Filed October 26, 1962
11 am

Ind Sec b57

Pursuant to authority vested in the Industrial Commission of Wisconsin by Section 101.01-101.29 Wisconsin Statutes, and pursuant to Chapter 227, the Industrial Commission on October 22, 1962 voted to repeal safety order Ind 52.15 and to amend safety orders Ind 50.01, Ind 50.10, Ind 51.09, Ind 51.15, Ind 51.17, Ind 51.20, Ind 52.02, Ind 52.03, Ind 52.10, Ind 52.14, Ind 52.50, Ind 52.53, Ind 53.06, Ind 53.13, Ind 53.19, Ind 53.24, Ind 53.25, Ind 56.12 and Ind 57.53 of the Building Code.

The repeal of the old order and the amendments shall become effective on the first day of the month following their publication in the Wisconsin Administrative Code as provided in Section 227.

INDUSTRIAL COMMISSION OF WISCONSIN

Helen E. Gill

Helen E. Gill, Secretary

October 23, 1962

STATE OF WISCONSIN)
) SS.
DEPT. OF INDUSTRIAL COMISSION)

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, Helen E. Gill, Secretary of the Industrial Commission of Wisconsin and custodian of the official records of said commission, do hereby certify that the attached copies of amendments to orders Ind 50.01, Ind 50.10, Ind 51.09, Ind 51.15, Ind 51.17, Ind 51.20, Ind 52.02, Ind 52.03, Ind 52.10, Ind 52.14, Ind 52.50, Ind 52.53, Ind 53.06, Ind 53.13, Ind 53.19, Ind 53.24, Ind 53.25 Ind 56.12 and Ind 57.53 of the Building Code were adopted by the Industrial Commission on October 22, 1962.

I further certify that said copy has been compared by me with the original on file in this commission and that the same is a true copy thereof, and of the whole of such original.

IN TESTIMONY WHEREOF, I have here unto set my hand and affixed the official seal of the department at the Capitol, in the City of Madison, this

23 day of October,

A.D., 1962.

Helen E. Gill

Secretary

Ind 50.01 Alterations. This code shall apply to all alterations in any building or structure which affects the structural strength, fire hazard, exits or lighting of any new or existing building or structure. This code does not apply to ordinary non-structural changes or minor repairs necessary for the maintenance of any building or structure.

Ind 50.10 Approval of plans and specifications. (1) Complete plans and specifications for all buildings and structures in the following classifications shall be submitted to the industrial commission for approval before letting contracts or commencing work.

(a) Theaters and assembly halls.
(b) Schools and other places of instruction.
(c) Apartment buildings, hotels and places of detention.
(d) Hazardous occupancies.
(e) Factories, office and mercantile buildings.

(2) The submission of plans and specifications for factories, office and mercantile buildings containing less than 25,000 cubic feet total volume is waived, providing they have no floor or roof spans greater than 30 feet and are not more than 2 stories high. Buildings for which the submission of plans and specifications is waived shall comply with the requirements of this code.

(3) All plans shall be submitted in triplicate and work shall not be started until plans are approved. The following data shall be a part of, or shall accompany, all plans submitted for approval.

(a) The location and grades of adjoining streets, alleys lot lines and any other buildings on the same lot or property.

(b) Name of owner.
(c) Intended use or uses of all rooms, and the number of persons to be accommodated therein.
(d) Assumed bearing value of soil.
(e) Assumed live loads.
(f) Assumed dead loads, itemized.
(g) Assumed unit stresses for structural materials.
(h) Stress diagrams for all trusses.
(i) Typical calculations for slabs, beams, girders and columns.

(4) Complete structural calculations shall be furnished upon request of the industrial commission or other authorized approving official. All plans and specifications shall be sealed or stamped by a registered architect or registered professional engineer except that plans for buildings having a total volume of less than 50,000 cubic feet shall be signed by the designer.

(5) This order shall apply to additions and alterations, as well as to new buildings, and shall also apply to all cases where there is a change of occupancy or use of a building.

(6) In cities where plans are examined, and building permits are issued, by a city building official in a manner approved by the industrial commission, additional approval by the industrial commission is not required.

(7) This section shall not apply to sanitary appliances, such as water supply and sewage disposal systems, chemical and septic toilets and similar equipment which shall be submitted for approval and installed in accordance with the regulations of the state board of health.

(8) After being approved, plans and specifications shall not be changed in any respect which may involve any provisions of this code, except with the written consent of the approving official.

(a) The approval of a plan or specification is not to be construed as the assumption of any responsibility for the design.

Ind 51.09 Fire-resistive doors. (1) Fire-resistive doors have no time resistance rating established by governmental agencies. It will be the policy of the industrial commission to approve, subject to the provisions of this section, any door given a rating by the Underwriters' Laboratories in their "Building Materials List" as Class A, B, C, D and E having varying degrees of resistance, and suitable for various locations.

(2) Where fire-resistive doors are required, Class A doors, or equal, shall be used for all openings in 3 and 4 hour fire-resistive walls. Class B doors, or equal, shall be used for all openings in 2-hour walls. Doors for elevator shafts shall be of class B type or equal. Class C doors, or equal, shall be used in openings in corridor partitions in fire-resistive buildings and for openings in one-hour fire-resistive partitions except that wood doors of solid flush type, 1-3/4 inches thick may be used in such buildings which are less than 85 feet in height. Class D and E doors, or better, shall be used in outside wall openings where required for fire escapes.

(3) All required fire-resistive doors shall be equipped with a self-closing device.

Ind 51.15 Standard exit. (1) Every door which serves as a required exit from a public passageway, stairway or building shall be a standard exit door unless exempted by the occupancy requirements of this code.

Note. For required exits see sections Ind 54.06, 55.10, 56.08, 57.09

(2) Every standard exit door shall swing outward or toward the natural means of egress (except as below). It shall be level with the floor, and shall be so hung that, when open, it will not block any part of the required width of any other doorway, passageway, stairway or fire escape. No revolving door, and no sliding door except where it opens onto a stairway enclosure or serves as a horizontal exit, shall be considered as a standard exit door.

(3) A standard exit door shall have such fastenings or hardware that it can be opened from the inside without using a key, by pushing against a single bar or plate, or turning a single knob or handle; it shall not be locked, barred, or bolted at any time while the building is occupied.

(4) A standard exit doorway shall not be less than 6 feet 4 inches high by 3 feet 4 inches wide, except where especially provided under occupancy classifications and in section Ind 51.20. Where double doors are provided with or without mullions, the width of each single door may be reduced to 2 feet 6 inches.

(5) All exit doors, unless otherwise exemped by the occupancy requirements of this code, shall be plainly marked by an illuminated translucent exit sign bearing the word EXIT or OUT in plain letters not less than 5 inches in height and in such other places as may be necessary to direct the occupants to the exit doorways.

(6) Doors, windows or other openings which are not exits but which give the appearance of exits shall be effectively guarded.

Ind 51.17. Smokeproof stair tower. (1) A smokeproof stair tower shall be an enclosed stairway which is entirely cut off from the building and which is reached by means of open balconies or platforms. The stairways, landings, platforms and balconies shall be of incombustible material throughout. The enclosing walls shall be of not less than 4-hour fire-resistive construction as specified in section Ind 51.05, and the floors and ceilings of not less than 2-hour fire-resistive construction as specified in section Ind 51.06.

(2) The doors leading from the buildings to the balconies and from the balconies to the stairways shall be fire-resistive doors as specified in section Ind 51.09, and all openings within 10 feet of any balcony shall be protected with fire-resistive windows as specified in section Ind 51.10, or fire-resistive doors.

(3) Each balcony shall be open on at least one side, with a railing not less than 3'6" high on all open sides.

Ind 51.20. Fire escapes. (1) Location. Every fire escape shall be so located as to lead directly to a street, alley, or open court connected with a street.

(a) Every fire escape shall be placed against a blank wall if possible. If such a location is not possible then every wall opening which is less than 6 feet distant horizontally from any tread or platform of the fire escape shall be protected by a fire-resistive door as specified in section Ind 51.09 or by a fire-resistive window as specified in section Ind 51.10.

(2) Exits to fire escapes. Every fire escape shall be accessible from a public passageway or shall be directly accessible from each occupied room. Exits to fire escapes shall be standard exit doors as specified in section Ind 51.15, except that doors to "A" fire escapes may be not less than 2 feet 6 inches wide.

(3) Design and fabrication. Each part of every fire escape (except counterweights for balanced stairways) shall be designed and constructed to carry a live load of 100 pounds per square foot of horizontal area over the entire fire escape. Each part of every fire escape shall be designed and constructed in accordance with the requirements of section Ind 53.24, except that the unit stresses therein spedfied shall be reduced by one-fourth. The minimum sections and sizes specified below shall be increased whenever necessary so that under full load the allowable unit stresses will not be exceeded.

(a) No other material than wrought iron, soft steel or medium steel shall be used for any part of a fire escape, except for weights, separators and ornaments. No bar material less than $\frac{1}{4}$ inch thick shall be used in the construction of any fire escape, except for separators, ornaments, structural shapes over 3 inches and rigidly built up treads and platforms of approved design. In the fabrication of a fire escape, all connections or joints shall be made by riveting, bolting or welding in an approved manner. All bolts or rivets, except for ornamental work, shall be not less than 3/8 inch in diameter.

(4) Platforms. Each platform on an "A" fire escape shall be at least 28 inches wide; each platform on a "B" fire escape shall be at least 3 feet 4 inches wide. Such widths shall be the clear distance between stringers, measuring at the narrowest point. Each platform shall extend at least 4 inches beyond the jambs of exit opening. The above minimum widths and lengths shall be increased, wherever necessary, so that no exit door or window will, when open, block any part of the required width of the fire escape. Every platform shall consist of either,

(a) Flat bars on edge, not less than 1 x $\frac{1}{4}$ inch, but not less than $1\frac{1}{4}$ x $\frac{1}{4}$ inch where bolts and separators are used except that platforms and treads constructed of flat bars on edge may be made of material 3/16 inch in thickness provided the material is galvanized after fabrication. Bars shall not be spaced more than $1\frac{1}{4}$ inches, center to center.

(b) $\frac{1}{2}$ inch or 5/8 inch square bars with sharp edge up, not more than $1\frac{1}{2}$ inches, center to center.

(c) 5/8 inch round bars, not more than $1\frac{1}{2}$ inches, center to center.

(d) Platform and treads may be solid if covered by a roof.

(e) The platform frame shall consist of not less than 2 x 3/8 inch flat bars on edge or equivalent, provided the brackets are not more than 4 feet apart. If brackets are more than 4 feet apart, the frame shall be correspondingly stronger and stiffer. Every platform wider than 30 inches, if made of square or round bars, shall have a third frame bar through the center; if made of flat bars, the platform shall have separators and bolts through the center. Frame bars shall not project more than $\frac{1}{4}$ inch above platform bars, except around the outside of platform.

(f) There shall be a platform at each story above the first, and intermediate platforms if floors are more than 18 feet apart vertically.

(g) Platforms shall not be more than 8 inches below the door sill.

(5) Brackets. Brackets for a 28 inch or 30 inch platform, when spaced not more than 4 feet apart, shall be made of not less than 7/8 inch square bars or $1\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{1}{4}$ inch angles; such bars or angles shall be larger if the platform is wider or if the brackets are farther apart. Each bracket shall be fastened at the top to the wall by a through bolt (at least 7/8 inch diameter), nut, and washer (at least 4 inch diameter). The slope of the lower bracket bar shall be not less than 30 degrees with the horizontal. The lower bar shall have a washer or shoulder to give sufficient bearing against the wall.

(a) The strength of the wall to which brackets are to be attached shall be carefully considered in determining the spacing, shape and inside connection of brackets, so that under full load the wall will not be unduly strained. Where it is necessary to install brackets adjacent to wall openings they shall be located at a suitable distance therefrom, or the wall shall be properly reinforced.

(6) Stairways. (a) Each stairway of an "A" fire escape shall be at least 24 inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches and a uniform run of not less than 8 inches.

(b) Each stairway of a "B" fire escape shall be at least 3 feet 4 inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches, and a uniform run of not less than 9 inches.

1. The rise is the vertical distance from the extreme edge of any step to the corresponding extreme edge of the next step. The run is the horizontal distance between the same points.

(c) Stairway stringers shall consist of either
1. A 5 inch channel or larger.
2. Two angles 2 x 2 x $\frac{1}{4}$ inch or larger.
3. Two flat bars 2 x 3/8 inch or larger.
4. One flat bar 6 x $\frac{1}{4}$ inch or larger.
5. If 2 angles or 2 flat bars are used, they shall be properly tied together by lattice bars, vertical as well as horizontal. If flat bars are used, every stairway of more than 10 risers shall have lateral bracing. The connection of stringers to platform, at top and bottom, shall be at least equal in strength to the stringers and shall safely carry the full live and dead loads. If stringers are carried by intermediate brackets, the stringers shall have a horizontal bearing on the brackets and shall be properly and securely connected thereto.

6. Treads shall consist of either flat or square bars, (not round), of the size and spacing specified for platforms. An "A" tread shall consist of at least 6 square bars, or 7 flat bars. A "B" tread shall consist of at least 7 square bars, or 8 flat bars. A "B" tread made of flat bars shall have separators and bolt through the center. A "B" tread made of square bars shall be trussed.

7. Treads and platforms may be solid if covered by a roof.

(7) Balanced stairway. All "B" fire escapes, and all fire escapes on schools, theaters, and assembly halls, and hospitals either shall reach to the ground or shall have a balanced stairway reaching to the ground. "A" fire escapes which are not on schools, theaters, or assembly halls, may or hospitals may terminate in a platform at least 3 feet long, located not more than 10 feet above the ground.

(a) Every balanced stairway shall conform to the requirements for other stairways except that the stringers and top rail may be lighter if they are properly trussed. The counterbalancing device shall be attached to both sides of the stairway equally, or a special attachment shall be used to prevent warping or twisting. The counterbalancing device shall operate gradually and easily as the live load is applied. Cable counterweights are not permitted.

(b) Treads for "A" balanced stairways may be made as follows: two $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{4}$ inch angles at front and back; two $1\frac{1}{4} \times \frac{1}{4}$ inch bars between, lying flatwise; one inch space between bars. Treads for "B" balanced stairways may be made as follows: two $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$ inch angles at front and back; two $1\frac{1}{2} \times \frac{1}{4}$ inch bars between, lying flatwise; one inch space between bars. All such treads shall be strongly fastened together with cross bars not more than 14 inches apart.

(8) Railings. A railing at least 42 inches in height and having 2 intermediate rails, uniformly spaced, measuring vertically from the floor of the platform, shall be provided on all open sides of platforms. Railings at least 36 inches in height, measuring vertically from the nose of the treads, shall be provided on the open sides of all stairways and on both sides of balanced stairways. Either a railing or a handrail fastened to the wall shall be provided on each side of all "B" fire escape stairways.

(a) Every railing shall have posts, not more than 5 feet apart made of not less than $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$ inch angles or tees, or $1\frac{1}{4}$ inch pipe; top rail not less than $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{4}$ inch angle or equivalent; center rail not less than $1\frac{1}{4} \times 5/16$ flat bar or equivalent. All connections shall be such as to make the railing stiff; 2 bolts (3/8 inch or larger) shall be used at the foot of each post wherever possible, or at least one $\frac{1}{2}$ inch bolt shall be used. Railing shall be continuous. No protections on the inside of the railing shall be permitted. Where a railing returns to the wall, it shall be fastened thereto with a through bolt (at least 5/8 inch diameter), nut, and washer; or (in reinforced concrete) with an approved insert; or the railing shall be made equally secure with a diagonal brace extending at least 3 feet horizontally and 3 feet vertically.

(b) All outside railings which are more than 60 feet above grade shall be at least 6 feet high, measuring vertically from floor of platform or from nose of step. Such railings shall be of special design approved by the industrial commission, having not less than 4 longitudinal rails, and vertical lattice bars not more than 8 inches apart, and proper stiffening braces or brackets.

(9) Ladder to roof. Every fire escape which extends higher than the second floor shall be provided with a ladder leading from the upper platform to the roof, unless the fire escape stairway leads to the roof. The ladder shall have stringers not less than $1\frac{1}{4}$ inch pipe, or not less than 2 x 3/8 inch flat bars, at least 17 inches apart in the clear. The rungs shall be not less than $\frac{1}{2}$ inch square or 5/8 inch round bars 14 inches center

The stringers shall be securely tied together at intervals no greater than every fifth rung. The stringers of each ladder shall extend not less than 4 feet above the roof coping and return to within 2 feet of the roof, with the top rung of the ladder level with the coping.

(10) Other types of fire escapes. Sliding or chute fire escapes may be used, upon the approval of the industrial commission, in place of "A" or "B" fire escapes. Every sliding fire escape shall be provided with a ladder constructed as in section Ind 51.20 (9), extending from 5 feet above grade, to 4 feet above the roof coping.

Ind 52.02. Windows. (1) Every room in which one or more persons live, sleep, or are employed, (except storage rooms or other rooms where the nature of the occupancy will not permit) shall be lighted by a window or windows opening directly upon a street or alley, or upon a court (as defined in section Ind 52.04) on the same lot with the building. The windows shall be so constructed and distributed as to afford proper light and ventilation. Every building more than 40 feet deep (measuring at right angles to the windows) shall have windows on at least 2 sides. Exception:

(a) The provisions of this rule may be waived for factory, office or mercantile buildings if provisions are made for proper artificial lighting, and if ventilation is provided in accordance with the provisions of the heating, ventilating and air conditioning code.

(b) Every building more than one story in height which does not have windows opening directly upon a street in each story above the first, shall be provided with a suitable access for fire department use. Such access shall be a window or door opening through the wall on each floor above the first story. The opening shall be at least 36 inches in width and not less than 48 inches in height with the sill not more than 32 inches above the floor. The openings shall be so spaced that there will be one opening in each 100 feet of wall length in any accessible wall of the building.

This requirement for access openings for fire department use shall not apply where a building is equipped throughout with an automatic sprinkler system approved for fire protection purposes ~~or in buildings where the nature of the occupancy will not permit such openings~~.

Ind 52.03 Window cleaning. (1) Where the tops of windows to be cleaned are more than 20 feet above the floor, ground, flat roof, balcony, or permanent platform, one of the the following means shall be provided to protect the window cleaners.

(a) Approved attachments for window cleaner safety belts to which belts may be fastened at each end. Said attachments shall be permanent devices that shall be firmly attached to the window frame, or to the building proper, and so designed that a standard safety belt may be attached thereto; or

(b) An approved portable platform that is projected through the window or supported from the ground, floor, roof or platform level, for the window cleaner to stand upon and that is designed, constructed, maintained and equipped with handrail and toeboard in compliance with the requirements of Chapter Ind 1, Rules on Safety.

(c) A suspended scaffold, swinging scaffold, swinging chair scaffold, or boatswain's chair scaffold designed, constructed, equipped and maintained in compliance with the requirements of Chapter Ind 35, Rules on Safety in Construction; or

(d) Other equally effective devices.

(e) Where the window consists of a fixed panel not more than 24 inches in width alongside a removable panel, the fixed panel may be cleaned by reaching through the opening of the removable panel. Where the window consists of a fixed panel between two removable panels, the fixed panel may be cleaned by reaching through the openings if such fixed panel is not more than 36 inches in width.

(2) For cleaning the insides of skylights (the highest parts of which are more than 20 feet above the floor, ground, balcony or permanent platform), to which access cannot be gained by any of the means described in section Ind 1.16 (1), scaffolds as specified in Chapter Ind 35, Rules on Safety in Construction , shall be provided.

(3) All equipment, including building parts and attachments, used in connection with window cleaning, shall be maintained in reasonably safe condition while in use and shall be inspected at least once each month while in use, and within 30 days before their use. It shall be the responsibility of the owner of the individual safety devices or equipment to inspect and maintain the devices or equipment belonging to him so that each will comply with the requirements of this section.

(4) Where the attachments specified in section (1)(a) are relied upon for compliance with the provisions of this rule, said employer shall furnish or see that there is provided, an approved suitable safety belt for each employe while cleaning windows.

Note. It will be the policy of the industrial

Ind 52.10 Chimneys. (1) The walls of all chimneys shall be built of brick or other approved fire-resistive material, except that a metal smokestack may be provided as specified in section Ind 52.11. No chimney shall rest upon a flooring of wood nor shall any wood be built into, or in contact with any chimney. Headers, beams, joists and studs shall not be less than 2 inches from the outside face of a chimney. The foundation of every chimney, flue, or stack, shall be designed and built in conformity with the requirements for foundations for buildings. In no case shall a chimney be corbeled out more than 8 inches from the wall and in every case the corbeling shall consist of at least 5 courses of brick. Chimneys shall extend at least 3 feet above flat roofs and not less than 2 feet above the ridge of gable and hip roofs, and lime-cement or cement mortar shall be used in the laying of chimney masonry above the roof line.

(2) Every masonry chimney shall have walls at least 8 inches in solid thickness, except that in a chimney with a flue not larger than 260 square inches where a fire clay or other suitable refractory clay flue lining is used for the full height of the chimney the walls shall not be less than 4 inches in solid thickness. No smoke flue shall have a cross sectional area less than 64 square inches, except that flue linings 7 inches by 7 inches inside, or 8 inches in diameter inside, may be used.

(3) All flue linings shall be adapted to withstand reasonably high temperatures and flue gases and shall have a softening point not lower than 1800°F. Flue linings shall be not less than 5/8 inch in thickness and shall be built in as outer walls of the chimney are constructed. Flue linings shall start from a point not less than 8 inches below the bottom of the smokepipe intake and shall be continuous to a point not less than 4 inches above the enclosing walls.

(4) Where there is more than one smokepipe connected to a flue, the connections shall be at different levels. Two or more heating units or appliances may be connected to a common smokepipe or breeching if joined by Y fittings as close as practicable to the flue. In all such cases, the size of the breeching and the flue shall be sufficient to accommodate the total volume of flue gases.

(a) Cleanout opening. Every chimney shall be provided with a cleanout opening at the base. Such openings shall be equipped with metal doors and frames arranged to remain closed when not in use.

(5) Every chimney shall be designed to withstand the following wind pressure in pounds per square foot over the diametrical area:

(a) Square chimneys ---------- 30
(b) Polygonal chimneys ---------- 25
(c) Round chimneys ---------- 20

(6) Prefabricated chimneys. Prefabricated chimneys complying with the requirements of section Ind 58.67 of the Heating, Ventilating and Air Conditioning Code may be used in lieu of masonry chimneys if approved by the industrial commission and are provided with foundations as specified for masonry chimneys, or metal smoke stacks or as otherwise approved.

Ind 52.14 Ducts. Every vertical shaft housing air ducts or a group of ducts in buildings in the theater, school, or hotel classification, shall be enclosed with incombustible material smoothly finished on the inside and having a fire-resistive rating as required for each specific situation.

Ind 52.15 Registers. (1) All register boxes shall be of metal and shall either be of double construction or be covered with asbestos not less than 1/8 inch thick.
Exception:
(a) Asbestos paper weighing not less than 12 pounds per square may be used as covering on forced air installations.

Ind 52.50. Toilet rooms required. (1) Every place of employment and public building shall have adequate toilet rooms as provided in the occupancy classifications of this code, completely enclosed and so arranged as to insure privacy.

(2) Separate toilet rooms shall be provided for employees and the general public where deemed necessary by the industrial commission or by the state board of health.

Ind 52.53 Location, light and ventilation. (1) Every toilet or bathroom shall be so located as to open to outside light and air, by windows or skylights opening directly upon a street, alley or court, except as provided in section Ind 52.54.

(2) The glass area for a toilet room containing one closet or urinal shall be at least 4 square feet, with 2 square feet additional for each additional closet or urinal.

(3) No toilet room shall have a movable window or ventilator opening on any elevator shaft, or on any court which contains windows of sleeping rooms above.

(4) Every toilet room having more than one fixture (closets and urinals) shall be ventilated in accordance with the provisions of section Ind 58.48 of the heating, ventilating and air conditioning code issued by the industrial commission, except that this requirement shall not apply to chemical or septic toilets which are installed in accordance with the provisions of the chemical toilet code or the septic toilet code issued by the state board of health.

(a) The size of gravity vent ducts, if surmounted with effective siphon type hoods, may be determined as follows: $\frac{A \times 2}{300}$ = net cross sectional area of vent duct in square feet. Where A = floor area in the toilet room in square feet.

Ind 53.06 Hollow building units. (1) Definitions. (a) Hollow tile are the products of surface clay, shale, fireclay, or admixtures thereof, moulded to permanent hollow form for use as masonry units in building construction.

(b) Hollow concrete masonry units are the products of Portland cement and suitable aggregates such as sand, gravel, crushed stone, bituminous or anthracite cinders, burned clay or shale or blast furnace slag, moulded to permanent form for use as masonry units in building construction. Hollow concrete masonry units with applied facings of any type shall conform to the requirements of this code.

(2) Hollow tile used in bearing and exterior walls. (a) Strength and Absorption. All hollow tile used in bearing and exterior walls shall conform to the following minimum requirements for strength absorption:

Compressive Strength (Based on Gross Area) Pounds per square inch				Absorption per cent		
End Construction Tile		Side Construction Tile				
Average of 5 Tests	Individual Minimum	Average of 5 Tests	Individual Minimum	Average of 5 Tests	Individual Maximum	Individual Minimum
1400	1000	1000	900	5 to 16	19	4

(3) Number of cells. Load bearing tile shall conform to the following requirements as to the minimum number of cells per unit in the direction of wall thickness:

Nominal Horizontal Thickness of Tile as Laid in Wall, in inches	Minimum Number of Cells in Direction of Wall Thickness
4	1
6	2
8	2
10	2
12	3

Note. Cells, as used herein, are hollow spaces enclosed within the perimeter of the exterior shells, and having a minimum dimension of not less than $\frac{1}{2}$ inch and a cross sectional area of not less than one square inch.

(4) Double-shell tile. In double-shell tile the 2 voids between exterior and interior shells on either side of the tile shall be considered as one cell in thickness of wall when their combined width is not less than $\frac{1}{2}$ inch, provided the short webs between the inner and outer shells are not greater in number and thickness than the long transverse webs holding the inner shells.

(5) Shell and web thickness. The average over-all thickness of the shells, measured between the inner and extreme outer surfaces of end-construction hollow tile, shall be not less than 3/4 inch, except that in double-shell tile the combined average over-all thickness of the inner and outer shell shall be not less than 3/4 inch.

The thickness of the webs shall be not less than $\frac{1}{2}$ inch.

(6) Average thickness. The average over-all thickness of the shells, measured between the inner and extreme outer surfaces of side-construction hollow tile, shall be not less than 5/8 inch, except that in double-shell tile the combined average over-all thickness of the inner and outer shell shall be not less than 3/4 inch. The thickness of the webs shall be not less than $\frac{1}{2}$ inch.

(7) Branding. All clay tile shall be branded with a distinctive indentation on the shell. Clay tile which comply with all requirements for exterior construction and bearing walls shall have the word BEARING impressed on them. All clay tile shall bear the name, initials or trade-mark of the manufacturer.

(8) Tests. Typical specimens of all sizes and designs of hollow tile used in exterior or bearing walls shall be tested originally to prove compliance with this code, and thereafter as directed by the industrial commission. Tile shall be sampled and tested in accordance with the Standard Methods of Sampling and Testing Structural Clay Tile.

Note. It will be the policy of the Industrial Commission to accept methods of sampling and testing structural clay tile as specified by the American Society of Testing Materials. (A.S.T.M. Designation C-112)

(9) Hollow concrete masonry units. (a) Compressive strength. All hollow concrete masonry units shall have a compressive strength of not less than 1000 pounds per square inch gross area as laid in the wall.

1. The average strength of any group of test specimens of hollow concrete masonry units shall not be less than the above requirement. The strength of any individual test specimen shall not be less than 900 pounds per square inch gross area.

(b) Absorption. Hollow concrete masonry units shall not absorb more than 14 pounds of water per cubic foot of concrete actually contained.

(c)Branding. At least one-third of all hollow concrete masonry units shall be branded with a distinctive indentation or waterproof stencilled mark, which shall bear the name, initials, or trade-mark of the manufacturer. All cubes or piles of block on the job shall be easily identified by branded blocks which are visible. Producers having more than one plant shall register and use a separate, distinctive brand for each plant. A facsimile of each individual brand shall be filed with the industrial commission.

(d) Tests. Typical specimens of all sizes and designs of hollow concrete masonry units shall be tested in an approved manner, originally to prove compliance with the requirements of this code, and thereafter as required by the industrial commission or its authorized agents.

Note. It will be the policy of the industrial commission to accept the method of testing as described in A.S.T.M. Designation C-140 "Methods of Sampling and Testing Concrete Masonry Units".

(e) Sampling of hollow concrete masonry units shall be done only by the industrial commission or their authorized agents. The time and place of sampling shall be at the discretion of the industrial commission or their authorized agents. It is intended that such tests will be made at intervals not to exceed one year.

1. At the time of the sampling, the producer or purchaser shall inform the sampling agent of the name and location of the approved testing laboratory to which the samples will be sent for testing. The sampling agent shall notify the industrial commission of the date, number, size, type and seal numbers of the samples selected. Compression tests shall be completed not later than 7 days after sealing. To validate the test, all seals must be accounted for in the laboratory report.

2. Producers having more than one plant will be considered as separate plants with separate samplings and tests for each plant.

(f) Approvals following original tests will remain in effect until later tests show non-conformance with the requirements of this code. To verify compliance with these requirements, the industrial commission may require that tests be made at its designated laboratory.

(g) Non-conformance with the requirements of section Ind 53.06 shall be determined by the failure of 3 complete tests on a particular job, as tested in an approved manner. In the event of job non-conformance, the necessary structural correction shall be made and the producer shall be barred from supplying any more units on that project.

(h) Testing laboratories must apply annually for certification by the industrial commission. Such certification shall be based on standards established by the industrial commission. Only those tests that are made by a certified laboratory will be accepted. To verify compliance with these standards the industrial commission may require that tests be made at its designated laboratory.

1. The owner or supplier shall have the choice of selecting a certified testing laboratory for any tests at his expense.

(10) Clay tile used in non-bearing partitions.

(a) Weight. The weight of hollow clay tile used in non-bearing partitions shall be not less than the following:

Dimension	Minimum No. of cells in unit	Minimum No. of cells in direction of wall thickness	Minimum Average weight, lb. per sq. ft. of tile	Individual minimum weight, lb. per sq.ft. of tile
2x12x12	3	1	14	13
3x12x12	3	1	15	14
4x12x12	3	1	16	15
6x12x12	3	1	22	21
6x12x12	4	2	25	24
8x12x12	4	2	30	28
10x12x12	4	2	35	33
12x12x12	4	2	40	38

1. The weights above are for scored tile. If any of the faces are unscored, the weights shall be increased 0.5 lb. per square foot of unscored area.

2. No dimension shall vary more than 3% from the specified dimensions for any form of tile.

3. The requirements for minimum weights of hollow clay tile used in non-bearing partitions shall be waived if the over-all thickness of the shells, measured between the inner and extreme outer surfaces, is not less than 5/8 inch and the thickness of webs is not less than $\frac{1}{2}$ inch.

(b) Shape and structure. All hollow clay tile used in non-bearing partitions shall be reasonably free from laminations and from such cracks, blisters, surface roughness and other defects which would interfere with the proper setting of the tile, or impair the strength, permanence or fire protection value of the construction.

1. The depth of curvature or warpage of any face, shall not exceed 3% of the greatest dimension of such face, but in no case more than $\frac{1}{4}$ inch.

2. Surfaces of all tile intended for the direct application of plaster or stucco shall be scratched or scored. When scored, each groove shall be not less than 1/8 inch nor more than 3/16 inch in depth, nor more than 1 inch in width. The area covered by the grooves shall not exceed 50% of the area of the scored faces.

(c) Branding. All hollow clay tile used in non-bearing partitions shall be branded with a distinctive indentation. All hollow clay tile not suitable for use in bearing and exterior walls but used in non-bearing partitions shall have the word PARTITION impressed on them.

1. All hollow clay tile used in partition work shall bear the name, initials or trade-mark of the manufacturer.

(11) Hollow concrete masonry units used in non-bearing partitions. All hollow concrete masonry units used in non-bearing partitions shall comply with the requirements of section Ind 53.06 (9).

(12) Clay tile and hollow concrete masonry units used in floor construction.

(a) General requirements. Where hollow clay tile are used in concrete floor construction in a way that the whole or any portion of a tile is subjected to a load, the requirements which apply to tile used in exterior and bearing construction shall be complied with. Where hollow concrete masonry units are used in floor construction in a way that the whole or any portion of a block is subjected to a load, the block shall comply with the requirements of section Ind 53.06(9).

(b) Tile and masonry floor units. Where hollow clay tile or hollow concrete masonry units are used in concrete floor construction in a way that no portion of a tile or block is subjected to a load, the requirements which apply to tile or block used in partitions shall apply.

(c) Branding. All clay tile or concrete masonry units used in floor construction shall conform to the branding requirements of section(9)(c).

Ind 53.13 Parapet walls. (1) Parapet walls not less than 8 inches in thickness and 2 feet in height shall be provided on all exterior walls of masonry or concrete, where such walls connect with roofs other than roofs that are of incombustible construction throughout; but this section shall not apply:

(a) To buildings where frame construction would be permitted under the provisions of this code.

(b) To walls which face streets, or alleys.

(c) To walls where not less than 10 feet of vacant space is maintained between the wall and the boundary line between premises.

(d) To walls which are not less than 10 feet from other buildings on the same premises.

(2) All parapet walls shall be properly coped with incombustible, weatherproof material.

(3) Parapet walls not less than 8 inches in thickness and 3 feet in height shall be provided on all division and party walls of masonry or concrete where such walls connect with roofs of other than 2-hour fire-resistive construction, or better.

Ind 53.19 Columns. (1) Limiting dimensions. The following sections apply to a short column, for which the unsupported height is not greater than 10 times the least lateral dimension. When the unsupported height exceeds this value, the design shall be modified as shown in section Ind 53.19. The unsupported height may be defined as the distance from the bottom of a slab, column capital, or beam to the top of the floor below.

Principal columns in buildings shall have a minimum diameter of 10 inches. Rectangular columns shall have a minimum thickness of 8 inches and a minimum gross area of 120 square inches.

Posts, bearing walls, piers, or mullions that are not continuous from story to story shall have a minimum diameter or thickness of 6 inches.

(2) Spiral columns. The maximum allowable axial load on columns reinforced with longitudinal bars and closely spaced spirals enclosing a circular core shall be as follows:

$$P = A_g (0.225 f'_c + f_s p_g)$$

Wherein

A_g = The gross area of the column.

f'_c = Compressive strength of the concrete.

f_s = Nominal allowable stress in vertical column reinforcement to be taken at 40% of the minimum specification value of the yield point; namely, for rail or hard grade steel - 20,000#; for intermediate grade steel - 16,000#.

p_g = Ratio of the effective cross sectional area of vertical reinforcement to the gross area A_g. The ratio p_g shall not be less than 0.01 nor more than 0.08.

(a) Vertical bars. The minimum number of vertical bars shall be 6, and the minimum diameter of bar shall be 5/8 inch. Spirals shall be at least $\frac{1}{4}$ inch in diameter and shall not be spaced less than $1\frac{1}{2}$ inches nor more than 3 inches apart.

(b) Spiral reinforcement. The ratio of spiral reinforcement p' shall not be less than the value given by the following formula:

$$p' = 0.45 \left(\frac{A_g}{A_c} - 1 \right) \frac{f'_c}{f'_s}$$

Wherein

p' = Ratio of volume of spiral reinforcement to the volume of the concrete core (out to out of spirals).

f'_s = Useful limit stress of spiral reinforcement to be taken as 40,000# per sq. in. for hot rolled rods of intermediate grade, 50,000# per sq. in. for rods of hard grade, and 60,000# per sq. in. for cold drawn wire.

(3) Tied columns. The maximum allowable axial load on columns reinforced with longitudinal bars and separate lateral ties shall be 80% of that given by the formula for spirally reinforced columns.

(a) The minimum number of vertical bars shall be 4, and the minimum diameter of bar shall be 5/8 inch. Lateral ties shall be at least $\frac{1}{4}$ inch in diameter and shall be spaced apart not over 16 bar diameters, 48 tie diameters, or the least dimension of the column. When there are more than 4 vertical bars, additional ties shall be provided so that every longitudinal bar is held firmly in its designed position.

(4) Long columns. The maximum allowable load P' on an axially loaded reinforced concrete column having a height, h, greater than 10 times its least lateral dimension, d, is given by the formula:

$$P' = P\left[1.3 - .03\,\frac{h}{d}\right]$$

in which P = the allowable axial load on a normal short column.

(5) Bending moments in columns. Columns in building frames shall be designed to resist the maximum moments and shears produced by dead load, live load, and wind load, as determined by some approximate method of elastic frame analysis. Assumptions as to relative rigidity of columns and floor members shall be consistent throughout and agree with the methods used in the analysis of floor members. Recognized methods of analysis shall be followed in calculating the stresses due to combined axial load and bending. The gross area of both spiral and tied columns may be used in these computations.

(a) Where lapped splices in the column verticals are used, the minimum amount of lap shall be as follows:

1. For deformed bars with concrete having a strength of 3,000# per sq. in. or above, 20 diameters of bar of intermediate or hard grade steel. For bars of higher yield point, the amount of lap shall be increased one diameter for each 1,000# per sq. in. by which the allowable stress exceeds 20,000# per sq. in. When the concrete strengths are less than 3,000 # per sq. in., the amount of lap shall be 1/3 greater than the values given above.

2. For plain bars, the minimum amount of lap shall be twice that specified for deformed bars.

3. Welded splices or other positive connections may be used instead of lapped splices. Welded splices shall preferably be used in cases where the bar diameter exceeds $1\frac{1}{4}$ inches. An approved welded splice shall be defined as one in which the bars are butted and welded and that will develop in tension at least the yield point stress of the reinforcing steel used.

Ind 53.24 Structural steel. (1) Material. (a) The minimum yield point in pounds per square inch for structural steel used in buildings and structures under this code shall be as follows:

Steel for bridges and buildings, Designation A-7 - - - - - - -	33,000
Structural steel for welding, Designation A-373 - - - - - - -	~~33,000~~ 32,000
Structural steel, Designation A-36 - - - - - - - - - - - - - - -	36,000
High-strength structural steel, Designation A-440 - - - - - -	42,000 - 50,000
High-strength low-alloy structural manganese vanadium steel, Designation A-441 - - - - - - - - - - - - - - - - - - -	42,000 - 50,000
High-strength low-alloy structural steel, Designation A-242 -	42,000 - 50,000

1. Certified test reports shall be submitted as evidence of conformity with the specifications when requested by the industrial commission.

2. Unidentified steel, if free from surface imperfections, may be used for parts of minor importance, or for unimportant details, where the precise physical properties of the steel and its weldability would not affect the strength of the structure.

(b) Other metals. Cast steel shall conform to one of the following specifications:

Mild-to-medium-strength carbon-steel castings for general application, Designation A-27, Grade 65-35.

High-strength steel castings for structural purposes, Designation A-148, Grade 80-50.

1. Certified test reports shall be submitted as evidence of conformity with the specifications when requested by the industrial commission.

2. Steel forgings shall conform to one of the following specifications:

Carbon steel forgings for general industrial use, Designation A-235, Class C1, F and G. (Class C1 forgings that are to be welded shall be ordered in accordance with supplemental requirements S5 of A-235.)

Alloy steel forgings for general industrial use, Designation A-237, Class A.

3. Certified test reports shall be submitted as evidence of conformity with the specifications when requested by the industrial commission.

(c) Rivet steel. Rivet steel shall conform to one of the following specifications:

Structural rivet steel, Designation A-141
High-strength structural rivet steel, Designation A-195
High-strength structural alloy rivet steel, Designation A-406

1. Certified test reports shall be submitted as evidence of conformity with the specifications when requested by the industrial commission.

(d) Bolts. High-strength steel bolts shall conform to one of the following specifications:

High-strength steel bolts for structural joints, Designation A325
Quenched and tempered alloy steel bolts and studs with suitable nuts, Designation A354, Grade BC

1. Other bolts shall conform to the specification for low-carbon steel externally and internally threaded standard fasteners, Designation A307, hereinafter designated as A307 bolts.

2. Manufacturer's certification shall be submitted as evidence of conformity with the specifications when requested by the Industrial Commission.

for

(e) Filler metal/welding. Welding electrodes for manual shielded metal arc welding shall conform to the E60 or E70 series of the specification for mild steel arc welding electrodes, Designation A233.

flux

1. Bare electrodes and granular fusible ~~flex~~ used in combinations for submerged arc welding shall be capable of producing weld metal having the following tensile properties when deposited in a multiple pass weld:

a. Grade SA-1	
Tensile strength	62,000 to 80,000 psi
Yield point, min.	45,000 psi
Elongation in 2 in., min.	25%
Reduction in area, min.	40%
b. Grade SA-2	
Tensile strength	70,000 to 90,000 psi
Yield point, min.	50,000 psi
Elongation in 2 in., min.	22%
Reduction in area, min.	40%

2. Manufacturer's certification shall be submitted as evidence of conformity with the specifications when requested by the Industrial Commission.

(2) Allowable unit stresses. All components of the structure shall be so proportioned that the unit stresses in pounds per square inch shall not exceed the following values except as specified in section Ind ~~53.001.~~ 53.01.

(a) Structural steel.

1. TENSION

a. On the net section, except as pin holes

$$F_t = 0.60F_y$$

b. On the net section at pin holes in eyebars, pin-connected plates or built-up members

$$F_t = \text{~~0.40F}_y\text{=~~} \quad 0.45\ F_y$$

Note. F_t = Allowable tensile stress
F_y = Minimum yield point of type of steel used

2. SHEAR. On the gross section of beam and plate girder webs

$$F_v = 0.40F_y$$

3. COMPRESSION

(a) On the gross section of axially loaded compression members when $\frac{l}{r}$, the largest slenderness ratio of any unbraced segment is less than C_c

(FORMULA 1)

$$F_a = \frac{\left[1 - \frac{\left(\frac{l}{r}\right)^2}{2C_c^2}\right] F_y}{F.S.}$$

Where

F. S. = factor of safety $= \frac{5}{3} + \frac{3\left(\frac{l}{r}\right)}{8C_c} - \frac{\left(\frac{l}{r}\right)^3}{8C_c^3}$

and

$$C_c = \sqrt{\frac{2\pi^2 E}{F_y}}$$

(b) on the gross section of axially loaded columns when $\frac{l}{r}$ exceeds C_c

$$F_a = \frac{149,000,000}{\left(\frac{l}{r}\right)^2} \qquad \text{(FORMULA 2)}$$

(c) On the gross section of axially loaded bracing and secondary members, when $\frac{l}{r}$ exceeds 120

$$F_{as} = \frac{F_a \text{ (by Formula 1 or 2)}}{1.6 - \frac{l}{200r}} \qquad \text{(FORMULA 3)}$$

(d) On the gross area of plate girder stiffeners

$$F_a = 0.60\ F_y$$

(e) On the web of rolled shapes at the toe of the fillet.

$$F_a = 0.75\ F_y$$

4. BENDING

(a) Tension and compression on extreme fibers of rolled shapes and built-up members having an axis of symmetry in the plane of loading and proportions meeting the requirements of compact sections, when the member is supported laterally at intervals no greater than 13 times its compression flange width

$$F_b = 0.66\ F_y$$

(b) Beams and girders which meet the requirements of the preceding paragraph and are continuous over supports or are rigidly framed to columns by means of rivets, high-strength bolts or welds, may be proportioned for 9/10 of the negative moments produced by gravity loading which are maximum at points of support provided that, for such members, the maximum positive moment shall be increased by 1/10 of the average negative moments. This reduction shall not apply to moments produced by loading on cantilevers. If the negative moment is resisted by a column rigidly framed to the beam or girder, the 1/10 reduction may be used in

portioning the column for the combined axial and bending loading, provided t the unit stress, due to any concurrent axial load on the member, does not exceed $0.15F_y$.

(c) Tension and compression on extreme fibers of unsymmetrical members supported in the region of compression stress as specified in section 4.(a).

$$F_b = 0.60F_y$$

(d) Tension and compression on extreme fibers of box-type members whose proportions do not meet the provisions of compact sections, but do conform to the provisions of section 5 - Width-Thickness Ratio.

$$F_b = 0.60F_y$$

(e) Tension on extreme fibers of other rolled shapes, built-up members, and plate girders.

$$F_b = 0.60F_y$$

(f) Compression on extreme fibers of rolled shapes, plate girders, and built-up members having an axis of symmetry in the plane of their web (other than box-type beams and girders), the larger value computed by Formulas (4) and (5), but not more than $0.60F_y$

$$F_b = \left[1.0 - \frac{\left(\frac{l}{r}\right)^2}{2C_c^2 C_b}\right] 0.60F_y \qquad \text{(FORMULA 4)}$$

$$F_b = \frac{12{,}000{,}000}{\frac{ld}{A_f}} \qquad \text{(FORMULA 5)}$$

where l is the unbraced length of the compression flange; r is the radius of gyration of a tee section comprising the compression flange plus 1/6 of the web area, about an axis in the plane of the web; A_f is the area of the compression flange; C_c is defined in section 3.(a), and C_b, which can conservatively be taken as unity, is equal to

$$C_b = 1.75 - 1.05\left(\frac{M_1}{M_2}\right) + 0.3\left(\frac{M_1}{M_2}\right)^2, \text{ but not more than } 2.3$$

where M_1 is the smaller and M_2 the larger bending moment at the ends of the unbraced length, taken about the strong axis of the member, and where $\frac{M_1}{M_2}$, the ratio of end moments, is positive when M_1 and M_2 have the same sign (single curvature bending) and negative when they are of opposite signs (reverse curvature bending). When the bending moment at any point within an unbraced length is larger than that at both ends of this length the ratio $\frac{M_1}{M_2}$ shall be taken as unity.

(g) Compression on extreme fibers of channels, the value computed by Formula (5), but not more than

$$F_b = 0.60F_y$$

(h) Tension and compression on extreme fibers of large pins.

$$F_b = 0.90 F_y$$

(i) Tension and compression on extreme fibers of rectangular bearing plates

$$F_b = 0.75F_y$$

5. BEARING (on contact area)

(a) Milled surfaces and pins in reamed, drilled or bored holes, pounds per square inch

$$F_p = 0.90F_y$$

(b) Finished stiffeners pounds per square inch

$$F_p = 0.80 F_y$$

(c) Expansion rollers and rockers, pounds per linear inch

$$F_p = \left(\frac{F_y - 13,000}{20,000} \right) 660d$$

where d is the diameter of roller rocker in inches

(d) Rivets and Bolts

1. Allowable unit tension and shear stresses on rivets, bolts and threaded parts (pounds per square inch of area of rivets before driving or unthreaded body area of bolts and threaded parts) shall be as given in Table 1.

TABLE 1

Description of Fastener	Tension (F_t)	Shear (F_v)	
		Friction-type Connections	Bearing-type Connections
A141 hot-driven rivets	20,000		15,000
A195 and A406 hot-driven rivets	27,000		20,000
A 307 bolts and threaded parts of A7 & A373 steel	14,000		10,000
Threaded parts of other steels	$0.40F_y$		$0.30F_y$
A325 bolts when threading is not excluded from shear planes	40,000	15,000	15,000
A325 bolts when threading is excluded from shear planes	40,000	15,000	22,000
A354, Grade BC, bolts when threading is not excluded from shear planes	50,000	20,000	20,000
A354, Grade BC, when			

2. Allowable bearing stress on projected area of bolts in bearing-type connections and on rivets

$$F_p = 1.35F_y$$

(Bearing stress not restricted in friction-type connections assembled with A325 and A354, Grade BC, bolts).

(d) Welds (stress in pounds per square inch throat area)

1. Fillet, plug, slot and partial penetration groove welds.

Fillet, plug, slot and partial penetration groove welds made with A233 Class E60 series electrodes and fillet welds made by submerged arc welding Grade SA-1 - - - - - - - - 13,600

Fillet, plug, slot and partial penetration groove welds made with A233 Class E70 series electrodes and fillet welds made by submerged arc welding Grade SA-2 - 15,800

2. Complete penetration groove welds

On complete penetration groove welds the allowable tension, compression, bending, shear and bearing stresses shall be the same as those allowed by section (2) in the connected material.

(e) Cast steel and steel forgings
1. Tension (on net section) F_t $0.60F_y$
2. Shear (on gross section) F_v $0.40F_y$
3. Compression - same as provided under section (2) (a) 3. (a)
4. Bending (on extreme fibers) F_b $0.60F_y$
5. Bearing - same as provided under section (2) (a) 5.

(f) Wind Stresses (See section Ind 53.01)

(3) Combined Stresses.
(a) Axial compression and bending. Members subject to both axial compression and bending stresses shall be proportioned to meet the requirements of both Formula (6) and Formula (7).

$$\frac{f_a}{F_a} + \frac{C_m f_b}{\left(1 - \frac{f_a}{F'_e}\right) F_b} \leq 1.0 \qquad \text{Formula (6)}$$

$$\frac{f_a}{0.6F_y} + \frac{f_b}{F_b} \leq 1.0 \text{ (applicable only at braced points)} \qquad \text{Formula (7)}$$

F_a = axial stress that would be permitted if axial stress alone existed

F_b = bending stress that would be permitted if bending stress alone existed

$F'_e = \frac{149,000,000}{\left(\frac{l}{r_b}\right)^2}$ (May be increased 1/3 in accordance with section ~~(2) 5. (f)~~ Ind 53.01)

l = actual unbraced length in the plane of bending

r_b = radius of gyration about axis of bending

f_a = computed axial stress

f_b = computed bending stress at the point under consideration

C_m = 0.85, except as follows:

1. When $\frac{f_a}{F_a} \leq 0.15$. (For this case the member selected shall meet the limitation that $\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$

2. For restrained compression members in frames braced against joint translation but not subject to transverse loading between their supports in the plane of loading, C_m may be taken as $0.6 + 0.4\left(\frac{M_1}{M_2}\right)$, where $\frac{M_1}{M_2}$ is the ratio of smaller to larger moments at the ends of the critical unbraced length of the member. $\frac{M_1}{M_2}$ is positive when the unbraced length is bent in single curvature and negative when it is bent in reverse curvature.

3. For restrained compression members in frames braced against joint translation in the plane of loading and subject to transverse loading between their supports (joints) in the plane of loading, a value of C_m may be determined by rational analysis.

(b) Shear and tension. Rivets and bolts subject to combined shear and tension due to force applied to the connected parts, shall be so proportioned that the tension stress produced by the force shall not exceed the following:

For A141 rivets - - - - - -	$F_t = 28,000 - 1.6f_v$	$\leq 20,000$
For A195 and A406 rivets -	$F_t = 38,000 - 1.6f_v$	$\leq 27,000$
For A307 bolts - - - - - -	$F_t = 20,000 - 1.6f_v$	$\leq 14,000$
For A325 bolts in bearing-type joints - - - - - -	$F_t = 50,000 - 1.6f_v$	$\leq 40,000$
For A354, Grade BC, bolts in bearing-type joints -	$F_t = 60,000 - 1.6f_v$	$\leq 50,000$

where f_v, the shear stress produced by the same force, shall not exceed the value for shear given in section (2) 5. (c)

For bolts used in friction-type joints, the shear stress allowed in section (2) 5. (c) shall be reduced as follows:

For A 325 bolts - - - - - $F_v \leq 15{,}000 \left(1 - \frac{f_t A_b}{T_b}\right)$

For A 354, Grade BC, bolts - - - - - $F_v \leq 20{,}000 \left(1 - \frac{f_t A_b}{T_b}\right)$

where f_t is the tensile stress due to applied load and T_b is the proof load of the bolt.

(4) Slenderness Ratios.

(a) Definition. In determining the slenderness ratio of an axially loaded compression member, l shall be taken as its effective length and r the corresponding radius of gyration.

(b) Sidesway prevented. The effective length of compression members in trusses, and in frames where lateral stability is provided by diagonal bracing, shear walls, attachment to an adjacent structure having adequate lateral stability, or by floor slabs or roof decks secured horizontally by walls or bracing systems parallel to the plane of the frame, shall be taken as the actual unbraced length, unless analysis shows that a shorter length may be used.

(c) Sidesway not prevented. The effective length of compression members in a frame which depends upon its own bending stiffness for lateral stability, shall be determined by a rational method and shall not be less than the actual unbraced length.

(d) Maximum Ratios. The slenderness ratio of compression members shall not exceed 200. The slenderness ratio of tension members, other than rods, preferably should not exceed:

For main members - - - - - - - - - - - - - - - - - 240
For bracing and other secondary members - - - - 300

(5) Width-Thickness Ratios.

(a) Projecting elements under compression.

1. Projecting elements of members subjected to axial compression or compression due to bending shall have ratios of width-to-thickness not greater than the following:

Single-angle struts; double-angle struts with separators - - - - - - - - - - $\frac{2{,}400}{\sqrt{F_y}}$

Struts comprising double angles in contact; angles or plates projecting from girders, columns or other compression members; compression flanges of beams; stiffeners on plate girders - - - - - - - - - - - - - - - - $\frac{3{,}000}{\sqrt{F_y}}$

Stems of tees - - - - - - - - - - - - - - - - $\frac{4{,}000}{\sqrt{F_y}}$

2. The width of plates shall be taken from the free edge to the first row of rivets, bolts, or welds; the width of legs of angles, channels and zees, and of the stems of tees, shall be taken as the full nominal dimension; the width of flanges of beams and tees shall be taken as $\frac{1}{2}$ the full nominal width. The thickness of a sloping flange shall be measured halfway between a free edge and and the corresponding face of the web.

3. When a projecting element exceeds the width-to-thickness ratio prescribed in the preceding paragraph, but would conform to same and would satisfy the stress requirements with a portion of its width considered as removed, the member will be acceptable.

(b) Compression elements supported along two edges.

1. In compression members the unsupported width of web, cover or diaphragm plates, between the nearest lines of fasteners or welds, or between the roots of the flanges in case of rolled sections, shall not exceed $\frac{8,000}{\sqrt{F_y}}$ times its thickness.

2. When the unsupported width exceeds this limit, but a portion of its width no greater than $\frac{8,000}{\sqrt{F_y}}$ times the thickness would satisfy the stress requirements, the member will be considered acceptable.

3. The unsupported width of cover plates perforated with a succession of access holes, may exceed $\frac{8,000}{\sqrt{F_y}}$, but shall not exceed $\frac{10,000}{\sqrt{F_y}}$, times the thickness. The gross width of the plate less the width of the widest access hole shall be assumed available to resist compression.

(6) Simple and Continuous Spans.

(a) Simple spans. Beams, girders and trusses shall ordinarily be designed on the basis of simple spans whose effective length is equal to the distance between centers of gravity of the members to which they deliver their end reactions.

(b) End restraint. When designed on the assumption of full or partial end restraint, due to continuous, semi-continuous or cantilever action, the beams, girders and trusses, as well as the sections of the members to which they connect, shall be designed to carry the shears and moments so introduced, as well as all other forces, without exceeding at any point the unit stresses prescribed in section (2)(a); except that some non-elastic but self-limiting deformation of a part of the connection may be permitted when this is essential to the avoidance of overstressing of fasteners.

(7) Deflections

(a) Beams and girders supporting floors and roofs shall be proportioned with due regard to the deflection produced by the design loads.

(b) Beams and girders supporting plastered ceilings shall be so proportioned that the maximum live load deflection will not exceed 1/360 of the span.

(c) The depth of beams and girders supporting flat roofs shall be not less than $\frac{F_y}{1,000,000}$ times their span length whether designed as simple or continuous spans.

onnections.

) Minimum connections. Connections carrying calculated stresses, except for , sag bars, and girts, shall be designed to support not less than 6,000 pounds.

(b) Eccentric connections. Axially stressed members meeting at a point shall have their gravity axes intersect at a point if practicable; if not, provision shall be made for bending stresses due to the eccentricity.

(c) Placement of rivets, bolts and welds. Except as hereinafter provided, the rivets, bolts or welds at the ends of any member transmitting axial stress into that member shall have their centers of gravity on the gravity axis of the member unless provision is made for the effect of the resulting eccentricity. Except in members subject to repeated variation in stress, disposition of fillet welds to balance the forces about the neutral axis or axes for end connections of single angle, double angle, and similar type members is not required. Eccentricity between the gravity axes of such members and the gage lines for their riveted or bolted end connections may be neglected.

(d) Unrestrained members. Except as otherwise indicated by the designer, connections of beams, girders or trusses shall be designed as flexible, and may ordinarily be proportioned for the reaction shears only. Flexible beam connections shall permit the ends of the beam to rotate sufficiently to accommodate its deflection by providing for a horizontal displacement of the top flange determined as follows:

$e = 0.007d$, when the beam is designed for full uniform load and for live load deflection not exceeding 1/360 of the span

$= \frac{f_b L}{3{,}600{,}000}$, when the beam is designed for full uniform load producing the unit stress f_b at mid-span

where

e = the horizontal displacement of the end of the top flange, in the direction of the span, in inches

f_b = the flexural unit stress in the beam at mid-span, in pounds per square inch

d = the depth of the beam, in inches

L = the span of the beam, in feet

(e) Restrained members. Fasteners or welds for end connections of beams, girders and trusses not conforming to the requirements of section (8) (d) shall be designed for the combined effect of end reaction shear and tensile or compressive stresses resulting from moment induced by the rigidity of the connection when the member is fully loaded.

(9) Column Bases.

(a) Loads. Proper provision shall be made to transfer the column loads and moments, if any, to the footings and foundations.

(b) Alignment. Column bases shall be set level and to correct elevation with full bearing on the masonry.

(c) Finishing. Column bases shall be finished in accordance with the following requirements:

1. Rolled steel bearing plates, 2 inches or less in thickness, may be used without planing, provided a satisfactory contact bearing is obtained; rolled steel bearing plates over 2 inches but not over 4 inches in thickness may be straightened by pressing; or, if presses are not available, by planing for all bearing surfaces (except as noted under requirement 3. of this section), to obtain a satisfactory contact bearing; rolled steel bearing plates over 4 inches in thickness shall be planed for all bearing surfaces (except as noted under requirement 3. of this section).

2. Column bases other than rolled steel bearing plates shall be planed for all bearing surfaces (except as noted under requirement 3 of this section).

3. The bottom surfaces of bearing plates and column bases which are grouted to insure full bearing contact on foundations need not be planed.

(10) Shop Painting

(a) General requirements. Unless otherwise specified, steelwork which will be concealed by interior building finish need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned in accordance with the following paragraph, by brush, spray, roller coating, flow coating, or dipping, at the election of the fabricator.

(b) After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing, or by other methods elected by the fabricator, of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by solvent. Steelwork specified to have no shop paint , after fabrication, shall be cleaned of oil or grease by solvent cleaners and shall be cleaned of dirt and other foreign material by thorough sweeping with a fiber brush.

(c) The shop coat of paint is intended to protect the steel for only a short period of exposure, even if it is a primer for subsequent painting to be performed in the field by others.

(d) Inaccessible surfaces. Surfaces inaccessible after assembly shall be treated in accordance with section (10)(a) before assembly.

(e) Contact surfaces. Contact surfaces shall be cleaned in accordance with section (10)(a) before assembly but shall not be painted.

(f) Finished surfaces. Machine finished surfaces shall be protected against corrosion by a rust-inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

(g) Surfaces adjacent to field welds. Unless otherwise provided, surfaces within 2 inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

(11) Erection.

(a) Bracing. The frame of steel skeleton buildings shall be carried true and plumb, and temporary bracing shall be introduced whenever necessary to take care of all loads to which the structure may be subjected, including equipment and the operation of same. Such bracing shall be left in place as long as may be required for safety.

(b) Wherever piles of material, erection equipment or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from such loads.

(c) Adequacy of temporary connections. As erection progresses, the work shall be securely bolted, or welded, to take care of all dead load, wind and erection stresses.

(d) Alignment. No riveting, permanent bolting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

(e) Field welding. Any shop paint on surfaces adjacent to joints to be field welded shall be wire brushed to reduce the paint film to a minimum.

(f) Field painting. Responsibility for touch-up painting and cleaning, as well as for general painting shall be allocated in accordance with accepted local practices and this allocation shall be set forth explicitly in the contract.

(12) Plastic design and fabrication.

(a) The design, fabrication and erection of structural steel for buildings and structures by the plastic design method shall conform with recognized good engineering practice as approved by the industrial commission.

Note. It will be the policy of the industrial commission to accept methods of plastic design which conform with the Rules for Plastic Design and Fabrication of Structural Steel issued by the American Institute of Steel Construction.

(13) Welds. (a) Type of welds. Butt, fillet, plug or slot welds, or a combination of these types, may be used in making joints and joining component parts.

(b) Qualification of weld details. The details of all joints (including for butt welds, the groove form, root face, root spacing, etc.) to be employed under this rule without qualification shall comply with all of the requirements for joints which are accepted without qualification test by the industrial commission. No joint form not included in the foregoing shall be employed until it shall have been qualified to the satisfaction of the industrial commission.

Note: It will be the policy of the industrial commission to approve of weld details, processes and methods conforming to the requirements of the standard code for Arc and Gas Welding in Building Construction of the American Welding Society.

(c) Operator qualifications. All welding shall be done by skilled workmen who shall give satisfactory proof of their skill and ability with process to be used on the proposed work.

(d) Qualifications and inspection requirements for welding operations and operators. 1. The state building code provides that the industrial commission shall determine necessary data, tests and other evidence required to prove the merits of materials, methods of construction and devices used in the construction, alteration and equipment of buildings or structures, and further, in connection with welding, requires such work to be done by skilled welders who must give satisfactory proof of their skill and ability.

2. In conformance with these provisions, the following regulations are adopted and promulgated to apply to all welding operations on buildings and structures coming within the scope of the state building code.

3. All welding operators employed as such in executive work covered by the Wisconsin state building code shall be previously qualified by tests as prescribed herein. These qualification tests shall be performed under the supervision of an approved testing laboratory or commercial testing engineer who will certify to the industrial commission that the operator has passed the prescribed qualification tests.

4. The industrial commission shall issue, to any operator who has successfuly passed the prescribed qualification tests, a certificate bearing the operator's name, address and signature, and the record of the extent of his successful qualification testing. This certificate shall remain in force for one year provided the operator is engaged in welding without an interruption of more than 3 consecutive months' duration, in which latter case the certificate shall automatically become void. The renewal of a certificate shall be granted only upon successful completion of new qualification tests.

5. The procedure for qualification of welding operators shall ~~be as~~ specified in appendix D of the Code for Arc and Gas Welding in Building Construction, latest edition, as published by the American Welding Society. ~~This~~ consists essentially of tests for the making of both groove and fillet welds in 4 positions each. One test is required for each position for fillet welds, and for groove welds one test for each position in material up to and including 3/4 inch thick shall be made in material 3/8 inch thick, except that if the construction involves welding of material over 3/4 inch thick, one test weld shall be made for each position in material of the maximum thickness to be used, but need not exceed one inch in thickness, if a test weld is made in the maximum or one inch thickness, no test weld is necessary in the 3/8 inch thickness.

6. All welding shall be subject to examination by a competent inspector approved by the industrial commission, who shall certify to the industrial commission that all welding has been completed in accordance with the approved plans and specifications and with the provisions of the Wisconsin state building code. The methods and procedures of such inspection shall be in accordance with the provisions of Section 5 of the Code for Arc and Gas Welding in Building Construction, latest edition, as published by the American Welding Society.

NOTE:

7. The form SB-13A "Certificate of Competency - WELDER" is issued pursuant to Ind 53.24 (13)(c).

Note: Section Ind 53.24 is based on the American Institute of Steel Specification dated November 30, 1961. For members and connections subject to repeated variation of stress, plate girders, composite construction, fabrication, shop practice, and plastic design, see A.I.S.C. Specification.

(14) Light gauge steel structural members. (a) Scope. The requirements this section shall apply to the design of structural members formed of sheet or strip steel less than 3/16 inch thick and used for load carrying purposes in buildings and structures within the scope of this code. All such structural members shall be capable of supporting all required loads without exceeding the allowable unit stresses specified in this section and shall be designed in accordance with recognized engineering practice.

(b) Material.

1. All steel used in the construction of buildings and structures shall be fabricated from materials of uniform quality and free from defects that would impair the strength or stability of the structure.

Note: It will be the policy of the industrial commission to approve, subject to the provisions of this section, steel that conforms to the following standard specifications of the American Society for Testing Materials:

a. Flat-rolled carbon steel sheets of structural quality. Designation A245

b. Hot rolled carbon strip of structural quality. Designation A303

c. High-strength low-alloy cold rolled steel sheets and strip. Designation A374

d. High-strength low-alloy hot rolled steel sheets and strip. Designation A375

2. Steel of higher strength than is covered by the above mentioned specifications may be used at the unit stresses herein specified for "other grades" of steel provided the design is based upon the minimum properties of those grades of steel as guaranteed by the manufacturer. When requested by the industrial commission, the manufacturer shall furnish certified data showing the properties of such grades of steel.

(c) Basic design stress. Allowable working stresses.

1. Tension on the net section of tension members, and tension and compression f_b on extreme fibers of flexural members shall not exceed the values specified in the following table, except as otherwise provided in this section:

Grade of Steel	Minimum Yield Point Pounds per Sq. In.	Allowable Working Stress Pounds per Sq. In.
C	33,000	20,000
B	30,000	18,000
A	25,000	15,000
Other Grades	Minimum Yield Point Divided by 1.65	

2. Compression on unstiffened elements. Compression f_c in pounds per square inch on flat unstiffened elements shall not exceed the values in accordance with the following formula:

a. For $\frac{w}{t}$ not greater than 10, $f_c = f_b$ except that when f_b exceeds 30,000 psi, the maximum $\frac{w}{t}$ ratio for which f_c may be taken equal to f_c shall not exceed $\frac{300,000}{f_b}$

b. For $\frac{w}{t}$ greater than 10 but not greater than 25
$f_c = (1.667\ f_b - 8640) - (1/15)\ (f_b - 12950)\ \frac{w}{t}$

For steels with a yield point in excess of 50,000 psi, the value of f_b to be used in the determination of f_c when $\frac{w}{t}$ exceeds 10 shall be 30,000 psi.

c. For $\frac{w}{t}$ from 25 to 60
For angle struts $f_c = \frac{8,090,000}{\left(\frac{w}{t}\right)^2}$

For all other sections $f_c = 20,000 - 282\left(\frac{w}{t}\right)$

In the above formula $\frac{w}{t}$ = ratio of flat width to thickness of an element.

3. Allowable web shear. (a) The maximum average web shear stress, v, in pounds per square inch on the gross area of a flat web shall not exceed the values in accordance with the following formula:

$$v = \frac{64,000,000}{\left(\frac{h}{t}\right)^2} \text{ with a maximum of } 2/3\ f_b.$$

In the above formula

t = web thickness

h = clear distance between flanges

f_b = allowable working stress as specified in (c).

(b) Where the web consists of 2 or more sheets, each sheet shall be considered as a separate member carrying its share of the shear.

(c) Maximum slenderness ratio.

1. The maximum allowable ratio $\frac{L}{r}$ of unsupported length L to radius of gyration r, of compression members shall not exceed 200.

Ind 53.25 Steel joist construction. (1) Definition. Steel joist construction shall consist of decks or top slabs defined in section Ind 53.25 (7), supported by separate steel members referred to as steel joists. Any steel member suitable for supporting floors and roofs between the main supporting girders, trusses, beams, or walls when used as hereinafter stipulated shall be known as a "steel Joist". Such steel joists may be made of hot or cold formed sections, strip or sheet steel, riveted or welded together, or by expanding.

(2) Limit of span and spacing. The clear span of steel joist shall not exceed 24 times the depth of the steel portion of the steel joist.

(a) The spacing of steel joist for floors shall not exceed the safe span for the top slab or flooring. Where the joist spacing for floors exceeds 24 inches on centers, the

bridging shall be adequate to distribute concentrated loads between joist. The spacing of steel joist for roofs shall not exceed the safe span of the top slab or roof deck.

(b) Where these spans or spacings are exceeded, the requirements for steel joist construction shall not apply, but the steel members shall be designed in accordance with the requirements of section Ind 53.24.

(3) Materials. All steel joist used in the construction of buildings and structures shall be fabricated from materials of uniform quality and free from defects that would impair the strength or stability of the structure. The steel used shall conform to the following specifications:

Structural steel for bridges and buildings:
Designation A-7; Minimum yield point, 33,000
Structural steel: Designation A-36;
Minimum yield point, 36,000
Flat rolled carbon steel sheets of structural quality:
Designation A-245; Minimum yield point, 33,000
Hot rolled carbon steel strip of structural quality:
Designation A-303; Minimum yield point, 33,000
High strength low alloy manganese, Vanadium steel;
Designation A-441; Minimum yield point, 42,000 - 50,000

High strength structural steel; Designation A-440; Minimum yield point, 42,000 - 50,000.

(a) All steel joist shall receive one coat of asphalt base paint or an equivalent protective covering before leaving the fabricating shop.

(4) Design of steel joist. An open web steel joist shall be built up of bars or other sections, or one fabricated by expanding a rolled section shall be designed as a truss. The compressive stress in chord members and diagonals of the joist shall not exceed those given in section Ind 53.24 for main members. The tensile stress shall not exceed 0.60 of the yield point of the grade of steel used in any member. The minimum shear to be used in designing the web members shall not be less than 20% of the rated end reaction at midspan and shall be increased lineally to 30% of the rated end reaction at a distance 0.35 from the end supports.

(a) A solid web steel joist shall be designed as a beam in accordance with the requirements of section Ind 53.24.

(b) In the completed structure, the top chord of open web steel joist or the top flanges of solid web steel joist may be considered as being stayed laterally when the deck or top slab over the steel joist complies with the provisions of section Ind 53.25 (7).

(c) All joints and connections of an open web steel joist shall be capable of withstanding a load at least 3 times the designed load and shall be sufficiently rugged to resist the stresses incident to transportation and erection when handled in a reasonable manner.

(d) All elements of an open web joist shall have their lines of center of gravity meet at a point if practicable; if not, stresses arising from eccentricity shall be included with other stresses in designing these elements.

(e) Ends of steel joist shall be designed to resist the bending produced by the eccentricity of the reaction at the support.

(5) Erection. The ends of steel joist shall extend a distance of at least 4 inches on to masonry or reinforced concrete supports and at least $2\frac{1}{2}$ inches on steel supports. In floor construction every third steel joist and in roof construction every steel joist supported on concrete or masonry supports shall be anchored thereto with an anchor equivalent to a 3/8 inch round bar. All steel joist supported on steel beams shall be secured thereto by welding or with an anchor made of not less than 3/16 inch bar fastened over the flanges of the supporting beams.

(a) The ends of long span steel joist shall extend a distance of not less than 6 inches on masonry or reinforced concrete supports and at least 4 inches on steel supports.

(b) During the construction period, care shall be exercised to prevent excessive concentrated or moving loads. The construction contractor shall provide for adequate distribution of such loads so that the carrying capacity of any steel joist is not exceeded during that period. When erected and bridged, the total concentrated load on any one steel joist shall not exceed 800 pounds and in the case of open web steel joist, such concentrated load shall not be imposed between panel points.

(6) Bridging. As soon as steel joist are erected, bridging shall be installed between the joist before the application of construction loads. This bridging shall be adequate to support the top chords or flanges against lateral movement during the construction period and shall hold the steel joist in a vertical plane passing through the bearings.

(a) Horizontal bridging shall consist of two continuous horizontal steel members, one of which is attached to the top chord and the other attached to the bottom chord. Attachment to the joist shall be made by welding or by mechanical means, and the attachments shall be capable of resisting a horizontal force of not less than 500 pounds.

The ratio of unbraced length to the least radius of gyration $\left(\frac{L}{r}\right)$ of the bridging member shall not exceed 300. Where a round bar is used for bridging the diameter shall be at least $\frac{1}{2}$ inch.

(b) Diagonal cross bridging may be used for joist spacing up to 30 inches. The ratio of unbraced length to the least radius of gyration $\left(\frac{L}{r}\right)$ shall not exceed 200. Connections to the top and bottom chords of the joist shall be made by positive mechanical means or by welding.

(c) In roof constructitn, where the slope is perpendicular to the longitudinal axis of the joist, sag rods may be used in lieu of bridging. The rods shall not be less than $\frac{1}{2}$ inch in diameter and the number of lines shall be the same as specified

(d) In no case shall the spacing of bridging be greater than specified in the following table:

Clear Span	Number of Lines of Bridging
Up to 14 feet	One row near center.
14 to 21 feet	Two rows placed at 1/3 point of span.
21 to 32 feet	Three rows placed at $\frac{1}{4}$ point of span.
32 to 40 feet	Four rows placed at 1/5 point of span.
40 to 48 feet	Five rows placed at 1/6 point of span.

(e) Bridging for long span joist shall consist of cross bracing with an $\frac{L}{r}$ ratio of not more than 200. The maximum spacing of lines of bridging for long span joist shall not exceed the following:

Joist Depth in Inches	Maximum Spacing of Lines of Bridging
18 to 24 inches, inclusive	10 feet
Over 24 to 36 inches, inclusive	12 feet
Over 36 inches	16 feet

(7) Decks and top slabs. Decks or top slabs over steel joist may be of concrete or gypsum poured on metal lath centering attached to the top chords or flanges of steel joist as required elsewhere in this section or on removable centering provided the top chords or flanges of the steel joist are properly stayed by the concrete or gypsum slab. Other equally suitable permanent centering may be used, provided it is substantially attached to the top chords or flanges as required elsewhere in this section and provided these attachments (or the centering itself) are securely anchored into the concrete or gypsum slab. Precast concrete or precast gypsum slabs when securely attached to the top chords or flanges and anchored thereto and brought to a firm bearing, wood decks as stipulated below, and corrugated or other steel roof decks securely anchored to the top chords or flanges may be used over steel joist. Any attachment or pair of attachments when applied shall be capable of staying the top chord or flange laterally in both directions and in the case of open web steel joist, shall be spaced not farther apart then the panel point spacing. Decks or top slabs over steel joist shall not be assumed to carry any part of the compression stress in the steel joist.

(a) Flat wood decks of single thickness of one inch nominal material shall not have a span of more than 20 inches for floors, or 30 inches for roofs. All such decks shall be securely fastened to the joist.

(b) Poured structural slabs of concrete, gypsum or other similar material shall not be less than 2 inches thick. They shall be poured upon 3/8 inch ribbed metal lath weighing not less than 4 pounds per square yard for spans not exceeding 24 inches and upon 3/4 inch rib lath weighing not less than 4.5 pounds per square yard for spans not exceeding 30 inches. Other material equally suitable as a form or centering for casting concrete or gypsum slabs may be used in place of rib lath. Rib lath or other centering which remains in place shall be substantially attached to the top chord or flange of each steel joist at intervals of not over 8 inches. Such slabs shall be reinforced with mesh or rods, in addition to the rib lath, except that when slabs are to be covered with a wood strip top floor, the rib lath or centering may, if adequate, serve also as the reinforcement.

(c) Any material used as centering for the top slab shall be installed so as not to exert an undue lateral pull on the top chords or flanges of the steel joist.

Ind 56.12 Basement Rooms. (1) Where classrooms in school buildings have floors more than 2 feet below the adjoining grade, such rooms shall comply with the following conditions in addition to the requirements of sections Ind 56.11 and [redacted] the school lighting code.

(a) All walls and floors which are in contact with the soil shall be moisture-proof and insulated.

Ind 57.53 Automobile parking decks. (1) Definition. For the purpose of this code, a parking deck is an unenclosed or partially enclosed structure used for the parking or storage of self-propelled vehicles, which are driven into the structure and are parked under their own power with no facilities for the repairing of such vehicles.

(2) Construction requirements. (a) Parking decks may be erected without enclosing walls except that unpierced enclosing walls of not less than 2-hour fire-resistive construction, as specified in section Ind 51.05, shall be provided on all sides which are located less then 10 feet from the boundary line between premises or from any other building.

(b)Parking decks of 4-hour fire-resistive construction shall not be limited in height or in floor area.

(c) Parking decks having floor and supporting members of 2-hour fire-resistive construction or better shall not exceed 75 feet in height or 40,000 square feet in area. This area may be increased to 50,000 square feet where the structure faces 2 streets and to 60,000 square feet where the structure faces 3 or more streets.

(d) Parking decks of unprotected incombustible construction shall not exceed 50 feet in height or 20,000 square feet in area. This area may be increased to 25,000 square feet where the structure faces 2 streets and to 30,000 square feet where it faces 3 or more streets.

(e) A continuous wheel guard not less than 10 in in height shall be provided on all sides of the struct on all floors.

(f) A guard rail not less than 3 feet 6 inches in height and having an intermediate rail at mid-height and a toeboard at least 6 inches high at the base, or the equivalent, shall be provided on all open sides of the structure on each floor.

(g) All parking decks and parts thereof shall be designed and constructed to support the following minimum superimposed live loads in pounds per square foot of horizontal area, in addition to the dead load:

Passenger Cars Only	Pounds Per Square Foot
Top floor	80
First floor	80
Intermediate floors	50
Ramps	80

Busses and Trucks	
All floor and ramp areas	8,000 pound axle load in any possible position or 80 pounds per square foot, whichever produces the greater stress.