing not less than fourteen (14) pounds per one hundred (100) square feet or any substantial waterproof paper which successfully passes a sixty (60) pound Mullen test shall be applied weatherboard fashion directly over the studs or sheathing. Horizontal joints shall be lapped not less than two (2) inches and vertical joints not less than six (6) inches. Where sheathing or similar backing is not used, a sixteen (16) W. & M. gauge wire stretched taut horizontally across the stud frame at not more than eight (8) inch centers shall be securely fastened in place before the paper or felt is applied; provided, that where such paper or felt is fastened to the metal reinforcing in such a manner as not to affect the waterproof qualities of such paper or felt the wire need not be installed.

In all cases a metal reinforcement shall be used of either expanded metal or wire fabric as follows:

1. Wire fabric composed of wires not smaller than shown in the following table and with no openings or mesh therein less than three-fourths (¾) of an inch nor greater than two (2) inches. The minimum allowable gauge of the wire for the various meshes shall be as follows:

   For openings not exceeding one (1) inch—18 W. & M. gauge.

   For openings not exceeding two (2) inches—16 W. & M. gauge.

2. Expanded metal lath weighing not less than two and seventy-five hundredths (2.75) pounds per square yard.

3. Electrically welded wire of sixteen (16) W. & M. gauge with openings not exceeding two (2) inches in greatest dimension and not exceeding four (4) square inches in area.

Metal reinforcing shall be securely fixed in place using a furring device that will positively fur the metal reinforcing at least one-fourth (¼) inch from the studs, sheathing or other backing. No form of strips or metal rods shall be used for furring which will serve to weaken the stucco. Metal reinforcing shall be secured with not less than four penny (4d) nails driven to at least three-fourths (¾) inch penetration in the studs or sheathing. Nails and furring devices shall be not more than six (6) inches apart vertically. Horizontal and vertical joints of the metal reinforcing shall be lapped at least one full mesh. All horizontal joints between studding shall have not less than one
Sections 2205-2208

tie with number eighteen (No. 18) annealed tie wire except when building is sheathed and all vertical joints shall be made at the studs when attached directly thereto.

Stucco shall be mixed and applied in accordance with the requirements of Section 4613.

Gunitite, as defined in Chapter 26, shall be applied in not less than two (2) coats, and shall be reinforced as specified for "Stucco" in this Section. Gunitite shall be not less than three-fourths (¾) of an inch in thickness.

(d) Masonry Veneer. In all cases before applying masonry veneer, a substantial water-proofed paper or asphalt saturated felt weighing not less than fourteen (14) pounds per one hundred (100) square feet shall be applied weatherboard fashion directly over the sheathing. All frames shall be sheathed diagonally with 1" boards securely nailed to studs.

Masonry veneer shall be not less than four (4) inches thick and shall not exceed two stories in height. The masonry shall be anchored to the studs by means of a one-fourth (¼) inch continuous pencil rod, bedded in every sixth horizontal course. The pencil rod shall be anchored to the studs by means of sixteen (16) gauge galvanized annealed wires passing through the backing and looped around each stud. The veneer shall be supported directly on the foundation.

(e) Galvanized Iron. Galvanized iron not less than twenty-eight (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 (4) feet. Galvanized iron shall not be permitted as wall coverings for buildings intended for human occupancy.

Interior Partitions

Sec. 2206. All interior partitions shall be constructed framed and fire stopped as required for exterior walls as specified in Section 2205, 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 (4) feet apart, two inch by three inch (2"x3") studs sixteen (16) inches on centers, may be used, or 2"x4" studs sixteen (16) inches on center placed flatwise.

Roof Covering

Sec. 2207. Type V buildings may be roofed with any roof covering permitted by this Code unless located in Fire Zones 1 or 2.

Combustible Materials Regulated

Sec. 2208. Other parts of Type V buildings may be constructed of wood or shall be constructed of approved combustible or incombustible materials, and all such wood construction shall be as specified in Chapter 25.

Combustible insulating materials may be placed in partition, floor or roof framing, but shall in no way interfere with the fire blocking or fire separations required by this Code. Provided,
further, that no non-rigid combustible insulating materials shall be used in any building unless all wiring is in rigid conduit. Provided, further, that where loose combustible insulating material is installed between studs, roof or ceiling joists, fire stops shall be installed between roof rafters at intersection with partitions and in walls or partitions not more than eight (8) feet apart in any direction.

Fire stop shall consist of solid wood blocking the same depth as the joists or studs, and not less than two (2) inches nominal in thickness, or of mortar, plaster or other incombustible material poured the full depth of the joists and not less than two (2) inches in thickness.

Loose combustible insulating material shall be mixed with incombustible materials or chemically treated in such a manner as to render them slow-burning and vermin-proof.

No insulating material shall be installed until a permit shall have been issued for same by the Chief Building Inspector. No insulating materials shall be offered for sale or sold in the City and County of Denver until such materials have been submitted to such tests as may be prescribed by the Chief Building Inspector and approved by him.
PART VI.

Engineering Regulations,
Qualities and Design of the
Materials of Construction

CHAPTER 23—LIVE AND DEAD LOADS

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.

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

Sec. 2302. (a) Loads. 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) Design. Any system or method of construction to be used shall admit of a rational analysis in accordance with well-established principles of mechanics.

Sec. 2303. (a) Provision shall be made in designing office floors for load of two thousand (2000) pounds placed upon any space two and one-half (2 1/2) feet square wherever this load upon an otherwise unloaded floor would produce stresses greater than those caused by a uniformly distributed load of fifty (50) pounds per square foot.

(b) Corridors in dwellings shall be designed for not less than forty (40) pounds per square foot.

(c) 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 where such machine or apparatus would cause a greater load than specified for such use in Section 2304.
(d) Floors in office buildings and in other buildings subject to shifting of partitions without reference to arrangement of floor beams or girders shall be designed to support, in addition to other loads, a single partition of the type used in the building placed in any position.

(e) 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.

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:

<table>
<thead>
<tr>
<th>Unit Live Loads</th>
<th>Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
<td>40</td>
</tr>
<tr>
<td>Armories and Drill Rooms</td>
<td>150</td>
</tr>
<tr>
<td>Auditoriums—Fixed Seats</td>
<td>50</td>
</tr>
<tr>
<td>Movable Seats</td>
<td>100</td>
</tr>
<tr>
<td>Balconies and Galleries—Fixed Seats</td>
<td>50</td>
</tr>
<tr>
<td>Movable Seats</td>
<td>100</td>
</tr>
<tr>
<td>Dance Halls</td>
<td>120</td>
</tr>
<tr>
<td>Dwellings</td>
<td>40</td>
</tr>
<tr>
<td>Exterior Balconies</td>
<td>100</td>
</tr>
<tr>
<td>Fire Escapes</td>
<td>100</td>
</tr>
<tr>
<td>Garages (for passenger cars)</td>
<td>100</td>
</tr>
<tr>
<td>Gymnasiums</td>
<td>120</td>
</tr>
<tr>
<td>Hospitals—Wards and Rooms</td>
<td>40</td>
</tr>
<tr>
<td>Corridors and Public Rooms</td>
<td>100</td>
</tr>
<tr>
<td>Hotels—Guest Rooms</td>
<td>40</td>
</tr>
<tr>
<td>Public Rooms</td>
<td>100</td>
</tr>
<tr>
<td>Corridors (Public)</td>
<td>100</td>
</tr>
<tr>
<td>Libraries—Reading Rooms</td>
<td>60</td>
</tr>
<tr>
<td>Corridors</td>
<td>100</td>
</tr>
<tr>
<td>Stack Rooms</td>
<td>125</td>
</tr>
<tr>
<td>Loft Building</td>
<td>100</td>
</tr>
<tr>
<td>Manufacturing—Light</td>
<td>100</td>
</tr>
<tr>
<td>Heavy</td>
<td>150</td>
</tr>
<tr>
<td>Marquise</td>
<td>50</td>
</tr>
<tr>
<td>Offices</td>
<td>50</td>
</tr>
<tr>
<td>Printing Plants—Press Rooms</td>
<td>150</td>
</tr>
<tr>
<td>Composing and Linotype Rooms</td>
<td>150</td>
</tr>
<tr>
<td>Public Rooms</td>
<td>100</td>
</tr>
<tr>
<td>Rest Rooms</td>
<td>50</td>
</tr>
<tr>
<td>Reviewing Stands and Bleachers</td>
<td>100</td>
</tr>
<tr>
<td>Roof Loads</td>
<td></td>
</tr>
</tbody>
</table>
Schools—Class Rooms ........................................ 50
Corridors .................................................. 100
Sidewalks .................................................. 250
Skating Rinks ........................................... 120
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

Sec. 2305. Roofs having a rise of four (4) inches or less per foot of horizontal projection shall be designed for a vertical live load of thirty (30) pounds per square foot of horizontal projection applied to any or all slopes. Roofs with a rise of more than four (4) inches, and not more than twelve (12) inches per foot shall be designed for a vertical live load of twenty-five (25) pounds per square foot on the horizontal projection thereof. If the rise exceeds twelve (12) inches per foot, no vertical load need be assumed but a wind force of twenty (20) pounds per square foot of such surface acting normal to the roof surface (on one slope at a time) shall be provided for.

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 reductions 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. feet</td>
</tr>
<tr>
<td>10%</td>
<td>200 sq. feet</td>
</tr>
<tr>
<td>15%</td>
<td>300 sq. feet 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 load applied to the entire tributary floor area:

Allowable Reductions for Warehouses and Storage Buildings—NONE.

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 Reduction 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

(4) 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 de-
termined 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 the column immediately above
the footing shall be the live load used in the above computation.

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 ten (10) pounds per square foot for those
portions of the building less than forty (40) feet above ground
and at not less than twenty (20) pounds per square foot for
those portions more than forty (40) feet 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 thirty (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 pres-
sure shall be assumed to act on six-tenths (6/10) of the pro-
jected area.

Where it shall appear that a building or structure will be ex-
posed to the full force of the wind throughout its entire height
and width, the pressure upon all vertical surfaces thus exposed
shall be taken at not less than twenty (20) pounds per square
foot.

The overturning moment resulting from the above calcula-
tions shall in no case exceed fifty (50) per cent of the dead load
resisting moment.

If the stresses due to wind in any member or connection
amounts to less than fifty (50) per cent of the total stress due
to other live and dead loads, it may be neglected. When stresses
due to wind pressure are in excess of fifty (50) per cent of the
combined other live and dead loads, all stresses may be added
together and the allowable unit stress for the total may be taken at fifty (50) per cent in excess of the values given in Chapters 24, 25, 26 and 27. 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.

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. 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.
CHAPTER 24 — MASONRY
(Quality and Design)

Sec. 2401. The quality and design of materials used in the construction of masonry buildings or of the masonry portions of any building shall conform to the minimum standards as specified in this Chapter.

The following materials when used with mortar, and plain concrete and gypsum shall be classed as masonry and wherever used in any building shall conform to the minimum requirements specified in this Chapter.

(a) Brick (clay; shale, or concrete)
(b) Concrete (plain concrete)
(c) Concrete (block or tile)
(d) Gypsum. See note (a)
(e) Hollow tile (clay or shale)
(f) Stone

The Building Inspector may require structural and fire-resistant materials to be subjected to tests to determine their quality whenever there is reason to believe the materials used do not come up to the requirements of this Code and may require any tests to be repeated if there is any reason to believe that the material is no longer up to the specifications on which the approval was based.

Tests of all masonry materials shall be made in accordance with the Standard Methods of Test of the American Society for Testing Materials, serial designations of which are as follows:

Solid Units ................ Serial Designation C62-30
Hollow Units ................ Serial Designation C34-31
Monolithic Construction ...... Serial Designation C39-33

Note: (a) This applies only to gypsum used in floor or roof construction, non-bearing walls or partitions, fireproofing or similar uses where not exposed to the weather.

Sec. 2402. Unless qualified by the word “cement,” brick as used in this Code shall mean a structural unit of burned clay or shale formed while plastic into a rectangular prism, usually solid and about eight inches by three and three-fourths inches by two and one-fourth inches (8"x3 3/4"x2 1/4") in size.

Brick of burned clay or shale shall have an average compressive strength when tested flatwise of not less than twelve hundred fifty (1250) pounds per square inch, taken on five (5) representative specimens and not less than one thousand (1000) pounds per square inch on any individual specimen. The average modulus of rupture of brick tested flatwise shall be not less than three hundred (300) pounds per square inch, taken on five (5)

Sec. 2403. Concrete brick shall have an average compressive strength when tested flatwise of not less than twelve hundred fifty (1250) pounds per square inch, taken on five (5) representative specimens, and not less than one thousand (1000) pounds per square inch on any individual specimen. The average modulus of rupture of brick tested flatwise shall be not less than three hundred (300) pounds per square inch, taken on five (5) representative specimens, and not less than two hundred (200) pounds per square inch on any individual specimen.


Concrete brick shall conform to the Tentative Specifications for Concrete Building Brick, A.S.T.M. Designation C55-28T of the American Society for Testing Materials.

Sec. 2404. Monolithic concrete construction containing not more than two-tenths (2/10) of one (1) per cent of reinforcement shall be classed as plain concrete. Plain concrete shall have a strength of not less than fifteen hundred (1500) pounds per square inch as specified in Section 2606, and such concrete shall be governed by the requirements specified in Chapter 26.

Cement, fine aggregate and coarse aggregate shall conform to the requirements specified in Chapter 26.

Sec. 2405. All hollow concrete block or tile used for exterior, party, fire or division walls shall be as specified in this Section. Concrete block or tile shall be made from Portland cement and such aggregates as sand, gravel, crushed stone, cinders, burned clay or shale, and blast furnace slag in such proportions and with such a process of manufacture that units meeting the requirements of this specification will be produced.

The average compressive strength of five units at the time of delivery to the site shall be not less than the following:

<table>
<thead>
<tr>
<th>Minimum Face Shell Thickness, Inches</th>
<th>Average Compressive Strength in Pounds per Square Inch Gross Cross Sectional Area as Laid in the Wall</th>
<th>Minimum Compressive Strength Permitted on Any Test Unit in Pounds per Square Inch Gross Cross Sectional Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼ or over</td>
<td>700</td>
<td>600</td>
</tr>
<tr>
<td>Under 1¼ and over ½</td>
<td>1000</td>
<td>800</td>
</tr>
</tbody>
</table>

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Concrete masonry units which will be exposed to the soil or weather in the finished work (without brick, stucco or other suitable protective covering approved by the Building Inspector) shall not absorb more than fifteen (15) pounds of water per cubic foot of concrete actually contained. Units which will be suitably protected from the soil or weather in the finished work need not conform to the absorption requirements of this paragraph.

All hollow concrete units shall meet the requirements of the Tentative Specifications and Tests for Load-bearing Concrete Units, A.S.T.M. Designation C90-34T of the American Society for Testing Materials.

Special concrete block or tile, in addition to meeting the requirements in this Section, shall comply with the Underwriters' Laboratories "Standard for Hollow Concrete Building Units," dated June 8, 1982.

Underwriters' Laboratories' certificated hollow concrete building units may be considered as Special Units.

Sec. 2406. Gypsum as used in this Section means a product containing not less than sixty-four and one-half (64 1/2) per cent by weight of calcium sulphate combined with water.

Neat Gypsum, gypsum fiber concrete or gypsum coarse aggregate concrete used in floor and roof construction of either the reinforced gypsum suspension system or reinforced gypsum in which the gypsum acts structurally shall develop the following minimum ultimate compressive strength in pounds per square inch when dried to constant weight.

(a) Neat Gypsum (as used in pre-cast tile) .................. 1800
(b) Gypsum fiber concrete containing not more than three (3) per cent by weight of wood chips, excelsior or fiber 1000
(c) Gypsum fiber concrete containing not more than twelve and one-half (12 1/2) per cent by weight of wood chips, excelsior or fiber 500

Gypsum coarse aggregate concrete of the following volumetric mixes:

(d) One and one-half (1 1/2) parts gypsum cement; one part sand; three (3) parts slag 800
(e) One and one-half (1 1/2) parts gypsum cement; one part sand; three (3) parts gravel 800
(f) One and one-half (1 1/2) parts gypsum cement; one part sand; three (3) parts stone 800

Note: Compressive tests shall be made on cylinders six inches in diameter and twelve (12) inches long.

The average compressive strength shall be not less than noted above and no one specimen shall test less than seventy-five (75) per cent of the average of the lot tested and not less than five (5) samples from the lot shall be tested to determine the average.
Gypsum tile or block used for partitions, walls, furring and enclosures may contain, intimately mixed, not more than fifteen (15) per cent by weight of binding material consisting of wood chips, excelsior or fiber.

Gypsum partition tile or block shall be equal in quality to that specified in the Standard Specifications for Gypsum Partition Tile and Block, Serial Designation C52-33, of the American Society for Testing Materials.

The chemical and physical properties of the Gypsum and Calcined Gypsum shall be equal to that specified in the Standard Specifications for Gypsum and Calcined Gypsum, Serial Designation C22-25 and C23-30, respectively, of the American Society for Testing Materials.

Sec. 2407. (a) Structural clay tile for load bearing walls or for walls wholly or in part exposed to the weather shall be of such a quality as to at least equal the requirements for Medium tile of the Standard Specification of the American Society for Testing Materials, Serial Designation C34-31 as to quality, workmanship and marking. The standard weights of the various sizes and designs used for this purpose shall be at least equal to thirty-six (36) pounds per square foot of wall surface for tile eight (8) inches thick, forty-two (42) pounds for tile ten (10) inches thick, and forty-eight (48) pounds for tile twelve (12) inches thick as laid in the wall. No tile shall weigh less than two (2) pounds under the standard weight. The aggregate thickness of a double shell for load bearing tile shall not be less than one (1) inch. The width of voids between parts of a double shell shall not exceed five-eighths (%) of an inch.

(b) For non-bearing walls and when not used in walls exposed wholly or in part to the weather, structural clay tile shall be of such a quality as to at least equal the requirements for soft tile of the Standard Specification of the American Society for Testing Materials, Serial Designation C34-31.

Sec. 2408. All cement and limes used in mortar shall conform to the requirements of the Standard Specifications for these materials issued by the American Society for Testing Materials, having Serial Designation as listed below:

- Quicklime for Structural Purposes .................. C5-26
- Hydrated Lime for Structural Purposes ............... C6-31
- Specifications for Tests of Portland Cement ........ C9-30

All mortar used in exterior and bearing walls, parapet, party, fire and fire division walls and piers shall be either special lime-cement, lime-cement mortar or Portland cement mortar.

Lime putty for masonry mortar shall be made by slaking to a smooth paste fresh and properly burned quicklime. The resultant paste shall be stored in a suitable box or other receptacle for not less than forty-eight (48) hours before mixing with sand. Hydrated lime may, in all cases, be substituted for an equivalent amount of lime putty.

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(a) Lime mortar shall be composed of one (1) part of lime putty or dry hydrated lime to not over three (3) parts of sand by volume. Cement may be added to lime mortar replacing equal volumes of lime putty.

(b) Special lime cement mortar shall be composed of two (2) parts of lime putty or dry hydrated lime, one (1) part Portland cement and not more than nine (9) parts of sand by volume.

(c) Lime cement mortar shall be composed of one (1) part lime putty or dry hydrated lime, one (1) part Portland cement and not more than six (6) parts of sand by volume.

(d) Cement mortar shall be composed of one (1) part of Portland cement and not more than three (3) parts of sand by volume with an allowable addition of lime putty or hydrated lime of not to exceed fifteen (15) per cent by volume of the cement content.

The above proportions shall be based strictly according to the constituent parts.

Sec. 2409. (a) Brick and Concrete Brick. The maximum allowable working compressive stresses in brick masonry due to combined live, dead and other loads shall not exceed the limits for the respective compressive strengths of the individual units listed in the following table:

<table>
<thead>
<tr>
<th>Minimum Average Compressive Strength of Units</th>
<th>MAXIMUM UNIT WORKING STRESSES (pounds per square inch) Using Various Mortars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lime Mortar</td>
</tr>
<tr>
<td>8000</td>
<td>100</td>
</tr>
<tr>
<td>4500</td>
<td>100</td>
</tr>
<tr>
<td>2500</td>
<td>75</td>
</tr>
<tr>
<td>1250</td>
<td>50</td>
</tr>
</tbody>
</table>

The above stresses may be increased fifty (50) per cent under concentrated loads. When the masonry is laid with smooth, level, horizontal joints and completely filled vertical joints under supervision of an architect or engineer, and when the effects of eccentric and concentrated loads and lateral forces is fully analyzed and allowance made for them, the working stresses in this table may be increased fifty (50) per cent.

The maximum allowable compressive stresses in hollow walls of brick due to combined live and dead loads shall not exceed the stresses given in the above table, based upon the effective net cross sectional area of the wall.

(b) Concrete — Plain. The maximum allowable working stresses in masonry of plain concrete shall be the following percentages of the ultimate strength of the concrete in compression as determined by the requirements of Chapter 26:
Compression ........................................ 0.20f'_ε
Shear and diagonal tension ...................... 0.02f'_ε
where f'_ε represents the ultimate compressive strength at twenty-eight (28) days.

(c) Concrete Block or Tile. The maximum allowable compressive stresses in masonry of concrete block or concrete tile, due to combined live and dead loads, shall not exceed eighty (80) pounds per square inch of gross cross-sectional area when laid with Portland cement mortar, and seventy (70) pounds per square inch of gross cross-sectional area when laid with lime-cement mortar.

(d) Gypsum. Gypsum suspension systems, poured in place or pre-cast, shall not be less than three (3) inches in thickness and shall be designed to carry the total estimated dead, live and other loads, with a factor of safety of not less than four (4), and shall be 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:

\[ T = \frac{WL}{8d} \sqrt{L^2 + 16d^2} \]

NOTE:

T equals maximum tension in wires or cables in pounds per foot width of slab.
W equals load in pounds per square foot.
L equals clear span in feet between supports.
d equals deflection or "dip" of wires or cables 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 twenty thousand (20,000) pounds per square inch.

When pre-cast or poured-in-place slabs or tiles or reinforced gypsum in which the gypsum acts structurally are used, they shall be designed to carry the total dead, live and other loads in accordance with the formulae for reinforced concrete construc-

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The following working stresses expressed in pounds per square inch shall not be exceeded:

<table>
<thead>
<tr>
<th></th>
<th>NEAT GYPSUM</th>
<th>GYPSUM FIBER CONCRETE with not more than 3% of wood chips, excelsior or fiber</th>
<th>GYPSUM FIBER CONCRETE with not more than 12% of wood chips, excelsior or fiber</th>
<th>GYPSUM COARSE AGGREGATE CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme fiber stress in compression in flexure</td>
<td>350</td>
<td>220</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Direct compression of bearing</td>
<td>200</td>
<td>165</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Bond between gypsum and reinforcing</td>
<td>40</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Shearing stress</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Modulus of elasticity in lbs. per square inch</td>
<td>1,000,000</td>
<td>600,000</td>
<td>200,000</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>
<td>150</td>
</tr>
</tbody>
</table>

(e) Hollow Tile. The maximum allowable compressive stresses in masonry of hollow tile, due to combined live and dead loads, shall not exceed eighty (80) pounds per square inch of the gross cross-sectional area, when laid with Portland cement mortar, and seventy (70) pounds per square inch of gross sectional area when laid with lime cement mortar.

(f) Stone. The maximum allowable compressive stresses in rubble stonework, due to combined live and dead loads, shall not exceed one hundred and forty (140) pounds per square inch when laid in Portland cement mortar, nor one hundred (100) pounds per square inch in lime cement mortar.

The maximum allowable compressive stress in ashlar masonry due to combined live and dead loads shall not exceed the following limits:

<table>
<thead>
<tr>
<th>UNIT</th>
<th>MAXIMUM UNIT WORKING STRESSES (pounds per square inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>laid in</td>
</tr>
<tr>
<td></td>
<td>Lime Cement Mortar</td>
</tr>
<tr>
<td>Granite......</td>
<td>640</td>
</tr>
<tr>
<td>Limestone....</td>
<td>400</td>
</tr>
<tr>
<td>Marble.......</td>
<td>400</td>
</tr>
<tr>
<td>Sandstone....</td>
<td>320</td>
</tr>
</tbody>
</table>
Sec. 2410. The effects of eccentric loads and lateral forces shall be fully analyzed and allowances made for them in design. Concentrated loads shall be distributed so as not to exceed the allowable working stresses as specified in Section 2410 by more than twenty-five (25) per cent.

Sec. 2411. The term "Cast Stone" as used in this Code shall be understood to mean a building stone manufactured from Portland cement concrete, precast and used as a trim or facing on or in buildings and other structures.

Cast stone shall have an average minimum compressive strength at the age of twenty-eight (28) days, or when delivered on the job, of not less than five thousand (5000) pounds per square inch and an average absorption of not more than seven (7) per cent of its dry weight.

Samples from which test specimens will be cut shall be selected by the Building Inspector or his representative. In the event specimens fail to meet requirements in the first test, the test may be repeated on a second set of specimens. Tests shall be paid for by the manufacturer. Tests for compression and absorption for cast stone shall be made on three (3) two by two (2x2) inch cylinders or two (2) inch cubes cut from the stone as delivered on the job or from the regular stock in the yard. If not homogeneous throughout, specimens of cast stone to be tested for absorption and compression shall be taken in such manner that they are composed of approximately one-half of facing and one-half of backing material and so that they can be tested in the position in which the cast stone will be laid in the masonry.

Compressive strength and absorption tests on cast stone specimens shall be made in accordance with the Tentative Specifications for Cast Stone, Serial Designation P-3-A-29T of the American Concrete Institute. No individual specimen used in the tests shall vary from the average requirements more than ten (10) per cent below in compression nor more than ten (10) per cent above in absorption. All cast stone shall be branded with a permanent identification mark of the manufacturer, which shall be registered with the Building Inspector.

Sec. 2412 (a) General.

The formulae and assumptions used in the design of reinforced brick masonry shall be the same as required for reinforced concrete in Chapter 26, except as provided in this section.

The notations and figures contained in Chapter 26 shall be used as given in so far as they apply, and the subscript (b) shall be used in place of the subscript (c) to indicate unit brick stress, as for example $f_{b}$ instead of $f_{c}$ and $f'_{b}$ instead of $f'_{c}$.

(b) Allowable Working Stresses.

The allowable unit stresses in pounds per square inch on brickwork to be used in design shall not exceed the following values.
FLEXURE:—f
Extreme fiber stress in compression, \( f_b \) .............. \( 0.30f'_b \)
Extreme fiber stress in compression adjacent to
supports of continuous or fixed beams or rigid
frames, \( f_b \) .................................. \( 0.35f'_b \)

SHEAR:—v
Beams with no web reinforcement and without spe-
cial anchorage of longitudinal steel, \( v_b \) .............. \( 0.013f'_b \)
Beams with no web reinforcement but with special
anchorage of longitudinal steel, \( v_b \) .............. \( 0.017f'_b \)
Beams with properly designed web reinforcement
but without special anchorage of longitudinal
steel, \( v \) .................................. \( 0.086f'_b \)
Beams with properly designed web reinforcement
and with special anchorage of longitudinal
steel, \( v \) .................................. \( 0.050f'_b \)
Footings where longitudinal bars have no special
anchorage, \( v_b \) ................................ \( 0.013f'_b \)
Footings where longitudinal bars have special an-
chorage, \( v_b \) ................................ \( 0.017f'_b \)

BOND:—u
In beams and slabs and one-way footings—
Plain bars, \( u \) .................................. \( 0.04f'_b \)
Deformed bars, \( u \) ................................ \( 0.05f'_b \)
Welded wire fabric, \( u \) .......................... \( 0.05f'_b \)

In two-way footings—
Plain bars, \( u \) .................................. \( 0.03f'_b \)
Deformed bars, \( u \) ................................ \( 0.0375f'_b \)

NOTE: Where special anchorage is provided,
double these values in bond may be used.

MODULUS OF ELASTICITY—E_{s} and E_{b}

\begin{align*}
E_{s} & \text{ for reinforcing steel} \ldots 30,000,000 \\
E_{b} & \text{ for brickwork built of bricks made of clay} \\
& \text{ or shale, laid in a mortar consisting of not} \\
& \text{ less than one (1) part of Portland cement,} \\
& \text{ and not more than one-half (1/2) part of} \\
& \text{ lime, and not more than four and one-half} \\
& \text{ (4 1/2) parts of sharp sand, and having a} \\
& \text{ minimum compression test prism strength of} \\
& \text{ 2000 pounds per square inch} \ldots 1,500,000 \\
E_{b} & \text{ for brickwork built of bricks made of clay} \\
& \text{ or shale, laid in a mortar consisting of not} \\
& \text{ less than one (1) part of Portland cement,} \\
& \text{ and not more than one-fourth (1/4) part of} \\
& \text{ lime, and not more than three and one-half} \\
& \text{ (3 1/2) parts of sharp sand, and having a} \\
& \text{ minimum compression test prism strength of} \\
& \text{ 2500 pounds per square inch} \ldots 2,000,000
\end{align*}
BEARING—\( f_b \)

Where a brick masonry member has an area of at least twice the area in bearing, \( f_b \)........... 0.20\( f_b \)

\( E_b \) ........................................ 1,500,000

AXIAL COMPRESSION:—\( f_b \)

In columns, with lateral ties, \( f_b \)........... 0.167\( f_b \)

Allowable Unit Stresses in Reinforcement

The following unit stresses in reinforcing steel shall not be exceeded:

TENSION:—\( f_s \) or \( f_v \)

<table>
<thead>
<tr>
<th>Pounds Per Sq. In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate grade billet steel, ( f_b )........... 20,000</td>
</tr>
<tr>
<td>Rail steel bars, ( f_s ).......................... 20,000</td>
</tr>
<tr>
<td>Welded wire fabric, ( f_s ).......................... 20,000</td>
</tr>
<tr>
<td>Web reinforcement, ( f_v ) including welded wire fabric, with welded intersections not farther apart than six (6) inches in direction of stress 16,000</td>
</tr>
<tr>
<td>Other steel reinforcement, fifty (50) per cent of the yield point but not to exceed, ( f_s )........... 20,000</td>
</tr>
</tbody>
</table>

COMPRESSION:

Bars ........................................... \( n f_b \)

Structural steel section in composite columns, \( f_r \) 15,000

\( (c) \) The allowable working stresses provided in this section for reinforced brick masonry construction shall be allowed only when workmanship and materials meet the following requirements:

Brick shall have an average compressive strength of 2,500 pounds per square inch, with an individual minimum of 2,000 pounds when tested as provided in Section 2402.

Mortar shall be composed of not less than one (1) part Portland cement to four and one-half (4\( \frac{1}{2} \)) parts of sand by volume, with an allowable addition of not more than one-half (\( \frac{1}{2} \)) part of lime putty or dry hydrated lime. All bed, end and wall joints shall be completely filled with mortar, and all reinforcing steel shall be entirely embedded in the mortar.

All reinforced brick work shall be laid with full header courses not more than every fourth course in height, or there shall be at least one (1) full header in every forty-eight (48) inches of wall surface, except that in brick work laid with all interior joints grouted, such header courses need not be placed closer than every sixth course or its equivalent.

Reinforcing steel shall be braced and held in place firmly enough to prevent the breaking of bond while brick work is being laid.
CHAPTER 25 — WOOD
(Quality and Design)

General
Sec. 2501. The quality and design of all wood except finish and millwork used in the construction of all buildings shall conform to the requirements of this chapter.

All members shall be so framed, anchored, tied and braced together as to develop the maximum 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.

Workmanship in fabrication, preparation and installation of material shall conform throughout to good engineering practice.

American Lumber Standards as set forth in “Simplified Practice Recommendations, R16-29” of the United States Department of Commerce, effective July 1, 1929, is hereby declared to be the basis for the determination of minimum acceptable sizes, for the assignment of allowable working stresses and quality of structural lumber for the purposes of this Code. Manufacturers association grades conforming to these provisions shall be accepted as complying with the requirements of this Code.

Determination of Required Sizes
Sec. 2502. All wood structural members shall be of sufficient size and strength to carry their imposed loads safely and without exceeding the allowable working stresses as specified in Sections 2503 and 2504.

In computations to determine the required size of timber members the net cross sectional area or actual size shall be used and not the nominal size. Sizes required by this Code shall be deemed to refer to the nominal or commercial description of size unless stated in fractional minimums. American Lumber Standards dressed sizes shall be accepted as conforming to nominal or commercial descriptions of sizes.

Allowable Unit Stresses
Sec. 2503.—Allowable unit working stresses for lumber shall be determined on the basis of the quality (grade) of lumber used.

For the purpose of assigning Allowable Unit Working Stresses three general classes of lumber shall be recognized as follows:

(a) "STRUCTURAL LUMBER"
(b) "YARD LUMBER"
(c) OTHER LUMBER

(a) STRUCTURAL LUMBER is (1) lumber manufactured and graded in accordance with any of the lumber association Structural Grades conforming to the American Lumber Standards, or (2) lumber graded under the Structural Grade Examples
of the American Lumber Standards (Part IV—Simplified Practice Recommendations R16-29), and in either case adequately identified.

Each piece of Structural Lumber shall be grade-marked and shall bear the trade-mark of the lumber association under whose rules the lumber is graded; provided, however, that the Building Inspector may accept a lumber manufacturer's Association Certificate of Grade in lieu of such grade and trade-marks.

The allowable unit working stresses for each grade of such lumber shall be as given in Table I of this section.

(b) YARD LUMBER is (1) lumber manufactured and graded in accordance with the rules of a lumber association for “Yard Lumber,” or (2) lumber graded in accordance with the basic Grade Classifications and with the Size Standards for “Yard Lumber” in American Lumber Standards. (Part III—Simplified Practice Recommendations R16-29.)

YARD LUMBER shall be used for load bearing purposes only after working stresses for the grades used shall have been assigned by the Building Inspector. Such working stresses shall be assigned when evidence is furnished, to the satisfaction of the Building Inspector, as to the grade of the lumber. Such evidences may be either (1) grade-marks on the lumber when accompanied by an Association trade-mark or (2) a lumber Association Certificate of Grade, or (3) in the absence of such identification the Building Inspector may determine the grade of the lumber by visual inspection.

The allowable unit working stresses for any grade of YARD LUMBER shall be assigned by the Building Inspector as follows:

He shall determine the maximum defects, present or permitted, in the lumber to be used. This determination may be made by inspecting the lumber or by referring to the Grading Rules of the lumber association under which the lumber was graded.

He shall compare the effect of defects found or permitted in the grade of lumber to be used, with the effect of defects permitted in the Grade Example for “Common” Structural Material as set forth in American Lumber Standards. (Part IV—Simplified Practice Recommendations, R16-29).

On the basis of such comparison he shall estimate the ratio of strength of lumber used to strength of lumber graded under the Grade Example for “Common” Structural Material.

This ratio shall be applied to the values in Table II for the same species of lumber, and working stresses shall be assigned proportionately.

(c) OTHER LUMBER is all lumber which does not, for any reason, qualify as a grade of “Structural Lumber” or “Yard Lumber” as defined hereinbefore.

OTHER LUMBER shall be used for load-bearing purposes only when approved by the Building Inspector.
The allowable unit working stresses for such lumber shall be assigned by the Building Inspector as follows:

He shall inspect such lumber and determine the maximum defects in any pieces thereof.

He shall compare the effect of the defects found with the effect of the defects permitted in the Grade Example for "Common" Structural Material as set forth in American Lumber Standards.

On the basis of such comparison he shall estimate the ratio of strength of lumber used to strength of lumber graded under the Grade Example for "Common" Structural Material.

This ratio shall be applied to the figures in Table II for the same species of lumber, and working stresses shall be assigned accordingly; provided, however, that working stresses so assigned shall not exceed eighty (80) per cent of the stresses in Table II.

(d) Supplementary provisions to above allowable unit working stresses are as follows:

The allowable stresses given in this section may be increased not to exceed fifty (50) per cent for dead and/or live loads in combination with wind or other loads, provided the resulting sections are not less than those required for dead and/or live loads alone.

The allowable stress in compression across the grain may be increased fifty (50) per cent above that specified in this section for joists supported on a ribbon board and spiked to the stud-

Working values may be used without allowance for impact up to impact of one hundred (100) per cent of loads figured.

Shear stresses for joint details may be taken as fifty (50) per cent greater than the values for horizontal shear given in the Table.

For direct tension the same values as for extreme fiber stress in bending may be used.

(e) Minimum permissible grades for specific load-bearing purposes shall be:

For studding, posts and similar load-bearing members the lumber used shall be equal to, or better than No. 2 Common Dimension (Yard) Grade.

For joists, rafters, plank and similar horizontal load-bearing members the lumber used shall be equal to, or better than, No. 1 Common Dimension (Yard) Grade.

For load-bearing members five inches (5") thick and thicker, the lumber used shall be equal to, or better than, the lowest grade for which working stresses are given in Tables I and II.
<table>
<thead>
<tr>
<th>Species of Timber</th>
<th>Grade</th>
<th>Allowable Stress in Pounds per Square Inch</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Extreme Fiber in Bending</td>
<td>Joists and Plank Sizes 4&quot; and less thickness</td>
<td>Beam and Stringer Sizes 5&quot; and thicker</td>
<td>Maximum Horizontal Shear</td>
<td>Compression Parallel to Grain Short Columns</td>
<td>Compression Perpendicular to Grain</td>
</tr>
<tr>
<td>Douglas fir,</td>
<td>Dense Structural</td>
<td>1800</td>
<td>1800</td>
<td>105</td>
<td>1300</td>
<td>380</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Coast Region,</td>
<td>Structural</td>
<td>1600</td>
<td>1600</td>
<td>90</td>
<td>1200</td>
<td>345</td>
<td>1,600,000</td>
</tr>
<tr>
<td>West Coast</td>
<td>Common Structural</td>
<td>1200</td>
<td>1400</td>
<td>84</td>
<td>1100</td>
<td>325</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Lumbermen's Ass'n</td>
<td>Common Structural</td>
<td>1200</td>
<td>1200</td>
<td>72</td>
<td>880</td>
<td>325</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Douglas fir,</td>
<td>Select Structural</td>
<td>1800</td>
<td>1800</td>
<td>120</td>
<td>1466</td>
<td>380</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Calif. Coast region, Western Pine Association</td>
<td>Structural</td>
<td>1600</td>
<td>1600</td>
<td>85</td>
<td>1175</td>
<td>325</td>
<td>1,500,000</td>
</tr>
<tr>
<td></td>
<td>Common Structural</td>
<td>1200</td>
<td>1200</td>
<td>80</td>
<td>1050</td>
<td>315</td>
<td>1,500,000</td>
</tr>
<tr>
<td>FIr, White,</td>
<td>Select Structural</td>
<td>1100</td>
<td>1100</td>
<td>70</td>
<td>700</td>
<td>300</td>
<td>1,100,000</td>
</tr>
<tr>
<td>Western Pine</td>
<td>Common Structural</td>
<td>880</td>
<td>880</td>
<td>56</td>
<td>560</td>
<td>300</td>
<td>1,100,000</td>
</tr>
<tr>
<td>Association*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larch,</td>
<td>Select Structural</td>
<td>1800</td>
<td>1800</td>
<td>133</td>
<td>1466</td>
<td>380</td>
<td>1,300,000</td>
</tr>
<tr>
<td>Western Pine</td>
<td>Structural</td>
<td>1600</td>
<td>1600</td>
<td>100</td>
<td>1200</td>
<td>345</td>
<td>1,300,000</td>
</tr>
<tr>
<td>Association*</td>
<td>Common Structural</td>
<td>1200</td>
<td>1200</td>
<td>90</td>
<td>1100</td>
<td>325</td>
<td>1,300,000</td>
</tr>
<tr>
<td>Pine, Ponderosa</td>
<td>Select Structural</td>
<td>900</td>
<td>900</td>
<td>85</td>
<td>750</td>
<td>250</td>
<td>1,000,000</td>
</tr>
<tr>
<td>and Sugar</td>
<td>Common Structural</td>
<td>720</td>
<td>720</td>
<td>68</td>
<td>600</td>
<td>250</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Western Pine</td>
<td>Association*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redwood,</td>
<td>Prime Structural</td>
<td>1707</td>
<td>1494</td>
<td>82</td>
<td>1245</td>
<td>267</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Calif. Redwood</td>
<td>Select Structural</td>
<td>1280</td>
<td>1322</td>
<td>70</td>
<td>1100</td>
<td>267</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Association*</td>
<td>Heart Structural</td>
<td>1024</td>
<td>1150</td>
<td>56</td>
<td>1000</td>
<td>267</td>
<td>1,200,000</td>
</tr>
</tbody>
</table>

NOTE: *Lumber Manufacturer's Association under whose Grading Rules the species of wood indicated is graded in the region shown.
TABLE II.
Basis for Determining Allowable Unit Working Stresses

For "YARD LUMBER" and "OTHER LUMBER"
(From Recommendations of United States Forest Products Laboratory for Lumber Conforming to the Grade Example of "COMMON" STRUCTURAL MATERIAL in American Lumber Standards.)

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>Allowable Stress in Pounds Per Square Inch</th>
<th>Modulus of Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extreme Fiber in Bending</td>
<td>Compression</td>
</tr>
<tr>
<td>Cedar</td>
<td>720</td>
<td>560</td>
</tr>
<tr>
<td>Western Red</td>
<td>880</td>
<td>720</td>
</tr>
<tr>
<td>Cedar</td>
<td>1200</td>
<td>880</td>
</tr>
<tr>
<td>Port Orford</td>
<td>880</td>
<td>640</td>
</tr>
<tr>
<td>Douglas Fir (Coast Region)</td>
<td>880</td>
<td>560</td>
</tr>
<tr>
<td>Douglas Fir (Rocky Mtn. Reg.)</td>
<td>960</td>
<td>880</td>
</tr>
<tr>
<td>Fir: Golden, Noble, Silver, White</td>
<td>1040</td>
<td>720</td>
</tr>
<tr>
<td>Hemlock</td>
<td>880</td>
<td>640</td>
</tr>
<tr>
<td>West Coast</td>
<td>960</td>
<td>880</td>
</tr>
<tr>
<td>Larch</td>
<td>720</td>
<td>600</td>
</tr>
<tr>
<td>Pine: Idaho White, Lodgepole, Sugar, Ponderosa, Calif.</td>
<td>960</td>
<td>800</td>
</tr>
<tr>
<td>White, and Western Yellow</td>
<td>600</td>
<td>480</td>
</tr>
<tr>
<td>Redwood</td>
<td>880</td>
<td>640</td>
</tr>
<tr>
<td>Spruce: Englemann</td>
<td>720</td>
<td>600</td>
</tr>
<tr>
<td>Spruce: Sitka</td>
<td>960</td>
<td>800</td>
</tr>
</tbody>
</table>

NOTE: — *For Posts and Timbers six inches by six inches (6”x6”) and larger and with unsupported length not greater than ten (10) times least dimension.

Sec. 2504. (a) The unit working stresses in compression with grain for columns whose ratio of unsupported length to least dimension does not exceed ten (10) (short columns) shall be not greater than that given in Section 2503.

(b) For columns the ratio of whose unsupported length to least dimension is greater than ten (10) (intermediate columns) the following formula shall be used until the reduction in allowable stress equals one-third (1/3) the stress for short columns:
\[
\frac{P}{A} = S \left[ 1 - \frac{1}{3} \left( \frac{l}{K} \right)^4 \right]
\]

where \( P \) equals Total load in pounds

\( A \) equals Area in square inches

\( \frac{P}{A} \) equals Unit compressive stress

\( S \) equals Safe stress in compression with grain for short columns

\( l \) equals Unsupported length in inches

\( d \) equals Least dimension in inches

\( E \) equals Modulus of elasticity

\( K \) equals the \( l/d \) at the point of tangency of the parabolic and Euler curves, at which

\( \frac{P}{A} \) equals \( 2/3S \)

The value of \( K \) for any species and grade is

\[
K = \frac{\Pi}{2} \sqrt{\frac{E}{6S}}
\]

NOTE: For "Structural" Lumber the value of "S" to be used is the value given in Table I of Section 2503 for "Compression Parallel to Grain" for the respective Grades and Species.

For "Yard Lumber" and "Other Lumber" the value of "S" to be used shall be assigned by the Building Inspector in the same manner as provided in Sections 2503 (b) or 2503 (c).

(c) For columns the ratio of whose unsupported length to least dimension \( l/d \) is greater than "K" (long columns) the Euler formula below shall be used:

(d) Columns shall be limited in slenderness to \( l/d = 50 \)

\[
\frac{P}{A} = \frac{\Pi^2 E}{36 l (-\Pi)^2}
\]

Sec. 2505. (a) Wood columns and posts shall be squared at the ends; shall be provided with metal base plates and dowels; shall be supported in basements by footings projecting at least two (2) inches above the finished floor; shall be superimposed on approved metal appliances where continuing through more than one story; shall not rest directly or indirectly on any floor beams, except in cases where there is no column below.

(b) Wood bolsters may be used to support a single floor or the roof beams only.

(c) Preservatives shall be applied to column ends where necessary to protect against possible dampness.

(d) Wood columns in basements when built in solid partitions shall be open on at least two (2) sides.

(e) Wood posts, except for minor structures and as piles, shall not be used as foundations below ground.

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Sec. 2506. (a) Girders and beams where entering or resting on masonry walls shall have a bearing of at least four (4) inches with the under surface protected by a piece of asphalt-saturated felt or paper or a metal bearing plate, or such end may be dipped or painted with creosote.

Where members meet at columns they shall be fitted around or butted up close and held in place by metal strips unless the post caps provide sufficient anchorage.

(b) Built-up timbers shall have members bolted tightly together, when deemed necessary by the Chief Building Inspector.

(c) Joists and rafter ends may be supported by a two-inch by four-inch (2"x4") wood strip or cleat bolted to the girder when the live load does not exceed fifty (50) pounds per square foot. Joists shall not be notched at the bearing exceeding one-third (1/3) of their depth.

(d) Wood members entering masonry party or fire walls shall be separated from the opposite side of the wall and from beams entering the opposite side of the wall by four (4) inch masonry. The ends of the joists, beams and/or girders entering masonry walls shall be fire-cut to a bevel to the face of the wall. All joists shall have a minimum bearing of two (2) inches.

(e) Where girders and beams enter masonry, they shall be provided with wall plates, boxes or anchors of an approved self-releasing type so arranged as to leave an air space of not less than one (1) inch at sides of member. Rigid boxes shall be provided in concrete walls. The ends of girders shall not be sealed in; provided that where ends of timbers are well treated with creosote or other approved preservative they may be sealed in.

(f) In ordinary construction all trimmers and at least one beam or joist in every six (6) feet, which rest on masonry walls shall be secured to such walls by approved metal anchors attached in a manner to be self-releasing. When one end of such a trimmer, beam or joist is supported by a girder, it shall be secured in an approved manner to such girder or to a trimmer, beam or joist correspondingly supported from the opposite side to such girder. Trimmers, beams or joists supported by girders at both ends shall be similarly secured to such girder or to trimmers, beams or joists supported from opposite sides of such girder, to form continuous ties between opposite masonry walls.

Where floor or roof joists or beams run parallel to masonry walls or alongside of piers otherwise unsupported, such walls and piers shall be secured to four or more joists of the floor or roof construction by approved metal anchors.

In ordinary construction, wall-plates and roof construction shall be anchored to the walls at least every six (6) feet. In heavy timber construction every roof girder, and every alternate roof beam, shall be anchored to an exterior or interior wall or to an interior column; roof planking where supported by a wall shall be anchored to such wall at intervals not exceeding twenty (20) feet; every monitor and every saw-tooth construction shall be anchored to the main roof construction. Such anchors shall consist of steel or iron bolts or straps of sufficient strength and
ample anchorage to resist a vertical uplift of the roof of not less than twenty (20) pounds per square foot of roof surface.

(g) The minimum permissible thickness of joists, rafters and studs shall be one and five-eighths (1 5/8) inches.

(h) Floor joists shall be supported by girders, bearing partitions or exterior walls. Where entering stud walls the joists shall be supported by a ribbon let into the studs if no plate is provided. Joists shall be well nailed to the supporting studs. Studs shall be doubled under the ends of doubled joists.

(i) Header joists over six (6) feet long and tail joists over twelve (12) feet long shall be hung in approved stirrup irons or joist hangers. All trimmer joists and header joists over four (4) feet long shall be doubled.

(j) Joists under bearing partitions and running parallel thereto shall be doubled and well spiked or separated by solid bridging not more than sixteen (16) inches on centers to permit the passage of pipes.

(k) Wood cross bridging shall be placed between floor joists if the span is over eight (8) feet. The distance between bridging or between bridging and bearing shall not exceed eight (8) feet. Wood cross bridging in dwellings may be three (3) inches in cross sectional area, but in other buildings shall not be less than six (6) inches.

Metal cross bridging of equal or greater strength may be used in place of the wood cross bridging.

(l) Solid blocking not less than two (2) inches in thickness and the full depth of the joists shall be provided in the following places: Over all girders except when not ceiled on the under side of joists, bearing walls, bearing partitions and around all stairways or other vertical openings. Such solid blocking shall serve as the required bridging specified in Section 2506-k.

(m) Cutting of wood girders, beams or joists shall be limited to cuts and bore holes not deeper than one-fifth (1/5) the beam depth below its top, located not further from the beam end than three (3) times the beam depth. Cuts in excess of above or bore holes with a diameter more than two (2) inches are not permitted without special provisions for framing the beams approved by the Building Inspector.

(n) 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 fourteen (14) inches clear space in continuous horizontal runs and/or vertical risers from the furnace to the register served.

Sec. 2507. (a) Stud partitions shall be provided with soles or plates with dimensions not less than the studs where the partition studs do not rest on walls, girders, beams, or do not pass through the floor to the top plate of the partition below.

(b) In bearing partitions the top plate shall be doubled and lapped at each intersection. Joints in the upper and lower mem-
bers of the top plate shall be staggered not less than two (2) feet.

(c) Studs in bearing partitions and walls shall not be less than two (2) inches by four (4) inches in size. Where a bearing partition supports more than the weight of the roof and one floor, the studs shall be not less than two inches by six inches (2”x6”) or three inches by four inches (3”x4”), except that underpinning may be of the same size as the studs immediately above when such underpinning is not more than four (4) feet in height.

(d) Where studs pass through from floor to floor they shall be fire-stopped at point of passage through floors.

(e) Angles at corners where stud walls or partitions meet shall be framed solid so no lath can extend from one room to another. All exterior and main cross stud partitions shall be effectively and thoroughly angle braced.

(f) 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.

(g) Openings in stud partitions and walls shall be framed around with double studs at each side and double headers across the top resting on the short stud at each end. The double header shall be placed on edge and shall be trussed above for all openings over four (4) feet in width or where more than two (2) studs are cut away.

(h) Wood lath, furring or framing shall be placed not less than two (2) inches from any chimney and not less than four (4) inches from the back of any fireplace.

(i) Where wood partitions and masonry walls join, one-half (½”) inch bolts ten (10) inches long with two inch by five inch by one-fourth (2”x5”x¼”) inch iron plate washers shall be built into the masonry wall opposite each line of fire blocking and near the top, top plate or ribbon in each partition. The projecting end of the bolt shall pierce the partition and be securely fastened thereto. In partitions eight (8) feet or less in height, two (2) bolts shall be used.

Sec. 2508. (a) Valley rafter shall be not less than one and five-eighths by five and one-half inches (1½”x5½”) in size. Roof sheathing shall have a minimum thickness of twenty-five thirty-seconds (25/32) of an inch.

(b) Flashings shall be placed around all openings in and extensions of mechanical appliances or equipment through the roof.

(c) Anchors for joists and rafters shall be provided where they enter masonry walls and also where they are parallel to
masonry walls as specified for joists in Section 2506 (f).

(d) 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, to the satisfaction of the Building Inspector, the span shall be considered as the distance between intersecting points of trussing, when the allowable stresses are not exceeded.

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. 2509. (a) Wood trusses and truss framing shall have all joints accurately cut and fitted together so that each bearing is true and drawn tight to the full bearing. All such trusses shall be properly secured in place by lateral bracing.

(b) Washers of sufficient size to distribute the loads properly shall be used in connection with rods or metal members. Before a truss is loaded, the tension rods shall be well tightened.

(c) Timber trusses shall be securely anchored to the wall at points of bearing.

Sec. 2510. (a) Fire stops shall be provided at all intersections of interior and exterior walls with floors, ceilings and roof in such a manner as to effectively cut off communication by fire through hollow concealed spaces and prevent both vertical and horizontal drafts.

(b) Furred walls shall have fire stopping placed immediately above and below the junction of any floor construction with the walls or shall be fire-stopped the full depth of the joist.

(c) All stud walls or partitions shall have a continuous row of bridging or fire stopping which shall form a complete and effective separation in the entire width of partition at that point, placed in such a manner that there shall be no concealed air spaces greater than eight (8) feet in any dimension. Fire stops shall be the full width of the studding and sufficiently stiff to act as lateral bracing for the individual studs.

(d) Stair stringers shall be fire-stopped at least once in the middle portion of each run, and shall be fire-stopped by a header beam at the top and bottom, so as to effectively prevent the passage of fire. Full width fire blocking shall be placed between studs along and in line with the run of stairs adjoining such partitions.

(e) When sliding doors are pocketed in partitions, such pockets shall be completely fire-stopped at end, sides, top and bottom.

(f) All spaces between chimneys and wood framing shall be solidly filled with refuse mortar, loose cinders or other incombustible material placed in incombustible supports.

(g) All fire-stopping as required in this section shall be not less than two (2) inches in thickness and not less in width than the enclosed space within the partition except as provided in paragraph (f) hereof for chimneys.
Sections 2510-2511

(h) All attic spaces or spaces between ceilings and the underside of roofs shall be divided into horizontal areas of not more than twenty-five hundred (2500) square feet 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.

Sec. 2511. The following table gives the maximum allowable spans for floor joists of Douglas Fir (Oregon pine) using a common structural joist grade, surfaced four sides to American Lumber Standards sizes and based on a live load of forty (40) pounds per square foot uniformly distributed, using a maximum fibre stress in bending of 1200 lbs. per square inch.

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.
<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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Plastered Ceiling Below</td>
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<td>24</td>
<td>18-11</td>
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<td>24</td>
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## Maximum Spans for Residence Floor Beams for Various Joist Sizes

<table>
<thead>
<tr>
<th>Beam Size</th>
<th>2x6, 16&quot; o.c. 9'1&quot; Span</th>
<th>2x8, 16&quot; o.c. 12'1&quot; Span</th>
<th>2x10, 16&quot; o.c. 15'3&quot; Span</th>
<th>2x12, 16&quot; o.c. 18'5&quot; Span</th>
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<tbody>
<tr>
<td>2--2x6</td>
<td>4'7&quot;</td>
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</tr>
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<td>5'7&quot;</td>
<td>4'2&quot;</td>
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<tr>
<td>4--2x6</td>
<td>6'6&quot;</td>
<td>4'10&quot;</td>
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<tr>
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<td>6'7&quot;</td>
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<td>4--2x8</td>
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<td>6'5&quot;</td>
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<td>5'9&quot;</td>
<td>6'10&quot;</td>
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<tr>
<td>3--2x10</td>
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<td>7'0&quot;</td>
<td>8'4&quot;</td>
<td>6'1&quot;</td>
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<tr>
<td>4--2x10</td>
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<td>8'1&quot;</td>
<td>9'7&quot;</td>
<td>7'0&quot;</td>
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CHAPTER 26 — REINFORCED CONCRETE
(Quality and Design)

ARTICLE 1—DEFINITIONS

Sec. 2601. 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; in general, aggregate consists of sand, pebbles, gravel, crushed stone, blast-furnace slag, or similar materials.

Anchorages—The embedment in concrete of a portion of a reinforcement bar, either straight or with hooks, designed to prevent pulling out or slipping of the bar when subjected to stress. (The anchorage of tension reinforcement in beams includes only the embedded length beyond a point of contra-flexure or of zero moment.)

Blast-Furnace Slag—The non-metallic product, consisting essentially of silicates and alumino-silicates of lime, which is developed simultaneously with iron in a blast furnace.

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. (See Middle Strip.)

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 concrete core enclosed by spiral reinforcement and further reinforced by longitudinal bars encases a structural steel or cast iron column designed to carry a portion of the load.

Concrete—A mixture of Portland cement, fine aggregate, coarse aggregate and water. (See Mortar.)

Consistency—A general term used to designate the relative plasticity of freshly mixed concrete or mortar.

Crushed Stone—Bedded rock or boulders, which have been broken by mechanical means into fragments of varying shapes and sizes.

Dead-Load—The weight of the permanent parts of the structure.

Deformed Bar—Reinforcement 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 inter-sections not farther apart than twelve inches in the direction of the principal reinforcing and with cross wires not smaller than No. 10 may be rated as a deformed bar.

**Diagonal Direction**—A direction parallel or approximately parallel to the diagonal of the panel of a flat slab.

**Direct Band**—In a four-way flat slab system, a group of bars covering a width approximately 0.4 l, symmetrical with respect to the line of centers of supporting columns.

**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 tension reinforcement and the compression surface in a beam or slab, and having a width equal to the width of the rectangular beam or slab, or the effective width of the flange of a Tee 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 reinforced-concrete slab generally without beams or girders to transfer the loads to supporting members.

**Footing**—A structural unit used to distribute wall or column loads to the foundation materials.

**Gravel**—Rounded particles larger than sand grains resulting from the natural disintegration of rocks. (See Sand.)

**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, usually recognized by its relatively light color.

**Live-Load**—Loads and forces other than the dead-load.

**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 moments are being considered.

**Mortar**—A mixture of Portland cement, fine aggregate, and water. (See concrete.)

**Negative Bending Moment**—That moment which exists between a support of a slab or beam and the point of inflection on either side of the support.

**Negative Reinforcement**—Reinforcement so placed as to take tensile stress due to negative bending moment.

**Panelered Ceiling**—A paneled ceiling refers to 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 in either rectangular direction between centers of two columns of a panel.

Pedestal—An upright compression member whose height does not exceed three times its least lateral dimension.

Pedestal Footing—A column footing projecting less than one-half its depth from the faces of the column on all sides and having a depth not more than three times its least width.

Plain Concrete—Concrete without metal reinforcement.

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 uncalcined gypsum.

Positive Bending Moment—That moment which exists at all other points in beams or slabs except where negative moment exists.

Positive Reinforcement—Reinforcement so placed as to take tensile stress due to positive bending moment.

Principal Design Section—The vertical sections in a flat slab on which the moments in the rectangular directions are critical. (See Section 2666.)

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.

Rectangular Direction—A direction parallel to a side of the panel of a flat slab.

Reinforced Concrete—Concrete in which metal is embedded in such a manner that the two materials act together in resisting forces.

Sand—Small grains resulting from the natural disintegration of rocks. (See Gravel.)

Screen—A metal plate with closely spaced circular perforations. (See Sieve.)

Sieve—Woven wire cloth with square openings. (See Screen.)

Strut—A compression member other than column or pedestal.

Surface Water—By the term “surface water” is meant all water carried by the aggregate except that held within the aggregate particles themselves by absorption.

Wall Beam—A reinforced-concrete beam which extends from column to column along the outer edge of a wall panel.

Water-Cement Ratio—By the water-cement ratio is meant the total quantity of water entering the mixture including the surface water carried by the aggregate, expressed in terms of the quantity of cement. The water-cement ratio shall be expressed in U. S. gallons per sack (94 lbs.) of cement.
ARTICLE II.
General

Scope

Sec. 2602. These regulations cover the use of reinforced concrete in any structure to be erected under the provisions of the Building Code of which they form a part. They are intended to supplement the general provisions of the Code in order to provide for the proper design and construction of structures of this material.

Permits and Drawings

Sec. 2603. Drawings and typical details of all reinforced concrete construction showing the sizes and position of all structural members, metal reinforcement, and the live load used in the design shall be filed with the Building Department as a permanent record before a permit to construct such work shall be issued. All calculations made may be required by the Building Department to be submitted with the drawings.

Special Systems of Reinforced Concrete

Sec. 2604. The sponsors of any system of reinforced concrete which has been in successful use, or the adequacy of which has been shown by tests, and the design of which is either in conflict with these provisions or not covered by them, shall have the right to present the data on which their design is based to the Chief Building Inspector.

ARTICLE III.
MATERIALS AND TESTS

Tests

Sec. 2605 (a) The tests called for in these regulations when ordered in accordance with the provisions of this Chapter by the Chief Building Inspector or his authorized representatives, shall be arranged for by the owner or his representative. No responsibility for the expense of these tests shall attach to the Building Department. Such tests shall be made in accordance with the standard method of test covering the particular material under consideration, of the American Society for Testing Materials in effect on the date of the adoption of these regulations, except as noted herein.

(b) All such tests shall be made by competent persons. The competency of the persons making the tests shall be judged by their training and experience. The Chief Building Inspector may disapprove for just cause those whose records show technical incompetency. Copies of the results of all tests shall be kept on file in the office of the Chief Building Inspector for a period of two years after the acceptance of the structure. Tests shall be made on any material entering into concrete or reinforced concrete construction when there is reasonable doubt as to its suitability for the purpose.

(c) The Chief Building Inspector or his authorized representative shall have the right to require reasonable tests of the
concrete from time to time to determine whether the materials and methods in use are such as to produce concrete of the necessary quality. Specimens for such tests shall be taken at the place where concrete is being deposited, and shall be taken, cured, and tested in accordance with the “Standard Method of Making Compression Tests of Concrete” (Serial Designation: C39-33) of the American Society for Testing Materials.

Sec. 2606. (a) The Chief Building Inspector or his authorized representative 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 was intended. Such tests shall not be required to be made on any concrete construction which is less than sixty (60) days old.

(b) In such tests, 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 twenty-four hours before removal. If, during the test, or upon removal of the load, the member or portion of 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 will be considered to have failed to pass the test if within twenty-four hours after the removal of the load the slabs or beams do not show a recovery of at least seventy-five (75) per cent of the maximum deflection shown during the twenty-four (24) hours while under load.

Sec. 2607. (a) All concrete work shall be inspected by the architect or engineer responsible for its design or by a competent representative responsible to the architect or engineer. A record shall be kept of such inspection which shall cover the quality and quantity of concrete materials, including water, the mixing and placing of the concrete, and the placing of the reinforcing steel. The inspection record shall also include a complete record of the progress of the work and of the temperatures, when these fall below 40 degrees F., and of the protection given to the concrete while curing. These records shall be available for inspection by the Chief Building Inspector at all times during the progress of the work and shall be preserved for two (2) years after the acceptance of the structure.

Sec. 2608. (a) Portland cement shall conform to the “Standard Specifications and Tests for Portland Cement” (Serial Designation: C9-30) of the American Society for Testing Materials.

Sec. 2609. (a) Concrete aggregates shall consist of natural sands and gravels, crushed rock, crushed air-cooled blast-furnace slag, or other inert materials having clean, uncoated grains of strong and durable minerals. Aggregates containing soft, friable, thin, flaky, elongated, or laminated particles totaling more than
three (3) per cent, or containing shale in excess of one and one-half (1½) per cent, or silt and crusher dust finer than the No. 100 standard sieve in excess of two (2) per cent shall not be used. These percentages shall be based on the weight of the combined aggregate as used in the concrete. When all three groups of these deleterious materials are present in the aggregates, the combined amounts shall not exceed five (5) per cent by weight of the combined aggregate.

(b) Aggregates shall not contain strong alkali or organic material which gives a color darker than the standard color when tested in accordance with the “Standard Method of Test for Organic Impurities in Sands for Concrete” (Serial Designation: C40-33) of the American Society for Testing Materials.

(c) The maximum size of the aggregate shall be not larger than one-fifth (1/5) of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars. By maximum size of aggregate is meant the clear space between the sides of the smallest square opening through which ninety-five (95) per cent by weight of the material can be passed.

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Water

Sec. 2610. (a) Water used in mixing concrete shall be clean, and free from strong acids, alkalis, or organic materials.

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Metal Reinforcement

Sec. 2611. (a) Metal reinforcement shall conform to the requirements of the “Standard Specifications for Billet-Steel Concrete Reinforcement Bars” of Intermediate Grade (Serial Designation: A15-33), or for “Rail-Steel Concrete Reinforcement Bars” (Serial Designation: A16-33) of the American Society for Testing Materials. The provision in these specifications for machining deformed bars before testing shall be eliminated.

(b) Wire for concrete reinforcement shall conform to the requirements of the “Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement” (Serial Designation: A82-33) of the American Society for Testing Materials.

(c) Structural steel shall conform to the requirements of the “Standard Specifications for Structural Steel for Building” (Serial Designation: A9-33) of the American Society for Testing Materials.

(d) Cast-iron sections for composite or combination columns shall conform to “Standard Specifications for Cast-Iron Pipe and Special Castings” (Serial Designation: A44-04) of the American Society for Testing Materials.

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Storage of Materials

Sec. 2612. (a) Cement and aggregates shall be stored at the work in a manner to prevent deterioration or the intrusion of foreign matter. Any material which has deteriorated or has been damaged shall be immediately and completely removed from the work.
ARTICLE IV.

CONCRETE QUALITY AND WORKING STRESSES

Sec. 2613. (a) The working stresses for the design of reinforced concrete structures shall be based upon the minimum ultimate twenty-eight (28) day strength of the concrete to be used in the structure in accordance with the values given in Section 2618. All plans submitted for approval or used on the work, shall clearly show the strength of concrete for which all parts of the structure were designed. The strength of concrete shall be fixed in terms of the water-cement ratio in accordance with one of the following methods:

(1) By established results for average materials, as provided in Section 2614.

(2) By specific test of materials for the structure, as provided in Section 2615.

(b) By the water-cement ratio is meant the total quantity of water entering the mixture including the surface water carried by the aggregate, expressed in terms of the quantity of cement. The water-cement ratio shall be expressed in U. S. gallons per sack (94 lbs.) of cement.

Sec. 2614. (a) Where no preliminary tests of the materials to be used are made, the water-cement ratios shall not exceed the values in the following table. The mixes shown in the table are approximate only, and may require adjustment to give proper workability.

ASSUMED STRENGTH OF CONCRETE MIXTURES

<table>
<thead>
<tr>
<th>Water Cement Ratio</th>
<th>Approximate Mix</th>
<th>Volume of Portland Cement to Sum of Separate Volumes of Fine and Coarse Aggregate as Measured Dry</th>
<th>Assumed Compressive Strength at 28 Days in Pounds per Square Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. Gallons per 94-lb. Sack of Cement</td>
<td>Volume of Portland Cement</td>
<td>Sum of Separate Volumes of Fine and Coarse Aggregate as Measured Dry</td>
<td>Assumed Compressive Strength at 28 Days in Pounds per Square Inch</td>
</tr>
<tr>
<td>Plastic Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 ¾</td>
<td>1:7</td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>7 ½</td>
<td>1:6</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>6 ¾</td>
<td>1:5 ¾</td>
<td></td>
<td>2,500</td>
</tr>
<tr>
<td>6</td>
<td>1:4 ½</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>Moderately Wet Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 ¾</td>
<td>1:6 ½</td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>7 ½</td>
<td>1:5 ½</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>6 ¾</td>
<td>1:4 ¾</td>
<td></td>
<td>2,500</td>
</tr>
<tr>
<td>6</td>
<td>1:4</td>
<td></td>
<td>3,000</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-cement ratio.
(b) During the progress of the work, a reasonable number of compression tests shall be made as may be required by the Chief Building Inspector, but at least one specimen shall be tested for each one hundred (100) cubic yards of concrete being placed. The tests shall be made in accordance with provisions of Section 2616. Should the average twenty-eight (28) day strength fall below the minimum ultimate strength called for on the plans, the Chief Building Inspector shall have the right to require a load test under the provisions of Section 2606.

Sec. 2615. (a) Where the water-cement ratios for the various strengths of concrete are to be established by test, these tests shall be made in advance of the beginning of operations using the materials proposed and consistencies suitable for the work and in accordance with the “Standard Method of Making Compression Tests of Concrete” (Serial Designation C39-33) of the American Society for Testing Materials, including the provisions for curing in a moist room at 70 degrees F., and testing wet. A curve representing the relation between the average twenty-eight (28) day strength of the concrete and water-cement ratio shall be established for a range of values including all of the strengths called for in the plans. The tests shall include at least four different water-cement ratios and at least four specimens for each water-cement ratio. The water-cement ratio to be used in the structure shall be that corresponding to a point on the curve established by these tests representing a strength of concrete fifteen (15) per cent higher than the minimum ultimate strength called for on the plans and satisfactory evidence shall be submitted to show that these water-cement ratios are not exceeded. No substitution shall be made in the materials being used on the work without additional tests in accordance, here-with, to show the new water-cement ratios to be used.

(b) During the progress of the work, a reasonable number of additional twenty-eight (28) day compression tests may be required by the Chief Building Inspector, but at least one specimen shall be tested for each fifty (50) cubic yards of concrete of any one strength, and not less than two specimens of each strength of concrete for any one day’s operation. Such tests shall be made in accordance with the provisions of Section 2616. Should the average strengths of the control cylinders shown by these tests for any portion of the structure fall below the minimum ultimate twenty-eight (28) day strengths called for on the plans, the Chief Building Inspector shall have the right to order a change in the mix or the water-cement ratios for the remaining portion of the structure and to require load tests as specified in Section 2606 on the portions of the building affected. Should the average strengths shown by the cylinders cured on the job and tested subsequent to twenty-eight (28) days fall below the required strength, the Chief Building Inspector shall have the right to require conditions of temperature and moisture necessary to secure the required strength.

Sec. 2616. (a) Field tests of concrete, when required, shall be made in accordance with the “Standard Method of Making
Compression Tests of Concrete” (Serial Designation C39-33) of the American Society for Testing Materials with the following exceptions:

(1) Two sets of samples of concrete for test specimens shall be taken as the concrete is being delivered at the point of deposit, care being taken to obtain a sample representative of the entire batch.

(2) On set designated as control cylinders shall be placed under moist curing conditions at approximately 70 degrees F. within twenty-four (24) hours after molding and maintained therein until tested.

(3) The second set, designated as job cylinders, shall be kept as near to the point of sampling as possible and yet receive the same protection from the elements as is given to the portions of the structure being placed. Specimens shall be kept from injury while on the work. They shall be sent to the laboratory not more than seven (7) days prior to the time of test, and while in the laboratory shall be kept in the ordinary air at a temperature of approximately 70°F.

(b) All specimens and tests shall be made by a properly qualified person or testing laboratory, who shall furnish the Chief Building Inspector with a report showing the results of tests and stating that they were made in accordance with the provisions of this Code.

Sec. 2617. (a) The proportions of aggregates to cement for concrete of any water-cement ratio shall be such as to produce concrete that will work readily into the corners and angles of the form and around the reinforcement without excessive puddling or spading and without permitting the materials to segregate or free water to collect on the surface. The combined aggregate shall be of such composition of sizes that when separated by the No. 4 standard sieve, the weight retained on the sieve shall not be less than one-third (⅓) nor more than two-thirds (⅔) of the total, nor shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure. When forms are removed, the faces and corners of the members shall show smooth and sound throughout.

(b) The methods of measuring concrete materials shall be such that the proportion of water to cement can be accurately controlled during the progress of the work and easily checked at any time by the Chief Building Inspector or his authorized representative.

Sec. 2618. (a) The unit stresses in pounds per square inch on the concrete to be used in the design shall not exceed the following values, where $f'_c$ equals the minimum ultimate strength of twenty-eight (28) days.

Concrete Proportions and Consistency

Allowable Unit Stresses in Concrete
### Allowable Unit Stresses

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>For Any Strength of Concrete as Fixed by Test in Accordance with Sec. 303 30000</th>
<th>When Strength of Concrete is Fixed by the Water-Cement Ratio in Accordance with Sec. 2614</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexure: ( f_c )</td>
<td></td>
<td>( f'_c ) = 2000 lb. ( f'_c ) = 2500 lb. ( f'_c ) = 3000 lb.  ( n = \frac{f'_c}{f_c} )</td>
</tr>
<tr>
<td>Extreme fiber stress in compression (( f_c ))</td>
<td>0.40( f_c' )</td>
<td>800  1000  1200</td>
</tr>
<tr>
<td>Extreme fiber stress in compression adjacent to supports of continuous or fixed beams or of rigid frames (( f_c ))</td>
<td>0.45( f_c' )</td>
<td>900  1125  1350</td>
</tr>
<tr>
<td>Shear: ( v )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beams with no web reinforcement and without special anchorage of longitudinal steel (( v_c ))</td>
<td>0.02( f_c' )</td>
<td>40   50   60</td>
</tr>
<tr>
<td>Beams with no web reinforcement, but with special anchorage of longitudinal steel (( v_c ))</td>
<td>0.03( f_c' )</td>
<td>60   75   90</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement, but without special anchorage of longitudinal steel (( v ))</td>
<td>0.06( f_c' )</td>
<td>120  150  180</td>
</tr>
<tr>
<td>Beams with properly designed web reinforcement and with special anchorage of longitudinal steel (( v ))</td>
<td>0.09( f_c' )</td>
<td>180  225  270</td>
</tr>
<tr>
<td>For conditions determining the use of greater shear values see Sec. 2663.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat slabs at distance ( d ) from edge of column cap or drop panel (( v_c ))</td>
<td>0.03( f_c' )</td>
<td>60   75   90</td>
</tr>
<tr>
<td>Footing where longitudinal bars have no special anchorage (( v_c ))</td>
<td>0.02( f_c' )</td>
<td>40   50   60</td>
</tr>
<tr>
<td>Footing where longitudinal bars have special anchorage (( v_c ))</td>
<td>0.03( f_c' )</td>
<td>60   75   90</td>
</tr>
<tr>
<td>Bond: ( u )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In beams and slabs and one-way footings: Plain bars (( u ))</td>
<td>0.04( f_c' )</td>
<td>80   100  120</td>
</tr>
<tr>
<td>Deformed bars (( u ))</td>
<td>0.05( f_c' )</td>
<td>100  125  150</td>
</tr>
<tr>
<td>In two-way footings:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain bars (( u ))</td>
<td>0.03( f_c' )</td>
<td>60   75   90</td>
</tr>
<tr>
<td>Deformed bars (( u ))</td>
<td>0.0375( f_c' )</td>
<td>75   94   112</td>
</tr>
</tbody>
</table>

(Where special anchorage is provided (see Sec. 2663), double these values in bond may be used.)
### Allowable Unit Stresses

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>For Any Strength of Concrete as Fixed by Test in Accordance with Sec. 303</th>
<th>When Strength of Concrete is Fixed by the Water-Cement Ratio in Accordance with Sec. 2614</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$f'<em>c$ = $\frac{f'</em>{c}}{n}$ = 2000 lb.</td>
<td>$f'<em>c$ = $\frac{f'</em>{c}}{n}$ = 2500 lb.</td>
</tr>
<tr>
<td>Bearing: $f_c$</td>
<td>0.25$f'_c$</td>
<td>500</td>
</tr>
<tr>
<td>Axial Compression: $f_c$</td>
<td>0.225$f'_c$</td>
<td>450</td>
</tr>
<tr>
<td>In columns with lateral ties ($f_c$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In columns with continuous spirals enclosing a circular core: ( p = 0.01 )</td>
<td>300 + 0.14$f'_c$</td>
<td>580</td>
</tr>
<tr>
<td>( p = 0.02 )</td>
<td>300 + 0.18$f'_c$</td>
<td>660</td>
</tr>
<tr>
<td>( p = 0.03 )</td>
<td>300 + 0.22$f'_c$</td>
<td>740</td>
</tr>
<tr>
<td>( p = 0.04 )</td>
<td>300 + 0.26$f'_c$</td>
<td>820</td>
</tr>
<tr>
<td>( p = 0.05 )</td>
<td>300 + 0.30$f'_c$</td>
<td>900</td>
</tr>
<tr>
<td>( p = 0.06 )</td>
<td>300 + 0.34$f'_c$</td>
<td>980</td>
</tr>
</tbody>
</table>

(Spiral reinforcement not to be less than 1/4 the longitudinal.)

1. Unit stress in spirally reinforced columns = \((300 + (0.10 + 4p)f'_c)\)

### Sec. 2619. (a) The following unit stresses in reinforcing steel shall not be exceeded:

#### Tension:
- Intermediate grade billet steel \((f_s) = 20,000 \text{ lbs. per sq. in.}\)
- Rail steel bars \((f_s) = 20,000 \text{ lbs. per sq. in.}\)
- Web reinforcement \((f_s) = 16,000 \text{ lbs. per sq. in.}\)
- Structural steel shapes \((f_s) = 18,000 \text{ lbs. per sq. in.}\)

Other steel reinforcement 50 per cent of the yield point stress, but not to exceed \((f_s) = 20,000 \text{ lbs. per sq. in.}\)

#### Compression:
- Bars \(n f_c\)
- Structural steel section in composite columns \(15,000 \text{ lbs. per sq. in.}\)
- Cast iron section in composite columns \(9,000 \text{ lbs. per sq. in.}\)

See Section 2683 for stresses in structural steel and cast iron not encased in concrete.

Structural steel section in combination column, see Section 2684.
ARTICLE V
Mixing and Placing Concrete

Sec. 2620. (a) Water shall be removed from excavations before concrete is deposited, unless otherwise directed by the Chief Building Inspector. Any flow of water into the 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 thoroughly hardened.

Cleaning Forms and Equipment

Sec. 2621. (a) Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and clay or cement tile that will be in contact with concrete shall be well drenched (except in freezing weather). Reinforcement shall be thoroughly cleaned of ice or other coatings.

Inspection

Sec. 2622. Concrete shall not be placed until the forms and reinforcement have been inspected by the architect or engineer responsible for the design, or his authorized representative.

Mixing

Sec. 2623. The concrete shall be mixed until there is a uniform distribution of the materials and the mass is uniform in color and homogeneous. The mixer shall be of such type as to insure the maintaining of the correct proportions of the ingredients. The mixing shall continue for at least one minute after all the ingredients are in the mixer.

Transporting

Sec. 2624. (a) Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will 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 partially hardened be deposited in the work.

(b) When concrete is conveyed by chute, the plant shall be of such size and design as to insure a practically continuous flow in the chute. The slope of the chute shall be such as to allow the concrete to flow without separation of the ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. When the operation is intermittent, the spout shall discharge into a hopper. The chute shall be thoroughly flushed with water before and after each run; the water used for this purpose shall be discharged outside the forms.

Placing

Sec. 2625 (a) When concreting is once started, it shall be carried on as a continuous operation until the placing of the sec-
tion or panel is completed. Where construction joints are necessary, they shall be made in accordance with Section 2634.

(b) Concrete shall be thoroughly compacted by puddling with suitable tools during the operation of placing, and thoroughly worked around the reinforcement, around embedded fixtures, and into the corners of the forms.

(c) Where conditions make puddling difficult, or where the reinforcement is congested, batches of mortar containing the same proportion of cement to sand used in the concrete shall first be deposited in the forms and the operation of filling with the regularly specified mix be carried on at such a rate that the mix is at all times plastic and flows readily into the spaces between the bars.

(d) A record shall be kept on the work of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the Chief Building Inspector.

Sec. 2626. Exposed surfaces of concrete shall be kept moist for a period of at least seven (7) days after being deposited. In hot weather, exposed concrete shall be thoroughly wetted twice daily during the first week.

Sec. 2627. When depositing concrete at freezing or near-freezing temperatures, the concrete shall have a temperature of at least 50°F, but not more than 120°F. The concrete shall be maintained at a temperature of at least 50°F for not less than seventy-two (72) hours after placing or until the concrete has thoroughly hardened. When necessary, concrete materials shall be heated before mixing. Dependence shall not be placed on salt or other chemicals for the prevention of freezing. No frozen materials or materials containing ice shall be used. Manure shall not be applied directly to concrete when used for protection.

ARTICLE VI.

Forms and Details of Construction

Sec. 2628. Forms shall conform to the shape, lines, and dimensions of the member as called for on the plans. They 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 and insure safety to workmen and passersby. Temporary openings shall be provided where necessary to facilitate cleaning and inspection immediately before depositing concrete.

Sec. 2629. The removal of forms shall be carried out in such a manner as to insure the complete safety of the structure. Where the structure as a whole is supported on shores, removable floor forms, beams and girder sides, column and similar vertical forms may be removed within twenty-four hours, pro-
viding the concrete has hardened sufficiently that it is not in-
jured. In no case shall the supporting forms 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 weight and the
load upon it.

Sec. 2630 (a) Metal reinforcement, before being placed, shall
be free from rust, scale or other coatings that will destroy or
reduce the bond. Reinforcement shall be formed to the dimen-
sions indicated on the plans. Cold bends shall be made around
a pin having a diameter of four or more times the least dimen-
sion of the bar.

(b) Metal reinforcement shall not be bent or straightened in
a manner that will injure the material. Bars with kinks or bends
not shown on the plans shall not be used. Heating of reinforce-
ment for bend.ing will not be permitted.

Sec. 2631. Metal reinforcement shall be accurately placed
and secured, and shall be supported by concrete or metal chairs
or spacers, or metal hangers. The minimum center to center
distance between parallel bars shall be 2 1/2 times the diameter for
round bars or three (3) times the side dimension for square bars;
if the ends of bars are anchored as specified in Section 2663, the
center to center spacing may be made equal to two (2) diameters
for round bars or to 2 1/2 times the side dimension for square
bars, but in no case shall the clear spacing between bars be less
than one inch, nor less than one and one-third (1 1/3) times the
maximum size of the coarse aggregate. Bars at the upper face
of any member shall be embedded a clear distance of not less
than one diameter nor less than one (1) inch.

Sec. 2632. (a) In slabs, beams and girders, splices of rein-
forcement shall not be made at points of maximum stress with-
out the approval of the Chief Building Inspector. Splices, where
permitted, shall provide sufficient lap to transfer the stress be-
tween bars by bond and shear. In such splices, the bars shall be
spaced at the minimum distance specified in Section 2631.

(b) Splices in column bars shall provide a lap of twenty-
four (24) diameters for deformed bars and thirty (30) diameters
for plain bars.

(c) Where changes in the cross-section of a column occur,
the longitudinal bars shall be sloped for the full length of the
column or offset in a region where lateral support is afforded.
Where offset, the slope of the inclined portion from the axis of
the column shall not be more than one (1) in six (6).

Sec. 2633. (a) At those surfaces of footings and other prin-
cipal structural members in which the concrete is deposited di-
rectly against the ground, metal reinforcement shall have a mini-
imum covering of three (3) inches of concrete. At other surfaces
of concrete exposed to the ground, metal reinforcement shall be
protected by not less than two (2) inches of concrete.
(b) In fire-resistive construction, metal reinforcement shall be protected by concrete of thickness as shown in table in Section 4301.

(c) Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion.

Sec. 2634. (a) Joints not indicated on the plans shall be so made and located as to least impair the strength of the structure. Where a horizontal 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 cleaned and roughened and all weak concrete removed.

(b) At least two (2) hours must elapse after depositing concrete in the columns or walls before depositing in beams, girders or slabs supported thereon. Beams, girders, brackets, column capitals and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

(c) Construction joints in floors shall be located near the middle of 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. In this last case provision shall be made for shear by use of inclined reinforcement.

Article VII.

Design—General Considerations

Sec. 2635. (a) The design of reinforced concrete members under these specifications 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 involving the following assumptions:

1. The steel takes all tensile stress;

2. The ratio "n" of the modulus of elasticity of the steel to that of the concrete shall be taken as follows (applies also for compression members):

\[ n = \frac{E_s}{1,000f'_c} = \frac{30,000}{f'_c} \]

Sec. 2636. The symbols and notation 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;
A' = Loaded area of pedestal, pier, or footing at the column base;
A_c = Area of core of spirally-hooped column measured to the outside diameter of the spiral;
A_g = Gross area of tied columns with lateral ties;
A_s = Effective cross-sectional area of metal reinforcement in tension in beams or compression in columns; and the effective cross-sectional area of metal reinforcement which crosses any of the principal design sections of a flat slab and which meets the requirements of Sections 2670, 2672, 2673, 2674.
A_v = Total area of web reinforcement in tension within a distance of s (measured perpendicular to the direction of the web reinforcement bar), 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_s = Dimensions of the dropped panel of a flat slab in the direction parallel to l;
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;
c = Projection of footing from face of column or pedestal;
d = Depth from compression surface of beam or slab to center of longitudinal tensile reinforcement;
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.;
f_c = Compressive unit stress in extreme fiber of concrete in flexure or axial compression in concrete in columns;
f_c' = Ultimate compressive strength of concrete at age of twenty-eight (28) days;
f_r = Compressive unit stress in metal core;
f_s = Tensile unit stress in longitudinal reinforcement;
f_v = Tensile unit stress in web reinforcement;
h = Unsupported length of column;
I = Moment of inertia of a section about the neutral axis for bending;
I = Span length of beam or slab (generally distance from center to center of supports; for special cases, see Sections 2640 and 2660);
I = Span length of flat slab panel (usually expressed in feet) center to center of columns, in the direction
in which moments are considered (see Sec. 2667);

\( l_i \) = Span length of flat slab, center to center of columns, perpendicular to the rectangular direction in which moments are considered;

\( M \) = Bending moment or moment of resistance in general;

\( M_c \) = Sum of positive and negative bending moments at the principal design sections of a panel of a flat slab (see Section 2667);

\( n = E_s/E_c \) = ratio of modulus of elasticity of steel to that of concrete;

\( \Sigma_o \) = Sum of perimeters of bars in one set;

\( p \) = Ratio of effective area of tensile reinforcement to effective area of concrete in beams = \( A_s/bd \); and the ratio of effective area of longitudinal reinforcement to the area of the concrete core in columns;

\( p_a \) = Permissible unit stress on pedestal, pier, or footing when the full area is loaded;

\( P \) = Total safe axial load on column whose length does not exceed eleven (11) times its least cross-sectional dimension;

\( P' \) = Total safe axial load on long column;

\( r_a \) = Permissible unit working stress in concrete over the loaded area of a pedestal, pier, or footing;

\( R \) = Least radius of gyration of a section;

\( s \) = Spacing of stirrups measured perpendicular to the direction of the stirrup;

\( t \) = Thickness of flange of T-beam;

\( t_i \) = Thickness of flat slab without dropped panels; or the thickness of flat slabs, including dropped panels where one is used;

\( t_o \) = Thickness of flat slab with dropped panels at points away from the dropped panel;

\( u \) = Bond stress per unit of area of surface of bar;

\( v \) = Sheering unit stress;

\( v_c \) = Unit shearing stress permitted on the concrete of the web; the value depending on the anchorage of the longitudinal reinforcement;

\( V \) = Total shear;

\( V' \) = Excess of the total shear over that permitted on the concrete;

\( w \) = Uniformly distributed load per unit of length of beam or slab;

\( w \) = Upward reaction per unit of area of base of footing;

\( w' \) = Uniformly distributed dead and live load per unit of area of a floor or roof (in flat slabs usually expressed in pounds per square foot);

\( W \) = Total dead and live load uniformly distributed over a single panel area (in flat slabs usually expressed in pounds and includes the dead weight of any raised or depressed portions).
Sec. 2637. The provisions for design herein specified are based on the assumption that all structures shall be designed for all dead and live-loads coming upon them, the live-loads to be in accordance with the general requirements of the building Code of which this forms a part, with such reductions for girders and lower story columns as are permitted therein.

Sec. 2638. Provisions shall be made for wind loads in accordance with the general provisions of the Code of which this forms a part. In designing the members to resist wind loads, the allowable unit stresses for dead and live-load and wind loads may be increased to one hundred fifty (150) per cent of the allowable values specified in Sections 2618 and 2619, but the section shall not be less than that required if the wind load be neglected.

ARTICLE VIII.

Flexural Computations and Moment Coefficients.

Sec. 2639. Computations of flexural resistance of reinforced concrete beams and slabs shall be based on the assumptions of Section 2635. The customary formulas or their equivalent shall be used.

Sec. 2640. (a) 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.

(b) The span length for continuous or restrained beams built to act integrally with supports shall be the clear distance between faces of supports.

(c) For continuous or restrained beams having brackets built to act integrally with both beam and support and of a width not less than the width of the beam and making an angle of 45 degrees or more with the horizontal, the span shall be measured from the section where the combined depth of the beam and bracket is at least one-third (\(\frac{1}{3}\)) more than the depth of the beam. No portion of such a bracket shall be considered as adding to the effective depth of the beam. Brackets making an angle of less than 45 degrees with the horizontal may be considered as increasing the effective depth of the beam, but not as decreasing the span length.

(d) Maximum negative moments are to be considered as existing at the ends of the span, as defined above.

Sec. 2641. The depth of the beam or slab shall be taken as the distance from the centroid of the tensile reinforcement to the top surface of the structural slab. Any floor finish not placed monolithic with the floor slab shall not be included as a part of the structural member. When the finish is placed monolithic with the structural slab in buildings of the warehouse or industrial class where the finish is subjected to unusual wear from trucking, or other causes, there shall be placed an additional depth of one-half (\(\frac{1}{2}\)) inch over that used in the design of the member.
Sec. 2642. For the purpose of these regulations, the point of inflection in beams and slabs of equal spans symmetrically loaded shall be assumed to be located at the fifth point of the span as defined in Section 2640.

Sec. 2643. The clear distance between lateral supports of a beam shall not exceed 32 times the least width of compression flange.

Sec. 2644. (a) In T-beam construction the slab shall be built integrally with the beam. 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.

(b) 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 next beam.

(c) 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, or in any case 18 inches.

(d) Provisions shall be made for the compressive stress at the support in continuous T-beam construction, care being taken that the provisions of Section 2631, relating to the spacing of bars, and 2625 (c), relating to the placing of concrete shall be fully met. In no case shall the area of steel in compression at any cross-section adjacent to the support exceed 2 per cent of the cross-sectional area of the stem of the beam in that section.

(e) 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.

(f) Isolated beams in which the T-form is used only for 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.

Sec. 2645. (a) Ribbed floor construction includes floor systems of ribs and slabs placed monolithically in which the ribs are not farther apart than 36 inches face to face. The ribs shall be straight, not less than 4 inches wide, nor of a depth more than three times the width.

(b) Where removable forms or fillers not complying with (c) 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 $2\frac{1}{2}$ inches.
(c) When burned clay or cement tile are used and concrete is placed on the top of such tile, it shall not be less than two inches in thickness, nor less than one-twelfth (1/12) of the clear distance between ribs. When the tile are so placed that the joints in alternate rows are staggered, the webs of the tile in contact with the ribs may be included in calculations involving shear or negative bending moment. No other portion of the tile may be included in design calculations.

(d) Where the floor is subject to impact from moving loads, or to wear, the slab thicknesses shall be increased one-half (1/2) inch. If a floor or covering one-half (1/2) inch or more in thickness, not included in the structural slab, is used for a wearing surface, no increase need be made.

(e) Where the slab contains conduits or pipes, the thickness shall not be less than one (1) inch plus the total overall depth of such conduits or pipes at any point. Such conduits or pipes shall be so located as not to reduce the strength of the construction.

(f) Shrinkage reinforcement in the slab must be provided as required in Section 2650.

Sec. 2646. Beams and slabs of approximately equal spans freely supported or built to act integrally with beams, girders, or other slightly restraining support, or beams and slabs built into brick or masonry walls in a manner which develops only partial end restraint, and carrying uniformly distributed loads shall be designed for the following moments at critical sections:

(1) Beams and slabs of one span,
Positive moment near center,

\[ M = \frac{wL^2}{8} \]  

(2) Beams and slabs continuous for two spans only,
Positive moment near center,

\[ M = \frac{wL^2}{10} \]  

Negative moment over interior support,

\[ M = \frac{wL^2}{8} \]  

(3) Beams and slabs continuous for more than two spans,
Positive moment near center and negative moment at support of interior spans,

\[ M = \frac{wL^2}{12} \]  

Positive moment near centers of end spans and negative moment at first interior support,

\[ M = \frac{wL^2}{10} \]  

(4) Negative moment at end supports for cases (1), (2), and (3) of this section.

\[ M = \text{not less than } \frac{wL^2}{24} \]
Sec. 2647. (a) Beams and slabs of approximately equal spans built to act integrally with columns, walls, or other restraining supports and assumed to carry uniformly distributed loads, shall (except as provided in Section 2646) be designed for the following moments at critical sections:

(1) Interior spans;
Negative moment at interior supports except the first,
\[ M = \frac{wl^2}{12} \] ..............................(7)
Positive moment near centers of interior spans,
\[ M = \frac{wl^2}{16} \] ..............................(8)

(2) End spans of continuous beams or slabs, and beams or slabs of one span;
Where I/1 is less than twice the sum of the values of I/h for the exterior columns above and below which are built into the beams;
Positive moment near center of span and negative moment at first interior supports,
\[ M = \frac{wl^2}{12} \] ..............................(9)
Negative moment at exterior supports,
\[ M = \frac{wl^2}{12} \] ..............................(10)
Where I/1 is equal to or greater than twice the sum of the values of I/h for the exterior column above and below which are built into the beams:
Positive moment near center of span and negative moment at first interior support,
\[ M = \frac{wl^2}{10} \] ..............................(11)
Negative moment at exterior support,
\[ M = \frac{wl^2}{16} \] ..............................(12)

(b) In this section, I represents the moment of inertia which, for those calculations, shall be computed on the assumption that the member is homogeneous, neglecting the reinforcement, but including that portion of the concrete section outside of the reinforcement which is ordinarily considered as fireproofing. I and h are the span length and column height, respectively, as defined in Sections 2640 and 2679.

Sec. 2648. Continuous beams with substantially unequal spans, or with other than uniformly distributed loading, whether freely supported or restrained, shall be designed for the maximum moments resulting from the most severe probable combination of loading and restraint. Provision shall be made where necessary for negative moment near the center of short spans which are adjacent to long spans, and for the negative moment at the end supports, if restrained.
Sec. 2649. 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 (¼) inch in size which shall be spaced not more than eight (8) inches apart over the distance where the compression steel is required.

Sec. 2650. 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, but in no case shall such reinforcing bars be placed farther apart than five times the slab thickness nor more than eighteen (18) inches.

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 twelve (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 twelve (12) inches......................................... 0.0022

Sec. 2651. (a) Concrete floors supported on four sides by beams, girders, or walls, and reinforced in two directions, shall be designed as follows, using moment coefficients given in Sections 2646, 2647 and 2648 as required, except as indicated under (e).

(b) If the length of the slab exceeds one and one-half (1½) times its width, the entire load shall be carried in the short direction.

(c) In case of square panels and uniformly distributed load, one-half (½) the live and dead load may be assumed as being resisted by each cross band.

(d) In rectangular panels of length L and breadth B, the portion of the load which shall be assumed as being supported by the slab in the short direction shall be equal to \( \frac{L}{B} \) times the total load. The remainder of the load shall be assumed as being supported by the slab in the long direction. The reinforcement in the long direction shall in no case be less than that specified in Section 2650 for shrinkage and temperature reinforcement.

(e) In placing the reinforcement account may be taken of the fact that the moment is less in the portions of the band which are adjacent and parallel to the supporting beams. In the one-quarter width of band parallel and adjacent to the beams, the computed moment may be reduced fifty (50) per cent.
(f) Beams supporting such slabs shall be assumed to take the portion of the load as determined in (b), (c) or (d) without advantage of any reduction in live-load permitted in other sections of this Code. The total load for each beam shall be assumed as uniformly distributed.

Sec. 2652. 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, nor shall the ratio of reinforcement be less than specified in Section 2650 (a).

ARTICLE IX.

Shear and Diagonal Tension

Sec. 2653. (a) The shearing unit stress \(v\) in reinforced concrete beams shall be computed by formula (14):

\[
\frac{8V}{7bd} \quad \text{...........................................(14)}
\]

When the value of the shearing unit stress computed by formula (14) exceeds the unit shearing stress \(v_e\) permitted on the concrete of the web (Sec. 2618), web reinforcement shall be provided to carry the excess.

(b) For beams of I or T section \(b'\) shall be substituted for \(b\) in formula (14).

(c) In tile and joist construction, \(b\) may be taken as a width equal to the thickness of the concrete web plus the thickness of the vertical webs of the concrete or clay tile in contact with the joists as in Section 2645 (c).

Sec. 2654. (a) Web reinforcement may consist of:

(1) Vertical stirrups or web reinforcing bars;

(2) Inclined stirrups or web reinforcing bars forming an angle of 30 degrees or more with the axis of the beam.

(3) Longitudinal bars bent up at an angle of 15 degrees or more with the axis of the beam.

(b) Stirrups or bent-up bars to be considered effective as web reinforcement shall be anchored at both ends, according to the provisions of Section 2664.

Sec. 2655. (a) Area of steel required in stirrup shall be computed by formula (15).

\[
A_v = \frac{V_s}{14000d} \quad \text{...........................................(15)}
\]
Sections 2656-2659

Spacing of Stirrups

Sec. 2656. Where the shearing stress is not greater than 0.06f', the distances between two successive stirrups measured perpendicular to the direction of the stirrup shall not exceed \( \frac{4}{3}d \), and where unit shearing stress exceeds 0.06f', it shall not be greater than \( \frac{4}{3}d \).

Bent-Up Bars

Sec. 2657. (a) Where there is a series of parallel bent-up bars at varying distances from the support, they shall be considered as inclined stirrups and the area required determined from formula (15).

(b) Where bent-up bars in a single plane are used for web reinforcement, the required area of the bar shall be computed by formula (16).

\[
A_v = \frac{V'}{16000 \sin \alpha}
\]

(16)

(c) In formula (16) \( V' \) shall not exceed 0.085f' \( \bullet \) bd nor \( \Sigma \) be less than 15 degrees. Only the center three-fourths of the inclined portion of such bar or group of bars shall be considered effective in resisting shear. Between the face of the support and the area reinforced by the bent-up bar, other web reinforcement shall be provided, except that when the distance is less than \( d/2 \) and the beam is designed for uniform load only, such additional reinforcement need not be provided.

Combined Web Reinforcement

Sec. 2658. Where two or more types of web reinforcement are used in conjunction, the total shearing resistance of the beam shall be assumed as the sum of the shearing resistances computed for the various types separately. In such computations the shearing resistance of the concrete shall be included only once.

Shearing Stress in Flat Slabs

Sec. 2659. (a) In flat slabs, the shearing unit stress on a vertical section which lies at a distance \( t_1 \) — 1½ inches from the edge of the column capital and parallel with it shall not exceed the following values when computed by formula (14) (in which \( d \) shall be taken as \( t_1 \) — 1½ inches):

1. \( 0.03f' \) when at least fifty (50) per cent of the total negative reinforcement passes directly over the column capital;

2. \( 0.025f' \) when twenty-five (25) per cent of the total negative reinforcement passes directly over the column capital (which is the least that shall be permitted);

3. For intermediate percentages, intermediate values of the shearing unit stress shall be used.

(b) In flat slabs, the shearing unit stress on a vertical section which lies at a distance of \( t_2 \) — 1½ inches from the edge of the dropped panel and parallel with it shall not exceed 0.03f', when computed by formula (14) (in which \( d \) shall be taken as \( t_2 \) — 1½ inches). At least fifty (50) per cent of the cross-sec-
tional area of the negative reinforcement in two column strips must be within the width of strip directly above the dropped panel.

Sec. 2660. (a) The shearing unit stress computed by formula (14) on a vertical section, which lies at a distance d from the face of the supported column or pier and parallel with it, shall not exceed 0.02$\frac{f'}{c}$ for footings with straight bars, nor 0.03$\frac{f'}{c}$ for footings in which the bars are anchored at both ends by adequate hooks or otherwise specified in Section 2663.

(b) In footings supported on piles, the critical section for diagonal tension shall be considered the distance 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 the shear.

ARTICLE X.

Bond and Anchorage

Sec. 2661. (a) Where reinforcement is used to resist tensile stresses developed by beam action, the bond stress shall be taken

$$u = \frac{8V}{7 \Sigma_{od}}$$

(b) For continuous or restrained members, the critical section for bond for the positive reinforcement shall be assumed to be at the point of inflection, that for the negative reinforcement shall be assumed to be at the face of the support, and at the point of inflection. For simple beams, or at the outer ends of freely supported end spans of continuous beams the critical section for bond shall be assumed to be at the face of the support.

(c) Bent-up longitudinal bars which, at the critical section, are within a distance d/3 from the horizontal reinforcement under consideration may be included with the straight bars in computing $\Sigma_{0}$.

Sec. 2662. (a) Tensile negative reinforcement in any span of a continuous, restrained, or cantilever beam, or in any member of a rigid frame, shall have a length of anchorage beyond the face of the supporting member sufficient to develop the full maximum tension at an average bond stress not greater than 0.04$\frac{f'}{c}$ for plain bars, or 0.05$\frac{f'}{c}$ for deformed bars. Within any such span, not less than one-third (1/3) of the negative reinforcements shall extend along the tension side of the beam at least to or beyond the point of inflection, and any bars not so extended shall be bent down at an angle of not more than 45 degrees with the axis of the member and made continuous with the positive reinforcement or anchored in a region of compression.

(b) Of the positive reinforcement in continuous beams, not less than one-fourth (1/4) the area shall extend at the same face of the beam into the support to provide an embedment of ten or more bar diameters beyond the face of the support.
(c) For non-continuous beams not less than one-half (½) the area of positive reinforcement shall extend at the same face of the beam into the support to provide an embedment of ten or more bar diameters.

Sec. 2663. (a) Where increased shearing or bond stresses on account of special anchorages are permitted as specified in Section 2618, anchorage of all reinforcement as required in Section 2662 shall be increased to conform with the requirements of (b), (c), (d), and (e) of this section.

(b) In continuous and restrained beams, anchorage beyond points of inflection of at least one-third (1/3) the area of the negative reinforcement and beyond the face of the support of at least one-third (1/3) the area of the positive reinforcement shall be provided to develop one-third (1/3) of the allowable working stress in tension at average bond stresses not to exceed 0.04$f_c'$ for plain bars nor 0.05$f_c'$ for deformed bars.

(c) In footings, all bars shall be anchored by means of hooks at the end of the bar. The total length of bar shall be the width of the footing plus twenty (20) bar diameters. The outer face of the hook shall not be less than three (3) inches nor more than four (4) inches from the face of the footing.

(d) In simple beams, or at the outer ends of freely supported end spans of continuous beams, at least one-half (1/2) of the tensile reinforcement shall extend along the tension side of the beam to provide an anchorage beyond the face of the support for one-third (1/3) of the allowable working stress in tension at an average bond stress not to exceed 0.04$f_c'$ for plain bars, nor 0.05$f_c'$ for deformed bars.

(e) In cases where the design of unusual members involves the use of unit shearing stresses in excess of 0.09$f_c'$, values up to 0.12$f_c'$ may be used, providing the requirements of this section are fully met, that the members in which these stresses are used shall be specially designated on the plans and that these members shall be constructed under the personal supervision of the designing engineer who shall notify the Chief Building Inspector at least one day in advance of the placing of the concrete in such member. When required by the Chief Building Inspector, the designing engineer shall submit an affidavit certifying that he has personally supervised the construction of these members and that the design and construction was in all respects as called for on the plans and in conformity with the provisions of this Code.

Sec. 2664. (a) Web reinforcement shall be anchored at both ends by one of the following methods or combination thereof, but only anchorage meeting the requirements of (1), (2) or (3) shall be used for shearing unit stresses in excess of 0.08$f_c'$.

1. Providing continuity with the main longitudinal reinforcement.

2. Bending around the longitudinal bar or steel shape.

3. A hook which has a radius of bend not less than four (4) times the diameter of the web bar.
(4) A length of embedment sufficient to develop the stress in the stirrup by bond as provided below, provided also that the other end of the stirrup is anchored as in (1).

(b) The anchorage of a web member not bearing on the longitudinal reinforcement shall be such as to engage an amount of concrete sufficient to prevent the bar from pulling out. In all cases the stirrups shall be carried as close to the upper and lower surfaces as fireproofing requirements permit.

(c) The stress in a stirrup or web reinforcement bar shall not exceed a value equal to the surface area of the bar embedded within the upper or lower one-half of the beam multiplied by 0.04f’, for plain bars or 0.05f’ _, for deformed bars, except that when wire fabric is used for web reinforcement it shall have welded intersections not farther apart than six (6) inches, but in no case shall the stress exceed sixteen thousand (16,000) pounds per square inch.

ARTICLE XI.
Flat Slabs
(Two-Way and Four-Way Systems with Square or Rectangular Panels)

Sec. 2665. (a) The term flat slabs as used in these regulations refers to concrete slabs, having reinforcement bars extending in two or four directions, without beams or girders to carry the load to supporting members.

(b) The moment coefficients, moment distribution, and slab thicknesses specified herein are for a series of slabs of approximately uniform sizes 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.

(c) Slabs with paneled ceiling or with dropped panels shall be considered as coming under the requirements herein given, provided the dropped panel shall have a length or diameter in each direction parallel to a side of the panel of not less than 0.35 of the panel length in that direction, and provided further that the depth of the thicker portion of the slab does not exceed one and one-half (1½) times the depth of the remainder of the slab.

(d) 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 Chief Building Inspector for approval.

Sec. 2666. (a) For convenience of reference, a flat slab panel shall be considered as consisting of strips as follows:

A middle strip one-half panel in width symmetrical with respect to the panel center line and extending through the panel in the direction in which moments are being considered;
A column strip one-half panel in width occupying the two quarter panel areas outside of the middle strip.

When considering moments in the direction of the width of the panel, the panel is similarly divided by strips, the widths of which are each one-half the length of the panel.

(b) The critical sections for moment calculations are referred to as principal design sections, and are located as follows:

Sections for Negative Moment. These shall be taken along the edges of the panel, on lines joining the column centers, and following the circumference of the column capital.

Sections for Positive Moment. These shall be taken on the center line of the panel.

Sec. 2667. (a) The numerical sum of the positive and negative moments in the direction of either side of a rectangular panel shall be not less than that given by formula (19).

\[
M_o = \frac{2c}{3l} Wl (1 - \frac{c}{l})^2
\]

where \( M_o \) = sum of positive and negative bending moments at the principal design sections, in the direction of which the length is given by "l." This moment is in foot-pounds where \( c \) and "l" are in feet and "W" is in pounds.

(b) The moments in the principal design sections shall be those given in the following table of moments, except that the maximum negative moment in the column strip may be greater or less than the values given in the table of moments by not more than 0.03\( M_o \), provided that the sum of the moments on the principal sections remains equal to \( M_o \), and provided further that the moment in each of the three other critical design sections be modified by not more than 0.01\( M_o \).

**MOMENTS TO BE USED IN DESIGN OF FLAT SLABS**

For Interior Panels Fully Continuous

General case: all values of \( c \): \( M_o \) given by formula (19)

<table>
<thead>
<tr>
<th>Strip</th>
<th>Flat Slabs Without Dropped Panels</th>
<th>Flat Slabs with Dropped Panels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slabs with 2-Way Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Strip</td>
</tr>
<tr>
<td>(-M_c = 0.46M_o)</td>
</tr>
<tr>
<td>Middle Strip</td>
</tr>
<tr>
<td>(-M_m = 0.16M_o)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slabs with 4-Way Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Strip</td>
</tr>
<tr>
<td>(-M_c = 0.50M_o)</td>
</tr>
<tr>
<td>Middle Strip</td>
</tr>
<tr>
<td>(-M_m = 0.10M_o)</td>
</tr>
</tbody>
</table>

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(c) The width of section at the column head shall be taken as the width of the dropped panel where used or half the width of panel where no dropped panel is used.

(d) The band width in the two-way system shall be such as to provide reinforcement over the entire one-half panel width.

(e) The band width for the direct bands in the 4-way system shall be approximately four-tenths (4/10) of the panel width at right angles to the direction of the band (0.4b), and for the diagonal bands approximately 0.4 of the average span length. In proportioning the reinforcement in this system, it shall be assumed that reinforcement in the direct band resists the entire positive moment for the column strip and the two diagonal bands resists the entire positive moment for the middle strip. Reinforcement for negative moment for the column strip shall include the area of reinforcement for negative moment in the diagonal bands multiplied by the cosine of the angle between the diagonal band and the axis of the direct band considered plus the full area of the reinforcement for negative moment in the direct band. The negative reinforcement for the middle strip shall be provided independently of the diagonal bands.

Sec. 2668. (a) For the particular case where "c" is equal to 0.225 times the average span length (the average of the distances center to center of columns on the two sides of the panel), formula (19) reduces to formula (19a).

\[ M_o = 0.065Wl \] \hspace{1cm} (19a)

(b) For two-way slab, the values of \( M_o \) may be obtained from formula (19a) and the distribution taken from the table in Section 2667 (b).

(c) For the four-way slab with dropped panel, the following table of coefficients may be used in computing the reinforcement required in each of the bands, provided that "l" for the direct bands shall be the center to center distance between columns in the direction in which the band extends, and for the diagonal bands the average value of "l" for the two direct bands of the panel. The moments in the table are those on "sections at right angles" to the direction of the respective bands:

<table>
<thead>
<tr>
<th>BAND</th>
<th>LOCATION</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>Center</td>
<td>+0.012Wl</td>
</tr>
<tr>
<td>Diagonal</td>
<td>Center</td>
<td>+0.009Wl</td>
</tr>
<tr>
<td>Direct</td>
<td>At column head</td>
<td>-0.020Wl</td>
</tr>
<tr>
<td>Diagonal</td>
<td>At column head</td>
<td>-0.011Wl</td>
</tr>
<tr>
<td>Top band across direct band</td>
<td>Between columns</td>
<td>-0.005Wl</td>
</tr>
</tbody>
</table>

Sec. 2669. (a) For slabs without dropped panels, using concrete of 2,000 lbs. per sq. in. ultimate strength, the total thickness of the slab \( t_s \) in inches shall be not less than the value given by formula (20).

175
\[ t_1 = 0.038 \left(1 - 1.44 \frac{l}{w'}\right) \frac{\sqrt{w'}}{l} + 1 \frac{1}{2} \quad \text{(20)} \]

where \( w' \) = uniformly distributed dead and live load, lbs. per sq. ft.

(b) For slabs with dropped panels, using concrete of 2,000 lbs. per sq. in. ultimate strength, the total thickness in inches at points beyond the dropped panel shall be not less than

\[ t_2 = 0.021 \sqrt{w'} + 1 \quad \text{(21)} \]

(c) The dropped panel shall have a thickness not greater than 1.5 \( t_2 \) nor less than 1.25 \( t_2 \). The side or diameter of the dropped panel shall not be less than 0.35 times the side of the panel in the parallel direction.

(d) In determining minimum thickness by formulas (20) and (21), the value of \( L \) shall be the panel length center to center of the columns, on the long side of the panel. For concrete of 2,000 lbs. per sq. in. ultimate strength, the slab thickness \( t_1 \) or \( t_2 \) shall in no case be less than \( 1/32 \)" for floor slabs, and not less than \( 1/40 \)" for roof slabs.

(e) Where concrete of higher ultimate strengths than 2,000 lbs. per sq. in. are used, the thickness given by formulas (20) and (21) and the limiting thickness may be reduced by multiplying by the factor

\[ \frac{3}{\sqrt{\frac{2,000}{f'_c}}} \]

in which \( f'_c \) is the ultimate strength of the concrete to be used.

Limiting Percentages of Reinforcement

Sec. 2670. (a) The ratio of reinforcement for negative moment in the column strip shall not exceed the values of \( "p" \) calculated for balanced reinforcement, that is, the amount of reinforcement for which both the steel and the concrete are stressed to the full amount permitted by Sections 2618 and 2619. Any reinforcement in excess of this amount shall not be included in the calculation. In computing the ratio of reinforcement for negative moment in the column strip, the width of section shall be taken as in Section 2667 (c). In the case of four-way design, the steel area shall consist of the area of steel for negative moment as defined in Section 2667 (e).

(b) The ratio of flat slab reinforcement in any strip shall not be less than .0025. Bars shall not be spaced farther apart than 1\( \frac{1}{2} \) times the slab thickness.

Point of Inflection

Sec. 2671. (a) In the middle strip the point of inflection for slabs without dropped panels shall be assumed at a line 0.381 distant from the center of the span and for slabs with dropped panels 0.31 distant from the center of the span.

(b) In the column strip, the point of inflection for slabs without dropped panels shall be at a line 0.33 (1-c) distant from
the center of the panel and 0.3 (1-c) for slabs with dropped panels.

Sec. 2672. In both two and four-way systems, provision shall be made for securing the reinforcement in place so as to resist properly not only the critical moments, but also the moments at intermediate sections. The full area of steel required for negative moment at the column head shall be continued in the same plane close to the upper surface of the slab to the edge of the dropped panel, but in no case less than a distance 0.21 from the center line of column. Lapped splices shall not be permitted at or near regions of maximum stress except as described in Section 2632.

Sec. 2673. (a) For column strips at least four-tenths (4/10) of the area of steel required at the section for positive moment in the column strip shall be of such length and so placed as to reinforce the negative moment section at the two adjacent column heads. These bars, and any other bars for negative reinforcement shall extend into the adjacent panel to a point at least 0.061 beyond the point of inflection. Not less than one-third of the bars used for positive reinforcement in the column strip shall extend into the dropped panel at least twenty diameters of the bar, but not less than twelve (12) inches or in case no dropped panel is used, shall extend to within 0.125 l of the center line of the columns or the supports. The balance of the bars for positive reinforcement in the column strip shall extend at least 0.33 l on either side of the center line of panel.

(b) For the middle strip at least one-half of the bars for positive moment shall be bent up and extend over the main bands at both sides of the panel to a point at least 0.25 l beyond the center line of columns. The location of the bands shall be such that for a distance 0.15 l for slabs with dropped panels (or 0.125 l for slabs without dropped panels), on each side of the center line of columns, the full reinforcement required for negative moment will be provided in the top face of the slab. The full reinforcement for positive moment in the middle strip shall extend in the bottom face of the slab to a point at least 0.3 l on either side of the panel center line, and at least fifty (50) per cent of it shall extend to points 0.325 l on either side of the panel center line for slabs with dropped panels, or 0.35 l for slabs without dropped panels.

Sec. 2674. (a) For direct bands, all provisions governing the placing of steel in column strips in two-way systems apply as well to the direct bands in four-way systems.

(b) For diagonal bands, at least four-tenths of the area of steel required at the section for positive moment shall be of such length and so placed as to reinforce the negative moment section at the two diagonally opposite column heads. These bars and any other bars for negative reinforcement shall extend into the adjoining panel to points at least 0.4 l beyond a line drawn through the column center perpendicular to the direction of the band. The straight bars for positive moment in the diagonal bands shall
not be shorter than the longer straight bars in the direct bands.

(c) For negative moment in the middle strip, the required steel shall extend not less than 0.25 l on either side of the column center line.

Wall and Other Irregular Panels

Sec. 2675. (a) In wall panels and other panels in which the slab is non-continuous on one edge, the maximum positive moments on the principal design sections parallel to the discontinuous edge (reinforcement perpendicular to that edge) shall be increased by twenty-five (25) per cent.

(b) The positive moment reinforcement perpendicular to the discontinuous edge shall extend to this edge and have an embedment of at least six inches (6") in spandrel beams or columns. All negative moment reinforcement shall be bent or hooked at spandrel beams or columns to provide adequate bond resistance.

(c) At the wall or discontinuous edge the negative moment in the column strip shall be taken as not less than ninety (90) per cent and in the middle strip not less than sixty-two and one-half (62½) per cent of the corresponding moments for a normal interior panel as given in the table of Section 2667 (b).

(d) Where there is a beam or a bearing wall at the center line of columns in the interior portion of a continuous flat slab, the negative moment at the beam or wall line in the middle strip perpendicular to the beam or wall shall be taken as thirty (30) per cent greater than the negative moment specified in Section 2667 (b) for a middle strip. The half column strip adjacent and parallel to and lying on either side of the beam or wall shall be designed to resist moments at least one-fourth of those specified in Section 2667 (b) for a column strip. The beam or wall in such cases shall be designed to carry a uniformly distributed load equal to one-fourth of the panel load on either side in addition to the loads directly imposed upon it.

Panels With Marginal Beams

Sec. 2676. (a) In panels having marginal beams on one edge or on each of the two adjacent edges, the beam shall be designed to carry at least the load superimposed directly upon it, exclusive of the panel load. A marginal beam which has a depth greater than one and one-half (1½) times the minimum slab thickness, shall be designed to carry, in addition to the load superimposed directly upon it, a uniformly distributed load equal to at least one-fourth (¼) of the total live and dead load for which the adjacent panel or panels are designed. Slabs supported by marginal beams on opposite edges shall be designed as freely supported slabs for the entire load.

(b) The half column strip adjacent to and parallel with marginal beams, having a depth not greater than one and one-half (1½) times the minimum slab thickness, shall be designed to resist half the moment specified for a full column strip.

(c) In wall panels having exterior columns where brackets (the faces of which make an angle with the face of the column, projected upward, of not more than 45 degrees) are used in place of capitals, the value of (c) in the direction in which the bracket
extends may be taken as twice the distance from the center of the column to a point where the structural portion of the bracket is one and one-half (1½) inches thick, and averaged with the value of (c) for an interior column capital in the computations for moment in formula (19). The value of (c) for column strips parallel and adjacent to a non-continuous edge of a slab where either no marginal beam is used, or where the beam used is not deeper than one and one-half (1½) times the minimum slab thickness, should be taken as equal to the width of the wall column if no bracket is used in this direction.

(d) The value of (c) for column strips parallel and adjacent to marginal beams having a depth greater than the thickness of the slab at the wall columns, shall, if no bracket is used in this direction, be taken as equal to the width of the wall column plus twice the difference between the depth of the beam and the depth of the slab through the dropped panel. This value of c is to be used in calculating the $-M_c$ and $+M_c$ for the half column strip parallel and adjacent to the marginal beams only. This half column strip should be designed to resist a moment at least one-fourth as great as that specified for a column strip in the Table of Moments.

(e) It shall be permissible to omit the dropped panels at wall columns provided the design complies with the requirements of Sections 2667 (b) and 2670 (a) for slabs without dropped panels.

Sec. 2677. (a) 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 Section 2667 (b) and that these total positive and total negative moments be redistributed between the remaining principal design sections to meet the new conditions.

(b) 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 1/20.

(c) 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.

(d) Any opening larger than described above shall be completely framed on all sides with beams to carry the loads to the columns.

**ARTICLE XII.**

**Reinforced-Concrete Columns and Walls**

Sec. 2678. Unless designed as long columns under the provisions of Section 2685, reinforced-concrete columns shall not be longer than eleven times the least lateral dimension. Principal columns in buildings shall have a minimum diameter or thickness of twelve (12) inches. Posts that are not continuous from story to story shall have a minimum diameter or thickness of six (6) inches.
Sections 2679-2680

Unsupported Length of Columns

Sec. 2679. (a) The unsupported length of reinforced concrete columns shall be taken as:

(1) In flat-slab construction the clear distance between the floor and the under side of the capital;

(2) In beam and slab construction, the clear distance between the floor and the under side of the shallowest beam framing into the column at the next higher floor level;

(3) In floor construction with beams in one direction only, the clear distance between floor slabs;

(4) In columns supported laterally by struts or beams only, the clear distance between consecutive pairs (or groups) of struts or beams, provided that to be considered an adequate support, two such struts or beams shall meet the column at approximately the same level and the angle between the two planes formed by the axis of the column and the axis of each strut respectively is not less than 75 degrees nor more than 105 degrees.

(b) When reinforced-concrete brackets are used at the junction of beams or struts with columns, the clear distance between supports may be considered as reduced by the depth of the bracket provided the width of the bracket is at least equal to that of the beam and not less than one-half of the column.

Design of Spiral Columns

Sec. 2680. (a) The permissible axial load on columns reinforced with longitudinal bars and closely spaced spirals enclosing a circular core, shall not be greater than that determined by formula (22).

\[
P = A_c \left[ 1 + (n-1) p \right] f_c \tag{22}
\]

in which \( A_c \) is the area within the outer circumference of the spiral hooping, and the values of \( f_c \) are as given in Section 2618, or as may be found for intermediate values of \( p \) by interpolation, or in general, by the formula,

\[
f_c = \left[ 300 + (0.10 + 4p) \right] f'_c \tag{22a}
\]

(b) The longitudinal reinforcement shall consist of at least six bars of minimum diameter of one-half (\( \frac{3}{8} \)) inch, and of an effective cross sectional area not less than 0.01, nor more than 0.06 of that of the core. The number of longitudinal bars concentrated in the ring at the periphery of the core shall be governed by the spacing requirements of Section 2631a. If all the bars cannot be placed at the periphery of the core, the bars within shall be stayed at intervals of twenty-four (24) inches, and shall not be nearer to the outer ring than two-tenths (2/10) times the core diameter. When the ratio of reinforcement in a spirally reinforced column is greater than 0.04, special placing drawings illustrating the proper distribution of steel shall be submitted with the detail plans. Splices in longitudinal reinforcement shall provide a lap of at least 24-bar diameters for deformed bars, and 30 diameters for plain bars.

(c) The ratio of the spiral reinforcement shall be not less than one-fourth the ratio of the longitudinal reinforcement. Spiral reinforcement shall consist of evenly spaced continuous
spirals held firmly in place and true to line by at least three vertical spacer bars. At the ends of all spirals and at points of splice, the outside diameter shall be maintained. The spacing of the spirals shall not be greater than one-sixth (1/6) of the diameter of the core and in no case more than three (3) inches.

(d) Reinforcement shall be protected everywhere by a covering of concrete cast monolithic with the core which shall have a minimum thickness of one and one-half (1 1/2) inches.

Sec. 2681. (a) The permissible axial load on columns reinforced with longitudinal bars and separate lateral ties shall not be greater than that determined by formula (23):

\[ P = 0.225 f'c A_e [1 + (n-1) p] \] .............................................. (23)

(b) The ratio of longitudinal reinforcement shall not be less than 0.005 nor shall the ratio considered in the calculations be more than 0.02 of the total area of the column. The longitudinal reinforcement shall consist of not less than four bars of minimum diameter of 5/8 inch, placed with clear distance from the face of the column not less than two (2) inches, nor more than three (3) inches. Splices in longitudinal reinforcement shall provide a lap of at least 24-bar diameters for deformed bars, and 30 diameters for plain bars.

(c) Lateral ties shall be at least 1/4 inch in diameter spaced not more than twelve (12) inches apart. In columns of rectangular section, cross ties shall be arranged to afford support to the vertical bars at intervals not greater than the shorter side of the section, but such interval need not be less than twelve (12) inches in any case.

Sec. 2682. (a) The bending moments in interior and exterior columns shall be determined on the basis of loading conditions and end restraint, and shall be provided for in the design.

(b) In flat-slab construction, the least dimension of the column shall be not less than one-fifteenth (1/15) of the average center to center span, nor less than sixteen (16) inches. For known eccentric loads or unequal spacing of columns, computations of moments shall be made accordingly. Wall columns in flat-slab construction shall be designed to resist a bending moment of W/35. Any counter moment due to the weight of the structure that projects beyond the column center line may be deducted from the moment computed as just described. Resistance to the bending moments shall be divided between the columns immediately above and below in direct proportion to the values of their ratios of 1/h (see Sections 2647 and 2679).

(c) The recognized methods shall be followed in calculating the stresses due to combined axial load and bending. The column section shall not be less than that required where axial load alone is considered. The limiting combined unit stresses shall be as follows:

(1) Columns with spiral reinforcement,

\[ [300 + (0.10 + 4p) f'c] + 0.15f'c \]
Sections 2682-2683

(2) Columns with lateral ties 0.3f′c. The total amount of reinforcement considered in the computations shall not be more than four (4) per cent of the total area of the column.

(3) Tension in longitudinal reinforcement due to bending on the column shall not exceed 16,000 pounds per sq. in.

(d) Where the allowable unit stress in columns is increased (to provide for combined axial load and bending) and wind loads are also added, the total shall still come within the allowable values specified for wind loads in Section 2638.

Composite Columns

Sec. 2683. (a) The permissible load on composite columns in which a structural steel or cast-iron column is thoroughly en- cased in a concrete core reinforced with not less than 0.02 nor more than 0.04 longitudinal reinforcement in the form of bars arranged at the periphery of the core, nor less than 0.01 of spiral reinforcement meeting the requirements for spirals of Section 2680 (c), shall be based on a certain unit stress for the steel or cast-iron section plus a unit stress of 0.25f′c on the net area of the concrete within the outer circumference of the spiral hooping enclosing the core. The longitudinal and spiral reinforcement ratios stated shall be based on the total core area enclosed within the outer circumference of the spiral hooping.

(b) The unit compressive stress on the steel section shall not exceed 15,000 lbs. per sq. in. Where the steel section is required to carry construction or other loads prior to its encasement in concrete, the stress shall not exceed that given by formula (24).

\[
f_r = \frac{18,000}{h^2} + \frac{1}{18,000 R^2} \]  

\[(24)\]

(c) The unit stress on the cast-iron section shall not exceed 9,000 lbs. per sq. in. Where the cast-iron section is required to carry construction, or other loads prior to its encasement in concrete, the stress shall not exceed that given by formula (25).

\[
f_r = \frac{h}{12,000 - \frac{60}{R}} \]  

\[(25)\]

(d) The unit stress on the longitudinal reinforcement shall be 0.25f′c.

(e) The diameter of the cast-iron section shall not exceed one-half the diameter of the core, nor shall its total area exceed twelve (12) per cent of the core area (area included within outer circumference of the spiral hooping). The dimension of the structural steel section shall be such as to provide at least three (3) inches between the spiral and the corners of the section and its area shall not exceed twelve (12) per cent of the core area. Metal columns shall be accurately milled at splices and positive provision shall be made for alignment of one column above another.
The spiral reinforcement shall be not less than 0.01 of the volume of the core, and shall conform in quality, spacing, and other requirements to the provisions for spirals in Section 2680 (c).

(f) In composite columns, provision shall be made at the base to transfer the load from the middle section at safe unit stresses in accordance with Section 2691. The base of the metal section shall be designed to transfer the load from the entire composite column to the foundation, or it may be designed to transfer the load from the metal section only, provided it is so placed in the pier or pedestal as to leave ample section of concrete above the base for the transfer of the load from the reinforced-concrete section of the column by means of bond on the vertical reinforcement and by direct compression from the concrete. At the top of the metal section, provision shall be made to receive the full load to be transferred to the metal section at this point. At points in the structure below this, where the load on the metal section is increased, positive means, consisting of cast or built-up brackets rigidly attached to the metal section, shall be provided to receive the increase in load.

(g) Ample section of concrete and continuity of reinforcement shall be provided at the junction with beams or girders. The area of the concrete between the spiral and the metal column shall be not less than that required to carry the total floor load of the story above on the basis of a stress in the concrete of 0.35$\sigma_n$, unless special brackets are arranged on the metal column to receive directly the beam or slab load.

Sec. 2684. (a) Structural steel columns of any rolled or built-up section wrapped with the equivalent of No. 8 U.S. standard gauge wire spaced four (4) inches on center and encased in concrete not less than one and one-half (1 1/2) inches thick over all of metal except rivet heads and connections will be permitted to carry a load equal to \((1 - A_c/100A_s)\) times permissible load for unencased steel columns.

(b) The permissible load for unencased steel columns shall be determined by formula (24), provided the structural steel column acting independently of the concrete shall have sufficient capacity to carry all dead loads which will be placed thereon, and provided the quality of the concrete is such that it shall show a compressive strength of at least 2,000 lbs. per sq. in. at twenty-eight (28) days when tested in accordance with Section 2605 (c).

Sec. 2685. (a) The permissible working load on the core in axially loaded spiral or composite columns which have a length greater than fifty (50) times the least radius of gyration of the column core (50$R$) shall not be greater than that determined by formula (26).

\[
P' = \frac{h}{1.50} \frac{100R}{P} \quad \text{.........................(26)}
\]

(b) The permissible working load on axially loaded tied columns, which have a length greater than forty (40) times the
Sections 2685-2689

least radius of gyration of the column section (40R) shall not be greater than that determined by formula (26a).

\[
\frac{P'}{P} = 1.33 - \frac{h}{120R} \tag{26a}
\]

(c) The radius of gyration of a column shall be computed from the concrete area used in design and the transformed section of the longitudinal steel area; that is the actual area of steel multiplied by "n."

Monolithic Walls

Sec. 2686. Reinforced concrete walls shall be as specified in Article III, Chapter 29.

ARTICLE XIII.

Footings

Loads

Sec. 2687. Footings resting directly on soil or on piles shall be proportioned as to 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.

Sloped or Stepped Footings

Sec. 2688. Footings in which the thickness has been determined by the requirements for shear as specified in Section 2660, may be sloped or stepped between the critical section and the edge of the footing, 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 (6) inches for footings on soil, nor less than twelve (12) inches for footings on piles. Sloped or stepped footings shall be cast as a unit.

Bending in Footings

Sec. 2689. (a) The critical section for bending in a concrete footing which supports a concrete column or pedestal, shall be considered to be at the face of the column or pedestal. Where steel or cast-iron column bases are used, the moment in the footings shall be computed at the middle and at the edge of the base; the load shall be considered as uniformly distributed over the column or pedestal base.

(b) The bending moment at the critical section in a square footing supporting a concentric square column, shall be computed from the load on the trapezoid bounded by one face of the column, the corresponding outside edge of the footing, and the portions of the two diagonals. The load on the two corner triangles of this trapezoid shall be considered as applied at a distance from the face equal to six-tenths (6/10) of the projection of the footing from the face of the column. The load on the rectangular portion of the trapezoid shall be considered as applied at its center of gravity. The bending moment is expressed by formula (27).
\[
M = \frac{w}{2}(a + 1.2c)c^2
\]

(27)

(c) For a round or octagonal column, the distance “a” shall be taken as equal to the side of a square of an area equal to the area enclosed within the perimeter of the column.

Sec. 2690. (See Section 2660, also Sections 2661 to 2664.)

Sec. 2691. (a) 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 column. The dowels shall extend into the column and into the pedestal or footing not less than 30 diameters of the dowel bars for plain bars, or 24 diameters for deformed bars.

(b) The permissible compressive unit stress on top of the pedestal or footing directly under the column shall be not greater than that determined by formula (28).

\[
r_a = p_a \frac{3\sqrt{A}}{A}
\]

(28)

(c) The value of \( p_a \) shall not exceed 0.25 \( f'_c \) for plain concrete. When lateral reinforcement in the form of spiral or hoops is provided, the value of \( p_a \) for the area within the spiral may be increased \((1-2.5np')\) times that for plain concrete, but no area outside the outer face of the spiral shall be considered. Where piers are designed as columns, the value of \( p_a \) shall be computed by the proper column design formula.

(d) In no case shall the total load computed by formula (28) be taken as greater than the load computed, using a stress equal to \( p_a \) on the gross area of the pedestal, pier, or footing at a point below special reinforcing provided at the top.

(e) Where the loaded area is not central on the top of the pedestal, pier or footing, the total area \( A \) shall not be taken as greater than the area of the largest circle that can be drawn about the load as a center and lying entirely within the top of the pedestal, pier, or footing.

(f) Where lateral reinforcement is provided to increase the value of \( p_a \), it shall extend to within three (3) inches of the top of the pedestal, pier, or footing and to a depth equal to the diameter of the spiral, and the loaded area shall lie at the center of the spiral or hoops. The pitch of the spiral or the spacing of the hoops in the clear shall not be less than two (2) inches, nor more than five (5) inches. The designed pitch shall be maintained by at least four spacers securely fastened to each spiral turn or hoop. The ratio of lateral reinforcement shall not exceed 0.015.

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Sections 2691-2692

(g) In sloped or stepped footing, "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 1 vertical to 2 horizontal.

Sec. 2692. (a) The allowable compressive unit stress on the gross area of a concentrically loaded pedestal or on the minimum area of a pedestal footing shall not exceed 0.25f'c unless reinforcement is provided and the member designed as a reinforced-concrete column.

(b) The depth of a pedestal or pedestal footing shall not be greater than three times its least width and the projection on any side from the face of the supported member shall not be greater than one-half the depth. The depth of a pedestal whose sides are sloped or stepped shall not exceed three times the least width or diameter of the section midway between the top and bottom. A pedestal footing supported directly on piles shall have a mat of reinforcing bars having a cross-sectional area of not less than 0.20 square inches per foot in each direction, placed three (3) inches above the top of the piles.
CHAPTER 27 — STEEL AND IRON
(Quality and Design)

Sec. 2701. The quality and design of all structural steel and iron used in buildings shall conform to the requirements specified in this Chapter.

Structural steel shall be of such quality as to conform to Standard Specifications for Structural Steel for Buildings, A.S.T.M. Designation A9-33, of the American Society for Testing Materials.

Cast iron used in building and/or structures shall be of such quality as to conform with the Tentative Specifications for Gray Iron Castings, A.S.T.M. Designation A48-32T, of the American Society for Testing Materials.

Cast steel used in buildings and/or structures shall be of such quality as to conform with the Standard Specifications for Steel Castings, A.S.T.M. Designation A27-24, of the American Society for Testing Materials.

All structural steel 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 shall be used in any building or structure which does not comply with the above requirements. All steel tests shall be made by competent testing laboratories and at the expense of the owner.

The computations 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 every structural frame 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.

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>Material</th>
<th>Allowable Unit Stresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolled Steel, on net section</td>
<td>18,000</td>
</tr>
<tr>
<td>Cast Steel, on net section</td>
<td>16,000</td>
</tr>
<tr>
<td>Cast Iron, on net section</td>
<td>Not Allowable</td>
</tr>
</tbody>
</table>
(b) Compression, on short lengths or where lateral deflection is prevented:

- Rolled Steel: 18,000
- Cast Steel: 16,000
- Cast Iron: 10,000

On gross section of structural steel columns:

\[
P = \frac{18,000}{1 + \frac{1}{18,000r^2}}
\]

with a maximum of 15,000

For main compression members, the ratio \( l/r \) shall not exceed one hundred and twenty (120) and for bracing, struts and similar members two hundred (200).

On gross section of steel pipe columns, with square or fixed ends:

\[P = 11,000 - 35 \frac{l}{r}\]

with a minimum gross diameter of five (5) inches.

On cast iron columns, with square or fixed ends:

\[P = 9,000 - 40 \frac{l}{r}\]

with a minimum gross diameter of six (6) inches and with the ratio \( l/r \) never in excess of seventy (70).

In the foregoing formulae “\( P \)” 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. On extreme fibres of rolled shapes, and built-up sections, net section, if lateral deflection is prevented, 18,000. When the unsupported length “\( L \)” exceeds fifteen (15) times “\( b \),” the width of the compression flange, the stress in pounds per square inch in the latter shall not exceed “\( F \)” in the following formula:

\[
F = \frac{20,000}{1 + \frac{L^2}{2,000b^2}}
\]

The laterally unsupported length of beams and girders shall in no case exceed forty (40) times “\( b \)” the width of the compression flange.

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 40\( b \).

On extreme fibers of pins, when the forces are assumed as acting at the center of gravity of the pieces: 27,000
(d) Shearing. On pins .......................... 13,500
    On power-driven rivets ................. 13,500
    On turned bolts in reamed holes with
      a clearance of not more than one-fiftieth
      (1/50) of an inch ................... 13,500
    On hand-driven rivets ................. 10,000
    On unfinished bolts ................... 10,000

On the gross area of the webs of beams and girders, where “h,”
the height between flanges in inches, is not more than sixty (60)
times “t,” the thickness of the web in inches .................. 12,000

On the gross area of the webs of beams and girders if the web
is not stiffened where “h,” the height between flanges in inches,
is more than sixty (60) times “t,” the thickness of the web, the
maximum shear per square inch, S/A shall not exceed

$$\frac{18,000}{1 + \frac{h^2}{7,200t^2}}$$

in which “S” is the total shear, and “A” is gross area of web in
square inches.

(e) Bearing

<table>
<thead>
<tr>
<th></th>
<th>Double</th>
<th>Single</th>
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<tbody>
<tr>
<td>Shear</td>
<td>30,000</td>
<td>24,000</td>
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<td>On pins</td>
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<td>On power-driven rivets</td>
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<td>On turned bolts in reamed holes</td>
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<td>On hand-driven rivets</td>
<td>20,000</td>
<td>16,000</td>
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<td>On unfinished bolts</td>
<td>20,000</td>
<td>16,000</td>
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<tr>
<td>On ends of web stiffeners</td>
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<td>See Section 2704 (e)</td>
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</tbody>
</table>

(f) Combined Stresses: For combined stresses due to wind
and other loads, the permissible working stress may be increased
thirty-three and one-third (33 1/3) per cent, provided the section
thus found is not less than that required by the dead and live
loads alone.

Members subject to both direct and bending stresses shall be
so proportioned that the greatest combined stresses shall not ex-
ceed 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 fifty (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 Only. For members carrying
wind stresses only, the permissible working stresses may be in-
creased thirty-three and one-third (33 1/3) per cent.
(h) The load in pounds per linear inch on expansion rollers shall not exceed six hundred (600) times the diameter of the roller in inches.

**Sec. 2703.** (a) 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 ten (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.

(b) Where a structural member is directly connected or framed to the flange of another member by means of a web connection, the lever arm shall be taken as the distance in the direction of bending, from the neutral axis to the flange connection plus one-half (½) inch; and in all other cases of an eccentric load or force, the lever arm shall be taken as the distance in the direction of bending from the neutral axis to the center line or center of bearing of the load or force.

(c) Where an eccentric load or force acts parallel with the axis of a compression member, the stresses due to the eccentric action may be provided for by adding to any direct load or force on the compression member an amount equal to M.K. as given in the following formula, and by then designing the compression member so that the maximum unit stress therein will not exceed that specified in Section 2702.

\[
\text{M.K. equals } A \left( \frac{P \times x}{S} \right);
\]

in which formula “M.K.” equals an equivalent concentric load or force for any given eccentric load or force; “A” equals the cross sectional area of the compression member; “P” equals the amount of the eccentric load or force in pounds; “x” equals the distance from the neutral axis of the compression member to the line of action of the eccentric load or force; and “S” equals the section modulus of the compression member in the direction of the bending.

**Sec. 2704.** (a) Rolled beams shall be proportioned by the moment of inertia of their net section. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in Section 2702 as determined by the moment of inertia of the net section.

When two (2) 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) Built-up Girders. Plate, box and similar structural steel girders shall be proportioned by the moment of inertia of their net sections, or shall be proportioned by assuming that one-eighth (¼) of the gross area of the web or webs act as a part
of the flanges thereof, in the event that every joint in the web is spliced so as to transmit the stress therein.

(c) Plate girder webs shall have a thickness of not less than one one-hundred-sixtieth (1/160) of the unsupported distance between the flanges.

(d) Web splices shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(e) Stiffeners shall be provided on both sides of the webs of built-up girders over bearings and at points of concentrated loading. Intermediate stiffeners shall be provided on both sides of the webs wherever the thickness of the web is less than one-sixtieth (1/60) of the unsupported distance between flanges and shall not be spaced farther apart in inches than the value of “S” in the following formula; and shall not exceed six (6) feet in any case:

\[ S = 85t \sqrt{\frac{18000A}{V}} \]

in which formula “A” equals the gross area of the web in inches; “V” equals the total vertical shear on the web; “t” equals the thickness of the web in inches; and “S” equals the clear distance between stiffeners in inches; provided, however, that stiffeners need not be provided on both sides of webs in case other adequate provision is made against buckling, torsion, and for the transmission of all stresses.

Stiffeners over bearings and at points of concentrated loading shall not be crimped, but shall be milled and fitted for bearing against the flange angles nearest the bearing load and shall be designed to distribute the force from the reactions and concentrated loads into the web. The bearing area of the ends of stiffeners shall be taken as the outstanding portion of the leg of the stiffener, excluding any chamfered portion thereof over the fillets of flange angles, and the bearing value of such portion may be taken at not to exceed twenty-four thousand (24,000) pounds per square inch; provided, however, that where fillers are provided between stiffeners and the web, equal in thickness to the radius of the fillet plus the thickness of the flange angle, the full area of the end of the stiffener may be used, but the bearing value shall not be taken at more than eighteen thousand (18,000) pounds per square inch.

Intermediate stiffeners need not bear against flange angles, and when girders are completely encased in concrete such stiffeners may be cut off at the edge of the fillet of the flange angle.

(f) Crane runway girders and the supporting framework shall be proportioned to resist a horizontal force equal to twenty (20) per cent of the maximum wheel loads.

(g) Rivets connecting the flanges to the web at points of direct load on the flange between stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.
Sections 2704-2708

(h) The flange plates of all girders, unless stiffened, shall be limited in width so as not to extend beyond the outer line of rivets connecting them to the flange angles more than six (6) inches or twenty (20) times the thickness of the thinnest outside plate connected.

(i) Beams, channels, girders and other members acting as skewbacks for floor arches shall be of ample strength and rigidity to withstand the lateral thrusts in addition to all other loads they may sustain.

Thickness of Materials

Sec. 2705. The minimum thickness of metal in structural steel shapes shall be one-fourth (¼) inch at every point and shall not be less than one-half (½) inch 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 by the above thickness requirements.

Compression Splices

Sec. 2706. The ends and abutting joints of all compression members shall be fully spliced, or where laterally supported and where no reversal of stresses is possible, may be faced to a plain surface parallel to the surfaces against which they bear and normal to the line of stress, and be spliced sufficiently to hold the connected members accurately and firmly in place.

Net Sections

Sec. 2707. In calculating tension members, the net section shall be used, and in deducting rivet holes they shall be assumed to be at least one-eighth (⅛) of an inch greater in diameter than the nominal diameter of the rivets.

Pin-connected tension members shall have the section through the pinhole at least twenty-five (25) per cent in excess of the net section of the member, and a net section back of the pin hole equal to at least seventy-five (75) per cent of that required through the pin hole.

Connections

Sec. 2708. Connections carrying calculated stresses, except for lacing, sag bars or angles or hand rails, shall not have less than two (2) rivets.

Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

Rivets at the ends of any member transmitting the stresses into that member should have their centers of gravity in 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.

When a beam or girder is connected to another member in such a manner that such beam or girder acts as a continuous
or fixed end beam, proper provision shall be made for the bending moments at such a connection.

Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased; tight-fitting fillers shall be preferred.

All joints in riveted work, whether in tension or compression, shall be so spliced as to properly transmit all stresses, except as provided in Section 2706.

The minimum distance between center of the rivets and edge of plates or angles shall be one and one-half (1½) times the diameter of rivet.

The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed sixteen (16) times the thinnest outside plate or shape, or twenty (20) times the thinnest enclosed plate or shape with a maximum of twelve (12) inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed thirty (30) times the thinnest plate or shape. For angles in built sections with two (2) gauge lines, with rivets staggered, the maximum pitch in the line of stress in each gauge line shall not exceed twenty-four (24) times the thinnest plate with a maximum of eighteen (18) inches.

Sec. 2709. In proportioning rivets, the nominal diameter of the rivet shall be used.

Rivets carrying calculated stresses, and whose grip exceeds five (5) diameters, shall have their number increased one (1) per cent for each additional one-tenth (1/10) inch in the rivet grip. Special care shall be used in heating and driving such rivets.

Rivets or their approved equivalent shall be used for the connection of all members producing direct shear.

Finished bolts in reamed holes may be used in shop or field work, in place of rivets. The finished shank shall be long enough to provide full bearing, and washers used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop of 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, and in other places where not subject to direct shear.

Sec. 2710. (a) In specific cases when approved by the Chief Building Inspector and when designed and supervised by a qualified architect or structural engineer, 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 working unit stresses given in the following table:

**Allowable Unit Working Stresses for Static Loads**

Tension in weld metal (butt welds) . . . . 13,000 lbs. per sq. in.
Sections 2710-2711

Shear in weld metal (fillet welds) ....... 11,300 lbs. per sq. in.
Compression in weld metal .......... 15,000 lbs. per sq. in.

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.

(b) The same proportional increase in the above working stresses shall be allowed for the various given conditions as specified in parts (f) and (g) in Section 2702.

(c) The electrode wire shall conform to the American Welding Society Specifications E no. 1-A or E no. 1-B as published December, 1921, in the American Welding Society Bulletin No. 2.

All portions of the members at the point of welding shall be completely freed from rust, paint and other foreign matter by brushing the surfaces with an iron brush, by chipping or by hammering.

(d) The Building Inspector shall require the welding operator to furnish evidence of his experience and competence in structural arc welding, and may require the welder to make sample butt welds. Such sample welds must show an average tensile strength of forty-five thousand (45,000) pounds per square inch, with no one sample developing a tensile strength of less than forty thousand (40,000) pounds per square inch.

(e) Where electric spot or resistance welding is used, the portion of the members to be welded shall be thoroughly cleaned of rust, scale or other foreign matter by pickling in a suitable acid before welding.


Construction Details

Sec. 2711. (a) Trusses preferably shall be riveted structures, and only when there are good reasons to justify, such as where riveted field connections become unwieldy, may they be designed as pin-connected structures.

(b) All joints in riveted work, whether in tension or compression, shall be spliced so as to properly transmit the stresses.

(c) Bracing shall be sufficient to safely withstand wind and other lateral forces when the building is in the process of erection as well as after completion.

(d) When two or more plates are in contact, they shall be stitch riveted with rivets not more than twelve (12) inches apart in either direction.

(e) 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.
(f) 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 group by a strap or through the carrying members with not less than two (2) bolts or rivets each not less than five-eighths (\(5/8\)) of an inch in diameter in the end of each connecting member.

(g) 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 of two or more pieces not connected by web or cover plates shall have their open sides provided with lattice bars or tie plates, and have tie plates as near each end as practicable, and at intermediate points where the lattice is interrupted. In main members the end tie plates shall have a length not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones not less than half this distance, and their thickness shall not be less than one-fiftieth (1/50) of the same distance, and the rivet pitch shall not be more than four (4) diameters. The latticeing of compression members shall be proportioned to resist a shearing stress at least equal to two (2) per cent of the direct stress in the member.

(b) The minimum thickness for lattice bars shall be for single lattice one-fortieth (1/40) and for double lattice one-sixtieth (1/60) of the distance between end rivets, and not less than one-fourth (\(\frac{1}{4}\)) inch in thickness.

(c) The inclination of all lattice bars to the axis of the member shall not be less than forty-five (45) degrees, and when the distance between the rivet lines in the flanges is more than fifteen (15) inches, the lattice shall be doubled.

(d) Lattice bars shall be so spaced that the ratio \(l/r\) of the flange included between their connections shall not be over three-fourths (\(\frac{3}{4}\)) of that of the member as a whole, where \(l\) and \(r\) are as defined in Sections 2702 (b).

Sec. 2713. (a) Pins shall be long enough to insure a full bearing of all parts connected upon the turned-down body of the pin.

(b) Members packed on pins shall be held against lateral movement.

(c) 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. (a) Steel joists may be rolled structural steel sections, sections built up of rolled structural sections, or shapes made from strip or sheet steel securely spot-welded together so as to form a cohesive structural unit, all of which shall have the
general shape or contour of an I-beam; or such steel joist may be of a determinate truss design built up of rolled structural steel sections effectively fusion welded together as specified in part (f) of this section.

(b) Steel joists shall be considered as secondary members of the structural steel frame. They shall be designed to carry all dead, live and other loads to which they may be subjected during the erection and after the completion of the structure. Such secondary members shall not be considered as affecting the vertical rigidity of the framework, but they shall be designed and considered as carrying horizontal forces to such parts of the frame as are designed to carry these horizontal forces to the foundation.

(c) Stresses in steel joists shall not exceed those specified in Section 2702, and no joist under its calculated load shall have a deflection exceeding one three-hundred-sixtieth (1/360) of the span. 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. Permanent bridging shall be installed sufficient 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 equivalent stiffness. Any row of bridging shall be capable of transferring five hundred (500) pounds from each joist to the adjoining joists. The actual spacing of the joists center to center shall be determined by their capacity to sustain the loads which they carry and the allowable load carrying capacity of the floor structure between the members.

(d) When used in buildings of Type I Construction, steel joists shall be connected to the supporting beams and/or girders by fusion welding, riveting, bolting or rigidly connecting. Fusion welds shall be made on both sides of each bearing, shall be not less than one (1) inch in length measured from the starting end to the center of the finishing crater, and shall have a minimum bead of one-fourth (¼) inch. Riveting and bolting shall comply with the requirements of Section 2709. When steel joists are supported on masonry or reinforced concrete, the end bearing shall be not less than four (4) inches in length and the ends of such joists shall be provided with approved joist anchors thoroughly embedded in the supporting masonry or reinforced concrete placed at not to exceed six (6) feet center to center. Bearing plates securely welded, bolted or riveted to the joists shall be provided when required by the design of the joist. In buildings over eight (8) stories in height in which steel joisted floor construction is used, all connections between steel joists and primary members of the structure shall be approved standard connection angle and power driven rivets, or unfinished bolts as provided for light steel beams in the handbook, Steel Construction, of the American Institute of Steel Construction, Inc., dated December, 1928.
(e) Strip or sheet steel used to produce strip steel joists shall in no case be less than seventy-two thousandths (0.072) of an inch in thickness. The flange width of such joist shall not exceed one-half (½) their depth.

(f) Trussed steel joists 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 joints of all trussed steel joists shall be made by connecting the members directly to one another by fusion welds or by rivets of sufficient capacity to develop the ultimate strength of the smallest connected member. When welds are used, each connection of member to member shall be made with not less than two (2) welds, and each weld shall be not less in length measured from starting end to the center of the finishing crater than twice the diameter of the smallest member connected, nor less in cross-sectional area than one-fourth (¼) of the cross-sectional area of the smallest member connected. Welds shall be located symmetrically on both sides of all connected members so as to eliminate eccentricity at joints. When sections other than round bars are used, the length and cross-sectional area of the welds shall be the same as those required for round bars of equivalent area.

(g) Whenever deemed necessary by the Building Inspector, any welded connections or welded joints shall be tested to not less than twice the designed load by the manufacturer or user, and such load shall be sustained without any signs of failure. Should any signs of failure develop, the joist or joists shall be rejected and removed immediately from the premises.

Sec. 2715. Proper provision shall be made for expansion and contraction.

Sec. 2716. (a) All workmanship shall be equal to the best practice in modern structural shops.

(b) Drifting to enlarge unfair holes shall not be permitted.

(c) The several pieces forming built-up sections shall be straight and fit close together; and finished members shall be free from twists, bend or open joints.

(d) Rolled sections shall not be heated in any manner which will impair their strength or quality.

(e) All steel castings shall be properly annealed.

(f) Material may be punched one-sixteenth (1/16) inch 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 (¼) inch. When the metal is thicker than the diameter of the rivet, plus one-eighth (¼) inch, the holes shall be drilled, or sub-punched and reamed.

(g) Rivets are to be driven hot and, wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform in size throughout the work for the same size rivet, full,
neatly finished and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(h) Compression joints depending upon contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight.

(i) Gas cutting may be done under the following conditions:

(1) The contractor shall be required to satisfy the Building Inspector as to his ability to produce satisfactory gas cuts.

(2) Gas cut edges shall be regular in contour.

(3) Gas cutting may be used in the preparation of base metal parts for welding, provided the edges so cut are thoroughly cleaned after cutting so as to expose clean metal.

(4) Gas cutting shall not be permitted to replace the milling of surfaces specified elsewhere in this Code.

(5) Gas cutting shall not be permitted on any member while it is carrying stress. This restriction shall not apply to detail cutting for the correction of minor fabricating errors, where the removal of metal resulting from such gas cutting would not reduce the required strength of the member that is to be cut.

Painting

Sec. 2717. (a) Parts not in contact, but inaccessible after assembling, shall be properly protected by paint.

(b) All steel work, except where entirely encased in concrete or masonry, shall be thoroughly cleaned and given one coat of acceptable metal protection well worked into the joints and open spaces.

(c) Machine finished surfaces shall be protected against corrosion.

Erection

Sec. 2718. (a) The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as required for safety or deemed necessary by the Building Inspector.

(b) As erection progresses, the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(c) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of the resulting stresses.

(d) No riveting or welding shall be done until the structure has been properly aligned.

(e) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.
(f) In the setting or erecting of steel work the individual pieces shall be considered plumb or level when the error does not exceed 1 to 500. For exterior columns and columns adjacent to elevator shafts of multiple story buildings, the error shall not exceed 1 to 1000 of the total height of the column.
PART VII.

Detailed Regulations

CHAPTER 28 — EXCAVATIONS, FOOTINGS AND FOUNDATIONS

Excavations

Section 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 (1) foot 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. No excavation shall be abandoned in such condition as to endanger life or property or in such condition as to permit an accumulation of stagnant water, rubbish, filth, or in any way to create a nuisance. When ordered by the Chief Building Inspector, such excavation shall be filled level with the adjoining grade. In case the owner or agent cannot be located, the Chief Building Inspector may cause such excavation to be filled and the cost thereof shall be assessed against the property as taxes.

Any person causing an excavation to be made on his own property, to a depth of ten feet six inches (10'6") or less, below the curb immediately adjoining such wall or structure, 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 ten feet six inches (10'6") in depth. Before commencing the excavation, the owner shall notify in writing the owners of adjoining buildings not less than ten (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 causing an excavation to be made exceeding ten feet six inches (10'6") in depth below the curb immediately adjoining 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 ten feet six inches (10'6") below the curb at his own expense. The owner of the adjoining buildings shall extend the foundations of his building to a depth of ten feet six inches (10'6") below grade at his own expense as provided in the preceding paragraph. All the underpinning shall be carried on in one operation.
Sec. 2802. Footings and foundations, unless specifically provided, shall be constructed of masonry or reinforced concrete, and shall be not less than eighteen (18) inches below the natural grade and three (3) feet below the finished grade, except that minor structures such as private garages, porches, frame dwellings, etc., shall have footings not less than eighteen (18) inches below finished grade. Solid masonry units used in foundation walls and footings shall be laid up in lime cement mortar. Hollow 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 2306.

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.

Unless designed to obtain uniform soil bearing, the minimum footing size shall be twelve inches (12") wider than the wall supported, and the minimum thickness shall be six inches (6").

Rock ............. Not more than twenty per cent (20%) 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 (2) square feet 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 forty-eight (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. Footings shall not be placed upon filled ground unless such fill is of dirt and free from ashes, cans, rubbish or other unsuitable materials, and has been in place a sufficient length of time to properly settle. No footing shall be placed upon filled ground except upon the specific approval of the Chief Building Inspector.
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 eccentricaly.

(b) Wood Piles. Wood piles shall be of oak, fir, cedar or other approved wood which is sound and reasonably straight. The diameter of wood piles at the point shall be not less than six (6) inches, and at the butt shall be not less than ten (10) inches for piles twenty-five (25) feet or less in length, and shall be not less than twelve (12) inches at the butt for piles more than twenty-five (25) feet in length. All wood piles shall be cut off level and below low water level or below permanent ground water level, and any capping or ranging timbers shall be so placed that the tops of such timbers shall be below the level required for pile cut-off. Wood piles shall be spaced apart not less than two feet six inches (2'6") center to center.

The allowable load on a wood pile shall in no case exceed twenty-five (25) tons, and shall in no case exceed the values determined by the following formulas:

For piles driven by drop hammer

\[ L = 2wh/s + 1 \]  \hspace{1cm} (1)

For piles driven by steam hammer

\[ L = 2wh/s + 0.1 \]  \hspace{1cm} (2)

Where "L" equals the safe load in tons, "w" equals the weight of the hammer in tons, "h" equals the height of fall or stroke of hammer in feet, "s" equals the average penetration in inches under the last five (5) blows.

(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 twenty (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.

Exception: When such pile is cast in a tight steel tube not less than five-sixteenths (5/16) inch thick, the allowable working stress shall be not more than twenty-five (25) per cent of the ultimate compressive strength of the concrete plus an allowable stress of not to exceed six thousand (6,000) pounds per square inch for the steel tube, not including in such latter computation the outer one-sixteenth (1/16) inch of the steel shell.

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 thirty (30) times the average diameter, except that when cast in steel tubes with a thickness of not less than five
sixteenths (5/16) inch the length of such piles shall be not greater than forty (40) times the average diameter. The diameter of concrete-filled steel tubes shall be not less than twelve (12) inches, and such piles shall be driven to a full bearing on rock. The diameter of other piles cast in place shall be not less than eight (8) inches at the point, and shall have an average diameter of not less than eleven (11) inches.

Pre-cast 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. Pre-cast concrete piles shall have a diameter at the point of not less than eight (8) inches, and an average diameter of not less than twelve (12) inches. The length of such piles when driven to rock shall be limited to twenty (20) times the average diameter, and shall not exceed forty (40) times the average diameter in any other case.

The allowable load on a concrete pile when driven by a drop hammer or by a steam hammer shall not exceed the values determined by Formulas No. 1 and No. 2, respectively, of this section.

(d) The safe bearing power of any pile shall be determined by a load test whenever deemed necessary and ordered by the Building Inspector. The test pile or piles shall be loaded to twice the design load and the resultant settlement shall be measured until during a forty-eight (48) hour period no appreciable additional settlement takes place. The total settlement in inches shall not exceed one one-hundredth (1/100) times the test load in tons where the foundations carry a structure continuous over two or more spans nor twice this amount where the foundation carries non-continuous spans.

Sec. 2804. The owner of any property may occupy a space under the sidewalk for the purpose of vaults, areaways or similar uses, only upon the approval of the Manager of Improvements and Parks. Such excavations shall be limited to the space between building line and a line five (5) feet from and parallel to the exterior line of the curb. In no case shall an areaway vault or other subsurface excavation be built under an alley or entrance to the alley from the street.

All such areaways, vaults and subsurface excavations shall be enclosed by walls of concrete, brick or stone, laid in cement mortar. The thickness of such walls shall be such as to resist all lateral earth and/or water pressure to which they may be subjected, together with any surcharge loads, but in no case shall such walls be less than twelve (12) inches if of brick or concrete, or less than sixteen (16) inches if of stone.

All such areaways, vaults and subsurface excavations shall be covered with reinforced concrete slab, carried on structural steel or reinforced concrete beams which shall be fireproofed with not less than three (3) hour fire-resistant protection. Such sidewalk shall be capable of sustaining a distributed live load of not less than two hundred fifty (250) pounds to the square
Section 2804

foot, and shall be flush with the adjoining sidewalks. No glass or other form of lights shall be permitted in the sidewalk slab.

Coal holes or ash hoists shall be limited to twenty-four (24) inches in diameter and shall be provided with a substantial metal frame and cover with non-slip surface. Sidewalk elevators may be installed only upon the approval of the Manager of Improvements and Parks, shall not extend more than five (5) feet from the building line, and shall be provided with water channel, non-slip covers and automatic safety railings when open.

All such areaways, vaults and subsurface excavations shall be made by the property owner, subject to the right of the City and County of Denver to the use of said ground whenever the same shall be needed by the City and County for public use, and said space shall be surrendered to the City and County of Denver within ten days after demand for same is made in writing by the City and County of Denver to the property owner.

Any property owner desiring to construct any such areaway, vault or subsurface excavation as provided herein shall give to the City and County of Denver an indemnity bond in the sum of five thousand ($5,000) dollars to indemnify the City and County of Denver against any damages which may occur to persons or property by reason of the construction or maintenance of such areaway, vault or excavation. Said bond shall be approved by and filed with the Manager of Improvements and Parks of the City and County of Denver.

The fee for any areaways, vaults or subsurface excavations shall be one dollar ($1.00) per square foot of area measured inside of the wall of such excavation.
CHAPTER 29 — WALLS AND PARTITIONS

ARTICLE I.

Solid Masonry Walls

Sec. 2901. Solid masonry walls shall be supported at right angles to the wall face at intervals not exceeding eighteen (18) times the wall thickness in the top story of buildings, or twenty (20) times the wall thickness elsewhere, except as specifically provided in Section 2903. Such lateral support may be obtained by masonry cross walls, piers, off-sets or buttresses when the limiting distance is measured horizontally or by floors or roof when the limiting distance is measured vertically. Bonding and anchoring of horizontal and vertical framing members to the wall shall be provided sufficient to resist the assumed wind force acting in an outward direction. Floors and roofs shall be so constructed and anchored to such walls as to form a continuous and sufficient anchorage across the building from wall to wall. Anchoring of wood framing to masonry walls shall be as specified in Sections 2506, 2507 and 2508. Piers or buttresses relied upon for lateral support shall have sufficient strength and stability to transfer the wind force acting in either direction to the ground. When walls are dependent upon floors for their lateral support, provision shall be made in the building to transfer the lateral forces resisted by all floors to the ground.

Corbels may be built into masonry walls to furnish bearing for joists or other structural parts, but such corbels shall not exceed one-half (½) the total thickness of the wall, and the projection for each course in such corbel shall not exceed one (1) inch.

Sec. 2902. The maximum allowable compressive stresses in solid masonry due to combined live, dead and other loads shall not exceed those specified in Sections 2409, 2410, and 2411.

Sec. 2903. (a) The thickness of solid masonry walls shall be sufficient at all points to keep the combined stresses due to live, dead and other loads for which the building is designed within the limits specified in Sections 2409, 2410 and 2411.

The minimum thickness in inches of solid masonry exterior bearing or party walls, except panel and enclosure walls and walls of dwellings, shall be not less in thickness than specified in the following table No. 1; provided, that in no case shall the uppermost thirty-five (35) feet of such walls be less than twelve (12) inches in thickness, and each successive thirty-five (35) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness.
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**Exceptions:** (1) Exterior walls for Group I buildings shall be as specified in part (c) of this section.

(2) Solid masonry exterior bearing or party walls constructed as specified in part (d) of this section may be of lesser thickness.

(b) Exterior non-bearing walls and interior bearing walls of solid masonry, except panel and enclosure walls and walls of dwellings, shall be not less in thickness than specified in the following Table No. 2; provided, that in no case shall the uppermost fifty (50) feet of such wall be less than twelve (12) inches thick and that each successive fifty (50) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness, and provided that in buildings 3 stories or less in height the uppermost fifteen (15) feet shall be not less than 8 inches thick.

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**Exceptions:** Solid masonry non-bearing walls for Group I buildings not over three (3) stories high shall be as specified in part (e) of this Section.

(c) Solid masonry walls, either bearing or non-bearing, for Group I buildings not over three (3) stories in height shall be not less in thickness than specified in Table No. 3, provided that in gable construction the maximum height of eight (8) inch wall to the peak of the gable, shall not exceed thirty (30) feet.

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(d) Where solid masonry bearing or non-bearing walls other than fire walls or fire division walls are strengthened laterally. by masonry buttresses or cross-walls the wall thicknesses specified in parts (a), (b) and (c) of this Section may be reduced between buttresses by one-half ($\frac{1}{2}$) of the projecting thickness of the buttress, except that no part of such buttressed wall shall be less than eight (8) inches thick. Buttresses shall be not less than one-eighth ($\frac{1}{8}$) the clear distance between them in width and their clear distance apart shall not exceed twenty-four (24) times the reduced wall thickness. Principal girders and trusses shall rest on the buttresses.

In one-story buildings having walls not over sixteen (16) feet high to the under side of girders or trusses and pilastered as above provided for an eight (8) inch wall between pilasters, such walls may be considered as bearing walls for roof loads and parapet walls only.

Sec. 2904. In all solid unit masonry walls at least every sixth course on both sides of the wall shall be a header course or there shall be at least one full header in every seventy-two (72) square inches of each wall surface. In walls more than twelve (12) inches thick, the inner joints of header courses shall be covered with another header course which shall break joints with the course below.

Where running bond is used, every fourth course on each face shall be bonded into the backing by cutting the face brick course and using diagonal headers behind it or by using split bricks.

Sec. 2905. The unsupported height of isolated piers shall not exceed ten (10) times their least dimension unless properly reinforced. Piers of solid unit masonry shall be laid up in cement mortar.

Walls in which the openings are of such an extent as to leave narrow sections exceeding ten (10) feet in height and two (2) feet or less in width, shall have such narrow sections computed and constructed as for isolated piers.

Sec. 2906. There shall be no chases cut into eight (8) inch walls or within the required area of any pier, and no chase in any wall or pier shall be deeper than one-third ($\frac{1}{3}$) the wall thickness. No horizontal chase shall exceed four (4) feet in length nor shall the horizontal projection of any diagonal chase exceed four (4) feet unless suitable structural support is provided.

Recesses for stairways or elevators may be made in walls, but in no case shall the walls at such points be less than the required thickness of walls of the fourth story above the ground floor unless reinforced by additional piers, by steel or reinforced concrete girders or steel or reinforced concrete columns and girders, securely anchored to the walls on each side of such recesses. Recesses for alcoves and similar purposes shall have not less than
eight (8) inches of material at the back. Such recesses shall be not more than eight (8) feet in width and shall be arched over or spanned with lintels.

The aggregate area of recesses and chases in the wall of any one story shall not exceed one-fourth (¼) the whole area of the face of the wall in that story.

No chases or recesses shall be permitted in fire or fire division walls that will reduce the thickness below the minimum specified in this Code.

Openings for doors and windows shall have well buttressed arches or lintels of masonry, or of metal, with bearing at each end of not less than four (4) inches on the wall. On the inside of openings less than four (4) feet wide, in which the thickness of arches and lintels is less than that of the wall supported, timber may be used, which will rest at each end not more than two (2) inches on the wall and be chamfered or cut to serve as arch centers.

The maximum percentage of openings in the horizontal cross section of any wall shall not exceed fifty (50) per cent unless the wall is increased four (4) inches in thickness or such portions of the wall between openings shall be as required for piers in Section 2905.

ARTICLE II.
Walls of Hollow Tile, Concrete Block or Tile, Hollow Walls of Brick and Hollow Monolithic Plain Concrete Walls

Sec. 2907. Walls of hollow clay tile, of concrete block or tile, hollow walls of solid masonry units and hollow monolithic plain concrete walls shall be supported at right angles to the face at intervals not exceeding sixteen (16) times the wall thickness in top stories or eighteen (18) times the wall thickness elsewhere.

The general provisions relating to solid masonry walls, as specified in Section 2901, shall apply to hollow walls as included in this Section; provided, that corbeling from hollow walls shall not be permitted except when such corbels are constructed of solid masonry or reinforced concrete.

Where air spaces are built into the wall the area of such air spaces combined with the area of the cellular space in the tile used in the construction of the wall shall not exceed forty-five (45) per cent of the gross cross-sectional area of the wall.

No combination solid masonry and hollow unit wall shall be allowed less than eight (8) inches nominal in total thickness.

Sec. 2908. The maximum allowable compressive stresses in walls of hollow tile, concrete block or tile, hollow walls of brick or hollow monolithic plain concrete walls due to combined live, dead and other loads shall not exceed those specified in Sections 2410 and 2411.
Sec. 2909. Exterior, bearing, and party walls of hollow clay tile and concrete block or tile, hollow walls of solid masonry units and hollow monolithic concrete walls shall be not less in thickness in inches than as specified in the following Table No. 4; provided, that in no case shall the uppermost twenty-five (25) feet of such walls be less than twelve (12) inches in thickness, and each successive twenty-five (25) feet or fraction thereof measured downward from the top shall be increased not less than four (4) inches in thickness.

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Except that walls of Grade A hollow clay tile or Grade A or Grade A Special Hollow concrete block or tile, as specified in Sections 2406 and 2408, may be of the same thickness as solid masonry walls when used above grade and not exceeding two (2) stories in height, and such walls shall be laid in lime cement mortar proportioned as specified in Section 2409.

One-story private garages and one-story residences may have bearing and non-bearing walls of hollow tile, concrete block or tile, hollow walls of brick or hollow monolithic plain concrete walls eight (8) inches thick.

Sec. 2910. All hollow masonry units in a wall shall be solidly embedded in mortar and laid with a full masonry bond.

Where two (2) or more hollow units are used to make up the thickness of a wall the inner and outer courses shall be bonded every course by lapping at least one cell completely over the cell below.

Sec. 2911. Suitable provision shall be made in hollow walls or walls of hollow units at each line of floor joists or beams to shut off the spaces above from those below with combustible material.

Except where hollow units having at least three (3) cells in each eight (8) inches of thickness are laid with cells horizontal, joists, beams or other structural members shall not be seated directly on hollow walls or walls of hollow units, but shall be supported on at least three (3) courses of brick or equivalent concrete or metal plate of sufficient thickness and size to distribute the load to the webs and shells in such a manner as not to exceed the allowable unit stress.

Sec. 2912. Hollow tile or concrete block or tile, shall not be used for isolated piers. Wall sections greater in height than ten (10) times their least dimension and two (2) feet or less in width shall be considered as isolated piers.
Sec. 2913. Chases and recesses in walls of hollow tile, hollow concrete block or tile, or in hollow walls of brick shall not exceed in extent those permitted for solid masonry walls under the same conditions. Chases and recesses shall not be cut in walls of the above types, but may be built in. No chases or recesses shall be permitted in fire walls that will reduce the thickness below the minimum specified in this Code.

Reinforced tile lintels over openings made by filling the cells of the hollow units with cement mortar or concrete and inserting reinforcing bars may be used. Such lintels shall be computed as reinforced concrete beams on the basis of the enclosed concrete or mortar.

ARTICLE III.

Reinforced Concrete Walls

Sec. 2914. The general provisions of Chapter 26 of this Code shall apply to the design and construction of reinforced concrete walls provided that where any conflict may occur the provisions of this Article shall govern.

Reinforced concrete bearing walls shall have a thickness of not less than one-twenty-fifth (1/25) of the unsupported height; provided, that approved buttresses, built-in columns or piers designed to carry all the vertical loads may be used in lieu of greater thicknesses.

Reinforced concrete walls shall be supported at right angles to the wall face at intervals not exceeding twenty-two (22) times the wall thickness in the top story or twenty-five (25) times the wall thickness elsewhere. Such lateral support may be obtained by masonry or reinforced concrete cross walls, piers, buttresses or built-in columns when the limiting distance is measured horizontally or by floors or roof when the limiting distance is measured vertically. When floors or roofs used for support are on one side of the wall only they shall be of Type I construction. Bonding and anchoring shall be provided between the wall and the supports to resist the assumed wind force acting in an outward direction. Piers, buttresses or built-in columns relied upon for lateral support shall have sufficient strength and stability to transfer the wind force acting in either direction, to the ground. When walls are dependent upon floors for their lateral support, provision shall be made in the building to transfer the lateral forces resisted by all floors, to the ground. Anchoring of interior wood framing shall be as specified in Chapter 25.

Corbeling of reinforced concrete walls for the support of beams, girders and other members shall be fully provided for in the design of the wall at that point.

Sec. 2915. The maximum allowable compressive stress in reinforced concrete walls due to combined live, dead and other loads shall not exceed .0625 when the unsupported height of the wall is twenty-five (25) times the thickness, nor .125 when the un-
supported height of the wall is fifteen (15) times the thickness or less with allowable stresses proportional between those limits of height.

Sec. 2916. The thickness of reinforced concrete bearing walls shall be sufficient at all points to keep the combined stresses due to dead, live and/or other loads for which the building is designed, within the limits specified in Section 2915.

The minimum thickness of reinforced concrete bearing or party walls shall be not less than the thickness specified in Table No. 5.

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Such reinforced concrete walls shall have not less than one-tenth (1/10) of one (1) per cent of reinforcement in each direction, horizontally and vertically and the steel shall be distributed equally to each face of the wall with a maximum bar spacing of twenty-four (24) inches in each face.

Non-bearing walls of reinforced concrete, except panel walls, enclosure walls and walls of dwellings, complying with all of the provisions of this Section shall be of not less thickness than that specified in the following Table No. 6.

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All such reinforced concrete walls shall be laterally supported by a reinforced concrete or fire-proofed structural steel floor.
Sections 2916-2923

system when supported from one side only and may be supported by combustible floors when supported laterally from both sides.

Piers

Sec. 2917. The unsupported height of piers of reinforced concrete walls shall not exceed ten (10) times their least dimensions unless designed as reinforced concrete columns.

Walls in which the openings are of such an extent as to leave relatively narrow sections exceeding ten (10) times their least dimension in height shall be considered as piers.

Chases and Recesses

Sec. 2918. Chases and recesses shall be as permitted in solid masonry walls in Section 2906.

Openings for doors and windows shall have reinforced concrete lintels designed as specified in Chapter 26, or fire-proofed steel lintels as specified in Chapter 27.

ARTICLE IV.

Stone Walls

Quality of Material

Sec. 2919. Stone used in masonry wall construction shall be at least equal in strength to the minimum specified for plain concrete in Section 2405.

Working Stresses

Sec. 2920. The maximum allowable compressive stresses in rubble stonework due to combined live, dead and other loads shall not exceed those specified in Section 2410 and 2411.

Lateral Support and Thickness

Sec. 2921. Rubble stone walls shall be four (4) inches thicker than is required for solid brick walls of the same respective heights, but in no part less than sixteen (16) inches.

The minimum thickness for walls or piers of ashlar masonry properly bonded shall be the same as required for solid brick walls and piers under similar conditions.

The lateral support for stone walls shall conform to the same requirements specified for solid masonry walls in Section 2901.

Chases and Recesses

Sec. 2922. Bond stones extending through the wall and uniformly distributed shall be provided to the extent of not less than ten (10) per cent of the area, and there shall be at least one bond store for every eight (8) stretchers.

Bond

Sec. 2923. Chases and recesses in stone walls shall not exceed in extent those permitted for solid masonry walls under the same conditions.
ARTICLE V.
Veneered Walls

Sec. 2924. Materials used in the veneering and backing of veneered walls shall conform in all respects to the requirements prescribed for such materials in Part VI. Stone or cellular architectural terra cotta, ashlar, or other approved masonry material used for veneering shall be not less than three (3) inches thick. In stone ashlar each stone shall have a reasonable uniform thickness, but all stones need not necessarily be the same thickness.

Sec. 2925. The maximum allowable compressive stress on the backing of veneered walls, due to combined live and dead loads, shall not exceed those permitted for masonry of the type which forms such backing. In no case shall the veneering be considered a part of the wall in computing the strength of bearing walls, nor shall it be considered a part of the required thickness of the wall.

Sec. 2926. When walls are veneered with brick, terra cotta, stone or concrete trim stone the veneering shall be tied into the backing either by a header for every three hundred (300) square inches of wall surface, or by an approved system of non-corrodible metal wall ties, not less than 24 gauge spaced not farther apart than one (1) foot vertically and two (2) feet horizontally. Headers shall project at least three and three-quarters (3 ¾) inches into the backing, and anchors shall be of substantial pattern. When veneering is used special care shall be taken to fill all joints flush with mortar around wall openings.

Sec. 2927. Veneer on masonry walls, other than panel or enclosure walls, shall not exceed forty (40) feet in height above foundations, or other definite and secure supports.

ARTICLE VI.
Faced Walls

Sec. 2928. Material used in the backing and facing of faced walls shall conform in all respects to the requirements prescribed for such materials in Part VI.

Materials used for facing shall be not less than three and three-fourths (3 ¾) inches thick, and in no case less in thickness than one-eighth (⅛) the height of the unit, excepting that spandrel and other recessed panels, when approved, may be higher than eight (8) times their thickness, provided they are of the minimum thickness required in this paragraph.

Sec. 2929. The maximum allowable compressive stresses on faced walls due to combined live, dead and other loads shall not exceed those permitted for masonry of the type which forms
the backing. Where bonded to the backing as provided in Section 2931, the full cross section of the facing may be considered in computing bearing strength.

**Thicknessec. 2930.** Faced walls shall be not less in thickness than is required for masonry walls of the type which forms the backing. Where bonded to the backing as provided in Section 2931 the facing may be considered a part of the wall thickness.

**Bond Sec. 2931.** Solid unit masonry facing shall be bonded to walls of solid masonry or of hollow clay tile, or of concrete block or tile with at least one (1) header course in every six (6) courses, or there shall be at least one (1) full length header in every seventy-two (72) square inches of wall surface.

Stone ashlar facing shall have at least fifteen (15) per cent of the superficial area not less than three and three-fourths (3 3/4) inches thicker than the remainder of the facing to form bond stones, which shall be uniformly distributed throughout the wall.

When some stones in every alternate course are at least seven and one-half (7 1/2) inches thick, and at least twenty (20) per cent of the superficial area of the wall is constituted of such bond stone uniformly distributed, the ashlar facing may be counted as part of the wall thickness. Every stone not a bond stone and every projecting stone shall be securely anchored to the backing with substantial non-corrodible metal anchors three-sixteenths inch by one inch (3/16"x1") minimum into the masonry backing. There shall be at least one anchor to each stone and not less than two anchors for each stone more than two (2) feet in length or three (3) square feet in superficial area. Facing stones over twelve (12) square feet in area shall have at least one (1) anchor to each four (4) square feet of superficial face area.

**ARTICLE VII.**

**Fire Walls, Fire Division Walls and Parapet Walls**

**Sec. 2932.** Solid masonry and reinforced concrete fire walls shall be not less in thickness than required for exterior bearing walls of corresponding height and shall have a fire-resistive rating of not less than four hours. No eight (8) inch fire wall shall be broken into subsequent to building, for the insertion of structural members, and a separation of not less than four (4) inches of solid masonry shall be provided in all fire and party walls between the ends of combustible members which may enter such walls from opposite sides. Party walls which function also as fire walls shall conform to the requirements of fire walls. No chases or recesses shall be built into fire walls which will reduce the required minimum thickness.

**Sec. 2933.** Hollow masonry fire walls shall not be permitted as fire walls in Fire Zone No. 1 unless faced on each side thereof by not less than a four (4) inch veneer of brick work well bonded into the hollow wall construction.
Fire walls of hollow clay tile, concrete block or tile shall be not less than sixteen (16) inches thick in any part, except that for Groups H and I buildings they may be not less than twelve (12) inches thick. Hollow walls of solid masonry units used as fire walls shall be not less than twelve (12) inches thick. No fire walls of the above types shall be broken into, subsequent to erection for the insertion of structural members.

When combustible or unprotected steel building members frame into the hollow part of fire walls of thickness not greater than twelve (12) inches, they shall not project more than four (4) inches into the walls and shall be so spaced that the distance between embedded ends is not less than four (4) inches. The space above, below and between such members shall be filled solidly with burnt clay materials, mortar, concrete or equivalent fire-resistive materials, to a depth of not less than four (4) inches on all sides of the members.

All open cells in tile blocks occurring at wall ends shall be filled solid with concrete or cement mortar for at least a depth of six (6) inches, or closure tile set in the opposite direction shall be used.

Party walls which function as fire walls shall conform to the requirements of fire walls.

Sec. 2934. Fire division walls shall be not less in thickness than required for exterior bearing walls of corresponding height and materials, except in skeleton construction, where they shall be not less than required for panel walls. Fire division walls shall have a fire-resistive rating of not less than four hours.

Sec. 2935. Parapet walls shall be provided when required by Sections 1805, 1905 and 2005. All required parapet walls shall be not less than thirty (30") inches above the roof immediately adjacent thereto and when exceeding six (6) times their thickness the height shall be laterally supported. All parapets shall be coped with incombustible weatherproof materials.

ARTICLE VIII.

Partitions

Sec. 2936. All interior bearing walls, which do not extend through more than one (1) story, except fire walls, fire division walls and party walls, shall be considered as bearing partitions.

Solid masonry bearing partitions shall be not less than eight (8) inches thick and those of hollow clay tile, concrete block or tile or hollow walls of brick shall be not less in thickness than one-eighteenth (1/18) of the height between floors or floor beams but never less than eight (8) inches.

Sec. 2937. Non-bearing partitions of brick, hollow clay tile, concrete block or tile, plain concrete, hollow walls of brick or of gypsum block or other similar materials shall be built solidly.
pressure specified in Section 2307, from either direction. Panel and enclosure walls of reinforced gunite shall be as required for reinforced concrete walls.

Enclosure walls shall be securely fastened to the adjoining framing members.

When panel or enclosure walls are built monolithic with columns or bearing walls they may be reinforced to carry their own weight.

Panel and enclosure walls which serve as party walls, shall be of the same thickness as required for fire walls or fire division walls in Article 7 of this Chapter.

ARTICLE XI.
Miscellaneous Requirements

Sec. 2941. All walls shall be securely anchored and bonded at points where they intersect and where they abut or adjoin the frame of a skeleton framed building.

When walls are not built at the same time the perpendicular joint shall be regularly toothed with not less than four (4) inch offsets and the joint shall be provided with anchors not less than two inches by three-eighths inch (2"x3/8") metal with ends bent up not less than two (2) inches or with cross pins to form anchorage. Such anchors shall be not less than three (3) feet long extending eighteen (18) inches in from each side of the joint and spaced not more than three (3) feet apart in the direction of the height of the wall.

Reinforcing in concrete walls shall be extended not less than twenty-four (24) inches around all corners and wall intersections.

Where walls of concrete block or tile, or hollow walls of brick decrease in thickness, a course of solid masonry shall be interposed between the two sections unless the vertical shells or withes of the upper section register with those next below.

Anchors in walls of concrete block or tile, structural clay tile or hollow walls of brick shall be embedded in solid masonry.

Sec. 2942. An existing masonry wall may be used in the renewal or extension of the building providing it meets the requirements of this Code, and is structurally sound or can be made so by reasonable repairs. Existing walls which are structurally sound but which are of insufficient thickness when increased in height shall be strengthened by an addition of the same material not less than eight (8) inches in thickness laid up in Portland cement mortar, or the wall may be built out with gunite to the thickness required for a new wall of that height. Foundations and lateral supports shall be provided as required for newly constructed walls under similar conditions. All additions or linings shall be thoroughly bonded into existing masonry by toothings to assure combined action of wall and lining. Such toothings shall be distributed uniformly throughout the wall and shall aggregate in vertical cross-sectional area not less than fifteen (15) per cent of the total vertical area of the wall or lining.
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 and/or ramps are required to be enclosed such enclosures shall also include a complete passageway not less in width at any part than the required width of such stairway or ramp and such enclosure shall extend from the lowest point to the highest point required. All doors opening into such enclosures shall be of metal or shall be metal-clad doors as specified 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 (10) feet 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 two-hour fire-resistive construction as specified in Section 4302; except as specifically provided in Sections 1907 and 2007, where one-hour fire-resistive construction is specified. 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 (2) 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 (9) square feet 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 (3) inches from the metal lining or be protected by not less than three-eighths (3/8) of an inch of plaster or one-fourth (1/4) of an inch of asbestos or plaster-board. 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 (1/4) of an inch of asbestos and not less than twenty-six (26) 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 twenty-six (26) gauge.
CHAPTER 31 — FLOOR CONSTRUCTION

General

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.

Concrete Floors

Sec. 3102. Concrete slab floors shall be not less than two and one-half (2½) inches 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 (½) inch into the slab. Concrete joists and pan construction shall be solidly bridged for lateral support as follows: One row of concrete bridging the distance between lateral supports of the compression area of any joist shall not exceed twenty-four (24) times the least width of stem. Such bridging shall be the full depth and width of the joists.

Clay tile and joist construction shall have a minimum coverage of two (2) inches of concrete where such slabs carry calculated stress. Joist and pan construction shall have a minimum coverage of two and one-half (2½) inches over the pans.

Steel Joists

Sec. 3103. Steel joisted floors shall consist of steel joists as specified in Section 2714. When used in Type I or Type II buildings they shall have a reinforced concrete or gypsum slab not less than two and one-half (2½) inches 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.

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 and/or other loads between joists. Joists other than those consisting of a single rolled structural steel section with solid web, shall be securely cross-bridged at intervals not to exceed eight (8) feet along the joist length. The lateral unsupported length of the top chord of any steel joist
shall not exceed forty (40) times the width of the compression flange.

Sec. 3104. Mill constructed floors shall be not less than three (3) inches nominal splined or tongued and grooved plank covered with one (1) inch nominal flooring laid crosswise or diagonal. Top flooring shall not extend closer than one-half (½) inch to walls to allow for swelling in case the floor becomes wet. Such one-half (½) inch space shall be covered by a moulding fastened to the wall and so arranged that it will not obstruct the swelling or shrinking movement 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.

Laminated floors consisting of planks not less than four (4) inches nominal width set on edge close together and spiked at about eighteen (18) inch intervals shall have the joints broken in such manner that no continuous line will occur across the floor and such flooring shall not be spiked to the supporting girders. Joints shall be made only at the supports and at the quarter points with no more than two-thirds (2/3) of such joints away from support. Joints between the planks of a laminated floor shall be made and kept tight.

The framing, fire cutting and anchoring of supporting timbers shall comply with the requirements of Chapter 25.

Floor timbers shall be not less than six (6) inches nominal in either cross sectional dimension.

Sec. 3105. Wood joisted floors shall be framed and constructed and anchored to supporting wood stud or masonry walls as specified in Chapter 25. All wood joisted floors shall be covered with diagonal sheathing of boards not less than three-quarters of an inch (3/4") thick, on which the finish floor shall be laid, the total thickness of the sub-floor and finish floor to be not less than one and one-quarter (1\(\frac{1}{4}\)) inches. This provision shall not apply to floors over unexcavated and unusable areas, or to any building less than five hundred (500) square feet in area. Wood joisted floors need not be fire protected on the underside except where specifically required under Occupancy in Part III, Location in Part IV or Type of Construction in Part V.
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 as 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 (2½) inches nominal in thickness and except that concrete or gypsum roof slabs shall be not less than two (2) inches 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. Wood roof trusses shall not be used where exposed to weather. 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.

Roof Coverings

Sec. 3204. Roof coverings shall be required over all combustible roof construction and shall be of one of the classes specified in Section 4305 as they are specified under Occupancy in Part III, Location in Part IV and Types of Construction in Part V. (See also Section 104 (d.).)

The placing of new roofing conforming to this section over existing combustible roofing shall not be prohibited; provided the existing roofing is removed for a distance of four inches along all edges of the roof and replaced by strips of weatherproof material over which the new roofing shall extend.

Access to Roof Space

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 (3) stories or more in height.
Sec. 3206. (a) All buildings shall be provided with proper gutters and downspouts. The roof of all buildings shall be kept in good repair and all water drained therefrom so as not to flow upon or against any wall, along any foundation of any building or upon the property of other than the owner of the building.

(b) No waters shall be discharged from any conductor pipes upon any sidewalk, but shall be conducted underneath the walk in iron or tile pipes.

(c) The water from conductor pipes shall not be discharged into any alley at a point higher than one (1) foot above the surface, nor shall such discharge be permitted to flow against any adjoining wall into any areaway or upon any private property other than the owner of the building from which the water is conducted.

(d) Snow guards shall be placed where necessary to keep all snow from sliding into any public place. Snow shall be removed from all roofs and guards immediately upon placement of same.
CHAPTER 33 — STAIRS, RAMPS AND SMOKEPROOF TOWERS

General Requirements

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 of 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 under side by not less than one hour fire-resistive construction as specified in Chapter 43. Metal stairways entirely enclosed as specified in the Chapter shall not be required to be fireproofed as required for floors in Part V of this Code. The provisions of this Chapter shall not apply to Group I buildings except as specifically stated in Sections 3302 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 one hundred (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 (3/16) of an inch. All treads shall have a nosing of not less than one (1) inch.

The surface material of stair treads and landings shall be such as not to involve danger of slipping.

When curved or winding stairs are used for any public stairway or for a stairway serving as a means of exit, except in dwellings, their width shall not be less than one and one-fourth (1 ¼) times that of an equivalent straight run stair, and the given dimension of the treads and risers shall be laid off on the center line of such run.

The width of a tread in any public stair or exit stair at the narrowest end, shall be not less than eight (8) inches exclusive of the nosing.

Exceptions: Steel spiral stairs as used in gymnasiums or for similar purposes, shall not come within the intent of the above requirements.

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Stairways and intermediate landings shall continue with no decrease in width along the direction of exit travel.

Sec. 3303. One-half of the required number of stairways shall be continued as permanent ladders or stairways to the roof, in all buildings three (3) stories or more in height. In two (2) story buildings, scuttles not less than two feet by three feet (2'x3') shall be provided to and through the roof.

All stairways shall lead to the street directly or by means of a yard, court or fire-resistant passageway having a width of not less than three-fourths (¾) of the aggregate widths of all the exits discharging into it; provided that where more than two stairways are required, one-half of the required number of stairs may terminate at the second floor level, provided the remaining stairs are entirely enclosed through the first story. Such stairs terminating at the second floor level shall lead directly to a street or alley front of the building and be provided with a balcony on the exterior of the building not less than three (3) feet wide and five (5) feet long. Such balcony shall be constructed of incombustible materials and when the floor of such balcony is located more than twelve (12) feet above the sidewalk directly below, such balcony shall be equipped with an approved counterbalanced stairway or ladder.

Where stairways discharge through the fire-resistant passageways such passageways shall be not less than seven (7) feet in clear height and with a width at least equal to the stairway served by such passageways. Where more than one stairway discharges into such passageway, the width of the passageway shall be not less than three-fourths (¾) of the aggregate width of such stairways discharging into it. All openings into such passageways shall be protected by one-hour fire-resistant doors as specified in Section 4304.

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 unless elevator shaft is in a fire-resistant enclosure.

No portion of any building shall be more than one hundred fifty (150) feet (along the line of travel) from the nearest exit and no corridor exit door shall be more than one hundred (100) feet (measured along the line of travel) from the nearest exit. In all buildings accommodating more than twenty-five (25) people, 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 Chief 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 (30) inches or when open interfere with the full use of the stairs.

All doors in exit enclosure or providing access to exterior stairways shall be equipped with automatic self-closing door checks and shall be of not less than one-hour fire-resistive construction as specified in Section 4304, except that doors facing a street and at street level may be of unprotected wood. All doors shall be constructed and installed in a workmanlike and tight fitting manner.

All doors used in connection with exits shall be so arranged as to be readily opened 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. In all public or semi-public buildings, all exit doors shall be equipped with panic bolts.

Revolving doors of full automatic panic-proof type, equipped with speed governor, may be used as a required means of egress, from any building, except Groups A, B or C occupancy, provided that where revolving doors are used as required exits they shall be credited as exits to the extent of the clear space remaining when the wings are collapsed in the panic position, and all deficiency of required exits must be made by additional doors.

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 for stairways exceeding forty-four (44) inches in width shall have handrails placed on each side. Stairways over seven (7) feet 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 (66) inches between adjacent handrails.

Handrails and railings shall be placed not less than thirty (30) inches above the nosing of treads.

Sec. 3306. Every stairway or other means of exit into corridors and passageways appurtenant thereto shall be provided with an adequate system of lighting. 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.

Sec. 3307. Except as required for buildings of Groups "A," "B" and "C" Occupancy, stairways and landings, returns and
passageways serving such stairways shall be not less than forty-four (44) inches 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 (3) feet. 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 (3½) inches at each side when the stairway is forty-four (44) or more inches in width and on one side when the stairway width is less than forty-four (44) inches. If newells 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 newell and the face of the wall or newell opposite.

The rise of stairways shall be not more than seven and one-half (7½) inches and the tread exclusive of the nosing not less than ten (10) inches (maximum pitch 37 degrees) and there shall be not more than sixteen (16) risers in any one run between landings; provided, that stairways in dwellings and stairways serving mezzanine floors not open to the public, may have a rise of not more than eight (8) inches and a tread exclusive of the nosing of not less than nine (9) inches.

Sec. 3308. All required stairways and ramps in buildings three (3) 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 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 (8) square feet 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.

Sec. 3309. (a) The dimensions and capacities of exits shall be proportioned to the number of persons to be accommodated.

(b) When the number of persons to be accommodated by the exits is not stated in the application for a permit, or is not otherwise fixed, it shall be decided on the basis of the area of the space devoted to a particular purpose, and shall be assumed to be one person for every six (6) square feet in dance halls, lodge halls and places of assembly; one person for every fifteen (15) square feet in court rooms, restaurants, class rooms in schools and colleges, and rooms in public buildings not otherwise provided for; one person for every twenty-five (25) square feet in stores, markets, lodging houses and reading rooms; one person for every thirty-five (35) square feet in factories and work rooms; one person for every fifty (50) square feet in offices and
show rooms; one person for every one hundred (100) square feet in hospitals, asylums, hotels, furnished rooming houses and other residence buildings; and one person for every one hundred fifty (150) square feet in warehouses and garages. For occupancies not herein specified, the building officials shall, by rule, establish the ratio to be assumed. The above referred to areas, shall be the net area actually occupied by such uses.

(c) The number of stairways and exits required for Groups A, B and C buildings, is specified in Chapters 6, 7 and 8, respectively. The number of stairways and exits required for Groups D, E, F, G and H buildings shall be not less than two from each story including basements and cellars, provided that in buildings of less than twenty-five hundred (2500) square feet in area and not over three stories in height, used solely for storage or similar purposes, the Chief Building Inspector may authorize the use of one stairway.

Every floor area having direct exit to a street and occupied by more than seventy-five (75) persons, shall have at least two (2) means of exit.

Every story not having direct exit to a street, shall have at least one interior stairway, or fire tower connected thereto. Every such story shall have at least one additional exit, except as provided above.

Every apartment that has not direct exit to a street or to a court opening on a street shall have access to at least one (1) additional exit separated from and independent of the primary interior stairway or fire tower.

Access to the separate and independent exits may be through the same corridor or hallway; provided that such corridor or hallway is enclosed by and separated from the stairway exits and other parts of the building by partitions having a fire-resistance rating of not less than one (1) hour, except as otherwise prescribed when the building is of fireproof construction.

In buildings exceeding fifty-five (55) feet in height, at least one stairway shall be a smokeproof tower; provided that in sprinklered buildings in which two or more stairways, conforming to the requirements of this article are provided, such fire tower shall not be required unless the building exceeds one hundred (100) feet in height.

Every building, except dwellings, in which high pressure steam boilers carrying fifteen (15) pounds per square inch or over, or other apparatus, using or producing gas or vapor, are placed below grade, shall have, in addition to the primary interior stairway, stationary iron ladder or stairs leading directly through a manhole to the street from the story in which boiler room or such apparatus is located, or some other direct exit to the exterior, unless a second separate exit by an enclosed stairway or a horizontal exit is provided.

(d) Unless otherwise specified in Type I buildings, exits shall be so located that every point in any floor area shall be within a distance of one hundred (100) feet of an enclosed stairway along the natural line of unobstructed travel, and seventy-
five (75) feet in Types II, III, IV or V buildings. This distance shall be measured along the corridor from the door of room or rooms to the nearest exit. If the building does not contain corridors, this distance shall be measured from the most remote point to the nearest exit.

All means of egress shall be as remote from each other as practicable and shall be so distributed within or around the floor area room or space they are to serve to effect a rapid discharge of the occupants.

(e) Group D—Division 2. In all hospitals, sanitariums, orphanages, nurseries, old peoples’ homes and similar buildings (accommodating more than six (6) ) the stairs shall be so situated that no bed will be more than fifty feet on the line of travel from the nearest exit.

Group E—Division 1—Garages. Every garage or part thereof except one or two car garages shall be provided with two independent means of egress. Every means of egress shall be as widely separated as conditions will permit and accessible from all parts of the building; and also exit to the outer air.

Group H—Divisions 1 and 2. In all buildings or parts of buildings in Divisions 1 and 2, groups of four or more rooms shall have at least two exits. These exits may be to a common corridor provided said corridor has at least two independent means of egress.

All groups of three rooms or less need have but one exit provided this exit is to a common corridor which has at least two independent means of egress.

No exit shall be more than seventy-five (75) feet from the nearest means of egress.

Sec. 3310. Wherever stairways are required by this Code, ramps with a slope not greater than one (1) foot in eight (8) feet 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 (1) foot in ten (10) feet.

Sec. 3311. A horizontal exit shall consist of one or more protected openings through or around an exterior or fire wall or of one or more bridges connecting two buildings or parts of buildings entirely separated by fire walls.

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.

Sec. 3312. Exit lights shall have white letters not less than four (4) inches high on a green field indicating the location of exits, and shall be provided in all buildings except "I" and "J" occupancy, except that in buildings of Groups "E," "F," and "G" occupancies which are not occupied at night, painted exit signs may be used in place of lights. Exit signs and lights shall be placed at all exits and at such additional points as may be necessary to indicate the direction of exit when such exit is not visible from all points in the corridor. In Groups "A," "B," and "C" buildings, lights shall be kept burning at all times during which the building is occupied. In other buildings requiring exit lights, such lights shall be kept burning from sunset to sunrise when the building is occupied.

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 buildings. The minimum clear width of any passageway, aisle or corridor shall be three (3) feet 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 specified.

Sec. 3314. Stairways in Group I buildings, stairways serving only one apartment not above the second floor level, or stairways leading to mezzanine floors not open to the public and not exceeding one thousand (1000) square feet 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 (8) inches and a tread exclusive of the nosing of less than nine (9) inches.

Sec. 3315. (1) Where required. A smokeproof tower consisting of a stairway 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 as specified in Chapter 43 and constructed as specified in this Section shall be required in every building of Groups D, E, F, G and H occupancies fifty-five (55) feet or more in height, except as provided in Section 3309 (c). Smokeproof towers shall be installed in Group A, B and C buildings as specified in Chapters 6, 7 and 8, respectively.

(2) 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 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 and six inches (3'6") in height. Exit lights shall
be provided as required in Section 3312.

(3) Access and Egress. Access to the smokeproof tower
shall be provided from each story by means of vestibules adja-
cent to outside walls which may be enclosed with plain glass
windows, or by means of balconies over-hanging 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 (15) feet in width and six hundred (600) square
feet in area.

Access from the building to vestibules or balconies and to the
enclosure shall be through doorways not less than thirty (30)
inches wide nor less than seventy-five (75) inches in clear
height. These openings shall be provided with self-closing fire
doors of not less than one-hour fire-resistant construction as
specified in Section 4302, swinging in the direction of exit travel.
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 uni-
form 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 (44) inches in
clear width and eight (8) feet in clear height to a street, yard or
alley not less than ten (10) feet in width. The walls of such
passageway shall be of not less than four-hour fire-resistant
construction and the ceiling and floor of not less than two-hour
fire-resistant construction as specified in Chapter 43. The walls
of any such passageway shall be unpierced throughout their en-
tire length.

(4) 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 (36) inches 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
remodeled buildings in which it is not practicable to obtain inside
stairways and on such buildings as warehouses, public garages
and similar occupancies, when approved by the Chief Building
Inspector, and when such buildings do not exceed fifty-five (55)
feet in height, but in no case shall such stairway constitute more
than fifty (50) per cent of the required exit capacity. All out-
side 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, except when located in Fire Zone 1. Structural metal shall be not less than one-quarter (¼) inch 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 as specified in Chapter 43.

No part of any such outside stairway shall be within ten (10) feet 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 not be less than one-fourth (¼) of an inch and in which a wire-netting is embedded. Wire glass shall be set with putty and metal stops.

Sec. 3402. All skylights shall be constructed with metal frames and shall be substantially built with interlocking seams. When wire glass is required for skylights the size shall not exceed seven hundred and twenty (720) square inches in area or forty-eight (48) inches 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 (¼) the cross sectional area of the shaft but never less than four (4) feet 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 (1) inch. The screen shall be substantially supported below the glass.

Skylights installed for the use of photographers and art studios may be constructed of metal frames and plate glass without wire netting.

Ordinary glass may be used in the roofs and skylights for greenhouses. The use of wood in the frames of skylights will be permitted in greenhouses outside of Fire Zones No. 1 and 2.

Glass used for the transmission of light, if placed in floors, shall be supported by metal or reinforced concrete frames, and such glass shall be not less than one-half (½) inch in thickness. Any such glass over sixteen (16) square inches 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 shall be of the same strength as is required by the Code for floor construction, except in cases where the floor is surrounded by a railing not less than three feet and six inches (3'6") in height, in which case the construction shall be calculated for not less than skylight loads. Glass lights shall not be used in sidewalks.
CHAPTER 35 — BAYS AND BALCONIES

Construction

Sec. 3501. Construction of walls and floors in bay and oriel windows shall be of incombustible materials except that bays and oriel in buildings of Types III and V construction may be of frame construction. 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 of Types I and II buildings shall have brackets or beams constructed of steel, concrete or other incombustible material. All railings for balconies or porches above the ground floor shall be not less than three feet and six inches (3'6") in height above the floor of such balcony or porch. Balconies shall be designed to support, in addition to their own weight, a live load of not less than one hundred (100) pounds per square foot. Railings of balconies shall be designed to support a horizontal thrust of not less than twenty (20) pounds per lineal foot of railing uniformly distributed along its length.
CHAPTER 36 — PENTHOUSES AND ROOF STRUCTURES

Sec. 3601. Roof structures of Type I buildings shall be constructed with walls, floors and roof as required for the main portion of the building. The aggregate of roof structures shall not exceed twenty (20) per cent of the area of the building.

Walls of roof structures parallel to and within four (4) feet 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 (2) feet above the roof and two (2) feet 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 (4) feet of an exterior wall on Type II or III buildings shall be of not less than one-hour fire-resistive 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 (75) feet above grade shall have their framework constructed of iron, steel or reinforced concrete. No tower or spire shall occupy more than one-fourth (¼) of the street frontage of any building to which it is attached, and in no case shall the base area exceed sixteen hundred (1600) square feet unless conforming entirely to the Type of Construction requirements of the building to which it is attached and being limited in height as a main part of the building. If the area of the tower or spire exceeds one hundred (100) square feet 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 wireless masts and placed on the roof of any building shall be constructed entirely of incombustible materials when more than twenty-five (25) feet 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.

Cooling towers may be constructed entirely of wood.
CHAPTER 37—CHIMNEYS AND HEATING APPARATUS

Chimneys

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, gas or oil, shall be built of brick, concrete, stone, hollow tile of clay or concrete or of concrete blocks; provided that a metal smokestack as specified in Section 3702 or a cement asbestos flue as provided in Section 3703 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 nineteen hundred and ninety-four (1994) degrees Fahrenheit, or may be an approved cement asbestos composition. Flue linings shall be not less than five-eighths (5/8) of an inch in thickness if of clay, or one-quarter (1/4) of an inch in thickness if cement asbestos composition, 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 slushed 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 (8) inches 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 (4) inches above the enclosing walls.

The walls of brick chimneys shall be not less than three and three-fourths (3 3/4) inches thick and shall be lined. 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 suitable reinforced vertically and horizontally. The walls shall be not less than three and three-fourths (3 3/4) inches thick and shall have a flue lining as specified in this section; provided, that flue linings may be omitted in reinforced concrete chimneys for private dwellings when the walls of such chimneys are not less than six (6) inches thick.

Hollow blocks or building 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 (8) inches of such a wall may serve as the outside wall of the chimney.
Chimneys shall extend at least three (3) feet above flat roofs and not less than two (2) feet 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. It shall be the duty of the owner of any chimney to extend the height of such chimney to a point where no smoke nuisance or fire hazard is created to adjacent buildings or structures by reason of the existence of such chimney.

Chimneys shall be built upon solid masonry or reinforced concrete foundations properly proportioned to carry the weight imposed without settlement or cracking, or fireproofed steel or reinforced concrete structural members. The chimney shall 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 thirty (30) degrees from the vertical.

When any single flue has an effective area exceeding two hundred (200) square inches the wall shall be not less than eight (8) inches thick and shall have flue lining as specified in this section, except that when flues become too large for fire clay flue lining, such flues shall be lined with fire brick. The requirements for fire brick lining may be waived in case of a stack detached from any building.

No flue shall have smoke pipe connections in more than one story of a building, unless provision is made for effectively closing smoke pipe openings with devices made of incombustible materials whenever their use is discontinued temporarily, and completely closing them with masonry when discontinued permanently.

Nothing in this ordinance shall prohibit the joining of two or more smoke pipes for a single flue connection; nor the venting of an automatic gas appliance to a flue serving appliances using other fuel; provided the gas appliance connection into such flue is made at a point not less than twelve (12) inches above the connection from such other appliance; provided further that in every case the smoke pipes and flues are of sufficient size to serve all the appliances thus connected; and provided that, except for outlet pipes for gas appliances, the several smoke pipes shall be constructed to comply with the severest requirements for any one of those connected. An automatic gas appliance, within the meaning of this paragraph, is one that is equipped with a safety pilot light, the extinguishment of which will automatically shut off the supply of gas.
Sections 3701-3702

Flues shall have a minimum size as shown in the following table:

Data on Flues, Areas and Chimneys with Flue Linings

<table>
<thead>
<tr>
<th>NOMINAL SIZES</th>
<th>Effective Area “E”</th>
<th>Maximum Sq. Ft. Steam Radiation or Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round Flue Lining, Inside Diameter</td>
<td>Rectangular Flue Lining, Outside Dimensions</td>
<td></td>
</tr>
<tr>
<td>10&quot;</td>
<td>8½&quot; x 13&quot;</td>
<td>70</td>
</tr>
<tr>
<td>12&quot;</td>
<td>13&quot; x 13&quot;</td>
<td>100</td>
</tr>
<tr>
<td>15&quot;</td>
<td>13&quot; x 17½&quot;</td>
<td>150</td>
</tr>
<tr>
<td>17½&quot; x 17½&quot;</td>
<td>183</td>
<td>2150</td>
</tr>
<tr>
<td>20&quot; x 20&quot;</td>
<td>234</td>
<td>2850</td>
</tr>
<tr>
<td>24&quot; x 24&quot;</td>
<td>314</td>
<td>4300</td>
</tr>
<tr>
<td>25&quot;</td>
<td>346</td>
<td>5000</td>
</tr>
</tbody>
</table>

Note: Above sizes are based on a chimney height of not less than thirty (30) feet above smoke pipe inlet. For chimneys of less height, flue sizes should be increased.

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, when required by the Chief Building Inspector, but the test shall not be made until the mortar has thoroughly seasoned. Such test shall be made by the contractor in the presence of the Building Inspector.

Metal Smokestacks

Sec. 3702. 1. Construction. (a) Metal smokestacks, unless structurally self-supporting, shall be guyed securely, or firmly anchored to or otherwise supported by the building served thereby.

(b) All metal work shall be painted.

(c) Clean-out openings shall be provided at the base of every such stack.

(d) All such stacks hereafter erected, outside or independent of a building, shall be supported on substantial masonry foundations, so designed that the pressure of the soil shall not exceed two-thirds of the maximum allowable pressure on the soil.

2. Height. All such stacks shall extend to a height of not less than ten (10) feet above the highest point of any roof within twenty-five (25) feet.

3. Exterior Stacks. (a) Every such stack, or part thereof, hereafter erected on the exterior of a building shall have a clearance from the wall of not less than twenty-four (24) inches if the wall is of frame construction, and not less than four (4) inches if it is of any other type of construction.
(b) No such stack shall be nearer than twenty-four (24) inches in any direction from a wall opening, exit or fire escape.

(c) When such stack is insulated on the exterior in some approved manner, the clearances herein prescribed may be reduced to two-thirds (⅔) of those specified.

4. Interior Stacks. (a) Every such stack, or part thereof, hereafter erected within a building other than a one-story building, shall be enclosed above the story in which the appliance served thereby is located, in walls of approved masonry or fire-partitions. The enclosing walls shall be without openings.

(b) Where such a stack passes through a roof constructed of combustible materials, it shall be guarded by a galvanized iron collar extending flush below and two inches above such roof construction. Such collars shall be of a size to provide a clearance on all sides of the stack of not less than eighteen (18) inches with two (2) inch air space between hood and top of collar.

5. Prohibition. Smokestacks shall not be carried up inside of vent stacks or vent flues unless such stacks or flues are constructed as required by this article for smokestacks or smoke flues and such stacks or flues are used solely for venting the room or space in which the appliance served by the smokestack is located.

Sec. 3703. Gas furnaces, gas water heaters and other domestic gas appliances, having a manufacturers rating not to exceed 50,000 B.T.U. per hour and/or approved devices developing stack temperature not to exceed 550⁰ F, which are required to be vented may, in lieu of the chimney required in Section 3701, be provided with a vent pipe of cement asbestos composition not less than one-quarter (¼) of an inch in thickness as may be approved by the Chief Building Inspector. Where such vents are enclosed within a wood stud partition, a clearance of not less than one (1) inch shall be maintained from woodwork by means of metal spacers and metal lath or plaster lath shall be used over the flue. The area of any flue or vent shall be not less than the area of the largest vent connection inlet plus fifty (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 (12) square inches, and shall be not less than two (2) inches in any internal dimension. No vent connection inlet shall be located at the bottom or within one (1) foot of the bottom of any gas vent, and any two inlets shall be offset or staggered so that it will be impossible for any horizontal plane to pass through any part of both inlets.

A 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 (6) inches distant from any combustible portion of the building, or the combustible material shall be protected by not less than one (1) hour fire-resistive construction as specified in Chapter 43. Every portion of a vent connection shall have
a rise of not less than one (1) inch 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 direction as possible and be continuous from the gas appliance to the outside of the building and extend at least two (2) feet above any portion of the roof within fifteen (15) feet 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 any 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.

Approved down draft diverters shall be installed in the flue connections of all gas appliances except incinerators. No so-called “gas saving” devices shall be sold or offered for sale, or be installed within the City and County of Denver, until such device shall have been approved by the Chief Building Inspector. Approval of the United States Bureau of Standards, or the American Gas Association Laboratories, shall constitute evidence for approval by the Chief Building Inspector.

Smoke Pipes and Thimbles  Sec. 3704. 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 twenty-four (24) U.S. Gauge or masonry, and shall fit tightly into the chimney.

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 (18) inches 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 woodwork shall be placed within six (6) inches of the thimble. When a smoke pipe enters a chimney breast through a studded off chimney partition the thimble shall be kept six (6) inches clear of all woodwork.

Fireplaces  Sec. 3705. All fireplace walls shall be not less than eight (8) inches thick, and if built of stone or hollow units shall be not less than twelve (12) inches thick. The faces of all such minimum thickness walls exposed to fire shall be lined with fire brick, soap stone, cast iron, sheet metal or other suitable fire-resistive material. When lined with four (4) inches 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. The area of fireplace flues shall be not less than one-tenth (1/10) the area of the fireplace opening.

All fireplaces and chimney breasts shall have trimmer arches or other approved fire-resistive construction supporting hearts. The arches and hearts shall be not less than sixteen (16) inches
wide measured from the face of the chimney breast and not less than eight (8) inches wider than the fireplace opening on each side. The arches shall be of brick, stone or hollow tile not less than four (4) inches 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 (6) inches 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 (8) inches of the jambs or within twelve (12) inches of the top or arch of any fireplace opening.

Sec. 3706. Warm air furnaces shall be encased in a double metal shield with an air space between, and shall be protected with at least three (3) inches of sand on top, and shall rest on masonry or concrete floors. No wood partitions shall be built within seven (7) feet of the front or four (4) feet of the sides of the outer shield of such furnaces, but the distance to the partitions at the side may be reduced to two (2) feet 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 (24) inches, and such wood ceiling or framing shall be protected with not less than one-hour fire-resistive construction, when the furnace is designed to burn solid or liquid fuel. When located in a building two stories or more in height, except private dwellings, the furnace room shall be separated from the remainder of the building by a “Special Fire Separation.”

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 (4) inches of masonry, and every portion thereof, including the smokepipe, shall be at least two (2) feet from any combustible material or such combustible material shall be protected by a covering of number twenty-four (No. 24) U.S. Gauge galvanized iron furred with metal furring not less than one and one-half (1½) inches from such combustible construction or shall be entirely covered by one-hour fire-resistive construction. Any such furnace set in brick shall be completely and tightly covered with at least four (4) inches 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.
Sections 3706-3709

Every gas furnace other than single pipe floor furnaces shall be set upon a masonry floor or shall be set upon not less than two (2) inches of masonry or on asbestos board not less than one-half (½) inch in thickness covered with No. 20 U.S. Standard Gauge galvanized iron or steel. The top of such furnace shall be not less than nine (9) inches from protected combustible material nor less than eighteen (18) inches 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.

Every furnace room or boiler room shall be provided with an adequate supply of air for combustion. When located in furnace rooms with the door maintained normally closed, the air supply may be taken from adjacent rooms by means of louvers in the furnace room door.

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 (6) feet. The floor of the furnace room shall be not less than seven (7) feet 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.

Low Pressure Steam Heating Plants

Sec. 3707. Steam or hot water heating plants, for not more than fifteen (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.

Boilers

Sec. 3708. Large boilers for power or steam purposes or for generating high pressure steam shall be located in a boiler room separated from the remainder of the building by a "Special Fire Separation." Steel, cast iron or concrete columns adjacent to such boilers shall not be in direct contact with furnace settings, but there shall be an open and unobstructed space at least four (4) inches wide for ventilation.

Stoves

Sec. 3709. 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 (12) inches beyond each side of such stove protected by not less than one-hour fire-resistive construction as specified in Chapter 43. Such stoves shall be securely supported at least six (6) inches above any wood floor by metal supports, and there shall be a metal and asbestos pad at least one-quarter (¼) of an inch thick below such stove extending at least six (6) inches beyond each side and at least eighteen (18) inches in front of such stove. Such
stoves shall not be placed nearer than six (6) inches to any combustible partition.

All such stoves shall be connected by a smoke pipe to a chimney meeting the requirements specified in Section 3701.

Sec. 3710. Gas ranges, domestic hot water heaters and hot plates shall be supported at least six (6) inches 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 and with a one (1) inch air space between or with a one-half (½) inch pad of metal and asbestos. Combustible partitions or walls within six (6) inches of any such appliances shall be protected by one-fourth (¼) of an inch of asbestos covered with a twenty-six gauge metal covering or shall have not less than a one-hour fire-resistant protection as specified in Chapter 43. Wood ceilings or other combustible materials shall be at least two (2) feet above such installations. The oven or ranges and 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.

Sec. 3711. Gas ranges for restaurants, bakeries or hotels shall be supported at least six (6) inches above any wood floor and if less than twelve (12) inches above the floor, the wood shall be protected by one-quarter (¼) inch asbestos and a metal shield, or such ranges may rest on an independent steel and masonry support. Such ranges shall not be placed nearer to any wood partitions or other combustible material than six (6) inches and if nearer than twelve (12) inches, such partitions 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 (12) inches; and if less than three (3) feet, the ceiling or combustible material above shall be protected with a double metal shield with one (1) inch air space between or with one (1) inch of metal lath and Portland cement plaster or one (1) inch of asbestos. Hood and ventilating flues from such ranges may be of sheet metal or masonry and if of sheet metal shall be protected from all wood or other combustible materials by four (4) inches of concrete, gypsum or terra cotta tile or an eight (8) inch air space and a metal shield. Such ventilating flues shall not be carried through wood floors or roofs, or up combustible partitions unless protected by at least four (4) inches of masonry or concrete.

Sec. 3712. 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 inflammable liquids shall be constructed and installed in accordance with existing ordinances of the City and County of Denver.
Sec. 3713. Other sources of heat and flame not specifically 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 one hundred and twenty-five (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 dangerous conditions.

Sec. 3714. Warm air ducts and other appurtenances in connection with warm air heating systems shall be designed and installed in accordance with the Standard Code Regulating the Installation of Warm Air Heating Systems in Residences, 8th Edition, August 1st, 1981, as published by the National Warm Air Heating Association, Inc.

Sec. 3715. (a) Flue-fed incinerators are those where the waste material is dropped directly into the combustion chamber from one or more floors. The chimney on installations shall serve both for charging of waste materials into the incinerator chamber, and as a flue.

(b) Incinerators shall be equipped with dumping, horizontal cast iron grates. Minimum grate areas shall be as per chart in paragraph (k).

(c) Vertical grates of metal or brick construction shall be provided to permit the free passage of air around and over the material on the grates. Clear space between the chamber wall and vertical grates not to be less than five (5) inches. Construction shall be so free air supply cannot be cut off by waste materials.

(d) Incinerators having nine (9) square feet of grate area or less shall be constructed of four (4) inch common brick work and a firebrick lining four and one-half (4½) inches thick. Over the incinerator combustion chamber, the roof construction shall be firebrick and four (4) inches of brickwork or an equivalent slab of reinforced concrete.

(e) Incinerators of greater than nine (9) square feet of grate area shall be built of eight (8) inch common brickwork and firebrick lining. Roof construction similar to paragraph (d) except a one and one-half (1½) inch air space shall be maintained by means of an additional set of steel members between fire brick and common brick.

(f) All firebrick shall be laid in fire clay mortar.

(g) Flues for incinerators as described in paragraph (d) shall be as required for chimneys in Section 3701.

(h) Flues shall be of a minimum size as specified in paragraph (k).

(i) All flues shall be perpendicular for their full height without slopes or offsets. Top of flues shall have galvanized
wire removable spark arrestor, not coarser than three-quarters (\%) of an inch mesh.

(j) All hopper doors on respective floors shall have the approval of the Underwriters Laboratories. They shall be set in an iron frame that is built firmly into the masonry, so no part will project into the flue. Doors shall be constructed so the opening into the flue is closed off during the loading operation.

(k) Incinerators shall be located within the boiler room or within a separate incinerator room separated from the remainder of the building by an “Ordinary Fire Separation.”

(l) Incinerators that are to have any moist or damp material shall be equipped with an auxiliary burner.

(m) The following chart for the minimum grate area, and cubical content as mentioned in paragraphs (b) and (c) shall be followed for size building or residence as listed:

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>Minimum Grate Area</th>
<th>Minimum Cubical Content</th>
<th>Minimum Flue Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residences of 6 rooms or under</td>
<td>2.22 sq.ft.</td>
<td>7.00 cu.ft.</td>
<td>*12”x12”</td>
</tr>
<tr>
<td>Residences of 10 rooms or under</td>
<td>4.70 sq.ft.</td>
<td>14.10 cu.ft.</td>
<td>*12”x12”</td>
</tr>
<tr>
<td>Residences of not more than 12 rooms. For Duplex 2 family buildings. For up to 16 kitchenette apartments of not over 32 rooms</td>
<td>6.67 sq.ft.</td>
<td>20.01 cu.ft.</td>
<td>*12”x12”</td>
</tr>
</tbody>
</table>
| Up to 24 kitchenette apartments. Other apartments containing not over 50 rooms. Residences greater than 12 rooms. | 8.22 sq.ft. | 24.66 cu.ft. | [16”x16” up to 4 story buildings. Over 4 stories, 20”x20”]
| Up to 36 kitchenette apartments. Other apartments not over 90 rooms. Hospitals to 35 beds. Schools to 500 pupils. | 9.50 sq.ft. | 33.25 cu.ft. | “ “ |
| Up to 60 kitchenette apartments. Other apartments up to 130 rooms. Hospitals from 35 to 60 beds. Schools 500 to 800 pupils. | 12.22 sq.ft. | 42.77 cu.ft. | [20”x20” up to 7 story buildings. Over 7 stories, 24”x24”]
| Up to 80 kitchenette apartments. Other apartments up to 170 rooms. Hospitals from 60 to 80 beds. Schools 800 to 1000 pupils. | 14.13 sq.ft. | 49.45 cu.ft. | “ “ |
| Up to 150 kitchenette apartments. Other apartments up to 300 rooms. Hospitals with 80 to 125 beds. Schools 1000-1500 pupils. | 18.00 sq.ft. | 63.00 cu.ft. | “ “ |

*If second floors are to have hoppers, flues shall be 16”x16”.

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Rubbish Incinerators

Sec. 3716. Rubbish incinerators shall consist of a central collection point for rubbish which may be conveyed by means of a chute or manually. Rubbish chutes shall rest upon substantial incombustible foundations and shall have enclosing walls eight (8) inches of common brick work or six (6) inches of reinforced concrete. The chute shall extend through the roof and shall be covered with a metal skylight glazed with thin glass.

Service openings through the chute shall be protected by approved self-closing fire doors or by an approved chute door, and shall terminate in a rubbish bin of metal or masonry located within the incinerator room or in an adjoining room. The incinerator and rubbish room shall be separated from the remainder of the building by an ordinary fire separation and shall be protected by an automatic sprinkler system.

Rubbish incinerators shall be constructed as required in Section 3715, except that by-pass grates and auxiliary burner may be omitted. Rubbish burners shall be connected to an approved chimney as specified in Section 3701.

Ash Pits

Sec. 3717. Ash pits shall be constructed of masonry not less than three and three quarters (3 ¾) inches thick, or of reinforced concrete not less than two and one-half (2½) inches thick, and shall be provided with a top of masonry or reinforced concrete not less than three (3) inches thick. The opening for receiving ashes shall not exceed twelve (12) inches in diameter, and if located in the yard, this opening shall be provided with a tight fitting metal cover not readily displaced, or with cross-bars such that no opening exceeds four (4) inches in any dimension. All ash pits shall be provided with suitable tight-fitting metal clean-out doors. All buildings burning solid fuel in any appliance shall be provided with an ash pit. When located in the yard, they shall be so placed as to create no nuisance to adjoining property, preferably adjoining an alley. In no case shall they be located within a shed or in such location as to create a fire hazard. When located in basements, they shall be not less than six (6) feet below combustible floor construction, which shall be protected with one-hour fire-resistive protection, three (3) feet on each side of the pit. No combustible construction shall be permitted in basements within two (2) feet of the sides of ash pits.

Ash cans may be used in lieu of ash pits. They shall be provided with a tight-fitting metal cover which shall be kept on at all times.

Ash pits and ash cans shall be kept in proper repair to prevent the spilling of ashes and to prevent children or animals from falling into pit.
CHAPTER 38 — FIRE EXTINGUISHING APPARATUS

Sec. 3801. Standard automatic sprinklers shall be installed as specified in this Chapter in the following places:

1. In all cellars, basements or sub-basements over 2500 square feet in area, used for the manufacture, sale or storage of combustible goods or merchandise, when in the judgment of the Chief Building Inspector and the Chief of the Fire Department a special fire hazard exists.

2. In Group "A" occupancies, as specified in Section 607.

3. In basements or cellars of all public garages, when used for the storage, sale or repair of motor vehicles and when exceeding an area of one thousand (1000) square feet.

4. In all public garages over one thousand (1000) square feet in area where such garage is located in a building below other occupancy.

5. In paint spray rooms or booths as specified in Section 1010.

6. In film exchanges, film storage, rewinding and shipping rooms as required in Section 1011 (d), and in storage vaults for nitrocellulose films as required in Section 1012.

7. Throughout all buildings of Group E, Division 2, over two (2) stories in height.

8. In existing buildings where in the judgment of the Chief Building Inspector and the Chief of Fire Department a severe fire hazard exists, a sprinkler system may be required.

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 governing the installation of automatic sprinkler equipment, September 1, 1931, where not contrary to the specific statements in this Chapter.

Exceptions: 1. A single water supply equal to the primary supply required by such regulations may be accepted as complying with the requirements of this Code.

2. The alarm valve required for a standard automatic sprinkler system shall not be required in the cellars of Groups C, D, E, F, G and H buildings when the area of such cellar is less than three thousand (3000) square feet.

Sec. 3803. Dry standpipes shall be installed in place of wet standpipes when in the opinion of the Chief Building Inspector it is impractical to use wet standpipes.
Sec. 3804. Construction. Dry standpipes shall be of wrought iron, galvanized steel, copper or brass and together with fittings and connections shall be tested in the presence of the Chief of the Fire Department to withstand three hundred (300) pounds of water pressure to the square inch when ready for service, without leaking at the joints, valves or fittings.

Size. Dry standpipes shall not be less than two and one-half (2½) inches in diameter for buildings fifty-five (55) feet or less in height and four (4) inches in diameter for all buildings more than fifty-five (55) feet in height.

Number Required. Every building fifty-five (55) feet in height where the area of any floor above the second floor is ten thousand (10,000) square feet or less shall be equipped with not less than one (1) dry standpipe and an additional standpipe shall be installed for each additional ten thousand (10,000) square feet or fractional part thereof. Where more than one (1) dry standpipe is installed all such standpipes shall be cross-connected in the basement with a pipe of the same size.

Location. Standpipes shall be located within stairway enclosures or as near such stairways as possible or shall be embedded within, or immediately inside, of an exterior wall and within one (1) foot of an opening in a stairway enclosure or the balcony or vestibule of a smokeproof tower or an outside exit stairway.

Siamese Connections. All four (4) inch dry standpipes shall be equipped with a two-way Siamese fire department connection. All Siamese inlet connections shall be located on a street front of the building and not less than one (1) foot nor more than four (4) feet 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.

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 (2½) inch outlet not more than four (4) feet above the floor level at each story. All dry standpipes shall be equipped with a two-way two and one-half (2½) inch outlet above the roof. All outlets shall be equipped with gate valves with substantial chains.

Threads. All hose connections on such standpipe installations shall be uniform with that used by the local fire department.

Signs. An iron or bronze sign with raised letters at least one (1) inch in height 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 building of any height and every Group D, E, F, G and H building three (3) or more stories in height shall be equipped with one (1) or more interior wet standpipes extending from the cellar or basement into the topmost story.
Sec. 3806. Construction. Interior wet standpipes shall be constructed as required for dry standpipes.

Size. Interior wet standpipes shall have an internal diameter of not less than two and one-half (2½) inches for buildings not over seventy-five (75) feet in height and four (4) inches for buildings over seventy-five (75) feet in height.

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 (75) feet in length.

Location. The location of all interior wet standpipes shall be approved by the Chief Building Inspector.

Outlets. All interior wet standpipes shall be equipped with a one and one-half (1½) inch straightway composition gate-valve in each story including the basement or cellar of the building and located not less than one (1) foot nor more than five (5) feet above the floor.

Threads. All hose threads in connection with the installation of such a standpipe, including valves and reducing fittings shall be uniform with that used by the local fire department, using twelve (12) threads to the inch for one and one-half (1½) inch connections.

Water Supplies. All interior wet standpipes shall be connected to a street water main of not less than four (4) inches in diameter and the connection to such main shall be the same size as the standpipe. When the water pressure is insufficient to maintain twenty-five (25) pounds pressure at the highest hose outlet such standpipes shall be connected to a pressure tank, gravity tank or fire pump. Such supply shall be sufficient to furnish at least twenty-five (25) pounds pressure at the topmost hose 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. All supply mains shall be equipped with gatevalves and straightway check valves located adjacent to the source of supply.

Pressure and Gravity Tanks. Tanks shall have a capacity sufficient to furnish at least two hundred and fifty (250) gallons per minute for a period of not less than twenty (20) minutes. Such tanks shall be located so as to provide not less than twenty-five (25) pounds pressure at the topmost hose outlet for its entire supply. Discharge pipes from pressure tanks shall extend two (2) inches 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 fifty (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 (3) foot clearance shall be maintained between the top and bottom of all pressure tanks.
Sections 3806-3808

Fire Pumps. Fire pumps shall have a capacity of not less than two hundred and fifty (250) gallons per minute with a pressure of not less than twenty-five (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 (4) inch diameter or a well or cistern containing a one (1) hour supply. Such pumps shall be supplied with an adequate source of power and shall be automatic in operation.

Hose and Hose Reels. Hose outlet of interior wet standpipes may be supplied with a hose not less than one and one-half (1½) inches in diameter. If hose is supplied, such hose shall be equipped with a suitable brass or bronze nozzle and shall be not over seventy-five (75) feet 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.

Basement Pipe Inlets 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, aluminum or bronze with lids of cast brass or bronze or aluminum and shall consist of a sleeve not less than eight (8) inches 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 readily permit its removal 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.

First Aid Equipment Sec. 3808. In every occupancy when, in the opinion of the Chief of the Fire Department, chemical first aid equipment is necessary, such equipment shall be a type approved by the National Board of Fire Underwriters, and shall be located and installed in accordance with the directions of the Chief of the Fire Department.

All fire extinguishing apparatus as called for in this Chapter shall meet with the approval of the Chief of the Fire Department.
CHAPTER 39 — STAGE VENTILATORS

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 the stage of every theatre, raised above the stage roof and having a total ventilating area equal to at least ten (10) per cent of the floor area within the stage walls. When in the opinion of the Chief Building Inspector and/or Chief of the Fire Department a severe fire hazard exists in any theatre, stage ventilators shall be installed in existing building when so ordered by the Chief Building Inspector. 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 one hundred and sixty (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 Chief Building Inspector.

4. The fusible link and the cord must hold the doors closed against a force of at least thirty (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.
CHAPTER 40 — MOTION PICTURE MACHINE BOOTHS

Sec. 4001. (a) No motion picture shall be exhibited within the City and County of Denver except in conformity with the provisions of this Chapter, provided, however, that the provisions of this Chapter shall not apply to miniature type machines using acetate (slow-burning) film for private home use only.

The terms as used in this Chapter shall have the following meanings:

**Miniature Type Machines:** Motion picture machines using film 16 millimeters or less in width.

**Standard Machines:** Motion picture machines using film over 16 millimeters in width.

**Approved Equipment:** Equipment which bears the label of approval of the National Board of Fire Underwriters and which is maintained in such condition of repair as shall be deemed safe by the Fire Department.

**Approved Picture Machine Booth.** A booth built and maintained in accordance with the requirements of this Chapter. Booths built prior to the passage of this ordinance may be approved by the Chief Building Inspector when not complying with the requirements of this Chapter.

**Licensed Operator.** A motion picture operator licensed by the City and County of Denver under the requirements of Ordinance 78, Series of 1915, or as may hereafter be amended.

**Slow Burning Film.** A film of acetate base. In order to be considered as slow burning, the film shall bear the marking of the manufacturer identifying it as such.

(b) Every motion picture machine using nitrate films, and/or using arc illumination, together with all electrical devices, rheostats, sewing machines and all films present in any building, 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 (7) feet high and have a floor area of not less than fifty (50) square feet to each motion picture machine in such booth. All such equipment shall be of an approved type.

(c) The floor of such booth shall be constructed of masonry or reinforced concrete or, if of wood, shall be covered with not less than two (2) inches of masonry. The walls and ceilings shall be of not less than one-hour fire-resistive construction as specified in Chapter 43. No combustible insulation or acoustical material shall be used either inside or outside of the booth.

(d) 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 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 not be more than one hundred and twenty (120) square inches. There shall be not more than one observation port for each projection port and their area shall not exceed one hundred and fifty (150) square inches each. There shall be not more than three combination observation and spot light ports and they shall not exceed thirty (30) inches by twenty-four (24) inches. 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 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 (1) foot 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 (36) inches 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 gauge sheet metal large enough to overlap at least one (1) inch 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 one hundred and sixty (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 (8) 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 (5) seconds.

(e) Every booth shall be equipped with ventilating inlets not less than ninety (90) square inches in combined area placed near the floor and protected by wire netting. At the top of every booth there shall be at least a ten (10) inch diameter vent for each motion picture machine. Such vent shall be constructed of sheet metal not less than twenty-four (24) U.S. gauge and go directly through the roof and twelve (12) inches above, and shall be provided with an exhaust fan which will produce a complete change of air in the booth every ten (10) minutes. No wood or other combustible material shall be allowed to come within four (4) inches of the vent. There shall be not more than one elbow or change in direction of this metal vent in any attic space. No vent shall pass through any occupied room unless encased in not less than four (4) inches of solid masonry. Soldered joints shall not be permitted.

(f) 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.

(g) 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 not have a capacity in excess of ten (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.

(h) Public or private exhibitions using incandescent illumination and slow burning film in approved miniature type machines, may be given outside of an approved booth, upon issuance of a special permit by the Fire Department, and a licensed operator is not required.

Public or private exhibitions using incandescent illumination and slow burning film in approved standard size machine may be given outside of an approved booth upon issuance of a special permit by the Fire Department. A licensed operator shall be in charge of the equipment and a uniformed member of the Denver Fire Department shall be in attendance during the entire performance.

Sanitation

Sec. 4002. Every motion picture machine booth in theatres and motion picture theatres shall be provided with a toilet located inside of the booth or within a compartment of the booth, and within sight of the machine.
CHAPTER 41 — PROSCENIUM CURTAIN

Sec. 4101. Proscenium curtains for Groups A and B buildings shall be made of incombustible materials constructed and mounted so as to intercept hot gases, flame and smoke, and to prevent glow from a severe fire on the stage showing on the auditorium side within a period of five (5) minutes. The curtain shall be raised and lowered each evening at the beginning of the performance. The closing of the curtain from the full open position shall be effected in less than thirty (30) seconds, but the last five (5) feet of travel shall require not less than five (5) seconds.

Sec. 4102. A proscenium curtain for stage openings shall be of not less fire-resistant qualities than as specified in this Section. The curtain shall be made of one thickness of asbestos cloth weighing not less than three and one-quarter (3 ¼) 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, nickel, brass or other metal or alloy having not less strength than these metals at temperatures up to seventeen hundred (1700) degrees Fahrenheit and no less resistance to corrosion at ordinary temperatures. Asbestos cloth made of long fibre blue crocidolite asbestos may be used in place of chrysotile 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 (3) 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 (6) pounds. The strength of the cloth in tension when tested by the strip method shall be not less than one hundred and sixty (160) pounds per inch of width of warp and fifty-two (52) pounds per inch of filling.

The asbestos fibre of yarns may contain cotton or other combustible fibre not to exceed twenty (20) per cent of the weight of the asbestos. The total carbon content of the cloth shall not exceed ten (10) per cent of the total weight of the fibre. 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 (4) parts of casein in each ten (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 strips of asbestos cloth. The widths of cloth shall overlap at the seams not less than one (1) inch 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 (8) inches, and shall overlap the top of the proscenium opening at least twelve (12) inches.

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 three (3) inches deep. A two (2) inch pipe batten shall be placed at the top and a one and one-half (1½) inch batten at the bottom. For stage openings over forty (40) feet in width the bottom batten shall be not less than two and one-half (2½) inches in diameter. The battens shall be reinforced at the joints with six-foot sections of pipe housed and riveted. Both top and bottom battens shall have six-inch nipples reamed and welded on each end.

The curtain shall be held to structural steel guides in the smoke pockets with substantial roller grips riveted or bolted to the side hem, not more than eighteen (18) inches on center. Each roller grip shall be fastened to the curtain with not less than three (3) bolts or rivets.

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 (3) inches thick to form a seal against the floor.

Sec. 4104. Structural steel guides shall be built into the side smoke pockets and shall extend from the floor to the gridiron. Guides and roller grips shall be designed, constructed and attached to the curtain so as to safely support it and work smoothly with a wind load of one (1) pound per square foot over the entire area of the curtain.

The support for the curtain shall be not less than four (4) three-eighths (¾) flexible steel cables. These cables shall be spaced not more than twelve (12) feet on centers. Supporting cables shall be tied to the top batten with a clove hitch and the end secured with two (2) three-eighths (¾) inch iron rope clips.

The supporting cables shall pass through sheaves in the gridiron and over to the counter-weight guides and shall fasten to the counterweight by means of three-eighths (¾) inch shackle and eye turnbuckles with clove hitches and wire cable clips. Eveners shall be provided where the cables connect to the counter-weights so that the weight of the counter-weights will be evenly divided on the cables.

There shall be at least six (6) safety stop chains of one-quarter (¼) inch straight link welded chain, fastened to the top curtain batten. The other end shall be attached to the proscenium wall by means of seven-eighths (7/8) inch bolts passing entirely through the wall, or equally substantial supports. Safety chains
shall be so adjusted as to support the curtain when it is lowered and the bottom batten is on the floor.

All cables shall be carried over head and loft blocks of not less than sixteen (16) inch diameter wheels. These blocks shall be ball bearing and the wheel grooves shall be machined. All blocks supporting the asbestos curtain shall be supported on the proscenium wall by means of steel brackets or shall be mounted on the beams of the gridiron with through bolts.

The mechanism and devices for controlling the curtain shall be of simple design and shall be positive in operation. Opening of the curtain may be by hand, hydraulic or electric power. Closing for emergency or for automatic operation shall be the same as for ordinary operation and shall be by gravity obtained by counterbalancing the curtain by counter-weights weighing not less than one-quarter (¼) pound per square foot of curtain.

The operating hand line shall be not less than \( \frac{1}{2} \)" flexible steel tiller rope permanently fastened to the top and bottom of the counter-weight arbor and shall pass through the stage floor in approved thimbles and over a tension pulley not less than eleven (11) inches in diameter, under the stage floor. This operating line shall be fitted to an automatic control line, or becket of sash cord, which when freed by the breaking of a fusible link will allow the curtain to automatically lower itself by means of a bucket release. Not less than four (4) fusible links shall be placed on the automatic control line, one on each side of the stage and two overhead in the gridiron.

Smoke grooves which protect the sides of the curtain shall be of structural steel shapes and plates not less than one-quarter (¼) inch thick. These grooves shall be not less than twelve (12) inches deep and six (6) inches wide. Grooves shall extend from the stage floor to a point immediately under the gridiron, and shall be securely bolted to the proscenium wall. Details of grooves shall be submitted to the Chief Building Inspector for approval.

Top and bottom counter-weights shall be cast iron four (4) inches wide by three (3) inches high by sixteen and three-quarters (16\%\;) inches long. There shall be smooth grooves on the ends of the top and bottom weights which engage the steel guides. Intermediate weights shall be four (4) inches wide by three (3) inches high by twelve (12) inches long, grooved to drop into place on top of the lower carrying weight. Two (2) three-quarter-inch bolts shall pass through each arbor of counter-weights. These bolts shall hold the sections of the counter-weight together and shall also have the supporting cables tied to them.

Counter-weight guide tracks shall be of steel elevator tees. The guide frame shall be securely bolted to the proscenium wall, and shall extend from the stage floor to the gridiron.

All machines and hoisting gear shall be designed in accordance with the Safety Code for Elevators, Dumbwaiters and Escalators, published 1931, by the American Society of Mechanical Engineers, as such requirements are specified for passenger ele-
Sections 4104-4106

vators, machines and cables. Travel limit stops and room for over-travel shall be provided.

Sec. 4105. The complete installation of every proscenium curtain shall be subjected to operating tests and any theatres in which such proscenium curtain is placed shall not be opened to public performance until after the proscenium curtain has been accepted and approved by the Chief 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 (5) minutes unless failure shall have occurred previously. The unexposed face of the curtain shall not glow within a period of five (5) minutes nor shall there be any passage of smoke or flame through the curtain.
PART VIII.

Fire Resitive 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-resistive construction," "three-hour fire-resistive construction," "two-hour fire-resistive construction" and "one-hour fire-resistive construction," for fire-resistive 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-resistive construction shall meet the respective requirements for such rating as specified in the Standard Specification for Fire Tests of Building Construction and Materials, A.S.T.M. Designation C-19-33, of the American Society for Testing Materials.

Any materials, systems, units or forms of construction which meet the requirements of the aforesaid Standard Specifications shall be accepted as fire-resistive construction of the degrees specified, if and when they shall be shown by an authoritative test conducted in accordance with all the provisions of such aforesaid specifications, to possess such fire resistance.

Sec. 4202. The following materials, combinations of materials, systems and units shall be classed as fire-resistive materials:

- 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)

Sec. 4203. All fire-resistive 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 cement 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 sufficient manner 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. Wherever plaster is used for fire protection purposes it shall be reinforced with a metal mesh or lath; provided, that where such plastering is placed on masonry or reinforced concrete such reinforcing may be omitted when the plastering is not more than one (1) inch thick. Gunite applied to masonry need not be reinforced, and when properly bonded shall be considered a part of the required thickness.
CHAPTER 43 — FIRE RESISTIVE STANDARDS

Sec. 4301. The thickness of fire-resistive materials for fire protection of structural parts shall be as shown in the following table for the respective degrees 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 (2/3) of the thickness of the gypsum plaster board (or lath) where such board (or lath) is used.
## Section 4301

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 Materials in Inches for the following Fire-Resistive Periods: 4 hr. 3 hr. 2 hr. 1 hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel or Cast Iron Columns;</td>
<td>Concrete</td>
<td>2  1½  1½  1</td>
</tr>
<tr>
<td>Projecting Steel Beam</td>
<td>Gunite</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td>or Girder Flanges;</td>
<td>Brick of Clay, Shale or</td>
<td>3½  3½  2½  1½</td>
</tr>
<tr>
<td>All Members of Primary Trusses</td>
<td>Concrete</td>
<td>4 or 4 or 2  2</td>
</tr>
<tr>
<td></td>
<td>Clay Tile, Clay Tile and</td>
<td>2 pl.  2 pl.</td>
</tr>
<tr>
<td></td>
<td>Concrete or Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Block</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solid Gypsum Blocks</td>
<td>2 pl.  2 pl.  2  2</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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Portland Cement Plaster</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2½  1</td>
</tr>
<tr>
<td></td>
<td>Concrete</td>
<td>2  1½  1  1</td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Brick of Clay, Shale or</td>
<td>3½  2½  2½  1½</td>
</tr>
<tr>
<td></td>
<td>Concrete or Concrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Block</td>
<td></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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Portland Cement Plaster</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2  1</td>
</tr>
<tr>
<td>Webs of Steel Beams and Girders</td>
<td>Concrete</td>
<td>2  1½  1½  1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcing Steel in Reinforced</td>
<td>Concrete</td>
<td>1½  1  1  %</td>
</tr>
<tr>
<td>Concrete Columns and the Soffits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of Beams, Girders, Trusses and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joists</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reinforcing Steel at the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sides of Reinforced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concrete, Beams, Girders,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trusses and Joists</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling Protection for Roof</td>
<td>Concrete</td>
<td>1  1  %</td>
</tr>
<tr>
<td>Members, Including Roof Trusses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Secondary Trusses</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metal or Wire Lath and</td>
<td>2  1½  1  %</td>
</tr>
<tr>
<td></td>
<td>Gypsum or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cement Plaster, Concrete,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burned Clay Products or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gypsum</td>
<td></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 protection.

* Two % inch layers with % inch air space between.

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For flat ceilings where the ceiling protection for beams, girders or slabs is suspended to form a free air space of not less than one inch between the member and the protection, the protection thicknesses may be one-half (½) inch less than that required in the above table for flat ceiling protection, but no thickness shall be less than three-fourths (¾) of an inch.

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 the foregoing table 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 (1) inch thickness. Fireproofing beyond the edges of projecting steel column and girder flanges shall be the same as required for sides of beams, joists and girders of reinforced concrete construction, but in no case shall be less than one (1) inch. For reinforced concrete members, the thickness given in the foregoing table shall be outside of the principal reinforcement. For purposes of design the protection shall not be considered as carrying load except as permitted for tied columns in Section 2681.

Plaster protections of over one (1) inch in thickness shall have an additional layer of metal lath, wire or metal mesh embedded not more than three-fourths (¾) of an inch from the surface and securely tied into the supporting members.

Wire of not less than number ten (No. 10) B and S gauge wound or tied around members at not more than a six (6) inch pitch, or wire or expended 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 (¾) of an inch 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 (1½) 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 (2.2) pounds per square yard, and two and one-half or more meshes per inch or equivalent. Gypsum plaster board not less than three-eighths (⅜) of an inch thick and having not more than fifteen (15) per cent combustible material combined with the gypsum may be substituted for metal lath for resistance periods of not more than two (2) hours; provided, the plaster is reinforced with metal or wire mesh weighing not less than one and one-half (1½) pounds per square yard, standing away from the board and secured to the supporting members, and two-thirds (⅔) of the thickness of the plaster-board may be considered as plaster.
Sec. 4302. Fire-resistive bearing and non-bearing walls and partitions shall be of not less than the thickness and construction specified in this section, to be classed for the respective degrees of protection indicated.

The structural requirements of the following masonry and reinforced concrete walls 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 section.

The following tabulated thicknesses 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 (2) inches 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 (4) inches 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 the hollow spaces are not thus filled or where hollow units are laid with cells vertical (end construction), the required effective thickness of wall shall be measured from the end of member in wall to the opposite face of 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 (½) of an inch on each side. Plaster over one (1) inch in thickness, as measured to the plaster base, shall have an additional layer of metal lath, wire or metal mesh embedded not more than three-fourths (¾) of an inch from the surface and securely tied into the supporting members.

Gypsum plaster board (or lath) not less than three-eighths (%') of an inch in thickness and having not more than fifteen (15) per cent of combustible material combined with the gypsum may be substituted for metal lath for resistance periods of not more than two (2) hours; provided, the plaster is reinforced with metal or wire mesh weighing not less than one and one-half (1½) pounds per square yard, standing away from the board (or lath) and secured to the supporting studs or joists. Two-thirds (%') of the thickness of the plaster board (or lath) may be considered as plaster.

Gypsum plaster board (or lath) conforming to the specifications contained in the preceding paragraph may be substituted for metal lath and the reinforcement of the plaster omitted; provided, that the joints of the plaster board (or lath) are covered with strips of metal fabric not less than three (3) inches in width and the plaster board (or lath) is plastered with not less than one-half (½) inch of fibered gypsum plaster containing not more than thirty-three and one-third (33 1/3) per cent by weight of silica. Gypsum plaster board (or lath) conforming to the above
requirements, perforated with holes not less than three-quarters (¾) of an inch in diameter and not more than four (4) inches on center in each direction, may be substituted for metal lath when plastered with not less than one-half (½) inch fibered gypsum plaster.

Metal or wire lath shall weigh not less than two and two-tenths (2.2) pounds per square yard, if over a solid base. For weight of lath required for various spacings of studs and joists, see Chapter 47. Metal or wire mesh where used as ties in concrete shall weigh not less than one and one-half (1½) pounds per square yard. Where used as ties for plaster it shall weigh not less than two and two-tenths (2.2) 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 two inch by four inch (2"x4") nominal size and be spaced not more than sixteen (16) inches apart.

Note: The term “plastered” in the following table shall mean walls plastered with not less than one-half (½) inch of gypsum or Portland cement plaster on each side of wall.
### Section 4302
**Rated Fire Resistance Period for Various Walls and Partitions**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>CONSTRUCTION</th>
<th>Minimum Finished Thickness face to face (incl'dng plaster where mentioned) in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick of Clay, Shale or Concrete, and Plain Concrete</td>
<td>Solid Unplastered</td>
<td>8 hr.  3 hr.  2 hr.  1 hr.  4°</td>
</tr>
<tr>
<td></td>
<td>Solid Plastered</td>
<td>9  5°</td>
</tr>
<tr>
<td></td>
<td>Hollow (rowlock) Unplastered</td>
<td>12  10  8</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>8°</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Two Cells in 8-inch or less Thickness. Unplastered</td>
<td>16  12  5° or 8°</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Two Cells in 8-inch or less Thickness. Plastered</td>
<td>13  9  7°</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Two Cells in Wall thickness. Unplastered</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Two Cells in Wall thickness. Plastered</td>
<td>5°</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Three Cells in 8-inch or less Thickness. Unplastered</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Three Cells in 8-inch or less Thickness. Plastered One Side</td>
<td>8½</td>
</tr>
<tr>
<td></td>
<td>End or Side Construction. Three Cells in 8-inch or less Thickness. Plastered</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Combination of Brick and A.S.T.M. Load-bearing Tile</strong></td>
<td>4-inch Brick and 4-inch Tile, Plastered One Side (tile side)</td>
</tr>
<tr>
<td>“Special” Hollow Concrete Block or Tile</td>
<td>One Cell in 8-inch or less Thickness. Unplastered</td>
<td>12#  8  6  3°</td>
</tr>
<tr>
<td></td>
<td>One Cell in 8-inch or less Thickness. Plastered</td>
<td>9#  5°</td>
</tr>
<tr>
<td></td>
<td>Hollow Concrete Block or Tile</td>
<td>One Cell in 8-inch or Less Thickness. Unplastered</td>
</tr>
<tr>
<td></td>
<td>One Cell in 8-inch or less Thickness. Plastered</td>
<td>13  11  9 or 7°</td>
</tr>
<tr>
<td></td>
<td><strong>Solid Concrete</strong></td>
<td>Reinforcement not less than 0.2% in each direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reinforcement not less than 0.2% in each direction</td>
</tr>
<tr>
<td></td>
<td><strong>Solid Gunite</strong></td>
<td>Unplastered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plastered</td>
</tr>
<tr>
<td></td>
<td><strong>Hollow Gypsum Blocks</strong></td>
<td>Outer Shell 2-inch Thick for 16-inch Wall and 1½-inch Thick for 8-inch Wall</td>
</tr>
<tr>
<td></td>
<td><strong>Solid Gypsum or Portland Cement Plaster</strong></td>
<td>Incombustible Studding with Metal or Wire Lath</td>
</tr>
<tr>
<td></td>
<td><strong>Hollow Partition with Gypsum or Portland Cement</strong></td>
<td>Incombustible Studding with Metal or Wire Lath, ¾-inch Plaster on Each Side</td>
</tr>
<tr>
<td></td>
<td><strong>Plaster or Gunite on Each Side</strong></td>
<td>Incombustible Studding with Metal or Wire Lath, 1-inch Plaster on Each Side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wood Studs with Metal or Wire Lath, Firestopped</td>
</tr>
</tbody>
</table>

*Indicates that such walls and partitions shall be used for non-bearing purposes only.

# This thickness to be given a four-hour rating only after an A.S.T.M. certified fire test.
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.

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 fire-resistive floor construction shall consist of reinforced concrete, gypsum and/or solid masonry slabs or arches not less than four (4) inches in thickness, or shall consist of hollow masonry slabs or arches not less than four (4) inches in thickness, with a top covering of not less than two (2) inches of solid masonry, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in the table in this section. 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 as specified in Section 4301.

(b) Three-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum, and/or solid masonry slabs or arches not less than three (3) inches in thickness or shall consist of hollow masonry slabs or arches not less than four (4) inches in thickness with a top covering of solid masonry not less than one and one-half (1½) inches in thickness, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in the table in this section. 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 as specified in Section 4301.

(c) Two-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum, and/or solid masonry slabs or arches not less than two and one-half (2½) inches in thickness, or shall consist of hollow masonry slabs or arches not less than three (3) inches in thickness with a top covering of not less than one (1) inch of solid masonry, or shall consist of steel joists protected with fire-resistive materials of the kind and thickness shown in the table in this section. 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 as specified in Section 4301.

(d) One-hour fire-resistive floor construction shall consist of reinforced concrete, gypsum, and/or solid masonry slabs or arches not less than two and one-half (2½) inches in thickness, or shall consist of hollow masonry slabs or arches not less than three (3) inches in thickness, with all joints in such hollow unit construction thoroughly filled with cement or gypsum mortar, or shall consist of steel joists protected with fire-resistive materials of the kinds and thickness shown in the table in this section. Except in the case of steel joisted construction, all reinforcing, tie rods and supporting structural members shall be
Sections 4303-4304

protected with not less than one-hour fire-resistive construction as specified in Section 4301: or

Wood joisted construction with a double wood floor on top (the sub-floor not less than three-fourths (\(\frac{3}{4}\)) of an inch thick, and the total thickness of the two layers not less than one and one-fourth (1\(\frac{1}{4}\)) inches thick), and with a fire-resistive ceiling as shown in the table in this section, securely fastened to or suspended from the under side of such joists.

For flat ceilings where the ceiling protection for beams, girders or slabs is suspended to form a free air space between the member and the protection, the protection thickness may be one-half (\(\frac{1}{2}\)) inch less than that required in the following table for flat ceiling protection, but no thickness shall be less than three-fourths (\(\frac{3}{4}\)) of an inch minimum protection of metal and wood joists based on time periods for various insulating materials.

In any reinforced concrete floor construction which includes a metal lath and cement or gypsum plastered ceiling on the under side, not less than three-fourths (\(\frac{3}{4}\)) of an inch thick, the required slab thickness may be reduced one-half (\(\frac{1}{2}\)) inch but in no case shall be less than two and one-half (2\(\frac{1}{2}\)) inches thick.

**Minimum Protection for Metal and Wood Joists**

**Based on Time Periods for Various Insulating Materials**

<table>
<thead>
<tr>
<th>Joists to be Protected</th>
<th>Insulating Material Used</th>
<th>Minimum Thickness of Material in Inches for the following Fire-resistive Periods:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling Protection of Steel Joists, where Incombustible Slab not less than 2(\frac{1}{2}) inches thick is placed above</td>
<td>Metal or Wire Lath and Gypsum or Portland Cement Plaster, Concrete, Burned Clay Products or Gypsum</td>
<td>4 hr. 3 hr. 2 hr. 1 hr.</td>
</tr>
<tr>
<td></td>
<td>Gunite</td>
<td>2 1(\frac{1}{4}) 1 (\frac{3}{4})</td>
</tr>
<tr>
<td>Ceiling Protection of Wood Joists with Double Floor on Top</td>
<td>Metal or Wire Lath and Gypsum or Portland Cement Plaster</td>
<td>(\frac{3}{4})</td>
</tr>
</tbody>
</table>

**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:

1. Tin-clad wood-core doors with the core made of three (3) plies of wood one (1) inch 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 March, 1926, and July, 1927, reprinted 1928.
2. Sheet metal doors construction of two (2) sheets of not less than twenty-six (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 (1/16) of an inch of asbestos placed in between the two metal sheets.

3. Sheet metal doors constructed of two (2) sheets of metal of not less than twenty-six (26) U. S. Gauge fastened to a structural steel frame in such manner as to leave a one (1) inch space in the panels, which space shall be filled with asbestos and with a one-eighth (1/8) inch asbestos covering on the stiles and structural steel frame.

Fire-resistive doors used for openings in stairway enclosures, smoke-proof towers, corridors and passageways, moving picture booths, room partitions, exterior walls facing streets or more than twenty-five (25) feet from adjacent property lines and for "Ordinary Fire Separations" as specified in Section 508, 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.

4. Tin-clad wood-core doors made of two (2) plies of wood one (1) inch nominal in thickness and covered with sheet metal, the doors to be constructed in accordance with the "Underwriters Standard for Tin-Clad Fire Doors and Shutters." Edition of March, 1926, and July, 1927, reprinted 1928.

5. Sheet metal doors as specified in paragraph 3 above, but with one-fourth (1/4) of an inch 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 (1 3/4) inches in thickness and with wood panels not less than three-fourths (3/4) of an inch in thickness, the whole door covered with not less than number twenty-six (No. 26) gauge metal. The panels of such doors shall fit into the frame not less than three-fourths (3/4) of an inch, and all joints of metal shall be lapped and nailed tightly to the wood frame.

Metal shall in all cases 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-quarter (1/4) inch wire glass shall be permitted in any of the above doors except when such doors are used on openings in fire walls, fire division walls, all openings for the stage portion of any Group A building or for openings in "Special Fire Separation" as specified in Section 503. Such glass panels shall be not more than seven hundred and twenty (720) square inches in area, nor exceed fifty-four (54) inches in height or forty-eight (48) inches in width. Grooves not less than three-fourths (3/4) of an inch in depth and three-eighths (3/8) of an inch wide providing not less than five-eighths (5/8) of an inch of bearing for the glass shall be required.
Section 4304

Fire doors bearing the label of the Underwriters' Laboratories, Incorporated, for the intended purpose, 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 Nos. 1, 2, 3 and 4 shall be made of good quality malleable iron not less than one-fourth (1/4) of an inch thick or of flat rolled structural steel not less than three-eighths (3/8) of an inch thick; provided, that tubular steel track made of at least one-eighth (1/8) inch 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 (3) one-half (1/2) inch bolts extending through the door. Latches for fire doors shall be not less than two and one-half inches by three-eighths inch (2 1/2" x 3/8"), and latch bars shall be not less than one and one-half inches by one-fourth inch (1 1/2" x 1/4").

Hardware for swinging hollow metal and metal-clad doors as referred to in paragraphs Nos. 5 and 6 shall be made as follows:

Hinges. For doors not exceeding eight (8) feet in height the hinges shall be of steel or bronze, and shall be applied by the use of steel studs.

Locks. Special locking devices shall be provided as required in Part III under occupancy, also 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 (3/4) of an inch.

Fire doors required by this Code shall be installed in the manner prescribed in the “Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire,” recommended by the National Fire Protection Association, Edition of 1927.

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.

Frames for fire-doors shall be of the same construction as for the door.

(b) Steel rolling shutters built in accordance with the requirements of the National Board of Fire Underwriters, for the intended use, may be used on door or window openings; provided, such opening is not a required means of exit.
(c) 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 (1/4) of an inch in thickness, and no one light shall exceed seven hundred and twenty (720) square inches in area. Grooves three-fourths (3/4) of an inch in depth shall be provided and glass so arranged as to have not less than five-eighths (5/8) of an inch of bearing in hollow metal frames and with grooves not less than one-half (1/2) inch and with glass provided with no less than three-eighths (3/8) of an inch 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 (60) square feet with a six (6) foot maximum width and a ten (10) foot maximum height for double hung and counter-balanced windows and to a maximum size of seventy (70) square feet with a seven-foot maximum width and ten (10) foot maximum height for stationary windows. Solid metal section windows shall be limited to a maximum size of eighty-four (84) square feet in area with a maximum dimension in either direction of twelve (12) feet. 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 (12) feet, and shall be used for non-bearing purposes only. Solid section mullions when used in lengths exceeding twelve (12) feet shall be fireproofed 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 parts (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. Roof coverings for all buildings shall be either "Fire Retardant" or "Ordinary" roofings as specifically required either by Location in Part IV, or by Type of Construction in Part V. The roof coverings shall be securely fastened to the supporting roof construction.

(a) Fire Retardant Roofings. "Fire Retardant" roofings shall be any roof covering which meets the requirements specified for any one of the following roofings, 1 to 16 inclusive, or shall be any roofing meeting the requirements of the Class A, B and C specifications of the Underwriters' Laboratories, Incorporated. Roofings bearing the label, and laid in the manner provided by the Underwriters' Laboratories, Incorporated, for Class A, B and C, may be accepted as meeting the requirements of this section for fire-retardant roofs.

1. Not less than two layers of prepared composition roofing, each layer weighing not less than thirty-two (32) pounds to the one-hundred-eight (108) square feet solidly mopped between with asphalt so that in no place shall layer touch layer, and cov-
ered with a flood coat of asphalt in which there shall be embedded gravel, crushed brick, stone or other approved incombus-
tible material to completely cover the surface.

2. Not less than four layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-
hundred (100) square feet solidly mopped between with as-
phalt so that in no place shall layer touch layer, and covered with a flood coat of asphalt in which there shall be embedded gravel, crushed brick or stone, or other approved incombus-
tible material to completely cover the surface.

3. No less than two layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-
hundred (100) square feet (or their equivalent in weight in one or more layers of asphalt saturated rag felt or prepared compos-
tion roofing) and either one layer of mineral surfaced prepared composition roofing weighing not less than eighty-two (82) pounds to the one-hundred-eight (108) square feet or one layer of smooth finished prepared composition roofing weighing not less than seventy-two (72) pounds to the one-hundred-eight (108) square feet. The said layers of felt and/or roofing mopped solidly between with asphalt so that in no place shall layer touch layer.

4. Not less than two layers of asphalt impregnated asbestos prepared roofing, the combined total weight of which shall be not less than seventy-four (74) pounds to the one-hundred-eight (108) square feet, mopped solidly between and surfaced with asphalt so that in no place shall layer touch layer.

5. One or more layers of asphalt saturated rag felt, the com-
bined weight of which shall be not less than forty-five (45) pounds, to the one-hundred-eight (108) square feet, over which there shall be laid two layers of asphalt impregnated asbestos roofing felt, each layer weighing not less than fourteen (14) pounds to the one-hundred-eight (108) square feet; or one layer of asphalt saturated prepared roofing weighing not less than ninety (90) pounds to the one-hundred-eight (108) square feet, over which there shall be laid not less than one layer of asphalt impregnated asbestos roofing felt weighing not less than fourteen (14) pounds to the one-hundred-eight (108) square feet. The said layers of roofing and/or felt shall be mopped—solidly between and surfaced with asphalt so that in no place shall layer touch layer.

6. Hydraulic compressed rigid shingles not less than one-
eighth (1/8) inch thick, composed of Portland cement and as-
bestos fibers, laid over a layer of saturated felt weighing not less than fourteen (14) pounds to the one-hundred (100) square feet; or hydraulic compressed rigid sheets not less than seven thirty-seconds (7/32) inch 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.

7. Asphalt saturated mineral surfaced prepared composition shingles laid so there shall be not less than two thicknesses at all places. The combined weight of such shingles shall not be less than one-hundred-ninety (190) pounds to the one-hundred
(100) square feet of completed roof area. Nails shall be copper, zinc, hot-dipped zinc coated or commercially pure iron nails at least fourteen and one-half (14½) gauge and not less than one (1) inch long. In reroofing over an old roof the nails shall be not less than one and one-half (1½) inches long. Metal flashing of copper, galvanized iron or roofing tin not less than ten (10) inches wide shall be installed around all roof openings, chimneys, parapet walls, etc. Valleys shall be of similar material, not less than fourteen (14) inches wide, or may be of roofing material not less in weight and thickness than the roof to be applied. In re-roofing jobs, new valleys shall be installed before the roof is applied.

8. Not less than two layers of asphalt saturated rag felt, each layer weighing not less than fourteen (14) pounds to the one-hundred (100) square feet (or their equivalent in weight in one or more layers of asphalt saturated rag felt or prepared composition roofing) and one layer of prepared composition roofing, either smooth finish or sanded on one side, and weighing not less than fifty-two (52) pounds to the one-hundred-eight (108) square feet. The said layers of felt and/or roofing mopped solidly between so that in no place shall layer touch layer.

9. One layer of asphalt impregnated asbestos prepared roofing (built up at the factory of not less than three (3) plies of asphalt impregnated asbestos felt) and weighing not less than sixty-two (62) pounds to the one-hundred-eight (108) square feet; provided, that such roofing shall not be used on roofs which have a rise of less than three (3) inches to each twelve (12) inches of horizontal projection.

10. Concrete Slab or Concrete Tile. Concrete slab roofs shall be constructed as specified in Chapter 26, and need not be covered with any additional roof covering.

11. Metal Roof Covering. Metal roof covering may be of a corrugated, standing seam or flat type of not less than number twenty-six (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.

12. Slate. Each slate shingle shall be securely fastened to the supporting roof construction with copper or zinc coated nails or with copper or zinc coated nails and copper or annealed wire, with nails of such length as to provide not less than three-fourths (¾) of an inch of penetration into the nailing strips or sheathing. All roofing slate shall be laid over not less than thirty (30) pound asphalt saturated rag felt roofing.

13. Clay or Cement Tile. Roof tile shall not absorb more than fifteen (15) per cent of the dry weight of the tile during a forty-eight (48) hour immersion test.

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 (6) inches each side of the center of the tile, giving four points of support and a span of twelve (12)
inches, and loaded with a concentration at the center, the average breaking load per tile for five representative tile tested shall be not less than four hundred (400) pounds, and the breaking load for any individual tile tested shall be not less than three hundred fifty (350) pounds.

All roof tile without any projection lug shall be nailed and/or wired in place.

Copper or zinc coated nails and copper or annealed wire shall be used wherever nailing and wiring of tile is required in this sub-section; provided, that when roofs do not exceed a one-third (\( \frac{1}{3} \) pitch), galvanized iron nails may be used. Wire shall be not smaller than number fourteen (No. 14) B and S gauge. Nails shall in all cases penetrate not less than three-fourths (\( \frac{3}{4} \)) of an inch after passing through the tile or other fastening device. All roofing tile shall be laid over not less than 30 pound asphalt saturated rag felt roofing.

14. Asphalt saturated mineral surfaced prepared composition roofing weighing not less than eighty-two (82) pounds to the one-hundred-eight (108) square feet.

15. Asphalt saturated prepared composition roofing, weighing not less than fifty-two (52) pounds to the one-hundred-eight (108) square feet and shall be used on Group J buildings only.

16. Tar and Gravel Roof. Not less than three (3) layers of tarred felt, weighing not less than fifteen (15) pounds to the square, each layer to lap not less than seventeen inches over the preceding layer. The first layer shall be mopped on to the roof deck and each succeeding layer mopped on to the preceding layer with hot coal-tar pitch so that in no place shall felt touch felt. When applied over wood sheathing, one thickness of sheathing paper or unsaturated felt, weighing not less than five (5) pounds per square shall first be applied to the sheathing, each sheet to lap the preceding one not less than one (1) inch, and the first layer of felt shall be nailed to the sheathing sufficiently to hold it in place; the initial mopping of pitch to be omitted. Spread over the entire surface a uniform coating of pitch, into which while hot, embed crushed slag or gravel so that the entire surface shall be uniformly covered. The gravel or slag shall be free from dirt and shall be from one-quarter (\( \frac{1}{4} \)) inch to five-eighths (\( \frac{5}{8} \)) inch in size. Gravel shall be heated in cold or damp weather. Not less than one hundred (100) pounds of pitch per square shall be used in application over concrete or steel decks, and not less than ninety (90) pounds per square on wood decks.

(b) Ordinary Roofings. “Ordinary” roof coverings shall be any roof covering which meets the requirements of Types 1 to 16 inclusive, or meets the requirements of Class C specifications of the Underwriters Laboratories Incorporated as of May, 1924, or as specified in Paragraphs 17 and 18.

17. Asphalt saturated mineral surfaced prepared composition shingles to be blind nailed in accordance with manufacturers’ directions, using nails as specified in item 7. Valleys and flashings shall be as specified in item 7.
18. Wood shingles used as roof covering shall be of clear vertical grain all-heart wood and shall be not less than five (5) shingles to two (2) inches in thickness at the butt (U.S. Government Standard) and shall be laid with the following exposure as compared to total length of shingle:

**Permissible Exposed Length**

<table>
<thead>
<tr>
<th>Total Length of Shingle</th>
<th>One-third or More Pitch</th>
<th>Less Than One-third Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 in.</td>
<td>5 in.</td>
<td>4 in.</td>
</tr>
<tr>
<td>18 in.</td>
<td>5½ in.</td>
<td>4½ in.</td>
</tr>
<tr>
<td>24 in.</td>
<td>7½ in.</td>
<td>6½ in.</td>
</tr>
</tbody>
</table>

All wood shingles shall be nailed firmly with copper, zinc, hot dipped zinc coated or commercially pure iron box nails of at least fourteen and one-half (14½) gauge and not less than one and one-fourth (1¼) inches long. Each shingle shall be nailed with at least two (2) nails driven substantially into the supporting roof construction. In reroofing over old shingles, a one and three-quarters (1¾) inch nail shall be used.
PART IX.

Regulations for Use or Occupancy of Streets and Projections Over Public Property

CHAPTER 44 — TEMPORARY USE OF STREETS DURING CONSTRUCTION

Sec. 4401. No part of any street, sidewalk or alley shall be used for the storing or handling of building material, except upon the written permission of the Chief Building Inspector. Such written permission shall state the portions of such streets, alleys, or sidewalks to be used and the length of time for which permission is granted. The party to whom such permission is granted shall place and maintain such fences, walkways or other protection as may be deemed necessary for the protection and convenience of the general public by the Chief Building Inspector, and shall maintain the same in a safe and substantial condition. He shall maintain red lights at the ends of any obstructions, which lights shall be kept burning from sunset to sunrise. He shall save the City and County of Denver harmless for any and all claims for damages which may arise from the placing or maintaining of such obstructions.

In Fire Zone No. 1, and when the proposed building exceeds a height of two (2) stories and is less than ten (10) feet from street property lines in any part of the city, and in other cases when deemed necessary for the protection of the public by the Chief Building Inspector, the owner or his agent shall construct, before any building or wrecking is commenced, a temporary covered walk-way not less than five (5) feet wide, of sufficient strength to protect the public from falling materials during construction and such covered walk-way shall remain in place until the completion of all of the exterior portions of the building. The roof over such walk-way shall be the full width of the walk-way and of not less than two (2) layers of one (1) inch boards with joints broken, and shall be covered with suitable roofing material, and shall be placed not less than eight (8) feet above the temporary walk-way. Whenever such roof is used for storing of materials a railing and foot board shall be so installed as to prevent the materials from spilling into the street.

Building materials may be placed in front of the property adjoining a building site under the same conditions as provided for the occupation of the street immediately in front of the building.
site, provided the written consent and waiver of claim for damages against the City and County of Denver is obtained from the owner or owners of such adjoining property, and filed in the office of the Chief Building Inspector.

No building material, fence, shed or any obstruction of any kind shall be placed so as to obstruct free approach to any fire hydrant, lamp post, man-hole, fire alarm box, or catch basin, or so as to interfere with the passage of water in the gutter.

Mortar or concrete may be prepared in the space permitted for storage of building materials, but shall be done in a mechanical mixer or in a tight box or on a tight mixing board, and shall be separated from the walkway by a tight board fence not less than six (6) feet high, in such a manner that dripping or splashing is prevented. Pavements shall be kept cleaned of all building materials at all times.

The covered walk-way shall be kept well lighted continuously between sunset and sunrise and the outer edge of the occupied space of the street or sidewalk shall have placed thereon red lights which shall be kept burning continuously between sunset and sunrise.

The street side of any barricade or fence and hand rails and sidewalks shall be kept reasonably smooth and in good repair while construction work is in progress or while such barricades, fences or walk-ways are placed on or over public property.
CHAPTER 45 — PERMANENT OCCUPANCY OF PUBLIC PROPERTY

Sec. 4501. No portion of any building whatsoever nor any accessory thereto shall project over the public street, alley or sidewalk except as specified in this Section.

(a) Fire escapes and balconies when approved by the Chief Building Inspector may extend over street or alley. No part of any such structure shall be less than ten (10) feet above the sidewalk immediately adjoining or twelve (12) feet above any alley.

(b) Movable awnings of combustible materials may extend over sidewalks as now provided, or as may hereafter be provided by ordinance.

(c) Cornices constructed entirely of and supported by fire-resistant materials if more than ten (10) feet above the sidewalk may project over a public street.

(d) A fixed awning or marquee projecting over the sidewalk shall conform to the following regulations and to the provisions of existing ordinances regulating same or as they may be hereafter revised:

(1) Such awning or marquee shall be supported entirely from the building and shall be directly supported from the structural frame of the building or shall be bolted through the walls and anchored to the floors in such manner as will not cause undue strain to be placed upon any part of the construction.

(2) No combustible materials shall be used in the construction of any fixed awning or marquee.

(3) Such awning or marquee shall be at least ten (10) feet in the clear between the lowest point of any projection and the sidewalk immediately below.

(4) Every awning or marquee shall be so located as not to interfere with the operation of any exterior standpipes, stairways or exits from the building and such location shall meet with the approval of the Chief Building Inspector.

(5) The roof of such awning or marquee shall be so drained as not to discharge water upon the sidewalk.

(e) Water tables, belt courses, sills, bases, columns, pilasters, capitals or other decorative features shall not project more than six (6) inches beyond any lot line, and then only at a distance of ten (10) feet above the sidewalk level.

(f) No part of any show window, store-front or show case shall project beyond the property line. Doors in Fire Zones Nos.
Section 4501

1 and 2 shall not project more than one (1) foot when open, beyond the property line bordering a street and shall not project into any alley. Doors in buildings outside of Fire Zones Nos. 1 and 2 which swing over the street property line shall be maintained normally closed.

(g) The space below the sidewalk level may be used as provided in Section 2804.

(h) No projection whatsoever shall be allowed in alleys except a curb or buffer block extending not more than nine (9) inches from the face of the building.

(i) Footings and foundation walls below grade may extend into a street or alley providing they do not interfere with any sewer, tunnel, or other structure of the City and County of Denver, or of any public utility located therein.
PART X.

CHAPTER 46 — PLASTERING, INTERIOR AND EXTERIOR

Sec. 4601. It shall be unlawful for any person to do or cause to be done any lathing or plastering, or any alteration of lathing or plastering in or upon any building or structure unless such lathing or plastering is done in the manner and of the materials hereafter specified in this Section, and in addition thereto, whenever plastering is required for fire protection it shall also comply with the provisions of Chapters 42 and 43.

Sec. 4602. Wood lath shall be equal to No. 1 grade Douglas fir, spruce, cedar, redwood, pine or western hemlock, and shall be reasonably clear, evenly manufactured and free from detrimental defects. Wood lath shall measure not less than five-sixteenths (5/16) inch nor more than three-eighths (3/8) inch in thickness, not less than one and three-eighths (1 3/8) inches nor more than one and five-eighths (1 5/8) inches in width, and not more than one-fourth (¼) inch less than four (4) feet in length. Each lath shall be nailed with 3d fine blued nails to a stud, joist or other support at each end thereof and at points not more than sixteen (16) inches apart along the length of such lath. Nails shall be driven full length. For lime plaster laths shall be spaced not less than three-eighths (3/8) inch and not more than one-half (½) inch apart, and for gypsum plaster not less than one-quarter (¼) inch and not more than three-eighths (3/8) inch apart. Joints at the ends of laths shall be broken at least every eighth lath and not less than six (6) laths shall constitute a break. Studs, joists, or other supports for lathing shall be spaced at not to exceed sixteen (16) inches on center. No vertical or diagonal lathing or crooked or warped lath shall be used.

Approximately eight (8) hours before being nailed in place, such lath shall be thoroughly soaked and kept damp until plaster is applied thereto.

It shall be unlawful to apply any interior wood lath until all exterior framing has been covered. All coves, bull noses and interior angles shall receive a strip of metal reinforcement before any plastering is applied. A strip of metal reinforcement shall also be used where masonry and wood join.

Sec. 4603. Wherever plaster lath is used it shall be composed of gypsum, wood and manila fibre, or of other similar materials, provided that not less than eighty-five per cent (85%) by weight of such composition shall be of incombustible material.
Such plaster lath shall be not less than five-sixteenths (5/16) inch in thickness and shall be spaced one-quarter (¼) inch apart horizontally and vertically and each joint broken. Such lath shall be not less than three-eighths (⅜) of an inch thick when used as required in Section 4302.

On wood joists, furring strips, studding or other wood supports the plaster lath shall be securely fastened by means of nails of sufficient length to extend at least three-fourths (⅜) inch into the joists, furring strips, studding or other supports. Such nails shall be spaced or driven not more than six (6) inches apart in one direction and sixteen (16) inches apart in the opposite direction. Where the furring strips, studs or other supports are of metal the plaster lath shall be securely fastened to the same with galvanized iron wire of not less than sixteen (16) W. & M. gauge or with twenty (20) U. S. gauge metal clips spaced the same as required for nails. All wire nails used for fastening plaster lath shall be at least number thirteen (13) W. & M. gauge with flat heads not less than three-eighths (⅜) inch in diameter.

It shall be unlawful to apply any interior plaster lath until all exterior framing has been covered. All coves, bull noses and interior angles shall receive a strip of metal reinforcement before any plastering is applied. A strip of metal reinforcement shall also be used where masonry and plaster lath join.

Fibre Board Lath

Sec. 4604. Any fibre board lath or other similar board lath which is equivalent to plaster board lath in strength, durability and bond may be used as a base for backing for plastering; provided, the type of such board lath shall have first been approved by the Chief Building Inspector and all such board lath shall conform strictly to the type so approved.

Such approved board lath may be used wherever wood lath is permitted, but shall not be used in substitution for plaster board lath or metal lath wherever such plaster board lath or metal lath are specifically required.

When fibre board lath is used it shall be applied in conformity with the provisions of Section 4603 for plaster board lath.

Metal Lath

Sec. 4605. 1. Interior Metal Lath. Interior metal lath shall be either ingot iron, rust-resisting alloy, galvanized or coated with an approved preservative material. Metal lath used on walls and ceilings shall be of weight not less than that shown in the following table:

<table>
<thead>
<tr>
<th>Spacing of Supports</th>
<th>Weight per Square Yard in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For Walls</td>
</tr>
<tr>
<td>12&quot;</td>
<td>2.5</td>
</tr>
<tr>
<td>16&quot;</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Metal lath shall be lapped at least one (1) inch and shall be tied at joints in at least one place between supports. The tie wire used to attach and tie metal lath shall be not less than eighteen (18) W & M gauge. Metal lath shall be secured to wood studs...
with not less than 4d wire nails driven to at least seven-eighths (7/8) inch penetration and the remaining portion of the nail bent up to engage at least one strand of fabric, and must be bent in such a manner as to not break the strands. Metal lath when applied to metal supports shall be fastened thereto with not smaller than eighteen (18) W & M gauge galvanized annealed wire or by metal clips of equivalent strength.

2. Exterior Metal Lath. Exterior metal lath shall weigh not less than three and four-tenths (3.4) pounds per square yard, and shall be galvanized, rust-resisting alloy, ingot iron or double coated with an approved preservative material. Such dip shall be alkali-resisting and shall be lime and acid proof. Metal lath shall be lapped not less than one (1) inch at each joint and shall be kept not less than one-quarter (1/4) inch away from all backing and supports by galvanized or blued furring nails, galvanized metal furring clips or other equivalent means of furring; provided, that when self-furring metal lath is used, such furring nails, clips or other equivalent means of furring shall not be required. All metal lath shall be held in place by means of galvanized or blued nails not smaller than 4d in size or by means of galvanized staples not less than one (1) inch in length made of not smaller than fourteen (14) W & M gauge wire, or by any other approved method of equivalent strength.

Nails for holding metal lath in place shall be driven to approximately seven-eighths (7/8) penetration and bent over one or more strands or its equivalent of such metal lath. Staples, furring nails, furring clips, or other methods of fastening metal lath shall develop a strength equivalent to the nails hereinbefore specified in this section. No fastening of any kind for metal lath shall be cracked, broken or otherwise defective.

Metal lath shall be nailed or stapled to wood studs, joists or other support or tied to metal supports at points not to exceed six (6) inches on center along such studs, joists or other supports.

Sec. 4606. Each suspended ceiling and each portion thereof shall be constructed and supported as hereinafter in this section provided.

The main runners or other supports for any suspended ceiling shall consist of steel channels, steel angles or steel tees, not smaller than one (1) inch in vertical depth when in place and weighing not less than four hundred forty-two (442) pounds per one thousand (1000) linear feet, or other structural members of equivalent strength.

Such main runners or other supports shall be spaced at not more than four (4) feet on centers and shall be supported by annealed steel wire hangers not smaller than 5 W & M gauge (3/16") spaced at not more than four (4) feet on center. Such wire hangers shall be securely fastened to the structural framing, masonry or concrete with approved metal clips or approved bolts and nuts, or such wire hangers shall be embedded in such structural framing, masonry or concrete. Such wire hangers
shall be secured to such main runners or other supports by wrapping each such wire hanger a full turn around the main runner or other support and twisting such wire hanger together over the top edge of the main runner or other support so as to develop the full strength of the wire.

The under side of such main runners or other supports shall be cross furred with steel channels which shall be not less than three-fourths (3/4) inch in vertical depth when in place and shall weigh not less than two hundred seventy-six (276) pounds per one thousand (1000) linear feet, and which shall be spaced at not more than twelve (12) inches on center. Each such three-quarter (3/4) inch channel shall be fastened to each main runner or other support directly above same by means of not smaller than sixteen (16) W & M gauge galvanized annealed wire wrapped around both members with a double turn and twisted securely together. Each main runner and cross furring channel shall be straight and true and shall be maintained in that condition until the finished ceiling has been applied. Any metal lath applied to such three-quarter (3/4) inch channels shall be of the quality and weight and shall be applied in the manner specified in Section 4605 for metal lath applied to metal supports.

Nothing contained in this section shall be deemed or construed to prohibit the use of any other material or method of construction for any suspended ceiling in the event that such other material or method of construction is the equivalent of the material or method of construction hereinabove specified; and in the further event that such other material or method of construction shall have been first approved by the Chief Building Inspector.

Each suspended ceiling, and each portion thereof, shall be constructed so as to be capable of sustaining a live load of not less than ten (10) pounds per square foot, in addition to all dead loads, without any deflection, settlement or distortion which will materially affect the strength, durability or safety thereof.

Whenever in the opinion of the Chief Building Inspector any suspended ceiling or any portion thereof is not capable of sustaining such live and dead loads as hereinabove in this section required, the Chief Building Inspector may require the owner, contractor, sub-contractor or other person constructing or causing to be constructed the suspended ceiling or any portion thereof, to test or cause to be tested such suspended ceiling, or any portion thereof, with a load test of not less than twenty (20) pounds per square foot, and it shall be unlawful for any such owner, contractor, sub-contractor or other person to fail, refuse or neglect to make such load test within the time specified.

The load test hereinabove provided for may also be required on any altered or reconstructed portion of any existing suspended ceiling.

Sand

Sec. 4607. All sand used for making plaster for any building or structure shall be clean, sharp, abrasive sand and shall not contain more than three per cent (3%) by weight of deleterious matter such as clay, loam and/or silt. In the test for organic matter the sodium hydroxide solution shall not be darker

All the sand shall pass a No. 4 sieve and not more than eighty per cent (80%) and not less than sixty per cent (60%) shall pass a No. 20 mesh sieve, and not more than thirty-five per cent (35%) and not less than fifteen per cent (15%) shall pass a No. 40 mesh sieve. All remaining on the No. 4 sieve shall be considered gravel.

The sand shall be of such quality that when mixed in the proportion of one part Portland cement to two parts of sand the mortar shall develop a tensile strength of not less than two hundred ten (210) pounds per square inch at the age of ten (10) days.


Lime Quicklime shall be well slaked, run through a No. 16 screen, stored and protected in an approved manner for the time recommended in the manufacturers' specifications.

Sec. 4609. Any metal reinforcing material, woven wire netting, expanded metal fabric or welded wire fabric used for exterior stucco or for any interior or exterior plaster reinforcing shall be galvanized or coated with an approved preservative material, which coating shall be alkali resisting and shall be lime and acid proof. Plaster reinforcing shall be furred and fastened in place in the same manner as required herein for metal lath, and shall have a mesh not exceeding two (2) inches in width and four (4) inches in length, and each such mesh shall have an area of not more than six (6) square inches. Such metal reinforcing material, woven wire netting, expanded metal fabric or welded wire fabric shall weigh not less than one and five-tenths (1.5) pounds per square yard. When woven wire netting is used, it shall be not less than sixteen (16) W & M gauge wire; provided, however, that a wire netting composed of eighteen (18) W & M gauge wire woven with a one (1) inch mesh and weighing not less than one and six-tenths (1.6) pounds per square yard may be used. All plaster reinforcing covered by this section shall be lapped not less than two (2) inches.

Sec. 4610. Keene's cement shall have a tensile strength of not less than four hundred fifty (450) pounds per square inch, seven days in the air, and shall conform to the Standard Specifications for Keene's Cement, A.S.T.M. Designation C61-80 and C-26-33, of the American Society for Testing Materials.

Keene's Cement
Sections 4611-4612

Portland Cement

Sec. 4611. All Portland cement used for making plaster shall conform to the Standard Specifications and Tests for Portland Cement (A.S.T.M. Designation C9-30) of the American Society for Testing Materials. The Building Inspector may require tests of cement used, when in his judgment the cement does not comply with this ordinance.

Waterproof Paper and Metal Flashing

Sec. 4612. In all cases where plastering or stucco is applied to the exterior of a wood frame building, such wood frame shall be covered with a substantial waterproof paper as hereinafter described in this section, except in back-plastered construction.

Wherever in this section waterproof building paper is required, a substantial waterproof building paper which successfully passes the fifty (50) pound Mullen test shall be used.

Wherever such paper is used it shall be applied so as to readily shed water, and care must be exercised in the application of such paper. All corners and returns shall be carefully shingled with such paper, and there shall be no holes or breaks in the paper. Horizontal joints shall be lapped not less than two (2) inches and vertical joints not less than six (6) inches beyond the stud on the weather side, except sheet lath, which shall be lapped not less than four (4) inches, and such paper shall be nailed to the backing with wire nails of not less than eleven (11) W & M gauge having a flat head of not less than three-eighths (3/8) inch in diameter. Such paper shall be nailed to the structural backing at points spaced at not more than twelve (12) inches on center vertically and sixteen (16) inches on center horizontally.

Provided, that any reinforced waterproof paper which is reinforced with metal in the process of manufacture, such reinforcement being in accordance with requirements of Section 4709 for plaster reinforcing, shall be lapped not less than two (2) inches horizontally and four (4) inches vertically.

Where sheathing or similar backing is not used in eighteen (18) W & M gauge or larger, wire stretched taut horizontally across the stud frame at not more than six (6) inches on center vertically shall be securely fastened in place before the paper is applied; provided, that where such paper is fastened to the metal reinforcing in such a manner as not to affect the waterproofing qualities of such paper, the wire need not be installed. Where the building is sheathed with wood, fiber board or plaster board sheathing, the waterproof paper shall be applied on the outside of such wood, fiber board or plaster board sheathing.

All exterior openings exposed to the weather shall be thoroughly and effectively flashed with metal flashing in such a manner as to make them waterproof. All copings and parapet walls shall be thoroughly flashed with metal in a manner approved by the Building Inspector. Wherever metal flashing is required, it shall consist of not less than sixteen (16) ounce copper or twenty-six (26) gauge galvanized iron or lead coated or asphaltum dipped metal not less than twenty-six (26) gauge, such coating or dipping to be rust-resisting.
Sec. 4613. Except when applied to tile, masonry or concrete, all exterior hand plastering or stucco shall be three (3) coat work and shall be reinforced with metal lath or metal plaster reinforcing as specified in Sections 4605 and 4609.

First Coat. The first coat shall consist of one part of Portland cement to not more than three and one-half parts of sand by volume, to which may be added slaked or hydrated lime or approved brands of diatomaceous silica in an amount not to exceed ten per cent (10%) by volume of cement; provided, that when approved waterproofing materials or compounds are used, no hydrated or slaked lime shall be used.

The first coat shall be well forced through all spaces or openings in the metal reinforcing so as to form a good mechanical key and to solidly fill any space between such plaster reinforcing and backing. The first coat shall be thoroughly scored, combed or scratched in two directions at approximately right angles to each other in such a manner as to cause furrows or channels in such first coat, in order to provide a good mechanical bond to receive the second coat of plaster or stucco.

The first coat of plaster shall be kept moist during the first twenty-four (24) hours after it has been applied so that at the end of the period of wetting the plaster will show a thoroughly set and hard condition. The first coat shall have been applied for at least seven (7) days before second coat is applied thereto.

Every first coat of exterior plaster or stucco shall have a minimum thickness of not less than three-eighths (3/8) inch measured from the face of the backing. When plaster is applied to tile, masonry or concrete, such tile, masonry or concrete shall be thoroughly washed and cleaned before any plaster is applied thereto.

Second Coat. The second coat of exterior plaster or stucco shall consist of one part of Portland cement to not more than three and one-half parts of sand by volume, to which may be added approved waterproofing or fattening compounds as provided for the first coat.

The second coat of plaster shall be applied and rodded and shall be water floated. The second coat shall have a minimum thickness of not less than three-eighths (3/8) inch measured from face of the first coat of plaster. This coat must be kept as prescribed for the first coat.

The second coat shall stand for at least ten (10) days before the third coat is applied.

Third Coat. The third or finish coat of exterior plaster or stucco shall be composed of any material or materials approved by the Chief Building Inspector, and shall have a minimum thickness of not less than one-eighth (1/8) inch measured from the face of the second coat.

The total thickness of the three coats of stucco shall be not less than seven-eighths (7/8) inch in any place measured from the backing.
Sec. 4614. Pneumatically placed stucco shall be deemed to 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 such conveyor and deposited by the air pressure in its place of final repose.

Rebound as applied to pneumatically placed stucco shall be defined as material ejected from the nozzle against a surface from which it rebounds and falls.

Sand used for pneumatically applied stucco shall comply with the requirements for sand for reinforced concrete construction as provided in Section 4607; provided, that the grading may vary from that required for concrete.

Rebound gathered up and screened may be used as sand in the mixture, but shall not constitute more than twenty-five per cent (25%) of the total sand contained in any one batch.

Pneumatically applied stucco shall contain not less than one sack of cement to each five (5) cubic feet of sand or gravel used.

Hydrated lime or other approved materials in an amount not to exceed ten per cent (10%) of the volume of the cement may be added to the mixture.

Pneumatically applied stucco shall be applied in not less than two (2) coats to a total minimum thickness of seven-eighths (7/8) inch.

Not less than seven (7) days shall elapse between the application of the first and second coats, during which time the first coat shall be sprayed with water and properly cured.

The second coat shall be rodded as provided for the second coat of hand applied stucco. No third coat will be required over the second coat of pneumatically applied stucco.

On buildings where sheathing is required, such sheathing may be omitted provided the frame is covered with not less than one (1) inch of pneumatically applied stucco reinforced by expanded metal weighing not less than four and five-tenths (4.5) pounds per square yard, or welded wire fabric weighing not less than four and three-tenths (4.3) pounds per square yard. Such pneumatically applied stucco shall be applied in the manner hereinabove specified.

Sec. 4615 Number of Coats Required. Plastering with lime mortar shall be three-coat work when applied over metal lath, and may be two-coat work when applied over wood lath or masonry.

Plastering with gypsum or hardwall plaster shall be three-coat work when applied over metal lath, and not less than two-two-coat work when applied over wood lath, plaster lath or fiber board or masonry.

Plastering with cement mortar shall be three-coat work when applied over metal lath, expanded metal or wire mesh.

Cement plaster shall not be applied over gypsum lath, wood lath or fiber board unless such gypsum lath, wood lath or fiber
board shall be first covered with a waterproofing paper and metal reinforcing as required for exterior plastering.

All plaster staff work shall have lugs of pure fiber and plaster of Paris, and shall be securely installed and fastened into place in a manner approved by the Chief Building Inspector.

Sec. 4616. First Coat. Lime mortar for first coat of interior plastering shall be mixed one part lime to not more than two and one-half parts of sand by volume. Each cubic yard of lime mortar shall contain not less than two hundred (200) pounds of Keene's cement, or Portland cement. To each cubic yard of lime mortar used for first or scratch coat, there shall be added not less than four (4) pounds of manila fiber, or loose hair, the same to be distributed thoroughly throughout the mortar.

The first coat of mortar applied over metal lath shall be well scored so as to form a good mechanical key. The first coat over metal shall be thoroughly set and dry before second coat is applied. The first coat shall completely embed and cover all of the lath.

Second Coat. The second coat of lime mortar shall be mixed one part of lime to not more than three parts of sand by volume and shall contain not less than one hundred fifty (150) pounds of Keene's or Portland cement in each cubic yard of mortar. To this shall be added not less than four (4) pounds of manila fiber or loose hair. The second coat of lime mortar shall be rodded to a straight surface.

The minimum thickness of the two coats of lime mortar shall be not less than three-fourths (¾) inch including the lath. The second coat of lime mortar shall be thoroughly set and dry before the third or finish coat is applied.

Third or Finish Coat. The third or finish coat may consist of one of the following:

1. A white coat mixed one part gypsum plaster or plaster of Paris to not more than two parts of lime putty. Such white coat shall thoroughly cover all brown mortar surfaces and shall be troweled smoothly with a steel trowel, and must be free from blemishes.

2. A sand finish consisting of one part gypsum plaster or hydrated lime or lime putty to not more than two and one-half (2½) parts of sand. Such sand finish shall thoroughly cover all brown mortar surfaces and may be left in any texture desired.

3. Any approved brand of interior stucco which shall cover all brown mortar surfaces.

Portland cement shall not be permitted for the third or finish coat over lime or gypsum brown mortar, nor shall any Portland cement be used over lime or gypsum mortar surfaces.

Lime mortar when applied over wood lath shall be mixed and applied as required for the brown coat and finish coat of lime mortar over metal lath, except that the brown coat shall be mixed
one part lime to not more than two and one-half parts of sand. It shall contain not less than two hundred (200) pounds of Keene's cement, or Portland in each cubic yard of mortar. To the brown coat shall be added at least four (4) pounds of manila fiber or loose hair.

Sec. 4617. Hardwall or gypsum plaster applied over wood lath, plaster lath or fiber board shall be not less than three-eighths (3/8) inch measured from the outer face of the lath.

The first or brown coat shall be mixed of one part of gypsum or hardwall plaster of an approved brand to not more than two parts of sand by weight. The first or brown coat shall have a minimum thickness of not less than one-fourth (1/4) inch measured from the outer face of the lath or board.

The first or brown coat shall be thoroughly set and shall be free from dry sets, sweat-outs, buckles or other harmful defects before the second or finish coat is applied.

The second or finish coat shall consist of one of the following:

1. Any approved brand of interior stucco, which may be applied over a brown mortar surface that is still green.

2. A white coat consisting of one part gypsum plaster to not more than two parts of lime putty thoroughly gauged together which shall be applied in the same manner as specified for white or putty coat over lime mortar.

3. A sand finish consisting of one part of gypsum plaster or hydrated lime or lime putty, mixed with not more than two and one-half (2 1/2) parts of sand. This may be applied over a brown mortar base while it is still green.

The second or finish coat of plaster applied over wood or plaster lath or fiber board shall be of sufficient thickness to bring the total minimum thickness of plaster measured from the outer face of the lath to not less than three-eighths (3/8) inch.

In no case shall a white coat or putty coat be applied over any other than a thoroughly dry brown mortar base.

Sec. 4618. Interior hardwall or gypsum plaster over metal lath must be at least three-coat work with a minimum thickness of not less than three-fourths (3/4) inch, lath included, measured from the outer face of metal lath supports.

The first or scratch coat shall consist of one part of an approved brand of gypsum plaster to not more than two parts of sand by weight, and shall be thoroughly mixed in a manner so as not to damage the setting qualities of the plaster. This coat shall be scored so as to provide a good key for the second or brown coat.

The first or scratch coat shall be thoroughly set and dry before the brown coat is applied.
The second coat or brown coat of gypsum plaster shall be mixed one part of approved gypsum plaster to not more than two and one-half (2½) parts of sand by weight, and shall be brought to a straight surface.

The third or finish coat shall be mixed and applied in the same manner as specified for the third coat over lime mortar, with the same time as required between second and third coats of lime mortar.

Sec. 4619. Interior hardwall or gypsum plaster over gypsum block, brick, clay tile or concrete shall be not less than two-coat work.

Such two-coat plaster work shall have a minimum thickness of three-eighths (3/8) inch over unit masonry or one-fourth (1/4) inch over monolithic concrete, except where plaster is used for fire-resistive purposes, in which case the minimum thickness shall be one-half (1/2) inch.

For application on brick, gypsum block or clay tile, gypsum plaster shall be mixed in the proportion of one part of gypsum plaster to not more than two and one-half parts of sand by weight.

On all exterior foundation walls below grade, and in other places where subject to moisture, plaster, if used, shall be Portland cement plaster as provided for exterior plastering. (See Section 4613.)

The finished coat shall not be applied until the first coat is thoroughly set and nearly dry, except when a putty coat finish is used, in which case the base shall be absolutely dry.

Concrete surfaces which are to be plastered shall be rough. If the required degree of roughness is not procured by using rough forms, the surface shall be hacked. Before plastering, all concrete surfaces shall be cleaned and all dust and loose particles removed. Grease, oil or efflorescence, if present, shall be washed off with a solution of one part of commercial muriatic acid to four parts of water and the surface then washed again with clean water.

Sec. 4620. Except where otherwise specified for fire-retardant walls and ceilings, interior cement plaster shall be applied over plaster reinforcing as required for exterior plastering.

All interior cement plaster shall be three-coat work except on masonry. The first two coats shall be mixed and applied with the same materials and in the same manner as required for the first two coats of exterior work.

The third or finish coat of interior cement plastering may be of the same materials, mixed and applied in the same manner as required for the third coat of gypsum plaster over metal lath or as required for the third coat of exterior stucco.
Sec. 4621. All staff shall be thoroughly soaked before sticking, except when approved adhesive gums are used. All lugs shall be of pure fiber and plaster of Paris. Excelsior shall not be used for lugs. In all cases where staff is heavy, auxiliary fastenings shall be used, and such fastenings shall be not less than the equivalent of fourteen (14) gauge copper wire or No. 12 galvanized wire, shall in all cases be of sufficient strength to securely fasten the staff to the support, and shall be rust resisting.
PART XI.

CHAPTER 47 — LEGISLATIVE

Sec. 4701. If any section, sub-section, 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 Council of the City and County of Denver hereby declares that it would have passed this Ordinance, and each section, sub-section, clause or phrase thereof, irrespective of the fact that any one or more sections, sub-sections, sentences, clauses and phrases be declared unconstitutional.

Sec. 4702. The specifications, ordinances and regulations which are referred to in various parts of this Ordinance are hereby declared to be a part of such Ordinance when not in conflict with a specific statement contained in the body of this Ordinance to the contrary. Copies of such specifications, ordinances and regulations shall be kept on file in the office of the City Clerk and in the office of the Chief Building Inspector.

Sec. 4703. The following portions of the Municipal Code of 1927 of the City and County of Denver, and all amending ordinances thereto, and all ordinances and parts of ordinances in conflict herewith, are hereby repealed: Chapter XV, Articles I to XVII inclusive, Articles XIX to XXIV inclusive, Articles XXVII and XXVIII; Chapter XXXVI, Article XV, Sections 1094 and 1095.

Sec. 4704. This Ordinance shall be, and is hereby declared to be in full force and effect from and after thirty (30) days from its date of final passage and approval.

Sec. 4705. It is hereby ordered that the text of this bill for an Ordinance, and the Ordinance, shall be published on first and final publication in the official newspaper of the City and County of Denver.

Form Approved:

JAMES D. PARRIOTT, City Attorney.

Section 4705 inserted by vote of Council, April 1, 1935.

BEN DRAPER, City Clerk.
PASSED BY THE COUNCIL and signed by its President this 13th day of May, A.D. 1935.

HARRY W. RISLEY, Acting President.

Signed and approved by me this 14th day of May, A.D. 1935.

GEO. D. BEGOLE, Mayor.

Attested by me with the corporate seal of the City and County of Denver.

A. C. MONSON,

Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver.

By BEN DRAPER, Deputy Clerk.
Use of The Building Code

In order to ascertain the requirements for any anticipated building, it is first essential to determine the zoning restrictions applicable to the location. Refer to the zoning map (copies of which may be obtained from the Board of Adjustment Zoning) for the zone in which the property is located. From the zoning ordinance, make sure that the intended use is permitted in the zone in which the property is located, and check the required yards, set backs, lot area, height and frontage.

From the map in Chapter 16 of the Building Code, determine the fire district in which the property is located, and in Chapter 16 study the requirements and restrictions for the particular fire district in which the property is located.

Refer next to the table in Sec. 503, to determine the occupancy group in which the building will be classified. Chapters 6 to 15 inclusive, detail the requirements for each occupancy group, giving the allowable floor area and heights for different types of construction. From this it can be determined the type of construction that will be permitted for the building.

After the type of construction has been selected, refer to Chapters 17 to 22, which give the detailed requirements for each type of construction: fire-resistive, heavy timber, ordinary wood joist, metal frame and wood frame.

Engineering regulations are covered in Part 6 of the code, Chapters 23 to 27 inclusive. By reference to the proper section in Part 6, the requirements for wall thicknesses, joist sizes, design of reinforced concrete and structural steel, may be determined.

Detailed regulations for foundations, masonry walls, enclosures of vertical openings, roof and floor construction, stairways and exits, doors, windows and skylights, chimneys and heating apparatus, fire extinguishing apparatus, theatre equipment and safety devices are contained in Part 7, Chapters 28 to 41 inclusive.

Part 8, Chapters 42 and 43, detail the requirements for various degrees of fire resistance.

Part 9, Chapters 44 and 45, regulate the temporary and permanent occupancies of the streets.

Part 10, Chapter 46, details the requirements for plaster and plastering.
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