

# City of Cambridge

Massachusetts

## ZONING LAW

AND

## BUILDING CODE

GOVERNING

THE CONSTRUCTION, ALTERATION, REMOVAL, EQUIPMENT, OCCUPATION, AND TEARING DOWN OF BUILDINGS, STRUCTURES OR OBSERVATION STANDS AND FOR THE PLUMBING AND GAS FITTING THEREIN AND FOR THE SETTING AND MAINTENANCE OF STEAM BOILERS AND FURNACES, AND THE INSTALLATION AND ALTERATION OF ELEVATORS



1924

## MAIN FEATURES OF ZONING ORDINANCE

The zoning ordinance, with certain precise exceptions designed to prevent hardship or unreasonable severity, protects specific districts of the city from unsuitable new buildings or uses. No existing uses are stopped but any changes must be towards conformity. It will be enforced as part of the Building Code. Amendments may be made by the Council, but in case of protest will require a three-fourths vote. Further relief is provided by Chapter 133, Acts of the Year 1924, which is as follows:

BUCKLEY & NICHOLSON

32 ESSEX ST., CAMBRIDGE

### [CHAP. 133.]

AN ACT RELATIVE TO APPEALS UNDER ORDINANCES OR BY-LAWS LIMITING BUILDINGS TO SPECIFIED ZONES OR DISTRICTS.

*Be it enacted, etc., as follows:*

Chapter forty of the General Laws is hereby amended by inserting after section twenty-seven the following new section:—  
*Section 27A.* A board of appeals designated or appointed under the preceding section may vary the application of any by-law or ordinance adopted under section twenty-five in specific cases wherein its enforcement would involve practical difficulty or unnecessary hardship and wherein desirable relief may be granted without substantially derogating from the intent and purpose of such by-law or ordinance, but not otherwise. No such variance shall be authorized except by the unanimous decision of the entire membership of the board, rendered upon a written petition addressed to the board and after a public hearing thereon, of which notice shall be mailed to the petitioner and to the owners of all property deemed by the board to be affected thereby as they appear on the most recent local tax list and also advertised in a newspaper published in the city or town. The board shall cause to be made a detailed record of all its proceedings relative to such petition, which record shall set forth the reasons for its decision, the vote of each member participating therein, and the absence of a mem-

ber or his failure to vote. Such record, immediately following the board's final decision, shall be filed in the office of the city or town clerk and shall be open to public inspection, and notice of such decision shall be mailed forthwith to each party in interest as aforesaid. Any person aggrieved by a decision of the board of appeals, whether previously a party to the proceeding or not, or any municipal officer or board, may, within fifteen days after the entry of such decision, bring a petition in the supreme judicial court for a writ of certiorari to correct errors of law therein, and the provisions of section four of chapter two hundred and forty-nine shall, except as herein provided, apply to said petition. No costs shall be allowed against the board unless the court finds that it acted with gross negligence or in bad faith. *Approved March 24, 1924.*  
Effective June 24, 1924.

KEY TO ZONE MAP

UMREST

District

U-1	No change— All uses now permitted, Buildings to height now permitted (100'), and covering as much of the lot.	Permitted
	None.	Prohibited
U-2	All uses now permitted, 6 story or 80' buildings. No change in sizes of open spaces.	Permitted
	No uses prohibited. Buildings of 7 or more stories or over 80'.	Prohibited
U-3	All uses now permitted, 6 story or 80' buildings, except within 100' of a B or R district.	Permitted
	No uses prohibited. Buildings of 7 or 8 stories, or over 80', and within 100' of a B or R district buildings of 5 or more stories or over 60'. Yards and courts where provided must be somewhat larger than at present.	Prohibited
U-4	All uses now permitted. 2½ story or 40' buildings.	Permitted
	No uses prohibited. Buildings of 3 or more stories or over 40'. Yards must be considerably larger than at present.	Prohibited
B-1	Residence, business, light and other non-noxious industries and similar uses. Buildings to height now permitted (100'), and covering as much of the lot.	Permitted
	Industries emitting noxious odors, dust, smoke, gas or noise.	Prohibited

District

**Permitted**

✓ B-2 Residence, business, light and other non-noxious industries and similar uses. 6 story or 80' buildings. No change in sizes of open spaces.

**Prohibited**

Industries emitting noxious odors, dust, smoke, gas or noise.

Buildings of 7 or more stories or over 80'.

**Permitted**

✓ B-3 Residence, business, light manufacturing chiefly for sale at retail and similar uses supplying of local needs. 4 story or 60' buildings (on large plots building may if set back 100' from every lot line have 6 stories and be 80' high.)

**Prohibited**

Heavy and general industry.  
Buildings of 5 stories or more or over 60' high.  
Yards and courts where provided must be somewhat larger than at present.

**Permitted**

B-4 Residence, business, light manufacturing chiefly for sale at retail and similar uses supplying local needs. 2½ story or 40' buildings.

**Prohibited**

Heavy and general industry.  
Buildings of 3 stories or more or over 40' high.  
Yards must be provided and must be considerably larger than at present.

**Permitted**

: R-1 Dwellings, hotels, clubs, churches, schools, philanthropic institutions, greenhouses and gardening, with customary incidental accessory uses including garage for not more than two cars.  
Buildings to height now permitted (100'), and covering as much of lot.

**Prohibited**

Business and industry of all sorts.

District

R-5

**Permitted**

R-2 Dwellings, hotels, clubs, churches, schools, philanthropic institutions, greenhouses and gardening, with customary incidental accessory uses including garage for not more than two cars.  
6 story or 80' buildings.  
No change in sizes of open spaces.

**Prohibited**

Business and industry of all sorts.  
Buildings of 7 or more stories or over 80'.

**Permitted**

✓ R-3 Dwellings, hotels, clubs, churches, schools, philanthropic institutions, greenhouses and gardening, with customary incidental accessory uses including garage for not more than two cars.

4 story or 60' buildings (on large plots buildings other than apartment houses may if set back 100' from every lot line have 6 stories or be 80' high).

**Prohibited**

Business and industry of all sorts.  
Buildings of 5 or more stories or over 60' high.  
Yards and courts where provided must be somewhat larger than at present.  
Buildings must be set back 5' and be at least 25' from the center of any street.

**Permitted**

R-4 Private and two-family dwellings, clubs, churches, schools, greenhouses, and gardening, with customary incidental accessory uses including garage for not more than two cars.

2½ story or 40' buildings, 3 story private dwellings.

**Prohibited**

Business and industry of all sorts.  
Car barns, amusement parks, hospitals, hotels and multiple dwellings.  
Buildings of 3 or more stories and over 40' high (except 3 story private dwellings).  
Yards must be provided and must be considerably larger than at present.  
Buildings must be set back 10' and be at least 30' from the center of any street.

CITY OF CAMBRIDGE

In the year One Thousand Nine Hundred and  
Twenty-three

AN ORDINANCE

entitled "Construction, Use, Maintenance and Ins-  
pection of Buildings."

DIVISION 1.—ADMINISTRATION.

**Section 1.** The provisions of this ordinance shall apply to the construction, alteration, removal, equipment, occupation, height, area, location and maintenance of all buildings as hereinafter set forth in the City of Cambridge but not to existing buildings when specifically treated, nor to bridges, quays, wharves, railway stations, buildings on land ceded to the United States, buildings owned or occupied by the Commonwealth or Middlesex County, portable school buildings erected and maintained by the city, nor to voting booths.

In interpreting and applying the provisions of this ordinance, they shall be held to be the minimum requirements adopted for the promotion of the health, safety, convenience and welfare of the inhabitants. This ordinance shall not repeal, abrogate, annul or in any way impair or interfere with any existing provision of law or ordinance other than an ordinance entitled "Construction, Maintenance and Inspection of Buildings" which is hereby repealed, or with any rules, regulations or permits previously adopted or issued or which shall be adopted or issued pursuant to law relating to the use of buildings or premises; nor shall this ordinance interfere with or abrogate or annul any easements, covenants or other agreements between parties; provided, however, that where this ordinance imposes

a greater restriction upon the use of buildings or premises or upon height of buildings or requires larger yards, courts, or other open spaces than is imposed or required by such existing provision of law or ordinance, or by such rules, regulations or permits or by such easements, covenants or agreements, the provisions of this ordinance shall control.

**Section 2.** There shall be a Building Department, hereinafter designated as the Department, under the charge of a Superintendent of Public Buildings, hereinafter designated as the Superintendent, who shall also be the Inspector of Buildings. The Superintendent shall be qualified by thorough training and experience in the supervision or execution of building operations. He shall be appointed by the mayor, subject to confirmation by the city council, and he shall receive such salary as shall be fixed by ordinance.

He shall enforce the provisions of this ordinance. He, except as otherwise provided by law, under the provisions of this ordinance, shall have sole charge of all buildings. He shall have the care of all public buildings not wholly in the charge of some board or department. He shall have charge of the construction of all buildings erected by the City of Cambridge or any department thereof. He shall submit yearly to the mayor a report of the doings of the Department.

The present officers and employees of the Department shall hold their several offices and positions during their term or office or until removed or discharged.

Under civil service rules, he shall appoint a deputy superintendent, a clerk, inspectors, and employees. No person shall be appointed an inspector of

construction who has not had at least five years' experience as a builder, architect, superintendent, foreman, or competent mechanic in charge of building construction.

The Deputy Superintendent shall, during the absence or disability of the Superintendent, exercise all his powers. In case the superintendent fails to appoint such deputy superintendent, the mayor may designate an employee of the Department as such deputy. No officers connected with the Department, except members of the Board of Appeal, shall engage or be interested in any other business or in the making of the plans or specifications, or in the doing of the work, or the purchase of the materials used in connection with any building for which a permit has been requested or granted by the Department, except as an owner of the building.

Under the direction of the Superintendent the clerk of the Department shall keep a record of its doings which shall be open to the public for inspection. The Superintendent may require plans and specifications of any proposed structure or for the alteration of any structure or building to be filed with him, duplicates of which, when approved by him, shall be kept at the building during the progress of the work.

If the Superintendent finds that the terms of a permit are being violated, he may, after notice mailed to the person to whom the permit was issued, order the whole or any part of the work which is being done under the permit to be stopped, and such work shall not be resumed until the terms of the permit have been complied with to the satisfaction of the Superintendent.

The Superintendent shall have power to determine any requirement to be necessary for the

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strength or stability of any proposed structure or the safety of the occupants thereof even if not specifically covered by this ordinance.

Methods of construction or maintenance equivalent to those required by the provisions of this ordinance may be allowed with the written consent of the Superintendent and the Board of Appeal. A record of the required and equivalent method allowed shall be kept in the office of the Superintendent.

The Superintendent shall cause to be examined as often as is practicable every building in the course of construction or alteration, any building reported as dangerous or damaged, and all buildings in respect to which applications have been made for permits to raise, enlarge, alter, or repair, and shall make a record of every such examination.

**Section 3.** There shall be a board to be called the Board of Appeal, which shall be appointed by the mayor, subject to confirmation by the city council, and consisting of three members, including always one architect, and one master builder.

In the month of February of each year the mayor shall appoint one member of said board, who shall hold office for a term of 3 years from the first day of March following.

The present members of the Board of Appeal shall hold their positions during their respective terms of office unless removed according to law.

The mayor shall likewise, subject to confirmation, as aforesaid, fill all vacancies in said board caused by death, resignation, or removal, for any unexpired term.

Members of said board shall hold office until their successors shall have been appointed and shall have qualified.

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No member of said board shall sit on a case in which he is interested, and in case of such disqualification, or of the necessary absence of any member, the other two members shall appoint a substitute. If two or more members are so disqualified or absent, the mayor may appoint substitutes to act during disqualification or absence.

The clerk of the Department shall act as clerk of said board. The members shall serve without pay but the reasonable expenses of said board, including such clerical assistance and office expenses as shall be approved by the mayor, shall be paid.

**Section 4.** An applicant for a permit whose application has been refused by the Superintendent may appeal therefrom within 90 days. A person may appeal from any other decision of the Superintendent within 10 days after being notified of such decision by giving the Superintendent notice in writing of his appeal. Said notice or a certified copy thereof shall be at once transmitted by the Superintendent to the Board of Appeal.

**Section 5.** After notice to the appealing party, to the Superintendent, and to such other parties as the board shall order, a hearing shall be had, and said board shall affirm, annul or modify said refusal.

The board may vary the provisions of this ordinance in specific cases in regard to existing buildings where such provisions or a requirement of the Superintendent would cause manifest injustice.

Every decision of said board shall be in writing, shall require the assent of two members, except as otherwise provided herein, and shall be filed in the office of the Superintendent within 10 days after the hearing. A certified copy shall be sent by mail or otherwise to the applicant, and a copy publicly posted in the office of the Superintendent for two

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weeks thereafter. If the order or the refusal of the Superintendent is affirmed, such order or refusal shall have full force and effect. If said order or refusal is modified or annulled, the Superintendent shall issue a permit in accordance therewith.

The provisions of this section shall also apply to any similar action or order of the City Electrician. It shall be the duty of the Board of Appeal to submit to the mayor on or before the first of December of each year a report giving a summary of all decisions of the board, together with such recommendations of revisions of this ordinance as may seem advisable to them.

**Section 6.** (See also Board of Health regulations for additional permits required for stables and rendering works, Department of Public Safety regulations for additional permits required for certain boilers, and for additional permits required for garages). The Superintendent shall grant permits for the construction, alteration, removal, equipment, occupation, or tearing down of buildings, structures, or observation stands, and for the plumbing and gas-fitting therein, and for the setting and maintenance of steam boilers and furnaces and the installation and alteration of elevators. No such work shall be started without such a permit nor shall be done except in accordance with drawings bearing the approval of the Superintendent.

All applications for permits under the provisions of this ordinance shall be in writing, on forms furnished by the Superintendent, and shall include a plan at suitable scale, showing the location of the proposed buildings upon the lot. Every application shall state the name and address of the owner. The Superintendent may require the material facts set forth in the application to be verified by the

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oath of the applicant; he may also require in his discretion, a survey of a lot on which any proposed building is to be erected to be filed with the application.

No building shall be used for a grain elevator or chemical works, and no boiler, engine, dynamo, furnace, or machinery for generation, transmission, or application of power except for domestic purposes shall be placed in any building without a special permit from the Superintendent covering such installation; provided, however, that the provisions of this paragraph shall not apply to installations for power or heating for dwellings, nor to installations of machinery for heating, ventilating, and elevator purposes, nor to the plants of the city of Cambridge, the Cambridge Electric Light Company, the Cambridge Gas Light Company, and the Boston Elevated Railway Company, nor to extensions or additions to existing plants or installations unless such extensions or additions shall, in the opinion of the Superintendent, be of a nature to become a nuisance or to injure the character of the neighborhood.

Every application for such permit shall be in writing in such form as the Superintendent may require. The applicant shall publish in at least two newspapers published in the City of Cambridge and shall also post conspicuously on the premises a copy of the application and shall deliver personally or by mail, postage prepaid, copies thereof to all the neighbors within a distance of 100 ft. from the property lines of the lot upon which the installation is proposed, and to such other persons as the Superintendent shall designate.

If no objection is filed with the Superintendent before the expiration of 10 days after the first application of the notice or within 10 days of the delivery or mailing and first posting of such notice if required, the



Superintendent shall, if the arrangement, location, construction, and character of the proposed apparatus is proper; suitable to the neighborhood, and in accordance with the provisions of this ordinance, issue a permit for the same. If the objection is filed by anyone within the time above mentioned, the application shall be referred to the Board of Appeal. After such notice as the board shall order, it shall hear the same and shall direct the Superintendent to issue a permit under such conditions as it may prescribe, or withhold the issuance of permit at its discretion.

No wall or ceiling of any building shall be lathed or otherwise covered until the Superintendent has been notified that the building is ready for such work and he has issued a permit therefor. The Superintendent shall act upon such permit within two days of its receipt.

Any permit under which no work is commenced within six months from the time of issuance shall expire by limitations.

**Section 7.** There shall be charged for all permits issued by the Superintendent the following fees:

Permits shall be kept posted in a conspicuous place on the building.

First-class buildings	\$15.00
Second-class buildings	10.00
Third-class buildings	5.00
Alterations and additions to cost less than \$300	1.00
Alterations and additions to cost \$300 or more	3.00
Taking down buildings	3.00
Boilers, engines, etc.	1.00
New plumbing	3.00
Alterations in plumbing	1.00
New gas fitting	1.00
Alterations in gas fitting	0.25
Installation of elevators	3.00

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Fees for permits for sheds, private garages, and like small buildings, and for preliminary permits for driving piles and for concrete foundations shall be determined in the discretion of the Superintendent, but not to exceed \$5.00.

**Section 8.** Any notice required by this ordinance shall be sufficient if mailed postage prepaid to the address of the interested party or parties given in the application filed by them or subsequently changed by notice in writing to the Superintendent.

### DIVISION 2.—DEFINITIONS.

(See also definitions in Division 26.)

**Section 9.** Certain words in this ordinance are defined for the purposes thereof as follows:

**Alcove.**—A portion of an apartment separated from an adjoining room by a partition, with an opening between the two of 60% to 80% of the area of the separating partition and with no door to close such opening. If the opening is less than 60%, or if it is closed by a door or doors, the portion thus enclosed shall be considered as a separate room, if more than 80%, the portion thus enclosed shall be considered as a part of the room.

**Alteration.**—Any change in the arrangement of a building, or any work affecting the structural parts of a building, or any change in walls, floors, partitions or means of exit affecting the fire resistance or the safety of persons in the building.

**Apartment.**—A room, or suite of two or more rooms, occupied as a residence for one family.

**Approved.**—Where not otherwise specifically stated, the word "approved" means approved by the Superintendent.

**Ashlar.**—A masonry wall facing backed by masonry.

**Basement.**—A story or portion of a story partly underground but having at least one half of its clear height above the highest level of the adjoining ground. (See also definition of first story.)

**Bearing Wall or Bearing Partition.**—One carrying a load other than its own weight.

**Block Stone Walls.**—Walls built of stone split into approximately rectangular blocks so as to form continuous beds substantially horizontal.

**Cellar.**—A story or portion of a story having more than one-half of its clear height below the highest level of the adjoining ground.

**Court.**—An open unoccupied space, other than a yard, on the same lot with a dwelling.

An "outer court" is one extending to a street or yard.

An "inner court" is one not extending to a street or yard.

**Curb Level.**—The level of the established curb in front of a building measured at the middle of such front. Where no curb has been established, the city engineer shall establish such curb level or its equivalent for the purposes of this ordinance.

**Dwelling.**—A house or building or portion thereof which is occupied by one or more families doing their cooking on the premises.

**Private Dwelling.**—A dwelling occupied by one family only.

**Two-family dwelling.**—A dwelling occupied by two families only, one living above the other.

**Multiple-dwelling.**—A dwelling occupied by more than two families.

**Existing.**—Existing at the date of the passage of this ordinance.

**Family.**—A group of persons living together, whether related to each other by birth or not, and may consist of one or more persons.

First, Second and Third-class Construction.—See classification in Division 7.

**First Story.**—In all buildings of class 1 (residence buildings) the first story shall be the lowest habitable story.

In all buildings of class 2 (public buildings) the first story shall be the story with its level not more than 10 ft., and in all buildings of class 3 (business buildings) not more than 6 ft. above the curb level, or the level of the adjoining ground when the street line is more than 20 feet distant.

**Foundation.**—That part of a wall below the level of the curb, or, if a wall is not on a street, that part of the wall below the level of the highest ground next to the wall, or, if so construed by the Superintendent, that part of a party, fire or bearing wall below the cellar floor, or below the basement floor where there is no cellar.

**Habitable Story.**—Includes basements if occupied by one or more families, except those in multiple dwellings occupied solely by the janitor and his family.

**Half-story.**—Any story which is under a sloping roof, which has the point of intersection of the tops of the rafters and the face of the wall less than 3 ft. above the floor level and which does not contain an independent apartment.

**Height of a Building.**—The vertical distance of the highest point of the roof above the mean grade of the curbs of all the streets upon which it abuts, or, if it does not abut on a street, above the mean grade of the ground adjoining the building.

**Incumbustible.**—Sufficiently fire-retarding or fire-resisting for its purpose as shall be determined by the Superintendent.

**Lot.**—The plot of ground covered by and adjacent to a building and devoted exclusively to the purposes of such building, as shown by the plan furnished to the Superintendent in pursuance of Sec. 6 of this ordinance.

A "corner lot" is a lot situated at the junction of two streets, or of a street and passageway; provided, that such street or passageway is at least 20 ft. wide or where a street changes direction, provided that at such junction or change of direction the interior angle is less than 120 degrees. Any portion of a corner lot distance more than 75 ft. from the corner shall be sub-

ject to all the provisions of this ordinance respecting interior lots.

An "interior lot" is any lot other than a corner lot. The "front of a lot" is that boundary line which borders on the street. In the case of a corner lot the owner may elect by statement on his plans either street boundary line as the front.

The "rear of a lot" is the side opposite the front. In the case of a corner lot with streets on three sides, or of a triangular or irregular shaped lot abutting on a corner, the rear shall be a side not bordering on a street.

The "depth of a lot" is the dimension measured from a front of the lot to the extreme rear line of the lot. In the case of irregularly shaped lots the mean depth shall be taken.

**Non-bearing Wall or Non-bearing Partition.**—One carrying no load except its own weight.

**Occupied.**—Where the word "occupied" is used it shall be construed as if followed by the words "or is intended, arranged, designed, built, altered, converted, rented, or leased to be occupied."

**Party Wall.**—A masonry wall that separates two or more buildings and is used or adapted for the use of more than one building.

**Public Corridor.**—A hall, corridor or passageway in a multiple-dwelling but not within an apartment.

**Repairs.**—The renewal of such superficial parts of a building as are injured by ordinary wear and tear or by weather. Special provisions made elsewhere in this ordinance may further define this definition.

**Rubble Walls.**—Walls built of irregular stone.

**Shaft.**—A shaft, whether for air, light, elevator, dumb-waiter or any other purpose, is an enclosed space within a building, extending through more than one floor.

Stair Hall.—A hall which includes the stairs, stair landings, and those portions of the building through which it is necessary to pass in going from the entrance floor to the top.

Story.—That part of a building between any floor and the floor or roof next above.

Theatre.—See Department of Public Safety regulations for definition.

Thickness of Wall.—The minimum thickness.

Used.—Where the word "used" is used it shall be construed as if followed by the words "or is intended, arranged, designed, built, altered, converted, rented, or leased to be used."

Yard.—An open unoccupied space on the same lot with a building.

A "front yard" is a yard between the front line of the building and the front line of the lot.

A "rear yard" is a yard between the extreme rear line of the building and the rear line of the lot.

The depth of such yard shall be measured at right angles to the rear line of the lot. Where the rear of the lot abuts on a street, a public alley, or a right of way dedicated to public use for the full width of the lot, the depth of the lot may be measured to the middle of such street, alley, or right of way.

A "side yard" is a yard between the side line of the building and the side line of the lot and extending from the street or front yard to the rear yard.

DIVISION 3.—CLASSIFICATION BY USE.

Section 10. For the purposes of this ordinance all buildings shall be classified according to occupancy, as residence buildings, public buildings and business buildings.

Residence Buildings

- A. Private dwellings, two-family dwellings; club and boarding houses with less than 5 sleeping rooms above the second story and not over 2½ stories high.
- B. Multiple-dwellings.

C. Lodging houses, dormitories, convents.

D. Hotels, club and boarding houses other than A. *Public Buildings*

A. Hospitals, asylums, nurseries, detention buildings.

B. Libraries, museums, court houses, city halls, fire and police stations, railroad passenger stations.

C. Schoolhouses, college class-room buildings.

D. Churches.

E. Buildings having an assembly hall or lodge rooms; amusement halls, exhibition buildings.

F. Theatres, moving-picture houses, opera houses, music halls.

Business Buildings

A. Office buildings.

B. Stores, restaurants.

C. Storage buildings and manufacturing buildings not used for any purposes listed under D.

D. Buildings used for any of the following trades, industries or uses:—

Ammonia, chlorine of bleaching powder manufacture.

Arsenals.

Asphalt manufacture or refining.

Assaying (other than gold or silver).

Blacksmithing or horseshoeing.

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Boiler making.  
 Brewing or distilling of liquors or spirits.  
 Brick, concrete products, terra cotta or tile manufacture.  
 Carpet or bag cleaning.  
 Celluloid manufacture or treatment.  
 Cold storage.  
 Contractors' yards.  
 Crematory other than a crematory located in a cemetery.  
 Disinfectant or insecticide manufacture.  
 Distillation of coal, wood or bones.  
 Drop forging.  
 Dyeing or dry cleaning at wholesale.  
 Dyestuffs manufacture.  
 Explosive manufacture or storage.  
 Fat rendering.  
 Fertilizer manufacture.  
 Flour and grain milling.  
 Gas (illuminating or heating) manufacture or storage, in excess of 1,000 cubic feet.  
 Glue, size or gelatine manufacture.  
 Ice manufacture.  
 Incineration or reduction of garbage, offal, dead animals or refuse.  
 Junk, scrap iron, scrap paper or rag storage or baling.  
 Lamp black manufacture.  
 Leather and leather goods manufacture.  
 Lime, cement or plaster of Paris manufacture.  
 Lumber storage except as incidental to the manufacture on the premises of furniture, boxes or other wooden products.  
 Milk bottling or distribution station.  
 Oil cloth or linoleum manufacture.  
 Paint, oil, varnish or turpentine manufacture.

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Petroleum refining or storage in excess of 1,000 gallons.  
 Printing ink manufacture.  
 Pyroxylin manufacture or articles therefrom.  
 Raw hides or skins—storage, curing or tanning.  
 Rubber manufacture from the crude material.  
 Saw or planing mill except as incidental to the manufacture on the premises of furniture, boxes or other wooden products.  
 Shoddy manufacture or wool scouring.  
 Slaughtering of animals or fowls.  
 Smelting of iron.  
 Soap manufacture.  
 Starch, glucose or dextrine manufacture.  
 Stock yards.  
 Stone crushing.  
 Stone or monumental works.  
 Structural steel.  
 Sugar refining.  
 Sulphurous, sulphuric, nitric, or hydrochloric acid manufacture.  
 Tallow, grease or lard manufacture or refining.  
 Tar distillation or manufacture.  
 Tar roofing or tar waterproofing manufacture.  
 Textiles manufacture.  
 E. Car barns, foundries, light and power plants and other buildings not classified herein.  
 F. Amusement parks, armories, baseball parks, bath houses, grand stands, greenhouses, ice houses.  
 G. Stables.  
 H. Garages. (See also Department of Public Safety regulations.)  
**Section 11.** Each building or part of a building shall be constructed and maintained as herein provided, according to its use; provided, however, that if in the opinion of the Superintendent, the requirements for a

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part of a building conflict with the requirement of any other part of the same building, the best and safest requirement shall apply to the whole building, subject, however, to the following other provisions:

When parts of a residence building are of class B, C, or D, and other part or parts are used for public or business purposes, such other part or parts shall be separated from the residence portion at least by metal lath and plaster ceiling and partitions nogged full height with brick or solid gypsum blocks laid in mortar, with cinder or stone concrete or with mineral wool and metal lathed and cement plastered on the side used for public or business purposes. No openings shall be allowed in such ceiling or partitions.

For any business buildings of class E or F the Superintendent may require construction, equipment, and maintenance giving protection and safety equivalent to that obtained by the requirements for other buildings in the same building district.

**Section 12.** For the purpose of regulating and restricting the location of trades and industries and the location of buildings designed for specified uses, the City of Cambridge is hereby divided into three classes of use districts: Residence districts, business districts and unrestricted districts, as shown on the zone map which accompanies this ordinance and is hereby declared to be part hereof. The use districts designated on said map are hereby established. The use district designations and map designation rules which accompany said zone map are hereby declared to be part thereof. No building, structure or premises shall be erected or used for any purpose other than a purpose permitted in the use district in which such building or premises are located.

In a residence district no building shall be erected other than a building, with its usual accessories, ar-

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ranged, intended or designed exclusively for one or more of the following classes of use, as defined in Section 10:—

- (1) Residence Buildings A, B, C, D.
- (2) Public Buildings (A), except detention buildings, B, C, D, and buildings accessory to Public Buildings D.
- (3) Business Buildings F.
- (4) Garages for not more than two motor vehicles and with no space for commercial trucks.
- (5) College, University or Technical School Buildings and buildings accessory to them.
- (6) Accessory Buildings not over one and one-half stories high on the same lot with any of the above Residences or Public Buildings; provided that, on a street occupied by street car tracks, between a business building of Class A or B, as defined in Section 10, and an intersecting street not more than 100 feet distant from such building or between two such business buildings of Class A or B not more than 100 feet apart, a business building of Class A or B not extending farther from the street occupied by street car tracks, nor higher than such building or either of them shall not be excluded.

In a residence district no building or premises shall be used for any use other than a use above specified, for which buildings may be erected and for the accessory uses customarily incident thereto unless heretofore so used. The term accessory use shall not include a business outside the building to which it is accessory or which occupies a total floor area in excess of 25% of the floor area of one story of such building, or which by reason of the appearance of the buildings or premises, or the emission of odor, smoke, dust or noise or in any other way is objectionable or detrimental to the residential character of the neighborhood or which

Div. 3

involves features in design not customary in buildings for the above uses or any structural alteration of the building.

Where any portion of a residence district lies within the boundaries of a Building District 4, as designated on the zoning map, no building in such portion of a residence district shall be used or erected which is arranged, intended or designed to be used for any one or more of the following classes of use as defined in Section 10:—

(1) Residence Buildings B, C, D, provided, however, that any building to be located between two residence buildings B, not more than 100 ft. apart measured along the street line and excluding from such measurement the width of any intersecting street, may be erected to a height of three stories.

(2) Public Buildings A.

(3) Business Buildings E, except Greenhouses. In a business district no building or premises shall be used, and no building shall be erected which is arranged, intended, or designed to be used for any one or more of the following classes of use as defined in Section 10:—

Business Buildings D, E, except light or power plants of less than 5,000 K. W. hourly capacity.

In a business district no building or premises shall be used, and no building shall be erected which is arranged, intended or designed to be used for any trade, industry or use that is noxious or offensive by reason of the emission of odor, dust, smoke, gas or noise; but car barns or places of amusement shall not be excluded.

Where any portion of a business district lies within the boundaries of a building district 3 or 4 as defined in Section 16 no building in such portion of a business district shall be used or erected which is arranged, intended or designed to be used for any kind of man-

Div. 3

facturing, other than the manufacture of products, the major portion of which are to be sold at retail on the premises by the manufacturer to the ultimate consumer.

No use permitted in a residence district by this section shall be excluded from a business district.

In an unrestricted district a building may be erected or used for any purpose in conformity with the provisions of this ordinance, and other existing ordinances and laws and regulations.

Section 13. In any building or premises any lawful use existing therein at the time of the passage of this ordinance may be continued therein, although not conforming to the regulations of the use district in which it is maintained, or such use may be changed or converted or extended throughout the buildings, provided, in either case, that no structural alterations, except as required by then existing laws and ordinances, are made therein and no new building is erected, and provided that in a residence or business district no building or premises unless now devoted to a use that is by Section 12 prohibited in a business district shall be converted to such use.

No existing building designed, arranged, intended or devoted to a use not permitted by this ordinance in the district in which such use is located shall be enlarged, extended, reconstructed or structurally altered unless such use is changed to a use permitted in the district in which such building is located, except that such building may be reconstructed or structurally altered to an extent not greater than 50 per cent of the value of the building, exclusive of foundations, for the purpose of continuing therein, without any extension thereof, a lawful use existing therein, at the time of the passage of this ordinance, and such use may be continued therein, although not conforming to the regulations of the use district in which it is maintained.

## Div. 3

**Section 14.** The Board of Appeal may, in appropriate cases, after public notice and hearing, and subject to appropriate conditions and safeguards, determine and vary the application of the use district regulations herein established in harmony with their general purpose and intention where such provisions or a requirement of the Superintendent would cause manifest injustice as follows:—

(a) Permit the extension of an existing building and the existing use thereof upon the lot occupied by such building or upon contiguous land in the same ownership at the time of the passage of this ordinance or permit the erection of an additional building upon a lot occupied at the time of the passage of this ordinance by a commercial or industrial establishment and which additional building is a part of such establishment;

(b) Where a use district boundary lines divides a lot in a single ownership at the time of the passage of this ordinance permit a use authorized on either portion of such lot to extend to the entire lot, but not more than 25 feet beyond the boundary line of the district in which such use is authorized;

(c) Permit the extension of an existing building into a more restricted district under such conditions as will safeguard the character of the more restricted district;

(d) Permit the restoration, subject to other provisions of this ordinance, of a building partly or wholly destroyed by fire, explosion, act of God or act of the public enemy;

(e) Permit in a residence district a central telephone exchange or any building or use in keeping with the uses expressly enumerated in Section 12 as the purposes for which buildings or premises may be erected or used in a residence district.

## Div. 3

**Section 15.** The Board of Appeal may permit in a residence district a garage for more than two motor vehicles and with space for commercial vehicles, but in no case with repair facilities, provided there are on file with the Board the written consents of the owners of seventy-five per cent of the area of the private property within five hundred feet of the center of the lot on which the garage is proposed to be erected, excluding such lot and excluding any property not abutting on the same street or alley, or one of them, and not within the same block bounded by public ways more than twenty-five feet wide.



## DIVISION 4.—BUILDING DISTRICTS.

**Section 16.** For the purpose of this ordinance, the City of Cambridge is hereby divided into four classes of building districts, designated Building Districts 1, 2, 3 and 4 respectively, as shown on the zone map which accompanies this ordinance and is hereby declared to be part thereof. The building districts designated on said map are hereby established. The building district map designations and map designation rules which accompany said zone map are hereby declared to be part thereof. No building or part of a building shall be erected, and no existing building shall be altered, enlarged or rebuilt, except in conformity with the regulations herein prescribed for the district in which the building is located.

## DIVISION 5.—BUILDING HEIGHTS.

**Section 17.** In building districts 1 no building or part thereof shall be erected to a height exceeding 2 times the width of the widest street on which the building stands measured from the face of any such part to the line of the street on the other side, nor exceeding 100 ft. in any case.

In building districts 2 no building or part thereof shall be erected to a height exceeding 2 times the width of the widest street on which the building stands, measured from the face of any such part to the line of the street on the other side, nor exceeding 6 stories or 80 feet in any case.

In building districts 3 no building or part thereof shall be erected to a height exceeding  $1\frac{1}{2}$  times the width of the widest street on which the building stands, measured from the face of any such part to the line of the street on the other side, nor exceeding 4 stories or 60 feet in any case; *provided, however*, that a building not used in any part as a dwelling for more than one family and not within one hundred feet of any street or property line or, if within an unrestricted district as designated on the zone map, not within one hundred feet of a residence district or of the nearer side of a street adjacent to a residence district may be erected to a height permitted in building districts 2.

In building districts 4 no building or part thereof shall be erected to a height exceeding the width of the widest street on which the building stands, measured from the face of any such part to the line of the street on the other side, nor exceeding  $2\frac{1}{2}$  stories or 40 feet in any case; *provided, however*, that any buildings to be located between two three-story buildings other than private dwellings and not more than 100 feet apart measured along the street line and excluding

from such measurement the width of any intervening street, may be erected to a height of three stories.

**Section 18.** On streets less than 20 feet wide the same height regulations shall be applied as on 20-foot streets.

The height upon a corner lot may be controlled by the widest street upon which the building abuts, but this height shall not extend along the narrower street more than twice the width of the narrower street.

When the width of a street opposite a building is variable, the mean width shall be used in the calculations.

All measurements shall be taken at right angles to the center line of the street.

**Section 19.** No part of any dwelling shall be built to a greater height than one habitable story for each 10 ft. in width of the street measured from the face of any such part to the line of the street on the other side, except that for existing accepted streets less than 40 ft. wide there may be one story for each 8 ft. of such width in Building Districts 1, 2 and 3 and *provided, further*, that a three-story dwelling may be erected on any existing accepted street 24 ft. or less wide in Building Districts 1, 2 and 3.

The provisions of this Division shall not apply to: Parapets, pent houses and other roof structures as provided in Div. 22.

Towers, steeples, domes, statuary, cupolas, or bellies, not used for human occupancy.

Chimneys, gas holders, and coal or grain elevators.

Poles, masts with their rigging, weather vanes, vent pipes, steam exhausts, and similar parts.

#### DIVISION 6.—AREA REGULATIONS.

**Section 20.** Yards and courts shall be at every point open to the sky unobstructed by buildings or parts thereof, except for the following projections, which are permitted:—

Cornices, balconies, belt courses, window and door heads and sills projecting not more than 1/10th of the actual width of the court or yard measured to the opposite wall of a court or to the lot line, except that returns of wider cornices on front may be carried back 12 ft. into a court or yard.

Fire-escapes permitted or required by this ordinance.

First story steps, platforms and porches when no contiguous portions of the basement are occupied for habitation.

**Section 21.** All yards and courts shall be graded and drained in an approved manner, and, when required by the Superintendent, they shall be suitably paved as directed.

**Section 22.** No yard, court, or setback shall be deemed to satisfy the requirements of more than one building.

No building shall be built, moved, or altered so as to reduce any dimension herein required for yards or courts. If any lot is subdivided or changed in size so as to bring a new lot line nearer to a building than the minimum distance required for such building, then the building shall be moved or altered so as to conform to the requirements; otherwise it may be ordered vacated and removed or demolished as a nuisance as herein or elsewhere provided.

A yard or setback need not be of the same dimensions for the full height of the building; provided, that throughout the height of every story it fulfills the requirement for that story.

**Section 23.** In building districts 3 no part of a

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Section 26. In building districts 1, 2 and 3 the depth of rear yard behind a dwelling, for interior lots 80 or more feet in depth, shall be in accordance with the following table of minimum dimensions:—

*Rear Yards*

Height of dwelling in habitable stories	Districts 1 and 2	District 3
1.....	10.....	13
2.....	10.....	13
2½.....	10.....	13
3.....	12.....	15
4.....	14.....	17
5.....	16.....	.....
6.....	18.....	.....
7.....	20.....	.....
8.....	22.....	.....
9.....	24.....	.....
10.....	26.....	.....

In building district 4 no building other than an accessory building may be erected on lots 80 feet or more in depth so as to produce rear yards less than 20 feet in depth.

All dwellings on interior lots less than 80 ft. deep shall have rear yards not less than 1-80th of the depths given in the foregoing requirements for each foot in depth of the lot.

Section 27. The rear yard may be omitted when the lot upon which the dwelling is built is bounded on every side by a street, a cemetery, or a public park.

No yard shall be required behind a dwelling erected upon an interior lot less than 150 feet deep and running

Div. 6

building above the first floor, except one-story unenclosed porches and piazzas, shall be erected in a residence district designated on the zone map within 25 feet of the center line of any abutting street, nor within 5 feet of the line of any street; provided, that on no lot existing at the time of the passage of this ordinance shall either the width or length of the portion that may be built upon be reduced to less than 40 feet by this requirement and provided further that between existing buildings not more than 100 feet apart no building need by this requirement be erected further from the street line than the mean of their distances from such street line.

Section 24. In building districts 4, no part of a building above the first floor, except one-story unenclosed porches and piazzas, shall be erected within 30 feet of the center line of any street, nor, if in a residence district as designated on the zone map, within 10 feet of the line of any street; provided, that on no lot existing at the time of the passage of this ordinance shall either the width or length of the portion that may be built upon be reduced to less than 35 feet by this requirement; and provided, further, that between existing buildings not more than 100 feet apart no building need by the requirement be erected farther from the street line than the mean of their distances from such street line.

Section 25. Immediately behind every dwelling, in the rear of the lot, there shall be, except as otherwise provided, a yard extending across the entire width of the lot with every part accessible from every other part except that one garage for not more than two motor vehicles and with no space to be occupied as a domicile and with no space for commercial trucks may be built in said yard.

\*Amended—May 23, 1924.

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If a dwelling is built behind or in front of another dwelling on the same lot there shall be left between the two buildings a yard extending across the full width of the lot and the distance between the two buildings shall not be less than two times the depth required herein for a rear yard for a building of the height of the higher of the two buildings. There shall be behind the rear dwelling a rear yard as herein required, and if this rear yard does not have access directly to a street, alley, or other public way, there shall be a passageway not less than 10 ft. wide leading from the yard between the two buildings directly to a street, alley, or other public way. The rear dwelling shall in no case be built to a greater height than is permitted for the front dwelling.

If the first story of a multiple-dwelling is used for business purposes, it may cover the whole area of the lot, and in such case the rear yard shall be maintained above the first story of the depth herein provided.

In the case of irregular shaped lots, the rear yards shall be so arranged as to be, in the opinion of the Superintendent, as nearly as possible equivalent in effect to the rear yards herein prescribed.

Where a block of dwellings is so arranged as to give, in the opinion of the Superintendent, an adequate distribution of light and air, the arrangement of yards may be varied from the requirements of this section; provided, however, that the width of the yard behind the whole block shall in no case be less than that required by this section.

**Section 28.** In building districts 1, 2 and 3 no side yard is required, but if any side yard is left between a dwelling and a lot line for the purpose of affording light and ventilation to rooms as required by this division, its width shall be in accordance with the following table of minimum dimensions:—

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alley or open passageway not less than 15 feet in width.

The depth of rear yard, for a corner lot, may be reduced to one-half the depth required for an interior lot for a length not exceeding 30 ft.

No yard shall be required behind a dwelling erected on a corner lot adjoining a lot less than 150 ft. deep and running through from street to street or from a street to an alley or open passageway not less than 15 ft. in width.

No yard shall be required behind a dwelling erected on a corner lot adjoining a lot 150 ft. or more in depth and running through from street to street or from a street to an alley or open passageway not less than 15 ft. in width; but if there be no yard an outer court upon such corner lot shall extend from the street, alley or open passageway along the line of such adjoining lot to the middle line of the block.

No yard shall be required behind a dwelling erected on a corner lot adjoining two or more lots any one of which bounds upon a single street, alley or open passageway not less than 15 ft. in width; but if there is no yard an outer court upon such corner lot shall extend from the street, alley or passageway along the line of such adjoining lot either to the extreme rear of the adjoining lot or to the extreme rear of said corner lot.

Whenever a dwelling is erected on a lot 150 ft. or more in depth and running through from street to street or from street to an alley, or open passageway there shall be left near the middle of the lot a yard extending across the entire width of the lot and not less than two times the depth required herein for a rear yard for the higher of the two buildings. The height of each building shall be fixed in relation to the street, alley, or open passageway which it faces.

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Side Yards

Height of building in habitable stories	Width of yard in ft.
1.....	5
2.....	5
2½.....	5
3.....	6
4.....	7
5.....	8
6.....	9
7.....	10
8.....	11
9.....	12
10.....	13

Provided, however, that side yards for 3-story multiple dwellings of third-class construction shall be not less than 7 feet wide, except that one bay window 12 feet or less in length may project on each side of such dwelling to not less than 5 feet from the side line.

In building districts 4 there shall be a side yard 7 feet wide on the same lot with every building, unless it occupies a street corner.

If the length of the building measured along the side yard is in excess of 50 ft., then the width of the side yard noted above shall be increased by 6 in. for every 10 ft. or portion thereof of such excess.

**Section 29.** Where a dwelling is erected by the side of but not contiguous to another building on the same lot there shall be left between the two buildings a space equal to the combined yards herein required for the two buildings.

A side yard space may begin at any level and its width shall be determined by the tables in this ordinance, according to the number of stories in the building above such level.

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**Section 30.** An outer court may begin at any level, and the minimum dimensions shall be determined by the tables in this ordinance, according to the number of stories in the building above such level.

An outer court may be less than the minimum width allowed, provided, that its length be not greater than its width.

Where outer courts are irregular in shape, their dimensions shall be such as to provide, in the opinion of the Superintendent, a court equivalent in effect to a rectangular court as herein prescribed.

**Section 31.** Outer courts shall be in accordance with the following table of minimum dimensions:—

Outer Courts

Height of building in habitable stories	Width in ft.	
	Outer court between wings	Outer court on lot line
1.....	10	6
2.....	10	7
3.....	12	8
4.....	14	9
5.....	16	10
6.....	18	11
7.....	20	12
8.....	22	13
9.....	24	14
10.....	26	15

Extension of outer courts at an angle with the initial horizontal direction of the court, or offsets or recesses in outer or inner courts may be built; provided, however, that the length of any such extension, offset, or recess shall not be greater than its width. There shall be no further extension to or offset or recess opening from any such extension, offset, or recess.

ever, that the area shall in no case be less than the minimum required in the above table.

Walls may be built across the inner angles of the inner courts, but the resulting unobstructed area of the court must not be less than the minimum area as above required.

In computing the area of an inner court, the additional area afforded by offsets, or recesses shall not be included.

**Section 34.** A vent shaft is a shaft used to light and ventilate stairways and, if covered at the top, shall have a metal skylight of the full size of shaft and shall have openings beneath the skylight on all sides, with or without louvres, of such height that the total area of such openings on any two adjacent sides shall equal the area of the shaft. Vent shafts shall be in accordance with the following table of minimum widths and areas:

Vent Shafts.

Height of shaft in stories	Ft. in width	Area in sq. ft.
1.....	3.....	15
2.....	3.....	15
3.....	3.....	15
4.....	4.....	25
5.....	5.....	35
6.....	6.....	45
7.....	7.....	55
8.....	8.....	65
9.....	9.....	81
10.....	10.....	100

Walls may be built across the inner angles of outer courts; provided, however, that the length of such angle walls shall not be greater than 2/3rds of the actual length of the court.

**Section 32.** Inner courts shall be in accordance with the following table of widths and areas:—

Inner Courts

Height of building in habitable stories	Inner court		Inner court on lot line	
	Width in ft.	Area in sq. ft.	Width in ft.	Area in sq. ft.
1	12	200	7	150
2	14	300	8	200
3	16	400	9	250
4	18	500	10	300
5	20	600	11	350
6	22	700	12	400
7	24	800	13	450
8	26	900	14	500
9	28	1000	15	550
10	30	1100	16	600

An inner court on lot line shall have a length parallel to the line of lot less than twice the minimum required width.

**Section 33.** Every inner court shall have at least one air intake.

An inner court may begin at any level and the minimum dimensions shall be determined by the table in this ordinance, according to the number of stories in the building above such level.

Where inner courts are irregular in shape, their dimensions shall be such as to provide, in the opinion of the Superintendent, a court equivalent in effect to a rectangular court as herein prescribed; provided, how-

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**Section 35.** An air intake is a passageway enclosed with incombustible material, not less than 4 ft. sq. for vent shafts and not less than 3 ft. wide and 7 ft. high for courts, connecting the bottom of a vent shaft or court with a street or yard to permit circulation of air and, when serving courts, closed only by open grille doors containing not less than 15 sq. ft. of unobstructed area.

In all dwellings every inner court shall be provided with one or more horizontal air intakes at the bottom. One such intake shall always communicate directly with the street or yard.

## Div. 7

## DIVISION 7.—CLASSIFICATION BY CONSTRUCTION.

**Section 36.** For the purposes of this ordinance all buildings shall be classified according to construction as a first-class, second-class, and third-class.

*First-Class Construction.*

A first-class building shall have external and party walls of brick, stone, steel, concrete, or other equally substantial and fire resistive material; floor and roof construction of metal, reinforced concrete, terra cotta, or brick; inside walls, partitions, and stairs of incombustible materials; structural metal protected as required by Sec. 38; roofs and roof structures covered with incombustible material; bays, cornices, and projections of incombustible materials. Under and upper floors, windows and door frames, sashes, doors, interior finish, hand rails for stairs and necessary sleepers or furrings bedded in concrete or mortar may be of wood.

*Second-Class Construction.*

*Second class A.* Shall be like a first-class building except that roof construction may be of wood but covered with incombustible materials and roof shall be fire-stopped. Columns supporting roof protected as for first-class construction.

*Second class B.* Shall have external and party walls of brick, stone, steel, concrete, or other equally substantial and fire-resistive material; roofs and roof structures covered with incombustible materials; bays, cornices, and projections of incombustible materials; steel columns in buildings three stories or more high or if supporting masonry walls or piers, and steel beams supporting masonry walls or piers over openings wider than 10 ft. shall be protected by at least metal lath and cement plaster; first floor construction

basement or cellar ceiling of metal lath and cement plaster or approved plaster boards not less than  $\frac{1}{2}$  in. thick, well-nailed and coated with not less than  $\frac{1}{4}$  in. of cement or gypsum plaster.

*Third-Class Construction.*

*Third class A.* May have wooden frame; shall be fire-stopped and walls, roofs, and dormer sides shall be covered with incombustible materials; main gutters and cornices made of, or lined with, incombustible materials; basement or cellar ceiling of metal lath and plaster or of approved plaster boards not less than  $\frac{1}{4}$  in. thick, well nailed, and coated with not less than  $\frac{1}{4}$  in. of plaster.

*Third class B.* May have wooden frame but shall be fire-stopped, and roofs and dormer sides shall be covered with incombustible material. No building shall be built of less than third class B construction.

**Section 37.** Any building, parts of which vary from other parts in classes of construction shall be rated as the lowest class unless such parts are separated by walls and floors of first-class construction with openings as permitted for fire and party walls according to Division 18.

**Section 38.** Buildings built in whole or in part of a better class of construction than required by this ordinance shall be required to have only such protection for structural metal as would be required in a building of the type that would be allowed in the given case. In all other cases fire-proofing for structural metal, when required, shall be of brick, terra cotta, concrete, or solid gypsum blocks, except that solid gypsum blocks shall not be used on the outside of wall columns. Metal lath and plaster shall be considered as fire-proofing only where specifically allowed.

and any floors or supports below it of first-class construction; the wooden floors and roofs fire-stopped.

*Second class C.* Shall have external and party walls of brick, stone, steel, concrete, or other equally substantial and fire-resistive material; roofs and roof structures covered with incombustible materials, bays of of incombustible materials; girders and beams, if of wood, shall have a sectional area of not less than 56 sq. in.; columns, girders, and beams, if of metal, need not be protected except that steel columns supporting masonry walls or piers or steel beams supporting masonry walls or piers over openings wider than 10 ft. shall be protected as required by Sec. 38. Under-floors and roof plank shall not be less than  $1\frac{1}{8}$  in. thick, tongued and grooved, or splined. No bearing partitions shall be allowed, but other partitions shall be of incombustible materials or of tongued and grooved or splined plank, not less than  $1\frac{1}{8}$  in. thick, or of double matched boards. No concealed spaces, wooden furring or wooden lathing shall be allowed. Shall be entirely equipped with approved automatic sprinklers on the interior.

*Second class D.*—Shall be like second class C, except that no automatic sprinklers are required, but columns, girders, and beams, if of metal, even if not supporting masonry, shall be protected by at least metal lath and cement plaster.

*Second class E.* Shall have external and party walls of brick, stone, steel, concrete, or other equally substantial and fire-resistive material; roofs and roof structures covered with incombustible materials, bays, gutters, and cornices of incombustible material; steel columns supporting masonry walls or piers and steel beams supporting masonry walls or piers over openings wider than 10 ft. shall be protected by at least metal lath, and cement plaster. Shall be fire-stopped;



Thickness of fire-proofing, except where metal lath and plaster are specifically allowed, shall be as follows: Wall columns, 4 in., but may be reduced to 1 in. on the outside if covered with cast iron at least  $\frac{3}{8}$  in. thick or steel at least  $\frac{3}{16}$  in. thick.

Interior columns, 3 in. Where this column protection is likely to be broken or damaged it shall be protected by a casing of steel not less than  $\frac{1}{8}$  in. thick, and 5 ft. high.

When any column has projecting flanges, the spaces between the flanges shall be filled solid with fire-proofing material against the web and extending at least 1 in. beyond the edges of the flanges.

Wall girders, 4 in. on the web and at least 1 in. beyond the edges of the flanges, plates or angles.

Interior floor girders and floor trusses 2 in. When the spaces between girder or truss flanges are filled solid with fireproofing material it need not extend more than 1 in. beyond the edges of the flanges.

Girders and trusses carrying only roof and ceiling load and protected by a suspended metal lath and plaster ceiling need not have any other fireproofing.

Girders and trusses carrying only roof load and with a clear open space at least 20 ft. high below need not be fireproofed.

In buildings not more than one story in height, girders, trusses, beams, purlins and bracing carrying only roof load need not be fireproof.

Floor and roof beams, 1 in.: *provided, however*, that roof beams protected by a suspended metal lath and plaster ceiling need not have any other fireproofing.

Lintels carrying masonry walls in first-class buildings, 2 in.

**Section 39.** Metal lath and plaster, wherever required, shall have thickness of  $\frac{3}{4}$  in. from the lath. Where cement plaster is required, the plaster shall be

at least  $\frac{1}{3}$  Portland cement. Approved equivalents may be used.

**Section 40.** Fire stopping for second-class buildings, when required, shall be as follows:

At all sills, dropped girts, ledger boards, plates, girders, bearing walls and bearing partition caps which support floor beams or rafters, spaces shall be filled to a height of 5 in. above floor beams, and above plates supporting rafters to the under side of the roof boarding with brick or solid gypsum blocks laid in mortar, with cinder or stone concrete or with mineral wool.

Spaces between chimneys and wooden beams and between wooden furrings on masonry walls for 5 in. above and below the floor beams with mortar or other approved incombustible material. Around pipes passing through wooden floors with metal or other approved incombustible stops.

Between the carriages of stairs twice in each flight and between rafters over dwarf partitions and between rafters at ends of ceiling beams, with closely fitted wood, tin, or galvanized iron.

Fire-stopping for third-class buildings shall be as required for second-class buildings except that closely fitted 2 in. plank may be substituted for the incombustible materials in all places except around chimneys and required stair enclosures.

In all places where fire-stopping is required the plastering shall run to the under-floor.

All fire-stopping shall be in place before the lathing permit required under Sec. 6 will be issued.

**Section 41.** Within the building districts herein defined all buildings shall be of such class of construction as their use and height determine, and not inferior to the classes required by the following tables: *provided, however*, that nothing in this division shall

change the height limitations established by Div. 5, and *provided, further*, that for the purposes of this section a basement in a residence building shall be counted as a story when occupied by more than one family. (See definition of first story.)

**RESIDENCE BUILDINGS A.**

(Private dwellings, two-family dwellings; all club and boarding houses with less than 5 sleeping rooms above second story and not over 3 stories high.)

	Number of Stories.					
	1	2	2½	3	4	5 6 or more
District	1	2	2	2	2	2 1 1
Districts 2, 3 and 4	3-B	3-B	3-B	3-A	2 1 1	

**RESIDENCE BUILDINGS C—D.**

(Lodging houses, dormitories, convents, hotels; club and boarding houses other than class A.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2	2-B	1 1
Districts 2, 3 and 4	3-R	3-B	2	2-B	1 1	

**PUBLIC BUILDINGS A.**

(Hospitals, asylums, nurseries, detention buildings.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2-B	1 1	1 1
Districts 2, 3 and 4	3-B	3-A	2-B	1 1	1 1	

**PUBLIC BUILDINGS B.**

(Libraries, museums, courthouses, city halls, fire and police stations.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2-A	1 1	1 1
Districts 2, 3 and 4	3-B	3-A	2 1 1	1 1		

**PUBLIC BUILDINGS C.**

(Schoolhouses, college classroom buildings.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2-B	2-A	1 1
Districts 2, 3 and 4	3-B	2	2-B	2-A	1 1	

**PUBLIC BUILDINGS D.**

(Buildings having an assembly hall or lodge room; churches, amusement halls, exhibition buildings.) A hall with one or more balconies shall be considered respectively as one or more stories above the story containing the main floor of the hall. The table determines the type of construction to be employed for the portion of the building up to and enclosing the assembly hall according to the floor on which the main floor of the hall is placed. If there are floors above the assembly hall and its balconies, the type of construction to be employed for the whole building shall be determined under Sec. 11. (See Department of Public Safety Regulations.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2	2-B	2-A 1
Districts 2, 3 and 4	3-B	3-A	2	2-B	2-A 1	

PUBLIC BUILDINGS E.

(Theatres, moving picture houses, opera houses, music halls.)

Each balcony shall be considered as a story for the requirements of this section. (See Department of Public Safety Regulations.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2-A	2-A	1	1	1
Districts 2, 3 and 4	2-A	2-A	2-A	2-A	1	1

*Provided, however,* that open air theatres without balconies may be built in District 2, 3 and 4 of 3-A construction.

BUSINESS BUILDINGS A-B.

(Office buildings, stores, restaurants.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2	2	2-C 1
Districts 2, 3 and 4	2	2	2	2	2	2-C 1

BUSINESS BUILDINGS C.

(Manufacturing and storage buildings.)

	Number of Stories.						
	1	2	3	4	5	6	7 or more
District	1	2	2	2-D	2-C	2-C	2-C 1
Districts 2, 3 and 4	3-A	3-A	2-D	2-C	2-C	2-C	2-C 1

*Provided, however,* that storage buildings may be built of 2-C construction to a height of 75 ft. also they may be built of steel frame with metal siding not over one story high in District 1.

BUSINESS BUILDINGS D.

(Stables.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2-D	2-C 1	1
Districts 2, 3 and 4	3-B	3-B	2-D	2-C 1	1	1

BUSINESS BUILDINGS E.

(Amusement parks, armories, baseball parks, bath-houses, car barns, grandstands, green houses, ice houses, light and power plants, other buildings not classified herein.)

	Number of Stories.					
	1	2	3	4	5	6 or more
District	1	2	2	2	2-D	1
Districts 2, 3 and 4	3-A	3-A	2	2-D	2-C	2-C

Any business building without definite stories established by its design shall be considered to have one story for each 20 ft. in height. The Superintendent may vary requirements as provided in Sec. 11.

The restrictions of these tables shall not apply to wharves, nor to buildings not exceeding 27 ft. in height on wharves, nor to market sheds or market buildings not exceeding such height, nor to buildings for the storage of coal, wood, lumber or grain, if the external parts of said buildings, elevators and structures are covered with slate tile, metal or other equally incombustible material, and the mode of construction and the location thereof are approved by the Superintendent. Temporary structures to facilitate the prosecution of any authorized work may be erected under such conditions as the Superintendent may prescribe.

Div. 7

The protection for structural metal in business buildings of Classes C and E may be omitted when, in the concurrent opinion of the Superintendent and the Board of Appeal, the occupation of fire equipment of the building will render such protection useless or unnecessary.

*Permanent Grandstands.* All permanent grandstands shall be built of second class A construction, except that in Districts 2, 3 and 4 grandstands less than 10 ft. high above the ground may be of third class A construction: *provided, however,* that when such third class A grandstands are within 30 ft. of any other building the Superintendent may require additional protection by incombustible coverings to portions thereby exposed and endangering life and property. No space underneath any grandstand shall be used for any purpose unless the part so used is of first class construction.

*Temporary Grandstands.* Temporary grandstands may be erected for a limited time. Their construction shall be approved by the Superintendent and the permit for their construction shall state the length of time of use and the further length of time allowed for removal.

Div. 8

DIVISION 8.—LOADS, MATERIALS, AND STRESSES.

**Section 42.** Dead loads shall consist of the weight of the walls, floors, roofs, and permanent partitions. Office building partitions are included in the live loads required in Sec. 43.

The weights of various materials shall be assumed as follows:

	Lb. per cu. ft.
Birch .....	48
Brickwork .....	120
Concrete, cinder, structural .....	108
Concrete, cinder filling .....	72
Concrete, stone .....	144
Granite .....	168
Granolithic surface .....	144
Limestone .....	150
Maple .....	48
Marble .....	168
Oak .....	48
Pine, yellow .....	48
Sandstone .....	144
Spruce .....	30
Terra cotta, architectural, voids unfilled .....	72
Terra cotta, architectural, voids filled .....	120
Plastering on metal lath, exclusive of furring, 8 lb. per sq. ft.	

**Section 43.** Live loads shall include all loads except dead loads. Every permit shall state the purpose for which the building is to be used and every floor shall be of sufficient strength to bear safely the weight to be imposed thereon in addition to the dead load, but shall safely support a minimum uniformly distributed live load per sq. ft. as specified in the following table:—

Class of Building lb. per sq. ft.

Armories, assembly halls, and gymnasiums	100
Fire houses:	
Apparatus floors	150
Residence and stable floors	50
Garages (private), storage and repair floors	75
Garages (public), storage and repair floors	150
Grandstands	100
Hotels, lodging houses, boarding houses, dormitories, convents, clubs, hospitals, asylums and detention buildings:	
Public portions	100
Residence portions	50
Office buildings:	
First floor	125
All other floors	75
Residence buildings A and B including porches and piazzas	50
Schools and colleges:	
Assembly halls	100
Classrooms, never to be used as assembly halls	50
Sidewalks	250
(Or 8,000 lb. concentrated, which ever gives the larger moment or shear.)	
Stables (public or mercantile)	150
Street entrance floors	150
Feed room	50
Carriage room	50
Stall room	50
Stairs, corridors, and fire-escapes from theaters, assembly halls, armories, and gymnasiums	100
Stairs and fire-escapes <i>except</i> from theaters, assembly halls, armories, and gymnasiums	75
Stores, retail	125

The Superintendent may require design for heavier loads than the above minimum values if, in his judgment, the purpose of the building requires it.

For buildings or structures not included in the above table, the Superintendent shall establish allowable live loads.

**Section 44.** Every plank, slab, and arch, and every floor beam carrying 200 sq. ft. of floor or less, shall be of sufficient strength to bear safely the combined dead and live load supported by it, but the floor live loads may be reduced for other parts of the structure as follows:—

In all buildings except armories, garages, gymnasiums, storage buildings and assembly halls, for all flat slabs of over 200 sq. ft. area reinforced in more than one direction and for all floor beams, girders or trusses carrying over 200 sq. ft. of floor, 15% reduction.

For the same, but carrying over 300 sq. ft. of floor, 25% reduction.

These reductions shall not be made if the member carries more than one floor and therefore has its live load reduced according to the table below.

In public garages, for all flat slabs of over 300 sq. ft. area reinforced in more than one direction, and for all floor beams, girders, and trusses carrying over 300 sq. ft. of floor, and for all columns, walls, piers, and foundations, 25% reduction.

In all buildings except storage buildings, wholesale stores, and public garages, for all columns, girders, trusses, walls, piers and foundations.

Carrying 1 floor	No reduction
“ 2 floors	25% reduction
“ 3 “	40% reduction
“ 4 “	50% reduction
“ 5 “	55% reduction
“ 6 “	60% reduction

**Section 45.** Roofs shall be designed to safely support minimum live loads as follows:—

Roofs with pitch of 4 in. or less per ft., a vertical load of 40 lb. per horizontal sq. ft. applied either to half or to the whole of the roof.

Roofs with pitch of more than 4 in. and not more than 8 in. per ft., a vertical load of 30 lb. per horizontal sq. ft. and a wind load of 10 lb. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

Roofs with pitch of more than 8 in. and not more than 12 in. per ft., a vertical load of 20 lb. per horizontal sq. ft. and a wind load of 20 lb. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

Roofs with pitch of more than 12 in. per ft., a vertical load of 10 lb. per horizontal sq. ft. and a wind load of 30 lb. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

**Section 46.** All buildings shall be calculated to resist a pressure per sq. ft. on any vertical surface as follows:—

For 40 ft. in height .....10 lb.

Portions from 40 to 80 ft. above ground ..20 lb.

Portions more than 80 ft. above ground ...30 lb.

but the Superintendent may require a building to be designed for larger pressures than those given in the table, if, in his judgment, the exposure of the building requires it.

If the resisting moments of the materials of construction are not sufficient to resist the moment of distortion due to wind pressure without exceeding the stresses allowed in this ordinance, additional bracing shall be introduced to supply the deficiency in the moment.

**Section 47.** All materials shall be of such quality as to insure, in the judgment of the Superintendent, ample safety to life, limb, and neighboring property. The Superintendent shall have power to reject all materials which in his opinion are unsuitable. He may establish standards and regulations for materials covered in this ordinance or for new materials and may require tests to be made by the owner or producer or may accept tests made elsewhere in his discretion. Wherever approval is mentioned in this ordinance it shall refer to the approval of the Superintendent. In case of doubt by the Superintendent as to quality of any material the owner shall furnish a proper amount of samples for comparison with standard samples or to be subjected to such examination or tests as the Superintendent may establish. Any tests thus required shall be made under the supervision or direction of the Superintendent, but at the expense of the owner.

**Section 48.** Brick may be of burnt clay, sand-lime, or cement, and, except for nogging, fire-stopping, and non-bearing and curtain walls not exposed to the weather, shall be hard and strong, of quality approved as satisfactory by the Superintendent. Second-hand bricks shall be thoroughly cleaned before delivery to the building.

**Section 49.** The term block as used in this section shall mean any shape of block, brick, or tile which forms a hollow or cellular wall.

Concrete building blocks shall be made of Portland cement and suitable aggregates in such proportions as to develop at the age of 28 days an ultimate crushing strength per sq. in. of gross area of not less than 750 lb. when tested with the cells placed vertically and 300 lb. with the cells placed horizontally.

Terra cotta building blocks shall be hard burned and shall develop an ultimate crushing strength per

sq. in. of gross area of not less than 1200 lb. when tested with the cells placed vertically and 300 lb. with the cells placed horizontally.

The absorption of building blocks to be used for bearing or enclosing walls shall not exceed 12% in 48 hours as an average, nor more than 15% in any case.

**Section 50.** Sand shall be clean and not more than 6% shall pass a sieve having 100 meshes per linear in.

Sand or other fine aggregate for reinforced concrete shall be of such quality that mortar of 1 part Portland cement and 3 parts sand by weight shall show a tensile strength of not less than 90% of the strength of mortar made in the same proportions with the same cement and standard Ottawa sand. The Superintendent may require such tests when, in his judgment, they are necessary, the tests to be at the expense of the owner.

**Section 51.** Stone for concrete shall be clean, hard, and durable.

**Section 52.** Lime shall be free from ashes, clinker, and other foreign material and shall not be air slacked.

**Section 53.** Portland cement shall conform to such specifications as may be promulgated by the Superintendent, or, in the absence of such specifications, to the standard specifications of the American Society for Testing Materials as from time to time revised.

**Section 54.** Lime mortar shall be made of slaked lime or hydrated lime with a proper proportion of sand.

**Section 55.** Cement-lime mortar shall be made 1 part Portland cement, not more than 2 parts slaked lime or hydrated lime and not more than 8 parts of sand by volume but mixtures with larger proportion of cement shall be allowed higher stresses as in Sec. 65.

**Section 56.** Portland cement mortar shall be made of 1 part Portland cement and not more than 3 parts of sand by volume. Lime putty or hydrated lime may be added to an amount equal to 25% of the volume of the cement.

**Section 57.** Concrete shall be made of Portland cement and a fine and coarse aggregate. Rubble concrete shall be made of Portland cement, a fine aggregate, and a coarse aggregate to which, after depositing, stones are added. The fine aggregate shall be sand or crusher screening passing a  $\frac{1}{4}$  in. screen. The coarse aggregate shall be screened gravel, crushed stone, or cinders from steam power plants, composed of hard clean, vitreous clinker, reasonably free from sulphides, unburned or partially burned coal and ashes, but cinder concrete may be used for walls of one-story buildings, for floor slabs, roof slabs, partitions, fire-stopping, and fireproofing only. Run-of-bank gravel shall be used only when approved by the Superintendent. When one-man stones are used to form rubble concrete there shall be not less than 3 in. between the stones and the forms and between edges of adjacent stone. When stones larger than one-man size are used to form rubble concrete there shall be not less than 6 in. between edges of adjacent stones. Stones shall be clean and wet and shall be deposited in concrete already in place before the latter has commenced to set. In piers less than 4 ft. long in greatest horizontal dimension no stone shall be larger than one quarter of the horizontal cross-section of the pier. Rubble concrete shall not be used for any projecting footing.

Joints formed between portions of concrete placed at different times shall be made in such a manner as not to weaken the completed structure. Whenever

tendent the area of the footing shall be proportioned so that the load per sq. ft. upon the respective characters of soil shall not exceed those in the following tables:—

Soil	Load in tons per sq. ft.
Soft clay, running sand (confined).....	1 to 2
Medium blue clay, whether or not mixed with fine sand .....	2 to 3
Compact damp sand, hard sandy clay, hard blue clay .....	4
Dry hard yellow clay, boulder clay, dry sand or dry gravel .....	5
Hardpan, to be determined by the Superintendent, but not to exceed .....	10

*Loads on Soil.*

**Section 63.** Wooden piles driven to refusal through loose fill or wet soil, incapable of adequately resisting lateral bending, shall be figured as columns with an area equal to the middle cross-section. The safe load on all other wooden piles driven by drop hammer shall not exceed 12 tons for spruce or Norway pine or 15 tons for yellow pine or oak, and shall be determined by the following formula:—

$$L = \frac{2 WH}{P + 1}$$

If driven by single-acting power hammer the safe sustaining power shall be determined by the following formula:

$$L = \frac{2 WH}{P + 0.1}$$

fresh concrete joins concrete which is set or partially set, the surface of the old concrete shall be rough, clean, and thoroughly wet.

**Section 58.** Steel for all structural work in buildings shall conform to such specifications as may be promulgated by the Superintendent, or, in the absence of such specifications, to the requirements of Standard Specifications for Structural Steel for Buildings of the American Society for Testing Materials as from time to time revised.

**Section 59.** Wrought iron shall be fibrous, tough and ductile.

**Section 60.** Cast iron for all structural work shall conform to such specifications as may be promulgated by the Superintendent, or, in the absence of such specifications, to the requirements of the Standard Specifications for Medium Gray Iron Castings of the American Society for Testing Materials as from time to time revised.

**Section 61.** Timber for structural purposes shall be of quality approved by the Superintendent.

**Section 62.** When doubt arises as to the safe sustaining power of soil upon which a building is to be erected, the Superintendent may order borings to be made or he may order tests of the sustaining power of the soil at the expense of the owner of the proposed building. The Superintendent shall be notified before any test is made, shall be present or represented thereat, and shall decide upon the allowable load to be used, and records of such borings or tests shall be filed with him. In the absence of an actual test of the sustaining power of the soil to the satisfaction of the Superin-



In both formulas

W is the weight of the hammer in lb.

L is the allowable load in lb.

H is the fall of the hammer in ft.

P is the average penetration in inches under the last three blows after the pile has been driven to a point where successive blows produce approximately equal penetrations.

**Section 64.** Concrete piles driven to refusal through loose fill or wet soil, incapable of adequately resisting lateral bending, shall be allowed a load not exceeding 400 lb. per sq. in. of the middle cross-section, plus 6,000 lb. per sq. in. of the steel reinforcement. The safe load for other piles shall be determined by the formulas given in Sec. 63 determined by striking the pile without cushion cap, or the Superintendent may require test piles to be loaded and may fix allowable loads based upon such tests, but he shall not allow a greater load than one half of the test load giving  $\frac{1}{4}$  in. settlement. Such tests shall be under the supervision of the Superintendent and the results shall be filed in his office, but shall be at the expense of the owner.

**Section 65.** Any body of masonry less than 4 ft. long in its greatest horizontal dimension shall be called a pier. The height of a pier between openings having a continuous wall above or below them shall be assumed equal to the height of the opening. The height of a pier or wall supporting floors or roofs shall be assumed as the distance from top of footing or concrete floor to under side of floor or roof beams or from center to center of beams.

The safe carrying capacity of the various materials of construction shall be determined by the following working stresses:

*Stresses for Brickwork.*

Mortar	Piers of height not more than 6 times their least dimension and walls of height not more than 9 times their least dimension (Tons per sq. ft.)	Piers of height more than 6 times their least dimension and walls of height more than 9 times their least dimension (Tons per sq. ft.)
Cement mortar	20	18
2 parts cement, 1 part hydrated or slaked lime, 8 parts sand	16	14
1 part cement, 1 part hydrated or slaked lime, 6 parts sand	14	12
1 part cement, 2 parts hydrated or slaked lime, 8 parts sand	12	10
Lime mortar	8	6

*Stresses for Concrete.*

Cement to be used for aggregate of the fine and coarse aggregate before mixing and proportioned so as to give a dense mixture.	Piers of height not more than 6 times their least dimension and walls of height more than 9 times their least dimension (Tons per sq. ft.)	Walls of height more than 9 times their least dimension (Tons per sq. ft.)
1 part cement, 6 parts aggregate	30	25
1 part cement, $7\frac{1}{2}$ parts aggregate	25	21
1 part cement, 9 parts aggregate	20	17
1 part cement, 4 parts run-of-bank gravel	15	10
1 part cement, 6 parts run-of-bank gravel	10	6

No plain concrete bearing pier shall have a greater height unstayed laterally than 6 times its least dimension, and no plain concrete bearing wall unless it is properly braced by cross walls, piers, or other means shall have a greater height unstayed laterally than 12 times its least dimension.

*Stresses for Grout and Stone Masonry.*

Cement to be Portland. Parts measured by volume	Tons per sq. ft.
Grout, 1 part cement, 1 part sand, when not less than 2 feet in least lateral dimension, not more than 1/2-in. joints	72
Granite masonry, 1 part cement, 2 parts sand, not more than 1/2-in. joints	72
Granite masonry, cement mortar, not more than 1/2-in. joints	60
Limestone and marble masonry, cement mortar, not more than 1/2-in. joints	40
Sandstone masonry, cement mortar, not more than 1/2-in. joints	30

*Provided, however,* that in stone masonry columns or in piers of excessive heights, the loads may be modified by the Superintendent.

**Section 66.**

*Stresses for Steel and Iron.*

Kind of Stress	Working Stresses lb. per Sq. In.		
	Rolled Steel	Cast Steel	Cast Iron
Bearing, direct (including bearing of stiffeners)	20,000	20,000	16,000
Bearing, pins and shop rivets	24,000		
Bearing, field rivets	20,000		
Bearing, bolts	16,000		
Extreme fibre (where top flange is stayed laterally at distances not greater than 20 times the width of flange)	16,000	16,000	*16,000 **4,000.
Extreme fibre, pins and rivets	24,000		
Shearing (including gross section of plate girder webs)	10,000	9,000	2,000
Shearing, pins and rivets	10,000		
Shearing, bolts	8,000		
Direct tension	16,000	16,000	

When the top flange of a steel plate girder, beam or channel is not stayed laterally at distances of 20 times its breadth, the above stress on extreme fiber shall be reduced as follows:—

1/b.	20	25	30	35	40	45
Stress per sq. in.	16,000	15,200	14,400	13,600	12,800	12,000
1/b.	50	55	60	65	70	
Stress per sq. in.	11,200	10,400	9,600	8,800	8,000	

Where l is length of flange in inches.  
b is breadth of flange in inches.

**Section 67.** Steel compression members shall not have a greater value of 1/r than 160, nor have metal (except for filling) less than 1/4 in. for interior columns, nor with metal less than 5/16 in. for exterior columns enclosed in masonry. The stress due to eccentric or transverse loading combined to that due to central loading shall not exceed 16,000 lb. per sq. in.

\* Compression.  
\*\* Tension.

For centrally loaded steel compression members the safe load in lb. per sq. in. shall be as follows:

*Steel Compression Members.*

1/r	70 or less	80	90	100	110
Load per sq. in.	13,000	12,000	11,000	10,000	9,000
1/r	120	130	140	150	160
Load per sq. in.	8,000	6,000	4,000	2,000	0

Where l is length of the column in inches  
r is the radius of gyration in inches taken around the axis about which the column will bend.

**Section 68.** Concrete-filled pipe columns of steel or wrought iron may be used only when manufactured under such inspection as the Superintendent shall direct and with such stresses as he may determine.

**Section 69.** Cast-iron compression members shall not have a greater value of 1/r than 70, nor a smaller outside diameter or side than 5 in., nor a greater unsupported length than 24 times their least lateral dimension or diameter: *provided, however,* that columns supporting roof loads only may have a value of 1/r not greater than 86 and an unsupported length of not more than 28 times the least lateral dimension or diameter. They shall not have metal less than 3/4 in., nor thinner than 1/12 of the greatest lateral dimension or side. The stresses due to eccentric or transverse loading, combined with those due to central loading, shall not exceed 9,000 lb. per sq. in.

Cast iron columns shall not be used where the loading is so eccentric as to cause tension.

Whenever the core of a column has shifted more than 1/4 of the thickness of the shell, the strength shall be computed assuming the thickness of metal all around to be equal to the thinnest part.

For centrally loaded cast-iron compression members the safe load in lb. per sq. in. shall be as follows:—

*Cast-Iron Compression Members.*

1/r	10	20	30	40	50	60	70	80	86
Load per sq. in.	8600	8200	7800	7400	7000	6600	6200	5800	5560

*Provided, however,* that the Superintendent may reduce these loads when, in his judgment, vibrating machinery makes it advisable.

## Section 70.

## Stresses for Timber.

	Stress per Sq. In.			
	Southern Yellow Pine, Dense Grade	Southern Yellow Pine, Sound Grade	Spruce	White Pine
Bearing				Oak
across grain	350	300	250	250
with grain	1200	900	700	700
Extreme fiber	1600	1200	1000	1000
Shear with grain	125	85	80	80
				125

Southern yellow pine for both dense and sound grades shall have defects restricted in accordance with specifications promulgated by the Superintendent, or, in the absence of such specifications, in accordance with the section on defects in the rules of the Southern Pine Association for Select Structural Material.

Timber compression members shall not have knots greater in diameter than  $\frac{1}{3}$  the least dimension of the member or 4 in. in any case.

**Section 71.** Timber compression members shall not be used of a greater unstayed length than 30 times their least dimension for isolated columns or 40 times their least dimension for columns in partitions or truss members. The stresses due to eccentric or transverse loading combined with those due to central loading shall not exceed the maximum stress allowed in table below.

For centrally loaded timber compression members the safe load in lb. per sq. in. shall be as follows:—

## Timber Compression Members.

Length divided by Least Dimension	Southern Yellow Pine, Dense Grade	Southern Yellow Pine, Sound Grade	Spruce	Pine	Oak
	10 or less	1,050	800	650	650
15	975	740	600	600	740
20	900	680	550	550	680
25	825	620	500	500	620
30	750	560	450	450	560
35	675	500	400	400	500
40	600	440	350	350	440

Timber compression members shall not have knots greater in diameter than  $\frac{1}{3}$  of the least dimension of the member or 4 in. in any case.

**Section 72.** Methods for reinforced concrete are given in Div. 14. For all other materials, the following methods shall be used:

The span of beams, girders, or trusses shall be taken as the distance from center to center of the bearings. If connected to the side of column, the span shall be taken to the center of a column.

If a tension piece is loaded eccentrically or transversely the maximum combined fiber stress shall not exceed the allowed stress in tension.

An eccentric load upon a column shall be taken as affecting eccentrically only the length of column extending to the next point below at which the column is stayed securely in the direction of the eccentricity.

If a piece is exposed to tension and compression at different times it shall be proportioned and connected to resist the maximum of each kind of stress.

Base-plates, bearing plates, and grillage beams shall be figured on the assumption that the maximum bending moments are under the center of bearing.

#### DIVISION 9.—EXCAVATIONS AND CELLARS.

**Section 73.** Excavations shall be properly guarded by the person making them against danger to life and so that the adjoining soil, wall, building, or structure shall not cave in.

Whenever an excavation is not carried more than 10 ft. below the curb level opposite the party line, the owner of every nearby wall, building or structure shall protect the same, so that they shall be safe, and he shall be permitted to enter upon the premises where such excavation is being made for the purpose if necessary.

Whenever an excavation is carried more than 10 ft. below curb level the person causing such excavation to be made, if afforded permission by the nearby owner, shall, at his own expense and under the direction of the Superintendent, preserve every nearby wall, building, or structure from injury, and support the same by proper foundation or retaining walls so that they shall be safe, whether said wall, building, or structure is down more or less than 10 ft. below the curb, and for this purpose proper foundations or retaining walls may be built upon the nearby premises.

If the necessary permission is not given by the nearby owner, then such nearby owner shall, at his own expense, and under the direction of the Superintendent, make his wall, building, or structure safe, supporting same so that the new excavation can be made, and he shall be permitted to enter upon the premises where such excavation is being made for that purpose if necessary.

No party wall between two estates shall be added to in height or underpinned unless the whole wall when so added to or underpinned conforms to the requirements of this ordinance, and in so far as said wall is

used or intended to be used in common, all additions or underpinning thereto shall be made symmetrically with the center of gravity of the wall. If the wall is added to by building in columns or a steel or reinforced concrete frame to be used exclusively on one side, proper foundations shall be built for such columns or frame, and the parties making such installation shall have the right to extend such foundations only as far under the adjoining premises as the foundations of the party wall existed before the addition.

**Section 74.** The cellar and basement of every building shall be protected from dampness as approved by the Superintendent, and, if below the grade 12 ft. above mean low water, shall be waterproofed to his satisfaction.

#### DIVISION 10.—PILING.

**Section 75.** All buildings shall, if the Superintendent determines that piling is necessary, be constructed on foundation piles, and the number, diameter and bearing of such piles shall be sufficient to support the superstructure proposed. The Superintendent shall determine the grade at which the piles shall be cut. He may require any applicant for a permit to ascertain by boring the nature of the ground on which it is proposed to build, and he may require a competent inspector satisfactory to him to be on the work at all times while piles are being driven, which inspector shall keep an accurate record of the length of each pile, the weight and fall of the hammer, and the penetration of each pile for each of the last two blows of the hammer.

**Section 76.** Wooden piles shall be sound, straight and not less than 6 in. in diameter under the bark at the tip.

**Section 77.** Concrete piles shall be subject to the regulations of the Superintendent as to their materials, method of fabrication, and driving.

**Section 78.** The minimum distance in the clear between piles shall be not less than 12 in., except that the Superintendent may allow the piles in any one row to be closer together if, in his judgment, it is proper, but the piles adjacent to such closely spaced row shall not be less than 12 in. apart in the clear. Detached column or pier footings shall have at least 3 piles each, but column or pier footings connected by proper masonry foundations or steel construction to provide adequate lateral support in both directions may be supported by one pile if the load does not exceed that allowed by this ordinance. Light wall foundations may be supported on a single row of piles, *provided* the length unsupported laterally by proper masonry foundations or steel construction does not exceed 10 ft. All

other foundations shall be supported on at least two rows of piles, the rows to be at least 16 in. c. to c.

Piles under masonry buildings shall be capped with concrete or with block granite. If capped with concrete, the proportions shall be 1 part Portland cement to not more than 6 parts aggregate, the volume of the aggregate being the sum of the volumes of the fine and coarse aggregate measured separately before mixing and proportioned so as to give a dense mixture. If capped with block granite, each block shall have a firm bearing on not more than 3 piles and shall be not less than 12 in. thick and shall project enough to fully cover the pile caps.

Piles under steel or wooden frame buildings without masonry walls may be capped with timber not less than 6 in. thick and securely joined together, in which case the piles may be cut off at any desired grade.

### DIVISION 11.—FOUNDATIONS AND MASONRY CONSTRUCTION.

**Section 79.** Bricks shall be wet before laying except in freezing weather. Brick walls shall be laid with full mortar joints and shall be bonded at least every 5th course by an all header or alternate-header course. Bricks laid in running bond without whole brick headers, or bricks laid in patterns without whole brick headers in the face for any length greater than 1 ft. in a pier or 3 ft. in a wall shall be bonded with metal ties. Brick footings shall not project more than 1½ in. per course, and bricks which are corbelled in chimneys or to support floors shall not project more than 1 in. per course. Corbels to support floors shall provide bearing not less than 4 in. wide, and the top of corbel shall be not less than two courses higher: but the Superintendent may allow smaller bearing for timbrel or other arch construction. All walls meeting at an angle shall be securely bonded to each other, or, if one wall is built in advance of the other, shall be united by proper bonding and at intervals of 5 ft. by metal anchors of type approved by the Superintendent built into one wall to at least half the thickness of the wall and into the side or partition wall not less than 2 ft.

Brick walls with air spaces shall contain, exclusive of bonding bricks, the same amount of material as required for solid walls, and the wall inside of the air space supporting more than two floors shall be not less than 8 in. thick. The double walls shall be headed over for at least 2 courses below all floor or roof beams and shall be bonded by brick or metal ties not more than 2 ft. apart vertically and horizontally.

The walls of each story shall be carried up full thickness to the tops of the beams above.

All walls shall be anchored to the floor construction, and to the roof construction where parapet walls occur, by metal anchors of type approved by the Superintendent, at intervals of not more than 10 ft. for walls supporting floor beams or slabs and to girders and partition caps, and at intervals of not more than 20 ft. for walls parallel to wooden or steel floor beams.

Hollow brick, when hard burned and of the dimensions of common brick and when properly bonded to wall, may be reckoned as part of the thickness of the wall.

Recesses in outer walls shall leave not less than 8 in. of masonry. Horizontal recesses and wide recesses for stairs, elevators, etc., may be allowed when, in the opinion of the Superintendent, the arrangement will give proper strength.

No timber lintels or posts shall be used to support masonry walls.

**Section 80.** Brick, stone, concrete, or terra cotta veneer on a wooden frame shall be bonded by proper painted or galvanized metal ties not less than 2 ft. apart horizontally, and not less than 16 in. apart vertically.

**Section 81.** Rubble walls shall have through stones for bonding built in at intervals of not more than 3 ft. vertically and horizontally.

**Section 82.** Block stone walls shall have joints thoroughly filled with spalls and mortar so that each stone will come to a solid bearing.

**Section 83.** Bearing walls faced with ashlar shall be at least 16 in. thick. Ashlar shall not be included in reckoning the thickness of walls unless it is either at least 8 in. thick or alternately 4 in. and 8 in. to allow at least a 4-in. bond. Ashlar not having at least 4-in. bond in alternate courses shall be tied to the backing

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by metal anchors, one to each block 3 ft. or less long, and two to each block over 3 ft. long.

**Section 84.** Architectural terra cotta shall be hard burnt, properly stiffened by webs, and with all voids filled with masonry as far as the outer face of the wall.

**Section 85.** In case it is necessary to increase the thickness of an existing wall the thickened wall must have a total thickness of 4 in. more than required for a new wall; the lining shall be not less than 8 in. thick; shall be supported on a proper foundation; shall be laid up in Portland cement mortar, bonded to the old wall to the satisfaction of the Superintendent.

No wall shall be lined until permission has been given by the Superintendent, nor until the existing wall has been cleaned of plaster, paint, or other coating.

**Section 86.** Wooden floor and roof beams entering the same fire or party wall from opposite sides shall have at least 4 in. of masonry between their ends in any direction, except in case of 8 in. walls, when there must be 8 in. of masonry between ends.

**Section 87.** Masonry shall not be built in freezing weather unless suitable precautions are taken.

**Section 88.** Mortar for foundations of all masonry buildings and for any rubble wall retaining more than 15 ft. of earth, for portions of chimneys and parapets above roofs, for all hollow block walls with cells set vertical, and for walls less than 12 in. thick and exposed to the weather, shall be Portland cement mortar. Mortar for first and second-class buildings and for piers and foundations for third-class buildings, and for all chimneys below roof shall be no poorer than cement-lime mortar.

**Section 89.** Foundations for all first and second-class buildings, of all third-class buildings having a

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cellar or basement, of all third-class buildings, shall be less than one story, and of all third-class buildings an area greater than 300 sq. ft. shall be enclosed. Foundations shall extend 4 ft. below any adjoining surface to frost unless they rest on bed rock, and they shall reach through loam or fill to undisturbed natural soil or shall rest on piles. All trenches shall be kept reasonably free from water when laying foundations and no foundation shall be started on frozen ground.

The thickness of foundation walls shall in all cases be irrespective of any other requirements of this section and be sufficient to keep the stresses in the masonry and on the soil within the working stresses prescribed by this ordinance.

Cellar or trench walls above grade not more than 6 ft. high for third-class buildings shall have the following minimum thickness in inches:—

Concrete, solid, or concrete blocks	8
Brick	8
Block stone, one course high	8
Block stone, more than one course high	12
Rubble	16

and any of these shall be increased 4 in. if more than 6 ft. high.

Foundations below grade for third-class buildings shall have the following minimum dimensions in inches:—

Wall Thickness	Footing Width Except on Ledges
Concrete, solid	10.....16
Brick	12.....16
Block stone	16.....20
Rubble	20.....20



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Provided, however, that walls retaining more than 6 ft. and less than 10 ft. of earth shall have the following minimum dimensions in inches:—

	Wall Thickness	Footing Width Except on Ledge
Concrete, solid	12	20
Brick	16	20
Block stone	16	24
Rubble	24	24

Foundations for masonry buildings, retaining not more than 10 ft. of earth shall be at least 4 in. thicker than the first story wall, but not less than the following dimensions in inches in any case:—

	Wall Thickness	Footing Width Except on Ledge
Concrete, solid	12	24
Brick	16	24
Block stone	16	24
Rubble	24	24

and each additional 10 ft. in depth shall be 4 in. thicker than the section above and the footing shall be widened 4 in.

Battered walls may be built, provided they give the same cross-sectional area and footing width as required above.

The Superintendent may allow reduction in the required thicknesses if the walls are of properly reinforced concrete, or are properly strengthened by steel columns or beams, or are held laterally by intermediate floors.

Isolated piers may be used instead of continuous foundations if the character of soil, building, or structure makes it necessary or advisable and the Superintendent approves.

Rubble foundation walls shall not be used for build-

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ings over 4 stories high. When rubble foundations are used under masonry buildings, the lowest course, if of stone, shall be good flat stones full width of footing, well bedded in mortar upon the ground.

Block stone foundations shall have the lowest course well bedded in mortar upon the ground. In projecting footing courses, the projecting portion of each stone shall be less than the width of the portion built in.

Concrete foundations shall not be poorer than 1 part Portland cement to 7½ parts of aggregate for pile cap-pings and for all other foundations shall be not poorer than 1 part Portland cement to 9 parts of aggregate, the volume of the aggregate in both cases being the sum of the volumes of the fine and coarse aggregate measured separately before mixing and proportioned so as to give a dense mixture: *provided, however*, that 1 part Portland cement to not more than 6 parts run-of-bank gravel may be used when the Superintendent approves. Foundations for masonry buildings shall be laid in forms both sides except for the lowest projecting footings course.

Brick footings shall project not more than 1½ in. per course and there shall be a double course at bottom, projecting not more than 3 in.

Reinforced concrete foundations and footings shall conform to requirements of Div. 14, but the concrete shall be no poorer than 1 part Portland cement and 7½ parts aggregate, the volume of the aggregate being the sum of the volumes of the fine and coarse aggregate measured separately before mixing and proportioned so as to give a dense mixture and there shall be not less than 3 in. of concrete below reinforcement or between reinforcement and the top of piles unless protected by waterproofing satisfactory to the Superintendent.

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For All Other Residence Buildings.

Stories	B'm't	1	2	3	4	5	6	7	8
1-story building	.....	12	12						
2 "	.....	12	12	12					
3 "	.....	12	12	12	12				
4 "	.....	12	12	12	12	12			
5 "	.....	16	12	12	12	12			
6 "	.....	16	16	12	12	12	12		
7 "	.....	16	16	12	12	12	12	12	
8 "	.....	20	16	16	12	12	12	12	12

Provided, however, that if roof frame be of wood the top story walls may be 8 in.

For All Public and Business Buildings.

Stories	B'm't	1	2	3	4	5	6	7	8
1-story building	.....	12	12*						
2 "	.....	12	12	12					
3 "	.....	16	12	12	12				
4 "	.....	16	16	12	12	12			
5 "	.....	16	16	16	12	12	12		
6 "	.....	20	16	16	12	12	12		
7 "	.....	20	20	16	16	12	12	12	
8 "	.....	20	20	20	16	16	12	12	12

\*In case the floor area is less than 500 sq. ft. the wall thickness may be 8 inches.

Provided, however, that if any portion of any building is lower than the rest, the low portion may have walls of the thicknesses required for a building of height equal to that of the low portion.

For the purpose of this section a half story shall not be considered but any balcony or mezzanine floor of more than 10 ft. span shall be considered as forming a story in fixing the thickness of the walls which support it.

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Steel grillage foundations shall have at least 6 in. of concrete below, and shall be entirely embedded in and surrounded by concrete at least 4 in. thick between steel and earth, and the concrete shall be no poorer than 1 part Portland cement and 7½ parts aggregate, the volume of the aggregate being the sum of the volumes of the fine and coarse aggregate measured separately before mixing and proportioned so as to give a dense mixture.

**Section 90.** For the purpose of this section a base-ment wall shall be construed to include any exterior wall between the ground and the first story and any party, fire and bearing walls from the top of foundations to the first floor.

The thickness of masonry walls shall in all cases, irrespective of the requirements of this section, be sufficient to keep the stresses in the masonry within the working stresses prescribed by this ordinance.

Brick walls above foundations for exterior, bearing, fire, or party walls shall have the following minimum thickness in inches:

For Private and Two-Family Dwellings with Wooden Floor Beams Spanning Not More Than 15 ft.

	Exterior Walls			Party Walls, Fire Walls, Bearing Walls				
	B'm't	1	2	3	B'm't	1	2	3
1 and 2-story buildings	..	12	8	8	12	8	8	
2½-story buildings	.....	12	8	8	12	8	8	
3-story buildings	.....	12	8	8	12	12	8	8

Provided, however, that wooden floor beams resting on both sides of an 8-in. wall shall not enter the wall, but shall be supported upon corbels or hangers.

forty feet and shall be of the same minimum thickness as required for brick bearing walls.

Solid, unreinforced concrete walls shall be the same minimum thickness as required for brick walls.

Reinforced concrete walls shall be of the thickness and construction required by the Superintendent.

**Section 92.** Masonry cornices and balconies may project as required in Div. 21 and shall balance about a point 1 in. inside the outer face of the wall with a live load of 40 lb. per sq. ft. on the projecting portion without relying upon any load above or upon the cornice, or shall be anchored to the floor construction, if the latter is of steel or reinforced concrete in an approved manner, or shall be supported by a metal frame work.

**Section 93.** For all buildings which have roofs sloping less than 4 in. per ft., all party walls, fire walls, and exterior walls less than 5 ft. from adjoining lot lines, except where such walls are finished with gutters, crown moulds, or cornices, shall have parapet walls of the same thickness as the walls below but shall not be required more than 12 in. thick. In buildings less than 45 ft. high the parapet shall be at least 12 in. high above roof covering, and in all other buildings the parapet shall be 2 ft. 6 in. high at least: *provided, however*, that in the first-class buildings the fire walls need not extend above the roof.

**Section 94.** Chimneys shall be carried to a height sufficient to protect adjoining buildings from fire and smoke, shall extend 4 ft. above any flat roof, and unless the roof covering is of incombustible material, shall extend at least 2 ft. above any part of the roof covering within 6 ft. horizontally distant, and shall be capped with incombustible material.

No chimney of stone or of hollow blocks shall be built without terra cotta flue lining for all smoke flues.

No brick pier carrying floor or roof loads shall have a greater height unstayed laterally than 12 times its least dimension, and no brick wall carrying floor or roof loads, unless it is properly stayed by cross walls, piers, or other means, shall have a greater height unstayed laterally than 20 times its least dimension except by approval of the Superintendent.

Non-bearing walls not used for fire or party walls may be 4 in. less in thickness than required by the preceding table: and walls supporting stairs and stair landings only may be 8 in. less; *provided, however*, that no such non-bearing or stair wall shall be less than 8 in. thick nor have a greater height unstayed laterally than 30 times its thickness except by the approval of the Superintendent.

Curtain walls between, columns, buttresses or projecting piers may be thinner than required by preceding tables: *provided, however*, that in dwellings not over three stories high such curtain walls shall not be less than 4 inches thick and in all other buildings such curtain walls shall not be less than 12 inches thick for party walls nor less than 8 inches thick for exterior walls, except that the portion between the top of one window opening and the bottom of the window opening above, if faced with metal, shall be backed by at least 4 inches of incombustible material.

Curtain walls in buildings of skeleton construction shall be securely anchored to the frame at each floor level. No curtain wall exceeding 20 feet in length shall have a greater height unstayed laterally than thirty times its thickness.

**Section 91.** Hollow block walls shall be the same minimum thickness as required for brick walls and may be used for bearing walls in buildings not over forty feet in height. In buildings more than forty feet in height hollow block walls may be used in the upper

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crete blocks shall be plastered on the outside surfaces behind all woodwork. Access for cleaning out shall be provided at the foot of all flues.

No chimney shall be corbelled from any wall less than 12 in. thick, nor for more than the thickness of the wall. Flues in party walls shall have the outside of their linings not less than 2 in. from the party line, or, if unlined, the inside of the flue shall not be less than 6 in. from the party line.

No chimney shall be supported on wood except that in one-story buildings, not over 400 sq. ft. in area, smoke flues may be built of well burned terra cotta pipe with hubs set in cement mortar, and such chimneys may be supported on wood to the satisfaction of the Superintendent.

When there is woodwork directly back of a fireplace, the backs shall have either a 2 in. air space with 4 in. of brick or concrete on each side of it, or, if of hollow terra cotta or concrete blocks, shall be at least 8 in. thick with a fireplace lining of cast iron or 4 in. of brick. Between fireplaces or where back of fireplace is exposed there shall be not less than 8 in. of masonry.

In all second and third-class buildings all fireplaces shall have hearths of incombustible materials not less than 18 in. wide from the finished facing and at least 8 in. longer on each side than the finished opening and supported on incombustible trimmer arches or slabs.

All woodwork around chimneys shall be kept at least 1 in. clear of the brickwork, except that projecting piers may be built to support girders or posts.

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All smoke flues, except as in hereinafter provided, shall be constructed of brick or reinforced concrete not less than 4 in. thick or of hollow terra cotta or concrete blocks not less than 6 in. thick, or of stone or plain concrete not less than 8 in. thick, and shall be lined continuously from the lowest thimble or smoke chamber to the top of the chimney with well burnt terra cotta flue linings with cemented joints: *provided, however*, that if the walls are constructed 8 in. thick of brick or of solid concrete the flue linings may be omitted. If the flue linings are omitted the joints on inside of flues shall be neatly struck. The walls between the flue linings may be 4 in. thick or may be omitted for a set of flues not exceeding four in number. Rough brick jambs of fireplaces and range and grate openings shall be at least 8 in. thick if there is no flue in the jamb. The walls between the flue linings and fireplaces may be omitted: *provided, however*, that not more than one on each side of the fireplace shall be left without side partition.

When smoke flues are connected with hot water or low pressure boilers having a grate area of over 10 sq. ft., bakers' ovens, or hotel or restaurant ranges, the flues shall be lined and the walls enclosing the linings, for a height of not less than 12 ft. from the point where the smoke connection enters the flue, shall be of brick or reinforced concrete 8 in. thick or of plain concrete, hollow terra cotta, or concrete block not less than 10 in. thick.

When smoke flues are connected with high pressure steam boilers or other appliances producing similar flue temperatures, they shall be constructed as approved by the Superintendent.

Exterior metal smoke flues shall be located and constructed as approved by the Superintendent.

All chimneys of brick, terra cotta blocks, or con-

### DIVISION 12.—STEEL CONSTRUCTION

**Section 95.** Materials, stresses, and methods of computation shall be as provided in Div. 8.

**Section 96.** Connections shall be designed to develop the full strength of the member under the conditions of loading, even though the computed stress is less.

Rivets shall be placed in accordance with good engineering practice. The diameter of rivet holes in tension members shall be assumed as  $\frac{1}{8}$  in. larger than the rivet.

**Section 97.** Every beam, channel, lintel, or girder supported by a wall shall be properly anchored thereto, and shall have bearing plates if necessary to distribute the load properly at the stresses required by this ordinance.

Beams and channels acting as skew-backs for arches shall be designed to resist the lateral thrusts in addition to their vertical loads, and tie rods not less than  $\frac{1}{4}$  in. in diameter shall be placed as near the line of thrust as practicable, and in any event shall be spaced not more than 8 times the depth of the beams, and not more than 8 ft.

Where beams or channels are used in pairs they shall be connected together with iron or steel separators near each end and at each concentrated load, and not more than 5 ft. elsewhere; and beams 12 in. or more in depth, if connected by bolted separators, shall have two bolts to each separator.

**Section 98.** Steel column ends shall either be machine faced and brought into actual contact or full riveted connections shall be provided to develop the strength of the columns. Latticing and tie plates shall be provided in accordance with good engineering practice.

**Section 99.** In proportioning the flanges of plate girders  $\frac{1}{8}$  of the web may be considered as available in each flange. When the top flange is not stayed laterally at distances of 20 times its breadth the stresses shall be reduced as required in Sec. 66. Stiffeners, properly fitted at ends, shall be provided over supports and under concentrated loads with sufficient area in the outstanding legs to transmit the stresses in bearing at 20,000 lb. per sq. in. and with sufficient rivets to transmit the stresses to the web. Intermediate stiffeners shall be so spaced, that the clear distances between the stiffeners or the clear distance between flange angles shall not exceed that given by the formula.

$$d = \frac{t}{40} (12,000 - s)$$

where  $d$  is the clear distance between stiffeners or flange angles

$t$  is the thickness of web

$s$  is the shear per sq. in.

**Section 100.** Trusses shall be designed so that the stresses in each member can be calculated with reasonable accuracy by statical methods. The center of gravity lines of members meeting at a joint shall, if possible, intersect at a point, and the center of gravity of a group of rivets connecting one member to another shall, in general, lie as nearly as practicable in the center of gravity line of the member. Trusses shall be properly braced.

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## DIVISION 13.—CAST IRON CONSTRUCTION.

**Section 101.** Materials, stresses, and methods of computation shall be as provided in Div. 8.

**Section 102.** Cast iron columns shall not be used in the structural frames of buildings whose height exceeds 2 times the least width of base. Cast iron columns shall be faced at ends to a true surface perpendicular to the axis to give full bearing for the cross-section of the column.

All hollow cast iron columns, except when open at both ends and without flanges, shall have two  $\frac{3}{8}$  in. holes drilled on the top or bottom side of column as cast, if the columns are cast on side, one hole about 12 in. each side of the center of the length of the column, to exhibit thickness of the shell. Columns cast on end shall have two  $\frac{3}{8}$  in. holes drilled by the maker, at an angle of 90 degrees to each other at the middle of the column, to exhibit thickness of shell. Additional holes shall be drilled when required by the Superintendent.

**Section 103.** Cast iron lintels shall not be used for spans exceeding 6 ft. and shall have no metal thinner than  $\frac{3}{4}$  in.

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## DIVISION 14.—REINFORCED CONCRETE CONSTRUCTION.

**Section 104.** Reinforced concrete shall mean an approved mixture of Portland Cement water, and fine and coarse aggregate, reinforced by steel.

**Section 105.** The Portland cement and fine and coarse aggregate for reinforced concrete work shall conform to the quality of materials as defined in division eight of this ordinance.

**Section 106.** Steel for reinforcement shall conform to the Standard Specifications for Steel Reinforcement Bars of the American Society for Testing Materials, as from time to time revised. It shall be free from mill scale and loose rust and shall not be coated in such manner as to weaken the bond.

**Section 107.** The ingredients shall be thoroughly mixed, and the mixing shall continue until the cement is thoroughly distributed and the mass is uniform in color. The consistency shall be such that the concrete will flow freely about and entirely enclose the reinforcement, but shall not be so wet as to cause separation of the ingredients in handling.

**Section 108.** The Superintendent may require an applicant for a permit for the structural use of concrete to have a competent inspector satisfactory to the Superintendent at all times on the work while concrete is being mixed or deposited, and such inspector shall make daily reports to the Superintendent on the progress of the work.

**Section 109.** Forms shall be sufficiently tight to prevent any considerable loss of material in the pouring.

**Section 110.** Concrete shall be used immediately after mixing, it shall not be placed in the work after it has begun to harden, and it shall be deposited in such manner and under such regulations as to secure a com-

#### Div. 14

part mass of the best quality for the proportions used. Forms shall remain until the concrete has hardened sufficiently to carry its load safely, and shall be removed without damage to the concrete.

Concrete shall not be deposited in forms until the reinforcement has been put in place and secured against displacement.

Columns shall be poured without any interruption to the bottom side of beams or girders which they support, or to the bottom of the flare in flat slab construction. Special care shall be taken in their pouring that no voids may result.

Columns and walls shall be poured not less than three hours in advance of the beams, girders, or slabs which they support. All columns of the same type in a story shall be of concrete mixed in the same proportions.

Structural slabs shall be poured the full thickness at time of pouring floor.

**Section 111.** Proper precautions shall be taken in stopping concrete work to stop it at the points of low shear.

**Section 112.** When fresh concrete is exposed to a hot or dry atmosphere or wind, special precautions to prevent premature drying shall be taken.

Concrete shall not be deposited when the temperature is below thirty-two degrees Fahrenheit, unless adequate precautions are taken to prevent freezing.

**Section 113.** Main reinforcement in floor slabs shall be protected by a minimum of three-fourths of an inch of concrete; in beams, girders, columns and walls by one and one-half inches from the surface of the concrete to the surface of the main reinforcement.

In columns the outer one and one-half inches of concrete shall be regarded as fireproofing which shall be assumed to carry no stress.

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**Section 114.** In foundations and retaining walls the steel shall be protected, and on the side toward the earth or water by a minimum of three inches of concrete.

**Section 115.** Slab reinforcement bars in tension shall be not farther apart horizontally than two and one-half times the total thickness of the slab. In beams and girders the lateral spacing of parallel bars shall be not less than three diameters from center to center, and the clear space between two layers of bars shall be not less than one inch.

**Section 116.** Calculations shall be made with reference to working stresses and safe loads rather than with reference to ultimate strength and ultimate loads, and shall be based on the following assumptions:

- (a) A plane section before bending remains plane after bending.
- (b) The modulus of elasticity of concrete in compressions, within the usual limits of working stresses, is constant. The distribution of compressive stresses in beams, therefore, is rectangular.
- (c) The tensile strength of the concrete in direct resistance to bending is neglected.
- (d) Under compressive stresses the two materials are stressed in proportion to their moduli of elasticity.
- (e) Initial stress in the reinforcement due to contraction or expansion in the concrete is neglected.

**Section 117.** The span length for beams and slabs simply supported shall be taken as the distance from center to center of supports, but need not be taken to exceed the clear span plus the depth of beam or slab. For continuous or restrained beams, or slabs built mon-

olithically into supports, the span length may be taken as the clear distance between faces of supports. Brackets shall not be considered as reducing the clear span in the same sense here intended, except that when brackets which make an angle of forty-five degrees or more with the axis of a restrained beam or the plane of a slab are built monolithically therewith, the span may be measured from the section where the total depth is at least one-third more than the depth at the edge of the bracket. Maximum negative moments are to be considered as existing at the end of the span as here defined.

**Section 118.** Bending moments for uniformly distributed dead and live loads, in beams and slabs reinforced in one direction only shall be computed upon the following assumptions, where "w" is the total dead and live load per linear foot, and "l" is the span length:

- (a) for a single span freely supported bending at mid-span is  $\frac{wl^2}{8}$
- (b) for a single span restrained at the ends bending at mid-span is  $\frac{wl^2}{12}$
- (c) for two equal continuous spans freely supported, the bending at mid-span is  $\frac{wl^2}{10}$  and at central support is  $\frac{wl^2}{8}$

- (d) for two equal continuous spans restrained at supports, the bending at mid-span is  $\frac{wl^2}{12}$  and at central support is  $\frac{wl^2}{10}$

- (e) for three or more equal continuous spans freely supported the bending at mid-span of the end span, and at the first interior support is  $\frac{wl^2}{10}$  and the bending at mid-span of interior spans and at other interior supports is  $\frac{wl^2}{12}$

- (f) for three or more equal continuous spans restrained at supports, the bending at the first interior support for beams is  $\frac{wl^2}{10}$  and for the slabs is  $\frac{wl^2}{12}$  and the bending at all other interior supports and at mid-span of all spans is  $\frac{wl^2}{12}$



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(g) at the restrained ends of continuous beams a negative bending of

$$wl^2$$

$$\frac{16}{12}$$

shall be generally assumed, but this shall be increased to not more than

$$wl^2$$

$$\frac{12}{16}$$

for small beams running into large columns. Beams and slabs shall be considered as restrained at the ends when they frame monolithically into a structure sufficiently stiff and strong to introduce a negative bending moment into the beam at the end in amount not less than

$$wl^2$$

$$\frac{16}{16}$$

For continuous beams subject to other than uniformly distributed loads, the positive bending moment shall first be computed as though the beam were freely supported. The positive moment may then be reduced in the same proportion as specified above for beams loaded uniformly, and provision shall be made at the restrained ends for negative moments having the same ratio to the positive moment first computed that the negative moments specified above bear to

$$wl^2$$

$$\frac{8}{8}$$

Beams parallel to the main reinforcement of a one-way slab and into which no other beams frame and which are restrained at the ends by being built monolithically into supporting columns shall be designed for bending moments at the ends equal to  $wl^2$  and at mid-span as follows:

When the width columns parallel to the axis of the beam is not less than fifteen per cent. of the distance center to center of columns, or twice the depth of the beam  $m = wl^2$ ; otherwise  $m = \frac{wl^2}{12}$

For spans of unusual or unequal length and other special cases the design shall be such as to carry out the intent of this ordinance to the satisfaction of the superintendent.

$$\frac{20}{16}$$

$$\frac{16}{16}$$

**Section 119.** For slabs supported on four sides and reinforced in both directions the distribution of loads shall be determined by the formula

$$r = \frac{l}{b} - 0.5$$

$$r = \frac{l}{b} - 0.5$$

$$l$$

where

$b$  is the breadth of slab.

$l$  is the length of slab.

$r$  is the proportion of load carried by the transverse reinforcement.

In placing reinforcement in such slabs account shall be taken of the fact that the bending moment is greater near the center of the slab than near the edges, and two-thirds of the calculated moments shall be assumed as carried by the center half of the slab and one-third by the outside quarters.

Beams supporting rectangular slabs reinforced in both directions shall be assumed to take the proportions of load as determined by the formula in this section.

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lithically into supporting columns shall be designed for bending moments at the ends equal to  $wl^2$  and at mid-span as follows:

$$\frac{12}{12}$$

When the width columns parallel to the axis of the beam is not less than fifteen per cent. of the distance center to center of columns, or twice the depth of the beam  $m = wl^2$ ; otherwise  $m = \frac{wl^2}{12}$

$$\frac{20}{16}$$

$$\frac{16}{16}$$

**Section 119.** For slabs supported on four sides and reinforced in both directions the distribution of loads shall be determined by the formula

$$r = \frac{l}{b} - 0.5$$

$$r = \frac{l}{b} - 0.5$$

$$l$$

where

$b$  is the breadth of slab.

$l$  is the length of slab.

$r$  is the proportion of load carried by the transverse reinforcement.

In placing reinforcement in such slabs account shall be taken of the fact that the bending moment is greater near the center of the slab than near the edges, and two-thirds of the calculated moments shall be assumed as carried by the center half of the slab and one-third by the outside quarters.

Beams supporting rectangular slabs reinforced in both directions shall be assumed to take the proportions of load as determined by the formula in this section.

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tion, the distribution of the load being assumed to vary in accordance with the ordinates of a parabola having its vertex at mid-span.

**Section 120.** Opening in floors and roofs shall be so framed as not to exceed the allowable stresses.

**Section 121.** In roof slabs the total depth shall not be less than three inches, and in floor slabs four inches.

In "T" beams the depth below the slab shall not exceed eight times the thickness of the slab adjacent to the stem. Cinder concrete slabs shall not be less than four inches thick; they shall not exceed eight feet in span.

**Section 122.** Reinforcing materials which are self-centering shall not be used in spans to exceed eight feet. Fireproofing under self-center reinforcement may be of Portland cement plaster.

**Section 123.** If a beam or floor slab is assumed as fixed or partially restrained at a support, the column, wall, or other structure furnishing such restraint shall be proportioned to resist the stresses thereby induced.

**Section 124.** Where adequate bond and shearing resistance between slab and web of beam is provided, the slab may be considered an integral part of the beam, but its effective width shall not exceed one-fourth part of the span length of the beam, nor shall its overhanging width on either side of the web exceed six times the thickness of the slab.

**Section 125.** Columns or piers of concrete shall be reinforced when the unsupported height exceeds six times the least gross dimension, and no reinforced concrete column shall have an unsupported height of more than twelve times its least gross di-

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ension except with stresses reduced from those allowed by this ordinance in accordance with the ratio.

24 —  $\frac{h}{d}$  —

d

12 where  $h$  is unsupported height and  $d$  is least dimension and — shall not in any case exceed eighteen.

The maximum effective area of columns shall be taken as the area within the outer one and one-half inches of concrete covering, or, in the case of hooped columns or columns reinforced with structural shapes, it shall be taken as the area within the circle enclosing the spiral or the polygon enclosing the structural shapes. Longitudinal reinforcement shall be assumed to carry stress in proportion to the respective moduli of elasticity as given in this ordinance.

Exterior columns and their reinforcement shall be so proportioned as to withstand bending in addition to the direct load without exceeding the fiber stresses specified for beams elsewhere in this ordinance.

Reinforced concrete buildings may be supported by structural steel or cast iron columns, fireproofed where required, as provided elsewhere in this ordinance.

Brackets shall be provided to transmit the load from the floors to the column. Such columns shall be computed as follows:

(a) If the brackets are placed immediately below the floor the structural steel or cast iron columns shall be assumed to carry the load of all the floors above.

(b) If the brackets are placed immediately above a floor the structural steel or cast iron columns shall be assumed to carry all the load