7.103 IRON AND STEEL

Structural Steel

(a) Structural steel shall conform to the "Standard specifications for Structural Steel for Buildings," serial designation A 9-29, of the American Society for Testing Materials.

Cast-Iron

(b) Cast iron shall conform to the "Standard Specifications for gray iron castings," serial designation A 48-29, of the American Society for Testing Materials.

Cast-Steel

(c) Cast steel shall conform to the "Standard Specifications for Steel Castings," serial designation A 27-24, of the American Society for Testing Materials.

7.104 WOOD

Quality of Material

(a) American Lumber Standards as defined in "Simplified Practice Recommendations, R16-29" of the United States Department of Commerce shall be the basis for the determination of minimum acceptable sizes and for the determination of allowable stresses.

All lumber used in any building shall be sound, free from rot, large or loose knots, shakes or other imperfections which would materially impair its strength and of such size, quality and dimensions as the purpose for which it is used requires.

7.105—GYPSUM

Quality of Material

(a) The chemical and physical properties of the gypsum and calcined gypsum shall conform to the requirements of the "Standard Specifications for Gypsum and Calcined Gypsum," of the American Society for Testing Materials, Serial designation C22-25 and C23-30 respectively.

Gypsum Tile

(b) Gypsum partition tile or block shall conform to the requirements of the "Standard Specifications for Gypsum Partitions Tile or Block," of the American Society for Testing Materials, Serial designation C52-27. Such tile or blocks shall contain not to exceed 15 per cent by weight of combustible binding material, wood, vegetable, or mineral fiber. Gypsum mortar shall be used for laying gypsum tile or block, which mortar shall consist of 1 part gypsum and not to exceed 3 parts, by weight, of sand.

Poured Gypsum

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

	Lbs. Per Sq. In.
1—Neat Gypsum (without aggregate)	1800
2—Gypsum fiber concrete containing not more than 12.5 per cent of weight of binding material	500
3—1.5 parts gypsum cement; 1 part sand; 3 parts cinders	500
4—1.5 parts gypsum cement; 1 part sand; 3 parts slag or stone	800

NOTE: Compressive tests shall be made on 4"x12"x4" specimens with the load applied to the 4"x12" face. The average compressive strength shall be not less than that noted above with no one specimen testing less than 75 percent of the required average.

7.106—NEW OR ALTERNATE MATERIALS

New Materials

(a) For the requirements for new or alternate materials see section 1.203 of this Code.

7.107—TESTS OF MATERIALS

Tests.

(a) All structural materials, whose character and quality are not generally known, shall be subject to such tests as will determine their character and quality. Such tests shall be made under the supervision of the Building Inspector, or he may require certified copies of the results of such tests as he may prescribe conducted by competent disinterested parties. The cost of such tests shall be borne by the person or persons desiring to use or promote the use of such materials.

Section 7.2—LOADS

General Requirements

7.201 (a) Buildings and all parts thereof shall be of sufficient strength to support safely their imposed loads, live and dead, in addition to their own proper dead load; provided, however, that no building shall be designed for live loads less than those specified in the following sections with proper additional allowance in unusual cases or where loads are known to be greater than those specified.

Dead Loads

7.202 (a) In the absence of definite information establishing the weights of construction materials which are to be used, the following unit weights shall be assumed:

MATERIALS	Lbs. Per Cu. Ft.
Brickwork ordinary	120
Brickwork pressed	130
Concrete Building Tile	85
Concrete	
Cinder (tamped)	100
Cinder (not tamped)	70
Stone or gravel	150
Cast Iron	450
Hollow Clay Tile	60
Hollow Gypsum block	48
Plaster	96
Steel	490
Wood	48
TYPES OF CONSTRUCTION	**Lbs. Per Sq. Ft.**
Ceilings	
Wood or gypsum lath and plaster	8
Suspended metal lath & plaster	10
Partitions	
2"x4" studs, lath and plaster both sides	16
4" hollow clay tile	18
6" hollow clay tile	25
8" hollow clay tile	30
Roofings	
Composition shingles	2
Slate 3/16"	7
Slate ¼"	10
Tar and gravel	6
Tile	12
Wood shingles	3

Live Loads (Floor).

7.203 (a) Buildings or portions thereof shall be designed in accordance with the provisions of this Code for not less than the floor live loads specified in the following tables;

Where known loads are greater than those specified, the design shall be for the known loads.

OCCUPANCY	Lbs. Per Sq. Ft.
Apartments	40
Assembly Halls (fixed seats)	80
Assembly Halls (other)	100
Attics (unused space)	20
Churches (fixed seats)	80
Churches (movable seats)	100
Dance Halls	125
Dining rooms	80
Drill halls	125
Driveways	300
Dwellings	40
Garages	
All type vehicles	100
Passenger Cars only	80
Grand Stands	100
Hospitals	40
Hotels and Clubs	40
Lobbies and Corridors	80
Lofts and Shops—light occupancies, first floor	125
Other floors	80
Manufacturing, 1st floor	125
Other floors	100
Office Buildings	
First floors	100
Other floors	50
Office space in all occupancies	50
Public Buildings	100
Restaurants	80
Roofs (see Par. b)	30
Schools (fixed seats)	50
Schools (movable seats)	80
Sidewalks	250
Stables	80
Stairways and landings in dwellings under 3 stories high	50
All other buildings	100
Storage Buildings	
Heavy occupancy	250
Light occupancy	150
Stores	
Wholesale, light occupancy	125
Retail	100
Theatres	
Fly Galleries	50
Stage Floors	250
Other portions	80

Wind Pressures.

(b) For the purpose of design, the wind pressure upon all vertical plain surfaces of all buildings and structures shall be taken at not less than 20 pounds per square foot on any exposed surfaces.

The wind pressure upon sprinkler tanks, sky signs, or upon similar exposed structures and their supports shall be taken at not less than 30 pounds per square foot of plane surface acting in any direction. In computing the wind pressure on circular tanks or stacks this pressure shall be assumed to act on 0.6 of the projected area.

Roofs shall be designed for wind pressures as specified in paragraph (c) of this Section.

The overturning moment resulting from the wind load shall in no case exceed 50 percent of the dead load resisting moment.

Roof Loads.

(c) Roofs shall be designed for the following live and wind loads:

Pitch of Roof	Rise in Inches Per Foot	Live Load per sq. ft. of Horizontal Projection (Pounds)	Wind Load per sq. ft. of Roof Surface (Pounds)
	1	30.0	0.0
	2	30.0	0.0
	3	30.0	0.0
1/6	4	18.5	11.5
1/5	4.8	16.7	13.1
	5	16.2	13.5
1/4	6	13.8	14.9
	30° slope	11.2	16.0
	7	10.9	16.1
1/3	8	8.0	17.0
	9	5.1	17.7
	10	3.1	18.2
	11	1.7	18.6
1/2	12 (45°)	1.1	18.9

The live or snow load shall be assumed as acting in a vertical direction.

The wind load shall be assumed as acting in a direction normal to the roof surface and shall be assumed as acting from one direction at a time.

For roofs with slopes greater than 45 degrees no allowance need be made for live load, but they shall be designed for a wind load of 20 pounds per square foot of roof surface acting in a direction normal to the roof.

The Horizontal thrust due to the wind load shall be computed as the horizontal component of the normal force as determined by the above method.

Live Load Reductions

(d) All structural members shall be designed to carry the entire dead load, the roof load, and the following percentages of the live load

Carrying 1 floor	100 %
Carrying 2 floors	95 %
Carrying 3 floors	90 %
Carrying 4 floors	85 %
Carrying 5 floors	80 %
Carrying 6 floors	75 %
Carrying 7 floors	70 %
Carrying 8 floors	65 %
Carrying 9 floors	60 %
Carrying 10 floors	55 %
Carrying 11 or more floors	50 %

NOTE: In warehouses and storage buildings the permissible reduction of the live load shall not exceed 20 percent, and for stores, garages and manufacturing buildings, the permissible reduction of the live load shall not exceed 30 percent.

Overloading

(e) The occupant of any building shall be responsible for keeping the actual loads below the safe loads as determined by this Code. Adequate measures shall also be taken by the Building Inspector to insure that the safe loads are not exceeded and no material is stressed beyond the limits set by this Code.

It shall be the duty of the owner, or in the event of a lease for a period of 1 year or more, the tenant, of any warehouse, storage or manufacturing building, or the storage portion of any mercantile building, existing or erected after the adoption of this Code, to post in conspicuous places thru-out such building, or portion thereof, placards setting forth in letters at least 2 inches high, the safe live loads, as determined by the Building Inspector, for which the building may be used.

It shall be the duty of the Building Inspector to check and approve or show cause for disapproving any calculations as to the safe carrying capacity of any floor construction, and in order to so check such calculations, he shall be allowed to examine any plans of such building in the possession of the owner or his agent, or may require that portions of the building be uncovered for inspection.

Section 7.3—STRESSES

Allowable Stresses.

7.301 (a) The allowable stresses shall be as specified in this section for the materials listed.

Masonry	see Section 8.4
Reinforced Concrete	see Section 8.5
Iron and Steel	see Section 8.6
Wood	see Section 8.7
Gypsum	see Section 8.8

Factor of Safety

7.302 (a) The allowable stresses to be used for any new material or type of construction or any material not covered by this Code shall be determined by the Building Inspector by applying a "Factor of Safety" of not less than 3 nor more than 10, depending upon the character and nature of the materials, the probability of poor workmanship in actual construction and the probable deterioration or damage after construction.

Section 7.4 BEARING VALUE OF SOILS

Allowable Bearing Capacity of Soils.

7.401 (a) The classification and safe bearing capacity of the different materials upon which buildings are founded shall be as determined by the Building Inspector, and in the absence of tests shall not exceed the values given in the following table:

CHARACTER OF SOIL	Tons per Sq. Ft.
Soft Clay	1
Firm clay, fine sand, or layers of sand & wet clay	2
Clay and fine sand, firm and dry	3
Course sand or gravel	3

When doubt arises as to the safe sustaining power of the soil upon which a building is to be erected, the Building Inspector may order test borings or tests to be made to establish the safe sustaining power, such tests shall be made in accordance with the requirements of the Building Inspector and at the expense of the owner of the proposed building. The Building Inspector shall be notified so that he may be present at the time the tests or borings are made and a record of such tests shall be filed with the Building Inspector. The Building Inspector shall, from the results of such tests, determine the allowable bearing capacity of the soil which may be used, regardless of the value given in the above table.

CHAPTER VIII

Design and Construction

Section 8.1 WORKMANSHIP

General Requirements.

8.101 (a) Workmanship in fabrication, preparation, and installation of material shall conform throughout to good established construction practice. All members or materials shall be so framed, anchored, tied and/or bonded together so as to develop the maximum strength of the members or materials. These provisions apply only to such features of construction as are liable to affect the safety or health of the occupants of a building or of the public when near such building.

Section 8.2 EXCAVATIONS

Protection of Adjoining Buildings and Structures.

8.201 (a) It shall be the duty of every person, partnership or corporation who excavates upon land owned or occupied by them to a depth exceeding 12 feet below the established grade of a street or highway, upon which such land abuts, or if there be no such established grade, below the surface of the adjoining ground, to furnish sufficient lateral and subjacent support to the adjoining land to protect said land and all structures thereon from injury due to the removed material in its natural state, or due to the disturbance of other existing conditions caused by such excavation. [Act 314; P. A. 1921 State of Michigan.]

Notice.

(b) Before proceeding with the excavation of any material furnishing support to any building the person making such excavation shall give a written notice to the owner or agent of said building, such notice to be delivered at least one week before proceeding with the excavation of the supporting material.

Miscellaneous Provisions.

(c) Any person making an excavation shall provide shoring, sheathing and other necessary precautions to maintain all public sidewalks, curbs and pavements, as well as all earth, trees and natural objects on adjoining land. He shall also provide reasonably smooth and substantial railings, at least 4 feet high, around such excavation at any point where the public might be endangered by the absence of such guards.

Section 8.3 FOUNDATIONS

Footings.

8.301 (a) All foundations and footings shall be constructed of plain concrete, reinforced concrete, stone or brick laid in cement or cement-lime mortar, or of wooden or concrete piles or of other materials approved by the Building Inspector. Temporary buildings erected for a period of less than 1 year may have foundations of cedar posts. The bottoms of footings under all permanent buildings, except frame or sheet metal sheds not exceeding 1 story or twelve feet in height, shall be at a depth of not less than 3 feet below the grade for exterior walls or further if necessary to rest on a firm foundation.

Design.

(b) The spread or area of footings shall be not less than that required to keep the soil pressure per square foot within the limits specified in Section 7.401. Plain concrete and masonry footings shall be so designed that the horizontal projections at any point does not exceed ½ of the vertical thickness, except as noted below. Footings shall be so designed that the loads they sustain per unit of area, shall be as nearly uniform as possible, and the stresses in the footings shall conform to the requirements of this Code.

Plain concrete or masonry footings shall be not less than 8 inches thick, except that for frame 1 and 2 story buildings, the thickness may be reduced to 6 inches. Footings shall project not less than 4 inches on each side of the foundation wall, except that, footings of less projection may be used if the resultant soil pressure does not exceed 2/3 of that specified in Section 7.401. At all surfaces of footings, in which concrete is deposited directly against the ground, metal reinforcement shall have a minimum protection of 3 inches of concrete. At all other surfaces of concrete exposed to the ground or weather, metal reinforcements shall be protected by not less than 2 inches of concrete.

Footings for columns or piers in frame buildings or other two story buildings shall be not less than 24 inches square and 12 inches in depth, which size shall be increased if necessary to keep the soil pressure within the allowable limits.

8.302 PILE FOUNDATIONS.

Materials.

(a) Piles may be of wood or concrete and may be set by driving or be moulded in place, and they shall be spaced to safely carry the superimposed load. When driven they shall be driven in accordance with good engineering practice.

Bearing Value.

(b) The safe load on driven piles shall not exceed that given by the following formulas:

FOR DROP HAMMER $$P = \frac{2WH}{S+1}$$

FOR STEAM HAMMER $$P = \frac{2WH}{S+0.1}$$

In which:

P is the safe load in pounds.
W is the weight of hammer in pounds.
H is the fall of hammer in feet (Average of last 5 blows).
S is the penetration in inches (Average of last 5 blows).

The safe load of piles, as determined by a load test, shall be not more than ½ of the test load which can be sustained for 24 hours with a settlement of not exceeding 0.01 inch per ton of test load.

No wooden pile shall be subjected to a load exceeding 50,000 pounds, nor to exceed 350 pounds per square inch of the top section of the pile. No concrete pile shall be loaded to exceed 400 pounds per square inch, except that where the quality of the concrete is controlled in a manner satisfactory to the Building Inspector the allowable working stress may be not to exceed 20 per cent of the ultimate strength of the concrete. The maximum allowable load on any concrete pile shall not exceed the allowable working stress multiplied by the average cross-section of the pile.

Piles which are not supported laterally shall have their safe bear-