ARTICLE 1

# ADMINISTRATION AND ENFORCEMENT

## SECTION 100.0 SCOPE

100.1 TITLE: These regulations shall be known as the Commonwealth of Massachusetts State Building Code hereinafter referred to as the Basic Code. In accordance with C. 802, of the Acts of 1972 as amended, these regulations shall control; a) the construction, reconstruction, alteration, repair, demolition, removal, inspection, issuance and revocation of permits or licenses, installation of equipment, classification and definition of any building or structure and use or occupancy of all buildings and structures and parts thereof or classes of buildings and structures and parts thereof; b) the rehabilitation and maintenance of existing buildings; c) the standards or requirements for materials to be used in connection therewith, including but not limited to provisions for safety, ingress and egress, energy conservation and sanitary conditions; d) the establishment of reasonable fees for the issuance of licenses and permits in connection therewith; except as such matters are otherwise provided for in the Massachusetts General Laws Annotated, or in the rules and regulations authorized for promulgation under the provisions of the Basic Code.

100.2 APPLICATION OF REFERENCES: Unless otherwise specifically provided in the Basic Code, all references to article or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such article, section or provision of the Basic Code.

100.3 CODE REMEDIAL: The Basic Code shall be construed to secure its expressed intent which is to insure public safety, health and welfare insofar as they are affected by building construction, through structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation and fire safety; and in general, to secure safety to life and property and community from all hazards incident to the design, erection, repair, removal, demolition or use and occupancy of buildings, structures, or premises. The intent of the Basic Code is also to effect the establishment of uniform standards and requirements for construction and construction materials, compatible with accepted standards of engineering and fire prevention practices and public safety; the adoption of modern technical methods, devices and improvements which may reduce the cost of construction without affecting the health, safety, and security of the occupants or users of buildings; the elimination of restrictive, obsolete, conflicting and unnecessary building regulations and requirements which may increase the cost of construction and maintenance over the life of the building, or

retard unnecessarily the use of new materials, or which may provide unwarranted preferential treatment of types of classes of materials, products or methods of construction without affecting the health, safety, and security of the occupants or users of buildings.

100.4 SPECIALIZED CODES: Specialized codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair, or demolition promulgated, and as amended from time to time, by the various authorized state agencies shall be incorporated in the Basic Code. The said specialized codes, rules or regulations include, but are not limited to, those listed in appendix K.

100.5 TECHNICAL CODE COUNCIL: The Technical Code Council is comprised of representatives from each of the state agencies having jurisdiction over the specialized codes including those cited in section 100.4, and listed in appendix K, and serves as an advisory board to the State Building Code Commission, herein referred to as the Commission, on matters related to uniformity of rules and regulations governing building construction and the establishment of uniform procedures relative to their administration and enforcement. Members of the Technical Code Council are listed in appendix L.

## SECTION 101.0 MATTERS COVERED

The provisions of the Basic Code shall apply to all buildings and structures and their appurtenant constructions, including vaults, area and street projections and accessory additions; and shall apply with equal force to municipal, county, state, authorities established by the legislature and private buildings and structures; except where such buildings and structures are otherwise specifically provided for by statute.

101.1 EXEMPTIONS: No building or structure shall be constructed, extended, repaired, removed, demolished, or altered in violation of these provisions, except for ordinary repairs as defined in section 102.

101.2 MATTERS NOT COVERED.

101.21 PROPOSED BUILDINGS: Any requirement essential for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, and fire safety of a proposed building or structure at the plan review stage and which is not specifically covered by the Basic Code, shall be determined by the State Building Code Commission.

101.22 EXISTING BUILDINGS AND BUILDINGS UNDER CONSTRUCTION: The building official shall determine any requirement which is not specifically covered by the Basic Code and which is essential for

structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, and fire safety of existing buildings and structures or buildings and structures under construction. The Commission and the Department of Public Safety shall be notified in writing within seven (7) working days of any action taken under this section.

101.3 ZONING RESTRICTIONS: When the provisions herein specified for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, and fire safety conflict with the local zoning by-laws or ordinances, the Basic Code shall control the erection or alteration of buildings.

## SECTION 102.0 ORDINARY REPAIRS

Ordinary repairs to buildings and structures may be made without application or notice to the building official; but such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the exitway requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

## SECTION 103.0 INSTALLATION OF SERVICE EQUIPMENT

When the installation, extension, alteration or repair of an elevator, moving stairway, mechanical equipment, refrigeration, air conditioning or ventilating apparatus, plumbing, gas piping, electric wiring, heating system or any other equipment is specifically controlled by the provisions of the Basic Code or the approved rules, it shall be unlawful to use such equipment until a certificate of approval has been issued therefor by the building official or other municipal or state agency having jurisdiction.

## SECTION 104.0 MAINTENANCE

All buildings and structures and all parts thereof shall be maintained in a safe and sanitary condition. All service equipment, means of egress, devices and safeguards which are required by the Basic Code in a building or structure shall be maintained in good working order. Any requirement necessary for the safety of the occupants thereof, not specifically covered by the Basic Code shall be determined by the building official.

104.1 OWNER RESPONSIBILITY: The owner, as defined in article 2, or his designated agent shall be responsible for the safe and sanitary maintenance of the building or structure and its exitway facilities at all times, unless otherwise specifically provided in the Basic Code.

SECTION 105.0 CHANGE IN EXISTING USE

105.1 CONTINUATION OF EXISTING USE: The legal use and occupancy of any structure existing on January 1, 1975, or for which it had been heretofore approved, may be continued without change, except as may be specifically covered in the Basic Code or as may be deemed necessary by the building official for the general safety and welfare of the occupants and the public.

105.2 CHANGE IN USE AND OCCUPANCY: It shall be unlawful to make any change in the use or occupancy of any structure or parts thereof without the building official having issued a certificate of use and occupancy indicating that such structure complies with the provisions of the Basic Code for the proposed new use or occupancy and that such change does not result in any greater hazard to public safety or welfare.

105.3 PART CHANGE IN USE: If a portion of the building is changed in occupancy or to a new use group and that portion is separated from the remainder of the building with the required vertical and horizontal fire division complying with the fire grading in table 9-1, then the construction involved in the change shall be made to conform to the requirements of the Basic Code for the new use and occupancy and the existing portion shall be made to comply with the exitway requirements of the Basic Code.

105.4 REESTABLISHMENT OF A PRIOR USE: After an approved change of use has been made to a building or parts thereof, the reestablishment of a prior use that is not legal to a new building or parts thereof of the same type of construction, is prohibited unless all the applicable provisions of the Basic Code have been met.

SECTION 106.0 ALTERATIONS & REPAIRS

Except as provided in this section, existing buildings or structures when altered or repaired as herein specified shall be made to conform to the full requirements of the Basic Code for new buildings:

106.1 ALTERATIONS EXCEEDING FIFTY PERCENT: If alterations or repairs are made within any period of twelve (12) months, costing in excess of fifty (50) percent of the physical value of the building; or

106.2 DAMAGES EXCEEDING FIFTY PERCENT: If the building is damaged by fire or any other cause to an extent in excess of fifty (50) percent of the physical value of the building before the damage was incurred.

106.3 ALTERATION UNDER FIFTY PERCENT: If the cost of alterations or repairs described herein is between twenty-five (25) and fifty (50) percent of the physical value of the building, the building official shall determine to what degree the portions so altered or repaired shall be made to conform to the requirements for new buildings:

106.4 ALTERATION UNDER TWENTY-FIVE PERCENT: If the cost of alterations or repairs described herein is twenty-five (25) percent or less of the physical value of the building, the building official shall permit the restoration of the building to its condition previous to damage or deterioration with the same kind of materials as those of which the building was constructed; provided that such construction does not endanger the general safety and public welfare and complies with the provisions of article 9 in respect to existing roofs.

106.5 PHYSICAL VALUE: In applying the provisions of this section, the physical value of the building, at the option of the owner, shall be based on the assessed value of the building as recorded in the assessor's office of the municipality or on the basis of the current replacement cost of the building less physical deterioration, provided that satisfactory evidence of the current replacement cost less physical deterioration is submitted to the building official for his approval.

SECTION 107.0 BUILDING DEPARTMENT

107.1 BUILDING COMMISSIONER OR INSPECTOR OF BUILDINGS: The building department shall have an administrative chief responsible for the administration and enforcement of the Basic Code who shall be known as the building commissioner or inspector of buildings.

107.11 LOCAL INSPECTOR: The local inspector shall assist the building commissioner or inspector of buildings in the performance of his duties and shall also be responsible for the enforcement of the Basic Code.

107.12 ALTERNATE INSPECTOR: An alternate inspector of buildings may be appointed to act in the disability of the inspector of buildings in case of illness, absence, or conflict of interest. The alternate inspector shall meet the qualifications of section 107.4.

107.2 APPOINTMENT: The chief administrative officer of each city or town shall employ and designate an inspector of buildings or building commissioner, as well as such other local inspectors as are reasonably necessary. The inspector of buildings or building commissioner shall report directly and be solely responsible to the appointing authority.

107.3 OTHER PERSONNEL: The building commissioner or inspector of buildings may appoint such other personnel as shall be necessary for the administration of the Basic Code and as authorized by the appointing authority.

107.4 QUALIFICATIONS OF THE BUILDING COMMISSIONER OR INSPECTOR OF BUILDINGS: Each building commissioner or inspector of buildings shall have had at least five (5) years of experience in the supervicion of building construction or design or in the alternative a four-year undergraduate degree in a field related to building construction or design. In addition, such persons shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe exits; and a general knowledge of other equipment and material essential for safety, comfort, and convenience of the occupants of the building or structure; plus whatever requirements of experience and knowledge that are deemed necessary by the municipality.

107.5 QUALIFICATIONS OF THE LOCAL INSPECTOR: Each local inspector shall have had at least five (5) years of experience in the supervision of building construction or design or in the alternative a two-year associate degree in a field related to building construction or design. In addition, such persons shall have a general knowledge of the quality and strength of building materials; a general knowledge of the accepted requirements for building construction; fire prevention, light, ventilation and safe exits; and materials essential for safety, comfort, and convenience of the occupants of a building or structure; plus whatever requirements of experience and knowledge that are deemed necessary by the municipality.

107.6 CERTIFICATION: The Department of Community Affairs shall offer a certification program for building officials and shall issue a certificate to those who satisfactorily complete said program.

107.6 TRAINING: The Department of Community Affairs shall offer a continuing educational program designed to assist all building officials and state inspectors in executing their responsibilities as defined herein. Regular attendance at these programs shall be required of all building officials and state inspectors and no building official or state inspector who attends such course of instruction shall lose any reights relative to compensation or vacation time.

107.8 RESTRICTION ON EMPLOYLOYEES: No full-time building commissioner, inspector of buildings, or full-time local inspector as defined herein shall be engaged in, or directly or indirectly connected with, the furnishing of labor, materials or appliances for the construction, alteration or maintenance of a building or structure, or the preparation of plans or of

specifications therefor, unless he is the owner of the building or structure; nor shall any officer or employee associated with the building department engage in any work which conflicts with his official duties or with the interests of the department.

107.9 RELIEF FROM PERSONAL LIABILITY: Insofar as the law allows, while acting for the municipality, the building official, charged with the enforcement of the Basic Code shall not be deemed personally liable in the discharge of his official duties.

## SECTION 108.0 DUTIES AND POWERS OF THE BUILDING OFFICIAL AND THE STATE INSPECTOR

108.1 THE BUILDING OFFICIAL: The building commissioner or inspector of buildings and the local inspector shall enforce all the provisions of the Basic Code and any other applicable state statutes, rules and regulations, or ordinances and by-laws, and act on any question relative to the mode or manner of construction, and the materials to be used in the construction, reconstruction, alteration, repair, demolition, removal, installation of equipment, and the location use, occupancy, and maintenance of all buildings and structures, including any building or structure owned by any authority, except as may otherwise be specifically provided for by statutory requirements or as herein provided.

108.11 APPLICATIONS AND PERMITS: The building official shall receive applications and issue permits for the construction, reconstruction, alteration, repair, demolition, removal, and installation of equipment, and inspect the premises for which such permits have been issued and enforce compliance with the Basic Code provisions.

108.12 BUILDING NOTICES AND ORDERS: The building official shall issue all necessary notices or orders to remove illegal or unsafe conditions, to require the necessary safeguards during construction, to require adequate exitway facilities in new and existing buildings and structures, and to insure compliance with all the code requirements for the safety, health and general welfare of the public.

108.13 NEW MATERIALS AND METHODS OF CONSTRUCTION: The building official shall accept duly authenticated reports from the Commission on all new materials and methods of construction proposed for use which are not specifically provided for in the Basic Code. Wherever there is insufficient evidence that any material or method of construction conforms to the requirements of the Basic Code or there is insufficient evidence to substantiate claims for alternative materials or construction, the building official may require tests meeting the functional requirements of the Basic Code, and such tests shall be conducted by a laboratory and/or personnel approved by the Commission. The costs of all such tests or other investigations required under these provisions shall be paid by the applicant.

108.131 TEST RESULTS: Copies of the results of all such tests shall be forwarded to the Commission within ten (10) days and shall be kept on file in the permanent records of the building department.

108.132 RETESTING: The Commission may require tests to be repeated, if at any time there is reason to believe that material or construction no longer conforms to the requirements on which its approval was based.

108.14 INSPECTIONS: The building official shall make all the required inspections, or he may accept reports of inspections from a qualified registered professional engineer or architect or others certified by the Commission, and all reports of such inspections shall be in writing; or the building official may engage such expert as he may deem necessary to report upon unusual technical issues that may arise.

108.15 INSPECTION AND CERTIFICATION - SPECIFIED USE GROUPS: The building official shall periodically inspect and certify buildings and structures or parts thereof in use groups F, H, L-1, and L-2, according to Table 1-1. No certificate of inspection as herein specified shall be issued until an inspection is made certifying that the building or structure, or parts thereof, complies with all the applicable requirements of the Basic Code, and until the fee is paid as specified on Table 1-1. A copy of said certificate shall be kept posted as specified in section 121.2.

108.16 ADMINISTRATIVE PROCEDURES: The building commissioner or inspector of buildings shall have the authority to formulate administrative procedures necessary to uniformly administer and enforce the Basic Code, provided that such procedures do not conflict with the rules and regulations promulgated by the Commission in the Basic Code or pursuant thereto.

108.17 DEPARTMENT RECORDS: The building official shall keep in a public place and open to public inspection during normal working hours official records of applications received, permits and certificates issued, fees collected, reports of inspections, variances grated, and notices and orders issued. File copies of all papers in connection with building operations shall be retained in the official records so long as the building or structure to which they relate remains in existence.

108.18 REPORTS: The building official shall submit the following reports:

a) to the Department of Community Affairs on a form provided by said department a report of the building permit activity for the month;

b) to the chief administrative officer of the municipality a written statement of all permits and certificates issued, fees collected, inspections made, and notices and orders issued for the year;

TABLE 1-1 -- REQUIRED MINIMUM INSPECTIONS AND CERTIFICATION FOR SPECIFIED USE GROUPS
(See ARTICLE 2 for complete descriptions of use groups.)

| USE GROUP | | | INSPECTIONS | CERTIFICATIONS | FEES* |
|---|---|---|---|---|---|
| F-1-A | Assembly Theatres (accommodating over 400) | With stage and scenery | Monthly | Annually | 150 |
| F-1-B | | Without Stage Movie Theatre | Semi-Annually | Annually | 50 |
| F-2 | Assembly -- Night clubs and similar uses (accommodating over 400) | | Semi-Annually | Annually | 50 |
| F-3 | Assembly -- Lecture halls, recreation centers, terminals, etc. (accommodating over 400) | | Semi-Annually | Annually | 50 |
| F-1-A | Assembly Theatres (accommodating 400 or less) | With stage and scenery | Prior to the issuance of each new certificate | Annually | 25 |
| F-1-B | | Without stage Movie Theatre | | Annually | 25 |
| F-2 | Assembly -- Night clubs and similar uses (accommodating 400 or less) | | | Annually | 25 |
| F-3 | Assembly -- Lecture halls, recreation centers, terminals, etc. (accommodating 400 or less) | | | Annually | 25 |
| F-4 | Assembly -- Churches, low density recreation | | | Up to five years | 25 |
| F-5 | Assembly -- Grandstands, bleachers, etc. | | | Every two years | 50 |
| F-6 | Assembly -- Schools: 10 or more students | | | Every two years | 50 |
| F-7 | Assembly -- All places of assembly accommodating between 20 and 49 persons | | | Annually | 25 |
| H-1 | Institutional -- Restrained | | | Every two years | 50 |
| H-2 | Institutional -- Incapacitated | | | Every two years | 50 |
| L-1 | Residential -- Hotels | | | Annually | 50 |
| L-2 | Residential -- Multi-Family | | | Up to five years | 50 |

*FEES: (Applicable to the issuance of <u>new</u> certificates of inspection)

c) to the Commission and Department of Public Safety reports on decisions regarding the matters not covered as specified in section 101.22; and

d) to the assessors of the municipality reports on permits issued as specified in section 114.11.

108.2 THE STATE INSPECTOR: In every city and town the Basic Code shall be enforced by the state inspector as to any structures or buildings or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies, or authorities of the Commonwealth. The state inspector shall have as to such buildings and structures all the powers of a building commissioner or inspector of buildings.

108.21 OTHER RESPONSIBILITIES: The state inspector may review any order or decision of the building official. He shall supervise the enforcement of the Basic Code, make periodic reviews of all building inspection practices of the local building department, make recommendations for improvements of such practices, and report in writing his findings to the building official.

108.22 REVIEW BY THE COMMISSIONER: The Commissioner of the Commonwealth of Massachusetts, Department of Public Safety shall establish districts which shall be supervised by a state inspector of the Division of Inspection. The Commissioner may review, on his own initiative or on the application of any state inspector, any action or refusal or failure of action by any building official the result of which does not comply with the uniform implementation of the Basic Code; and may reverse, modify or annul, in whole or in part, such action except with respect to the specialized codes, provided that no order or action of the Commissioner shall reverse, modify, annul, or contravene any order, action, determination, interpretation or any decision by the Commission or the State Building Code Appeals Board.

108.23 REPORTS: The state inspector shall file with the Commission reports of his periodic reviews and recommendations for improvements of building inspection practices. The format and due dates for these reports shall be determined by the Commission.

## SECTION 109.0 RULES AND REGULATIONS

109.1 RULE MAKING AUTHORITY: Under authority granted by Chapter 802, Acts of 1972, as amended, the Commission is empowered in the interest of public safety, health and general welfare, to adopt and promulgate rules and regulations to interpret and implement the provisions of the Basic Code to secure the intent thereof and to establish applicable requirements due to local climatic or other conditions.

109.11 LICENSING OF CONSTRUCTION SUPERVISORS: Effective January 1, 1976, any individual directly supervising persons engaged in construction, reconstruction, alterations, repairs, removal or demolition involving the structural elements of buildings and structures shall be licensed according to the rules and regulations promulgated by the Commission entitled "RULES AND REGULATIONS FOR LICENSING CONSTRUCTION SUPERVISORS." No city or town shall be prohibited from requiring such licensing of construction supervisors from January 1, 1975 through December 31, 1975.

109.12 LICENSING OF LABORATORIES AND TEST PERSONNEL: The Commission shall issue rules and regulations for the licensing of individuals, laboratories, and firms responsible for the testing of materials, devices and methods of construction, as provided in section 127.1.

109.13 MANUFACTURED BUILDINGS: The Commission shall issue rules and regulations pursuant to article 19 governing manufactured buildings and building components.

109.14 MOBILE HOMES: The commission shall issue rules and regulations pursuant to article 19 governing mobile homes.

109.2 ACCEPTED ENGINEERING PRACTICE: In the absence of approved rules, the regulations, specifications and standards listed in the appropriate article or in the appendices shall be deemed to represent accepted engineering practice with respect to the material, equipment, system or method of construction therein specified.

109.3 AMENDMENTS AND PROMULGATION OF RULES: Any person may propose amendments to the Basic Code. Public hearings shall be held in the city of Boston in May and October of each year, and at such other times and places as the Commission may determine, to consider petitions for such amendments. Amendments adopted by the Commission shall be binding and have the full force and effect of law in all cities and towns.

## SECTION 110.0 VARIANCES

When there are practical difficulties involved in carrying out structural or mechanical provisions of the Basic Code, the board of appeals may allow a variance or a modification from such provisions as applied for by the owner as provided in section 126.0, provided that the decision of the board shall not conflict with the general objectives of the Basic Code and its enabling legislation and provided that no decision shall be considered by any person or agency as a precedent for future decisions.

SECTION 111.0 INSPECTION

111.1 PRELIMINARY INSPECTIONS: Before issuing a permit, the building official may examine or cause to be examined all buildings, structures and sites for which an application has been filed for a permit to construct, enlarge, alter, repair, remove, demolish or change the use thereof.

111.2 NEW BUILDINGS AND STRUCTURES

111.21 INSPECTION: The building official shall make all required inspections as specified in the provisions of the Basic Code and he shall conduct such inspections from time to time during and upon completion of the work for which he has issued a permit; and he shall maintain a record of all such examinations and inspections and of all violations of the Basic Code. In conjunction with specific construction projects the building official may designate specific inspection points in the course of construction that require the contractor or builder to give the building official twenty-four (24) hours notice prior to the time when those inspections need to be performed. The building official shall make the inspection within forty-eight (48) hours after such notification.

111.3 MANUFACTURED BUILDINGS

111.31 PLANT INSPECTION: Inspection of all manufactured buildings, building components, and mobile homes at the plant shall be performed by a third party which shall be certified and approved by the Commission and monitored by the Department of Public Safety as specified in article 19 and the rules and regulations pursuant thereto.

111.32 SITE INSPECTION: Inspection of all manufactured buildings, building components, and mobile homes at the installation site shall be made by the building official as specified in article 19 and the rules and regulations pursuant thereto.

111.4 EXISTING BUILDINGS.

111.41 PERIODIC INSPECTIONS: The building commissioner or inspector of buildings shall develop plans for the systematic periodic inspection of all existing buildings and structures and shall cause such buildings and structures to be periodically or otherwise inspected as specified in section 108.15 and section 121.4, for compliance with the Basic Code.

111.42 CHANGES OF OCCUPANTS: Before any building or part thereof, except multi-family and one and two-family dwellings (use groups L-2 and L-3), is re-occupied, the building official shall be notified by the owner. The building may be inspected and when in compliance with the Basic Code the building official shall re-certify the building or structure.

111.43 CHANGES OF OCCUPANTS-DWELLING UNITS: When any dwelling unit is vacated, the building official shall be so notified by the owner before the unit is re-occupied within any twelve-month period. Upon the determination of the building official, said dwelling unit may be inspected to determine if said unit conforms to the Basic Code. A dwelling unit shall be inspected with three (3) working days from the date of notification or it shall be deemed to be approved for occupancy. Nothing in this section is intended to require an owner to so notify the building official where another vacancy occurs within a twelve-month period of a prior notification.

111.5 FINAL INSPECTION: The owner or his authorized representative shall notify the building official upon completion of the building or structure or part thereof. Prior to the issuance of the certificate of use and occupancy required in section 120.0, a final inspection shall be made and all violations of the approved plans and permit shall be noted and the holder of the permit shall be notified of any discrepancies.

111.6 INSPECTION SERVICES: The building official may accept the written report of inspections from a qualified registered professional engineer or architect or others certified by the Commission; and such inspection report shall specify but not be limited to any violation of the requirements of the Basic Code in respect to egress requirements, floor load, fire grading, occupancy load and use of the buildings.

## SECTION 112.0 RIGHT OF ENTRY

In the discharge of his duties, the building official shall have the authority to enter at any reasonable hour any building, structure or premises in the municipality to enforce the provisions of the Basic Code.

If any owner, occupant, or other person refuses impedes, inhibits, interferes with, restricts, or obstructs entry and free access to every part of the structure, operation or premise where inspection authorized by the Basic Code is sought, the building official, or state inspector may:

a) seek in a court of competent jurisdiction a search warrant so as to apprise the owner, occupant or other person concerning the nature of the inspection and justification for it and may seek the assistance of police authorities in presenting said warrant and/or

b) revoke or suspend any license, permit or other permission regulated under the Basic Code where inspection of the structures, operation or premises is sought to determine compliance with the Basic Code.

112.1 OFFICIAL BADGE: The Commission may adopt a badge of office for building officials which shall be displayed for the purpose of identification.

112.2 MUNICIPAL COOPERATION: The assistance and cooperation of police, fire, and health departments and all other municipal officials shall be available to the building official as required in the performance of his duties.

SECTION 113.0 APPLICATION FOR PERMIT

113.1 WHEN PERMIT IS REQUIRED: It shall be unlawful to construct, enlarge, alter, remove or demolish a building, or change the occupancy of a building from one use group to another; or to install or alter any equipment for which provision is made or the installation of which is regulated by the Basic Code, without first filing an application with the building official in writing and obtaining the required permit therefor; except that ordinary repairs as defined in section 102 which do not involve any violation of the Basic Code shall be exempt from this provision.

113.2 FORM OF APPLICATION: The application for a permit shall be submitted in such form as the building official may prescribe and shall be accompanied by the required fee as prescribed in section 118.0.

113.3 BY WHOM APPLICATION IS MADE: Application for a permit shall be made by the owner, as defined in article 2, of the building or structure. The full names and addresses of the owner, applicant, and of the responsible officers, if the owner is a corporate body, shall be stated in the application.

113.4 DESCRIPTION OF WORK: The application shall contain a general description of the proposed work, its location, the use and occupancy of all parts of the building or structure and of all portions of the site or lot not covered by the building; and shall state whether or not fire extinguishing equipment, plumbing, water piping, gasfitting, heating or electrical work is involved, the estimated cost of such work including the general work, and such additional information as may be required by the building commissioner or inspector of buildings. The building commissioner or inspector of buildings may require the facts contained in each application to be certified by the applicant under oath.

113.5 PLANS AND SPECIFICATIONS: The application for the permit shall be accompanied by not less than three (3) copies of specifications and of plans drawn to scale, with sufficient clarity and detail dimensions to show the nature and character of the work to be performed. When quality of materials is essential for conformity to the Basic Code, specific information shall be given to establish such quality; and in no case shall the code be cited or the term "legal" or its equivalent be used as a substitute for specific information. The building official may waive the requirement for filing plans when the work involved is of a minor nature.

All plans filed with the building official shall include but not be limited to:

a) the accurate locations and dimension of all means of egress from fire and an occupancy schedule of persons for all occupiable spaces.

b) the method and amount of ventilation and sanitation.

c) the methods of fire stopping as required in this code.

d) schedules and details indicating compliance of interior trim and finish with provisions of article 9.

113.51 STRUCTURES SUBJECT TO CONTROL: In those structures subject to control as required in section 128.0, affidavits must be submitted with the permit application, that the individuals and testing laboratories responsible for carrying out the duties of section 128.0 have been licensed and registered by the Commission through the provisions of sections 800.4, 800.41 and 800.42.

113.6 PLOT PLAN: There shall also be filed a plot plan showing to scale the size and location of all the new construction and all existing structures on the site, distances from lot lines and the established street grades; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the plot plan shall show all construction to be demolished and the location and size of all existing buildings and construction that are to remain on the site or plot. The plot plan shall not be changed except as specified in section 115.4.

113.7 ENGINEERING DETAILS: The building official may require adequate details of structural, mechanical and electrical work, including computations, stress diagrams and other essential technical data to be filed. All such plans and computations shall bear the Massachusetts seal of registration of the qualified registered professional engineer or architect.

113.8 AMENDMENTS TO APPLICATION: Subject to the limitations of section 113.9, no amendments or revisions to a plan or other records accompanying the same may be made until the proposed changes have been filed with and approved by the building official; and such approved amendments shall be deemed part of the original application and shall be filed therewith.

113.9 TIME LIMITATION OF APPLICATION: An application for a permit for any proposed work shall be deemed to have been abandoned six (6) months after date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that for reasonable cause the building official may grant one or more extensions of time for additional periods not exceeding ninety (90) days each.

## SECTION 114.0 PERMITS

114.1 ACTION ON APPLICATION: The building commissioner or inspector of buildings shall examine or cause to be examined all applications for permits and amendments thereto within thirty (30) days after filing. Before a permit is granted for the excavation or for the erection of any building or structure, a written statement shall be furnished by the owner from a town or city engineer as to the established grades. If the application or the plans do not conform to the requirements of the Basic Code or of all pertinent laws, he shall reject such application citing the specific sections of the Basic Code or pertinent law. If he is satisfied that the proposed work conforms to the requirements of the Basic Code and all pertinent law applicable thereto, he shall issue a permit.

114.11 REPORT TO ASSESSORS: The building official shall give to the assessors of the municipality written notice of the granting by him of permits for the construction of any buildings or for the removal or demolition or for any substantial alteration or addition thereto. Such notice shall be given within seven (7) days after the granting of each permit, and shall state the name of the person to whom the permit was granted and the location of the building to be constructed, altered, demolished or removed.

114.2 EXPIRATION OF PERMIT: Any permit issued shall become invalid unless the work authorized by it shall have been commenced within six (6) months after its issuance in which case it shall be deemed abandoned, or if the work authorized by such permit is suspended for a period of one (1) year after the time the work is commenced; provided that, for cause, one or more extensions of time, for periods not exceeding ninety (90) days each, may be allowed in writing by the building commissioner or inspector of buildings. For purposes of this section, any permit issued shall not be considered invalid, if such suspension or abandonment is due to a court order prohibiting such work as authorized by such permit. Provided however, in the opinion of the building commissioner, inspector of buildings or state inspector, the person so prohibited by such court order, adequately defends such action before the court.

114.3 PREVIOUS APPROVALS: Nothing in the Basic Code or the rules and regulations pursuant thereto shall affect any building permit lawfully issued, or any building or structure lawfully begun in conformance with such permit, before the effective date of the Basic Code in a city or town, provided, that work under such a permit is commenced within six months after its issue, and that such work, whether under such permit or otherwise lawfully begun, proceeds in good faith continuously to completion so far as is reasonably practicable under the circumstances.

114.4 SIGNATURE TO PERMIT: The building commissioner or inspector of buildings shall affix his signature to every permit.

114.5 APPROVED PLANS: If approved by him the building commissioner or inspector of buildings or supervisor of plans of the Division of Inspection of the Department of Public Safety shall stamp and endorse in writing the plans submitted in accordance with section 113.5; two sets of such stamped and endorsed plans shall be retained and he shall not allow the removal of any such plans and specifications from the department except in his sole discretion for the purposes of examination by another municipal or state department; the other set of plans shall be kept at the building site, open to inspection of the building commissioner, inspector of buildings, Commissioner of the Department of Public Safety or their authorized representative, at all reasonable times.

114.6 REVOCATION OF PERMITS: The building official may revoke a permit or approval issued under the provisions of the Basic Code in case any false statement or misrepresentation of fact in the application of the plans on which the permit or approval was based.

114.7 APPROVAL IN PART: When application for a permit to erect or add to a building or other structure has been filed, as required in section 113.5, and pending issuance of such permit, the building official may at his discretion issue a special permit for the foundations or any other part of a building or structure. The holder of such a special permit may proceed at his own risk without assurance that a permit for the entire structure will be granted.

114.8 POSTING OF PERMIT: A copy of the building permit provided by the building department shall be kept in view and protected from the weather on the site of operations open to public inspection during the entire time of prosecution of the work and until the certificate of occupancy shall have been issued. The building permit shall serve as an inspection record card to allow the building official conveniently to make entries thereon regarding inspection of the work.

114.9 NOTICE OF START: At least twenty-four (24) hours' notice of start of work under a building permit shall be given to the building official.

## SECTION 115.0 CONDITIONS OF PERMIT

115.1 COMPLIANCE WITH CODE: The permit shall be a license to proceed with the work and shall not be construed as authority to violate, cancel or set aside any of the provisions of the Basic Code, except as specifically stipulated by modification or legally granted variation in accordance with section 126.0.

115.2 COMPLIANCE WITH PERMIT: All work shall conform to the stamped or endorsed application and plans for which the permit has been issued and any approved amendments thereto.

115.3 COMPLIANCE WITH PLOT PLAN: All new work shall be located strictly in accordance with the approved plot plan.

115.4 CHANGE IN PLOT PLAN: No lot or plot shall be changed, increased or diminished in area from that shown on the official plot plan, as specified in section 113.6, unless a revised plan showing such changes accompanied by the necessary affidavit of owner or applicant shall have been filed and approved; except that such revised plot plan will not be required if the change is caused by reason of an official street opening, street widening or other public improvement.

## SECTION 116.0 DEMOLITION OF BUILDINGS

116.1 SERVICE CONNECTIONS: Before a building can be demolished or removed, the owner or agent shall notify all utilities having service connections within the building such as water, electric, gas,

sewer and other connections. A permit to demolish or remove a building shall not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged in a safe manner.

SECTION 117.0 REMOVAL OF BUILDINGS

117.1 LOT REGULATION: When a building or structure has been demolished or removed and no building operation has been projected or approved, the vacant lot shall be filled with non-organic fill, graded and maintained in conformity with adjacent grades. The lot shall be maintained free from the accumulation of rubbish and all other unsafe or hazardous conditions which endanger the life or health of the public; provisions shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property; and the necessary retaining walls and fences shall be erected in accordance with the provisions of article 13.

SECTION 118.0 FEES

No permit shall be issued to begin work for new construction, alteration, removal, demolition or other building operation until the fees prescribed by municipal ordinance or by-law shall have been paid to the city or town collector or other municipal agency authorized to collect such fees.

118.1 SPECIAL FEES: The payment of the fee for the construction, alteration, removal or demolition and for all work done in connection with or concurrently with the work contemplated by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that may be prescribed by law or ordinance for water taps, sewer connections, electrical and plumbing permits, erection of signs and display structures, marquees or other appurtenant structures, or fees for inspections, certificates of use and occupancy or other privileges or requirements, both within and without the jurisdiction of the building department.

SECTION 119.0 FEE COMPUTATION

The permit fees shall be computed according to the fee schedule and procedures adopted in the municipality.

SECTION 120.0 CERTIFICATE OF USE AND OCCUPANCY

120.1 NEW BUILDINGS: No building hereafter erected shall be used or occupied in whole or in part until the certificate of use and occupancy shall have been issued by the building official. The

certificate shall not be issued until all the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required, except as provided in section 120.4.

120.2 BUILDINGS HEREAFTER ALTERED: No building hereafter enlarged, extended or altered to change the use group classification, the fire-grading, the maximum live load capacity, or the occupancy load capacity, in whole or in part, and no building hereafter altered for which a certificate of use and occupancy has not been heretofore issued, shall be occupied or used until the certificate shall have been issued by the building official, certifying that the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required. Any use or occupancy, which was not discontinued during the work of alteration, shall be discontinued within thirty (30) days after the completion of the alteration unless the required certificate is issued by the building official.

120.3 EXISTING BUILDINGS: Upon written request from the owner of an existing building, the building official shall issue a certificate of use and occupancy, provided there are no violations of law or orders of the building official pending, and it is established after inspection and investigation that the alleged use of the building has heretofore existed. Nothing in the Basic Code shall require the removal, alteration or abandonment of, or prevent the continuance of the use and occupancy of a lawfully existing building, unless such use is deemed to endanger public safety and welfare.

120.4 TEMPORARY OCCUPANCY: Upon the request of the holder of a permit, the building official may issue a temporary certificate of occupancy for a building or structure, or part thereof, before the entire work covered by the permit shall have been completed, provided such portion or portions may be occupied safely prior to full completion of the building without endangering life or public welfare, and provided that the agencies having jurisdiction for permits issued under other applicable codes are notified of the decision to issue a temporary certificate.

120.5 CONTENTS OF CERTIFICATE: The certificate shall certify compliance with the provisions of the Basic Code and the purpose for which the building or structure may be used in its several parts; and shall be issued by the building official within ten (10) days after final inspection, provided that the provisions of the approved permits and of the applicable codes for which permits are required have been met. For use groups A, B, C, D and E the certificate of use and occupancy shall specify; the use group, in accordance with the provisions of article 2, the fire grading as defined in article 2 and table 9-1, the maximum live load on all floors as prescribed in article 7, the occupancy load in the building and all parts thereof as defined in article 2 and article 6, and any special stipulations and conditions of the building permit.

SECTION 121.0 POSTING BUILDINGS

121.1 POSTED USE AND OCCUPANCY: A suitably designed placard approved by the building official shall be posted by the owner on all floors of every building and structure and part thereof designed for high hazard, storage, mercantile, industrial or business use (use groups A, B, C, D, and E) as defined in article 2. Said placard shall be securely fastened to the building or structure in a readily visible place, stating: the use group, the fire grading, the live load and the occupancy load.

121.2 POSTED OCCUPANCY LOAD: A suitably designed placard approved by the building official shall be posted by the owner of every building and structure and part thereof designed for use as a place of public assembly or as an institutional building for harboring people for penal, correctional, educational, medical or other care of treatment, or as residential buildings used for hotels, lodging houses, boarding houses, dormitory buildings, multiple-family dwellings (use groups F, H, L-1 and L-2). Said placard shall designate the maximum occupancy load.

121.3 REPLACEMENT OF POSTED SIGNS: All posting signs shall be furnished by the owner and shall be of permanent design; they shall not be removed, or defaced and, if lost, removed or defaced, shall be immediately replaced.

121.4 PERIODIC INSPECTION FOR POSTING: The building official shall periodically inspect all existing buildings and structures except one and two-family dwellings for compliance with the Basic Code in respect to posting; or he may accept the report of such inspections from a qualified registered engineer or architect or others certified by the Commission; and such inspections and reports shall specify any violation of the requirements of the Basic Code in respect to the posting of floor load, fire grading, occupancy load and use group of the building.

SECTION 122.0 VIOLATIONS

122.1 NOTICE OF VIOLATION: The building official shall serve a written notice of violation or order on the owner, as defined in article 2, or the person responsible when in violation of any of the provisions of the Basic Code. Such notice or order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

122.12 NOTICE OR ORDERS - SERVICE AND CONTENT: Every notice or order authorized by the Basic Code shall be in writing, and shall be served on the person responsible:

a) personally, by any person authorized by the building official: or

b) by any person authorized to serve civil process by leaving a copy of the order or notice at his last and usual place of abode; or

c) by sending him a copy of the order by registered mail, return receipt requested, if he is within the Commonwealth; or

d) if his last and usual place of abode is unkown or outside the Commonwealth, by posting a copy of the order or notice in a conspicuous place on or about the premises in violation and by publishing it for at least three (3) out of five (5) consecutive days in one or more newspapers of general circulation wherein the building or premises affected is situated.

122.2 PROSECUTION OF VIOLATION: If the notice of violation is not complied with within thirty (30) days after service, unless otherwise provided in the Basic Code, the building official may institute the appropriate proceeding at law or in equity in a court of competent jurisdiction to restrain, correct or abate such violation or to require the removal or termination of the unlawful use of the building or structure in violation of the provisions of the Basic Code or of the order or direction made pursuant thereto; or

122.3 VIOLATION PENALTIES: A person who shall violate a provision of the Basic Code shall be punishable by a fine of not more than one thousand dollars ($1,000) or by imprisonment for not more than one year, or both, for each violation. Each day during which any portion of a violation continues shall constitute a separate offense.

122.4 ABATEMENT OF VIOLATION: The imposition of the penalties herein prescribed shall not preclude the building official from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a building, structure or premises or to stop an illegal act, conduct, business or use of a building or structure in or about any premises.

SECTION 123.0 STOP-WORK ORDER

123.1 NOTICE TO OWNER: Upon notice from the building official that any work on a building or structure is being prosecuted contrary to the provisions of the Basic Code or in an unsafe or dangerous manner, such work shall be immediately stopped. The stop-work order shall be in writing and shall be served on the owner, as defined in article 2, or on the person responsible as provided in section 122.12; and shall state the conditions under which work

may be resumed; provided, however, that in instances where immediate action is deemed necessary for public safety or in the public interest, the building official may require that work be stopped upon verbal order.

123.11 POSTING: A stop-work notice shall be posted in a conspicuous place on the job site and can only be removed by the building official.

123.2 UNLAWFUL CONTINUANCE: Any person who shall continue any work in or about the job site after having been served with a stop-work order, except such work as he is directed to perform to remove a violation or unsafe conditions, shall be liable to prosectution as provided in section 122.0.

SECTION 124.0 UNSAFE BUILDINGS - SURVEY BOARD

124.1 DUTIES OF BUILDING OFFICIAL - UNSAFE BUILDINGS: The building official, immediately upon being informed by report or otherwise that a building or other structure or anything attached thereto or connected therewith is dangerous to life or limb or that any building in that city or town is unused, uninhabited or abandoned, and open to the weather, shall inspect the same; and he shall forthwith in writing notify the owner as provided in section 122.12, as defined in article 2, to remove it or make it safe if it appears to him to be dangerous, or to make it secure if it is unused, uninhabited or abandoned and open to the weather. If it appears that such structure would be especially unsafe in case of fire, it shall be deemed dangerous within the meaning hereof, and the building official may affix in a conspicuous place upon its exterior walls a notice of its dangerous condition, which shall not be removed or defaced without authority from him.

124.2 REMOVAL OR MAKING STRUCTURE SAFE - PUTTING UP FENCE: Any person so notified shall be allowed until twelve o'clock noon of the day following the service of the notice in which to begin to remove such structure or make it safe, or to make it secure, and he shall employ sufficient labor speedily to make it safe or remove it or to make it secure; but if the public safety so requires and if the mayor or selectmen so order, the building official may immediately enter upon the premises with the necessary workmen and assistants and cause such unsafe structure to be made safe or demolished without delay and a proper fence put up for the protection of passersby, or to be made secure.

124.3 FAILURE TO REMOVE OR MAKE STRUCTURE SAFE, SURVEY BOARD, SURVEY, REPORT: If an owner, as defined in article 2, of such unsafe structure refuses or neglects to comply with the require-

ments of such notice within the specified time limit, and such structure is not made safe or taken down as ordered, therein, a careful survey of the premises shall be made by a board consisting; in a city, of a city engineer, the head of the fire department, as such term is defined in Section 1 of Chapter 148 of the Massachusetts General Laws Annotated, as amended, and one disinterested person to be appointed by the building official; and, in a town, of a surveyor, the head of the fire department and one disinterested person to be appointed by a building official. In the absence of any of the above officers or individuals, the mayor or selectmen shall designate one or more officers or other suitable persons in place of the officers so named as members of said board. A written report of such survey shall be made, and a copy thereof served on such owner.

SECTION 125.0 EMERGENCY MEASURES

125.1 REMOVAL OF DANGEROUS OR ABANDONED STRUCTURES: If such survey report as outlined in section 124.0, declares such structure to be dangerous or to be unused, uninhabited or abandoned, and open to the weather, and if the owner, as defined in article 2, continues such refusal or neglect the building official shall cause it to be made safe or taken down or to be made secure, and, if the public safety so requires, said building official may at once enter the structure, the land on which it stands or the abutting land or buildings, with such assistance as he may require, and secure the same, and may remove and evict, under the pertinent provisions of Chapter 239 of the Massachusetts General Laws Annotated as amended or otherwise, any tenant or occupant thereof, and may erect such protection for the public by proper fence or otherwise as may be necessary, and for this purpose may close a public highway. In the case of such demolition, the said building official shall cause such lot to be levelled to conform with adjacent grades by a non-organic fill. The costs and charges incurred shall constitute a lien upon the land upon which the structure is located and shall be enforced in an action of contract, and such owner shall for every day's continuance of such refusal or neglect after being so notified, be punished by a fine in accordance with section 122.3. The provisions of the second paragraph of Section 3A of Chapter 139 of the Massachusetts General Laws Annotated as amended, relative to liens for such debt and the collection of claims for such debt, shall apply to any debt referred to in this section, except that the said building official shall act hereunder in place of the mayor or board of selectmen. During the time such order is in effect, it shall be unlawful to use or occupy such structure or any portion thereof for any purpose.

125.2 REMEDY OF PERSON ORDERED TO REMOVE A DANGEROUS STRUCTURE OR MAKE IT SAFE: An owner, as defined in article 2, aggrieved by such order may have the remedy prescribed by Section 2 of Chapter 139 of the Massachusetts General Laws Annotated as amended; provided, that no provision of said Section 2 shall be construed so as to hinder, delay or prevent the building official acting and proceeding under section 125.1; and provided, further, that this section shall not

prevent the city or town from recovering the forfeiture provided in said section 125.1 from the date of the service of the original notice, unless the order is annulled by the jury.

## SECTION 126.0 BOARD OF APPEALS

126.1 STATE BUILDING CODE APPEALS BOARD: Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under the Basic Code by any agency or official of the city, town or region, or agency or official of the State charged with the administration or enforcement of the Basic Code or any of its rules or regulations, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board as provided in section 126.

Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under the Basic Code by any agency or official of a city, town or region charged with the administration or enforcement of the Basic Code or any of its rules and regulations, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board or may appeal first to a local or regional appeals board and then to the State Building Code Appeals Board as provided in section 126.

In the event an appeal is taken directly to the State Building Code Appeals Board from an interpretation, order, requirement or direction, said appeal shall be filed as specified in section 126.31, with the State Building Code Appeals Board no later than forty-five (45) days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken directly to the State Building Code Appeals Board for the failure to act, the appeal shall be taken no later than forty-five (45) days after a request to act has been made by the aggrieved person in writing and served to the appropriate building official or chief administrative officer of the state or local agency which fails to act.

If the aggrieved person elects to appeal before the local or regional board, he shall not be allowed to enter such appeal with the State Building Code Appeals Board until such time as the said local or regional board renders a decision, unless the reason for appeal to the State Building Code Appeals Board is the failure of the local or regional board to act.

### 126.2 MEMBERSHIP

126.21 THREE MEMBER PANEL: The State Building Code Appeals Board (hereinafter referred to in section 126 as the Board) shall consist of the membership of the State Building Code Commission. The chairman of the Commission shall be chairman of the Board. The chairman of the

Board may designate any three (3) members of the Board to act as a three (3) member panel to hold any public hearing under section 126, and to hear testimony and take evidence. The chairman of the Board shall select one (1) of the three (3) members to act as chairman of the said three (3) member panel. If a three (3) member panel is so designated, the three (3) member panel shall act as the appeals board and render a decision as provided in section 126.

126.22 CLERK: The Executive Secretary of the Commission shall designate one (1) of the staff of the Commission to act as Clerk to the Board. The Clerk shall keep a detailed record of all decisions and appeals and a docket book on file with the name of each appeal properly indexed and the disposition of the appeal. Said docket book shall be open to public inspection at all times during normal business hours.

126.23 QUORUM: A majority of the Board shall constitute a quorum if the appeal is heard by the entire Board. If the appeal is heard by a three (3) member panel, two (2) members shall constitute a quorum.

126.3 APPEALS PROCEDURE FOR STATE BUILDING CODE APPEALS BOARD

126.31 ENTRY: Appeals shall be entered on forms provided by the Commission and shall be accompanied by an entry fee of fifty dollars ($50) or such other amounts as may be determined by the Commission from time to time.

The appeal shall be signed by the appellant or his attorney or agent and shall note the name and address of the person or agency in whose behalf the appeal is taken and the name of the person and address wherein service of notice for the appellant is to be made. The appeal shall also state in detail the interpretation, order, requirement, direction or failure to act which are the grounds of the appeal as well as the particular section or sections of the Basic Code which are involved in the appeal and the reasons the appellant advances supporting the appeal.

A copy of the appeal shall be served in accordance with section 122.12 by the appellant on the person or state, regional or local agency from whose action or inaction the appeal is taken, on or before entry of the appeal. A return of service under oath shall be filed with the Board forthwith by the appellant.

126.32 STAY OF PROCEEDINGS: Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the state, regional or local agency or any person charged with the administration or enforcement of the Basic Code or any of its rules or regulations presents evidence and the Board or a three (3) member panel or a single member of the Board appointed by the chairman for said purpose, finds that upon the evidence presented a stay would involve imminent peril to life or property. In such an event, stay of all proceedings shall be waived or the Board or three (3) member panel or single member may order such other action necessary to preserve public safety.

Before waiving the stay of proceedings, the Board or three (3) member panel or single member of the Board appointed by the chairman for said purpose, shall hold a hearing and give the appellant and state, regional or local agency or any person claiming that a stay would involve imminent peril to life or property, notice in writing of the hearing not less than twenty-four (24) hours before said hearing.

126.33 DOCUMENTS: Upon entry, the Clerk shall request in writing from the state, city, regional or town officer in charge of the matter on appeal, a copy of the record and all other papers and documents relative to the appeal to be transmitted forthwith to the Board. Said state, city, regional or town officer shall upon receipt of the request of the board transmit forthwith all the papers and documents and a copy of the record relating to the matter on appeal.

126.34 HEARINGS: The chairman of the Board shall fix a convenient time and place for a public hearing. Said hearings shall be held not later than thirty (30) days after the entry of such appeal, unless such time is extended by agreement with the appellant. Any such party may appear in person or by agent or attorney at such hearing. The chairman or clerk shall give notice of the time and place of said hearing to all parties to the hearing and to anyone else requesting notice in writing at least ten (10) days prior thereto. Failure to hold a public hearing within thirty (30) days shall not affect the validity of the appeal or any decision rendered. The board or three (3) member panel in its hearings conducted under this section shall not be bound by strict rules of evidence prevailing in courts of law or equity.

126.4 DECISIONS

126.41 VOTES REQUIRED: If the appeal is conducted by a three (3) member panel, then the concurrence of two (2) of the three (3) members holding the public hearing shall be required. If the appeal is conducted by the entire board, then a majority vote of those hearing the case shall be required.

126.42 STANDARD: The board or a three (3) member panel may vary the application of any provision of this Code to any particular case when in the opinion of the board or a three (3) member panel, the enforcement of the Code would do manifest injustice, provided that the board or three-member panel finds that the decision to grant a variance shall not conflict with the general objectives set forth in Section 18 of Chapter 23B of the General Laws of the Commonwealth or with the general objectives of the Basic Code.

126.43 TIME FOR DECISION: The board shall within thirty (30) days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within thirty (30) days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the Clerk to all parties to the appeal and anyone requesting in writing a copy of the decision.

126.44 CONTENTS OF DECISION: All decisions shall be in writing and state findings of fact, conclusions and reasons for decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. No decision shall be considered by any person or agency as a precedent for future decisions.

126.45 ADDITIONAL POWERS: The board or a three (3) member panel may impose in any decision, limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to the Basic Code.

126.5 ENFORCEMENT: Upon receipt of the decision of the Board or a three (3) member panel, the parties to the appeal shall take action forthwith to comply with the decision unless a later time is specified in the decision.

126.6 APPEALS FROM STATE BUILDING CODE APPEALS BOARD: Any person aggrieved by a decision of the State Building Code Appeals Board may appeal to a court of law or equity in conformance with Chapter 30A, Section 14 of the General Laws.

126.7 LOCAL OR REGIONAL BOARD OF APPEALS: Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under the Basic Code by any agency or official of a city, region or town charged with the administration or enforcement of the Basic Code or any of its rules and regulations may appeal first to the appeals board in that city, region or town and then to the State Building Code Appeals Board as provided in section 126.

In the event an appeal is taken from an interpretation, order, requirement or direction, said appeal shall be filed with the local or regional appeal board no later than forty-five (45) days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken for the failure to act, the appeal shall be taken no later than forty-five (45) days after a request to act has been made by the aggrieved person in writing and served to the appropriate building official or chief administrative officer of the city, regional or town agency which fails to act.

126.8 LOCAL AND REGIONAL BOARD OF APPEALS

126.81 MEMBERSHIP: Any building code board of appeals duly established by ordinance or by-law or otherwise in a city, region or town and in

existence on January 1, 1975, shall qualify as a local board of appeals under section 126 notwithstanding anything to the contrary contained herein. However, the procedure and rights for appeals for such board of appeals shall be governed by this Code.

If a city, region or town has not duly established by ordinance or by-law or otherwise a local or regional building code appeals board by January 1, 1975, said city, region or town may establish a local or regional board of appeals, hereinafter referred to as the local board of appeals, consisting of five (5) members appointed by the chief administrative officer of the city, region or town: one (1) member appointed for five (5) years, one (1) for four (4) years, one for three (3) years, one for two (2) years and one to serve for one (1) year; and thereafter each new member to serve for five (5) years or until his successor has been appointed.

126.82 QUALIFICATIONS OF LOCAL BOARD MEMBERS: Each member of a local board of appeals established under section 126.81 shall have had at least five (5) years experience in the construction, alteration, repair and maintenance of building and building codes. At least one (1) member shall be a registered structural or civil professional engineer and one (1) member a licensed professional architect.

126.83 CHAIRMAN OF LOCAL OR REGIONAL BOARD: The board shall select one (1) of its members to serve as chairman, and the building official shall designate a person from the department to serve as secretary to the board, who shall keep a detailed record of all proceedings on file in the said building department.

126.84 ABSENCE OF MEMBERS: During the absence of a member of a local board of appeals for reason of disability or disqualification, the chief administrative officer of the city, region or town shall designate a substitute who shall meet the qualifications as outlined in section 126.82.

126.85 QUORUM: A quorum shall be three (3) members, but when five (5) qualified members are not present to consider a specific appeal, either the appellant or appellee may request a postponement of the hearing.

126.86 PROCEDURES: Entry of appeals shall be governed by section 126.31 excepting that the city, region or towns may set their own entry fee.

Upon notice of entry of appeal the local building commissioner or inspector of buildings shall transmit a copy of the record and all the papers and documents to the local board of appeals.

Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the building commissioner or inspector of buildings certifies in writing to the local

board of appeals that a stay would involve imminent peril to life or property. Notice in writing of such certification by the building commissioner or inspector of buildings shall be given the appellant at least twenty-four (24) hours prior to the hearing. In such an event a hearing on such stay shall be given first priority and be the first matter heard by the local board of appeal at its next scheduled meeting. The hearing on the appeal shall be held as soon as possible thereafter in accordance with section 126.87.

The local board of appeal may establish its own rules for procedure not established herein or not inconsistent with this Code or the enabling legislation creating a statewide building code.

126.87 HEARINGS: All hearings shall be public and notice of said hearings shall be advertised in a newspaper of general circulation in the city, region or town in which the appeal is taken, at least ten (10) days before said hearing. Notice of the hearing, setting forth the date and time of said hearing shall be mailed by the local board of appeals to all parties and all those who requested notice in writing at least fourteen (14) days before said hearing. Said hearings shall be held not later than thirty (30) days after the entry of such appeal, unless such time is extended by agreement with the appellant. This section as it pertains to notice shall not apply to hearings on a stay as provided in section 126.86.

126.88 DECISIONS OF LOCAL BOARDS: A concurring vote of a majority of all the members shall be required for any decision. The local appeals board may vary the application of this Code to any particular case when in its opinion the enforcement of this Code would do manifest injustice, provided that the decision of the board shall not conflict with the general objectives of the state building code or any of its enabling legislation. The local board of appeal may impose in any decision, limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to the Basic Code.

126.89 TIME FOR DECISION: The board shall within thirty (30) days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within thirty (30) days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and to anyone requesting in writing a copy of the decision.

126.90 CONTENTS OF DECISION: All decisions shall be in writing and state findings of fact, conclusions and reasons for the decisions.

Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. Any decision shall not be considered by any person or agency as a precedent for future decisions.

126.91 ENFORCEMENT OF DECISION: If said decision is approved by the State Building Code Appeals Board, all parties to the appeal shall take immediate action in accordance with the decision of the local board unless the person aggrieved by such decision appeals to the State Building Code Appeals Board as provided in section 126.

126.92 COPY OF DECISION: A copy of any decision by a local board of appeals shall be transmitted to the State Building Code Appeals Board within ten (10) days after the rendering of such decision. If the State Building Code Appeals Board disapproves of the said decision of the local board, it may on its own motion, appeal from the local appeals board's decision according to section 126 and call for a hearing de novo.

If the State Building Code Appeals Board does not notify the local board in writing within forty-five (45) days from the date of the local board's decision, the said decision shall be deemed approved; provided that the decision shall not conflict with the general objectives of the state building code and any of its enabling legislation.

126.93 REVIEW: Any person, including the State Building Code Appeals Board, aggrieved by a decision of the local board of appeals, whether or not a previous party to the decision, or any municipal officer or official board of the municipality, may not later than forty-five (45) days after the mailing of the decision of the local board, apply to the State Building Code Appeals Board for a hearing de novo before the state board, in accordance with the regulations contained in section 126.

## SECTION 127.0 CONSTRUCTION MATERIALS SAFETY BOARD

127.1 RULES AND REGULATIONS FOR LICENSING: The commission shall issue rules and regulations for the examination and licensing, and the revocation of licenses of individuals, laboratories and firms responsible for the inspection, control, testing and quality of materials, devices and methods of construction. Said rules and regulations shall require that all testing equipment and procedures shall comply with standards issued by the American Society for Testing and Materials, provided that such standards shall not conflict at any time with any rules and regulations established by and for the said commission.

127.11 CONSTITUTION OF THE CONSTRUCTION MATERIALS SAFETY BOARD: There shall be a board under the control of the commission called the Construction Materials Safety Board, hereafter in section 127 called the board, which shall consist of nine (9) members, one (1) of whom shall be a member of the commission who shall be ex officio and a voting member of the

board, and eight (8) members to be appointed by the chairman of the commission: one of whom shall be a registered professional engineer who is a structural engineer; one of whom shall be a registered architect; one of whom shall be a representative of a Commercial Testing Laboratory; one of whom shall be a representative of a Public Testing Laboratory; two of whom shall be representatives from the construction industry; one of whom shall be a member of a university faculty engaged in research and teaching in structural materials; and one of whom shall be a member of a university faculty engaged in research and teaching in the area of theoretical and applied mechanics.

127.12 CONSTRUCTION MATERIALS SAFETY BOARD: The board will review applications for registration for licensing of individuals and laboratories responsible for the inspection, control and testing of construction materials and report to the State Building Code Commission their recommendations. The board will collect information and review cases where disciplinary action against an existing license, whether an individual, laboratory or firm, has been proposed, and make recommendations to the State Building Code Commission. The commission will issue applications, receive payment of registration and licensing fees, and maintain records for the efficient dispatch of the duties of the board. The board shall submit to the commission reports from time to time as requested by the commission, but at least annually.

127.2 TESTING AND EVALUATION GROUP: The State Building Code Commission shall establish and maintain a Testing and Evaluation Group, who will have the responsibility of administering and directing, under the supervision of the commission, the testing and controls for evaluating individual applicants and laboratories wishing to become registered and licensed as required under section 128.9.

127.3 ACTIVITIES REQUIRING LICENSES

127.31 CONCRETE TESTING: On and after the first day of January 1975, no person shall engage in the activities of field testing, plant testing or field inspection of concrete unless such person is licensed to do so by the commission. Any person who violates the provisions of this section, any person who falsifies or counterfeits a license issued by the board, or any person who fraudulently issues or accepts such a license shall be punished as provided in section 122.0 of this Code. The commission shall require strict adherence to the standards of the American Society for Testing and Materials, Designation E-329, entitled "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

128.0 CONTROLLED CONSTRUCTION

128.1 STRUCTURES SUBJECT TO CONTROL: Structures and/or parts thereof which fall within the categories below shall be subject to control as provided in this section:

CATEGORIES

a) one-story structures with a story height of twenty-five (25) feet or more

b) four (4) or more floors of framed construction

c) more than two (2) levels of shored concrete framework

d) piles, caissons, pressure-injected footings

e) underpinnings

f) temporary shoring or sheeting ten (10) feet or more in height

g) masonry bearing walls four (4) stories or more in height

h) structures using post-tensioned concrete

i) four (4) stories or more of precast concrete

j) retaining walls ten (10) feet or more in total height

k) bridges, quays and wharfs.

128.2 WAIVER OF STRUCTURAL PLANS: The examination of structural plans and specifications of structures and/or parts thereof which fall within the categories listed in section 128.1 may be waived by the building official when such plans and specifications are submitted by a qualified registered professional engineer. In such case they shall be accompanied by an affidavit stating that the registered professional engineer has supervised the preparation of the structural design contract documents, and that such documents conform to all provisions of this Code and legal rules adopted under its provisions.

128.3 WAIVER OF STRUCTURAL FIELD EXAMINATION: If required by the building official, the detailed department field inspection of those parts of plans and specifications submitted under the provisions of section 128.2 shall be performed by a qualified registered professional engineer. Such qualified registered professional engineer shall submit an affidavit stating that the structure shall be built under his observation or that of his qualified designated representative and in accordance with the approved contract documents and furthermore, that he will review and approve all working drawings for the construction. Such qualified registered professional engineer or representative shall certify that the construction is in substantial accordance with the drawings and specifications submitted under sections 128.2 and 128.3.

128.4 BUILDING OFFICIAL RESPONSIBILITY: Nothing contained in this section shall have the effect of waiving or limiting the building

official's authority to enforce the Code with respect to examination of plans and field inspections.

128.5 REPORTS: The engineer retained under the provisions of section 128.3 shall submit progress reports to the building official at least weekly. Such reports will terminate upon the completion of the work on the structural elements, submitted in the structural drawings subject to section 128.3 and the exterior enclosure of such structural elements.

128.6 QUALIFICATIONS: The registered professional engineer shall be approved by the building official as qualified by experience in the specific field of construction involved in the building project under consideration.

128.7 PERMIT PROCEDURE: Structures and parts thereof included in the listing of section 128.1 shall be subject to the permit procedures of section 113.51.

128.8 LICENSING OF CONSTRUCTION SUPERVISORS: Construction supervisors operating under the provisions of section 128.0 shall be subject to licensing according to the rules and regulations promulgated by the Commission as provided in section 109.11.

128.9 LICENSING OF LABORATORIES AND TEST PERSONNEL: Laboratories and test personnel operating under the provisions of section 128.0 shall be subject to licensing according to the rules and regulations promulgated by the Commission as provided in section 109.12.

## SECTION 129.0 VALIDITY

The provisions of this Code are severable, and if any of its provisions shall be held unconstitutional or otherwise invalid by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

ARTICLE 2

# DEFINITIONS AND CLASSIFICATIONS

## SECTION 200.0 SCOPE

The provisions of this article shall control the classification of all buildings as to use group and type of construction; and the definition of all terms relating thereto in the Commonwealth of Massachusetts.

200.1 APPLICATION OF TERMS: The terms herein defined shall be used to interpret all the applicable provisions of the Basic Code. Definitions of technical terms relating to specific structural and means of egress requirements and to the installation of mechanical, electrical and service equipment are included in the respective articles.

200.2 APPLICATION OF OTHER LAWS: Nothing herein contained shall be deemed to nullify any provisions of the zoning by-law or ordinance of any municipality in the Commonwealth of Massachusetts insofar as those provisions deal exclusively with those powers of regulating zoning granted by the provisions of Chapter 40A and 41 of the Massachusetts General Laws Annotated, as amended.

## SECTION 201.0 GENERAL DEFINITIONS

Unless otherwise expressly stated, the following terms shall, for the purpose of the Basic Code, have the meaning indicated in this section.

201.1 TENSE, GENDER AND NUMBER: Words used in the present tense include the future; words used in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

201.2 TERMS NOT DEFINED: Where terms are not defined, they shall have their ordinarily accepted meanings or such as the context may imply. Any terms relating to Elevators, Dumbwaiters and Escalators shall have their meaning as defined by Regulations ELV-1 and ELV-2 of the Department of Public Safety of the Commonwealth of Massachusetts. Any terms relating to plumbing and electrical wiring shall have their terms as defined by the Regulations of the Commonwealth of Massachusetts pertaining to plumbing and electrical wiring.

ABUT: to touch or be contingent.

ACCEPTED ENGINEERING PRACTICE: that which conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

ACCESSORY STRUCTURE: a building the use of which is incidental to that of the main building and which is located on the same lot.

ACCESSORY USE: a use incidental to the principal use of a building as defined or limited by the provisions of the local zoning laws.

ACCREDITED AUTHORITATIVE AGENCIES: (see appendix A).

ADDITION: an extension or increase in floor area or height of a building or structure.

AIR CONDITIONING: (see section 1801.0).

AIR DUCT: (see section 1801.0).

AIRPLANE HANGAR: (see section 401.0).

AISLE: a clear and unobstructed passageway through a room.

ALLEY: a secondary thoroughfare less than thirty (30) feet in width dedicated for the public use of vehicles and pedestrians affording access to abutting property.

ALTERATION: change in or addition to a building which reduces the means of exit or fire resistance or changes its structural support, use or occupancy.

ALTERNATE INSPECTOR: a person appointed to act in the absence of the inspector of buildings in case of illness, disability, or conflict of interest. (see section 107.12)

AMUSEMENT DEVICE: a device or structure, open to the public, by which individuals are conveyed or moved in an unusual manner for diversion.

APARTMENT: a dwelling unit as defined in this Code.

APPROVED: approved by the Commission, the building official or other authority having jurisdiction.

APPROVED COMBUSTIBLE PLASTIC: (see section 1401.0).

APPROVED MATERIAL, EQUIPMENT AND METHODS: approved by the Commission or by an agency approved by the Commission.

APPROVED PLASTIC: (see section 2001.0).

APPROVED RULES: those rules approved by the State Building Code Commission unless otherwise specified.

APPURTENANT STRUCTURE: a device or structure attached to the exterior or erected on the roof of a building designed to support service equipment or used in connection therewith, or for advertising or display purposes, or other similar uses.

ARCHITECTURAL TERRA COTTA: (see section 801.0).

AREA (BUILDING): the maximum horizontally projected areas of the building at or above grade, exclusive of court and vent shafts.

AREA (FLOOR): the useable area of each story of a building or portion thereof, within surrounding exterior walls. (see section 601.0).

AREAWAY: (form of construction). An uncovered subsurface space adjacent to a building.

ASHLAR FACING: (see section 801.0).

ASHLAR MASONRY: (see section 801.0).

ATTIC: the space between the ceiling beams of the top habitable story and the roof rafters.

-HABITABLE ATTIC: a habitable attic is an attic which has a stairway as a means of access and egress and in which the ceiling area at a height of seven and one-third (7-1/3) feet above the attic floor is not more than one-third (1/3) the area of the floor next below.

AUTOMATIC: a device or system which has the capability of providing a predetermined function when predetermined conditions exist.

AUTOMATIC COLLAPSIBLE REVOLVING DOOR: (see section 601.0).

AUTOMATIC FIRE ALARM SYSTEM: (see section 1201.0).

AUTOMATIC FIRE DOOR: (see section 901.0).

AUTOMATIC SPRINKLER HEAD: (see section 1201.0).

AUTOMATIC SPRINKLER SYSTEM: (see section 1201.0).

AUTOMATIC WATER SUPPLY SOURCE: (see section 1201.0).

BASEMENT: a portion of the building partially underground, but having less than half its clear height below the grade plane (see cellar).

BASIC CODE: the State Building Code of the Commonwealth of Massachusetts, also referred to as this Code.

BAY: (Part of a structure). The space between two (2) adjacent piers or mullions or between two (2) adjacent lines of columns.

BAY WINDOW: a window projecting beyond the wall line of the building and extending down to the foundations.

BILLBOARD: (see section 1401.0).

BOILER: (see section 1101.0).

BRICK: (see section 801.0).

BUILDING: (see structure) A structure enclosed within exterior walls or firewalls, built, erected and framed of a combination of any materials, whether portable or fixed, having a roof, to form a structure for the shelter of persons, animals or property. For the purpose of this definition, "roof" shall include an awning or any similar covering, whether or not permanent in nature. The word "building" shall be construed where the context requires as though followed by the words "or part or parts thereof."

BUILDING (EXISTING): any structure erected or one for which a legal building permit has been issued prior to the adoption of the Basic Code.

BUILDING COMMISSIONER: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of the Basic Code. See also inspector of buildings. (see section 107.1)

BUILDING COMPONENT: (see section 1901.0)

BUILDING DEPARTMENT: The person, body, agency, department or office of any municipality charged with the administration and enforcement of the Basic Code.

BUILDING OFFICIAL: The officer or other designated authority charged with the administration and enforcement of the Basic Code. Building official as used herein includes the building commissioner or the inspector of buildings and the local inspector.

BUILDING LINE: The line established by law, beyond which a building shall not extend, except as specifically provided by law.

BUILDING SERVICE EQUIPMENT: The mechanical, electrical and elevator equipment, including piping, wiring, fixtures and other accessories, which provide sanitation, lighting, heating, ventilation, fire-fighting and transportation facilities essential for the habitable occupancy of the building or structure for its designated use and occupancy.

BUILDING SITE: The area occupied by a building or structure, including the yards and courts required for light and ventilation, and such areas that are prescribed for access to the street.

BUILDING SYSTEM: (see section 1901.0)

BUTTRESS: (see section 801.0)

CELLAR: The portion of the building partially underground, having half or more than half of its clear height below the grade plane.

CENTRAL STATION SYSTEM: (see section 1201.0)

CERAMIC SURFACE UNIT: (see section 801.0)

CERTIFICATE OF USE AND OCCUPANCY: The certificate issued by the building official which permits the use of a building in accordance with the approved plans and specifications and which certifies compliance with the provisions of law for the use and occupancy of the building in its several parts, together with any special stipulations or conditions of the building permit.

CERTIFICATION: (see section 1901.0)

CHANGE OF USE: An alteration by change of use in a building heretofore existing to a new use group which imposes other special provisions of law governing building construction, equipment or means of egress.

CHIMNEY: (see section 1001.0)

CHIMNEY CONNECTOR: (see section 1001.0)

CLASSROOM: A room with desks or equivalent used for group instruction purposes for ten (10) or more students. For the purpose of the provisions contained in section 460.0, libraries, study halls, science laboratories, shops, domestic science rooms and typing rooms shall be considered classrooms for the number of students indicated in the occupancy schedule.

CLAY MASONRY UNIT: (see section 801.0)

CLOSED SIGN: (see section 1401.0)

COMBUSTIBLE: (see section 901.0)

COMBUSTIBLE (MATERIAL): (see section 901.0)

COLD-FORMED STEEL CONSTRUCTION: (see section 801.0)

COMBINATION OF MUNICIPALITIES: Any two or more cities and/or towns who have agreed to combine in order to share costs necessary for the administration and enforcement of the Basic Code in the said cities and/or towns.

COMBINATION SIGN: (see section 1401.0)

COMBUSTIBLE FIRE DAMPER: (see section 901.0)

COMMENCED: Any physical action begun on the job site for the purposes of construction, for which a building permit is required.

COMMISSION: (see State Building Code Commission)

COMMON HALLWAY: (see section 601.0)

COMPLIANCE ASSURANCE PROGRAM: (see section 1901.0)

CONCRETE: (see section 801.0)

CONCRETE BRICK: (see section 801.0)

CONCRETE MASONRY UNIT: (see section 801.0)

CONFLAGRATION HAZARD: (see section 901.0)

CONTROLLED CONSTRUCTION: (see sections 128.0 and 701.0)

CONTROLLED MATERIALS: (see sections 701.0 and 722.0)

CONSTRUCTION EQUIPMENT: The construction machinery, tools, derricks, hoists, scaffolds, platforms, runways, ladders and all material handling equipment safeguards and protective devices used in construction operations.

CONSTRUCTION OPERATION: The erection, alteration, repair, renovation, demolition or removal of any building or structure; and the excavation, filling, grading and regulation of lots in connection therewith.

CONSTRUCTION SUPERVISOR: Any individual directly supervising persons engaged in construction, reconstruction, alterations or repairs involving the structural elements of buildings and structures.

CORRIDOR: (see passageway, section 601.0)

COURT: (see section 501.0)

CURB LEVEL: The elevation of the street curb as established in accordance with law.

-BUILDING OR WALL HEIGHT: The elevation of the street grade opposite the center of the wall nearest to and facing the street lot line.

-EXCAVATIONS: The elevation of the street grade nearest to the point of excavation.

DAY CARE CENTER: Any facility operated on a regular basis whether known as a day nursery, nursery school, kindergarten, child play school, progressive school, child development center, or preschool, or known under any other name, which receives children not of common parentage under seven (7) years of age or under sixteen (16) years of age if such children have special needs for nonresidential custody and care during part or all of the day separate from their parents. Day care center shall not include: any part of a public school system; any part of a private, organized educational system unless the services of such system are primarily limited to kindergarten, nursery or related preschool services; a Sunday school conducted by a religious

institution; a facility operated by a religious organization where children are cared for during short periods of time while persons responsible for such children are attending religious services; a family day care home, as defined by section nine (9) of chapter 28A of the MGLA as amended; an informal cooperative arrangement among neighbors or relatives; or the occasional care of children with or without compensation therefor.

DELUGE SYSTEM: (see section 1201.0)

DISPLAY SIGN: (see section 1401.0)

DISPLAY SURFACE: (see section 1401.0)

DOORWAY: The clear width of the opening protected by a door, subject to the width reduction provisions of this Code.

DRAFT HOOD: (see section 1001.0)

DRAFT REGULATOR: (see section 1001.0)

DUCT: (see section 1001.0)

DWELLINGS:

-ONE-FAMILY DWELLING: A building containing one (1) dwelling unit with not more than three (3) lodgers or boarders. L-3 Use Group.

-TWO-FAMILY DWELLING: A building containing two (2) dwelling units with not more than three (3) lodgers or boarders per dwelling unit. L-3 Use Group.

-MULTI-FAMILY APARTMENT HOUSE: Any building or portion thereof used as a multiple dwelling for the purpose of providing three (3) or more separate dwelling units with shared means of egress. L-2 Use Group.

-BOARDING HOUSE, TOURIST HOME: A building arranged or used for lodging, with or without meals, by more than three (3) lodgers or boarders. L-1 Use Group.

-LODGING HOUSE: Any building or portion thereof arranged or used for lodging by more than three (3) lodgers or boarders and where cooking or sanitary facilities may be provided. L-1 Use Group.

-DORMITORY: A space in a unit where group sleeping accommodations are provided, with or without meals, for persons not members of the same family group, in one room, or in a series of closely associated rooms under joint occupancy and single management, as in college dormitories, fraternity houses, military barracks and ski lodges. Use Group L-1.

-HOTEL: Any building containing six (6) or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied or which are occupied for sleeping purposes by guests. Use Group L-1.

DWELLING UNIT: One or more rooms arranged for the use of one (1) or more individuals living together as a single housekeeping unit, with cooking, living, sanitary and sleeping facilities.

ESCALATOR: (see section 601.0)

EXISTING BUILDING: A building erected prior to the adoption of the Basic Code, or one for which a legal building permit has been issued.

EXITWAY: (see section 601.0)

EXITWAY ACCESS: (see section 601.0)

EXITWAY DISCHARGE: (see section 601.0)

EXITWAY DISCHARGE COURT: (see section 401.0)

EXTERIOR MASONRY WALL CONSTRUCTION: (see section 217.0)

FIRE AREA: The floor area enclosed and bounded by fire walls or exterior walls of a building to restrict the spread of fire.

FIRE DAMPER: (see section 1801.0)

FIRE DISTRICTS: The territories defined and limited by the provisions of the Basic Code for the restriction of types of construction.

FIRE DIVISION: (see section 901.0)

FIRE DOOR: (see section 901.0)

FIRE DOOR ASSEMBLY: (see section 901.0)

FIRE DRILL: (see section 1201.0)

FIRE GRADING: (see sections 202, 901, 902 and Table 9-1)

FIRE HAZARD: (see section 901.0)

FIRE LIMITS: (see section 301.0)

FIRE PARTITION: (see section 901.0)

FIRE PREVENTION: (see section 901.0)

FIRE PROTECTION: (see section 901.0)

FIRE SAFETY: (see section 901.0)

FIRE SEPARATION: (see section 901.0)

FIRE TOWER: Smokeproof tower (see section 601.0)

FIRE WALL: (see section 901.0)

FIRE WINDOW: (see section 901.0)

FIREPROOF CONSTRUCTION: (see section 215.0)

FIRERESISTANCE: (see section 901.0)

FIRERESISTANCE RATING: (see section 901.0)

FIRERESISTIVE PARTITION: (see section 901.0)

FIRERETARDANT CONSTRUCTION: (see section 901.0)

FIRERETARDANT LUMBER: (see section 901.0)

FLAME SPREAD: (see section 901.0)

FLAME SPREAD RATING: (see section 901.0)

FLAMERESISTANCE: (see section 901.0)

FLAMMABLE: (see section 401.0)

FLAMMABLE FILM: (see section 401.0)

FLEXIBLE TUBING: (see section 1001.0)

FLOOR AREA, GROSS: (see section 601.0)

FLOOR AREA, NET: (see section 601.0)

FLOOR FILL: (see section 801.0)

FLOOR FILLING: (see section 801.0)

FLOOR FINISH: (see section 801.0)

FLOOR FURNACE: (see section 1101.0)

FLUE: (see section 1001.0)

FORCED AND INDUCED DRAFT FUEL BURNING APPLIANCES: (see section 1001.0)

FORMED STEEL: (see section 701.0)

FOUNDATION WALL: (see section 701.0)

FOYER: (see section 401.0)

FRAME CONSTRUCTION: (see section 218.0)

FUEL OIL: (see section 401.0)

GARAGE: (see section 401.0)

GAS VENTS: (see section 1001.0)

GRADE: A reference plane representing the average of finished ground level adjoining the building at all exterior walls.

GRADE BEAM: A beam of masonry, reinforced concrete or structural steel incased in concrete at or below grade that receives the load from the superstructure and transmits it to the foundation.

GRADE HALLWAY: (see section 601.0)

GRANDSTAND: (see section 401.0)

GROUND SIGN: (see section 1401.0)

GROUP RESIDENCE: (see section 433.1)

HABITABLE ROOM: (see section 501.0)

HALLWAY, GRADE: (see section 601.0-Grade hallway)

HALLWAY, COMMON: (see section 601.0-Common hallway)

HAZARD: (Low, moderate, high. see section 901.0).

HEAD OF THE FIRE DEPARTMENT: The chief executive officer of the fire department in a city, town or fire district having such an officer, otherwise the fire commissioner, board of fire commissioners or fire engineers, or commissioner of public safety; and in towns not having a fire department, the chief engineer, if any, otherwise the chairman of the board of selectmen. The words "head of the fire department" shall be construed, where the content allows, as though followed by the words "or person delegated by him."

HEATING APPLIANCES: (see section 1101.0)

HEIGHT, BUILDING: The vertical distance from the grade to the highest point of the roof. When a building faces more than one street the height shall be measured from the average of the grade at the center line of each street front.

-COURT: The vertical distance from the lowest level of the court to the mean height of the top of the enclosing walls.

-STORY: The vertical distance from top to top of two (2) successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists, or, where there is no ceiling, to the top of the roof rafters.

-WALL: The vertical distance from the foundation wall or other immediate support of such wall to the top of the wall.

HEREAFTER: After the time that the Basic Code becomes effective.

HERETOFORE: Before the time that the Basic Code became effective.

HIGH HAZARD USE: (see section 203.0)

HIGH PRESSURE BOILER: (see section 1101.0)

HOLLOW BRICK: (see section 801.0)

HOOD: (see section 1001.0)

HORIZONTAL EXIT: (see section 601.0)

HORIZONTAL FIRE LINE: (see section 1201.0)

INFLAMMABLE: (see Flammable. section 401.0)

INSPECTOR OF BUILDINGS: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of the Basic Code. See also building commissioner. (see section 107.1)

INSTALLATION: (see section 1901.0)

INTERIOR LOT LINE: Any lot line other than one adjoining a street or public space.

KEROSENE: (see section 401.0)

LABEL: (see section 1901.0)

LIGHT GAUGE STEEL CONSTRUCTION: (see section 701.0)

LIGHT-DIFFUSING SYSTEM: (see section 2001.0)

LIMIT CONTROL: (see section 1801.0)

LINTEL: (see section 801.0)

LOAD: (see section 701.0)

LOBBY: (see section 401.0)

LOCAL ENFORCEMENT AGENCY: (see section 1901.0)

LOCAL INSPECTOR: A person in a municipality who assists the building commissioner or inspector of buildings in the performance of his duties and is charged with the enforcement of the Basic Code. (see section 107.11)

LOT: A portion or parcel of land considered as a unit.

-CORNER LOT: One with two (2) adjacent sides abutting upon streets or other public spaces.

-INTERIOR LOT: One which faces on one street or with opposite sides on two (2) streets.

LOT LINE: A line dividing one lot from another, or from a street or any public place.

LOW HAZARD USE: (see section 204.2)

LOW PRESSURE BOILER: (see section 1101.0)

MANUAL FIRE-ALARM SYSTEM: (see section 1201.0)

MANUFACTURED BUILDING: (see section 1901.0)

MARQUEE: (see section 1401.0)

MARQUEE SIGN: (see section 1401.0)

MASONRY: (see section 801.0)

MEANS OF EGRESS: A continuous and unobstructed path of travel from any point in a building or structure to a public space and consists of three (3) separate and distinct parts: (a) the exitway access, (b) the exitway, and (c) the exitway discharge; a means of egress comprises the vertical and horizontal means of travel and shall include intervening room spaces, doors, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts and yards.

MECHANICAL VENTILATION: (see section 1801.0)

MECHANICAL WARM AIR FURNACE: (see section 1101.0)

MEZZANINE: An intermediate floor between the floor and ceiling of any story, and covering less than thirty-three and one-third (33 1/3) percent of the floor area immediately below.

MINIMUM HABITABLE ROOM HEIGHT: (see section 501.0)

MINIMUM HABITABLE ROOM SIZE: (see section 501.0)

MOBILE HOME: (see sections 401.0 and 1901.0)

MOBILE HOME SYSTEM: (see section 1901.0)

MODERATE HAZARD USE: (see section 204.1)

MORTAR: (see section 801.0)

MOTEL: A hotel as defined in this Code.

MOTOR FUEL SERVICE STATION: (Oil selling station, Gasoline service station, section 401.0)

MOTOR VEHICLE REPAIR SHOP: (see section 401.0)

MOVING STAIRWAY: (see section 601.0)

MUNICIPALITY: Any city or town in the Commonwealth of Massachusetts. The word "municipality" shall be construed, where the context requires, as though followed by the words "or combination of municipalities."

NOMINAL DIMENSION: (see section 801.0)

NON-AUTOMATIC SPRINKLER SYSTEM: (see section 1201.0)

NONCOMBUSTIBLE BUILDING MATERIAL: (incombustible)(see section 901.0)

NONCOMBUSTIBLE CONSTRUCTION: (see section 216.0)

NOTICE: (see section 122.12)

OCCUPANCY: The purpose for which a building, or part thereof, is used or intended to be used.

OCCUPANCY LOAD: The number of individuals normally occupying the building or part thereof, or for which the exitway facilities have been designed.

OCCUPANTS: Persons normally located within the building or structure or part thereof.

OCCUPIABLE ROOM: (see section 501.0)

OCCUPIED: As applied to a building, shall be construed as though followed by the words "or intended, arranged or designed to be occupied."

ONE-SOURCE SPRINKLER SYSTEM: (see section 1201.0)

OPEN SIGN: (see section 1401.0)

ORDINARY MATERIALS: (see section 701.0 and 722.0)

ORIEL WINDOW: A window projected beyond and suspended from the wall of the building or cantilevered therefrom.

OWNER: Every person who alone or jointly or severally with others (a) has legal title to any building or structure; or (b) has care, charge, or control of any building or structure in any capacity including but not limited to agent, executor, executrix, administrator, administratrix, trustee or guardian of the estate of the holder of legal title; or (c) lessee under a written letting agreement; or (d) mortgagee in possession; or (e) agent, trustee or other person appointed by the courts. Each such person is bound to comply with the provisions of the Basic Code.

PANEL: (part of a structure). The section of a floor or wall comprised between the supporting frame of two (2) adjacent rows of columns and girders, or column bands of floor construction.

PANEL WALL: (see wall-skeleton or panel)

PARKING STRUCTURE, OPEN: (see section 401.0)

PARTIAL SPRINKLER SYSTEM: (see section 1201.0)

PARTY WALL: (see section 901.0)

PASSAGEWAY: (see section 601.0-grade hallway)

PENTHOUSE: An enclosed structure above the roof of a building, other than a roof structure or bulkhead occupying not more than thirty-three and one-third (33 1/3) percent of the roof area.

PERMIT: An official document or certificate issued by the authority having jurisdiction authorizing performance of a specified activity.

PERSON: Every individual, partnership, corporation, firm, association, trustee or group, including a city, town, county, authority or other governmental unit, owning property or conducting any activity regulated by this Basic Code.

PLACE OF ASSEMBLY: A room or space accommodating fifty (50) or more individuals for religious, recreational, educational, political, social or amusement purposes or for the consumption of food and drink, including all connected rooms or spaces with a common means of egress and entrance.

PLACE OF OUTDOOR ASSEMBLY: Premises used or intended to be used for public gatherings of two hundred (200) or more individuals in other than buildings.

PLASTIC GLAZING: (see section 2001.0)

PLASTIC ROOF PANELS: (see section 2001.0)

PLASTIC WALL PANEL: (see section 2001.0)

PLENUM CHAMBER: (see section 1801.0)

POLE SIGNS: (see section 1401.0)

POSTED USE AND OCCUPANCY: The posted classification of a building in respect to use, fire grading, floor load and occupancy load.

POSTED SIGN: The tablet, card or plate which defines the use, occupancy, fire grading and floor loads of each story, floor or parts thereof for which the building or part thereof has been approved.

POSTER PANEL: (see section 1401.0)

PRESERVATIVE TREATED WOOD: (see section 801.0)

PRIMARY MEMBER: (see section 701.0)

PROFESSIONAL ENGINEER OR ARCHITECT: (see qualified registered professional engineer or architect)

PROJECTING SIGN: (see section 1401.0)

PROTECTED CONSTRUCTION: That in which all structural members are constructed, chemically treated, covered or protected so that the individual unit or the combined assemblage of all such units has the required fireresistance rating specified for its particular use or application in table 2-5, and includes protected-frame, protected-ordinary and protected-noncombustible construction.

PUBLIC PARKING DECKS: (see section 401.0)

PUBLIC SPACE: A legal open space on the premises, accessible to a public way or street, such as yards, courts or open spaces permanently devoted to public use which abuts the premises.

PYROXYLIN PLASTIC: (see section 401.0)

QUALIFIED REGISTERED PROFESSIONAL ENGINEER OR ARCHITECT: A registered professional engineer who is qualified by his experience and training to perform the work for which he is responsible.

RAISED PLATFORM: A raised portion of floor to be used for simple stage purposes that involves a minimum of fire hazard, so located that it extends not more than eighteen (18) feet behind the probable curtain line of the proscenium opening and of an area limited to seventeen and one-half (17.5) percent of the assembly room floor area of 1,550 square feet, whichever is less.

REFRIGERANT: (see section 1801.0)

REFRIGERATION: (see section 1801.0)

REINFORCED CONCRETE: (see section 801.0)

REINFORCED THERMOSETTING PLASTIC: (see section 2001.0)

REMOVAL OF BUILDINGS: The moving of a building or structure from one site to another.

REPAIR: The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REQUIRED: Shall be construed to be mandatory by provisions of the Basic Code.

ROOF: The roof slab or deck with its supporting members, not including vertical supports.

ROOF COVERING: The covering applied to the roof for weather resistance, fireresistance or appearance.

ROOF SIGN: (see section 1401.0)

ROOF STRUCTURE: An enclosed structure on or above the roof of any part of a building.

RUBBLE MASONRY: (see section 801.0)

RUNWAY: (see section 1301.0)

RUPTURE MEMBER: (see section 1801.0)

SCAFFOLD: Any elevated platform which is used for supporting workmen, materials, or both.

SCHOOLHOUSE: Any building or premise in which a regular course of public or private instruction is given to not less than ten (10) students at one time except for rooms in buildings separate from or attached to churches used for the primary purpose of religious instruction.

SECONDARY MEMBER: (see section 701.0)

SELF-CLOSING: (see section 601.0)

SERVICE EQUIPMENT: (see building service equipment)

SHALL: The term when used in the Basic Code shall be construed as mandatory.

SHAFT: (see section 901.0)

SLIDESCAPE: (see section 601.0)

SLOW-BURNING PLASTIC: (see check test). (see section 2001.0)

SMOKE DETECTOR: (see section 1801.0)

SMOKEPIPE: (see section 1001.0)

SMOKEPROOF TOWER: (fire tower, see section 601.0)

SMOKESTACK: (see section 1001.0)

SOLID MASONRY UNIT: (see section 801.0)

SPACE HEATER: (see section 1101.0)

SPECIALIZED CODE: All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts.

SPRINKLER SYSTEM: (see section 1201.0)

SPRINKLERED: (see section 1201.0)

STAGE: (see section 401.0)

STAIRWAY: (see section 601.0)

STANDARD FIRE TEST: (see section 901.0)

STANDPIPE: (see section 1201.0)

STATE BUILDING CODE: The State Building Code and amendments and rules and regulations thereto as promulgated by the State Building Code Commission under sections sixteen (16), seventeen (17) and eighteen (18) of Chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended.

STATE BUILDING CODE COMMISSION: The Massachusetts State Building Code Commission established by section sixteen (16) of chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended.

STATE INSPECTOR: An employee of the Division of Inspection, State Department of Public Safety who is charged with administering and enforcing the Basic Code relative to any structure or building or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies or authorities of the Commonwealth. The state inspector is also charged with supervising the enforcement of the Basic Code relative to all buildings and structures other than those owned by the Commonwealth. (see section 108.2)

STEEL JOIST: (see section 701.0)

STORY: That portion of a building included between the upper surface of a floor and upper surface of the floor or roof next above. (see also mezzanine)

STORY, FIRST: A story in which the finished floor is nearest to, and the ceiling of which is six (6) feet or more above the average grade of the sidewalk or ground adjoining.

STREET: A primary thoroughfare or highway thirty (30) feet or more in width as dedicated or devoted to public use by legal mapping use, or other lawful means.

STREET LOT LINE: The lot line dividing a lot from a street or other public space.

STRUCTURAL CLAY TILE: (see section 801.0)

STRUCTURAL STEEL MEMBER: (see section 701.0 and 801.0)

STRUCTURE: A combination of materials assembled at a fixed location to give support or shelter, such as a building, framework, retaining wall, tent, reviewing stand, platform, bin, fence, sign, flagpole, recreational tramway, mast for radio antenna or the like. The word "structure" shall be construed, where the context requires, as though followed by the words "or part or parts thereof."

SUPERVISED SPRINKLER SYSTEM: (see section 1201.0)

TECHNICAL CODE COUNCIL: (see section 100.5)

TEMPORARY SIGN: (see section 1401.0)

THEATRE: A building or part thereof in which it is intended to make a business of the presentation of performances for the entertainment of spectators, which has a seating capacity of more than four hundred (400), with a stage which can be used for scenery and other appliances. (see section 208.1)

THERMOPLASTIC MATERIAL: (see section 2001.0)

THERMOSETTING MATERIAL: (see section 2001.0)

TILE: (see section 801.0)

TON OF REFRIGERATION: (see section 1801.0)

TRAVEL TRAILERS: (see section 401.0)

TWO-SOURCE SYSTEM: (see section 1201.0)

UNFIRED PRESSURE VESSEL: (see section 1101.0)

UNIT HEATER: (see section 1101.0)

USE GROUP: The classification of a building or structure based on the purpose for which it is used.

USE-USED: The purpose for which the building or structure is designed, used or intended to be used.

VENT: (see section 1001.0)

VENT CONNECTOR: (see section 1001.0)

VENT DUCT: (see section 1801.0)

VENT PIPE (GAS): (see section 1001.0)

VENT SYSTEM: (see section 1001.0)

VENTILATION: (see section 1801.0)

VERTICAL OPENING: An opening through a floor or roof.

VOLATILE FLAMMABLE: (see section 401.0)

WALL: (see also section 801.0 and section 901.0)

-APRON WALL: That portion of a skeleton wall below the sill of a window.

-BEARING WALL: A wall supporting any vertical load in addition to its own weight.

-CURTIN WALL: A non-bearing enclosure wall not supported at each story.

-DIVISION WALL: A wall used to divide the floor area of a building or structure into separate parts for fire protection, for different uses, for restricted occupancy, or for other purposes specified in the Basic Code.

-NON-BEARING WALL: A wall which supports no vertical load other than its own weight.

-PARAPET WALL: That part of any wall entirely above the roof line.

-RETAINING WALL: A wall designed to prevent the lateral displacement of soil or other material.

-SKELETON OR PANEL WALL: A non-bearing wall supported by each story on a skeleton frame.

-SPANDREL WALL: That portion of a skeleton wall above the head of a window or door.

WALL HEATER: (see section 1101.0)

WALL SIGN: (see section 1401.0)

WARM AIR FURNACE: (see section 1101.0)

WATER CURTAIN: (see section 1201.0)

WINDER: (see section 601.0)

WRITING: The term shall be construed to include handwriting, typewriting, printing, photo-offset or any other form of reproduction in legible symbols or characters.

YARD: (see section 501.0)

ZONING: The reservation of certain specified areas within a community or city for building and structures, or use of land, for certain purposes with other limitations such as height, lot coverage and other stipulated requirements.

## SECTION 202.0 USE GROUP CLASSIFICATION

Every building, structure and space therein shall be classified with respect to use in one of the following use groups: group A, high hazard; group B, storage; group C, mercantile; group D, industrial; group E, business; group F, assembly; group H, institutional; group L, residential; and group M, miscellaneous buildings.

202.1 FIRE GRADING OF BUILDINGS: All buildings and structures shall be graded in accordance with the degree of fire hazard of their use. Such fire hazard may be expressed in terms of hours and fractions of an hour, fire loading or rate of energy contribution, so long as the building official can adequately relate such fire hazard to the requirements of this code. In case of doubt the building official may accept an evaluation of fire hazard from a qualified registered professional engineer or architect.

202.2 NEW USES: The building official shall establish by approved rules the degree of hazard involved and the fire grading of any use not specifically provided for in this Code, or may require the evaluations of such fire hazard by a qualified registered professional engineer or architect.

## SECTION 203.0 USE GROUP A, HIGH HAZARD BUILDINGS

All buildings and structures or parts thereof shall be classified in the high hazard use group which are used for the storage, manufacture or processing of highly combustible or explosive products or materials which are likely to burn with extreme rapidity or which may produce poisonous fumes or explosions; for storage or manufacturing which involves highly corrosive, toxic or noxious alkalies, acids or other liquids or chemicals producing flame, fume, explosive, poisonous, irritant or corrosive gases; and for the storage or processing of any materials producing explosive mixtures of dust or which result in the division of matter into fine particles subject to spontaneous ignition.

203.1 LIST OF HIGH HAZARD USES: The processes, materials and manufactures listed in table 2-1 are indicative of and shall be included among high hazard uses.

TABLE 2-1 - USE GROUP A, HIGH HAZARD USES

Acetylene gas and gases under pressure of fifteen (15) pounds or more and in quantities of greater than twenty-five hundred (2500) cubic feet; including hydrogen, illuminating natural, ammonia, chlorine, phosgene, sulphur dioxide, methyl oxide and all gases subject to explosion, fume or toxic hazard.

Artificial flowers and synthetic leather manufacture.

Ammunition, explosives and fireworks manufacture.

Celluloid and celluloid products.

Cereal, feed, flour and grist mills.

Cotton batting and cotton waste processes.

Cotton dressmaking.

Dry cleaning establishments using or storing more than three (3) gallons of gasoline or other hazardous liquids with a flash point under seventy-five (75) degrees F., or more than sixty (60) gallons of volatile flammable liquids with flash point between seventy-five (75) and one hundred and forty (140) degrees F., in a closed-up tester.

Feather renovating.

Fruit ripening processes.

Grain elevators.

Hydrogenation processes.

Industries employing solids or substances which ignite or produce flammable gases on contact with water.

Kerosene, fuel, lubricating, or any oil storage with a flash point under two hundred (200) degrees F.

Match manufacture or storage.

Metal enameling or japanning.

Nitro-cellulose film exchanges and laboratories.

Paint and varnish manufacture.

Paint spraying or dipping, except as specified in sections 213.2 and 302.3.

Petroleum manufacture.

Processing of paper or cardboard in loose form.

Pyroxylin products manufacture and storage.

Rag sorting and storage.

Refrigerating systems using high hazard refrigerants as defined in article 18.

Shoddy mills.

Shoe polish manufacture.

Smoke houses (industrial).

Straw goods manufacture or broom corn storage.

Sugar and starch pulverizing mills.

Tar, pitch or resin processing.

Tanneries with enameling or japanning.

Waste paper sorting, shredding, storage or bailing.

## SECTION 204.0 USE GROUP B, STORAGE BUILDINGS

All buildings and structures or parts thereof shall be classified in the storage use group which are used primarily for the storage of goods, wares or merchandise, except those that involve highly combustible or explosive products or materials; including among others, warehouses, storehouses and freight depots.

204.1 LIST OF MODERATE HAZARD USES: Buildings used for storage of moderate hazard contents which are likely to burn with moderate rapidity but which do not produce either poisonous gases, fumes or explosives, including among others the materials listed in table 2-2, shall be classified in the group B-1 storage use group.

TABLE 2-2 - USE GROUP B-1, STORAGE USES - MODERATE HAZARD

Bags, cloth, burlap and paper
Bamboo and rattan
Baskets
Belting, canvas and leather
Books and paper in rolls or packs
Boots and shoes
Button, including cloth-covered, pearl or bone
Linoleum
Livestock shelters
Lumber yards
Motor vehicle repair shops
Petroleum warehouses for storage of lubricating oils with a flash point of three hundred (300) degrees F. or higher (See section 905.3).

Cardboard and cardboard boxes
Clothing, woolen wearing apparel
Cordage
Furniture
Furs
Glue, mucilage, paste and size
Horn and combs, other than celluloid
Leather enameling or japanning
Photo-engraving
Public garages and stables
Silk
Soap
Sugar
Tobacco, cigars, cigarettes and snuff
Upholstering and mattress manufacturing
Wax candles

204.2 LIST OF LOW HAZARD USES: Buildings used for the storage of noncombustible materials, and of low hazard wares that do not ordiarily burn rapidly, shall be classified in the B-2 storage use group unless herein otherwise classified, including among others the materials listed in table 2-3.

TABLE 2-3 - USE GROUP B-2, STORAGE USES - LOW HAZARD

Asbestos
Chalk and crayons
Food products
Glass
Ivory
Metals
Porcelain and pottery
Talc and soapstones

SECTION 205.0 USE GROUP C, MERCANTILE BUILDINGS

All buildings and structures or parts thereof shall be classified in the mercantile use group which are used for display and sales purposes involving stocks of goods, wares or merchandise incidental to such purposes and accessible to the public; including among others retail stores, shops and salesrooms and markets. Highly combustible materials shall be limited to small quantities that do not constitute a high hazard. Where the hazard of the contents is greater than the normal fire hazard for such use, the building official may require an evaluation by a qualified registered professional engineer or architect and based on such evaluation the building commissioner or inspector of buildings may require compliance with the requirements of high hazard use groups as established by the provisions of article 4 and tables 2-5 and 2-6.

SECTION 206.0 USE GROUP D, INDUSTRIAL BUILDINGS

All buildings and structures or parts thereof in which occupants are engaged in performing work or labor in fabricating, assembling or processing of products or materials shall be classified in the industrial use group; including among other factories, assembling plants, industrial laboratories and all other industrial and manufacturing uses, except those involving highly combustible, flammable or explosive products and materials of the high hazard use group (use group A).

206.1 LIST OF INDUSTRIAL USES: The processes and manufacturers listed in table 2-4 shall be indicative of and include the uses permitted in use group D buildings.

TABLE 2-4 - USE GROUP D, INDUSTRIAL USES

Bakeries
Boiler works
Breweries
Canneries, including food products
Condensed and powdered milk manufacture
Dry cleaning using other than volatile flammable liquids in cleaning or dyeing operations or other than classified in table 1
Electric light plants and power houses
Electrolytic reducing works
Glass plants
Ice plants
Leather and tanneries, excluding enameling or japanning
Millwork and woodworking
Sugar refineries
Tenant factories, excluding ladies' dresses and other high hazard uses.
Textile mills, including canvas, cotton cloth, bagging, burlap, carpets and rags
Upholstery and manufacturing shops
Water-pumping plants

206.2 SPECIAL INDUSTRIAL USES: All buildings and structures designed to house low hazard industrial processes, including among others the production and distribution of electric, gas or steam power and rolling mills and foundries, requiring large areas and unusual heights to accommodate craneways or special machinery and equipment shall be exempt from the height and area limitations of table 2-6.

206.21 CONSTRUCTION: Buildings and structures for such low hazard industrial uses shall comply with the requirements of section 309.0 except as to height and when constructed of noncombustible (type 2-C) construction may have balconies and mezzanine floors which do not exceed two-thirds (2/3) the area of the main floor in any one tier.

206.22 ENCLOSURE WALLS: The enclosure walls of buildings of such low hazard industrial uses shall be constructed of approved noncombustible and weather resisting materials and when located with a fire separation of less than thirty (30) feet from interior lot lines of any other building shall be protected or constructed to provide a fireresistance rating of not less than two (2) hours.

206.23 FIREFIGHTING AND EXTINGUISHING EQUIPMENT: Special use industrial buildings as herein defined shall comply with the requirements of article 12 for auxiliary fire extinguishing equipment; except that the provisions of section 309.0 for automatic sprinkler equipment in unlimited area buildings may be waived by the building official when such installations would be detrimental or dangerous to the specific use and occupancy.

SECTION 207.0 USE GROUP E, BUSINESS BUILDINGS

All buildings and structures or parts thereof shall be classified in the business use group which are used for the transaction of business, for the rendering of professional services or for other services that involve stocks of goods, wages or merchandise in limited quantities for use incidental to office uses or sample purposes; including among others offices, banks, civic administration activities, professional

services, testing and research laboratories, radio stations, telephone exchanges and other similar establishments.

## SECTION 208.0 USE GROUP F, ASSEMBLY BUILDINGS

All buildings and structures or parts thereof shall be classified in the assembly use group which are used or designed for places of assembly as defined in the Basic Code.

### 208.1 USE GROUP F-1 - THEATRES.

208.11 USE GROUP F-1-A STRUCTURES shall include all theatres and other buildings used primarily for theatrical or operatic performances and exhibitions, arranged with a raised stage, proscenium curtain, fixed or portable scenery or scenery loft, motion picture booth, mechanical appliances or other theatrical accessories and equipment and provided with fixed seats.

208.12 USE GROUP F-1-B STRUCTURES shall include all theatres without a stage and equipped with fixed seats used for motion picture performances.

208.2 USE GROUP F-2 STRUCTURES shall include all buildings and places of public assembly, without theatrical stage accessories, designed for use as dance halls, night clubs and for similar purposes including all rooms, lobbies and other spaces connected thereto with a common means of egress and entrance.

208.3 USE GROUP F-3 STRUCTURES shall include all buildings with or without an auditorium in which persons assemble for amusement, entertainment or recreation, and incidental motion picture, dramatic, theatrical or educational presentations, lectures, or other similar purposes, without theatrical stage other than a raised platform; and principally used without permanent seating facilities, including art galleries, exhibition halls, museums, lecture halls, libraries, restaurants other than night clubs, and recreation centers; and buildings designed for other similar assembly purposes including passenger terminals.

208.4 USE GROUP F-4 STRUCTURES shall include all buildings used as churches and for similar religious purposes. Also included are buildings used for low density recreation such as swimming pools, tennis and skating and where there is accommodations of less than 100 spectators.

208.5 USE GROUP F-5 STRUCTURES shall include grandstands, bleachers, coliseums, stadiums, drive-in theatres, tents and similar structures for outdoor assembly use and shall comply with the provisions of the Basic Code for special uses and occupancies. (see article 4).

208.6 USE GROUP F-6 STRUCTURES shall include those buildings, structures, premises and parts thereof in which a regular course of public or private instruction is given to not less than ten (10) individuals at one time. Schools or rooms used for religious instruction which are under the jurisdiction or administration of a church or other defined religious body are regulated under Use Group F-4.

F-1B Schoolhouse Use: Schoolhouse structures or parts thereof used for F-1B assembly shall include all halls without a stage, except for a raised platform, equipped with fixed seats, and which may be used

for motion picture performances.

F-3 Schoolhouse Use: Schoolhouse structures shall include all buildings with or without an auditorium in which persons assemble for amusement, entertainment or recreation, and incidential motion pictures, dramatic or educational presentations, lectures or similar purposes, without a stage other than a raised platform and principally used without permanent seating facilities, including cafeterias and recreation centers; and buildings designed for other similar assembly purposes.

H Schoolhouse Use: All schoolhouse buildings and structures or parts thereof shall be classified in the institutional use group in which people suffering from physical limitations are harbored for medical, other care or treatment, or in which people are detained for penal or correctional purposes, or in which the liberty of the inmates is restricted.

H-1 Schoolhouse Use shall include all schoolhouse buildings designed for the detention of people under restraint, including among others jails, prisons, reformatories, institutions licensed under the State Department of Mental Health and similar uses.

H-2 Schoolhouse Use shall include all schoolhouse buildings used for housing people suffering from physical limitations, including among others hospitals, sanitariums, infirmaries, orphanages, and institutions licensed under the State Department of Mental Health, and/or State Department of Public Welfare, and State Department of Education.

208.7 USE GROUP F-7 STRUCTURES shall include those buildings, structures, premises and parts thereof which are used to provide a place to assemble individuals for any use covered by Use Group F, but which accommodate more than twenty (20) but less than fifty (50) people. Use Group F-7 structures shall be classified the same as Use Group E.

SECTION 209.0 USE GROUP H, INSTITUTIONAL BUILDINGS

All buildings and structures or parts thereof shall be classified in the institutional use group in which people suffering from physical limitations because of health or age are harbored for medical or other care or treatment, or in which people are detained for penal or correctional purposes, or in which the liberty of the inmates is restricted.

209.1 USE GROUP H-1 shall include all buildings designed for the detention of people under restraint including among others jails, prisons, reformatories, insane asylums and similar uses.

209.2 USE GROUP H-2 shall include all buildings used for housing people suffering from physical limitations because of health or age, including among others day nurseries, hospitals, sanitariums, clinics, infirmaries, orphanages, homes for aged and infirm; and buildings designed for prosecuting public or civic services and activities of emergency character, including among others fire houses, police stations and similar uses.

SECTION 210.0 USE GROUP L, RESIDENTIAL BUILDINGS

All buildings and structures or parts thereof shall be classified in

the residential use group, in which families or households live or in which sleeping accommodations are provided for individuals with or without dining facilities, excluding those that are classified as institutional buildings.

210.1 USE GROUP L-1: Use Group L-1 shall include buildings and spaces that are primarily occupied for the shelter and sleeping accommodation of individuals on a day-to-day or week-to-week basis. Such occupancies shall include hotels, lodging houses, boarding houses and similar occupancies.

210.2 USE GROUP L-2: Use Group L-2 shall include buildings with three or more dwelling units and other uses intended for living and sleeping accomodations of families or individuals on a long-term basis, and which shall include all multiple family dwellings, apartment houses, and dormitories.

210.3 USE GROUP L-3: Use Group L-3 shall include buildings occupied as one and two-family dwellings. Such buildings shall also include semi-detached houses which are vertically separated by fire divisions of the required use group fire grading, and have separate means of egress directly to the outside which are independent of any other dwelling unit.

Mobile homes are defined and controlled under the provisions of article 19.

## SECTION 211.0 USE GROUP M, MISCELLANEOUS USES

Structures and buildings of a temporary character and miscellaneous structures not classified in any specific use group shall be constructed, equipped and maintained to meet the requirements of the Basic Code commensurate with the fire and life hazard incidental to their use. Miscellaneous uses shall include all accessory buildings and structures used as private garages, sheds, fences and similar purposes.

## SECTION 212.0 DOUBTFUL USE CLASSIFICATION

When a building or structure is proposed for a use not specifically provided for in the Basic Code or the classification of which is doubtful, such building or structure shall be included in the use group which it most nearly resembles in respect to the existing or proposed life and fire hazard and it shall be so classified by the building official.

## SECTION 213.0 MIXED USE AND OCCUPANCY

213.1 TWO OR MORE USES: When a building is occupied for two (2) or more uses not included in the same use group, one of the following shall apply:

a) The provisions of the code applying to each use shall apply to such parts of the building as come within that use group; and if there are conflicting provisions, the requirements securing the greater public safety shall apply to the entire building, or

b) The mixed uses shall be completely separated both horizontally and vertically by fire separation walls and floor-ceiling assemblies having a fireresistance rating corresponding to the highest fire grading prescribed in table 9-1 for the separate uses. Each part of the building shall be separately classified

as to use. The most restrictive height and area limitations in this Code for the mixed uses shall apply to the entire building, or except as otherwise provided for in this Code, or

c) The mixed uses shall be completely separated by fire walls having a fireresistance rating corresponding to the highest fire grading prescribed in table 9-1 for the separate uses. Each group shall then comply with the provisions of this Code applicable to that group.

213.2 INCIDENTAL USES: Where the higher hazard use is supplemental to the main use of the building and the area devoted to such use is constructed and segregated by fireresistive construction as required in article 4, the building shall be classified according to the main use.

213.3 FIRE DIVISIONS: When mixed uses are completely separated horizontally and vertically from adjoining occupancies by fire divisions of the highest fire grading prescribed in table 9-1 for the separated uses, each part of the building shall be separately classified as to use.

## SECTION 214.0 CONSTRUCTION CLASSIFICATION

All buildings, structures, rooms or spaces hereafter altered or erected shall for the purposes of this Code be classified in one (1) or a combination of the four (4) construction types herein defined: Type 1, Fireproof Construction; Type 2, Noncombustible Construction; Type 3, Exterior Masonry Wall Construction; and Type 4, Frame Construction.

214.1 FALSE DESIGNATION: No building or space shall be designated a given type of construction unless it conforms to the minimum requirements for that type; and it shall be unlawful to post, or use, or designate, or advertise a building as of a given type of construction unless it complies with the minimum code requirements for that type.

214.2 MINIMUM REQUIREMENTS: When a superior type of construction is used than the minimum herein required for any specified use, height and area of the building, nothing in the Basic Code shall be construed to require full compliance with the specifications for the higher type; but the designated construction classification of the building shall be that of the lesser requirement, unless all the requirements for the higher type are fulfilled.

214.3 MIXED CONSTRUCTION: When two or more types of construction occur within the same structure which is occupied for only one use group classification, then any of the types of construction must be able to satisfy the requirements for the use group. If there is more than one use occupancy of the structure, then the construction must be able to satisfy the provisions of section 213.1.

## SECTION 215.0 TYPE 1, FIREPROOF CONSTRUCTION

Buildings and structures of fireproof construction are those in which the walls, partitions, structural elements, floors, ceilings, and roofs, and the exitways are constructed and protected with approved noncombustible materials to afford the fireresistance specified in table 2-5; except as otherwise specifically regulated by the provisions of article 9. Fireproof buildings shall be further classified as types 1-A and 1-B.

Fire-retardant treated wood may be used as specified in table 2-5 and section 903.8.

## SECTION 216.0 TYPE 2, NONCOMBUSTIBLE CONSTRUCTION

Buildings and structures of noncombustible construction are those in which the walls, partitions, structural elements, floors, ceilings, and roofs, and the exitways are constructed of approved noncombustible materials meeting the fireresistive requirements specified in table 2-5, and as further regulated in article 9. Noncombustible buildings shall be further classified as types 2-A, 2-B, and 2-C.

Fire-retardant treated wood may be used as specified in table 2-5 and section 903.8.

## SECTION 217.0 TYPE 3, EXTERIOR MASONRY WALL CONSTRUCTION

Buildings and structures of exterior masonry wall construction are those in which the exterior, fire and party walls are constructed of masonry or other approved noncombustible materials, of the required fireresistance and structural properties; and the floors, roofs, and interior framing are wholly or partly of wood or of metal or other approved construction; the fire and party walls are ground supported; except that girders and their supports carrying walls of masonry shall be protected to afford the same degree of fireresistance of the walls supported thereon; and all structural elements have the required fireresistance rating specified in table 2-5.

217.1 TYPE 3A: Buildings and structures of heavy timber construction are those in which fire resistance is attained by placing limitations on the minimum sizes of wood structural members and on minimum thickness and composition of wood floors and roofs; by the avoidance, or by the proper protection by firestopping or other acceptable means, of concealed spaces under floors and roofs; by the use of approved fastenings, construction details, and adhesives for structural members; and by providing the required degree of fire resistance in exterior and interior walls. (See section 852.0 for construction details.)

COLUMNS: Wood columns may be sawn or glued laminated and shall be not less than eight (8) inches, nominal, in any dimension when supporting floor loads and not less than six (6) inches, nominal, in width and not less than eight (8) inches, nominal, in depth when supporting roof and ceiling loads only.

FLOOR FRAMING: Beams and girders of wood may be sawn or glued laminated and shall be not less than six (6) inches, nominal, in width and not less than ten (10) inches, nominal, in depth. Framed or glued laminated arches which spring from the floor line and support floor loads shall be not less than eight (8) inches, nominal, in any dimension. Framed timber trusses supporting floor loads shall have members of not less than eight (8) inches, nominal, in any dimension.

ROOF FRAMING: Framed or glued laminated arches for roof construction which spring from the floor line or from grade and do not support floor loads shall have members not less than six (6) inches, nominal, in width and not less than eight (8) inches, nominal, in depth for the lower half of the height and not less than six (6) inches, nominal, in depth for the upper half. Framed or glued laminated arches for roof construction which spring from the top of walls or wall abutments, framed timber trusses, and other roof framing which do not support floor loads, shall have members not less than four (4) inches, nominal, in width and not less than six (6) inches, nominal, in depth. Spaced members may be composed of two (2) or more pieces not less than three (3) inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than two (2) inches, nominal in thickness, secured to the underside of the members. Splice plates shall be no less than three (3) inches, nominal in thickness. When protected by approved automatic sprinklers under the roof deck, framing members shall be not less than three (3) inches, nominal, in width.

FLOORING: Floors shall be without concealed spaces and shall be of sawn or glued laminated plank, splined, or tongue-and-groove, of not less than three (3) inches, nominal, in thickness covered with one (1) inch, nominal, dimension tongue-and-groove flooring, laid crosswise or diagonally, or one-half (½) inch plywood, or one-half (½) inch particle board; or of planks not less than four (4) inches, nominal, in width, set on edge close together and well spiked, and covered with one (1) inch, nominal, dimension flooring, or one-half (½) inch plywood, or one-half (½) inch particle board.

ROOF DECKING: Roofs shall be without concealed spaces and roof decks shall be sawn or glued laminated, splined or tongue-and-groove plank, not less than two (2) inches, nominal, in thickness, one and one-eighth (1-1/8) inches thick interior plywood (exterior glue), or of planks not less than three (3) inches, nominal, in width, set on edge close together and laid as required for floors. Other types of decking may be used if providing equivalent fireresistance and structural properties.

BEARING WALLS: Bearing portions of exterior and interior walls shall be of approved noncombustible material and shall have a fireresistance rating of not less than two (2) hours.

NON-BEARING WALLS: Nonbearing portions of exterior walls shall be of approved noncombustible materials except as otherwise noted and; where a horizontal separation of less than twenty (20) feet is provided, nonbearing exterior walls shall have a fireresistance rating of not less than two (2) hours. Where a horizontal separation of twenty (20) feet to thirty (30) feet is provided, nonbearing exterior walls shall have a fireresistance rating of not less than one (1) hour. Where a horizontal separation of thirty (30) feet or more is provided, no fireresistance rating is required. Where a horizontal separation of twenty (20) feet or more is provided, wood columns and arches conforming to heavy timber sizes may be used externally.

217.2 TYPE 3-B: Structures of type 3-B (ordinary protected) shall include all exterior masonry wall buildings in which the interior structural elements are wholly or partly of fire-protected wood of not less than two (2) inch nominal thickness, or of other approved protected combustible materials, or of metal protected and insulated to afford three-quarter (3/4) hour fireresistance rating where specified in table 2-5.

217.3 TYPE 3-C: Structures of type 3-C (ordinary unprotected) construction shall include all exterior masonry wall buildings in which the interior structural members are of wood of not less than two (2) inch nominal thickness or consist of other combustible or noncombustible materials with protection of less than three-quarter (3/4) hour fireresistance rating.

## SECTION 218.0 TYPE 4, FRAME CONSTRUCTION

Buildings and structures of frame construction are those in which the exterior walls, bearing walls, partitions, floor and roof construction are constructed wholly or partly of wood stud and joist assemblies with a minimum nominal dimension of two (2) inches, or of other approved combustible materials; with firestopping at all vertical and horizontal draft openings as regulated in section 874.0, and in which the structural elements have the required fireresistance ratings specified in table 2-5. Frame buildings shall be further classified as types 4-A and 4-B.

TABLE 2-5. FIRE RESISTANCE RATINGS OF STRUCTURAL ELEMENTS IN HOURS

TYPE OF CONSTRUCTION

| Notes on Page 2-33 | | | TYPE 1 | | TYPE 2 NONCOMBUSTIBLE Note b | | | TYPE 3 EXTERIOR MASONRY WALLS | | | TYPE 4 FRAME | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRUCTURAL ELEMENT | | | FIREPROOF | | PROTECTED | | Unprotected | Heavy Timbers (Mill) | Ordinary Protected | Ordinary Unprotected | Protected | Unprotected |
| | EXTERIOR WALLS | Note a | 1A | 1B | 2A | 2B | 2C | 3A | 3B | 3C | 4A | 4B |
| 1 | On street lot lines or with fire separation of 30' or more from interior lot lines or any building | Bearing | 4 | 3 | 2 | 3/4 | 0 | 2 | 2 | 2 | 3/4 | 0 |
| | | Non-Bearing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3/4 | 0 |
| | On interior lot lines or less than 6' therefrom, or from any building | Bearing | 4 | 3 | 2 | 1 1/2 | Note c 3/4 | 2 | 2 | 2 | 3/4 | 3/4 |
| | | Non-Bearing | 2 | 2 | 1 1/2 | 3/4 | Note c 3/4 | 2 | 2 | 2 | 3/4 | 3/4 |
| | 6' or more but Less than 11' | Bearing | 4 | 3 | 2 | 3/4 | 0 | 2 | 2 | 2 | 3/4 | 0 |
| | | Non-Bearing | 2 | 2 | 1 1/2 | 3/4 | 0 | 2 | 2 | 2 | 3/4 | 0 |
| | 11' or more but Less than 30' | Bearing | 4 | 3 | 2 | 3/4 | 0 | 2 | 2 | 2 | 3/4 | 0 |
| | | Non-bearing | 1 1/2 | 1 1/2 | 3/4 | 3/4 | 0 | See Sec217 | 1 1/2 | 1 1/2 | 3/4 | 0 |
| 2 | Interior bearing walls and partitions | | 4 | 3 | 2 | 3/4 | 0 | 2 | 3/4 | 0 | 3/4 | 0 |
| | | | ← Noncombustible → | | | | | | | | | |
| 3 | Fire walls | | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | Note d 2 |
| | | | ← In No Case less than Fire Grading of Use Group (See Table 16) → | | | | | | | | | |
| 4 | Fire Divisions | | ← Fire Resistance Rating corresponding to Fire Grading of Use Group (See Table 16) → | | | | | | | | | |
| 5 | Fire Enclosure of Exitways, Elevator Hoistways, Exitway Hallways and Stairways Note e | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3/4 | 3/4 |
| | | | ← Noncombustible → | | | | | | | | | |
| 6 | Shafts other than Stairways | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3/4 | 3/4 |
| | | | ← Noncombustible → | | | | | | | | | |
| 7 | Exitway Access Hallways & Vertical Separation of Tenant Spaces | | 3/4 | 3/4 | 3/4 | 3/4 | 0 | 3/4 | 3/4 | 0 | 3/4 | 0 |
| | | | ← Noncombustible → Note h | | | | | | | | | |
| | Other Non-bearing Partitions (See Art. 9) | | ← Noncombustible → Note h | | | | | 0 | 0 | 0 | 0 | 0 |
| 8 | Columns, Girders, Trusses (other than roof trusses) and Framing | Supporting one Floor or Roof | 3 | 2 | 1 1/2 | 3/4 | 0 | See Sec217 | 3/4 | 0 | 3/4 | 0 |
| | | Supporting more than One Floor | 4 | 3 | 2 | 3/4 | 0 | See Sec217 | 3/4 | 0 | 3/4 | 0 |
| 9 | Structural Members Supporting Wall | | ← Required Fire Resistance of Wall Supported but not less than Fire Resistance Rating for Type of Construction → | | | | | | | | | |
| 10 | Floor Construction including Beams Note g | | 3 | 2 | 1 1/2 | 3/4 | 0 | See Sec217 | 3/4 | 0 | 3/4 | 0 |
| 11 | Roof Construction including Beams 15' or Less in Height Note g | | 2 | 1 1/2 | 3/4 | 3/4 | 0 | See Sec217 | 3/4 | 0 | 3/4 | 0 |
| | | | | | ← Note h → | | | | | | | |
| 12 | Roof Trusses and Framing including Arches & Roof Deck Note f | More than 15' but less than 20' in height to lowest member | 3/4 | 3/4 | 3/4 | 0 | 0 | See Sec217 | 0 | 0 | 3/4 | 0 |
| | | | ← Note h → | | | | | | | | | |
| | | 20' or more in height to lowest member | 0 | 0 | 0 | 0 | 0 | See Sec217 | 0 | 0 | 0 | 0 |
| | | | ← Note h → | | | | | | | | | |

NOTES APPLICABLE TO TABLE 2-5

GENERAL

For special high hazard uses involving a higher degree of fire severity and higher concentration of combustible contents, the fireresistance requirements for structural elements shall be increased accordingly. (See section 400).

SPECIFIC

Note a The fire separation or fire exposure in feet as herein limited applies to the distance from other buildings on the site, or from an interior lot line or from the opposite side of a street or other public space not less than thirty (30) feet wide to the building wall. (See Definitions, section 901).

Note b Protected exteriors shall be required within the fire limits in type 2 construction as follows: high hazard uses, two (2) hour fireresistance with fire separation up to eleven (11) feet.

Note c One-story buildings of type 2-C construction which do not exceed three thousand (3000) square feet in area in all use groups except high hazard assembly and institutional shall be exempt from the protected exterior wall requirements of table 2-5. (See section 302.4.)

Note d Party walls in type 4 buildings shall be as follows: one and two-family dwellings, three-quarter (3/4) hour fire resistance. (See section 907.3) Other uses, except F-6, two (2) hours, but not less than the fire grading of the use group (See table 9-1).

z Note e Stair enclosures in all buildings, other than one and two-family dwellings, which do not exceed three (3) stories or forty (40) feet in height with an occupancy load of less than forty (40) below and less than seventy-five (75) above the grade floor shall be of not less than three-quarter (3/4) hour fireresistance. In buildings of types 3 or 4 construction, such three-quarter (3/4) hour enclosures may be of combustible construction as provided in section 618.92.

Fire enclosures of exitways, exitway hallways, and stairways in schoolhouse buildings which do not exceed three (3) stories in height shall be of not less than three-quarter (3/4) hour fireresistance.

Note f In all buildings, except F-6 use group, in which the roof framing may be unprotected, roof slabs and decking may be noncombustible without fire resistance rating except that in buildings not more than five (5) stories in height, roof decking may be of mill type construction or of any other materials providing equivalent fireresistant and structural properties. (See sections 217 and 915.)

Note g In Type 3A construction members which are of material other than heavy timber shall have a fireresistance rating of not less than three-quarter (3/4) hour.

Note h Fire-Retardant Treated Wood, complying with section 903.72, may be used as provided in section 903.8.

TABLE 2-6. HEIGHT LIMITATIONS (UPPER FIGURE: STORIES AND FEET ABOVE GRADE) AND AREA LIMITATIONS (LOWER FIGURE: AREA IN SQUARE FEET PER FLOOR PER STORY) OF BUILDINGS FACING ON ONE STREET OR PUBLIC SPACE NOT LESS THAN 30 FEET WIDE

N.P.—NOT PERMITTED
UNLIMITED

TYPE OF CONSTRUCTION

| Notes on Page 2-35 USE GROUP | | | TYPE 1 Fireproof Note b | | TYPE 2 Noncombustible | | | TYPE 3 Exterior Masonry Walls | | | TYPE 4 Frame | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Protected | | Un-protected | (HT) Mill | Ordinary Joisted Protected | Ordinary Joisted Un-protected | Protected | Un-protected |
| | | | 1A | 1B | 2A | 2B | 2C | 3A | 3B | 3C | 4A | 4B |
| A | HIGH HAZARD | Notes f and j. | 5 ST 65' 16,800 | 3 ST 40' 14,400 | 3 ST 40' 11,400 | 2 ST 30' 7,500 | 1 ST 20' 4,800 | 2 ST 30' 7,200 | 2 ST 30' 6,600 | 1 ST 20' 4,800 | 1 ST 20' 5,100 | N.P. |
| B-1 | STORAGE-Moderate | Notes a, c, d, g and h. | | | 5 ST 65' 19,950 | 4 ST 50' 13,125 | 2 ST 30' 8,400 | 4 ST 50' 12,600 | 3 ST 40' 11,550 | 2 ST 30' 8,400 | 2 ST 30' 8,925 | 1 ST 20' 4,200 |
| B-2 | STORAGE-Low | Notes a, c and d. | | | 7 ST 85' 34,200 | 5 ST 65' 22,500 | 3 ST 40' 14,400 | 5 ST 65' 21,600 | 4 ST 50' 19,800 | 3 ST 40' 14,400 | 3 ST 40' 15,300 | 2 ST 30' 7,200 |
| C | MERCANTILE | Notes a, c and d. | | | 6 ST 75' 22,800 | 4 ST 50' 15,000 | 2 ST 30' 9,600 | 4 ST 50' 14,400 | 3 ST 40' 13,200 | 2 ST 30' 9,600 | 2 ST 30' 10,200 | 1 ST 20' 4,800 |
| D | INDUSTRIAL | Notes a, c and d. | | | 6 ST 75' 22,800 | 4 ST 50' 15,00 | 2 ST 30' 9,600 | 4 ST 50' 14,400 | 3 ST 40' 13,200 | 2 ST 30' 9,600 | 2 ST 30' 10,200 | 1 ST 20' 4,800 |
| E | BUSINESS | Notes a, c and d. | | | 7 ST 85' 34,200 | 5 ST 65' 22,500 | 3 ST 40' 14,400 | 5 ST 65' 21,600 | 4 ST 50' 19,800 | 3 ST 40' 14,400 | 3 ST 40' 15,300 | 2 ST 30' 7,200 |
| F-1-A | ASSEMBLY THEATRES | With stage and scenery | | 6 ST 75' 14,400 | 4 ST 50' 11,400 | 2 ST 30' 7,500 | 1 ST 20' 4,800 | 2 ST 30' 7,200 | 2 ST 30' 6,600 | 1 ST 20' 4,800 | 1 ST 20' 5,100 | N.P. |
| F-1-B | ASSEMBLY THEATRES | Without stage (Movie theatres) | | | 5 ST 65' 19,950 | 3 ST 40' 13,125 | 2 ST 30' 8,400 | 3 ST 40' 12,600 | 3 ST 40' 11,550 | 2 ST 30' 8,400 | 1 ST 20' 8,925 | 1 ST 20' 4,200 |
| F-2 | ASSEMBLY - Night clubs and similar uses | | | 4 ST 50' 7,200 | 3 ST 40' 5,700 | 2 ST 30' 3,750 | 1 ST 20' 2,400 | 2 ST 30' 3,600 | 2 ST 30' 3,300 | 1 ST 20' 2,400 | 1 ST 20' 2,550 | 1 ST 20' 1,200 |
| F-3 | ASSEMBLY - Lecture halls, recreation centers, terminals, restraurants Note c. | | | | 5 ST 65' 19,950 | 3 ST 40' 13,125 | 2 ST 30' 8,400 | 3 ST 40' 12,600 | 3 ST 40' 11,550 | 2 ST 30' 8,400 | 1 ST 20' 8,925 | 1 ST 20' 4,200 |
| F-4 | ASSEMBLY - Churches, schools Notes k and l. | | | | 5 ST 65' 34,200 | 3 ST 40' 22,500 | 2 ST 30' 14,400 | 3 ST 40' 21,600 Note e | 3 ST 40' 19,800 | 2 ST 30' 14,400 | 1 ST 20' 15,300 Note e | 1 ST 20' 7,200 Note e |
| F-6 | ASSEMBLY - Schools (Schoolhouses) Notes m and n | | | | 5 ST 65' 34,200 | 3 ST 40' 22,500 | 2 ST 30' 14,400 | 3 ST 40' 21,600 | 3 ST 40' 19,800 | N.P. | 1 ST 20' 15,300 | N.P. |
| H-1 | INSTITUTIONAL - Restrained | | | 6 ST 75' 18,800 | 4 ST 50' 14,250 | 2 ST 30' 9,375 | 1 ST 20' 6,000 | 2 ST 30' 9,000 | 2 ST 30' 8,250 | 1 ST 20' 6,000 | 1 ST 20' 6,375 | N. P. |
| H-2 | INSTITUTIONAL - Incapacitated | | | 8 ST 90' 21,600 | 4 ST 50' 17,100 | 2 ST 30' 11,250 | 1 ST 20' 7,200 | 2 ST 30' 10,800 | 2 ST 30' 9,900 | 1 ST 20' 7,200 | 1 ST 20' 7,650 | N. P. |
| L-1 | RESIDENTIAL - Hotels | | | | 9 ST 100' 22,800 | 4 ST 50' 15,000 | 3 ST 40' 9,600 | 4 ST 50' 14,400 | 4 ST 50' 13,200 | 3 ST 40' 9,600 | 3 ST 40' 10,200 | 2 ST 35' 4,800 |
| L-2 | RESIDENTIAL - Multi-family | | | | 9 ST 100' 22,800 | 4 ST 50' 15,000 | 3 ST 40' 9,600 | 4 ST 50' 14,400 | 4 ST 50' 13,200 | 3 ST 40' 9,600 | 3 ST 40' 10,200 | 2 ST 35' 4,800 |
| L-3 | RESIDENTIAL - 1 & 2 family | | | | 4 ST 50' 22,800 | 4 ST 50' 15,000 | 3 ST 40' 9,600 | 4 ST 50' 14,400 | 4 ST 50' 13,200 | 3 ST 40' 9,600 | 3 ST 40' 10,200 | 2 ST 35' 4,800 |
| M | MISCELLANEOUS & TEMPORARY | | | | | | | | | | | |

NOTES TO TABLE 2-6

GENERAL

For all buildings, except F-6 of type 3B construction, which have more than twenty-five (25) percent of the building perimeter fronting on a street or other unoccupied space which is at least thirty (30) feet wide and has unrestricted accessibility for fire equipment and apparatus, the tabular area may be increased by two (2) percent for each one (1) percent of such perimeter excess above the twenty-five (25) percent.

Example: Perimeter = 400 feet
Accessible Perimeter = 300 feet
1. 25% of 400 feet = 100 feet
2. Excess of accessible perimeter
accessible perimeter = 300 feet
25% deduction = 100 feet
Excess of accessible perimeter = 200 feet
3. Percentage of excess = $\frac{200 \times 100\%}{400} = 50\%$
4. Increase allowable = 2 x 50% = 100%

A one-hundred (100) percent increase in the tabular area is allowed, thus doubling the allowable area.

SPECIFIC

Note a In use groups B-1, B-2, C, D, E and F-4, the tabular areas may be increased two hundred (200) percent for one (1) story buildings and one hundred (100) percent for buildings over one (1) story in height when such buildings are equipped with automatic sprinkler systems not specifically required by law. (See section 308).

Note b Type 1 buildings permitted unlimited tabular heights and areas are not subject to special requirements that allow increased heights and areas for other types of construction.

Note c In use groups B, C, D, E and F-3, isolated buildings of other than frame construction may be of unlimited areas outside of the fire limits when not more than one (1) story or eighty-five (85) feet in height when complying with specific provisions of the Basic Code. (See section 309).

Note d In use groups B-1, B-2, C, D and E types 1, 2 and 3 construction may be increased one (1) story but not more than twenty (20) additional feet in height when equipped with automatic sprinkler systems not specifically required by law. (See section 310.2).

Note e Church auditoriums of type 3-A construction may be erected to sixty-five (65) feet in height, and of type 4 construction to forty-five (45) feet in height.

Note f For exceptions to height and area limitations of high hazard use buildings, see article 4 governing the specific use. For

other special fireresistive requirements governing specific uses, see section 905.

Note g For height and area exceptions covering public parking decks, see section 905.2.

Note h For height and area exceptions covering petroleum bulk-storage buildings, see section 905.3.

Note i For exceptions to height of multi-family dwellings of types 2-B and 3-B construction, see section 905.6

Note j For one (1) story combustible fibre warehouses, see section 408.3.

Note k The tabular area of one (1) story school buildings of use group F-4 may be increased two hundred (200) percent provided every classroom has at least one door opening directly to the exterior of the building. Not less than one-half (½) of the required exitways from any assembly room included in such buildings shall also open directly to the exterior of the building.

Note l For exception to area limitations for one (1) story buildings of type 2, 3-A and 3-B construction, see section 309.11.

Note m The tabular area for 4A construction shall be limited to 6,300 square feet for F-1B, F-3, and F-4 schoolhouse use and to 3,600 square feet for F-1A schoolhouse use.

Note n The first story in the two (2) story portions of buildings of this type of construction shall be constructed of the next most fire-resistive type of construction, i.e., type 2B and 2C. For the purposes of this table, concrete filled steel tube columns shall be considered to have the equivalent of a three-quarter (3/4) hour fireresistance rating.

ARTICLE 3

# GENERAL BUILDING LIMITATIONS

## SECTION 300.0 SCOPE

The provisions of this article shall control the division of the municipalities of the Commonwealth of Massachusetts into fire districts and the general limitations of height and area of all buildings hereafter erected, and extensions to existing buildings hereafter altered or enlarged as affected by the fire and life hazard incident to type of construction, use group, density of development, exterior exposure and accessibility of buildings and structures to fire-fighting facilities and equipment.

## SECTION 301.0 FIRE DISTRICT SUBDIVISIONS

For the purpose of control of use and construction of buildings, the building official may establish limiting districts designated Fire District No. 1, Fire District No. 2 and Outside Fire Limits under the legal procedure of the municipalities of the Commonwealth of Massachusetts for creating and establishing fire districts.

NOTE A: NUMBER OF FIRE DISTRICTS. - The number of fire districts to be established will depend upon the prevailing character of construction and typical development of the specific locality. In large cities, two (2) fire districts are generally desirable while in cities of moderate size and in small political subdivisions, one fire district may be adequate to provide for the fire hazard inherent in concentrated commercial and manufacturing occupancies. The fire district should include all those areas of the municipality in which buildings of business, mercantile, industrial, storage and other use groups of similar fire and conflagration hazard are concentrated. If provision is made for only one fire district, the restrictions herein prescribed for Fire District No. 1 will be applicable to such district.

301.1 FIRE DISTRICT NO. 1: Fire District No. 1 shall comprise the areas housing highly congested business, commercial, manufacturing and industrial uses or in which such uses are developing.

301.2 FIRE DISTRICT NO. 2: Fire District No. 2 shall comprise the areas housing residential uses (use groups L-1 and L-2), together with retail stores, business and amusement centers, or in which such uses are developing.

301.3 OUTSIDE FIRE LIMITS: All other areas not included in Fire District Nos. 1 and 2 shall be designated as Outside Fire Limits.

SECTION 302.0 GENERAL FIRE DISTRICT PROVISIONS

302.1 CHANGES IN DISTRICTS: Any changes in the boundaries of fire districts or changes of designation of any area from one fire district to another fire district shall be established by the local municipality.

302.2 OVERLAPPING DISTRICTS: A building or structure located in more than one fire district shall be deemed to be in that one of the three districts which contains the major part of the building area; and in the event of equal distribution in two or more districts, the limitations of the most restricted district shall apply.

302.3 HIGH HAZARD USES: Except as specifically approved by the municipal authorities, all buildings of high hazard use (use group A) shall be prohibited from location in Fire District No. 1. Paint spray, drying rooms and rooms for similar incidental uses not exceeding one thousand (1000) square feet in area in industrial buildings shall be permitted when enclosed in fireresistive construction as specified in article 4 for special uses and occupancies and when segregated by fire divisions of the required fireresistance specified in table 9-1.

302.31 PROTECTED EXTERIORS: All buildings of type 2 construction for high hazard uses (use group A) within the fire districts shall be constructed with walls of two (2) hours fireresistance when located within eleven (11) feet of interior lot lines or any buildings on the same lot.

302.4 NONCOMBUSTIBLE CONSTRUCTION EXEMPTIONS: One (1) story buildings of type 2-C construction which do not exceed three thousand (3000) square feet in area in all use groups except high hazard, assembly and institutional shall be exempt from all protected exterior wall requirements.

302.5 FRAME CONSTRUCTION: No building of frame construction (type 4) shall be erected within the fire districts nor shall such building or structure be moved from without to within, or from one lot to another with the fire districts, except as provided in sections 303 and 304; and no building of otherwise lawful construction shall be extended in height or area within the fire districts by frame construction; except that one-and two-family frame dwellings may be extended in area by not more than three hundred (300) square feet and to a height of not more than two and one-half (2½) stories nor more than thirty-five (35) feet.

302.6 ROOF COVERINGS: All roof coverings shall be constructed of Class A, Class B or Class C roofings, complying with the provisions of article 9.

SECTION 303.0 RESTRICTIONS OF FIRE DISTRICT NO. 1

All buildings and structures, and all additions to existing buildings and structures, hereafter erected within the boundaries of Fire

District No. 1 shall be of fireproof (type 1), protected noncombustible (types 2-A and 2-B), heavy timber (type 3-A), or ordinary protected (type 3-B) construction as defined in article 2 and regulated in table 2-5; and shall be constructed within the height and area limitations of table 2-6; except as herein provided.

Open parking structures may be constructed as permitted under section 905.2.

303.1 FENCES: Fences not over six (6) feet in height may be erected of frame (type 4) construction.

303.2 STORM ENCLOSURES: Storm enclosures may be erected of frame construction not more than ten (10) feet in height and not more than three (3) feet wider than the entrance doors which they serve, provided they do not project more than six (6) feet beyond the building line.

303.3 ACCESSORY BUILDINGS

303.31 OUTBUILDINGS AND PARKING LOT OFFICES: Outbuildings and parking lot offices not more than ten (10) feet in height and one hundred (100) square feet in area may be erected of frame (type 4) construction when accessory to one- or two-family dwelling on the same lot or accessory to a lot approved for motor vehicle parking, when located not less than six (6) feet from the lot line or any other building.

303.32 GREENHOUSES: Greenhouses and similar structures may be erected of frame (type 4) construction when accessory to a one- or two-family dwelling on the same lot and when located not less than six (6) feet from interior lot lines or any building.

303.4 SHEDS: Sheds open on the long side not more than fifteen (15) feet in height nor more than five hundred (500) square feet in area may be erected of frame (type 4) construction when located not less than six (6) feet from the lot lines.

303.5 BUILDERS' SHANTIES AND REVIEWING STANDS: Temporary builders' shanties erected in connection with approved building operations, platforms, reviewing stands, and other similar miscellaneous structures may be erected of frame (type 4) construction for a limited period of time as approved by the building official.

303.6 PRIVATE GARAGES: Private garages not more than one (1) story nor more than fifteen (15) feet in height when accessory to a one- or two-family dwelling may be erected of protected frame (type 4-A) construction not more than seven hundred and fifty (750) square feet in area, or of frame (type 4-B) construction not more than five hundred (500) square feet in area, when located not less than six (6) feet from interior lot lines or any building.

303.7 BINS, TANKS, TOWERS AND ROOF STRUCTURES

303.71 TIMBER CONSTRUCTION: Coal and material bins, water towers, tank structures and trestles may be erected of mill type heavy timber construction with dimensions not less than required for type 3-A construction, not over thirty-five (35) feet in height, when located

thirty (30) feet from the interior lot lines or any building, except when located on lot lines along a railroad right of way or waterfront.

303.72 STRUCTURES ON BUILDINGS: Aerial supports not more than twelve (12) feet in height, water tanks and flag poles may be erected of wood on buildings, not more than three (3) stories nor more than forty (40) feet in height, and drip bars in cooling towers may be constructed of wood.

303.8 MOTOR FUEL SERVICE STATIONS: Gasoline service stations, and structures of similar business uses, not including high hazard uses, may be erected of unprotected noncombustible (type 2-C) construction within the height and area limits of use group E of table 2-6 provided thay are located less than eleven (11) feet from the lot line or any building.

303.9 BUS AND PASSENGER TERMINALS: Roofs over parking lots, bus and passenger terminals may be erected one story and not over twenty (20) feet in height and not more than eleven thousand (11,000) square feet in area of noncombustible (type 2-C) construction or of heavy timber mill (type 3-A) construction.

303.10 STORE FRONTS: Wood veneers of one (1) inch nominal thickness or exterior grade plywood not less than three-eighths (3/8) inch thick may be used on store fronts when facing public streets; provided the veneer does not exceed one (1) story in height and is applied to noncombustible backing or is furred not to exceed one and five-eighths (1-5/8) inch and firestopped in accordance with sections 874 and 912.2.

SECTION 304.0 RESTRICTIONS OF FIRE DISTRICT NO. 2

All buildings and structures hereafter erected within the boundaries of Fire District No. 2 shall be fireproof (type 1), noncombustible (type 2) or exterior masonry wall (type 3) construction as regulated by table 2-5 and shall be constructed within the height and area limitations of table 2-6; except that all the variations permitted in Fire District No. 1 shall apply to permissible construction in Fire District No. 2 with the following additional exceptions:

304.1 DWELLINGS: One and two-family dwellings (use group L-3) may be erected of protected frame (type 4-A) construction when not less than three (3) feet from interior lot lines and of unprotected frame (type 4-B) construction when not less than six (6) feet from interior lot lines within the height and area limitations of table 2-6. Roof coverings shall be of Class A, B or C roofings complying with the provisions of article 9.

304.2 VERANDAS: Verandas, balconies, entrance porticos and similar appurtenant structures on dwellings, not exceeding ten (10) feet in depth nor projecting more than two (2) feet above the second story floor beams may be erected of frame (type 4-B) construction provided they do not extend nearer than five (5) feet to the lot line. When connected to a similar structure of an adjoining building, they shall be separated therefrom by walls of two (2) hour fireresistance.

304.3 BOAT HOUSES: Boat houses not more than two (2) stories nor more than thirty (30) feet in height nor more than one thousand (1000) square feet in area may be erected of frame (type 4-B) construction.

304.4 EXTERIOR TRIM: Wood cornices and half timbering may be erected on residence (use group L) and business (use group C, D and E) buildings; and existing openings in exterior walls of masonry enclosed buildings (type 3-A, 3-B and 3-C) which are not required for ventilation or access purposes, may be filled in with wood studs, metal lath and stucco or other approved construction of equal fireresistance.

## SECTION 305.0 RESTRICTIONS OUTSIDE FIRE LIMITS

Outside the fire limits, all types of construction except as herein specifically prohibited, or for which special approval is required in connection with high hazard uses and occupancies in article 4, shall be permitted within the height and area limitations of table 2-6.

305.1 LOT LINE SEPARATION: In frame construction an exterior wall erected less than six (6) feet from its adjacent lot line shall be of three-quarter (3/4) hour fireresistive construction, including opening protectives except store front and window and door openings in one- and two-family dwellings, but in no case shall such wall be located less than three (3) feet from interior lot lines.

305.2 ROOF COVERINGS: Roof coverings shall conform to the fireresistive requirements for Class A, B, C or non-rated roofings complying with the provisions of sections 903 and 928.

## SECTION 306.0 EXISTING BUILDINGS

### 306.1 ALTERATIONS

306.11 LIMITATIONS: Nothing in these provisions shall be deemed to prohibit alterations within the limitations of section 106.0 provided no unlawful change of use is involved.

306.12 MINOR CHANGES: Changes, alterations or repairs to the interior of a building and to the front facing a street or other public space may be permitted provided such changes, in the opinion of the building official, do not increase the size, or the fire hazard of the building, or endanger the public safety and are not specifically prohibited by this Code.

306.13 EXISTING PROJECTIONS: No change or enlargement shall be made to an existing part of a building now projecting beyond the street lot line or building line where such is established by law, except in conformity to the provisions of section 312 governing new construction.

306.2 INCREASE IN HEIGHT AND AREA: It shall be unlawful to increase the height or area of an existing building or structure unless it is of a type of construction permitted for new buildings of the increased height and area and use group within the fire district in which it is located and as regulated by table 2-6.

306.3 EXISTING EXCESSIVE AREA: Any building heretofore lawfully approved which exceeds the maximum allowable area specified in table 2-6 may be extended if the addition is separated from the existing building by an approved fire wall or fire division meeting the requirements of article 9 and table 2-5 and the additional area does not exceed the limits of table 2-6 for the specific use group and type of construction.

307.0 GENERAL AREA AND HEIGHT LIMITATIONS

All buildings, structures and parts thereof erected or altered shall be subject to the requirements of table 2-5 and table 2-6 for the appropriate type of construction and use groups classification involved subject to any specific modifications and exceptions allowed in this code.

307.1 AREA LIMIT: The area limitations specified in table 2-6 shall apply to all buildings fronting on a street, or public space not less than thirty (30) feet in width accessible to a public street.

307.2 HEIGHT LIMIT: The height in feet and number of stories specified in table 2-6 shall apply to all buildings and to all separate parts of a building enclosed within lawful fire walls complying with the provisions of article 9.

307.3 MULTI-STORY BUILDINGS: Buildings more than one story in height shall be subject to the area requirements of the table 2-6 and modified by the following table of factors:

TABLE 3-1
PERCENT REDUCTION
IN THE AREA LIMITS OF TABLE 2-6

| No. of Stories | 1A & 1B | 2A | 2B | 2C | 3A & 3B | 3C | 4A & 4B |
|---|---|---|---|---|---|---|---|
| 1 | None | None | None | None | None | None | None |
| 2 | None | None | None | None | None | None | None |
| 3 | None | 5% | 20% | 20% | 20% | 20% | 20% |
| 4 | None | 10% | 20% | 20% | 20% | 20% | |
| 5 | None | 15% | 30% | | 30% | | |
| 6 | None | 20% | 40% | | 40% | | |
| 7 | None | 25% | 50% | | | | |
| 8 | None | 30% | 60% | | | | |
| 9 | None | 35% | 70% | | | | |
| 10 | None | | | | | | |

SECTION 308.0 AREA EXCEPTIONS

The provisions of this section shall modify the area limits of table 2-6 as herein specified. Section 308.1 shall not apply to F-6 use group buildings of type 3B construction.

308.1 STREET FRONTAGE INCREASE: When a building or structure has more than twenty-five (25) percent of the building perimeter fronting on a street or other accessible unoccupied space not less than thirty (30) feet in width leading to a street, the tabular areas may be increased two (2) percent for each one (1) percent of such excess frontage.

308.2 SPRINKLER INCREASE: When a building is equipped with an approved one (1) source automatic sprinkler system, unless such sprinkler system is required by the provisions of article 4 for structures of special use and occupancy, the tabular values may be increased by two hundred (200) percent for one (1) story buildings and one hundred (100) percent for buildings more than one (1) story in height.

308.3 MAXIMUM TOTAL AREA: The maximum total area under the combined provisions of sections 308.1 and 308.2 shall not exceed three and one-half (3½) times the tabular area in table 2-6.

SECTION 309.0 UNLIMITED AREAS

309.1 ONE-STORY BUILDINGS: In other than frame construction, the area of all buildings of assembly (use group F-3), business, industrial mercantile and storage use groups not including high hazard uses, which do not exceed one (1) story or eighty-five (85) feet in height shall not be limited outside the fire limits; provided the exitway facilities comply with the provisions of section 604, an automatic sprinkler system is provided complying with the provisions of section 1212.0 and the building is isolated as specified in section 309.2 except that a sprinkler system shall not be required for buildings of type 2 or type 3A construction used exclusively for storage of noncombustible material not packed or crated in combustible material or as exempt by section 206.2 for special industrial uses.

309.11 SCHOOL BUILDINGS: School buildings, use group F-6, shall be subject to the provisions of Reference Standard F-6, Building Regulations for Schoolhouses, of the State Building Code Commission.

309.2 FIRE SEPARATION: The minimum fire separation on any side of one (1) story buildings of unlimited area shall be determined by the type of construction and fireresistance rating of the exterior wall adjacent thereto as herein specified:

| Type of Construction | Fireresistance Rating of Exterior Bearing Walls | Minimum Fire Separation** | Fireresistance rating of bearing & nonbearing portions of exterior walls | Minimum Fire Separation |
|---|---|---|---|---|
| 2A | 2 hr. | 30 ft. | - | - |
| 2B | 3/4 hr. | 40 ft. | 2 hr.* | 30 ft. |
| 2C | 0 hr. | 50 ft. | 3 hr.** | 30 ft. |
| 3A | 2 hr. | 40 ft. | 3 hr.** | 30 ft. |
| 3B | 2 hr. | 40 ft. | 3 hr.** | 30 ft. |
| 3C | 2 hr. | 50 ft. | 4 hr.** | 30 ft. |

* All exterior wall openings shall be protected with one and one-half rated approved opening protectives.

** All exterior wall openings shall be protected with three hour rated approved opening protectives.

*** When the fire separation exceeds the herein specified minimum, the requirements of Table 2-5, Row 1 (Exterior Walls with Fire Separation of 30 ft. or more: Bearing) shall apply.

## SECTION 310.0 HEIGHT EXCEPTIONS

310.1 ROOF STRUCTURES: In applying the provisions of the Basic Code governing height limits, the following appurtenant structures shall not be included in the height of the building: roof tanks and their supports; ventilating, air conditioning and similar building service equipment; roof structures other than penthouses; chimneys and parapet walls not exceeding four (4) feet in height; unless the aggregate area of such structures including penthouses, exceeds one-third (1/3) of the area of the roof of the building upon which they are erected.

310.2 AUTOMATIC SPRINKLERS: Except in buildings where automatic sprinkler equipment is a requirement of article 4 or article 12 for special uses or occupancies, all structures of fireproof (type 1), noncombustible (type 2), and exterior masonry wall (type 3) construction, designed for business, industrial, mercantile, low or moderate hazard storage uses may be erected one (1) story or twenty (20) feet higher than specified in table 2-6 when equipped with an approved one-source automatic sprinkler system.

## 311.0 STREET ENCROACHMENTS

No part of any building hereafter erected and no additions to an existing building heretofore erected shall project beyond the lot lines or beyond the building line when such line is established by

the zoning law or any other statute controlling building construction, and irrespective of any other allowance for such encroachments, the following regulations shall apply:

311.1 BELOW GRADE: No part of a building hereafter erected below grade that is necessary for structural support of the building shall project beyond the lot lines except that the footings of street walls or their supports located at least eight (8) feet below grade may project not more than twelve (12) inches beyond the street lot line.

311.2 ABOVE GRADE: All projections hereafter permitted beyond the street lot line or the building lot line above grade shall be so constructed as to be readily removable without endangering the safety of the building.

311.3 PROJECTIONS NECESSARY FOR SAFETY: In any specific application, the building official may designate by approved rules such architectural features and accessories which are deemed desirable or necessary for the health or safety of the public and the extent to which they may project beyond the street lot line or the building line where such is established by statute, subject to all provisions and restructions that may be otherwise prescribed by law, ordinance or rule of the authorities having jurisdiction over streets or public spaces.

311.4 PERMIT REVOCABLE: Any permit granted or permission expressed or implied in the provisions of the Basic Code to construct a building so as to project beyond the street lot line or building line shall be revocable by the municipality at will.

311.5 EXISTING ENCROACHMENTS: Parts of existing buildings and structures which already project beyond the street lot line or building line may be maintained as constructed until their removal is directed by the proper municipal authorities.

## SECTION 312.0 PERMISSIBLE STREET PROJECTIONS

Subject to such provisions as may be otherwise prescribed by law or ordinance, or by rule of the municipal authorities having jurisdiction over streets, highways, and public spaces, the following projections shall be permitted beyond the street lot line or the building line, as the case may be:

312.1 MAIN CORNICES OR ROOF EAVES located at least twelve (12) feet above the curb level shall project not more than three (3)feet;

312.2 BELT COURSES, LINTELS, SILLS, ARCHITRAVES, PEDIMENTS and similar architectural decorations shall project not more than four (4) inches when less than ten (10) feet above the curb level, and not more than ten (10) inches when ten (10) feet or more above the curb level;

312.3 ORNAMENTAL COLUMNS, OR PILASTERS including the bases and moldings which emphasize the main entrance of the building shall project not more than twelve (12) inches;

312.4 ENTRANCE STEPS shall project not more than twelve (12) inches and shall be guarded by cheek pieces not less than three (3) feet high or shall be located between ornamental columns or pilasters;

312.5 ORIEL WINDOWS with the lowest position at least ten (10) feet above the curb level shall project not more than two and one-half (2½) feet;

312.6 BALCONIES located at least ten (10) feet above the curb level shall project not more than three (3) feet except that when the balcony is required in connection with a fire escape or exterior stairway as an element of a means of egress, the projection may be increased, but not to exceed four (4) feet.

312.7 AWNINGS AND MARQUEES.

312.71 AWNINGS: Retractable or fixed awnings shall have clearances above the grade and shall be installed in accordance with the requirements of section 315.

312.72 MARQUEES: For the purpose of this section a marquee shall include any object or decoration attached to or a part of said marquee.

PROJECTION AND CLEARANCE - The horizontal clearance between a marquee and the curb line shall be not less than two-thirds (2/3) of the distance from the property line to the curb shall be not less than ten (10) feet above the ground or pavement below.

THICKNESS - The maximum height or thickness of a marquee measured vertically from its lowest to its highest point shall not exceed three (3) feet when the marquee projects more than two-thirds (2/3) of the distance from the property line to the curb line and shall not exceed nine (9) feet when the marquee is less than two-thirds (2/3) of the distance from the property line to the curb line.

ROOF CONSTRUCTION - The roof or any part thereof may be a skylight of approved plastics, or wired glass not less than one-fourth (¼) inch thick with no single pane more than eighteen (18) inches wide. Every roof and skylight of a marquee shall be sloped to downspouts which shall conduct any drainage from the marquee in a manner not to spill over the sidewalk.

LOCATION PROHIBITED - Every marquee shall be so located as not to interfere with the operation of any exterior standpipe or to obstruct the clear passage of stairways or exitway discharge from the building or the installation or maintenance of street lighting.

CONSTRUCTION - A marquee shall be supported entirely from the building and constructed of noncombustible material. Marquees shall be designed and constructed to withstand wind of other lateral loads

and live loads as required in article 7 of this Code. Structured members shall be protected to prevent deterioration as required by article 8.

312.8 AWNING COVERS OR BOXES located at least eight (8) feet above the curb level shall project not more than three (3) feet.

## SECTION 313.0 PERMISSIBLE YARD AND COURT ENCROACHMENTS

No part of any building or structure shall extend into side courts, inner courts or yards required for light and ventilation of habitable and occupiable rooms by the provisions of article 5, or of the zoning law or other statutes controlling building construction, except as hereinafter provided; but in no case shall the encroachment exceed twenty (20) per cent of the legal area of yard or court required for light and ventilation purposes.

313.1 ROOF EAVES shall project not more than three (3) feet beyond the face of the wall.

313.2 STEPS AND ARCHITECTURAL FEATURES: Steps, window sills, belt courses and similar architectural features, rain leaders and chimneys shall project not more than two (2) feet beyond the face of the wall.

313.3 EXTERIOR STAIRWAYS AND FIRE ESCAPES: Outside stairways, smoke-proof tower balconies, fire escapes or other required elements of a means of egress shall project not more than four (4) feet beyond the face of the wall.

## SECTION 314.0 SPECIAL AND TEMPORARY PROJECTIONS

314.1 ALLEY PROJECTIONS: The permissible projection beyond street lot lines shall apply in general to building projections into alley-ways except as may be modified by the local administrative authority having jurisdiction or by special deed restriction.

314.2 SPECIAL PERMITS: When authorized by special permit, vestibules and storm doors may be erected for periods of time not exceeding seven (7) months in any one year, and shall project not more than three (3) feet nor more than one-fourth (¼) the width of the sidewalk beyond the street lot line. Temporary entrance awnings may be erected with a minimum clearance of seven (7) feet to the lowest portion of the hood or awning when supported on removable steel or other approved noncom-bustible supports.

## SECTION 315.0 AWNINGS AND CANOPIES

315.1 PERMIT: A permit shall be obtained from the building official for the erection, repair or replacement of any fixed awning, canopy or hood except as provided in section 315.11, and for any retractable awning located at the first story level and extending over the public

street or over any portion of a court or yard beside a building serving as a passage from a required exitway discharge to a public street.

315.11 EXEMPTION FROM PERMIT: No permit shall be required for the erection, repair or replacement of fixed or retractable awnings installed on one- and two-family dwellings, unless they project over public property, or for retractable awnings installed above the first story or where the awning does not project ober the public street or over any court or yard serving as a passage from a required exitway to a public street.

315.2 INSTALLATION OF AWNINGS.

315.21 RETRACTABLE AWNINGS: There shall be a minimum clearance of seven (7) feet from the sidewalk to the lowest part of the framework or any fixed portion of any retractable awning, except that the bottom of the valance of canvas awnings may extend to six (6) feet nine (9) inches above the sidewalk. Retractable awnings shall be securely fastened to the building and shall not extend closer than twelve (12) inches from the curb line. They shall be equipped with a mechanism or device for raising and holding the awning in a retracted or closed position against the face of the building.

315.22 FIXED OR PERMANENT AWNINGS: The clearance from the sidewalk to the lowest part of any fixed or permanent awning shall be the same as required in section 315.21 for retractable awnings. Fixed or permanent awnings installed above the first story shall not project more than four (4) feet.

315.3 CANOPIES: Canopies shall be constructed of a metal framework, with an approved covering, attached to the building at the inner end and supported at the outer end by not more than two (2) stanchions with braces anchored in an approved manner and placed not less than two (2) feet in from the curb line. The horizontal portion of the framework shall be not less than eight (8) feet nor more than twelve (12) feet above the sidewalk and the clearance between the covering or valance and the sidewalk shall be not less than seven (7) feet. The width of canopies shall not exceed eight (8) feet.

315.4 SPECIAL APPLICATIONS OF AWNINGS: Rigid awnings supported in whole or part by members resting on the ground and used for patio covers, car ports, summer houses or other similar uses shall comply with the requirements of section 315.5 for design and structure. Such structures shall be braced as required to provide rigidity.

315.5 DESIGN AND CONSTRUCTION: Fixed awnings, canopies and similar structures shall be designed and constructed to withstand wind or other lateral loads and live loads as required by article 7 of the Basic Code with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration.

## SECTION 316.0 SUBDIVISION OF ATTIC SPACES

The attic spaces of all buildings, except where the roof and attic are of noncombustible or fireproof construction, shall be subdivided into areas not exceeding three thousand (3,000) square feet by means of approved fire stops. When doors or other openings are provided in such subdividing partitions, they shall be of noncombustible or similarly protected materials and the construction shall be tightly fitted around all ducts or other assemblies piercing such partitions.

## SECTION 317.0 TEMPORARY STRUCTURES

Pursuant to a variance granted by the local board of appeals under the provisions of section 126.0, the building official may issue a permit for temporary construction as approved by the board of appeals. Such permits shall be limited as to time of service, but in no case shall such temporary construction be permitted for more than one year.

317.1 SPECIAL APPROVAL: All temporary construction shall conform to structural strength, fire safety, means of egress, light, ventilation and sanitary requirements of this Code necessary to insure public health, safety and general welfare.

317.2 TERMINATION OF APPROVAL: The building official is hereby authorized to terminate such special approval and to order the demolition of any such construction at his discretion, or as directed by the decision of the local board of appeals.

ARTICLE 4

# SPECIAL USE AND OCCUPANCY REQUIREMENTS

## SECTION 400.0 SCOPE

In addition to the general requirements of the Basic Code governing the location, construction and equipment of all buildings and structures and the fireresistive, height and area limitations of tables 2-5 and 2-6 the provisions of this article shall control all buildings and structures designed for high hazard uses and occupancies which involve extreme fire, smoke, explosion or toxic gas risks, and places of assembly in which people congregate in large numbers and which are susceptible to panic incidental to crowds. Except as herein specifically provided, the applicable standards listed in the reference standards of this article shall be deemed to comply with the requirements of this article.

Chemical plants, packing plants, grain elevators, refineries, flour mills and other special structures may be constructed in accordance with the recognized practices and requirements of the specific industry. The building official may permit such variations from the requirements of the Basic Code which will secure reasonable and economical construction with the necessary fire, life and property safeguards. In granting such variations, due regard shall be given to the isolation of the structure and fire hazard from and to surrounding property.

400.1 USES INVOLVING EXPLOSION HAZARDS: The provisions of this article shall apply to all uses involving the storage, manufacture, handling or filling of flammable and volatile solids, liquids or gases which generate combustible and explosive air-vapor mixtures and toxic gases including nitrocellulose film; pyroxylin plastics; grain and other combustible dusts and pulverized fuels; combustible fibers; pyroxylin lacquer-spraying operations; liquefied petroleum gases; alcohol, ether and gasoline; flammable dusts and residues resulting from fabrication, grinding and buffing operations, and all other explosion hazard risks.

400.2 SPECIAL HIGH HAZARDS: When the fire hazard potential exceeds that which would be considered within the range of fire loading acceptable for high hazard use, the requirements of table 2-5 may be increased to provide additional fireresistance in proportion to the excess fire loading. Where high hazard uses exceed five (5) stories or sixty-five (65) feet in height, requirements in excess of those required by table 2-5 may be specified in proportion to the anticipated additional fire hazard.

400.3 MEANS OF EGRESS: The means of egress for buildings of hazardous uses and occupancies shall conform to the requirements of article 6, except as may be modified by more restrictive provisions of this article for specific uses.

400.4 HEATING AND VENTING: The requirements herein prescribed for the installation of heating and venting appliances and equipment for high hazard uses and occupancies shall be construed as supplemental to the provisions of article 5, 10, 11 and 18.

400.5 LIGHT AND ELECTRIC WIRING: Whenever flash fires and explosion hazards are involved, all artificial lighting shall be restricted to incandescent electric lights or other approved lighting with keyless sockets and dust-tight, vapor-proof globes protected against mechanical injury. All wiring in vaults or compartments for the storage of highly flammable materials shall be in metal or other approved conduit complying with the provisions of the Massachusetts State Electrical Code.

400.6 BOILER AND HAZARDOUS EQUIPMENT ROOMS: Boilers and other equipment or devices, including breechings which involve flame or spark producing apparatus shall not be exposed to fire or explosive-hazard gases, vapors or volatile flammable liquids. Such rooms and equipment shall be segregated by construction of not less than two (2) hour fireresistance except as may be required for specific uses, without openings in the enclosure walls and with means of direct ingress and egress from the exterior, or such equipment shall be located in accessory structures segregated from the main building.

400.7 FIRE-FIGHTING AND EXTINGUISHING EQUIPMENT: All buildings designed for specific hazardous uses shall be protected with approved automatic sprinkler systems or such other fire-extinguishing and auxiliary equipment as herein provided and in accordance with the requirements of article 12.

400.8 SEGREGATION OF STORAGE SPACES: All rooms and spaces used for the storage of volatile and flammable materials shall be separately enclosed and segregated with fireresistive construction as herein required for specific uses and occupancies.

400.9 RESTRICTED LOCATIONS: No high hazard use may be located within two hundred (200) feet of the nearest wall of a building classified in a public assembly or institutional use group.

SECTION 401.0 DEFINITIONS

AIRPLANE HANGAR, PRIVATE: a hangar for the storage of four (4) or less single motor planes and in which no volatile or flammable oil is handled, stored or kept other than that contained in the fuel storage tank of the plane.

-PUBLIC: a building for the storage, care or repair of private or commercial airplanes not included in the term "private airplane hangar."

EXITWAY DISCHARGE COURT: an exterior unoccupied space which is open to the sky for its entire area, located on the same lot with a theatre or other assembly building which it serves exclusively as an unobstructed passageway to the street or other public space.

FLAMMABLE: Subject to easy ignition and rapid flaming combustion.

FOYER: the enclosed space surrounding or in the rear of the auditorium of a theatre or other place of assembly which is completely shut off from the auditorium and is used as an assembly or waiting space for the occupants.

FUEL OIL: a liquid mixture or compound derived from petroleum which does not emit flammable vapor below a temperature of one hundred and twenty-five (125) degrees F. in a Tag closed-cup tester.

GARAGE, PRIVATE: a garage for four (4) or less passenger motor vehicles with no provision for repairing or servicing such vehicles for profit.

GARAGE, PUBLIC: a building or structure for the storage or parking of more than four (4) passenger motor vehicles, or more than one (1) commercial motor vehicle, and in which provision may be made for the dispensing of gasoline, oil or similar products for the servicing of such vehicles. Public garages shall be classified according to their specific use in one (1) of the following groups:

-GROUP 1: a public garage in which provision is made for the care, storage, repair or painting of motor vehicles.

-GROUP 2: a public garage used exclusively for passenger vehicles that will accommodate not more nine (9) passengers.

GRANDSTAND: any structure, except movable seating and sectional benches, intended primarily to support individuals for the purposes of assembly, but shall not apply to the permanent seating in theatres, churches, auditoriums and similar buildings.

KEROSENE: an oil or liquid product of petroleum which does not emit a flammable vapor below a temperature of one hundred and fifteen (115) degrees F. when tested in a Tag closed-cup tester.

LOBBY: the enclosed vestibule between the principal entrance to the building and the doors to the main floor of the auditorium or assembly room of a theatre or place of assembly or to the main floor corridor of a business building.

MOBILE HOME: a dwelling unit built on a chassis and containing complete electrical, plumbing and sanitary facilities, and designed to be installed on a temporary or permanent foundation for permanent living quarters.

MOTOR FUEL SERVICE STATION: a structure, building or premise or any portion thereof where a flammable fluid is stored, housed or sold for supply to motor vehicles.

MOTOR VEHICLE REPAIR SHOP: a building, structure or enclosure in which the general business of repairing motor vehicles is conducted including a public garage.

PARKING STRUCTURE, OPEN: a structure for the parking of passenger cars wherein two (2) or more sides of such structure are not less than fifty (50) percent open on each floor or level for fifty (50) percent of the distance from the floor to the ceiling and wherein no provision for the repairing of such vehicles is made. Such open parking structures are not classified as public garages, but shall comply with the requirements of section 905.2.

PYROXYLIN PLASTIC: any nitro-cellulose product or compound soluble in a volatile, flammable liquid, including such substances as celluloid, pyroxylin, fiberloid and other cellulose nitrates (other than nitro-cellulose film) which are susceptible to explosion from rapid ignition of the gases emitted therefrom.

STAGE: a partially enclosed portion of an assembly building which is designed or used for the presentation of plays, demonstrations, or other entertainment wherein scenery, drops, or other effects may be installed or used; and where the distance between the top of the proscenium opening and the ceiling of the stage is more than five (5) feet; and the stage extends seventeen (17) feet or more in back of the proscenium arch or there is a gridiron.

TRAVEL TRAILER: a vehicular, portable structure built on a chassis and designed to be used for temporary occupancy for travel, recreational or vacation use; with the manufacturer's permanent identification "Travel Trailer," thereon; and when factory equipped for the road, being of any length provided its gross weight does not exceed forty-five hundred (4500) pounds, or being of any weight provided its overall length does not exceed twenty-eight (28) feet.

## SECTION 402.0 EXPLOSION HAZARDS

Every structure, room or space occupied for uses involving explosion hazards shall be equipped and vented with explosion relief systems and devices arranged for automatic release under predetermined increase in pressure as herein provided for specific uses or in accordance with approved engineering standards and practice.

402.1 VENTING DEVICES: Venting devices to relieve the pressure resulting from explosive air-vapor mixtures shall consist of windows, sky-lights, vent flues or releasing roof or wall panels which discharge directly to the open air or to a public place or other unoc-

cupied space not less than twenty (20) feet in width on the same lot. Such releasing devices shall be so located that the discharge end shall be not less than ten (10) feet vertically and twenty (20) feet horizontally from window openings or means of egress facilities in the same or adjoining buildings or structures. The exhaust shall always be in the direction of least exposure and never into the interior of the building.

402.2 AREA OF VENTS: The aggregate clear vent relief area shall be regulated by the type of construction of the building and shall be not less than herein prescribed:

| | |
|---|---|
| Heavy reinforced concrete frame | 1 sq. ft. for 80 cubic feet of volume |
| Light structural steel frame and ordinary construction | 1 sq. ft. for 65 cubic feet of volume |
| Light wood frame construction | 1 sq. ft. for 50 cubic feet of volume |

In no case shall the combined area of open windows, pivoted sash or wall panels arranged to open under internal pressure be less than ten (10) percent of the area of the enclosure walls, with not less than fifty (50) percent of the opening arranged for automatic release.

402.3 CONSTRUCTION OF VENTS: All explosion relief devices shall be of an approved type constructed of light weight, noncombustible and corrosion-resistive materials, and the discharge end shall be protected with approved screens of not more than three-quarter (3/4) inch mesh, arranged to blow out under relatively low pressures.

SECTION 403.0 VOLATILE FLAMMABLES

403.1 CONTROL OF USE.

403.11 INSIDE STORAGE: Refer to FPR-4, FPR-8, and FPR-13 for requirements.

403.12 HANDLING: Refer to FPR-4 for requirements.

403.13 CONSTRUCTION OF ENCLOSURES: Process rooms shall be separated from other uses and occupancies by walls, floors and ceilings of not less than two (2) hours fireresistance with one and one-half (1½) hour fire doors or the approved labeled equivalent complying with article 9. The interior door openings shall be provided with non-combustible sills not less than six (6) inches high and the room shall be vented as required in section 402. Floors shall be waterproofed and drained to comply with section 871.

403.14 FIRE PROTECTION: First aid fire appliances and automatic sprinklers or other extinguishing equipment shall be provided in accordance with article 12 and the standards listed in the reference standards of this article.

403.2 MAIN STORAGE: Main storage system of volatile flammable liquids shall be constructed and installed in accordance with the applicable standards listed in this article subject to the approval of the fire official. Any tank greater than ten thousand (10,000) gallons capacity shall be subject to the provisions of the Department of Public Safety Board of Boiler Rules. Such storage may be either outside underground, outside aboveground, inside underground, or outside storage house. No above ground bulk storage tank shall be located less than three hundred (300) feet from any assembly buildings (use group F) or institutional (use group H) uses.

403.21 OUTSIDE UNDERGROUND SYSTEM: Outside tanks shall be buried underground below the basement level of adjacent buildings, with the top of the tanks not less than two (2) feet below grade or with a reinforced concrete or other approved structural cover not less than four (4) inches thick and a twelve (12) inch earth cover. The maximum capacity of such tanks shall be limited by their location in respect to adjacent buildings which are not an essential part of the installation and adjacent lot lines as provided in table 4-1.

Table 4-1 - Capacity of Outside Underground Tanks for Volatile Flammable Liquids

| Fire separation in feet | Quantity of storage in gallons |
|---|---|
| 50 | Unlimited |
| 40 | 50,000 |
| 30 | 20,000 |
| 25 | 12,000 |
| 20 | 6,000 |
| 10 | 3,000 |

When within ten (10) feet of any building not an essential part of the installation, and the top of the tank is above the lowest floor of the building, the capacity of the tank shall be not more than five hundred and fifty (550) gallons.

The capacity of storage of combustible liquids other than volatile flammable as herein defined shall be restricted to five (5) times the values specified in table 4-1.

403.22 OUTSIDE ABOVEGROUND SYSTEM: Above ground tanks shall be located only outside the fire limits; and the capacity, location, construction and exposures shall be subject to special approvals of the building official and the fire official; but in no case shall the fire separation be less than specified in table 4-2. Tanks in excess of ten thousand (10,000) gallon capacity shall be subject to the Department of Public Safety Board of Boiler Rules.

403.23 INSIDE UNDERGROUND SYSTEM: Inside underground tanks shall be located not less than two (2) feet below the level of the lowest floor of the building in which located or any other building within a radius of ten (10) feet of the tank. In no case shall such tanks be located under the sidewalk or beyond the building line. It shall be unlawful to cover any tanks from sight until after inspection and test and written approval of the building official.

Table 4-2 - Capacity of Outside Aboveground Tanks for Volatile Flammable Liquids

| Fire seperation in feet | Quantity of Storage in gallons |
|---|---|
| 50..... | 50,000 |
| 40..... | 30,000 |
| 30..... | 24,000 |
| 20..... | 12,000 |

The maximum limit of individual tank capacity shall be not more than five hundred and fifty (550) gallons and the entire system shall be subject to special approval of the building and fire officials.

403.24 OUTSIDE STORAGE HOUSE: All outside storage houses shall be constructed of noncombustible (type 2) construction or better. No opening shall be permitted in the enclosure walls within eleven (11) feet of adjoining property lines or with a fire exposure of less than eleven (11) feet from any building or structure not part of the installation.

403.25 SPECIAL RESTRICTIONS: The building official may require greater fire separations or he may limit storage capacities under severe exposure hazard conditions when necessary for public safety.

SECTION 404.0 EXISTING BUILDINGS

404.1 SPECIAL PERMIT FOR EXISTING USES: Any existing hazardous use which was heretofore authorized by a permit issued under the provisions of law or the regulations of the fire official may be continued by special permit provided the continuance of such use or occupancy does not endanger the public safety.

404.2 EXISTING USE PROHIBITED: No existing building of frame (type 4) construction which is more than two (2) stories in height or more than five thousand (5000) square feet in area shall be continued in use or hereafter occupied for any use which represents an exceptional hazard with respect to fire or explosion.

404.3 PLACES OF ASSEMBLY.

404.31 CHANGE OF USE: No existing building or structure or part thereof shall be altered or converted into a place of assembly unless it complies with all provisions of this Code applicable to places of public assembly hereafter erected.

404.32 EXISTING USE ALTERED: When an existing building or structure heretofore used as a place of public assembly is altered and the cost of such alteration is more than fifty (50) percent of the physical value of the building as defined in section 106.5, all provisions of this Code relating to new places of public assembly shall be complied with. When the cost of such alteration is less than fifty (50) percent of the physical value of the building, such alterations shall comply as nearly as is practicable with the provisions of this Code which govern the arrangement and construction of seats, aisles, passageways, stage and appurtenant rooms, fire-fighting and extinguishing equipment and the adequacy of means of egress.

404.33 INCREASE OF OCCUPANCY LOAD: Whenever the occupancy load of an existing place of public assembly is increased beyond the approved capacity of its exitways, the building or parts thereof shall be made to comply in all respects with the requirements for a new building hereafter erected for such public assembly use.

SECTION 404.4 SWIMMING POOLS

404.41 CHANGE OF USE: No existing pool used for swimming or bathing or accessory equipment of part thereof shall be altered or converted for any other use unless it complies with all provisions of this Code applicable to the use intended.

404.42 CONTINUATION OF EXISTING USE: Existing swimming pools may be continued without change, provided the safety requirements are observed where required by the building official.

SECTION 405.0 LIQUEFIED PETROLEUM GASES

The provisions of this section shall apply to the design, construction, location, installation and operation of propane, butane and other petroleum gases, normally stored in the liquid state

under pressure for use in all buildings and structures. Refineries, tank farms and utility gas plants shall be subject to special approvals in accordance with accepted engineering practice as defined in the reference standards of this article.

405.1 THE COMMONWEALTH OF MASSACHUSETTS REGULATIONS: The design, construction, location, installation and operation of facilities for propane, butane and other petroleum gases, normally stored in the liquid state under pressure for use in all buildings and structures shall be in conformance with the Massachusetts State Fire Prevention Regulations, FPR-5; the Department of Public Safety Board of Boiler Rules; and other standards listed in the reference standards of this article.

## SECTION 406.0 PYROXYLIN PLASTICS

The provisions of this section, including the reference standards of this article shall regulate all buildings, structures and parts thereof used for the storage, handling or fabrication of pyroxylin plastics permitted by Massachusetts law whether as raw material, process, finished product or scrap.

406.1 EXCEPTIONS: The provisions of this section shall not apply to the manufacture, use or storage of nitro-cellulose film or the incidental storage of articles manufactured from pyroxylin plastics offered for sale in mercantile buildings. (See section 205.)

406.2 RESTRICTIONS: No permit for the storage or manufacture of pyroxylin plastics, except as specified in section 406.1, shall be issued for a building or structure hereafter erected, altered or used which is occupied or located as follows:

406.21 PLACE OF ASSEMBLY: Within fifty (50) feet of the nearest wall of a school, theatre or other place of public assembly;

406.22 RESIDENTIAL BUILDING: As a residential building, use groups L-1, L-2 or L-3;

406.23 HIGH HAZARD USES: In quantities exceeding one thousand (1000) pounds in buildings where paints, varnishes or lacquers are manufactured, stored or kept for sale; or where matches, resin, oils, hemp, cotton or any explosives are stored or kept for sale;

406.24 OTHER FLAMMABLE MATERIALS: Where drygoods, garments or other materials of a highly flammable nature are manufactured in any portion of the building above that used for nitro-cellulose products;

406.25 TENANT FACTORY BUILDING: In quantities exceeding one hundred (100) pounds in any tenant factory building (use Group D) in which more than five (5) people are employed or likely to congregate on one floor at any one time.

406.3 INSIDE STORAGE: All pyroxylin raw material and products intended for use in further manufacture shall be stored as herein provided:

406.31 CABINETS: Quantities of more than twenty-five (25) pounds and not more than five hundred (500) pounds shall be stored in approved cabinets constructed of noncombustible materials but in no case shall the total quantity of storage be more than one thousand (1000) pounds in any workroom or space enclosed in floors, walls and ceilings of not less than two (2) hours fireresistance;

406.32 VAULTS: Quantities of more than one thousand (1000) pounds and not more than ten thousand (10,000) pounds shall be stored in vaults enclosed in floors, walls and ceilings of not less than four (4) hours fireresistance. The interior storage volume of the vault shall be not more than fifteen hundred (1500) cubic feet and the vault shall be constructed vapor and gastight in accordance with the approved rules, with one and one-half (1½) hour vapor-tight fire doors or the approved labeled fire door assembly equivalent on each side of the door opening. The vault shall be drained and provided with scuppers.

406.33 TOTE BOXES AND SCRAP CONTAINERS: During manufacture, pyroxylin materials and products not stored in finished stock rooms, cabinets or vaults shall be kept in approved covered noncombustible tote boxes. Scrap and other refuse material shall be collected in approved noncombustible containers in quantities not greater than three hundred and fifty (350) pounds and removed at frequent intervals as directed by the building official with the approval of the fire official;

406.34 VENTILATION: Each separate compartment in storage vaults shall be vented directly to the outer air through flues complying with the requirements of article 10 for low temperature chimneys, or exterior metal smokestacks, or as otherwise provided in the approved rules. The vent shall discharge not less than four (4) feet above the roof of the building or on a street, court or other open space not less than fifty (50) feet distant from any other opening in adjoining walls which are not in the same plane, nor nearer than twenty-five (25) feet vertically or horizontally to an exterior stairway, fire escape or exitway discharge. The area of the vent shall be not less than one (1) square inch for each seven (7) pounds of pyroxylin stored;

406.35 STRUCTURAL STRENGTH: The floors, walls, roof and doors of all vaults, structures or buildings used for the storage or manufacture of pyroxylin materials and products shall be designed to resist an inside pressure load of not less than three hundred (300) pounds per square foot;

406.36 FIRE PROTECTION: Vaults located within buildings for the storage of raw pyroxylin shall be protected with an approved automatic sprinkler system capable of discharging one and sixty-six one-hundredths (1.66) gallons per minute per square feet over the area of the vault.

406.4 ISOLATED STORAGE BUILDINGS: Pyroxylin products in quantities greater than permitted for interior storage shall be housed in isolated storage buildings. Such buidings shall be used for no purpose other than packing, receiving, shipping and storage of pyroxylin plastics unless otherwise approved by the building official.

406.41 CAPACITY: The maximum storage in any fire area enclosed in construction of four (4) hours fireresistance shall be not greater than one hundred thousand (100,000) pounds. The storage capacity of the building and its separation from lot lines and other buildings on the same lot shall be limited as provided in table 4-3. When equipped with an approved automatic sprinkler system complying with the provisions of article 12 and as herein modified, the exposure distances may be decreased fifty (50) percent. Such systems shall be provided with not less than one (1) automatic sprinkler head for each thirty-two (32) square feet of protected area.

Table 4-3 - Exposure Distance for Pyroxylin Storage Buildings

| Maximum quantity stored in pounds | Fire separation from lot line or other buildings in feet |
|---|---|
| 1,000 | 40 |
| 2,000 | 50 |
| 3,000 | 60 |
| 4,000 | 70 |
| 5,000 | 80 |
| 10,000 | 100 |
| 20,000 | 125 |
| 30,000 | 150 |
| 40,000 | 160 |
| 50,000 | 180 |
| 75,000 | 200 |
| 100,000 | 225 |
| 150,000 | 250 |
| 300,000 | 300 |

406.5 FIRE PROTECTION.

406.51 HEATING EQUIPMENT: All radiators, heating coils, piping and heating apparatus shall be protected with approved noncombustible mesh to maintain a clearance of six (6) inches of all pyroxylin products from such equipment. All piping and risers within six (6) feet of the floor shall be insulated with approved noncombustible covering unless protected with wire guards.

406.52 LIGHTING CONTROL: All lighting shall comply with the provisions of section 400.5 and shall be controlled from panel boards located outside of storage compartments and vaults.

406.53 STANDPIPES: First-aid standpipes shall be provided for each five thousand (5000) square feet of floor area equipped with one and one-half (1½) inch hose, complying with article 12.

406.54 AUTOMATIC SPRINKLERS: All manufacturing and storage spaces and vaults where required shall be protected with an approved automatic sprinkler system as herein specified and with fire pails and portable fire extinguishers complying with article 12.

406.55 SPECIAL PROTECTION: Special chemical extinguishers and other first aid fire appliances shall be provided around motors and other electrical equipment in accordance with the approved rules.

SECTION 407.0 USE AND STORAGE OF FLAMMABLE FILM

407.1 PERMIT REQUIRED: No permit for handling, use, storage or recovery of flammable film shall be issued for any building located as specified in section 406.2; except that those restrictions shall not apply to the screening and projection rooms of theatres and other places of amusement or instruction. It shall be unlawful to store, stock or use any nitro-cellulose or other flammable film in quantities of more than two thousand (2000) feet in length or more than ten (10) pounds in weight unless approved by the fire official. All installations shall comply with the applicable standards listed in the reference standards of this article.

407.2 STORAGE: Other than motion picture projection and rewind rooms, or as herein specifically exempted, all rooms in which flammable film is stored or handled shall be enclosed in not less than two (2) hour fireresistive construction complying with the provisions of article 9. All film, except when in process or use, shall be kept in approved closed containers.

407.21 CABINETS: Flammable film in amounts of twenty-five (25) to one thousand (1000) pounds shall be stored in approved noncombustible cabinets constructed and vented in accordance with the approved rules. No one cabinet shall contain more than three hundred and seventy-five (375) pounds. All cabinets with a capacity of more than seventy-five (75) pounds shall be equipped with not less than one (1) automatic sprinkler head.

407.22 VAULTS: Flammable film in amounts greater than one thousand (1000) pounds shall be kept in vaults constructed as provided in section 406; except that the interior storage volume shall not exceed seven hundred and fifty (750) cubic feet.

407.23 ROOMS: Unexposed film may be stored in the original approved shipping cases complying with the rules of the Interstate Commerce Commission in rooms equipped with an approved one-source sprinkler system complying with the provisions of section 406.36.

407.24 VENTILATION: Storage rooms shall be ventilated as specified in section 406.34 with the vents arranged to open automatically in the event of fire, in accordance with the approved rules.

407.25 LIGHTING: Artificial illumination shall comply with section 400.5 except that other approved forms of lights may be used in film studios.

407.26 HEATING: All heating equipment and installations shall conform to the requirements of section 406.51. The duct systems of warm air heating and air conditioning systems shall comply with article 18, and shall be protected with automatic fire dampers to cut off all rooms in which film is handled from all other rooms and spaces in the building. The heating of film vaults shall be automatically controlled to a maximum temperature of seventy (70) degrees F.

407.27 FIRE PROTECTION: Approved automatic sprinkler systems shall be provided in all buildings and structures and parts thereof in which flammable film is stored or handled in amounts of more than fifty (50) pounds and as herein specifically required, except in projection booths and rewind rooms conforming to the requirements of section 407.3 and 407.4.

407.3 PROJECTION ROOMS: Every room for the use and operation of motion picture projectors hereafter installed as an integral part of a building shall be enclosed in walls, floor and ceiling of approved noncombustible materials and construction, as herein provided.

407.31 CONSTRUCTION OF PROJECTION ROOMS: The size of the room shall be adequate to accommodate the apparatus and equipment and permit manual operation, but in no case less than forty-eight (48) square feet in area and seven (7) feet in height for one projector and twenty-four (24) square feet for each additional machine. The enclosure shall be constructed smoke and vapor-tight of not less than two (2) hour fireresistance. Observation and projector openings shall in no case exceed twelve (12) inches in any dimension and shall be equipped with automatic metal, or other approved noncombustible shutters capable of auxiliary manual operation from the outside.

407.32 MEANS OF EGRESS FROM PROJECTION ROOMS: At least two (2) means of egress shall be provided, equipped with three-quarter (3/4) hour self-closing fire doors, or their approved labeled equivalent, opening outwardly, not less than two and one-half (2½) feet by six (6) feet in size, unless otherwise approved by the building official.

407.33 VENTILATION OF PROJECTION ROOMS: Ventilation shall be provided by an approved mechanical system of ventilation, exhausting either directly to the outdoors or through a noncombustible flue, which shall be used for no other purpose. The exhaust capacity shall be not less than fifteen (15) cubic feet nor more than fifty (50) cubic feet per minute for each arc lamp, plus two hundred (200) cubic feet per minute for the volume of the room. The ventilation system may be extended to serve rewind rooms associated therewith, but shall not be connected in any way with ventilating or air conditioning systems serving other portions of the building. All ventilating flues shall be constructed and installed to comply with article 18. All fresh air intakes other than direct open air supply shall be protected with fire shutters arranged to operate automatically with the port shutters.

407.34 LIGHTING CONTROL: Provision shall be made for control of the auditorium lighting and the emergency lighting systems of theatres from inside of the booth and from at least one other convenient point in the building as required in section 416.8.

407.35 ELECTRICAL EQUIPMENT: Separate compartments of similar construction to the projection booth shall be provided for storage batteries and motor generators, respectively. Ventilation shall be provided for such compartments; ventilation for the motor compartment being independent of any other system. The duct from such compartments leading to outdoors shall be constructed of approved acid-resisting noncombustible material.

407.36 FILM CAPACITY: The film storage capacity of each projection or rewind room shall be not more than one hundred and twenty-five (125) pounds.

407.4 REWIND AND AUXILIARY ROOMS: Rewinding of film shall be done in the booth in accordance with the approved standards or in a special rewind room not less than eighty (80) square feet in area constructed as provided in this section for the projection room. Special auxiliary rooms may be provided for film storage of not more than one hundred and twenty-five (125) pounds capacity; but the total storage capacity of projection, rewind and auxiliary rooms shall be not more than two hundred and fifty (250) pounds.

407.41 TOILET: A toilet room with approved toilet facilities shall be connected directly with the projection booth.

407.5 TRIAL EXHIBITION ROOMS: Preview rooms shall provide a seating capacity of not more than one hundred (100) persons, with not less than two (2) approved means of egress complying with article 6. Such rooms shall be enclosed in three-quarter (3/4) hour fireresistive partitions with self-closing fire doors or their approved labeled equivalent at the openings. All seats shall be permanently fixed in position and the arrangement shall comply with the requirements of section 416.3.

407.6 TEMPORARY MOTION PICTURE INSTALLATIONS: Temporary motion picture installations shall require a building permit from the building official and shall be of approved construction.

407.7 MOTION PICTURE STUDIOS.

407.71 CONSTRUCTION: All buildings designed or used as motion picture studios shall be protected with an approved two-source automatic sprinkler system complying with the provisions of article 12; except that the building official may exempt rooms designed for housing electrical equipment from this requirement when constructed of fireproof (type 1) construction.

407.72 SPECIAL ROOMS: Rooms and spaces used as carpenter and repair shops, dressing rooms, costume and property stage rooms shall be enclosed in floors, walls and ceilings of not less than two (2) hour fireresistive construction.

407.73 TRIM, FINISH AND DECORATIVE HANGINGS: All permanently attached acoustic, insulating and light reflecting materials and temporary hangings on walls and ceilings shall comply with the requirements of article 9.

407.74 FILM STORAGE: All film shall be stored as required in section 407.2 and no surplus film shall be kept on the studio stage except loaded magazines in the cameras and sound recording apparatus. All extra loaded magazines shall be stored in a separate magazine room enclosed in two (2) hour fireresistive construction.

407.8 FILM LABORATORIES: No film laboratories shall be conducted in other than fireproof (type-A) buildings or structures, equipped throughout with an approved automatic sprinkler system.

407.9 FILM EXCHANGES: All film exchanges and depots shall be housed in buildings and structures of fireproof (type 1-A) construction equipped throughout with an approved automatic sprinkler system. All flammable film other than that in process of receipt, delivery or distribution shall be stored in vaults complying with the requirements of section 406.32.

SECTION 408.0 USE AND STORAGE OF COMBUSTIBLE FIBERS

The provisions of this section shall apply to all buildings and structures involving the storage or use of finely divided combustible vegetable or animal fibers and thin sheets or flakes of such materials involving a flash fire hazard, including among others cotton, excelsior, hemp, sisal, jute, kapok and paper and cloth in the form of scrap and clippings in excess of one thousand (1000) pounds. All such uses shall be subject to the Massachusetts State Fire Prevention Regulations, FPR-13, and the following provisions:

408.1 CONSTRUCTION REQUIREMENTS: All buildings designed for the storage of combustible fibers as herein described shall be constructed within the limits of height and area specified in table 2-6 for high hazard use (use group A) except as follows:

408.11 SPECIAL LIMITS: No single storage room or space shall be more than twelve hundred and fifty (1250) square feet in area or more than twelve thousand five hundred (12,500) cubic feet in volume unless of protected noncombustible (type 2-B) or better construction;

408.12 FLOOR LOADS: The floors of all buildings designed for the storage of combustible fibers shall not be loaded in excess of one-half (½) the safe load capacity of the floor, nor shall such materials be piled to more than two-thirds (2/3) of the clear story height;

408.13 SALVAGE DOORS: Every exterior wall shall be provided with a door to each storage compartment arranged for quick removal of the contents;

408.14 WALL OPENINGS: All openings in outside walls shall be equipped with approved fire doors and fire windows complying with article 9;

408.15 ROOF OPENINGS: All skylights, monitors and other roof openings shall be protected with galvanized wire or other approved corrosion-resistive screens with not less than thirty-six (36) meshes to the square inch or with wired glass in stationary frames;

408.16 BOILER ROOMS: All power and heating boilers and furnaces shall be located in detached boiler houses or in a segregated boiler room enclosed in three (3) hour fireresistive construction with direct entrance from the outside, except that rooms containing gas-fired heating equipment may have openings into the warehouse protected with one and one-half (1½) hour fire doors or their approved labeled equivalent.

408.2 FIRE PROTECTION: Fire-extinguishing equipment shall be provided complying with article 12 consisting of casks, pails and portable chemical extinguishers and standpipes. Where deemed necessary by the fire official, a system of outside hydrants and hose shall be provided.

408.3 OPEN STORAGE: Only temporary open storage of combustible fibers shall be permitted on the same premises with a fiber warehouse and shall be kept covered on top and sides with tarpaulins secured in place. Not more than seven thousand two hundred (7200) cubic feet of fiber shall be stored in the open; and fire-extinguishing equipment shall be provided as directed by the fire official.

408.4 SPECIAL TREATMENTS: When combustible fibers are packed in special noncombustible containers or when packed in bales covered with wrappings to prevent ready ignition, or when treated by approved chemical dipping or spraying processes to eliminate the flash fire hazard, the restictions governing combustible fibers shall not apply.

## SECTION 409.0 COMBUSTIBLE DUSTS, GRAIN PROCESSING AND STORAGE

The provisions of this section shall apply to all buildings in which materials producing flammable dusts and particles which are readily ignitable and subject to explosion hazards are stored or handled, including among others, grain bleachers and elevators, malt houses, flour, feed or starch mills, wood flour manufacturing and manufacture and storage of pulverized fuel and similar uses. The applicable standards listed in the reference standards of this article, except as herein specifically required, shall be deemed to conform to the requirements of the Basic Code.

409.1 CONSTRUCTION REQUIREMENTS.

409.11 BUILDINGS: All such buildings and structures, unless herein otherwise specifically provided, shall be of fireproof (type 1), noncombustible (type 2), or of laminated planks or lumber sizes qualified for heavy timber mill (type 3-A) construction, within the height and area limits of high hazard uses (use group A) of table 2-6, except that when erected of fireproof (type 1-A) construction, the height and area of grain elevators and similar structures shall be unlimited, and when of heavy timber (type 3-A) construction, the structure may be erected to a height of sixty-five (65) feet; and except further that in isolated areas, the height of type 3-A structures may be increased to eighty-five (85) feet.

409.12 GRINDING ROOMS: Every room or space for grinding or other operations producing flammable dust shall be enclosed with floors and walls of not less than two (2) hour fireresistance when the area is not more than three thousand (3000) square feet and of not less than four (4) hour fireresistance when the area is greater than three thousand (3000) square feet.

409.13 CONVEYORS: All conveyors, chutes, piping and similar equipment passing through the enclosures of such rooms or spaces shall be constructed dirt and vapor tight, of approved noncombustible materials complying with Massachusetts State Electrical Code.

409.2 EXPLOSION RELIEF: Means for explosion relief shall be provided as specified in section 402, or such spaces shall be equipped with the equivalent mechanical ventilation complying with article 18.

409.3 GRAIN ELEVATORS: Grain elevators, malt houses and buildings for similar uses shall not be located within thirty (30) feet of interior lot lines or structures on the same lot, except when erected along a railroad right of way.

409.4 COAL POCKETS: Coal pockets located less than thirty (30) feet from interior lot lines or structures on the same lot shall be constructed of not less than protected noncombustible (type 2-A) construction. When more than thirty (30) feet from interior lot lines, or erected along a railroad right of way, such structures may be built of lumber sizes qualifying for heavy timer or laminated construction, provided they are not more than sixty-five (65) feet in height.

## SECTION 410.0 PAINT AND SPRAY BOOTHS

The provisions of this section shall apply to the construction, installation and use of buildings and structures or parts thereof for the spraying of flammable paints, varnishes and lacquers or other flammable materials, mixtures or compounds used for painting, varnishing, staining of similar purposes. All such construction and equipment shall comply with the approved rules and the applicable standards listed in the reference standards of this article.

410.1 LOCATION OF SPRAYING PROCESSES: Such processes shall be conducted in a spraying space, spray booth, spray room or shall be isolated in a detached building or as otherwise approved by the building official in accordance with accepted engineering practice.

410.2 CONSTRUCTION.

410.21 SPRAY SPACES: All spray spaces shall be ventilated with an approved exhaust system to prevent the accumulation of flammable mist or vapors. When such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of fire.

410.22 SPRAY BOOTHS: All spray booths shall be constructed of approved noncombustible materials equipped with mechanical ventilating systems.

410.23 SPRAY ROOMS: All spray rooms shall be enclosed in partitions of not less than three-quarter (3/4) hour fireresistance. Floors shall be waterproofed and drained in an approved manner. Floor drains to the building drainage system and the public sewer shall be prohibited.

410.24 STORAGE ROOMS: Spraying materials in quantities of not more than twenty (20) gallons may be stored in approved cabinets ventilated at top and bottom, when in quantities of more than twenty (20) gallons and not more than one hundred (100) gallons, they may be stored in approved double-wall noncombustible cabinets vented directly to the outer air; and all spraying materials in quantities of more than one hundred (100) gallons shall be stored in an enclosure of not less than two (2) hour fireresistance or in a separate exterior storage building. In no case shall such storage be in quantities of more than two hundred and fifty (250) gallons, except when stored in isolated storage buildings; and except further that not more than twenty-five (25) gallons of spraying material shall be stored in buildings in which exceptionally highly combustible materials are manufactured or stored.

410.3 VENTILATION OF SPRAYING PROCESSES: The ventilation system shall comply with the provisions of section 402 and shall be adequate to exhaust all vapors, fumes and residue of spraying material directly to the outer air. Fresh air shall be admitted to the spraying spaces in an amount equal to the capacity of the fan in such manner as to avoid short-circuiting the path of air in the working space and to provide air movement with a velocity of not less than one hundred (100) feet per minute at the face of the spray booth. All ducts and vents shall be constructed and installed to comply with sections 1017 and 1117 and article 18. Unless equipped with approved explosion-proof motors with nonferrous blade fans, the mechanical exhaust equipment shall be located outside of spray spaces. Make-up air shall be supplied from a point outside the spraying or dipping space such that it will be uncontaminated by the process exhaust fumes.

410.31 VENTILATING: Ventilating ducts shall run directly to the outer air and be protected with a hood against the weather. Such ducts shall not terminate within ten (10) feet horizontally of any chimney outlet, or within twenty (20) feet of any exit or any opening in an adjoining wall.

410.32 The exhaust system for any spraying, dipping or drying space shall not be connected to any other ventilating system or be discharged into a chimney or flue used for the purpose of conveying gases of combustion.

410.4 ELECTRICAL EQUIPMENT: Artificial lighting and electric equipment shall comply with section 400.5.

410.5 FIRE PROTECTION: Sprinkler heads shall be provided in all spray, dip and immersing spaces and storage rooms and shall be installed in accordance with accepted engineering practice and the standards listed in the reference section of article 12. Where buildings containing spray areas are not equipped with an approved automatic sprinkler system, the sprinkler heads in booths and other spray areas and storage rooms may be supplied from the building water supply when approved by the building official, to comply with the provisions of section 1213 for partial sprinkler systems.

## SECTION 411.0 DRY CLEANING ESTABLISHMENTS

Before any dry cleaning plant is constructed or an existing plant is remodeled or altered, complete drawings shall be filed showing to scale the relative location of the dry cleaning area, the boiler room, finishing department, solvent storage tanks, pumps, washers, drying tumblers, extractors, filter traps, stills, piping and all other equipment involving the use of flammable liquid solvents. All dry cleaning by immersion and agitation shall be carried on in closed machines, installed and operated in accordance with the approved rules and the applicable standards listed in the reference standards of this article.

411.1 CLASSIFICATION: For the purpose of the Basic Code, all dry cleaning and dry dyeing establishments shall be classified as follows:

411.11 HIGH HAZARD: All such establishments shall be classified as high hazard which employ gasoline or other solvents having a flash point below seventy-five (75) degrees F. (Tag. closed-cup) in quantities of more than three (3) gallons, or more than sixty (60) gallons of flammable solvents with a flash point between seventy-five (75) and one hundred and forty (140) degrees F. (Tag. closed-cup).

411.12 MODERATE HAZARD: All such establishments employing less than three (3) gallons of volatile flammables with a flash point of less than seventy-five (75) degrees F. or less than sixty (60) gallons of solvent with a flash point between seventy-five (75) and one hundred and forty (140) degrees F. (Tag. closed-cup) shall be classified as moderate hazard.

411.13 LOW HAZARD: All such establishments using solvents of other than volatile flammable liquids or solvents with a flash point more than one hundred and forty (140) degrees F. (Tag. closed-cup) in cleaning and dyeing operations shall be classified as low hazard.

411.2 CONSTRUCTION OF DRY CLEANING PLANTS

411.21 HIGH HAZARD: The construction of new high hazard dry cleaning plants, and the installation of high hazard dry cleaning establishments in new locations shall be prohibited.

411.22 MODERATE HAZARD: Moderate hazard dry cleaning plants as herein defined may be located in buildings or structures of any type of construction other than frame (type 4) buildings subject to the fire district limitations of article 3 and the height and area limitations for high hazard buildings (use group A) of table 2-6. The room or space in which such operations are conducted shall be enclosed in not less than two (2) hour fireresistive construction with not less than two (2) means of egress from each dry cleaning or dry dyeing room or space.

411.23 LOW HAZARD: Low hazard dry cleaning plants shall not be restricted as to type of building construction within the height and area limitations for use group E of table 2-6; except that such uses shall not be located in basements nor in a building used for public assembly (use group F) or institutional (use group H) purposes.

411.24 ROOF CONSTRUCTION OF DRY CLEANING PLANTS: The roof over high hazard dry cleaning plants shall be flat without attic or concealed spaces and shall be provided with a pivot type skylight or other approved vent complying with section 402, arranged to release outwardly under explosion pressures.

411.25 FLOOR CONSTRUCTION OF DRY CLEANING PLANTS: The floor finish in high hazard dry cleaning plants shall be constructed of impervious noncombustible materials with nonsparking surfaces. There shall be no openings, vaults or pits below the floor.

411.26 EXTERIOR WALLS OF DRY CLEANING PLANTS: Exterior walls of high hazard dry cleaning plants having a fire separation of less than thirty (30) feet shall be solid masonry without openings, but in no case shall more than two (2) sides of the building be enclosed in blank walls. Opening protectives of exterior doors and windows shall have not less than three-quarter (3/4) hour fireresistance or the labeled equivalent construction, and the windows shall be pressure-releasing to comply with section 402.

411.27 BASEMENTS OF DRY CLEANING PLANTS: The basements of all buildings in which high or moderate hazard dry cleaning establishments are conducted shall be completely separated from the superstructure with unpierced floor construction of not less than two (2) hours fireresistance. The access to such basements shall be from the exterior only.

411.3 BOILER ROOM SEPARATION: Boiler rooms and heating equipment for moderate hazard dry cleaning plants shall be separated from drying room, dry cleaning and dry dyeing rooms with unpierced walls of not less than two (2) hours fireresistance; or such boiler rooms shall be located in a separate building.

411.4 VENTILATION: Mechanical ventilation systems in moderate hazard plants shall be adequate to effect ten (10) complete air changes per hour, low hazard dry cleaning establishments shall be provided with mechanical ventilation adequate to effect four (4) complete air changes per hour. Exhaust of all process fumes shall be directly to the outside air.

411.5 SOLVENT STORAGE: All volatile flammable solvents with a flash point under seventy-five (75) degrees F. (Tag. closed-cup) shall be stored underground in accordance with the provisions of section 403. Interior aboveground storage shall be permitted for solvents with a flash point above seventy-five (75) F. (Tag. closed-cup) provided the ag-

gregate quantity of such solvent in use in the system and in storage is not more than five hundred and fifty (550) gallons and the capacity of any individual tank is not more than two hundred and seventy-five (275) gallons.

411.6 ELECTRIC WIRING AND EQUIPMENT: All electrical equipment and wiring shall conform to the requirements of the Massachusetts State Electrical Code for hazardous locations; and the cylinders and shells of all washing machines, drying tumblers, drying cabinets, extractors, and all aboveground storage containers shall be grounded as therein required.

411.7 FIRE PROTECTION: Every dry cleaning room and dry dyeing room employing high and moderate hazard solvents shall be protected with a fire-extinguishing system consisting of approved automatic sprinklers, manually controlled steam-blankets, carbon dioxide flooding systems or other approved fire-extinguishing equipment.

## SECTION 412.0 PRIVATE GARAGES

412.1 ATTACHED GARAGES.

412.11 ONE AND TWO-FAMILY DWELLINGS: Private garages, wherever attached or adjoining a one or two-family dwelling, shall have a fireresistance rating of not less than three-quarter (3/4) hours. The sills of any door communicating with the dwelling shall be raised at least four (4) inches above the garage floor. The doors shall be three-quarter (3/4) hour fire doors complying with article 9 or one and three-quarter (1-3/4) inch solid core wood door.

412.12 MOTELS AND MULTI-FAMILY DWELLINGS: Private garages located above or beneath motels and multi-family dwellings and in which no gasoline or oil is stored or handled shall be of protected construction of not less than two (2) hour fireresistance.

412.13 OTHER CONDITIONS: All private garages not falling within the purview of sections 412.11 and 412.12 attached to or located beneath a building shall comply with the requirements of section 413.13 for public garages.

412.2 MEANS OF EGRESS: Where living quarters are located above a private garage, required means of egress facilities shall be protected from the garage area with three-quarter (3/4) hour fireresistive construction.

## SECTION 413.0 PUBLIC GARAGES

Public garages shall comply with the applicable requirements of the following sections. The portions of such buildings and structures in which gasoline, oil and similar products are dispensed shall comply

with the requirements of section 414; the portions in which motor vehicles are repaired shall comply with section 415; and the portions in which paint spraying is done shall comply with the requirements of section 410. All garages shall be subject to the provisions of FPR-4.

413.1 CONSTRUCTION: All group one (1) public garages hereafter erected shall be classified as storage buildings, moderate hazard (use group B-1) and all group two (2) public garages shall be classified as storage buildings, low hazard (use group B-2) and shall be located on the grade floor and shall comply with the requirements of section 414.

413.11 SPECIAL HEIGHT LIMITATIONS: Public garage buildings shall comply with the height and area limitations of table 2-6 for the classification of the use as specified in section 413. Such heights may be increased one (1) additional story when the building is equipped with an approved sprinkler system.

413.12 BASEMENTS: The first floor construction of public garages of all classifications and public hangars with basements shall be water and vapor proof. Where openings are provided in the floor they shall be protected by a curb or ramp not less than six (6) inches high above the floor to avoid the accumulation of explosive liquids or vapors and prevent them from spilling to the lower floor. There shall be not less than two (2) means of egress from such areas, one of which shall be directly to the outside independent of the exitways serving other areas of the building.

413.13 MIXED OCCUPANCY: No public garage shall be located within or attached to a building occupied for any other use, unless separated from such use by walls or floors complying with table 9-1 for fireresistance. Such fire division shall be continuous and unpierced by openings; except that door openings equipped with self-closing fire doors complying with article 9 shall be permitted. In buildings of single occupancy not excluding the area limitations of table 2-6 doors without fireresistance shall be permitted between the garage area and salesroom or offices that are operated in connection with the garage.

413.14 ROOF STORAGE OF MOTOR VEHICLES AND AIRPLANES: The roof of a public garage shall not be used for the parking or storage of motor vehicles unless the building is of construction type 1A, 1B, or 2A. When the roof of a building is used for parking or storage of motor vehicles, it shall be provided with a parapet wall or guard rail not less than three (3) feet six (6) inches in height and a wheel guard not less than six (6) inches in height, located so as to prevent any vehicle from striking the parapet wall or guard rail. The use of roofs for airplane storage and landing shall be subject to the approval of the Civil Aeronautics Authority.

413.15 FLOOR CONSTRUCTION AND DRAINAGE: Floors of public garages and airplane hangars shall be graded to drain through oil separators or traps to avoid accumulation of explosive vapors in building drains or sewers as provided in the Massachusetts State Plumbing Code. The floor finish shall be of concrete or other approved nonabsorbent noncombustible material.

413.2 VENTILATION: All public garages and airplane hangars shall be provided with mechanical or natural ventilation adequate to prevent the accumulation of carbon monoxide or exhaust fumes in excess of one (1) part in ten thousand (10,000) (.01 percent) explosive limit. The building official may require a test by a qualified testing laboratory to determine the adequacy. The cost of such test shall be borne by the owner. The building official may require certification of the adequacy of the system by a qualified registered professional engineer.

413.21 BELOW GRADE: Public garages below grade shall be equipped with mechanical ventilation adequate to provide the ventilation required under section 413.2. The ventilation system shall be operated at all times the garage areas are occupied by human beings.

413.22 REPAIR SHOPS OR ROOMS: Products of combustion from internal combustion engines shall be collected directly from the exhaust and discharged directly to the outside air by means of a positive induced draft. The discharge from such system shall be located so as not to create a hazard to adjoining properties, but not less than eight (8) feet above the adjacent ground level on the exterior of the building and shall discharge into a yard or court. When necessary to discharge across a walkway or private thoroughfare, the discharge opening shall be carried to a height of not less than twenty-five (25) feet above the ground level or to a distance four (4) inches above the highest point of the wall of the building or structure on which it is located.

413.23 PITS: No pits shall be installed in floors below the first; and pits in first and upper stories shall be provided with mechanical ventilation adequate to provide the ventilation required under section 413.2. The ventilation system shall be operated at all times the pits are occupied by human beings.

413.3 SPECIAL HAZARDS: Any process conducted in conjunction with public garages involving volatile flammable solvents shall be segregated or located in a detached building or structure, except as provided in section 403 for the storage and handling of gasoline and other volatile flammables. The quantity of flammable liquids stored or handled in public garages other than in underground storage and in the tanks of motor vehicles shall be not more than five (5) gallons in approved safety cans.

413.4 HEATING AND PROTECTION OF EQUIPMENT: Radiation and heating coils and pipes located within six (6) inches of the floor shall be protected with wire mesh or other approved noncombustible shields of adequate strength; and with asbestos or other insulation on top of the equipment when located in partitions or near combustible racks or woodwork.

413.5 BOILER ROOMS OF PUBLIC GARAGES: All heat generating plants other than approved direct fired heaters shall be located in separate buildings or shall be separately enclosed within the structure with solid, water and vapor tight masonry. All rooms housing boilers, stoves or other heating apparatus shall be cut off from all other parts of the building with four (4) hour fireresistive construction with entrance from outside only, and no openings through the fire division other than those necessary for heating pipes or ducts.

413.6 SPRINKLER REQUIREMENTS: For sprinkler requirements refer to article 12, table 12-3.

## SECTION 414.0 MOTOR FUEL SERVICE STATIONS

414.1 CONSTRUCTION: Buildings and structures used for the storage and sale of motor fuel oils may be of all types of construction within the height and area limitations of table 2-6 for business (use group E) buildings and as modified by sections 303 and 304.0. The canopies and supports over pumps and service equipment when located less than twenty (20) feet from interior lot lines shall be constructed of approved noncombustible materials.

414.11 OPENING PROTECTIVES: All permissible openings in walls with a fire separation of less than twenty (20) feet shall be protected with approved fire windows or fire doors complying with article 9, except doors in such walls to rest rooms.

414.12 BASEMENTS: Motor fuel service stations shall have no cellars or basements; and when pits are provided they shall be vented as required in section 413.2.

414.2 GASOLINE STORAGE: All volatile flammable liquid storage tanks shall be installed below ground and vented as specified in section 403. Such tanks shall be subject to the approval of the fire official and comply with the provisions of FPR-4.

## SECTION 415.0 MOTOR VEHICLE REPAIR SHOPS

All buildings and structures designed and used for repair and servicing motor vehicles, motor boats, airplanes or other motor driven means of transportation shall be subject to the limitations of tables 2-5 and 2-6 for moderate hazard storage (use group B-1). Such buildings shall be used solely for that purpose.

415.1 ENCLOSURE WALLS: Exterior walls, when located within six (6) feet of interior lot lines or other buildings shall have no openings therein.

415.2 VENTILATION: All rooms and spaces used for motor vehicle repair shop purposes shall be provided with an approved system of mechanical ventilation providing at least four (4) air changes per hour and meeting the requirements of section 413.2 and article 18.

415.3 FIRE PREVENTION: No open gas flames except heating devices complying with section 413.5, torches, welding apparatus, or other equipment likely to create an open flame, or spark shall be located in a room or space in which flammable liquids or highly combustible materials are used or stored.

## SECTION 416.0 PLACES OF PUBLIC ASSEMBLY

The provisions of this section shall apply to all places of public assembly and all parts of buildings and structures classified in the use group F-1, theatres and in other places of public assembly, use groups F-2, F-3, and F-4, except as specifically exempted in section 417.

416.1 RESTRICTIONS.

416.11 HIGH HAZARD USES: No place of public assembly shall be permitted in a building classified in the high hazard group (use group A).

416.12 FRAME CONSTRUCTION: No theatre with stage, fly gallery and rigging loft shall be permitted in a building of frame (type A) construction.

416.13 LOCATION: All buildings used for assembly purposes shall front on at least one (1) street in which the main entrance and exitway discharge shall be located. The main exitway shall be adequate to accommodate one-third (1/3) the total occupant load, but in any case, the capacity of the main exitway shall be adequate to provide for the total capacity of all exitway elements which lead to the main exitway.

416.14 TRIM, FINISH AND DECORATIVE HANGINGS: All permanent acoustic, insulating and similar materials and temporary hangings shall comply with the flameresistance requirements of article 9. Moldings and decorations around the proscenium openings shall be constructed entirely of noncombustible material.

416.15 EXISTING BUILDINGS: Nothing herein contained shall prohibit the alteration of a building heretofore occupied as a place of public assembly for such continued use provided the occupancy load is not

increased and seats, aisles, passageways, balconies, stages, appurtenant rooms and all special permanent equipment comply with the requirements of this article.

416.16 NEW BUILDINGS: No building not heretofore occupied as a place of public assembly shall hereafter be altered to be so occupied unless it is made to comply with all the provisions of this article.

416.2 THEATRE MEANS OF EGRESS REQUIREMENTS.

416.21 TYPES OF EXITWAYS: The required exitways from every tier or floor of a theatre shall consist of grade exitway discharge doors, interior or exterior stairways or horizontal exits which provide direct access to a street, an exitway discharge court, or unobstructed passageway, hallway or lobby leading to a street or open public space. The number, location and construction of all means of egress facilities shall comply with the requirements of article 6 and the provisions of this section.

416.22 NUMBER OF STAIRWAYS IN AUDITORIUM: Each tier above the main floor of a theatre or other auditorium shall be provided with at least two (2) interior enclosed stairways which shall be loacted on opposite sides of the structure with the following exception: stairs serving the first balcony only or mezzanine thereunder shall not require enclosures; however, such stairs shall discharge to a lobby on the main floor. Exitway stairways serving galleries above the balcony shall lead directly to the street or open public space as provided in section 416.21.

416.23 EMERGENCY MEANS OF EGRESS FROM MAIN FLOOR OF AUDITORIUM: In addition to the main floor entrance and exitway, emergency exitway discharge doors shall be provided on both sides of the auditorium which lead directly to a street, or through an exterior passageway to the street independent of other exitways, or to an exitway discharge court as defined in this Code.

416.24 EMERGENCY MEANS OF EGRESS FROM BALCONIES AND GALLERIES: Emergency exitways shall be provided from both sides of each balcony and gallery with direct egress to the street, or to an independent passageway, or to an exitway discharge court. There shall be no communication from any portion of the building to the emergency exitway stairways except from the tier for which such exitway is exclusively intended.

416.25 EXITWAY DISCHARGE COURTS: All exitway discharge courts shall be not less than six (6) feet wide for the first six hundred (600) persons to be accommodated or fraction thereof, and shall be increased one (1) foot in width for each additional two hundred and fifty (250) persons. Such courts shall extend sufficiently in length to include the side and rear emergency exitways from the auditorium.

416.26 HARDWARE: Refer to section 612.42 for requirements.

416.27 EXITWAY DOORWAY WIDTHS: The maximum width of single exitway doorways shall be forty-two (42) inches and the minimum width of double doorways shall be sixty-six (66) inches.

416.28 "EXIT" LIGHTS: All exitway doors shall be marked with illuminated "Exit" signs complying with section 624 which shall be kept lighted at all times during occupancy of the building.

416.3 THEATRE SEATINGS.

416.31 FIXED SEATS: In all theatres and similar places of assembly except churches, stadiums and reviewing stands, individual fixed seats shall be provided with an average width of not less than thirty-two (32) inches apart, back to back, measured horizontally. The clear unobstructed distance which can be provided for passage between rows of seats shall be twelve (12) inches.

416.32 NUMBER OF SEATS: Aisles shall be provided so that not more than seven (7) seats intervene between any seat and the aisle or aisles, except that the number of seats in a row shall not be limited when self-raising seats are provided which leave an unobstructed passage between rows of seats of not less than eighteen (18) inches in width leading to side aisle in which exitway doorways are located at not more than twenty-five (25) foot intervals to the exitway corridor or exitway discharge court.

416.33 BOX SEATS: In boxes or loges with level floors, the seats need not be fastened when not more than fourteen (14) in number.

416.34 WHEELCHAIR FACILITIES: Facilities shall be provided for the handicapped according to the provisions of the reference standards of this article.

416.4 THEATRE AISLES.

416.41 LONGITUDINAL AISLES: The width of longitudinal aisles at right angles to rows of seats and with seats on both sides of the aisle shall be not less than forty-two (42) inches. The width of the longitudinal aisles with banks of seats on one (1) side only shall be not less than twenty-four (24) inches.

416.42 CROSS AISLES: When there are twenty-seven (27) or more rows of seats on the main floor of theatres, cross aisles shall be provided so that no block of seats shall have more than twenty-two (22) rows. The width of cross aisles shall be not less than the widest aisle with which they connect or the width of exitway which they serve; but no cross aisle shall be less than forty-two (42) inches wide, or when bordering on means of entrance not less than forty-eight (48) inches wide. In balconies and galleries of theatres, one or more cross aisles shall be provided when there are more than ten (10) rows of seats.

416.43 GRADIENT: Aisles shall not exceed a gradient of one and three-quarters (1-3/4) inches per foot except where subject to requirements for use of handicapped. No aisles or the main floor may be stepped.

416.44 BALCONY STEPS: Steps may be provided in balconies and galleries only, and such steps shall extend the full width of the aisle with treads and risers complying with article 6, which shall be illuminated by lights on both sides or by a step light or otherwise to insure an intensity of not less than one (1) foot candle.

416.45 RAILINGS: Metal or other approved noncombustible railings shall be provided on balconies and galleries as herein prescribed:

At the facia of boxes, balconies and galleries not less than thirty (30) inches in height; and not less than thirty-six (36) inches in height at the foot of steps;

Along cross aisles not less than twenty-six (26) inches in height except where the backs of the seats along the front of the aisle project twenty-four (24) inches or more above the floor of the aisle;

Where seatings are arranged in successive tiers, and the height of rise between platforms exceeds eighteen (18) inches, not less than twenty-six (26) inches in height along the entire row of seats at the edge of the platform.

416.5 THEATRE FOYERS.

416.51 CAPACITY: In every theatre or similar place of public assembly, not including churches, for theatrical use with stage and scenery loft, a foyer or lobby shall be provided with a net floor area, exclusive of stairs or landings, of not less than one and one-half (1½) square feet for each occupant having access thereto. The use of foyers and lobbies and other available spaces for harboring occupants until seats become available shall not encroach upon the clear floor area herein prescribed or upon the required clear width of front exitways.

416.52 EGRESS: When the foyer is not directly connected to the public street through the main lobby, an unobstructed corridor or passage shall be provided which leads to and equals in minimum width the required width of main entrances and exitways.

416.53 GRADIENT: The rear foyer shall be at the same level as the back of the auditorium and the exitways leading therefrom shall not have a steeper gradiwnt than one (1) foot in ten (10) feet.

416.54 CONSTRUCTION: The partitions separating the foyer from the auditorium and other adjoining rooms and spaces of theatres shall

be constructed of not less than two (2) hour fireresistance; except that opening protectives may be constructed of noncombustible materials without fireresistance rating.

416.55 WAITING SPACES: Waiting spaces for harboring occupants shall be located only on the first or auditorium floor. Additional capacity of exitway shall be provided for the waiting space occupancy based on an allowance of three (3) square feet for each person.

416.6 THEATRE STAGE CONSTRUCTION.

416.61 STAGE ENCLOSURE WALLS: Every stage hereafter erected or altered for theatrical performances which is equipped with portable or fixed scenery, lights and mechanical appliances, shall be enclosed on all sides with solid walls of not less than four (4) hour fireresistance, extending continuously from foundation to at least four (4) feet above the roof. There shall be no window opening in such walls within six (6) feet of an interior lot line; and all permissible window openings shall be protected with three-quarter (3/4) hour fire windows complying with article 9.

416.62 FLOOR CONSTRUCTION: The entire stage, except that portion used for the working of scenery, traps, and other mechanical apparatus for the presentation of the scene, shall be not less than three (3) hour fireresistive construction. All openings through the stage floor shall be equipped with tight-fitting, solid wood trap doors not less than three (3) inches in thickness or other materials of equal physical and fireresistive properties.

416.63 ROOF AND RIGGING LOFT: The roof over the stage shall be of not less than three (3) hour fireresistive construction. The rigging loft, fly galleries and pin rails shall be constructed of approved noncombustible materials.

416.64 FOOTLIGHTS AND STAGE ELECTRICAL EQUIPMENT: Footlights and border lights shall be installed in troughs constructed of noncombustible materials. All electrical equipment shall conform to the requirements of Massachusetts State Electrical Code, and the switchboard shall be readily accessible and protected from any potential damage.

416.65 STAGE, MEANS OF EGRESS: There shall be provided at least one (1) approved means of egress from each side of the stage leading to an approved discharge area.

416.66 PROSCENIUM WALL: There shall be no other openings in the wall separating the stage from the auditorium except the main proscenium opening; two (2) doorways at the stage level, one (1) on each side thereof; and, where necessary, not more than two (2) doorways to the musicians' pit from the space below the stage floor. Each such doorway shall not exceed twenty-one (21) square feet in area and

shall be protected with approved automatic and self-closing fire door assemblies complying with article 9 with a combined fireresistance rating of three (3) hours or the approved labeled equivalent.

416.67 PROSCENIUM CURTAIN: Where required, the proscenium opening shall be protected with an approved automatic fireresistive and smoke-tight curtain, or its approved equivalent, designed to resist an air pressure of not less than ten (10) pounds per square foot normal to its surface, both inward and outward. The curtain shall withstand a one-half (½) hour fire test at a temperature of not less than seventeen hundred (1700) degrees F. without the passage of flame. The curtain shall be operated by an automatic heat-activated device to descend instantly and safely and to completely close the proscenium opening at a rate of temperature rise of fifteen (15) to twenty (20) degrees F. per minute, and by an auxiliary operating device to permit prompt and immediate manual closing of the proscenium opening.

416.68 STAGE VENTILATION: Metal or other approved noncombustible ventilators, equipped with movable shutters or sash shall be provided over the stage, constructed to open automatically and instantly by approved heat-activated devices, with an aggregate clear area of opening not less than one-eighth (1/8) the area of the stage. Supplemental means shall be provided for manual operation of the ventilator.

416.7 DRESSING AND APPURTENANT ROOMS.

416.71 CONSTRUCTION: Dressing rooms, scene docks, property rooms, work shops and store rooms and all compartments appurtenant to the stage shall be of fireproof (type 1) construction and shall be separated from the stage and all other parts of the building by walls of not less than three (3) hour fireresistance. No such rooms shall be placed immediately over or under the operating stage area.

416.72 OPENING PROTECTIVES: No openings other than to trunk rooms and the necessary doorways at stage level shall connect such rooms with the stage and such openings shall be protected with one and one-half (1½) hour self-closing fire doors or the approved labeled equivalent complying with article 9.

416.73 INTERIOR TRIM: All shelving and closets in dressing rooms, property rooms or storage rooms shall be constructed of flameresistant materials complying with article 9.

416.74 DRESSING ROOM AND STAGE EXITWAYS: Each tier of dressing rooms shall be provided with at least two (2) means of egress, one of which shall lead directly to an exitway corridor, exitway discharge court or street. Exitway stairways from dressing and storage rooms may be unenclosed in the stage area behind the proscenium wall. At least one approved exitway shall be provided from each side of the stage and from each side of the space under the stage, and from

each fly gallery and from the gridiron to a street, exitway discharge court or passageway to a street. An iron ladder shall be provided from the gridiron to a scuttle in the stage roof.

416.8 LIGHTING.

416.81 EXITWAYS: During occupancy all exitways in places of assembly shall be lighted to comply with the requirements of section 624.

416.82 AUDITORIUMS: Aisles in auditoriums shall be provided with general illumination of not less than one-tenth (1/10) foot candles at the front row of seats and not less than two-tenths (2/10) foot candles at the last row of seats and the illumination shall be maintained throughout the showing of motion pictures or other projections.

416.821 FOYERS AND WAITING SPACES: Foyers and waiting spaces shall be artificially lighted by electrical means at all times during occupancy of a place of assembly so as to provide all illumination of at least five (5) foot candles at the level of the floor and on the surface of all stairs, steps, ramps, and escalators within the foyers and waiting spaces.

416.822 OPEN EXTERIOR SPACES: Yards or courts which serve as open exterior spaces shall be artificially lighted by electrical means at all times between sunset and sunrise during occupancy of a place of assembly so as to provide illumination of at least five (5) foot candles at the level of the floor over at least the required area.

416.83 OTHER PLACES OF PUBLIC ASSEMBLY: All areas and portions of buildings used as places of public assembly other than theatres shall be lighted by electric light to provide a general illumination of not less than one (1) foot candle.

416.84 CONTROL: The lighting of exitways, aisles and auditoriums shall be controlled from a location inaccessible to unauthorized persons. Supplementary control shall be provided as specified in section 407.34 in the motion picture projection room.

416.85 EMERGENCY LIGHTING: In all theatre buildings and similar structures used for public assembly purposes, all exitways shall be lighted by means of electricity so arranged and controlled that the interruption of service on any other circuit inside the building or structure will not interrupt the required exitway lighting, including corridors, stairways, foyers, and lobbies.

416.9 FIRE PROTECTION AND FIRE FIGHTING EQUIPMENT: Every theatre classified in the F-1 use group shall be equipped with fire-extinguishing equipment complying with the requirements of article 12 and as herein specified.

416.91 SPRINKLER SYSTEM: Approved automatic sprinkler systems complying with the provisions of sections 1212 and 1213 shall be provided to protect all parts of the building except the auditorium, foyers and lobbies or in the immediate vicinity of automatic equipment or over dynamos and electric equipment. Such protection shall be provided over the stage, under the gridiron, under all fly galleries, in dressing rooms over the proscenium opening on the stage side, under the stage, in all basements, cellars, work rooms, store rooms, property rooms and in toilet, lounge, and smoking rooms.

416.92 STANDPIPES: Standpipe fire lines complying with the provisions of sections 1206 and 1207 shall be provided with outlets and hose attachments one on each side of the auditorium in each tier; one in each mezzanine; one in each tier of dressing rooms; and protecting each property, store and work room.

416.93 FIRST-AID STANDPIPES: First-aid standpipes complying with the provisions of section 1209 shall be provided on each side of the stage. Such standpipes shall be not less than two and one-half (2½) inches in diameter, equipped with one and one-half (1½) inch hose and three-eighth (3/8) inch nozzles.

416.94 HOSE OUTLETS: A sufficient quantity of hose shall be provided, equipped with regulation fire department couplings, nozzle and hose spanner, to reach all areas as specified in article 12.

416.95 FIRST-AID HAND EQUIPMENT: Approved portable two and one-half (2½) gallon fire extinguishers shall be provided and located as follows: two (2) on each tier on floor of the stage; one (1) immediately outside of the motion picture projection room; one (1) in each dressing room; and one (1) in each work, utility and storage room. Fire axes and fire hooks shall also be provided as directed by the fire official; and all fire extinguishers and fire tools shall be securely mounted on walls in plain view and readily accessible.

## SECTION 417.0 PUBLIC ASSEMBLY OTHER THAN THEATRES

Other places of public assembly including auditoriums, armories, bowling alleys, broadcasting studios, chapels, community houses, dance halls, gymnasiums, lecture halls, museums, exhibition halls, night clubs, restaurants, rinks, roof gardens and similar occupancies and uses shall comply with the general exitway requirements of article 6 and the applicable requirements of section 416, except the provisions of sections 416.45 and 416.54 or as herein specifically exempted. Places of public assembly which are equipped with a stage, movable scenery, scenery loft and dressing rooms shall comply with all the requirements of section 418, except use groups F-1 theatres.

417.1 NUMBER OF EXITWAYS: Every tier, floor level and story of places of public assembly other than theatres, shall be provided with the number of required exitways herein specified of not less than the required width complying with article 6 for the occupancy load. The required exitways shall be remote and independent of each other and located on opposite sides of the area served thereby.

| Occupancy Load Per Floor | Minimum Number of Exitways |
|---|---|
| Not more than 500 ..... | 2 |
| 501 to 900 ..... | 3 |
| 901 to 1800 ..... | 4 |
| Over 1800 ..... | 5 |

417.2 AISLES WITH FIXED SEATS: All rows of seats shall be individually fixed or fixed in rigid units between longitudinal aisles complying with section 416.32 and 416.4 except as provided for chapels and churches in section 610.3. Where permitted, continuous fixed benches shall comply with the provisions of section 421.7.

417.3 AISLES WITHOUT FIXED SEATS: Tables and chairs in all rooms and spaces for assembly use shall provide convenient access by unobstructed aisles not less than thirty-six (36) inches wide which lead to required exitways complying with article 6. Tables and chairs shall be so arranged that the distance from any chair at any table by way of a path between tables and chairs is not greater than eighteen (18) feet to an aisle leading to an exitway. The width of the path shall be at least eighteen (18) inches; except that it may be reduced by one (1) inch for each one (1) foot that the distance to the aisle is less than eighteen (18) feet, but may not be reduced to less than twelve (12) inches. Chairs, when placed with the front edge of the seat on a line with the edge of the table, shall not protrude into this path. Booths containing up to eight (8) seats may be used, provided they open directly on an aisle.

417.4 KITCHEN AND SERVICE PANTRIES: Where kitchen and service pantries are provided, they shall be separately enclosed in partitions, floors and ceilings of not less than three-quarter (3/4) hour fireresistance, except for opening protectives; and no required element of exitway shall pass through such areas.

417.5 BOWLING ALLEYS: The storage and use of all volatile flammable liquids shall comply with section 403 and the finishing rooms shall be separately enclosed in two (2) hour fireresistive construction with floor finish of concrete or other noncombustible, nonabsorbent material.

417.6 SKATING RINKS: No skating rinks shall be located below the floor nearest grade.

SECTION 418.0 AMUSEMENT PARKS

All buildings and structures used as part of an amusement park shall be subject to the provisions of this Code as applicable. Unusual buildings, structures or devices which require a building permit by the provisions of this Code but are beyond the normal scope of applicability of this Code shall be subject to the provisions of section 128.0 and shall be considered to be within those categories of structures listed in section 128.1 as subject to control.

418.1 TEMPORARY AMUSEMENT FACILITIES AND DEVICES: Any moving structure or structure with any moving parts, and any structure, which in the opinion of the local building official, may represent a potential danger or hazard, shall have an affadavit submitted by a qualified registered professional engineer that the structure as designed and constructed is safe for its intended use and he shall provide certification that the structure has been inspected by a qualified registered professional engineer within six (6) months and meets all the requirements necessary to operate safely according to its design use. Furthermore, a qualified registered professional engineer shall be responsible for direction of the erection of such structures and shall certify that they have been erected in compliance with their design requirements. Any such structure, which is to accommodate human use in any way, shall be certified for the number of persons for which it is designed or as may be allowed by the local building official.

## SECTON 419.0 STADIUMS AND GRANDSTANDS

Stadiums and grandstands shall be constructed as required by this Code and in accordance with the approved rules and the Standard for Tents and Grandstands Used for Places of Assembly (NFPA 102) listed in the reference standards of this article.

419.1 RAILS: Every ramp, stairway, deck and tier shall have an approved protective railing or guard not less than three (3) feet six (6) inches high on all open sides when three (3) feet or more above grade level or above any other level occupied by the public. Front railings of grandstands when the foot rest is more than two (2) feet above the ground shall be not less than thirty-three (33) inches high.

419.2 SPACES UNDERNEATH SEATS: Spaces underneath grandstand seats shall be kept free of all combustible and flammable materials and shall not be occupied or used for other than exitways; except that when enclosed in not less than three-quarter (3/4) hour fireresistive construction, the building official may approve the use of such spaces for other purposes that do not endanger the safety of the public.

## SECTION 420.0 TENTS AND OTHER TEMPORARY STRUCTURES

Tents shall be constructed as required by this Code and in accordance with accepted engineering practice and the Standard for Tents, Grandstands and Air-Supported Structures Used for Places of Assembly (NFPA 102) listed in the reference standards of this article.

420.1 CONDITIONS OF PERMIT AND LOCATION: Tents and other temporary structures may be erected for a period as determined by the building official. Such structures may not be erected within the fire district

for a period of more than twenty-four (24) hours unless such use is reviewed and approved by the fire official, and any such structure erected within the fire district shall be subject to any condition of use and protection as may be determined by the building official.

420.2 TENT CONSTRUCTION: Tents and other temporary structures shall be of an approved type and shall have evidence submitted that the structure satisfies all structural and fire-safety requirements.

420.3 COMBUSTIBLE MATERIALS: No combustible materials shall be permitted under stands or seats at any time. Excessive vegetation shall not be allowed beneath the stands or seats.

## SECTION 421.0 RADIO AND TELEVISION TOWERS

Commercial radio and television towers shall have complete structural drawings and specifications submitted by a qualified registered professional engineer, bearing his seal and signature.

## SECTION 422.0 SWIMMING POOLS

422.1 GENERAL: Pools used for swimming or bathing shall be in conformity with the requirements of this section; provided, however, these regulations shall not be applicable to any such pool less than twenty-four (24) inches deep or having a surface area less than two-hundred and fifty (250) square feet. For purposes of this Code, pools are classified as private swimming pools or public swimming pools, as defined in section 422.2.

422.2 CLASSIFICATION OF POOLS: Any pool intended to be used primarily for swimming and designated as being a private pool for the use only of the occupants of a one- or two-family dwelling shall be designated a private pool. Any pool intended to be used primarily for swimming which is not a private pool as defined above shall be classified as a public pool.

422.3 PLANS AND PERMIT.

422.31 PERMITS: No swimming pool subject to the provisions of this Code shall be constructed, installed, enlarged, or altered until a building permit has been obtained from the building official.

422.32 PLANS AND SPECIFICATIONS: The application for the permit shall be accompanied by copies of the specifications and plans drawn to scale. The plans shall accurately show dimensions and construction of the pool including vertical elevations and sections showing depth in sufficient clarity to clearly indicate the nature of the structure and show all details necessary for conformance with the provisions of this Code. All plans for public pools must be submitted with the seal and signature of a qualified registered professional engineer.

422.4 DESIGN AND CONSTRUCTION.

422.41 GENERAL: Pools shall be constructed so as to be water tight and easily cleaned. They shall provide safe and easy means of egress.

422.42 STRUCTURAL DESIGN: The pool structure shall be engineered and designed in conformance with the normal engineering practices and subject to all the provisions of this Code.

422.43 WALL SLOPES: In public swimming pools, which are designed and constructed subject to the provisions of this Code, the side and end walls shall be vertical and shall have a safety ledge at the deep end of the pool, located at a level four (4) feet six (6) inches below the surface of the water. Safety ledges shall be four (4) inches wide.

422.44 FLOOR SLOPES: In public pools, the slope of the floor on the shallow side of the transition point between shallow and deep water shall not be more than five (5) feet deep.

422.45 SURFACE CLEANING: All swimming pools shall be provided with a recirculating skimming device or overflow gutters to remove scum and foreign matter from the surface of the water in conformance with Article VI of the Commonwealth of Massachusetts, Department of Public Health Sanitary Code.

422.46 WALKWAYS: All public swimming pools shall have walkways not less than four (4) feet in width extending entirely around the pool. Where curbs or sidewalks are used around any swimming pool, they shall have a nonslip surface for a width of not less than one (1) foot at the edge of the pool and shall be so arranged to prevent return of surface water to the pool.

422.47 STEPS AND LADDERS: Steps or ladders may be used as approved means of egress from swimming pools. At least one (1) approved means of egress must be provided in any pool constructed subject to the provisions of this Code. Steps must be nonskid and have the following requirements: Width ten (10) inches minimum, area two hundred and forty (240) square inches minimum, risers twelve (12) inches maximum.

In public pools, step holes inserted in the pool wall shall not be accepted as a required means of egress. All steps and ladders shall have handrails on both sides extending onto the deck surface adjacent to the pool. Handrails are not required in private pools where there are four steps or fewer.

In public pools, approved means of egress must be provided for a maximum of seventy-five (75) feet of pool perimeter wherever the height from the bottom of the pool to the ledge or top of the wall exceeds twelve (12) inches.

422.5 WATER SUPPLY, TREATMENT AND DRAINAGE SYSTEMS: All water supply, treatment and drainage systems shall conform to the requirements of Article VI of the Commonwealth of Massachusetts, Department of Public Health Sanitary Code.

422.6 APPURTENANT STRUCTURES

422.61 APPURTENANT STRUCTURES: All appurtenant structures, installations, and equipment; such as showers, dressing rooms, equipment houses or other buildings and structures, including plumbing, heating, and air conditioning, amongst others appurtenant to a swimming pool, shall comply with all applicable requirements of the Basic Code, the Massachusetts State Plumbing Code, the Massachusetts State Electrical Code, and Article VI of the Commonwealth of Massachusetts, Department of Public Health Sanitary Code.

422.62 ACCESSORIES: All swimming pool accessories shall be designed, constructed, and installed so as not to be a safety hazard. Installations or structures for diving purposes shall be properly anchored to insure stability, and properly designed and located for maximum safety.

422.7 SAFETY PRECAUTIONS.

422.71 ELECTRICAL SAFETY: The construction and installation of electrical wiring for equipment in or adjacent to swimming pools, to metalic appurtenances in or within five (5) feet of the pool, and to auxiliary equipment such as pumps, filters, and similar equipment shall conform to article 680 of the Massachusetts State Electrical Code.

422.72 EQUIPMENT INSTALLATIONS: Pumps, filters, and other mechanical and electrical equipment for public and semi-public swimming pools shall be enclosed in such a manner as to be accessible only to authorized persons and not to bathers. Construction and drainage shall be such as to avoid the entrance and accumulation of water in the vicinity of electrical equipment.

422.8 GENERAL SAFETY REQUIREMENTS: Any public swimming pool shall be enclosed by an impassible four (4) foot high fence with a self-latching gate or an equivalent enclosure or means of protection from access to the pool.

SECTION 423.0 OPEN PARKING STRUCTURES

Opening parking structures shall be subject to the provisions of this section, Massachusetts State Fire Prevention Regulation, FPR-4 and NFPA 88 such that those regulations which provide for the greatest public safety shall apply in any case. In addition, where applicable, sections 414, 415 and 410 of this Code shall apply.

423.1 GENERAL REQUIREMENTS: Open Structures for the parking of passenger motor vehicles shall be constructed of noncombustible materials throughout, including structural framing, floors, roofs and walls.

423.11 VEHICLE CAPACITY: Open passenger vehicle parking structures are those structures used for the parking or storage of passenger motor vehicles designed to carry not more than nine (9) persons.

423.12 RAMP TYPE STRUCTURES: Ramp type parking structures are those employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of passenger automobiles under their own power to and from the street level.

423.13 MECHANICAL TYPE PARKING STRUCTURES: Mechanical type parking structures employ specially designed parking machines, elevators, lifts, conveyors, moving cranes, dollies, or other devices for moving passenger vehicles to and from the street level.

423.2 SEPARATIONS: Parking structures may be erected without enclosure walls with the following exception: when located within fifteen (15) feet of interior lot lines a noncombustible enclosure wall of two (2) hours fireresistance rating with no openings is required.

423.3 MEANS OF EGRESS: Refer to section 609.3.

423.4 BASEMENTS: Basements, if used for parking vehicles, shall be sprinklered in accordance with article 12, and shall comply with the ventilation requirements of section 415.12.

423.5 HEIGHTS AND AREAS: Heights and areas of open parking structures shall not exceed the limits in the following table:

TABLE 4-4 HEIGHT AND LIMITATION FOR OPEN PARKING STRUCTURES

| Type of Construction | Height | Area |
|---|---|---|
| 1A, 1B, 2A | Unlimited | Unlimited |
| 2B | 100' | Unlimited |
| 2C | 75' | Unlimited |

423.51 HORIZONTAL DISTANCE: The horizontal distance from any point on any level to an exterior wall opening on a street, alley, courtyard, or any other permanent open space shall not exceed two hundred (200) feet.

423.52 STREET FRONTAGE INCREASE: The areas of open parking structures shall be subject to the provisions of section 308.1.

423.6 CURBS AND BUMPERS: Curbs or bumpers of noncombustible materials shall be provided at the perimeter of each parking tier. Such curbs or bumpers shall be at least twelve (12) inches high, substantially anchored, and so located that no part of any motor vehicle will contact a wall, partition or railing.

423.7 RAILINGS: Substantial railings or protective guards of non-combustible materials shall be provided at the perimeter of all parking tiers; except where exterior walls are provided, and around all interior floor openings. Such railings or guards shall be at least three (3) feet six (6) inches high, and shall be designed in accordance with the requirements of article 7.

423.8 FLOOR OPENINGS: Floor openings shall be protected by enclosure barriers at least six (6) inches high.

## SECTION 424.0 GROUP RESIDENCE IN THE COMMONWEALTH OF MASSACHUSETTS

424.1 DEFINITION: A premise, licensed or operated by an agency of the Commonwealth of Massachusetts for the residential care in any single building of not more than twelve (12) unrelated persons between the ages of seven (7) and fifteen (15) inclusive, or up to twenty-five (25) unrelated persons sixteen (16) years of age or over, as may be approved by the licensing or operating state agency, who are capable of self-preservation. The use of such accommodations provided for a group residence as defined herein shall be considered the same as a normal single-family residence for the purpose of these regulations and shall not be construed as being similar to a boarding house, lodging house or dormitory. These provisions will apply to group residence uses providing accommodations for the care of not more than twenty-five (25) individuals.

424.2 NEW AND EXISTING OCCUPANCIES: These regulations apply to existing buildings, which are to be used as group residences as defined in section 424.1 of this Code, and to buildings and/or structures hereinafter erected or altered, which are to be used as group residences as defined in section 424.1 of this Code.

424.21 PLANS AND SPECIFICATIONS: Any existing building whose occupancy is altered for use as a group residency under the provisions of section 424.0 shall have filed with the local building department a complete set of plans showing in detail all rooms, doors, corridors, windows, stairs and stairways, hazard vertical openings (section 424.51), and the location of all fire detection equipment, alarms, and fire suppression equipment.

424.3 HAZARD OF CONTENTS: Any household contents, which represent a fire hazard greater than that which could be expected of ordinary household furnishings, shall not be allowed.

424.4 MEANS OF EGRESS: A means of egress shall be a continous path of travel from any point in a building to the open air outside at ground level.

424.41 PRINCIPAL MEANS OF EGRESS: There shall be a principal means of egress normally used by the occupants to leave the building. Under fire conditions this exit would be the first choice for exiting.

424.42 ESCAPE ROUTE: There shall be a back-up, or escape route, available to each occupant from any occupied portion of the building to preclude any possibility of entrapment in the event that the principal means of egress is blocked by fire, smoke or structural collapse. This escape route shall be so determined as to minimize the likelihood that it can be deliberately compromised.

424.43 TIME FOR EGRESS: The time taken to accomplish total evacuation of the building shall not exceed one (1) minute per floor, with a maximum time of two and one-half (2½) minutes as determined by and to the satisfaction of the licensing agency in accordance with Section 9.1 of 9 CHSR S. 51 Title 9 Code of Human Services Regulations, promulgated by the Executive Office of Human Services of the Commonwealth of Massachusetts.

424.44 REQUIREMENTS FOR EGRESS AND ESCAPE ROUTES: All main egress doors must swing in the anticipated direction of egress or escape where practicable.

424.5 FIRE PROTECTION FEATURES.

424.51 HAZARDOUS VERTICAL OPENINGS: Hazardous Vertical Openings such as laundry chutes, dumb waiters, heating plenums or combustible concealed spaces shall be enclosed or protected with a minimum of three-eights (3/8) inch gypsum sheet rock on the side of the expected exposure to delay the spread of fire and smoke. Automatic detection systems as specified in Section 6 shall be provided in each space.

424.52 SMOKE SCREENS: For the purposes of this Code a solid bonded core smokestop wood door with an automatic closer will be acceptable as a divider in providing two noncrossing, independent, egress routes.

424.53 INTERIOR FINISH: Only Class A and B Interior Finishes shall be permitted in the principal means of egress (to flame spread of seventy-five (75)). In the refinishing of any area, materials with a flame spread rating in excess of two hundred (200) are not allowed.

424.6 ALARM DETECTION SYSTEM: An approved automatic fire/smoke detector system and alarm system shall be provided.

424.61 TYPES AND LOCATIONS OF DETECTORS:

| TYPE | LOCATION |
|---|---|
| Products of Combustion | Principal means of egress on each floor. |
| Smoke Detectors | Living-Dining-Recreation Areas. |
| Rate of Rise Detectors | Boiler Room-Kitchen-Bedroom. |
| Fixed Temperature Detectors | Closets and vent shafts, and concealed spaces. |

424.62 TYPES AND LOCATIONS OF ALARMS:

| TYPE | LOCATION |
|---|---|
| Manual Sending | Each exit of principal means of egress.* |
| Manual Sending | One outdoor alarm of a type acceptable to local Fire Departments; maximum two hundred (200) feet from building.* |
| Automatic Connection to Manual | From each detector. |

*To municipal fire department as well, wherein practicable.

424.63 ALARM SOUNDING AND VISIBLE DEVICES: Alarm sounding devices shall be provided of such character and so distributed as to be effectively heard in every room above all other sounds. Visible alarm devices may be used only in conjunction with an approved back-up system, and where specifically approved.

Every alarm sounding device shall be distinctive in pitch and quality from all other sounding devices.

424.64 MAINTENANCE AND SUPERVISION: Each detector (or system) and alarm shall be provided with a signal (either visible or audible) to indicate when it is not capable of functioning according to its designed purpose; and shall be periodically inspected and certified by the licensing agency. The entire electrical alarm and detector system circuit shall be designed so that the disruption of any part of the continuous circuit will set off an alarm.

424.7 FIRE FIGHTING EQUIPMENT: Manually operated fire-fighting equipment such as hand extinguishers, shall be available to the custodian and other designated personnel.

424.8 INSPECTION: Inspections shall be made frequently by authorized inspectors to insure conformance with this Code. The results of such inspections shall be reported to the licensing agency on a prepared checklist and signed by the authorized inspector.

424.9 FINAL CERTIFICATION OF OCCUPANT: After preliminary certification by those qualified certifying personnel as specified in 9 CHSR S.51 Title 9 Code of Human Services Regulations, Section 51, each occupant must be certified at regular intervals but not less than once every quarter at the place of proposed residency by the licensing agency.

SECTION 425.0 COVERED MALLS

Covered malls shall be constructed in accordance with one of the following options:

425.1 OPTION 1: The covered mall and all buildings connected thereto shall be treated as a single building and shall be subject to the provisions of this Code for the specific use group and type of construction;

425.2 OPTION 2: The mall may be considered to be an accessible unoccupied open space that separates the construction into one or more buildings if the following requirements are met:

a) the covered mall shall be at least thirty (30) feet in width.

b) the least, unobstructed, horizontal dimension at any place in the covered mall shall be ten (10) feet.

c) combustible kiosks or other similar structures shall not be located within the covered mall.

d) kiosks or similar areas (temporary or permanent) located within the covered mall shall be provided with approved fire suppression and detection devices as required by the building official.

e) the minimum horizontal separation between kiosks and similar areas and buildings connected to the covered mall shall be twenty (20 feet.

f) the covered mall shall be of noncombustible or type 3A construction.

g) the covered mall and all buildings connected thereto shall be provided throughout with an approved fire suppression system. The suppression system in the covered mall shall be independent of the suppression systems in the buildings connected to the covered mall.

h) multi-level covered malls shall be sufficiently open, so that a hazardous condition occurring on one level will be readily visible to occupants on all levels.

i) floor-ceiling assemblies and their supporting columns and beams within multi-level covered malls shall be of one (1) hour fire-resistive noncombustible construction.

j) the covered mall shall be provided with break-out panels, skylights mechanical ventilation or other approved method of providing for ventilation of products of combustion in case of fire.

k) one-half (½) of the required number of exitways from each tenant area shall lead to the outside by means other than through the covered mall.

Exception: Tenant areas less than twenty-five hundred (2500) square feet in area.

l) exit signs and directional (exit) signs indicating the nonmall exitways shall be located so as to be easily visible from the mall-tenant area entrance.

m) exitways from the covered mall shall be located so that the length of travel from any mall-tenant area entrance to the exitway shall not exceed two hundred (200) feet.

n) standpipes and hose cabinets shall be provided at two hundred (200) foot intervals along the covered mall.

## SECTION 426.0 NURSING HOMES, REST HOMES, CHARITABLE HOMES FOR THE AGED, CONVALESCENT HOMES AND HOSPITALS.

Buildings in use group H-2 used as nursing homes, rest homes, charitable homes for the aged, convalescent homes and hospitals shall meet the provisions of NFPA 101 Life Safety Code, 1967, the applicable provisions of the Basic Code and the following provisions:

426.1 MEANS OF EGRESS.

426.11 CORRIDORS: Corridors shall terminate at stairwells or at doors to grade, except that subsidiary corridors off main corridors, restricted to service areas (linen closets, janitor closets, bathing areas, beauty or barber shops, storage, utility rooms, treatment or examining rooms or offices) may be dead-ended providing they do not extend farther than thirty (30) feet beyond the exit stair, door or corridor and serve a total occupant load of not more than ten (10) persons.

426.12 PATIENT ROOM EGRESS: Two independent egresses shall be provided from each patient's room, one of which may be by communicating door or direct to the outside.

426.13 WARD OR DORMITORY EGRESS: In wards or dormitories with six (6) or more occupants (patients or boarders) there shall be two (2) egresses, one of which shall be directly to the outside.

426.14 COMMUNICATING DOORS: Communicating doors in patients' rooms and the direct-to-the-outside door from wards or dormitories may be omitted from type 1, 2A or 2B construction.

426.15 STAIRWAYS: Stairs shall be a minimum of four (4) feet between walls or between walls and balustrades.

426.16 EGRESS DOORS: All designated egress doors shall open in the direction of egress. Patient bedroom doors may swing in either direction, providing those swinging into a corridor are recessed and will protrude not more than five (5) inches into the corridor when opened ninety (90) degrees.

426.17 EGRESS DOOR WIDTHS: Egress doors to the outside shall be forty-four (44) inches in width. Doors from the patients' rooms to the corridor shall be three (3) feet eight (8) inches in width. Communicating doors between rooms shall be a minimum of two (2) feet eight (8) inches in width.

426.2 CONSTRUCTION REQUIREMENTS: Nursing homes and convalescent homes shall be built only of type 1 and 2 construction.

SECTION 427.0 DAY CARE CENTERS (H-2)

Day care centers shall be subject to the applicable provisions of the Basic Code and the provisions of this section. Day care centers licensed by the Office of Children shall be subject to compliance with the rules and regulations of that authority.

427.1 LOCATION

427.11 HIGH HAZARD RESTRICTION: No day care centers may occupy the same building with or be within two hundred (200) feet of a high hazard occupancy.

427.12 BASEMENT USE: A basement, as defined in the Basic Code, of a type 4B construction structure, may not be used for a day care center.

427.2 MEANS OF EGRESS

427.21 FEWER THAN THIRTY (30) CHILDREN: Where the basement is used as the day care center or part thereof, for fewer than thirty (30) children there shall be two exitways placed as remote from each other as possible. One such exitway shall be directly to the outside at grade level and shall require less than eight (8) feet of vertical travel to reach the exitway discharge. In such an exitway, where stairs are used, the stairway may not be enclosed if the vertical travel is less than four (4) feet. Otherwise, a two (2) hour enclosure is required for the stairway with a one and one-half (1½) hour self-closing fire door.

427.22 THIRTY (30) OR MORE CHILDREN: Where the basement is used as the day care center or part thereof, for thirty (30) or more children, at least two (2) exitways, placed as remotely as possible from each other, shall be provided directly to the outside, one (1) of which shall discharge at ground level.

427.23 EXITWAY REQUIREMENTS: Exitway other than those required by sections 427.21 and 427.22 shall lead to the primary floor for discharge. Stairways for such exitways shall have egress doors which are self-closing and one and one-half (1½) hours fireresistance rating.

427.24 EGRESS ON FLOORS OTHER THAN BASEMENT: Each story shall be provided with not less than two (2) means of egress properly located, and such additional approved egresses shall be located from the occupied spaces so that to reach an egress, it will not be necessary to pass through a common corridor or space.

427.25 EGRESS FROM EACH ROOM: Two (2) approved egresses properly located shall be provided from each occupied room (one (1) of which may be by communicating door) leading to two (2) separate exits so arranged that to reach one it will not be necessary to pass through the common corridor or space.

427.26 STAIRWAYS: All required egress stairways shall be enclosed with not less than one (1) hour fireresistance rating and one (1) hour fire-resistance self-closing doors unless otherwise specified in this section.

427.27 EGRESS LIGHTING: Egress lighting shall be provided as required by the building official and in conformance with article 6, including requirements for emergency lighting.

427.3 DOORWAYS: All exitway doorways shall be at least thirty-six (36) inches in width. All other doorways shall be at least thirty-two (32) inches in width.

427.4 HANDRAILS: All required egress stairways shall be provided with double handrails on both sides, and these shall be continuous including all runs and platforms and shall be built as follows:

a) the upper rail shall be installed at approximately thirty-three (33) inches high measured vertically at the face of the riser.

b) the lower rail shall be installed at approximately twenty (20) inches high measured vertically at the face of the riser.

427.5 HEATERS: Any heaters in spaces occupied by children shall be separated from the occupied space by partitions, guards, screens, or other means. Space and unit heaters using combustibles shall be prohibited.

427.6 BOILER ROOMS: Boilers, furnaces or other fire units shall be enclosed as required in section 1113. No boiler room door shall open into an occupied area.

427.7 FLOOR AND CEILING PROTECTION: When the occupied floor is above any usable space, the floor shall have a three-quarter (3/4) hour fire rating.

SECTION 460.0 SCHOOLHOUSE BUILDINGS

The provisions of this section shall apply to all buildings, structures and parts thereof which are classified as schoolhouse buildings as defined in article 2.

460.1 ADMINISTRATIVE

460.11 INCREASE IN BUILDING SIZE: If the building is increased in floor area or number of stories, the entire building shall be made to conform with these regulations in respect to means of egress, fire safety, light and ventilation with the following exceptions: a) Horizontal additions with fire divisions, and b) An increase in floor area of ten (10) percent or less for nonclassroom use--are permitted provided compliance with the area limitations of Table 2-6 and of section 304 are maintained for the existing building.

460.12 STATEMENT OF COMPLIANCE: All drawings submitted in compliance with section 113 shall be prepared by a registered architect, a registered surveyor, and/or a registered professional engineer and shall bear their registration stamp. The first sheet of their respective drawings shall bear signed statements by them that the materials and construction indicated conforms to at least the requirements of this Code.

460.2 SPECIAL USE AND OCCUPANCY REQUIREMENTS

460.21 WELDING

460.211 Welding booths shall be constructed of noncombustible material and in a manner which will permit escape by slight pressure.

460.212 In a multi-storied building, the floor and ceiling of a room where welding is being performed shall be of type 1 or type 2 construction.

460.213 Each shop where welding is performed shall have two (2) individual means of egress not less than three (3) feet wide leading to separate exits remote from each other. One of these means of egress shall be direct to the outside and shall be equipped with an outward swinging, panic equipped escape door. Doors for such shops shall be constructed of a fire resistant material or be metal clad. Doors shall be equipped with automatic door closers.

460.214 Walls for shops shall be not less than two (2) hour noncombustible and constructed of solid masonry or of concrete blocks with metal wall reinforcement in alternate courses.

460.22 GLASS

460.221 Nonshattering glass, or guard rails or comparable protection shall be used when glass is installed below a height of thirty-two (32) inches, except that nonshattering glass or double

guard rails shall be provided below a height of forty-eight (48) inches in corridors or congregating areas. Guard rails shall be placed on the exterior if the adjacent outside area is paved.

460.222 In control screens and smoke screens, glass shall be nonshattering and three-quarter (3/4) hour fireresistant.

460.223 Glass used in doors shall comply with the American National Standard known as Z97-1 (1966) except where required to be wire glass to achieve a degree of fireresistance. This section shall also apply to sliding glass doors, storm doors, shower doors, bathtub enclosures and fixed glass panels adjacent to entrance and exit doors which because of their location, size and design may be mistaken as a means of ingress or egress.

460.224 Each light of safety glazing material installed as required by section 460.223 shall be permanently labeled by means of etching, sandblasting or firing of ceramic material to identify the labeler, whether manufacturer, fabricator or installer, and the nominal thickness and the type of safety glazing material and the fact that said material meets the test requirements of section 856.37.

460.23 SANITATION: Design total student population for calculating sanitation requirements shall be certified by the architect or owner.

All sanitation requirements shall be those as specified in the applicable provisions of the Massachusetts State Plumbing Code.

460.231 FACILITIES FOR HANDICAPPED: Sanitation for the handicapped shall conform to the Rules and Regulations of the Board to Facilitate the Use of Public Buildings by the Physically Handicapped, Form PHR-1, dated December 18, 1968.

460.24 CEILING HEIGHT: Classrooms shall have an average height of eight (8) feet six (6) inches minimum under the beams or ceilings. In establishing the average, a minimum of seven (7) feet shall be used.

460.3 LIGHT AND VENTILATION

460.31 LIGHTING: All rooms, corridors, stairways and exits, including outside steps, shall be suitably lighted when in use.

460.311 All classrooms used for students below grade 7, and a minimum of fifty (50) percent of all other classrooms shall be provided with natural lighting from transparent glass windows in outside walls. Colleges and universities are excepted from this requirement.

460.312 Artificial lighting shall be so designed to provide minimum intensities "maintained" as listed below. Except where noted, illumination measurements shall be made in a horizontal plane thirty (30) inches above floor level.

460.313 Classrooms, laboratories, study halls, libraries, offices, shops, combination-use rooms if used as study halls or libraries, and other instruction areas: 30-foot candles.

460.314 Drafting rooms, sewing rooms and sight-saving classrooms: 50-foot candles.

460.315 Gymnasiums, lunchrooms, playrooms and multi-purpose rooms: 20-foot candles.

460.316 Auditoriums and corridors: 10-foot candles.

460.317 Stairways: 10-foot candles, measured at the edge of the tread.

460.318 Toilet rooms: 20-foot candles.

460.319 Rooms designed for more than one (1) instructional purpose shall be illuminated at the highest level required for any of the activities they are designed to serve.

460.32 LIGHTING FIXTURES: The lighting fixtures in assembly halls, gymnasiums, and rooms used for instruction or study shall be of a type which will provide proper illumination. Protection against accidental breakage shall be provided in any areas used for physical activities.

460.33 VENTILATION: General mechanical means of ventilation shall be provided for all schoolrooms with a minimum capacity of twenty-four (24) cubic feet of standard air per minute for each occupant.

460.331 The air supply shall be taken from a source as free from dust or other impurities as possible. There shall be at least six (6) feet between the air intake of any unit and any other exhaust outlet.

460.332 OUTSIDE AIR: A minimum of ten (10) c.f.m. shall be fresh outdoor air. The volume of supply air shall be maintained constant by proper operation of the equipment and shall slightly pressurize the room. Provision shall be made for the removal of nine (9) c.f.m. of standard air per student in each room, through openings located at or near the floor or ceiling, vent ducts, etc., with proper means to control and regulate same. In determining the amount of outdoor air to be supplied to a given space, the amount required per student, together with enough to slightly pressurize the room and a proportionate amount of make-up air to contribute to any unsupplied but ventilated areas (corridors, toilet rooms, etc.) shall be used.

460.333 STUDENT POPULATION: The design total student population of each area for calculating ventilation requirements in accordance with section 113.5 shall be certified by the architect and the owner.

460.334 SPECIAL EXCEPTIONS TO VENTILATION REQUIREMENTS

460.335 BUILDINGS NOT OCCUPIED: The ventilation system shall be kept in operation at all times during normal occupancy of the building or space so used. When a space is not occupied, its ventilation system may be shut down and its outside air supply closed.

460.336 COLD WEATHER CONDITIONS: At outdoor air temperatures below thirty-five (35) degrees F., the minimum outside air requirements (508.2) may be reduced progressively to as low as zero (0) c.f.m. per occupant at a winter outdoor design temperature of zero (0) degrees or below.

460.337 AIR CONDITIONED CLASSROOMS: Classrooms provided with air conditioning equipment designed to provide a maximum temperature of seventy-eight (78) degrees F. at a relative humidity not to exceed fifty (50) percent when the outside temperature is at ninety-three (93) F.D.B. and seventy-five (75) degrees F.W.B., the minimum outside air requirement of section 508.2 may be reduced to not less than five (5) cubic feet per minute per occupant during the cooling cycle. The air to be removed also shall be proportionately reduced.

460.34 VENTILATION OF SPECIAL SPACES

460.341 Lunchrooms, auditoriums, gymnasiums, and locker-shower rooms: In lunchrooms, auditoriums, gymnasiums, and locker-shower rooms, the supply of air shall be equivalent to one and one-half (1 1/2) cubic feet of standard air per minute per square foot of floor area, of which one-half (1/2) shall be fresh outdoor air. The removal of air shall provide a minimum of four (4) air changes per hour of three-quarter (3/4) cubic feet per minute per square foot of floor area, whichever is less. Where such rooms, except those used for lunchrooms, have a ceiling height exceeding fifteen (15) feet, with a minimum outside wall exposure of forty (40) percent, provisions for the removal of air may be reduced to two (2) air changes or three-quarter (3/4) cubic feet per minute per square foot of floor area, whichever is less. Removal of air from the gymnasiums may be partially taken through the locker and shower rooms, provided that this air is passed through a heating coil to raise the temperature of the air to seventy-five (75) degrees F.

460.342 Kitchens: The kitchen areas shall be exhausted separately. The lunchrooms may be partially exhausted not more than thirty-three and one-third (33 1/3) percent through the kitchen exhaust system, provided that the lunchroom air is taken by ducts from near the floor level at the wall between the kitchen and lunchroom from the lunchroom side, or through grills near the floor.

460.343 Coat room, wardrobe and locker ventilation: All coat rooms shall be ventilated through proper ducts provided for this purpose.

460.344 Classrooms may be vented through wardrobes installed in

classrooms, provided they are mechanically exhausted.

460.345 Wardrobes shall be provided with permanent inlet openings at or near the floor, equivalent to an opening four (4) inches high and the full length of the wardrobe.

460.346 In classrooms which have individual, independent mechanical exhausts or with the classroom exhaust grills located at the floor of the wardrobes, the wardrobes shall be provided with top and bottom openings.

460.347 Lockers installed in corridors, locker rooms or other areas which are not mechanically ventilated shall have doors with top and bottom openings or grills.

460.348 Chemistry, laboratories, welding shops and automotive shops ventilation: Every chemistry room shall be provided with one or more fume cabinets. In lieu thereof, metal vent hoods shall be placed over each experiment table. Every welding booth or work bench space shall be provided with a metal hood close to the work. Every paint spray booth or rooms shall be provided with a separate direct mechanical exhaust. Every automative shop shall be provided a special gasoline fume exhaust to remove air from the lowest part of the floor or pit, and if the floor is provided with a floor drain, the exhaust shall be from the trap thereof.

If internal combustion engines are to be operated in the shops, approved gravity or mechanical muffler connections for exhaust of fumes direct to outside atmosphere shall be provided. All hoods, cabinets and exhausts shall be connected through suitable vent ducts to mechanical exhaust fans for removing the fumes and gases. Where necessary, there shall be bottom vents to provide a source of air. Proper shut-off dampers and manual controls shall be provided.

These special vents and ducts shall be separated from and in addition to the required classroom ventilation. In areas where there may be noxious gases, one-half (1/2) the classroom exhausts may be placed on the upper wall.

460.35 TOILET ROOM VENTILATION

460.351 VENTILATION THROUGH WALL OPENINGS: Each water compartment or urinal shall be provided with a proper vent opening into a duct leading to an exhaust fan or a heated flue, provided that wall ventilation shall not be permitted for stall urinals. Each vent opening shall be provided with a substantial "lock type" register, the bottom of which shall be placed not less than twelve (12) inches from the floor nor more than four (4) feet above the floor.

As alternative to compartment ventilation, toilet rooms may be provided with one (1) or more large substantial "lock type" registers on the fixture wall, the bottom of which may be placed

approximately at the top of the compartment partitions.

The exhaust fan shall have a capacity of sixty (60) cubic feet of air per minute for each water closet compartment vent, and in no case of less capacity than shall provide a change of air in the toilet room eight (8) times an hour. If the total number of compartment vents connected to the duct leading to the exhaust fan or heated flue, rated at sixty (60) cubic feet per minute each, is not sufficient to accomplish an eight (8) minute air change in the toilet room, an additional vent opening from the room into the duct leading to the exhaust fan or heated flue shall be provided.

460.352 DIRECT FIXTURE VENTILATION: When the ventilation of toilet rooms is effected through local vent openings on water closet and urinal fixtures, the exhaust therefrom shall be by means of a mechanical exhaust fan or fans. Each water closet so ventilated shall have an integral raised vent of not less than eight (8) square inches net area unobstructed by waterways or connections, which shall be connected to the fan inlet through a tight sheet metal duct having a minimum cross-sectional area of twenty (20) square inches, and enlarging in size eight (8) square inches for each fixture connected thereto.

Stall urinals shall be ventilated by not less than two (2) inch inside diameter brass, copper or cast iron vent pipe beneath the fixture and connecting to the duct, having not less than two (2) inch tight connections to toilet room vent flues, or through a vent not less than two (2) inches from beneath an integral hood at top of the fixture. The ducts leading to the fan inlet shall be proportioned as in the preceding paragraph.

The mechanical exhaust fan for fixture ventilation shall be rigidly constructed and quiet in operation, with a capacity of thirty-five (35) cubic feet of air per minute for each water closet and urinal fixture, and in no case of less capacity than will provide a change of air in toilet rooms of six (6) times an hour. If the total number of fixture vents connected to the duct leading to the fan rated thirty-five (35) cubic feet of air per minute for each fixture is not sufficient to accomplish a ten (10) minute air change in the toilet room, an additional vent opening from the room into the duct leading to the fan shall be provided.

The vent duct shall have a minimum cross-sectional area of fifty (50) square inches, and shall increase in area forty-two (42) square inches for each compartment vent connected thereto. This shall apply to heat-activated gravity systems only.

460.353 Ventilation shall not be directly into a "utility space," so called, but the duct to which the vents shall be connected may be run in such space.

460.354 Individual toilet rooms may be ventilated at the ceilings.

460.355 TOILET ROOM VENT DUCTS: The ducts connecting the local vents from water closets, urinals, and compartments shall pitch up sharply from the fixtures and outlets to the toilet room vent-flue or fan inlet with a minimum rise of one (1) inch to each foot of run.

460.356 SEPARATION OF TOILET ROOM VENTILATION: All toilet room ventilation systems shall be distinct and apart from all other ventilation.

460.357 VENTILATING EQUIPMENT AND DISTRIBUTION DUCTS: The mechanical ventilation systems, equipment, and distributing ducts shall be installed in accordance with the provisions of articles 11 and 18.

460.36 EXISTING SCHOOLHOUSE BUILDINGS

460.361 UNSAFE CONDITIONS: In all existing rooms or spaces in which the provisions for light and ventilation do not meet the requirements of this Code and which in the opinion of the building official are dangerous to the health and safety of the occupants, he shall order the required repairs or installation to render the building or structure in compliance with this Code.

460.362 ALTERATIONS: No schoolhouse building shall hereafter be altered or rearranged so as to reduce either the size of a room or the fresh air supply or the amount of available natural light to less than that required for buildings hereafter erected; or to create an additional room unless made to conform to the requirements of this Code. The building official may permit new rooms to be of the same height as existing rooms in the same story unless in his opinion greater provision of artificial light and ventilation is deemed necessary to insure healthful living conditions.

460.4 INTERCOMMUNICATING FLOOR LEVELS

Where necessary for the functional design of the building, any structure other than one classified in occupancy group H-2, may be permitted to have a maximum of three (3) communicating floor levels without enclosure or protection between such areas, provided that there is compliance with all of the conditions prescribed within this section and subject to the approval of the building official. The entire area, including all communicating floor levels, shall be sufficiently open and unobstructed so that it may be reasonably assumed that the occupants of this area will be aware that a fire or other dangerous condition exists. The combined areas of the intercommunicating floor levels shall not exceed thirty thousand (30,000) square feet.

460.41 ARRANGEMENT: The arrangement of any intercommunicating floor levels shall comply with the requirements of Table 2-6.

460.42 GRADE: The lowest or next to the lowest level is a level

accessible from the street, or from outside the building at grade, with floor level at main entrance not more than twenty-one (21) inches above nor more than twelve (12) inches below grade at said main entrance.

460.43 EXITWAYS: Exitway capacity shall be sufficient to provide simultaneously for all the occupants of all communicating levels and areas. All communicating levels in the same fire area shall be considered as a single floor area for purposes of determination of required exitway capacity. Each floor level, considered separately, shall have at least one-half (1/2) of its required exitway capcity provided by exitways leading directly out of that area without traversing another communicating floor level or being exposed to the spread of fire or smoke therefrom.

460.44 ENCLOSING WALLS: The enclosing walls of the space created by the communicating floor levels shall have a fireresistive rating of not less than that required for interior exitway stairways as specified in section 618, with approved fire doors or windows provided in openings therein, all so designed and installed as to provide a complete barrier to the spread of fire or smoke through such openings.

406.5 MEANS OF EGRESS: For all areas, spaces or rooms with an occupancy load of ten (10) or more persons used for instructional or assembly purposes there shall be at least two independent means of egress leading to separate exits remote from each other, so arranged that to reach one it will not be necessary to pass through a common corridor or space. For the purpose of this section, a smoke screen barrier shall be construed as effectively dividing a corridor or space into independent areas.

460.51 DEAD END CORRIDORS: The maximum length of travel of a dead end corridor for classroom buildings shall be thirty (30) feet with no more than one (1) classroom on each side of the corridor.

460.52 AISLE AND CORRIDOR WIDTHS: Aisle and corridor widths shall be as provided for in section 610.3 with the following minimum total widths:

460.521 Corridors with classrooms on both sides shall have a clear width of seventy-two (72) inches for four (4) and five (5) classrooms; eighty-four (84) inches for six (6) and seven (7) classrooms; and ninety-six (96) inches for eight (8) or more classrooms.

460.522 Corridors with classrooms on one (1) side shall have a minimum clear width of seventy-two (72) inches.

460.523 Corridors not over thirty (30) feet in length leading to no more than two (2) shops or non-classroom spaces, averaging not more than twenty-five (25) persons per room may be four (4) feet wide.

460.524 Corridors of the lobby type serving as assembly areas in connection with cafeterias shall have a minimum clear width of ten (10) feet.

460.525 Corridors providing side exits shall be a minimum clear width of four (4) feet to a minimum three (3) foot six (6) inch door, properly marked with exit signs in the main corridor.

460.526 With lockers or coat-hanging spaces along one (1) wall of the above corridors add twelve (12) inches to the minimum clear width; along both walls, add twenty-four (24) inches to the minimum clear width.

460.53 AISLE: When fixed seating is used, the aisle in classrooms shall be not less than the following widths:

| | |
|---|---|
| All clear aisles | 1 foot 5 inches |
| Wall aisles next to window | 3 feet |
| Other wall aisles | 2 feet 6 inches |

460.54 REQUIRED MEANS OF EGRESS DOORWAYS

460.541 Doors to shops having not more than thirty (30) pupils and doors to rooms formed by two (2) classrooms connected with a folding partition may swing in.

460.542 All classroom doors may swing in either direction, providing those swinging into a corridor are recessed and will protrude not more than five (5) inches into the corridor when fully open.

460.543 CLASSROOM GRADE EXIT DOORS: A five (5) inch step is permitted where a classroom door opens to the outside, and where a designated exit is not protected from the weather; otherwise, the outside platform shall be approximately at floor level.

460.55 STAIRWAYS

460.551 VERTICAL RISE: The height of vertical rise shall not exceed nine (9) feet between landings and intermediate platforms

460.552 MINIMUM DIMENSIONS: In addition to the provisions of section 616.4, treads and risers of required stairs shall be so proportioned that the sum of two (2) risers and a tread, exclusive of projection of nosing, is not less than twenty-four (24) inches nor more than twenty-five (25) inches. The height of risers shall not exceed seven and one-half (7 1/2) inches, and treads, exclusive of nosing, shall be not less than ten (10) inches wide. Every tread less than eleven (11) inches wide shall have a nosing, or effective projection, of approximately one (1) inch over the level immediately below that tread. The height of the riser shall not exceed six and one-half (6 1/2) inches and the width of the tread shall not be less than twelve (12) inches for all exterior entrance stairways.

460.553 SUPPLEMENTAL STAIRWAYS: Monumental stairs, either inside or outside, may be accepted as required exits if all requirements for exit stairs are complied with, including required enclosures and minimum width of tread, except that curved stairs may be accepted with a radius of twenty-five (25) feet or more at the inner edges.

460.56 EXITWAY SIGNS AND LIGHTS: Exitway signs and lights shall conform to the requirements of section 623 except for existing schoolhouses having means of egress signs reading "EXIT" in red letters at least five (5) inches high on a white background or in other approved distinguishable colors, illuminated by an electric light of not less than twenty-five (25) watts, visible from the exit approach and supplemented by directional signs in the access corridors indicating the direction and ways of egress. Such signs may be internally illuminated with an enclosing noncombustible case through ruby glass. The letters of internally illuminated signs shall not be less than four and one-half (4 1/2) inches high.

460.57 MEANS OF EGRESS LIGHTING

460.571 In auditoriums, multi-purpose rooms and gymnasiums, where used for assembly purposes, provisions shall be made for control of general artificial illumination from the rear of the room, the projection room (if any) and the probable location of a projector.

460.572 EMERGENCY LIGHTING REQUIREMENTS: Emergency lighting shall be provided for all exits, corridors, passages and stairways. In addition, emergency lighting shall be required in all gymnasiums, auditoriums, multi-purpose rooms, and rooms without natural lighting. Rooms less than four hundred (400) square feet of floor area without natural lighting used as service or storage areas will not require emergency lighting. Emergency lighting shall be installed in accordance with the requirements of sections 624.4 and 624.41.

460.6 FIRERESISTIVE PARTITIONS

460.61 EXCEPTION: Fireproof Construction - In all buildings and structures of other than schoolhouse institutional (use group H) of fireproof (type 1), or of protected noncombustible (type 2) construction, space and office dividers, not including partitions, of a single thickness of wood or approved composite panels, and glass or other approved materials of similar combustible characteristics, may be used to subdivide rooms and spaces, provided they do not establish a public corridor or a private corridor serving an occupant load of fifty (50) or more and not exceeding ten thousand (10,000) square feet between fireresistive or fire partitions, fire walls and fireresistive floors. Larger areas may be subdivided with fireretardant wood or with materials of similar combustible characteristics when complying with section 903.72, but not to exceed fifty (50) percent increase in area.

460.62 LATCHES AND ASTRAGALS: Latches and astragals for Class C doors in path of egress may be omitted in use Group F-3 and F-4 occupancies if required to be self-closing. Frames shall be of steel or metal-covered wood of label construction. Doors shall be steel, metal-covered core and of label construction.

460.63 FIRE DOORS

460.631 SPECIAL SITUATIONS: Shop and chemistry laboratory doors shall be Class C doors.

460.632 GLASS PANELS: Wired glass panels shall be permitted in fire doors within the limitations of section 919 and as herein specifically prescribed.

460.633 Smoke barriers or screens shall consist of noncombustible partitions containing or not containing wire glass panels and/or smoke stop doors conforming to the following: Smoke stop doors shall be self-closing, swinging doors of metal, metal-covered, aluminum, or one and three-quarter (1 3/4) inch solid core wood with clear wire glass panels having an area of at least six hundred (600) square inches per door; except that in buildings not over two (2) stories high, smoke stop doors may be of one and three-eighths (1 3/8) inch solid core wood with clear wire glass panels, unless the doors are also used as horizontal exits in which case they shall comply with the provisions of section 917.21 for Class B or Class C doors as the exitway may require. Smoke stop doors shall close the opening completely with only such clearance as is reasonably necessary for proper operation. Smoke stop doors shall normally be in the closed position, except that they may be left open if they are arranged to close automatically by an approved device meeting the requirements of section 612.44.

460.634 WIRED GLASS: For schoolhouses, the maximum dimension of twelve (12) inches in section 919.2, the maximum twelve (12) inch height for Class B door in section 919.4, and the size limitation of section 919.5 shall not apply.

## Reference Standards - Article 4

| | | | |
|---|---|---|---|
| ANSI | PH22.31 | 1967 | Motion Picture Safety Film |
| APHA | | 1957 | Swimming Pools and other Public Bathing Places, Recommended Practice for Design, Equipment and Operation |
| Mass-DPS | FPR 2 | 1963 | Dry-Cleaning and Dry-Dyeing, and the Keeping, Storage and Use of Cleaning and Dyeing Fluid in Connection Therewith |
| Mass-DPS | FPR 4 | 1968 | Construction and Maintenance of Buildings or Other Structures Used as Garages and the Related Storage, Keeping and Use of Gasoline |
| Mass-DPS | FPR 5 | 1962 | Construction, Location, Installation and Operation of Liquefied Petroleum Gas Systems, Gas Piping and Appliance Installations in Buildings |
| Mass-DPS | | | Board of Boiler Rules |
| Mass-DPS | FPR 6 | 1948 | Manufacturing and Handling of Plastics |
| Mass-DPS | FPR 13 | 1965 | Keeping, Storage, Manufacture or Sale in Limited Quantities of Flammable Fluids, Solids, or Gases |
| Mass-DPH | Article VI | 1969 | Minimum Standards for Swimming Pools |
| NFPA | Vol. 1 | 1969-70 | Flammable Liquids |
| NFPA | 24 | 1973 | Outside Protection (Yard Piping) |
| NFPA | 30 | 1973 | Flammable and Combustible Liquids Code |
| NFPA | 32 | 1972 | Dry Cleaning Plants |
| NFPA | 33 | 1973 | Spray Finishing Using Flammable and Combustible Materials |
| NFPA | 34 | 1966 | Dip Tanks Containing Flammable or Combustible Liquids |
| NFPA | 40 | 1967 | Cellulose Nitrate Motion Picture Film |
| NFPA | 42 | 1967 | Pyroxylin Plastic in Factories, Storage, Handling and Use |
| NFPA | 43 | 1967 | Pyroxylin Plastic in Warehouses, Wholesale and Retail Store |
| Mass-DPS | PHR-1 | | Rules and Regulations of the Board to Facilitate the Use of Public Buildings by the Physically Handicapped |

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|---|---|---|---|
| NFPA | 58 | 1972 | Liquefied Petroleum Gases, Storage and Handling |
| NFPA | 59 | 1968 | Liquefied Petroleum Gases at Utility Gas Plants |
| NFPA | 60 | 1973 | Pulverized Fuel Systems, Installation and Operation of |
| NFPA | 61A | 1962 | Starch Factories, Prevention of Dust Explosions in |
| NFPA | 61B | 1959 | Terminal Elevators, Prevention of Dust Explosions |
| NFPA | 61C | 1962 | Flour and Feed Mills, Allied Grain Storage Elevators, Prevention of Dust Explosions |
| NFPA | 63 | 1971 | Industrial Plants, Fundamental Principles for Prevention of Dust Explosions in |
| NFPA | 64 | 1959 | Country Grain Elevators, Prevention of Dust Ignitions in |
| NFPA | 68 | 1954 | Explosion Venting Guide |
| NFPA | 88 | 1968 | Garages |
| NFPA | 90A | 1973 | Air Conditioning and Ventilating Systems |
| NFPA | 101 | 1967,1971 1973 | Life Safety Code |
| NFPA | 102 | 1972 | Tents and Grandstands and Air-Supported Structures Used for Places of Assembly |
| NFPA | 204 | 1968 | Smoke and Heat Venting Guide |
| NFPA | 329 | 1965 | Underground Flammable and Combustible Liquid Tanks, Leakage From |
| NFPA | 654 | 1963 | Dust Explosion Prevention in Plastic Industry |
| NFPA | 656 | 1959 | Spice Grinding Plants, Prevention of Dust Ignitions in |
| NFPA | 657 | 1967 | Confectionery Manufacturing Plants, Prevention of Dust Explosions in |
| NFPA | 701 | 1969 | Flameresistant Textiles and Films, Standard Method of Tests for |

ARTICLE 5

# LIGHT AND VENTILATION

## SECTION 500.0 SCOPE

The provisions of this article shall govern the means of light and ventilation required in all habitable and occupiable spaces and rooms. Every building and structure hereafter erected and every building, room or space which is changed in use shall be constructed, arranged and equipped to conform to the requirements of this article and the applicable standards listed in the reference section of this article.

500.1 OTHER REGULATIONS: Nothing in this article shall be construed to nullify the provisions of the local zoning by-laws or ordinances or subdivision controls promulgated under authority of Chapter 41, or Chapter 40A respectively of the Massachusetts General Laws Annotated as amended.

500.2 OTHER STANDARDS: Compliance with the applicable provisions of the standards listed in the reference section of this article shall be deemed to meet the requirements of this article, unless otherwise specifically provided herein.

## SECTION 501.0 DEFINITIONS

COURT: an open, uncovered unoccupied space partially or wholly surrounded by the walls of a structure.

-ENCLOSED OR INNER: a court surrounded on all sides by the exterior walls of a structure or by such walls and an interior lot line.

-OUTER COURT: a court having at least one side thereof opening on to a street, alley, or yard or other permanent open space.

HABITABLE ROOM: a room or enclosed floor space arranged for living, eating, and sleeping purposes (not including bathrooms, water closet compartments, laundries, pantries, foyers, hallways and other accessory floor spaces).

HABITABLE ROOM, MINIMUM HEIGHT: a clear height from finished floor to finished ceiling of not less than seven and one-half (7½) feet, except that in attics and top half-stories the height shall be not less than seven and one-third (7-1/3) feet over not less than one-third (1/3) the area of the floor when used for sleeping, study or similar activity.

HABITABLE ROOM, MINIMUM SIZE: a room with a minimum dimension of seven (7) feet and a minimum area of seventy (70) square feet, between enclosing walls or partitions, exclusive of closet and storage spaces.

OCCUPIABLE ROOM: a room or enclosed space designed for human occupancy in which large numbers of individuals congregate for amusement, educational, or similar purposes or in which occupants are engaged at labor; and which is equipped with means of egress, light, and ventilation facilities meeting the requirements of the Basic Code.

VENTILATION. (See section 1801.0.)

WIDTH.

-INNER COURT: as applied to an inner court, means its least horizontal dimension.

-OUTER COURT: as applied to an outer court, means the shortest horizontal dimension measured in a direction substantially parallel with the principal open end of such court.

YARD: an open unoccupied space on the same lot with a building extending along the entire length of a street, or rear, or interior lot line.

## SECTION 502.0 PLANS AND SPECIFICATIONS

Plans for all buildings and structures other than one and two-family and multi-family dwellings, which are designed for human occupancy shall designate the number of occupants to be accommodated in the various rooms and spaces and when means of artificial lighting and ventilation are required, the application shall include sufficient details and description of the mechanical system to be installed as herein required or as specified in article 18.

## SECTION 503.0 STANDARDS OF NATURAL LIGHT

In the application of the provisions of this article, the standard of natural light for all habitable rooms, unless otherwise specifically required by the provisions of article 4 for special uses and occupancies, shall be based on two hundred and fifty (250) foot candles of illumination on the vertical plane adjacent to the exterior of the light transmitting device in the enclosure wall and shall be adequate to provide an average illumination of six (6) foot candles over the area of the room at a height of thirty (30) inches above the floor level.

503.1 WINDOW AND SKYLIGHTS: All habitable rooms or spaces shall contain windows, skylights, monitors, glazed doors, transoms, glass block panels or other light transmitting media opening to the sky or on a public street, yard or court complying with the provisions of this article. The light transmitting properties and the area of the devices used shall be adequate to meet the minimum daylighting requirements specified herein.

503.2 WINDOW SIZE: Windows and exterior doors may be used as a natural means of light and when so used their aggregate glass area shall amount to not less than one-tenth (1/10) of the floor area served.

503.3 INTENSITY OF ILLUMINATION: In all required exitways, except in one and two-family dwellings, and wherever natural lighting is not available, artificial lighting shall be provided to furnish not less than three (3) foot candles at the floor level of all required exitways.

503.4 STAIRWAYS AND EXITWAYS IN RESIDENTIAL AND INSTITUTIONAL BUILDINGS

503.41 WINDOWS: In all multi-family dwellings (use group L-2) and in institutional buildings for the care or treatment of people (use group H-2) required interior stairways shall be provided with windows to the outer air having a glass area of not less than ten (10) square feet which opens on a required street, alley, yard or court, or with the equivalent source of light for each story through which the stairway passes; and such additional artificial lighting to provide the equivalent illumination at all times that the building is occupied as specified in section 624.0.

503.42 SKYLIGHTS: When the building is not more than three (3) stories in height, a ventilating skylight of the required area may be used in lieu of windows.

503.43 HALLWAYS: Hallways shall have at least one window opening directly on a street or on a required yard or court in each story, located so that light penetrates the full length of the hallway, with additional windows for each change of direction of the hallway; or the equivalent artificial lighting shall be provided. Every recess or return with a depth or length which exceeds twice the width of the hall, and every corridor separately shut off by a door, shall be treated as a separate hall in applying the provisions of this section.

SECTION 504.0 STANDARDS OF NATURAL VENTILATION

Natural Ventilation shall be from unobstructed windows, skylights, monitors, doors, louvres, jalousies, or other similar openings. Such openings shall be direct to the sky, public street, space, alley, park, highway or right of way, or upon a yard, court plaza, or space above a setback located on the same lot and which complies with the requirements of Section 512.

504.1 AREA OF NATURAL VENTILATING OPENINGS: Natural ventilating openings from habitable spaces shall have a free area when open of at least 5 percent of the floor area of the space ventilated. The

occupiable spaces, the free openable area shall be the basis to determine the minimum requirements for supplementary mechanical ventilation. Free openable area is the cross-sectional area at plane of greatest restriction to air flow, exclusive of screening.

504.2 VENTING OF SPECIAL SPACES

504.21 ALCOVE ROOMS: When alcove rooms open without obstruction into adjoining rooms, the required window openings to the outer air shall be based on the combined floor area of room and alcove. No such alcove space shall be more than sixty (60) square feet in area and the opening to the adjoining room shall be not less than eighty (80) per cent of the superficial area of the dividing wall, unless provided with separate means of light and ventilation.

504.22 ATTIC SPACES: All attic spaces and spaces between roofs and top floor ceilings shall be ventilated by not less than two (2) opposite windows, louvres, or vents with a total clear area of opening not less than one-third (1/3) of one (1) per cent of the horizontally projected roof area.

504.23 CRAWL SPACES: In buildings and structures constructed without basements, in which the first floor construction does not bear directly on the ground, a space shall be provided under the first floor not less than eighteen (18) inches in depth; and such space shall be vented with screened openings having a clear area of not less than one-third (1/3) of one (1) per cent of the enclosed building area, or shall be provided with other means of ventilation approved by the building official. When floating mat foundations are provided in accordance with section 734.0, the requirement for ventilation shall not apply.

## SECTION 505.0 VENTILATION OF INSTITUTIONAL BUILDINGS FOR FORCED DETENTION

In buildings of the Institutional use group used for enforced detention, all rooms shall comply with the requirements of this article for light and ventilation. However, where necessary, alternate means of complying with these provisions may be approved, providing that it can be shown that they fulfill all the requirements of these provisions for light and ventilation as applicable.

## SECTION 506.0 EXISTING BUILDINGS

506.1 UNSAFE CONDITION: In all existing rooms or spaces in which the provisions for light and ventilation do not meet the requirements of this article and which in the opinion of the building official are dangerous to the health and safety of the occupants, he shall order the required repairs or installations to render the building or structure livable for the posted use and occupancy load.

506.2 ALTERATIONS: No building shall hereafter be altered or rearranged so as to reduce either the size of a room, or the fresh air supply, or the amount of available natural light to less than that required for buildings hereafter erected; or to create an additional room unless made to conform to the requirements of section 503. The building official may permit new rooms to be of the same height as existing rooms in the same story unless in his opinion greater provision of artificial light and ventilation is deemed necessary to insure healthful living conditions.

506.3 UNCOVERED YARD AND COURT AREA: No building shall be hereafter enlarged, nor shall the lot on which it is located be diminished so as to decrease the required courts or yards to less than that prescribed in this article for the lighting and ventilation of new buildings.

## SECTION 507.0 STANDARDS OF ARTIFICIAL LIGHT

507.1 ARTIFICIAL LIGHT REQUIREMENTS: Adequate means for providing artificial light shall be provided in every occupiable space in every building hereafter erected and in the portions of existing buildings where alterations are performed.

507.2 MEANS OF EGRESS: Means of egress lighting shall comply with the requirements of article 6.

507.3 PLACES OF ASSEMBLY: Artificial lighting shall be provided as required in articles 4 and 6.

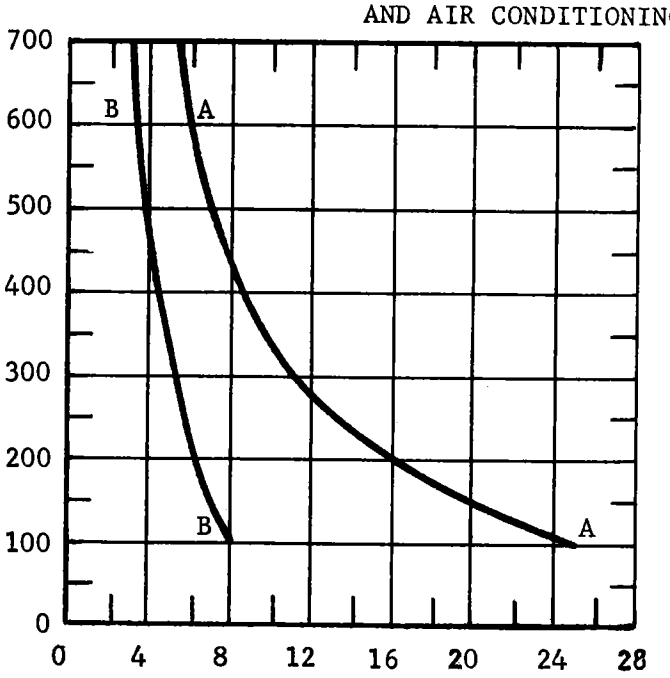
507.4 BATHROOMS AND TOILET ROOMS: Artificial lighting of bathrooms and toilet rooms shall be provided to produce an average of three (3) foot candles thirty (30) inches above the floor.

## SECTION 508.0 STANDARDS OF MECHANICAL VENTILATION

508.1 AREAS REQUIRING MECHANICAL VENTILATION: Mechanical ventilation shall be provided in all occupiable rooms or spaces where the requirements for natural ventilation are not met; in all rooms or spaces, which because of the nature of their use or occupancy, involve the presence of dust, fumes, gases, vapors, or other noxious or injurious impurities, or substances which create a fire hazard; or where required by the provisions of section 509.0 or articles 4 and 6.

508.2 OUTSIDE AIR: Where mechanical ventilation is required the minimum amount of outside air introduced into any room or enclosed space shall be at least equal to the amount required by Figure 5-1.

508.21 FIGURE 5-1 MINIMUM OUTSIDE AIR REQUIREMENTS FOR VENTILATION AND AIR CONDITIONING




Minimum Outside Air, Cu. Ft. Per Person Per Min.

508.22 CURVE A - VENTILATION ONLY: The values obtained from Curve A in Figure 5-1 represent the minimum volume of outside air required for adults quietly occupied. Where the space has mechanical cooling, the values of Curve A represent the minimum amount of air to be circulated.

a) Values of Curve A shall be increased by twenty-five (25) per cent for areas in which the occupancies contain or involve:

   1) Grade school children
   2) Light smoking
   3) Food Service
   4) Other occupancies involving air contamination

b) Values of Curve A shall be increased fifty (50) per cent for areas in which the occupancies contain or involve:

   1) Manual labor
   2) Sports
   3) Dancing
   4) Heavy smoking
   5) Other occupancies involving heavy air contamination

c) Values of Curve A shall be increased by an appropriate amount to remove excess heat or moisture generated by equipment in the occupied area.

508.23 CURVE B - MECHANICAL COOLING: The values obtained from Curve B in Figure 5-1 represent the minimum volume of outdoor air required for adults quietly occupied where adequate control is maintained over temperature and humidity and where odor removal apparatus is used if smoking is permitted in the occupied area.

a) Where only part of the above-mentioned controls are maintained, the values of Curve B must be increased in accordance with good engineering design and subject to the approval of the building official.

508.3 MEANS OF EXHAUST: Exhaust may be accomplished by:

a) Forcing leakage through openings communicating directly to the outdoor air.

b) By drawing the vitiated air from spaces into the return duct of the system apparatus. When exhaust is to a return duct, the system apparatus shall be equipped to mix outdoor and return air under conditions which assure that the minimum amount of outdoor air will never be less than the sum of the minimum outdoor air ventilation requirements of all the spaces served by that system.

c) By drawing air into a fan-powered exhaust system discharging directly to the outdoor air.

508.4 MAKE-UP AIR: Sufficient air to replace the exhaust quantity shall be admitted to spaces which are under forcible exhaust by one or by any combination of the following methods:

a) If permitted by this Code, by infiltration through louvres, registers, or other permanent openings in walls, doors, or partitions of adjoining spaces where air is supplied in sufficient excess to meet the requirements of both spaces.

b) By infiltration through natural ventilation openings when the heating system is properly designed to permit such infiltration without causing drafts objectionable to the occupants.

c) By other methods acceptable to the building official, and in conformance with good engineering practice.

d) If permitted by this Code, exhaust may be accomplished by forcing leakage through permanent openings to adjoining spaces from which air is removed by method (c) above, provided the total amount of ventilation of both spaces is not reduced to less than the amounts required by Figure 5-1 and provided the space is not of the type from which recirculation of air is prohibited.

508.5 RECIRCULATION: Portions of the fresh air supply required in this section may consist of recirculated air as stated herein, subject to the prohibited use requirements of section 508.51 and the allowance for adsorption devices of section 508.6.

508.51 PROHIBITED USE OF RECIRCULATED AIR: The use of the air from Kitchens, Lavatories, Toilet Rooms, Bathrooms, Rest Rooms, Laboratories and Garages for recirculation shall be prohibited.

508.52 HABITABLE ROOMS: Recirculation of up to seventy-five (75) percent of the air supplied may be permitted in habitable rooms except kitchens, provided the air recirculated does not come from a plenum or system fed with air returned from habitable rooms in other dwelling units, or from stairways or common hallways. Recirculation of one-hundred (100) percent of the air supplied may be permitted if the system supplied only a single dwelling unit.

508.53 WORK ROOMS: Recirculation of not more than seventy-five (75) percent of the air supplied may be permitted in work rooms, provided the air is free from harmful dusts, fumes, vapors, mists, or gases.

NOTE: Recirculation of air removed by local exhaust systems is prohibited unless the contaminant is removed by an approved method to a safe limit of concentration. The amount of air supplied to replace all air exhausted by local exhaust ventilation systems shall be considered as fresh air in the calculation of the requirements in section 505.31 and 505.32 provided that the air supplied is free from contamination and is from an approved source. This provision also applies to cold air douches used in hot industries.

508.54 RESTAURANTS AND DINING HALLS: Not more than fifty (50) percent of the air supplied to restaurants and dining halls shall be recirculated.

508.55 OFFICES AND PUBLIC INSTITUTIONAL BUILDING: Not more than seventy-five (75) percent of the air supplied to offices and public and institutional buildings shall be recirculated.

508.56 HOSPITALS AND MEDICAL CARE FACILITIES: Hospitals and Medical Care Facilities may employ recirculated air in compliance with the approved methods and systems of the reference section of this article.

508.6 USE OF ADSORPTION DEVICES: If recirculation of air is permitted, the required outdoor air supply may be reduced to to fifty (50) percent, provided that an equivalent quantity of the recirculated air is passed through approved adsorption devices. The adsorption material, the material quantity and the means provided for maintaining the effectiveness of the absorption devices shall be acceptable to the building official and in conformance with good engineering practice.

a) Improper maintenance - Should absorption devices be improperly maintained in the opinion of the building official, he may order their removal. If the adsorption devices are removed, the ventilating system shall not be operated unless it will supply 100 percent of the outdoor air required by this section or section 508.0.

b) Test records - The building owner shall continuously maintain a record showing the manufacturer's recommendation for frequency of tests, the method of making tests, and the results of periodic tests of the adsorption devices. Such tests shall be made and certified by an approved agency at least twice every six months. The records of such tests shall be maintained for a period of at least two years, and shall be available for inspection by the building official.

## SECTION 509.0 VENTILATION OF SPECIAL SPACES

509.1 KITCHENS: Kitchens shall be ventilated as follows:

a) Kitchens located within dwelling units and having a floor area of greater than seventy (70) square feet shall have natural ventilation as prescribed in section 504.0. When the floor area is seventy (70) square feet or less the kitchen shall be ventilated by either of the following:

   1) Natural means complying with section 504.0.

   2) Mechanical means exhausting at least two (2) cfm of air per square foot of floor area.

b) Kitchens, except those located within dwelling units, and any spaces where cooking of any kind is done, shall be ventilated by either of the following:

   1) Natural means complying with section 504.0 or mechanically air-cooled means complying with Figure 5-1 Section 508.21 and supplemented with auxiliary mechanical supply and exhaust ventilation adequate to remove the fumes and smoke from the cooking equipment when operating, in accordance with the provisions of article 18.

   2) Non-air-cooled mechanical means exhausting at least three (3) cfm of air per square foot of floor area, but in no case less than one-hundred and fifty (150) cfm.

c) Kitchens, snack bars, or pantries, where the operation consists of heating or warming previously prepared food that was cooked elsewhere, or where food is prepared in vending machines, may be ventilated by either or a combination of the following:

1) Natural ventilation complying with section 504.0.

2) Mechanical ventilation complying with section 508.0.

d) Air shall be exhausted through ducts or chimneys constructed in accordance with the provisions of articles 10, 11 and 18.

e) Make-up air shall be provided by one of the methods described in section 508.4.

509.2 BATHROOMS AND TOILET ROOMS: Bathrooms and toilet rooms shall be ventilated as follows:

a) When ventilated by natural means, the natural ventilation openings shall comply with section 504.0 except:

1) In no case shall the net free area of the ventilation openings be less than one and one-half (1½) square feet.

2) In occupancy groups H-1 and H-2, the ventilation openings may be to a vent shaft provided that the net free area of the opening is not less than three (3) square feet. The vent shaft cross-sectional area shall be equal to the sum of the required minimum ventilation openings plus one-fifth (1/5) square foot for every foot of height but not less than nine (9) square feet and open to the outer air at the top; or, the vent shaft may be open at the sides above the roof with louvres providing net free area equal to the area of the shaft.

b) By individual vent shafts or ducts constructed of non-combustible materials with a minimum cross-sectional area of one (1) square foot plus one-third (1/3) square foot for each additional water closet or urinal above two in number. The upper termination of such ducts shall be equipped with a wind actuated ventilator cap with throat area equal to the duct area.

c) When a bathroom or toilet room is not ventilated by a natural ventilation as required by this section, it shall be mechanically ventilated as follows:

1) Rooms containing only one water closet or urinal shall be mechanically ventilated by an exhaust system capable of exhausting at least forty (40) cfm.

2) Rooms containing more than one water closet or urinal, and any auxiliary spaces such as those used in hand basins, slop sinks, and locker rooms, shall be mechanically ventilated by an independent exhaust system capable of exhausting at least forty (40) cubic feet of air per minute per water closet or urinal. The outdoor air supply shall conform to the requirements of section 508.0.

3) Toilet exhaust systems shall be arranged to expel air directly to the outdoors.

d) Make-up air shall be provided by one of the methods described in section 508.4.

509.3 INSIDE LOCKER ROOMS: Inside locker rooms and dressing rooms for more than one person shall be ventilated at a rate of four changes of air per hour or as required by Section 508.22, whichever is greater.

509.4 CORRIDORS: Corridors shall have ventilation provisions to supply outdoor air in conformance to whichever of the following is greater:

a) For make-up of air exhausted to adjoining spaces. Provisions for make-up air supply shall conform to Section 508.4.

b) Natural sources complying with Section 504.0 to provide ventilating openings equivalent to at least two and one-half (2½) percent of the floor area.

c) In occupancy groups H-1 , H-2 and L-2, mechanical supply of at least one-half (½) cubic foot of outdoor air per minute per square foot of floor area.

## SECTION 510.0 VENTILATION OF SHAFTS OTHER THAN ELEVATOR AND DUMBWAITER HOISTWAYS

All enclosed vertical shafts extending through more than two (2) stories of every building or structure, except elevator or dumbwaiter hoistways, shall be automatically vented to the outer air as herein required or as specified in section 911.0.

510.1 EXTENDING TO ROOF: Shaft enclosures extending to the roof shall be provided with a metal skylight constructed to comply with section 927.2 or with windows of equivalent area or with other approved automatic means of removing hot air and gases.

510.2 THERMOSTATIC CONTROL: The automatic operation of fire shutters, skylights and other vent relief devices may be controlled by fusible links designed to operate at a fixed temperature of not more than one hundred and sixty (160) degrees F., or by electric or pneumatic operation under a rapid rise in temperature at a rate of fifteen (15) to twenty (20) degrees F. per minute or by other approved methods.

510.3 NOT EXTENDING TO ROOF: Shaft enclosures not extending to the roof shall be provided with gas and smoke relief vents or adequate mechanical means of ventilation in conformity to the provisions of section 911.4 and article 18.

## SECTION 511.0 INDUSTRIAL BUILDINGS WITH UNPIERCED ENCLOSURE WALLS

511.1 AIR CONDITIONING: When light and ventilation yards, courts or other required open spaces are not provided as herein specified, buildings may be erected for industrial and commercial uses within the height and area limitations of article 3 and table 2-6 when such buildings and structures are equipped with approved artificial lighting, ventilating and air conditioning systems furnishing the equivalent light and ventilation. The installation of all such systems shall comply with the provisions of article 18.

511.2 FIRE PROTECTION: Buildings and structures without exterior window openings in all stories which are provided with approved mechanical ventilating and air conditioning systems shall be equipped with the fire protection and fire-extinguishing media herein prescribed complying with the requirements of article 12;

511.21 ACCESS PANELS: Fire Access Panels of the required size and location shall be installed in the enclosure walls as specified in section 858.0.

511.22 FIRE ALARMS: Interior Fire Alarm signal systems shall be provided and maintained as specified in article 12;

511.23 SPRINKLERS: Two-Source Automatic Sprinkler systems with supervisory service and fire department connections shall be installed to comply with article 12;

511.24 FIRE-VENTING: The building or structure shall be fire-vented as prescribed in section 514.

## SECTION 512.0 COURTS

All courts required to serve rooms for light and ventilation purposes shall comply with the requirements of this section.

512.1 WIDTH OF COURT.

512.11 MINIMUM WIDTH: Every such court shall have a minimum width of three (3) inches for each foot of height or fraction thereof but not less than five (5) feet for outer courts and twice these values for inner courts.

512.12 IRREGULAR COURT WIDTH: In the case of irregular or gore-shaped courts, the required minimum width of court may be deemed to be the average width, provided that no such court shall be less than five (5) feet at any point.

512.2 AREA OF COURT: The cross-sectional area of a required court shall be not less than one and one-half (1½) times the square of its width; nor shall the length of any court be more than twice its width.

512.3 ACCESS TO COURT: A door or other means of access shall be provided at the bottom of every court that is not otherwise conveniently accessible for purposes of cleaning.

512.4 AIR INTAKES TO COURT.

512.41 INNER COURT: Every court serving one or more habitable rooms that does not open for its full height on one or more sides to a street or legal yard shall be connected at or near the bottom with a street or yard by a horizontal intake or passage of fireresistive construction. Such intake or passage shall have a cross-sectional area of not less than twenty-one (21) square feet, and shall remain fully open at both ends and unobstructed for its full size and length, except that grilles of noncombustible construction complying with the approved rules may be permitted at the ends of the intake.

512.42 FIRERESISTANCE: The walls, floors and ceiling of such intakes or passages shall have a fireresistance rating of not less than two (2) hours in buildings of types 1, 2 or 3 construction and not less than three-quarter (3/4) hour in type 4 construction.

512.5 COURT WALLS: When in the opinion of the building official, windows facing on courts do not receive adequate direct light by reason of peculiar arrangement or orientation, he may require the walls to be constructed of light colored masonry, or to be painted and maintained a light color to furnish additional reflected light.

512.6 COURT DRAINAGE: The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the Massachusetts State Plumbing Code; and shall be paved with concrete or other non-absorbent material when required by the building official.

## SECTION 513.0 OBSTRUCTION OF COURTS AND YARDS

513.1 PERMISSIBLE PROJECTIONS: Every required court and yard shall remain unobstructed for its required area and full height, except for the projections permitted in section 313.0. In residential and institutional buildings, clothes poles, arbors, garden trellises and other such accessories shall not be prohibited in the open spaces at ground level.

SECTION 514.0 FIRE EMERGENCY VENTILATING SYSTEM

In all buildings and structures herein required to have fire emergency ventilating systems, the common hallways shall be constructed with:

a) vertical fire vent stacks and lateral fire vent ducts as herein provided, or

b) windows to the outer air, or

c) mechanical ventilating or exhaust systems, or

d) other equivalent approved means for dissipating smoke, heated air and toxic gases directly to the outer air in the event of fire.

514.1 WHERE REQUIRED: Fire emergency ventilating systems shall be provided:

a) in buildings used for H-1 and H-2 (institutional) use groups which:

   1) exceed three (3) stories or forty (40) feet in height, and

   2) exceed ten thousand (10,000) square feet in floor area, and

   3) are occupied by more than fifty (50) persons above the first floor or have more than twenty-five (25) sleeping rooms above the first floor;

b) in buildings used for L-1 and L-2 (hotel and apartment house) use groups which:

   1) same as 1 above,

   2) same as 2 above,

   3) same as 3 above.

c) in all fully enclosed industrial building without provision of exterior openings for ventilation purposes.

514.2 FIRE VENT DUCTS: When the common hallways and exit ways are not ventilated by windows opening directly to the outer air as required in section 503, a system of collecting fire ducts shall be provided in each story of aggregate size to remove the smoke, hot air and noxious fumes or gases in event of fire. Each duct shall be not less than one (1) square foot in area located in the common hallways with screened openings complying with the approved rules, constructed as provided for hot air ducts in sections 1019 and 1119.

514.3 THERMOSTATIC OPERATION: When not connected to a vent stack the inlet openings on each story shall be controlled by automatic heat-operated devices as required in section 510.2 and in accordance with the approved rules.

514.4 FIRE VENT STACKS: When the fire ducts do not discharge directly to the outer air in each story, one or more fire vent stacks of adequate capacity shall be installed to accommodate the discharge from the fire duct system in any one floor or enclosed fire area, but in no case shall any individual stack be less than four (4) square feet in area, and all stacks shall terminate in an approved automatic cowl or ventilator outlet above the roof.

514.5 LOCATION OF STACKS: The vent stack shall be located in as central a position as practicable with respect to the floor area vented thereby, preferably in the vicinity of vertical shafts, and shall extend continuously to the roof.

514.6 VENT CONTROL OF STACKS: The vent control of the vertical stacks shall consist of approved noncombustible dampers, shutters, or glazed metal sash designed to open outwardly, located not less than twenty (20) feet distant from window openings or exitway doors in adjoining walls, and shall be equipped with a thermostatic unit arranged to open at a predetermined rate of temperature rise in accordance with the approved rules. Auxiliary mechanical means for manual operation of all vent controls shall be provided in an accessible location designated by the building official.

514.7 STACK CONSTRUCTION: The stack enclosure shall be constructed to be vapor and smoke tight with walls of not less than two (2) hours fireresistance, with no openings other than the fire duct inlets and the top automatic ventilator outlet.

514.8 MECHANICAL EXHAUST SYSTEMS: When mechanical exhaust is required to operate the emergency ventilating system either in horizontal ducts or vertical vent stacks, the installation shall be thermostatically controlled and installed in accordance with the provisions of article 18 and the approved rules.

## SECTION 515.0 FIRE VENTILATION OF OPEN WELLS

Unenclosed well openings for moving stairways constructed in accordance with the provisions of ELV-2 and not accepted as a required element of an exitway shall be permitted in mercantile buildings when equipped with an approved two-source supervised automatic sprinkler system and protected on every floor pierced by the opening with an approved automatic exhaust system or by other approved methods as herein required to prevent the passage of fire, smoke and gases to the story above.

515.1 EXHAUST SYSTEM: The approved automatic exhaust system may be a separate unit or integrated with an approved air conditioning system and shall be thermostatically controlled to operate simultaneously with the detection of fire.

515.11 CAPACITY OF EXHAUST SYSTEM: The exhaust system shall be of adequate capacity to create a down draft in the open well with sufficient velocity of flow over the entire area of the well opening under normal conditions of window and door openings in the building. In air conditioned buildings the system shall operate satisfactorily to the building official with the normal air conditioning fans shut off.

515.2 WATER CURTAIN: An approved water curtain with baffles shall be located to form a continuous water barrier extending from floor to ceiling on all exposed sides of the well opening. Such water curtain shall be formed and operated automatically, either with open sprinklers or spray nozzles or with approved automatic sprinklers, or other approved thermostatically controlled devices.

515.3 POWER CONTROL: The power lines to all parts of the exhaust system and fresh air intake shall be furnished from an independent power supply complying with article 15 and the reference standards of this article for the control of automatic fire pumps and blower and exhaust systems.

515.4 AIR CONDITIONED BUILDINGS: The exhaust system herein required, when installed in an air conditioned building, shall be so arranged so to automatically stop the operation of the mechanical air conditioning and ventilating systems and close the dampers of the return air duct connection in the event of fire.

## SECTION 516.0 WINDOW CLEANING SAFEGUARDS

All buildings and structures over fifty (50) feet or four (4) stories in height, in which the windows are cleaned from the outside, shall be provided with anchors or other approved safety devices shall be of approved design, constructed of corrosion-resistive materials securely attached to the window frames or anchored in the enclosure walls of the building. Cast iron or cast bronze anchors shall be prohibited.

## Reference Standards - Article 5

| | | | |
|---|---|---|---|
| USHEW | HRA-74-4000 | | General Standards of Construction and Equipment for Hospital and Medical Facilities |
| Mass-DPH | Article II | 1969 | Minimum Standards of Fitness for Human Habitation |
| ASHRAE | | 1967 | Guide and Data Book, Handbook of Fundamentals |
| ASHRAE | | 1968 | Guide and Data Book, Applications |
| ASHRAE | | 1969 | Guide and Data Book, Equipment |
| Mass-DPS | ELV-2 | 1971 | Board of Elevator Regulations: Elevator, Dumbwaiter, Escalator, and Moving Walk Regulations |

ARTICLE 6

MEANS OF EGRESS

SECTION 600.0 SCOPE

The provisions of this article shall control the design, construction and arrangement of building elements required to insure safe means of egress from all buildings hereafter erected, and from all buildings thereafter altered to a new occupancy load, or manner of use, or inherent fire hazard. Existing buildings and uses shall be controlled by the provisions of section 605.

600.1 MODIFICATION OF EXITWAY REQUIREMENTS: When strict compliance with the provisions of the Basic Code is not practical, the building official may accept alternate means of egress which will accomplish the same purpose, by the procedure established in article 1, section 101.22.

600.2 MINIMUM REQUIREMENTS: It shall be unlawful to alter any building or structure in any manner that will reduce the number of exitways or the capacity of exitways below the requirements of this Code for new buildings of the proposed use and occupancy.

600.3 OTHER STANDARDS: Compliance with the applicable provisions of the standard listed at the end of this article shall be deemed to meet the requirements of this article, unless otherwise specifically provided herein.

SECTION 601.0 DEFINITIONS

AUTOMATIC FIRE DOOR: (see section 901.0)

AUTOMATIC COLLAPSIBLE REVOLVING DOOR: a door which is designed, supported and constructed so that the wings will release and fold back in the direction of egress under pressure exerted by persons under panic conditions, providing a legal passageway on both sides of the door pivot.

COMMON HALLWAY: a common corridor or space separately enclosed which provides any of the following in any story:

a) common access to the required exitways of the building, or
b) common access for more than one (1) tenant, or
c) common access for more than thirty (30) persons.

DOORWAY: the clear width of the opening protected by a door, subject to the width reduction provisions of this Code.

ESCALATOR: a moving stairway.

EXITWAY: that portion of a means of egress which is separated from all other spaces of a building or structure by construction or equipment as required in this Code to provide a protected, unobstructed way of travel to the exitway discharge.

EXITWAY ACCESS: exitway access is that portion of a means of egress which leads to an entrance to an exitway.

EXITWAY DISCHARGE: that portion of a means of egress between termination of an exitway and a public space with access to a public way or street.

FIRE DOOR: (see section 901.0)

FIRE DOOR ASSEMBLY: (see section 901.0)

FIRE WINDOW: (see section 901.0)

FLOOR AREA, GROSS: for the purpose of determining the number of persons for whom exits are to be provided, gross floor area shall be the floor area within the perimeter of the outside walls of the building under consideration, with no deduction for hallways, stairs, closets, thickness of walls, columns, or other features.

FLOOR AREA, NET: for the purpose of determining the number of persons for whom exits are to be provided, net floor area shall be the actual occupied area, not including accessory unoccupied areas or thickness of walls.

GRADE HALLWAY, GRADE LOBBY, GRADE PASSAGEWAY: an enclosed hallway or corridor that is an element of an exitway, terminating at a street or an open space or court communicating with a street.

HALLWAY, GRADE: (see grade hallway)

HORIZONTAL EXIT: a way of passage from one building or fire area to an area of refuge in another building or fire area on approximately the same level, which affords safety from fire or smoke from the area of escape and areas communicating therewith.

MEANS OF EGRESS: a continuous and unobstructed path of travel from any point in a building or structure to a public space and consists of three (3) separate and distinct parts: (a) the exitway access, (b) the exitway and (c) the exitway discharge; a means of egress comprises the vertical and horizontal means of travel and shall include intervening room spaces, doors, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts and yards.

MOVING STAIRWAY: escalator.

SELF-CLOSING: as applied to a fire door or other opening protective, means normally closed and equipped with an approved device which will insure closing after having been opened for use.

SLIDESCAPE: a straight or spiral chute erected on the interior or exterior of a building which is designed as a means of human egress direct to the street or other public space.

SMOKEPROOF TOWER (FIRE TOWER): an interior enclosed stairway, with access from the floor area of the building either through outside balconies or ventilated vestibules opening on a street or yard or open court, and with a separately enclosed direct exitway leading directly to an exitway discharge at the street or grade floor.

STAIRWAY: one or more flights of stairs and the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one floor to another. A flight of stairs, for the purposes of this article, must have three (3) or more risers.

WINDER: a step in a winding stairway.

## SECTION 602.0 PLANS AND SPECIFICATIONS

602.1 ARRANGEMENT OF EXITWAYS: The plans shall show in sufficient detail the location, construction, size and character of all exitways together with the arrangement of aisles, corridors, passageways and hallways leading thereto in compliance with the provisions of this Code.

602.2 NUMBER OF OCCUPANTS: In other than one and two-family and multi-family dwellings, the plans and the application for permit shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces when required by the building official. When not otherwise specified, the minimum number of occupants to be accommodated by the exitways shall be determined by the occupancy load prescribed in section 606. The posted occupancy load of the building shall be limited to that number.

## SECTION 603.0 USE AND OCCUPANCY REQUIREMENTS

603.1 NEW BUILDINGS: Every building and structure and part thereof hereafter erected shall have the required number of exitways complying with the requirements of this Code. Exitways in combination with the exitway access and exitway discharge shall provide a safe and continuous means of egress to a street or to an open space with direct access across to a street.

603.2 MIXED OCCUPANCY GROUPS: When a building is classified in more than one (1) occupancy group, in accordance with the provisions of article 2, the exitway requirements for the entire building shall be determined on the basis of the occupancy group having the strictest exitway requirements; or the exitway requirements for each building section shall be determined separately; or when places of assembly, night clubs and rooms and spaces for similar occupancies are provided in a building section, the exitways shall be adequate for the combined occupancy tributary thereto.

603.3 MULTIPLE TENANTS: When more than one (1) tenant occupies any one floor of a building or structure, each tenant shall be provided with direct access to approved exitways.

603.4 BUILDING ACCESS FOR HANDICAPPED: All buildings and parts thereof classified in use groups C (Mercantile), D (Industrial), E (Business), F (Assembly), H (Institutional), L-1 and L-2 (Residential) shall have at least one primary entrance accessible to and usable by the handicapped. Such entrance shall provide access to a level that makes elevators available in buildings where elevators are provided. Where ramps are used to comply with this requirement, they shall have a slope not greater than one (1) in ten (10) and comply with the other provisions of this article for access to the handicapped.

SECTION 604.0 AIR-CONDITIONED BUILDINGS

604.1 LOCATION OF STAIRWAYS: In all buildings, without exterior window openings in all stories, that are artificially ventilated and air-conditioned as provided in section 511, the stairway element of required exitways shall be located as to be accessible to the fire department either through the access openings specified in section 858.0 or as otherwise approved in at least alternate stories of the building.

604.2 EXHAUST DUCTS: No exhaust ducts or vents of air-conditioning systems shall discharge into stairway or elevator enclosures nor shall corridors serving as exitway access be used as the return exhaust from air-conditioned spaces through louvres or other devices in the doors or partitions enclosing such air-conditioned spaces; unless such passageways are equipped with approved products of combustion detectors to automatically stop the supply and exhaust fans and close the louvres and unless such use is approved by the building official.

SECTION 605.0 EXISTING BUILDINGS

605.1 OWNER RESPONSIBILITY: The owner or lessee of every existing building and structure shall be responsible for the safety of all persons in or occupying such premises with respect to the adequacy of means of egress therefrom as required by this Code.

605.2 UNSAFE MEANS OF EGRESS

605.21 INADEQUATE EXITWAYS: In any existing building or structure, not now provided with exitway facilities as herein prescribed for new buildings and in which the exitways are deemed inadequate for safety by the building official, such additional provision shall be made for safe means of egress as he shall order.

605.3 NO CHANGE IN USE: When there is no change in use group or occupancy load, the minimum exitway requirements shall be as follows:

605.31 NEW EXITWAYS: If new or altered exitway facilities are installed or construction, they shall comply with all the requirements for new buildings.

605.32 EXISTING EXITWAYS: In all buildings (other than one and two-family dwellings) exceeding three (3) stories or forty (40) feet in height, or having more than seventy-five (75) occupants above or more than forty (40) occupants below grade floor, all existing enclosed stairways shall be enclosed with partitions and opening protectives of two (2) hour fireresistance rating complying with article 9; doors shall be self-closing. Existing enclosures of substandard fireresistive construction shall be covered on the stair side only with the component materials required for a two (2) hour fireresistive assembly.

605.33 FIRE ESCAPES: In buildings not over five (5) stories or sixty-five (65) feet in height, fire escapes complying with the requirements of section 621 may be accepted as a secondary means of egress when deemed adequate by the building official and when approved access to the street is provided from the termination of the fire escape.

605.4 EXISTING USE CHANGED: In every building or structure in which there is a change from one use group to another with special requirements, or when there is an increase in occupancy load, the exitway facilities serving the new use and occupancy shall be made to comply with all the provisions of this article for buildings hereafter erected.

## SECTION 606.0 OCCUPANCY LOAD

606.1 DESIGN OCCUPANCY LOAD: In determining required exitway facilities, the number of occupants for whom exitway facilities shall be provided shall be established by the largest number computed as follows:

606.11 The actual number of occupants for whom each occupied space, floor, or building, as the case may be, is designed for; or,

606.12 The number of occupants computed at the rate of one (1) occupant per unit of area as prescribed in table 6-1; or,

606.13 The number of occupants of any space as computed in section 606.11 or 606.12 above plus the number of occupants similarly computed for all spaces that discharge through space in order to gain access to an exitway.

606.2 MEZZANINE FLOORS: The occupancy load of a mezzanine floor discharging through a floor below shall be added to the main floor occupancy and the capacity of the exits shall be designed for the total occupancy load thus established.

606.3 ROOFS: Roof areas occupied as roof gardens or for assembly, storage or other purposes shall be provided with exitway facilities

to accommodate the required occupancy load, but in no case shall there be less than two (2) approved means of egress for assembly uses from such roof areas.

606.4 SPECIAL USES: For areas in other use groups not specified in the Basic Code, the building official shall establish the occupancy load to be assumed in the design.

606.5 CONFLICTS: When there are special requirements for specific occupancies and uses in article 4 which differ from general requirements herein prescribed, such special provisions shall take precedence.

TABLE 6-1 FLOOR AREA ALLOWANCE PER OCCUPANT

| USE | FLOOR AREA IN SQUARE FEET PER OCCUPANT |
|---|---|
| Areas without fixed seats | 12 net |
| Areas with fixed seats (theatres, bleachers, etc.) | 6 net (Note 1) |
| Areas with fixed seats (restaurants, bars, etc.) | 8 net |
| Standing space | 3 net |
| Bowling alleys, allow five (5) persons for each alley, including fifteen (15) feet of runway, and for additional areas | 10 net |
| Business areas | 100 gross |
| Court rooms | 40 net |
| Day nurseries | 35 net |
| Educational | (Note 2) |
| Garages and open parking structures | 250 gross |
| Industrial areas | 200 gross |
| Institutional | |
| Sleeping areas: | |
| Single occupant room | 125 net |
| Multiple occupant room | 90 net per occupant |
| In-patient areas | 240 gross |
| Kitchens (non-residential) | 200 gross |
| Locker rooms | 20 gross |
| Mercantile, basement and grade floor area | 30 gross |
| Areas on other floors | 60 gross |
| Schoolhouses (Note 3) | |
| Classrooms | 20 net |
| Shops and vocational | 50 net |
| Assembly (conference rooms, dining rooms, refreshment areas, exhibit rooms, gyms, lounges) | 15 net |
| Storage, shipping areas | 100 gross |
| Residential | 200 gross |
| Stages | |
| Performing areas | 15 gross |
| Other areas | 50 gross |
| Storage areas, mechanical equipment room | 300 gross |

Note 1: The occupant load for an assembly area having fixed seats shall be determined by the number of fixed seats installed.

Note 2: Standards for Educational uses are subject to the provisions of Reference Standard F-6, Building Regulations for Schoolhouses, of the State Building Code Commission.

Note 3: The capacity or occupant load permitted in a building or portion thereof may be increased above that specified if the necessary aisles and exits are provided subject to the approval of the building official.

SECTION 607.0 TYPES AND LOCATION OF EXITWAYS

All approved exitways, including doorways, passageways, corridors, hallways, interior stairways, exterior stairways, moving stairways, smokeproof towers, ramps, horizontal exits, bridges, balconies, fire escapes and combinations thereof shall be arranged and constructed as provided herein and in article 9 for fire enclosure requirements.

607.1 ARRANGEMENT: All required exitways shall be so located as to be visible and readily accessible with unobstructed access thereto and so arranged as to lead directly to the street or to an area of refuge with supplemental means of egress that will not be obstructed or impaired by fire, smoke or other cause.

607.2 SEPARATION OF EXITWAYS: Whenever more than one (1) exitway is required from any room, space or floor of a building, they shall be placed as remote from each other as practicable, and shall be arranged to provide direct access in separate directions from any point in the area served.

607.3 LENGTH OF TRAVEL: All exitways shall be so located that the maximum length of exitway access travel, measured from the most remote point to an approved exitway along the natural and unobstructed line of travel shall not exceed the distances given in table 6-2; except that in buildings of residential, mercantile or institutional use groups where the area is subdivided into rooms or compartments, and the egress travel in the room or compartment is not greater than fifty (50)* feet, the distance shall be measured from the exitway access entrance to the nearest exitway.

* May be increased to 100 feet, in use groups equipped with automatic sprinklers.

607.4 FLOORS BELOW GRADE: In buildings of all use groups the permissible length of exitway access travel on any floor more than one (1) story below grade shall not exceed seventy-five (75) feet.

TABLE 6-2 MAXIMUM LENGTH OF EXITWAY ACCESS TRAVEL (FEET)

| USE GROUP | LENGTH | LENGTH WITH FIRE SUPPRESSION SYSTEM |
|---|---|---|
| High Hazard (A) ... | -- | 75 |
| Storage (B) ..... | 100 | 150 |
| Mercantile (C) .... | 100 | 150 |
| Industrial (D) .... | 150 | 250 |
| Business (E) ..... | 200 | 300 |
| Assembly (F) ..... | 150 | 200 |
| Institutional (H) . | 100 | 200 |
| Residential (L) ... | 100 | 150 |

SECTION 608.0 CAPACITY OF EXITS

608.1 UNIT OF EXIT WIDTH: The basic whole unit of clear exit width is twenty-two (22) inches and its whole multiples. The allowance for excess width of twelve (12) inches to twenty-one (21) inches is one-half (1/2) unit. (No credit given for excess width less than twelve (12) inches.

22" to 33" = 1 unit
44" to 55" = 2 units
66" to 77" = 3 units
33" to 43" = 1 1/2 units*
56" to 65" = 2 1/2 units
78" to 87" = 3 1/2 units

*A door 40" in width = 2 units; a single door 33" to 39" = 1 1/2 units; 40" to 44" = 2 units.

608.2 DESIGN CAPACITY ALLOWANCE: Specific modifications: article 4

Means of Computation:
Design Capacity = units of egress width (608.1) x number of persons per unit egress width (table 6-3).

TABLE 6-3 CAPACITY PER UNIT EGRESS WIDTH

| | Without Suppression System Number of Occupants | | With Suppression System Number of Occupants | |
|---|---|---|---|---|
| USE GROUP | Stairways and Ramps | Doors and Corridors | Stairways and Ramps | Doors and Corridors |
| High Hazard (A) | -- | -- | 60 | 100 |
| Storage (B) | 60 | 100 | 90 | 150 |
| Mercantile (C) | 60 | 100 | 90 | 150 |
| Industrial (D) | 60 | 100 | 90 | 150 |
| Business (E) | 60 | 100 | 90 | 150 |
| Assembly (F) | 75 | 100 | 113 | 150 |
| Assembly (F-6) (Classroom areas) | | | | |
| 1 or 2 stories | 90 | 100 | 120 | 150 |
| 3 stories or more | 75 | 100 | 120 | 150 |
| Institutional (H) | 22 | 30 | 33 | 45 |
| Residential (L) | 75 | 100 | 113 | 150 |

NOTE: The main exitway of a bowling alley shall be of sufficient capacity to accommodate fifty (50) percent of the total occupant load, without regard to the number of aisles which it serves.

SECTION 609.0 NUMBER OF EXITWAYS

The following general requirements apply to buildings of all use groups. More restrictive requirements that may be provided in article 4 for special uses and occupancies shall take precedence over the general provisions of this section.

609.1 MINIMUM NUMBER: Except in one and two-family dwellings, there shall be two (2) or more approved independent exitways serving every floor area above and below the grade floor, one (1) of which shall be an interior enclosed stairway. Exitways in dwellings shall be so arranged that they may be reached without passing through another living unit.

609.11 EXITWAYS IN RESIDENTIAL USE GROUPS: In all multi-family residential use groups (L-2), except as provided in section 609.12, each apartment shall have access to at least two (2) independent exits which are remote from each other; such exits shall be so arranged that to reach either exit it will not be necessary to pass through a public corridor which serves the other.

609.12 EXITWAYS IN TYPE 1-A, 1-B, 2-A AND 2-B, L-2 USE GROUPS: In buildings of type 1-A, 1-B, 2-A and 2-B construction a single exitway shall be permitted for every room, or group of less than four (4) rooms used for residential occupancy on multi-family floors, provided that elevator lobbies on all floors except the ground floor are enclosed with self-closing fire doors, so that no entrance door of any room or apartment shall be more than fifty (50) feet from the nearest egress or segregating fire partition. Doors from elevator lobbies, doors in segregating fire partitions, and doors to stair enclosures, shall not be over two hundred (200) feet apart. Sleeping facilities shall be limited to not more than six (6) persons beyond the enclosed stairs. Rooms other than bedrooms connected with the same living unit may be permitted.

609.2 BASEMENT RECREATION ROOMS: In residential buildings (use group L-1 and L-2), the basements of which are used as playrooms or for similar recreation purposes, with an occupancy load of twelve (12) or more, such areas and the exitway shall be enclosed with partitions and ceiling of not less than three-quarter (3/4) hour fireresistive construction. A direct secondary exit from the basement to streets, yards or courts leading to the street, shall be acceptable in lieu of the requirement for an enclosed stairway.

609.3 OPEN PARKING STRUCTURES: Parking structures shall have at least two (2) or more exitways from each parking tier, except that where vehicles are mechanically parked, only one (1) exitway need be provided in structures not exceeding eighty-five (85) feet in height. The maximum distance from any point on a parking tier to an exitway at that tier shall be three hundred (300) feet. Ramps used for the movement of vehicles need not be enclosed and may be considered as required exitways in structures not exceeding eighty-five (85) feet in height where

vehicles are attendant parked and in other structures having not less than two (2) enclosed stairways. The construction of stairways, ramps and stairway enclosures shall comply with the applicable requirements of this Code; except that stairways in a structure where vehicles are attendant parked and the height of the structure does not exceed fifty (50) feet, or in structures not exceeding eighty-five (85) feet in height where vehicles are mechanically parked, only one (1) stairway need be enclosed.

SECTION 610.0 EXITWAY ACCESS PASSAGEWAYS AND CORRIDORS

610.1 ACCESS PASSAGEWAYS: Direct exitway access shall be provided to required exitways through continuous passageways, aisles or corridors, conveniently accessible to all occupants and maintained free of obstruction.

610.11 TURNSTILES AND GATES: Access through turnstiles, gates, rails or similar devices shall not be permitted unless such a device is equipped to readily swing in the exiting direction of travel under a total pressure of not more than fifteen (15) pounds.

610.2 DEAD ENDS: Exitway access passageways and corridors in all stories which serve more than one (1) exitway shall provide direct connection to such exitways in opposite directions from any point in the corridor, insofar as practicable. In no case shall the length of a dead end corridor be more than twenty (20) feet except in type 1A and 1B the corridor length may be thirty (30) feet.

610.3 WIDTHS: The unit exit width and occupancy allowance of aisles and corridors, unless otherwise provided for special uses and occupancies in article 4, shall be the same as for exitway stairways (table 6-3) with a minimum total width of forty-four (44) inches in buildings of the storage, business, industrial and assembly use groups; sixty (60) inches in mercantile and institutional buildings other than those used for the movement of beds which shall be ninety-six (96) inches; and seventy-two (72) inches in church schools; except that in churches and chapels, side aisles may be one-half (½) the width but in no case less than thirty-two (32) inches clear.

610.4 OPENING PROTECTIVES: All door assemblies from rooms opening onto a common corridor, required by table 2-5 to be of three-quarter (3/4) fireresistive construction, shall be equipped with approved automatic or self-closing:

a) three-quarter (3/4) hour fire doors; or,
b) one and three-quarter (1-3/4) inch thick solid core wood doors; or,
c) their approved equivalent.

All door assemblies from rooms opening onto a common corridor, required by table 2-5 to be of two (2) hour fireresistive construction, shall be one and one-half (1½) hour fire doors.

## SECTION 611.0 GRADE PASSAGEWAYS AND LOBBIES USED AS AN EXITWAY ELEMENT

611.1 ENCLOSURES OF PASSAGEWAYS: Every required interior and exterior exitway element which does not adjoin a street shall be directly connected to the street or to an open court leading to the street by an enclosed passageway, hallway, lobby or other unobstructed exitway element constructed as provided in this section and in section 909.0.

611.2 WIDTH AND HEIGHT: The effective width of the lobby or other enclosed passageway shall be not less than three-quarters (3/4) of the aggregate width of all required exitway stairways leading thereto and all required exitway doorways opening into the passageway. Such passageway shall have a minimum width of forty-four (44) inches and a minimum clear ceiling height of eight (8) feet.

611.3 MAXIMUM STAIRWAY LIMITATIONS: Not more than fifty (50) percent of required exitway capacity shall discharge through the same passageway.

611.4 CONSTRUCTION: The enclosures of grade passageways and lobbies connecting required means of egress to the street shall be of the firerated construction required for exitways in table 2-5. All openings which are elements or components of a required means of egress shall comply with the requirements of article 9 relative to opening protectives.

When there are accessory uses within the grade passageway or lobby a fire suppression system will be required.

## SECTION 612.0 MEANS OF EGRESS DOORWAYS

The requirements of this section shall apply to all doorways serving as a component or element of a means of egress; except this section shall not apply to doorways leading to or from required stairways (see sections 616.6, 618.5, and 619.3).

612.1 NUMBER OF DOORWAYS: Every room with an occupancy load of more than fifty (50) or which exceeds one thousand five hundred (1500) square feet in area shall have at least two (2) egress doorways and the doors shall be hung to swing in the direction of exit travel without obstructing the required width of exitway.

612.11 ENTRANCE AND EGRESS DOORWAYS: Where separate doors are provided for entrance and egress use, the entrance door shall be clearly marked "ENTRANCE ONLY" in letters not less than six (6) inches in height and legible from both inside and outside; unless such doors are equipped with an emergency release bracket that will disengage the door operator and permit the door to swing outward under total pressure of not more than fifteen (15) pounds. Unless so equipped, doors swinging inward only shall not be accepted as part of the required egress elements. When doors are operated by mechanical opening device they shall comply with the requirements of section 612.44.

612.2 SIZE OF DOORWAYS: The minimum width of single doorways shall be thirty-two (32) inches and the maximum width shall be forty-four (44) inches with the following exception:

Access for the handicapped: In all buildings and parts thereof subject to the provisions of section 603.4 primary entrance and access doorways shall be thirty-six (36) inches or greater in width.

When the doorway is subdivided into two (2) or more separate openings, the minimum clear width of each opening shall be at least thirty-two (32) inches, and each opening shall be computed separately in determining the number of required units of exit width.

The minimum clear width of single doorways in one and two-family dwellings and from retail stores and similar spaces on the grade floor to the street, when not required as access for the handicapped, shall be thirty (30) inches or greater in width.

The height of doorways shall be at least six (6) feet eight (8) inches. In applying the provisions of this Code, the normal doorway opening with the allowance for door jambs as provided in section 612.21 shall be used for computing the required size doorways.

612.21 DOORWAY WIDTH REDUCTION: Door jambs may project into required width of an exit door opening not more than one (1) inch for each full twenty-two (22) inch exit unit.

612.3 LOCATION OF DOORS: The required doorways opening from a room or space within a building leading to an exitway access shall be located as remote as practicable from each other.

The distance of exitway access travel from any point in a room or space to a required exitway door shall not exceed the limitations of section 607.3 and table 6-2.

612.4 DOOR HARDWARE

612.41 OPERATION: Locks and fastenings on egress doors shall be readily opened from the inner side without the use of keys. Draw bolts, hooks and other similar devices shall be prohibited. The locking device must be of a type that will be readily distinguishable as locked. These requirements shall apply in any case only during the normal hours of occupancy.

612.411 LOCKS IN MULTI-FAMILY DWELLINGS: Requirements for locks in multi-family dwellings are subject to the provisions of section 3R of Chapter 143 of the Massachusetts General Laws Annotated, as amended.

612.42 PANIC PROOF: In rooms of use group F-2 (assembly) with an occupancy load of more than fifty (50) and in rooms of use groups F-1 and F-3 (assembly) with an occupancy load of more than three hundred (300), egress doors shall be equipped with approved panic proof latches or bolts which release under a pressure of fifteen (15) pounds.

612.43 REMOTE CONTROL: In rooms of use group H-1 (institutional) occupied as places of detention, approved releasing devices with remote control shall be provided for emergency use.

612.44 MECHANICAL OPERATIONS: Except as may be otherwise provided for openings in fire and fire division walls, all fire doors shall be self-closing and shall be closed during occupancy of the building or part thereof, except that fail safe electro-magnetic holders when activated by approved rate of temperature raise and approved smoke detection devices located on both sides of the opening and connected to the central fire alarm stations may be used on all exit and smoke screen doors in horizontal hallways, exitways and corridors but not on doors connected to stairwells. Where egress doors are arranged to be opened by mechanical devices of any kind, they shall be so constructed that the door may be opened manually and will release under a total load of not more than fifteen (15) pounds applied in the direction of exitway travel.

612.5 DOOR CONSTRUCTION: All required egress doors that serve as an element of an exitway shall be self-closing or automatic fire doors with approved hardware, except for grade floor exitway discharge doors and revolving exitway doors as provided for in sections 612.51 and 613.0.

612.51 GRADE EXITWAY DISCHARGE DOORS: Plate glass doors having one or more unframed edges may be used provided they are constructed of tempered glass not less than three-quarter (3/4) inches thick. Glass doors and adjacent lights which may, in the opinion of the building official, constitute a hazard by virtue of not being readily visible as a barrier, must be of approved safety glasing material.

SECTION 613.0 REVOLVING EXITWAY DOORS

613.1 LIMITATIONS OF USE

613.11 WHERE PERMITTED: Except in places of use group F (assembly) with an occupancy load of more than two hundred (200) and in buildings of use group H (institutional), approved automatic collapsible revolving doors when constructed and installed as herein provided shall be accepted in required exitway doorways from the first floor to the street but not to exceed fifty (50) percent of the total required grade floor exits.

613.12 PROHIBITED CONSTRUCTION: Braces or other devices that prevent normal operation of the automatic releasing mechanism shall be prohibited.

613.13 SUPPLEMENTAL EXITS: Approved swinging doors shall be provided to furnish one-half (½) the required exitway width in accordance with the provisions of this article. In any case, there shall be a minimum of two (2) approved swinging doors provided, one on each side and immediately adjacent to the revolving door.

613.2 WIDTH OF PASSAGE

613.21 UNIT EXIT WIDTH: Automatic collapsible revolving doors approved as an element of a required exitway shall provide a minimum clear unit exit width of passageway through the vestibule when the leaves are in a collapsed position.

613.22 MINIMUM DIAMETER: The minimum diameter of approved revolving doors shall be adequate to provide the required clear exit width when collapsed, but in no case less than six and one-half (6½) feet in diameter.

613.3 SPEED CONTROL: All approved automatic collapsible revolving doors shall be equipped with an approved speed control governor adjustable to safe traffic speed, but in no case more than fifteen (15) nor less than ten (10) revolutions per minute.

613.4 CONSTRUCTION: All approved automatic collapsible revolving doors shall be constructed as follows:

613.41 OPERATING MECHANISM: The collapsing mechanism shall be constructed of stainless steel or other approved corrosion-resistive materials;

613.42 USE OF WOOD: Where not otherwise required by the provisions of article 9, the doors may be constructed of wood or other approved materials of similar combustible characteristics, providing the construction is at least equivalent to that of a solid core three-quarter (3/4) hour fire rated door construction;

613.43 FLOOR COVERING: Approved mats of other floor coverings, complying with the provisions of article 9, not more than one-half (½) inch thick, may be installed within the enclosure when permanently secured to the structural flooring and finishing flush with the adjacent floor area;

613.44 GLAZING: The doors shall be glazed with not less than seven thirty-seconds (7/32) inch plate glass.

613.5 INSPECTION AND MAINTENANCE: The owner shall be responsible for the care, operation and maintenance of all revolving door installations after such doors are placed in operation. The building official may from time to time, and shall annually between December first and March first, examine each revolving door within his jurisdiction. If the buidling official finds that any revolving door fails to comply with the provisions of these regulations, he shall notify the owner of the changes which are necessary for compliance, and if the owner fails to make the necessary changes within thirty (30) days, shall order in writing the removal of the door. Periodic inspections shall be made by the person or firm responsible for the installation at intervals of not more than three (3) months and shall maintain all parts in proper working order.

TABLE 6-4 MINIMUM CLEAR DOORWAY WIDTHS

| LOCATION | USE | | | Maximum Single Doorway Door Width |
|---|---|---|---|---|
| | 1 AND 2-FAMILY DWELLINGS RETAIL STORES | E | ALL OTHER USE GROUPS | |
| GRADE EXIT DOORWAY | 30" (Ref. section 612.2) | 32" | 32" | 44" |
| DOORWAYS SERVING AS COMPONENT OR ELEMENT OF MEANS OF EGRESS | 32" | 32" (Ref. section 612.2) Doorway divided into 2 or more doors: 28" each | | 44" |
| STAIRWAY EXIT DOORWAY | 36" (Ref. section 616.61) | 42" (Ref. section 616.61) | As calculated by section 608.1 | 44" |
| SMOKEPROOF TOWERS<br>1) Interior stairs to vestibule<br>2) Vestibule or balcony to stairway<br>3) Stairway exit | No Requirements | 42" (Ref. section 620.3) | As calculated by section 608.1 | 44" |
| EXTERIOR STAIRWAYS ACCESS | 32" If part of required means of egress | As calculated by section 608.1 | | 44" |
| DOORWAY REQUIRED AS ACCESS FOR HANDICAPPED | 36" in retail stores | 36"; doorway divided into 2 or more doors: 32" each | | 44" |

SECTION 614.0 HORIZONTAL EXITS

Horizontal exits as herein defined shall be accepted as an approved element of a required means of egress when complying with the requirements of this article. The connection between the areas of refuge as herein specified may be accomplished by protected openings in a fire wall, by a vestibule, or by an open-air balcony or bridge.

614.1 OPENING PROTECTIVES: One side of the opening in fire walls or fire divisions which are required to have a fireresistance rating of two (2) hours or more shall be protected with a one and one-half (1½) hour self-closing fire door, swinging in the direction of exitway travel, and on the opposite side with an approved automatic fire door or water curtain. When serving as a dual element of a means of egress, there shall be adjacent openings with swinging fire doors opening in opposite directions.

614.2 SIZE OF DOORS: Size of openings in fire walls shall comply with the provisions of section 908, but in no case shall the width of one opening used as a required exit be greater than eighty-eight (88) inches nor shall the area exceed eighty (80) square feet.

614.3 AREA OF REFUGE: The areas connected by the horizontal exit shall be either public areas or spaces occupied by the same tenant and each such area of refuge shall be adequate to house the total occupancy load of both connected areas as provided in table 6-1.

614.4 UNLOCKED DOORS: Horizontal exit doors shall be kept unlocked and unobstructed whenever the area on either side of the horizontal exit is occupied.

614.5 EGRESS FROM AREA OF REFUGE

614.51 STAIRWAY EXITWAY: There shall be at least one (1) interior enclosed stairway of smokeproof tower on each side of the horizontal exit and any fire area not having a stairway accessible thereto shall be considered as part of an adjoining section with such stairway; but in no case shall the length of travel between the horizontal exit and the required exitway exceed the requirements of section 607.3 and table 6-2.

614.52 AUXILIARY ELEVATOR: When horizontal exits are provided in floors located twelve (12) or more stories above grade, the required stairway shall be supplemented by at least one (1) passenger elevator complying with section 621, maintained ready for use during normal occupancy of the building.

SECTION 615.0 EXITWAY RAMPS

Ramps with a gradient of not more than one (1) in ten (10) may be used as an exitway component and shall comply with all the applicable requirements of required interior stairways as to enclosure, capacity,

and limiting dimensions; except in existing buildings and where specified in article 4 for special uses and occupancies, larger gradients may be permitted, but in no case greater than one and one-half (1½) in ten (10). For all slopes exceeding one (1) in ten (10) and wherever the use is such as to involve danger of slipping, the ramp shall be surfaced with approved non-slip materials. In no case shall ramps required for the use of handicapped persons have a gradient of more than one (1) in ten (10).

615.1 HANDRAILS: Ramps required for use by handicapped persons shall have a handrail on at least one side that is not less than thirty (30) inches nor more than thirty-three (33) inches in height measured from the surface of the ramp. Handrails shall be smooth and shall extend one (1) foot beyond the top and the botton of the ramps and return to walls or ports at the ends.

615.2 LANDINGS: On ramps required for the use of handicapped persons, landings shall be provided at all ramp points of turning, entrance, exitway and doors at a minimum of thirty (30) foot intervals. All landings shall provide a clear distance of forty-two (42) inches from any door swinging to the ramp. Minimum landing length shall be forty-two (42) inches and the bottom landing of any ramp or set of ramps and landings of a straight run shall be a minimum length of seventy-two (72) inches.

## SECTION 616.0 INTERIOR EXITWAY STAIRWAYS

616.1 CAPACITY OF EXITWAY STAIRS: The capacity of stairways and doors per unit of exit width shall be computed in accordance with section 608.

616.2 MINIMUM DIMENSIONS

616.21 WIDTH: All required interior stairways shall be at least forty-two (42) inches in width except that such width may be reduced to thirty-six (36) inches in buildings of use group L-3 (one and two-family dwellings) or in exitways from boiler rooms and similar service spaces not open to the public or in general use by employees.

616.22 HEADROOM: The minimum headroom in all parts of the stair enclosure shall be not less than six and two-thirds (6-2/3) feet.

616.23 RESTRICTIONS: No stairways shall reduce in width in the direction of exit travel.

616.3 LANDINGS AND PLATFORMS

616.31 WIDTH: The least dimension of landings and platforms shall be not less than the required width of stairway.

616.32 VERTICAL RISE: In buildings of use group F (assembly) and use group H (institutional) occupancy, the height of vertical rise shall not exceed eight (8) feet between landings and intermediate platforms.

TABLE 6-5 DOOR CONSTRUCTION

| USE GROUP / DOOR USE | REQUIRED EGRESS ELEMENT OF EXITWAY | DOOR USE: GRADE FLOOR EXITWAY DISCHARGE | DOOR USE: STAIRWAY EXITWAY DOOR | SMOKEPROOF TOWERS: DOORS TO VEST. BAL. & STAIR | EXTERIOR STAIRWAY ACCESS DOOR |
|---|---|---|---|---|---|
| ALL | Self-Closing or Automatic Fire Door | Glass (Ref. Sections 612.51 and 859) | Approved Self-Closing Swinging Fire Doors Complying with Article 9 | 1 1/2 Hours or Approved Labeled Equivalent Per Article 9 | 3/4 Hour Self-Closing Fire Door |
| ALL EXCEPT: F WITH MORE THAN 200 OCCUPANTS, AND H | | Revolving Doors (Ref. Section 613.11) Materials (Ref. Sections 613.42 - 613.44) | | | |
| 1 AND 2-FAMILY DWELLINGS | Not Specified | Not Specified | 1 3/4 Inch Solid Core Wood | Not Applicable | Not Specified |

TABLE 6-6 MINIMUM STANDARDS FOR STAIRWAY AND ENCLOSURE CONSTRUCTION

| USE GROUP (ARTICLE 2) | A, B, C, D E, F, H, L | A, B, C, D E, F, H, L | A, B, C, D E L | F, H | L-3 1 & 2-Family Dwelling | L-3 1 & 2-Family Dwelling |
|---|---|---|---|---|---|---|
| TYPE OF CONSTRUCTION (ARTICLE 2) | 1, 2, 3, 4 | 1, 2 | 3, 4 | 3, 4 | 1, 2; 3, 4 | 1, 2, 3, 4 |
| HEIGHT NO. OF STORIES | >3 | ≤3 | ≤3 | ≤3 | ≤3 | >3 |
| HEIGHT OR FEET | >40 | ≤40 | ≤40 | ≤40 | | |
| NO. ABOVE | >75 | ≤75 | ≤75 | ≤75 | Not applicable | Not applicable |
| OF GRADE | -- | -- | -- | -- | | |
| OCCUPANTS BELOW | >40 | ≤40 | ≤40 | ≤40 | | |
| STAIRWAYS | Non-combustible | Non-combustible | No requirements | Non-combustible | No requirements | No requirements |
| ENCLOSURES | Non-combustible | Non-combustible | Note 1 No require. | Note 1 No require. | No requirements | No requirements |
| FIRE RATING | 2 hrs | 3/4 hr. | 3/4 hr. | 3/4 hr. | No requirements | 3/4 hr. |

Note 1: The enclosure and underside of stairways of combustible construction, except in one and two-family dwellings, shall be protected with fireresistive partitions and ceilings as herein required; fire-stopped as specified in sections 876, 909 and 921; and the space below the stairs shall be solidly enclosed with fireresistive partitions.

In all other buildings, no stairway shall have a height of rise of more than fifteen (15) risers between landings, nor shall any single stairway have less than three (3) risers.

616.4 TREADS AND RISERS

616.41 MINIMUM DIMENSIONS: The height of risers and the width of treads in inches shall be as follows:

| Use Group | Maximum Risers[1] | Minimum Tread[2] |
|---|---|---|
| One and two-family dwellings (use group L-3) | | |
| All stairs with closed risers | 8-1/4 inches | 9 inches |
| Stairs with open risers | 8-1/4 inches | 9 inches |
| Assembly and Institutional | 7-1/2 inches | 10 inches |
| All others | 8 inches | 9 inches |

[1]The maximum allowable variation in the height of risers is ± one-quarter (1/4) inches.

[2]All treads shall have an effective nosing of one (1) inch to one and one-quarter (1-1/4) inches and shall be the same for the entire stairway.

616.42 WINDERS: No winders shall be permitted in required exitway stairways except that in one and two-family dwellings and in ornamental stairways not required as an element of an exitway, treads with a minimum width of four (4) inches and an average width of nine (9) inches may be permitted.

616.5 STAIRWAY GUARDS AND HANDRAILS: Unless otherwise specifically provided for in this Code all stairways, except accessory stairways in one and two-family dwellings, shall have continuous guards and handrails on both sides, and in addition thereto, stairways required to be more than eighty-eight (88) inches in width shall have intermediate handrails dividing the stairway into portions not more than eighty-eight (88) inches wide.

616.51 HANDRAIL DETAILS:

a) handrails may project not more than three and one-half (3½) inches into the required stair width.

b) handrails shall be not less than thirty (30) inches nor more than thirty-three (33) inches, measured vertically, above the nosing of the treads.

c) stairways provided for use by handicapped persons shall have handrails which shall extend eighteen (18) inches beyond the top and bottom step if a guard or wall exists. All handrails covered by this section shall be returned to walls or posts at the ends of the stairways.

d) handrails shall be designed to support an applied load of two hundred (200) pounds in any direction at any point.

616.52 GUARD DETAILS:

a) guards shall be not less than thirty (30) inches in height measured vertically above the nosing of the tread.

b) guards shall be constructed so that the area in the plane of the guard from the top of the tread to the top of the guard is subdivided or filled in one of the following methods:

1) a sufficient number of intermediate longitudinal rails constructed so that the clear distance between rails (measured at right angles to the rail) does not exceed ten (10) inches. The bottom rail shall be not more than ten (10) inches (measured vertically) from the tread nosing.

2) balusters spaced not more than six (6) inches apart.

3) panels of wire mesh, or expanded metal, or ornamental grills which provide protection equivalent to that provided by the intermediate rails or balusters specified in the two preceeding paragraphs.

4) walls.

5) any combination of the foregoing.

616.6 STAIR EXITWAY DOORS

616.61 WIDTH: The clear width of every exitway doorway to or from a stairway shall be not less than the number of units of exit width required for the capacity of the stairway which services the floor or floor area from which the exitway door leads; but in no case shall such a doorway width be less than thirty-six (36) inches nominal in use group L-3 buildings (one and two-family dwellings) and forty-two (42) inches nominal width in use group E (business buildings).

616.62 DIRECTION OF SWING: All doors shall swing on a landing in the direction of exitway travel. When open, stair exitway doors shall not reduce the width of landings to less than the minimum required for its capacity and in no case to less than thirty-six (36) inches.

616.63 DOOR CONSTRUCTION: All doorway opening protectives, including the frames and hardware, shall be approved self-closing swinging fire doors complying with article 9 except in one and two-family dwellings where one and three-quarter (1-3/4) inch solid core wood doors are permitted.

616.7 SPIRAL STAIRWAYS: Spiral stairways of noncombustible construction may be used as an element of a means of egress from mezzanine areas not more than two hundred fifty (250) square feet in area nor more than one-third (1/3) the area of the floor below. The minimum width shall be twenty-two (22) inches for the accommodation of not more than ten (10) persons.

616.8 SUPPLEMENTAL STAIRWAYS: Monumental, ornamental, or accessory stairways shall not be allowed without required enclosures in use groups D (Industrial), F (Assembly), and H (Institutional), and structures of type 3B, 3C, 4A, and 4B construction, unless specifically allowed in section 418.22. In all other structures, monumental, ornamental or accessory stairways extending from the grade floor to the basement or to the second floor, when not required as an element of exitway and not connecting more than two (2) adjoining stories, shall be allowed without enclosures. Monumental, ornamental or accessory stairways shall be additional to and shall not obstruct or interfere with required exitways.

616.9 STAIRWAY CONSTRUCTION: Unless herein otherwise provided, all required interior stairways shall be built entirely of noncombustible materials with solid risers, treads and landing platforms and all finish floor surfaces on non-slip noncombustible materials; except that wood handrails shall be permitted, complying with the requirements of section 616.5. In one and two-family dwellings, open risers may be used.

616.91 STRENGTH: All stairways, platforms, landings and exitways in other than one and two-family dwellings, shall be adequate to support a live load of one hundred (100) pounds per square foot.

616.92 MINIMUM STANDARDS FOR STAIRWAY AND ENCLOSURE CONSTRUCTION: Reference table 6-6.

## SECTION 617.0 ACCESS TO ROOF

617.1 BY STAIRWAY: In buildings four (4) stories or more in height with roofs having a slope of less than twenty (20) degrees, access to the roof shall be provided by means of a stairway. Where the roof is used as a roof garden or for other habitable purposes, sufficient stairways shall extend to it to provide the necessary exitway facilities from the roof as required for such occupancy.

617.2 ROOF ENCLOSURES: Stairways extending through roofs shall be enclosed in roof structures of fireresistive construction meeting the requirements of section 927.

## SECTION 618.0 SMOKEPROOF STAIRWAY ENCLOSURE

618.1 WHERE REQUIRED: Al least one (1) of the required exitways shall be a smokeproof stairway enclosure in buildings over five (5) stories or over seventy (70) feet in height when one (1) of the following use groups:

a) C (Mercantile)
b) D (Industrial)
c) E (Business)
d) F-2, F-3, F-4, F-5, F-6, F-7 (Assembly buildings other than theatres)
e) H (Institutional)
f) L-1 (Hotel, dormitory)

618.2 ACCESS: Exitway access to the stairway at each story shall be through a vestibule or balcony with an unobstructed width not less than the required stairway width and a minimum dimension of seventy-two (72) inches in the direction of exit travel.

618.3 DOOR OPENINGS: Door openings from interior spaces to the vestibule or balcony and from the vestibule or balcony to the stairway shall be as required in section 612.2. The doors from interior spaces to the vestibule shall have a fireresistance rating not less than one and one-half (1½) hours and shall comply with the requirements of section 616.6 for stair exitway doors. The door from the vestibule to the stairway shall be not less than a one and three-quarter (1-3/4) inch solid wood door set in a steel frame. Wired glass may be used in the door not to exceed one hundred (100) square inches in area and set in a steel frame. Any door assembly must be fitted to ensure minimal air leakage.

618.4 TERMINAL PASSAGEWAY: The smokeproof enclosure shall terminate at grade level and shall provide egress to the street independently of all other exitways. When grade passageways are used, they shall comply with the requirements of section 611, except that there shall be no openings therein other than the smokeproof enclosure and street exit doorways. The passageway walls shall be of four (4) hour fireresistive construction and the floor and roof of three (3) hour fireresistive construction.

618.5 CONSTRUCTION: The construction of smokeproof enclosures shall be of walls with a four (4) hour fireresistive rating without openings other than the required doorways. The vestibule shall be considered to be an element of the exitway and shall be constructed in accordance with the fireresistive requirements of table 2-5. The balcony shall be constructed in accordance with the fireresistive requirements in table 2-5 for floor construction.

The stairshaft vestibule or balcony shall be provided with emergency lighting from an approved independent power source to assure continued illumination in case of emergency. In buildings over seventy (70) feet in height, the emergency lighting system may be integrated with the emergency power system required for fire suppression systems as required in article 12.

618.51 WINDOWS: All window openings in the exterior wall of the building, facing on the yard or court within thirty (30) feet below or to the side of any access balcony or vestibule shall be protected with three-quarter (3/4) hour opening protectives complying with article 9.

618.52 DOOR WIDTHS: Door openings from building to vestibules or balconies and to the stairways shall be not less than forty-four (44) inches wide. The doors shall be capable of being opened from both sides without a key, complying with all the requirements of section 616.6 for exitway doors for stairways, except that the fireresistance rating shall be not less than one and one-half (1½) hours or the approved labeled equivalent complying with article 9.

618.6 VENTILATION OF SMOKEPROOF STAIRWAY ENCLOSURES: Smokeproof stairway enclosures shall be ventilated with natural ventilation or mechanical ventilation meeting the requirements of section 618.7 or 618.8. In buildings over seventy (70) feet in height, ventilation in exitway stairways must conform to the requirements of article 12.

618.7 SMOKEPROOF STAIRWAY ENCLOSURES BY NATURAL VENTILATION: The balcony separating the smokeproof enclosure from the interior building spaces shall have at least one (1) open side adjacent to a street, alley, or yard with four (4) feet high guard railings across the open side(s). One open side of the balcony shall have a minimum open area of sixteen (16) square feet with no dimension less than thirty (30) inches. Doors must be located so as to be openable in any weather. There shall be no step between the balcony and the smokeproof stairway enclosure.

618.8 SMOKEPROOF ENCLOSURE BY MECHANICAL VENTILATION: The stairshaft and vestibule shall be provided with a mechanical ventilation system as specified herein that will be automatically activated on three (3) or more floors in case of emergency. Buildings over seventy (70) feet in height shall conform to the requirements for ventilation of article 12.

618.81 OPERATION OF VENTILATING EQUIPMENT: Vestibule and stairshaft mechanical ventilation may be inactive or may operate at reduced levels for normal operations, but when the detectors referred to herein either fail or are activated, the vestibule and stairshaft mechanical ventilation system shall operate at the levels specified in sections 618.82 and 618.83. The vestibule ventilation system shall be designed and activated in accordance with one of the following methods:

Method 1) - TOTAL SYSTEM. Simultaneous operation of all vestibules. If the vestibule mechanical ventilation system is designed to provide the ventilation in the vestibules on all floors simultaneously, a products-of-combustion detector shall be located outside each vestibule so designed that activation or failure of any one of the detectors will simultaneously activate the vestibule ventilation system on all floors.

Method 2) - ZONED SYSTEM. Simultaneous operation of three or more vestibules. If the vestibule ventilation system is designed as one or more zones to provide the simultaneous ventilation in the vestibules for at least a three (3) floor zone, automatic supply and exhaust dampers shall be provided in all vestibules in order to obtain the zoned control of the ventilation as follows:

A smoke detector shall be located outside each vestibule so designed to open the supply and exhaust duct dampers in the vestibules within the affected zone three (3) or more floors, and to actuate the stairshaft ventilation system in case any detector in the affected zone either fails or is activated.

618.82 VESTIBULE VENTILATION: The vestibule shall have an emergency ventilating system providing not less than one (1) air change per minute supply. The exhaust shall be one hundred fifty (150) percent of the supply. The supply shall be sufficient to maintain a pressure of 0.025 inches of water (0.0009 pounds per square inch) above ambient with all doors closed.

618.83 STAIRSHAFT VENTILATION: The stairshaft shall be provided with emergency mechanical supply and exhaust air. There shall be a minimum of one (1) air change per minute. The supply shall be sufficient to provide a minimum of 0.05 inches of water column pressure (0.00185 pounds per square inch) above ambient with all doors closed. Supply air shall be introduced at the level of the grade exitway discharge.

618.84 STANDBY POWER: Mechanical vestibule stairshaft ventilation systems and detector systems shall be powered by an approved self-contained generator designed to operate whenever there is a loss of power in the normal house current. The generator shall be located in a separate room of two (2) hour fireresistive construction and shall have a minimum fuel supply to operate the equipment for two (2) hours. In buildings over seventy (70) feet high, refer to article 12 for requirements for standby power in fire suppression system.

618.85 EMERGENCY LIGHTING: The vestibules and stairshaft shall be provided with emergency lighting. The standby generator which is installed for the vestibule and stairshaft mechanical ventilation equipment may be used for the standby emergency lighting power supply. In buildings over seventy (70) feet high, refer to article 12 for requirements for standby power in fire suppression systems.

618.86 FIRE PROTECTION INDICATOR PANEL: A fire protection indicator panel may be required by the fire official and located as practical inside the entrance to the smokeproof tower stairshaft at grade. Said panel shall indicate the floor or floors having caused the alarm. Said panel shall have an overriding manual switch capable of deactivating the ventilation equipment. For buildings over seventy (70) feet in height, refer to article 12 for fire protection indicator panel requirements.

618.87 FIRE DEPARTMENT CONNECTION: The fire protection indicator panel shall have a direct connection to the fire department facilities if required by the fire official.

618.88 ACCEPTANCE AND TESTING: Before the foregoing equipment is accepted by the building official, it shall be certified by a qualified registered professional engineer as being designed and capable of operating in compliance with these requirements and the equipment shall be tested and certified by a qualified registered professionsal engineer that it is operating in compliance with the requirements of this section.

618.89 BUILDING OWNERS' RESPONSIBILITY: The building owner shall have tested all the equipment referred to in these requirements at least once every ninety (90) days to ensure that all parts are in operable condition;

and he shall maintain a log attesting to the results. The log shall be available for inspection by the building official and the fire official. Once each year the system shall be inspected, tested and certified by a qualified registered professional engineer that it is in condition and capable of operating to meet these requirements.

## SECTION 619.0 EXTERIOR EXITWAY STAIRWAYS

619.1 AS REQUIRED EXITWAY: Exterior stairways conforming to the requirements for interior stairways in all respects, except as to enclosures and except as herein specifically modified, may be accepted as an element of a required means of egress in buildings not exceeding five (5) stories or sixty-five (65) feet in height for other than use group H (institutional) provided there is at least one (1) additional stairway.

Exterior stairways which are accepted as exitway elements in residential buildings of use groups L-2 and L-3 shall be relieved from requirements for fire doors, but shall be provided with handrails and guards as required for interior stairs (section 616.5 and 616.52) and shall be protected from the weather as required in section 619.2.

619.11 LOCATION AND ARRANGEMENT: Exterior stairways may be utilized where at least one (1) door from each tenant space opens onto a roofed-over open porch or balcony served by at least two (2) stairways so located as to provide a choice of independent, unobstructed means of egress directly to the grade. Such porches and stairways shall comply with the requirements for interior exitway stairways as specified in section 616.0. Porches and balconies shall not be less than four and one-half (4½) feet in width. The stairways shall be located remotely from each other. The maximum travel distance from any tenant space to the nearest stairway shall be as specified in table 6-2. Porches and stairways shall be located at least ten (10) feet from adjacent property lot lines and from other buildings on the same lot unless openings in such buildings are protected by three-quarter (3/4) hour fireresistive doors or windows.

619.2 GUARDS AND CANOPIES: Guards shall be provided on all exposed sides of required exterior stairways to a height of five (5) feet, constructed of wire or other noncombustible weather resisting mesh having a maximum opening of one and one-half (1½) inches. The stairway shall be protected by metal or other approved noncombustible material to the extent necessary to ensure that the stairway remains in a safe, unobstructed and easily accessible condition in any weather.

619.3 OPENING PROTECTIVES

619.31 DOORS: Except as specified in section 619.1 for residential buildings, access shall be provided at each story through a three-quarter (3/4) hour self-closing fire door of the required number of unit exit widths.

619.32 WINDOWS: In buildings more than three (3) stories in height, or with an occupancy load of more than seventy-five (75) above or more than forty (40) below grade, the openings below and within ten (10) feet horizontally of the stairway shall be protected with approved three-quarter (3/4) hour automatic fire windows.

619.4 LOCATION

619.41 ACCESS TO STREET: All required exterior stairways shall be located so as to lead directly to a street or open space with direct access to a street; or when located on the rear of the building may lead through a passageway at grade complying with section 611.

619.5 CONSTRUCTION: Exterior stairs shall be constructed entirely of steel or other approved noncombustible materials with pipe handrails on both sides of stairways and platforms. On buildings of type 3 or type 4 construction, not more than three (3) stories in height, exterior stairways may be constructed of wood members not less than two (2) inches in thickness.

619.6 CAPACITY: The capacity of exterior exitway stairways which are used as a required means of egress are determined by section 608.1.

SECTION 620.0 MOVING EXITWAY STAIRWAYS

620.1 WHEN ACCEPTABLE: Moving stairways of the horizontal non-slip tread type moving in the direction of egress may be accepted as an approved exitway element in buildings of all use groups except assembly and institutional uses, when constructed and approved in accordance with the requirements of this article and the provisions of ELV-2, elevator, dumbwaiter, escalator, and moving walk regulations, promulgated by the Board of Elevator Regulations, of the Commonwealth of Massachusetts, Department of Public Safety. When accepted as an element of a required means of egress, they shall be enclosed with fire-resistive partitions as specified in section 616.

620.2 WIDTH: The width shall be not less than forty (40) inches between guards and the moving tread shall be not less than thirty-six (36) inches in width, and fifteen and three-quarter (15-3/4) inches in depth.

620.3 CAPACITY: The occupancy capacity shall be computed as provided in section 608 for exitway stairways.

620.4 LANDINGS AND PLATFORMS: Landings and platforms shall be provided at the top and bottom of each unit as required for interior exitway stairways.

620.5 RAILINGS: Guards shall be surmounted with moving handrails traveling at the same speed as the stairway.

620.6 EGRESS: Means of egress to the street shall be provided as specified herein for interior stairways except that in mercantile buildings completely equipped with a two-source automatic sprinkler system moving stairways may be accepted for one-third (1/3) the total required exit capacity when discharging through the main grade floor area.

620.7 CONSTRUCTION

620.71 NONCOMBUSTIBLE MATERIALS: Only noncombustible materials shall be used in the construction of moving stairways accepted as a required means of egress except for step wheels, handrails, electrical equipment, and wood veneers not more than one twenty-eighth (1/28) inch thick directly attached to metal or other noncombustible backing with a nonvolatile and nonflammable cement.

620.72 FIRERESISTANCE: The enclosure shall afford the fireresistance required for approved interior exitway stairways as specified in section 616.9.

620.73 HEIGHT OF TRAVEL PER UNIT: No single moving stairway unit shall have a vertical travel height of more than two (2) stories nor more than thirty-five (35) feet.

SECTION 621.0 FIRE ESCAPES

621.1 WHERE PERMITTED: Fire escapes shall be permitted only by special order of the building official, in existing buildings or structures not exceeding five (5) stories or sixty-five (65) feet in height, and when more adequate exitway facilities cannot be provided.

621.2 CONSTRUCTION: The fire escape shall be designed to support a live load of one hundred (100) pounds per square foot and shall be constructed of steel or other approved noncombustible materials, except as specified in sections 621.24 and 621.25. All fire escapes of other than wood, and any wood fire escape three (3) stories or higher, must have drawings and specifications submitted by a qualified registered professional engineer with his seal and signature, which include supporting structures.

621.21 DIMENSIONS: The width of the stairs shall be as specified in 621.22, but in any case shall be at least twenty-two (22) inches wide. Risers will be not more than eight (8) inches in height and treads not less than eight (8) inches in depth. Landings shall be a minimum of forty (40) inches wide by thirty-six (36) inches long, located not more than eight (8) inches below the access window or door.

621.22 CAPACITY: The capacity will provide for the intended occupancy load as designated by the building official and determined by section 608.1, but in no case may the width be less than twenty-two (22) inches. The width will be adequate to provide for the number of occupants.

621.23 OPENING PROTECTIVES: Doors and windows along the fire escape shall be protected with three-quarter (3/4) hour opening protectives in other than residence buildings of use groups L-2 and L-3.

621.24 OUTSIDE FIRE LIMITS: On buildings not over three (3) stories nor more than forty (40) feet in height located outside the fire limits, accommodating not more than twenty (20) persons, fire escapes may be constructed of wood or other approved material of similar combustible characteristics.

621.25 WITHIN FIRE LIMITS: Within Fire District No. 2, fire escapes may be constructed of wood not less than two (2) inches thick on buildings of type 3 or type 4 construction which are not more than three (3) stories in height.

## SECTION 622.0 SLIDESCAPES

Slidescapes and safety chutes shall be permitted in buildings of the high hazard use group and in existing school and institutional buildings as emergency means of egress when unusual conditions warrant, as approved by the building official.

622.1 LOCATION: The arrangement and location of slidescapes shall conform to this article for means of egress and shall be designated by exit signs and lights as provided in section 624.

622.2 CONSTRUCTION: All chutes shall be constructed of approved noncombustible materials with a pitch in the line of travel of not less than twenty-four (24) nor more than forty-two (42) degrees measured on the developed circumference of spiral chutes. Straight chutes shall be not less than twenty-four (24) inches and spiral chutes not less than twenty-eight (28) inches wide in the clear; nor more than forty-four (44) inches wide in any case. When erected on the interior of a building, they shall be enclosed as required in section 616.9 for interior stairways with direct means of egress to the street or other public space.

622.3 EXTENSION TO ROOF: Where constituting a supplemental means of egress from roofs, all slidescapes and chutes shall extend to the roof as required for exitway stairways in section 617.

## SECTION 623.0 EXITWAY SIGNS AND LIGHTS

623.1 SIZE AND LOCATION: Except in one- and two-family dwellings (L-3), and in exitways serving only three or fewer dwelling units in L-2 multi-family dwelling uses, all required exitways shall be provided with exit signs sufficient in number to indicate at any point in the required exitway the approved direction of egress discharge. Such signs shall incorporate an approved symbol to ensure understanding by non-English reading people and, if so desired, the

word "EXIT." Such symbol and lettering shall be at least six (6) inches in height. Such signs shall have either red outlines on a white background or the reverse, and shall be made of noncombustible material. All required exit signs shall be illuminated in conformance with section 623.2. All types of exit signs must be approved for use in the Commonwealth of Massachusetts by the State Building Code Commission.

623.2 ILLUMINATION: Lighting of all required "EXIT" signs will be adequate and of a character to ensure that the signs can be easily read under normal conditions wherever the building or area served is occupied. The level of light provided on the exposed face of the sign shall be at least twenty-five (25) foot candles or the equivalent.

623.21 POWER LEVELS: All "EXITWAY" signs shall be illuminated at all times when the building or area is occupied, by a power source which can be sustained at the required level for a period of at least the fire rating of the exitway at all times and provide power independent of the failure of any other circuit or source of power. Fire suppression systems incorporating an independent power source required by article 12 may serve as the independent power source for exitway signs and lights.

SECTION 624.0 EXITWAY LIGHTS

624.1 ARTIFICIAL LIGHTING: In all structures except one and two-family dwellings, all stairways, exitways and passageways appurtenant thereto shall be equipped with artificial lighting facilities to provide the intensity of illumination herein prescribed continuously during the time that conditions of occupancy of the building require that the exitways be available. All means of egress in other than one and two-family dwellings shall be equipped with artificial lighting facilities to provide the intensity of illumination herein prescribed continuously during the time that conditions of occupancy of the building require that the exitways be available. In schoolhouses switches controlling these facilities shall not be accessible to the public; a key switch shall be considered meeting this requirement.

624.2 INTENSITY OF ILLUMINATION: The intensity of floor lighting shall be not less than three (3) foot candles measured at floor level and maintained everywhere along the required exitway. There shall be adequate overlap of illumination sources to ensure that no area will be left in darkness due to the failure of a light element.

624.3 PLACES OF ASSEMBLY: In places of assembly for the exhibition of motion pictures or other projections by means of directed light, the illumination of floors of exitway access areas may be reduced during such period of projection to not less than one (1) foot candle.

624.4 INDEPENDENT POWER SOURCE: Emergency lights shall be provided with a power system ensuring continuous lighting at all times required in section 624.1 and incorporating a power source which can be sustained at the level specified in section 624.2 for a period of at least one and one-half (1½) hours, or as required by section 623.21 for cases in excess of one and one-half (1½) hours, and provide power at all times and independently of the failure of any other circuit or source of power. The independent power source may be the same required by article 12 for fire suppression systems.

624.41 POWER LEVELS: The power system shall be designed to ensure that whenever the voltage of the normal service falls below fifty (50) percent of nominal lamp voltage, emergency lighting service is instantly transferred to the independent power source. The service may be transferred back to the normal supply when that supply can provide at least eighty (80) percent of the nominal lamp voltage.

624.5 PLANS AND SPECIFICATIONS: The building official may require that all plans and specifications for emergency lighting be submitted by a registered professional engineer qualified by background in the design of such electrical circuits, and such plans and specifications shall have the seal and signature of the registered professional engineer certifying that the required systems are in compliance with the requirements of this Code.

## Reference Standards - Article 6

| | | | |
|---|---|---|---|
| NFPA | 101 | 1967 | Life Safety Code |
| NFPA | 101 | 1967 | Life Safety Code |
| NFPA | 101 | 1973 | Life Safety Code |

ARTICLE 7

# STRUCTURAL AND FOUNDATION LOADS AND STRESSES

## SECTION 700.0 SCOPE

The provisions of this article shall control the structural design of all buildings and structures and their foundations hereafter erected to insure adequate strength of all parts thereof for the safe support of all superimposed live and special loads in addition to their own dead load, without exceeding the allowable stresses or design capabilities prescribed in this Code or by accepted engineering practice.

## SECTION 701.0 DEFINITIONS

CONTROLLED CONSTRUCTION: the construction of a building or structure or a specific part thereof which has been designated and erected under the supervision of a licensed or registered engineer or architect using controlled materials as herein defined in compliance with accepted engineering practice under the procedure of section 128.0.

CONTROLLED MATERIALS: materials which are certified by an accredited authoritative agency as meeting accepted engineering standards for quality and as provided in sections 722 and 800.

FORMED STEEL CONSTRUCTION: that type of construction used in floor and roof systems consisting of integrated units of sheet or strip steel plates which are shaped into parallel steel ribs or beams with a continuous connecting flange deck; generally attached to and supported on the primary or secondary members of a structural steel or reinforced concrete frame.

FOUNDATION WALL: a wall below the floor nearest grade serving as a support for a wall, pier, column or other structural part of a building.

LIGHT GAGE STEEL CONSTRUCTION: that type of construction in which the structural frame consists of studs, floor joists, arch ribs, rafters, steel decks and other structural elements which are composed and fabricated of cold-formed sheet or strip steel members less than three-sixteenths (3/16) inch thick.

LOAD

-DEAD LOAD: the weight of all permanent construction including walls, floors, roofs, partitions, stairways and of fixed service equipment.

-DURATION OF LOAD: the period of continuous application of a given load, or the aggregate of periods of intermittent application of the same load.

-EARTHQUAKE LOAD: the assumed lateral load acting in any horizontal direction on the structural frame due to the kinetic action of earthquakes.

-IMPACT LOAD: the load resulting from moving machinery, elevators, craneways, vehicles, and other similar forces and kinetic loads.

-LATERAL SOIL LOAD: the lateral pressure in pounds per square foot due to the weight of the adjacent soil, including due allowance for hydrostatic pressure.

-LIVE LOAD: the weight superimposed by the use and occupancy of the building, not including the wind load, earthquake load, or dead load.

-WIND LOAD: the lateral pressure on the building or structure in pounds per square foot due to wind blowing in any direction.

ORDINARY MATERIALS: materials which do not conform to the requirements of the Basic Code for controlled materials.

PRIMARY MEMBER: any member of the structural frame of a building or structure used as a column; grillage beam; or to support masonry walls and partitions; including trusses, isolated lintels spanning an opening of eight (8) feet or more; and any other member required to brace a column of a truss.

SECONDARY MEMBER: any member of the structural framework other than a primary member including filling-in beams of floor systems.

STEEL JOIST: any secondary steel member of a building or structure made of hot or cold-formed solid or open-web sections, or riveted or welded bar, strip or sheet steel members or slotted and expanded or otherwise deformed rolled sections.

STRUCTURAL STEEL MEMBER: any primary or secondary member of a building or structure consisting of a rolled steel structural shape other than formed steel, light gage steel or steel joist members.

SECTION 702.0 DESIGN SAFE LOAD

702.1 STRUCTURAL ANALYSIS: The safe load for any structural member or system of construction shall be determined by accepted engineering analysis except as provided in sections 703 and 803 for tests of assemblies not capable of analysis.

702.2 CHECK TESTS: When there is reasonable doubt as to the design capacity of any structural unit or assembly, the building official may require that tests be made of such unit or assembly under the supervision of a qualified registered professional engineer. Such tests shall be made by an approved testing facility and personnel, and the procedures and results of such tests shall be signed and stamped by the said designated qualified registered professional engineer.

SECTION 703.0 TEST SAFE LOAD

703.1 WHEN REQUIRED: When not capable of being accurately analyzed, any system of construction or structural unit and its connections shall be subjected to tests prescribed in article 8 or in the test standards of this article or article 8, or to such other tests which may be certified by a qualified registered professional engineer as being acceptable for providing the information required. Any tests performed shall be conducted as required by the provisions of section 702.2 for testing.

703.2 TEST LOAD: The test load shall be subject to the provisions of section 804.1 and where applicable, deflections shall be limited as provided in section 804.2.

SECTION 704.0 DESIGN LIVE LOAD

704.1 REQUIRED LIVE LOAD: The live loads to be assumed in the design of buildings and structures shall be the greatest load produced by the intended use and occupancy, but in no case less than the minimum uniformly distributed unit loads required in section 707 for specific uses.

704.2 LOADS NOT SPECIFIED: The building official shall approve the live load for any use not specificially provided for in Table 7-1.

SECTION 705.0 DESIGN DEAD LOAD

705.1 CONSTRUCTION MATERIALS: In estimating dead load for the purposes of structural design, the actual weights of materials shall be used, but in no case less than the unit dead loads prescribed in the reference standards of this article.

705.2 SERVICE EQUIPMENT: The weight of all building service equipment including plumbing stacks, heating and air conditioning equipment and similar fixtures shall be included in the dead load supported by the structural frame.

705.3 PARTITION LOAD: In office and other buildings, in which subdividing partitions may be subsequently erected, rearranged or relocated, provision shall be made to support the actual weight of such partitions where they occur, or for an equivalent uniform load, which shall be assumed not less than twenty (20) pounds per square foot of floor area, in addition to the specified uniformly distributed live load. Provision for partitions weight shall be made whether or not partitions are shown on the plans, unless the specified live load exceeds eighty (80) pounds per square foot.

## SECTION 706.0 EXISTING BUILDINGS

In the reconstruction, repair, extension or alteration of existing buildings, the allowable working stresses used in design shall be as follows:

706.1 BUILDING EXTENDED: When an existing building is altered by an extension in height or area, all existing structural parts affected by the addition shall be strengthened where necessary and all new structural parts shall be designed to meet the requirements for buildings hereafter erected.

706.2 BUILDING REPAIRED: When repairs are made to the structural portion of an existing building, and the uncovered structural portions are found unsound, such parts shall be made to conform to the requirements for buildings hereafter erected.

706.3 EXISTING LIVE LOAD: When an existing building heretofore approved is altered or repaired within the limitations prescribed in sections 106.3 or 106.4, the structure may be designed for the loads and stresses applicable at the time of erection, provided the public safety is not endangered thereby.

706.4 POSTED LIVE LOAD: Any existing building heretofore approved, in which there is no change in use to a new use group requiring greater floor loads, may be posted for the originally approved live loads, provided the building is structurally safe in all its parts and adequate for its existing use, and the public safety is not endangered thereby.

## SECTION 707.0 UNIT LIVE LOADS

The plans for all buildings and structures intended for other than residential uses shall specify the live and partition loads for which each floor or part thereof has been designed.

707.1 UNIFORM LIVE LOAD: The minimum uniformly distributed live load in pounds per square foot shall be as provided in Table 7-1 and for all concentrated loads wherever they occur as provided in section 708.

TABLE 7-1 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS

| OCCUPANCY OR USE | LIVE LOAD (PSF) |
|---|---|
| Apartments (see Residential) | |
| Armories and drill rooms | 150 |
| Assembly halls and other places of assembly: | |
| Fixed seats | 60 |
| Movable seats | 100 |
| Platforms (assembly) | 100 |
| Balcony (exterior) | 100 |
| One- and two-family residences only and not exceeding 100 sq. ft. | 60 |
| Bowling Alleys, poolrooms, and similar recreational areas | 75 |
| Cornices | 60 |
| Corridors: | |
| First Floor | 100 |
| Other Floors, same as occupancy served except as indicated | |
| Court Rooms | 100 |
| Dance halls and ballrooms | 100 |
| Dining rooms and restaurants | 100 |
| Dwellings (see Residential) | |
| Elevator Machine Room | 150 |
| Fire escapes | 100 |
| On multi- or single-family residential buildings only | 40 |
| Garages (passenger cars only) | 50 |
| For trucks and buses use AASHTO (1) land loads (see table 7-2 for concentrated load requirements | |
| Grandstands (see Reviewing stands) | |
| Gymnasiums, main floors and balconies | 100 |
| Hospitals | |
| Operating rooms, laboratories | 60 |
| Private rooms | 40 |
| Wards | 40 |
| Corridors, above first floor | 80 |
| Hotels (see Residential) | |
| Libraries: | |
| Reading rooms | 60 |
| Stack rooms (books & shelving at 65 pcf) but not less than | 150 |
| Corridors, above first floor | 80 |
| Manufacturing: | |
| Light | 125 |
| Heavy | 250 |
| Marquees | 75 |
| Office Buildings: | |
| Offices | 50 |
| Lobbies | 100 |
| Corridors, above first floor | 80 |
| File and computer rooms require heavier loads based upon anticipated occupancy | |

TABLE 7-1

| OCCUPANCY USE | LIVE LOAD (PSF) |
|---|---|
| Open parking structures (passenger cars only) | 50 |
| Penal institutions: | |
| Cell blocks | 40 |
| Corridors | 100 |
| Residential: | |
| Multi-family houses: | |
| Private apartments | 40 |
| Public rooms | 100 |
| Corridors | 80 |
| Dwellings: | |
| First Floor | 40 |
| Second floor and habitable attics | 30 |
| Uninhabitable attics (2) | 20 |
| Hotels: | |
| Guest rooms | 40 |
| Public rooms | 100 |
| Corridors serving public rooms | 100 |
| Corridors | 80 |
| Reviewing stands and bleachers (3) | 100 |
| Schoolhouses: | |
| Classrooms | 50 |
| Corridors | 100 |
| Flexible and open plan areas | 100 |
| Sidewalks, vehicular driveways, and yards, subject to trucking | 250 |
| Skating rinks | 100 |
| Stairs and exitways | 100 |
| Storage warehouse: | |
| Light | 125 |
| Heavy | 250 |
| Stores: | |
| Retail: | |
| First floor, rooms | 100 |
| Upper floors | 75 |
| Wholesale | 125 |
| Theatres: | |
| Aisles, corridors and lobbies | 100 |
| Orchestra floors | 60 |
| Balconies | 60 |
| Stage floors | 150 |
| Yards and terraces, pedestrians | 100 |

TABLE 7-1

NOTES:

1) American Association of State Highway and Transportation Officials.

2) Live load need be applied to joists or to bottom chords of trusses or trussed rafters only in those portions of attic space having a clear height of forty-two (42) inches or more between joist and rafter in conventional rafter construction; and between bottom chord and any other member in trussed or trussed rafter construction. However, joists or the bottom chords or trusses or trussed rafters shall be designed to sustain the imposed dead load or ten pounds per square foot (10 psf) whichever be greater, uniformly distributed over the entire span.

3) For detailed recommendations, see the Standard for Tents, Grandstands and Air-Supported Structures Used for Places of Assembly, NFPA 102, 1971.

4) Deflections for floors in areas of public assembly shall be limited to 1/360 the span.

707.2 POSTING OF LIVE LOADS: In every building or other structure or part thereof, used for mechanical, business, industrial or storage purposes, the design and partition loads shall be marked on plates of approved design which shall be supplied and securely affixed by the owner of the building in a conspicuous place in each space to which they relate. Any plates lost, removed or defaced shall be replaced by the owner.

SECTION 708.0 CONCENTRATED LOADS

Floors of buildings used as specified in Table 7-2 shall be designed to support the uniformly distributed live loads prescribed in Table 7-1 or the following concentrated loads in pounds, whichever produces the greater stresses. Unless otherwise specified, the indicated concentration shall be assumed to occupy an area of two and one-half (2 1/2) feet square and shall be so located as to produce the maximum stress conditions in the structural members.

Floors of schoolhouses used as specified in Table 7-2 shall be designed to support the uniformly distributed live loads prescribed in Table 7-1 following concentrated loads in pounds whichever produces the greater stresses. Unless otherwise specified, the indicated concentration shall be assumed to occupy an area of two and one-half (2-1/2) feet square, and shall be so located as to produce the maximum stress conditions in the structural members; except that in steel joist construction, bridged in accordance with the requirements of section 829, the specified concentration shall be assumed as distributed over three (3) of the secondary members and each individual joist shall be capable of sustaining a concentrated load of eight hundred (800) pounds at the panel point.

TABLE 7-2 CONCENTRATED LOADS

| LOCATION | POUNDS |
|---|---|
| Elevator machine room grating (on area of 4 square inches) | 300 |
| Finish light floor plate construction (on area of 1 square inch) | 200 |
| Garages | (1) |
| Manufacturing and Storage Buildings | (2) |
| Office Floors | 2000 |
| Scuttles, skylight ribs and accessible ceilings | 200 |
| Sidewalks | 8000 |
| Stair treads (on area of 4 square inches at center of tread) | 300 |

Note 1: Floors in garages or portions of buildings used for storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 7-1 or for the following concentrated loads:

a) for passenger cars accommodating not more than nine (9) passengers, two thousand (2000) pounds acting on an area of twenty (20) square inches;

b) mechanical parking structures without slab or deck, passenger cars only, fifteen hundred (1500) pounds per wheel;

c) for trucks or buses, maximum wheel load on an area of twenty (20) square inches.

Note 2: For buildings in which mechanical material handling equipment will be utilized, the structural floor slab shall be designed for the actual concentrated loads.

SECTION 709.0 IMPACT LOADS

The live loads specified in section 707 shall be assumed to include adequate allowance for ordinary impact conditions. Provision shall be made in the structural design for special uses and loads which involve vibration and impact forces.

709.1 ELEVATORS: All moving elevator loads shall be increased one hundred (100) percent for impact and the structural supports shall be designed within the limits of deflection as specified in the Department of Public Safety, Board of Elevator Regulations ELV-2.

709.2 MACHINERY: For the purpose of design, the weight of machinery and moving loads shall be increased as follows, to allow for impact:

| TYPE OF MACHINERY | PERCENTAGE |
|---|---|
| Elevator Machinery | 100 |
| Light machinery, shaft or motor driven | 20 |
| Reciprocating machinery or power driven units | 50 |
| Hangers for floors or balconies | 33 |

These percentages shall be increased when so recommended by the manufacturer.

709.3 CRANEWAYS: All craneways shall have their design loads increased for impact as follows:

a) a vertical force equal to twenty-five (25) percent of the maximum wheel load;

b) a lateral force equal to twenty (20) percent of the weight of the trolley and lifted load only, applied one-half (1/2) at the top of each rail; and

c) a longitudinal force of ten (10) percent of the maximum wheel loads of the crane applied at top of rail.

709.4 ASSEMBLY STRUCTURES: Grandstands, stadiums and similar assembly structures shall be designed to resist a horizontal swaying load applied parallel to the rows of seats, in addition to any wind loads, of not less than twenty-four (24) pounds per lineal foot of seats per row; and of not less than ten (10) pounds per lineal foot of seats applied transversely.

SECTION 710.0 SPECIAL LOADS

Provisions shall be made for all special loads herein prescribed and all other special loads to which the building or structure may be subjected. In addition to the requirements of section 711, the following requirements shall also apply.

710.1 BELOW GRADE: All retaining walls and other walls below grade shall be designed to resist lateral soil pressures with due allowance for hydrostatic pressure and for all superimposed vertical loads.

710.2 HYDROSTATIC UPLIFT: All foundation slabs and other footings subjected to water pressure shall be designed to resist a uniformly distributed uplift equal to the full hydrostatic pressure.

710.3 RAILINGS: Railings around stairwells, balconies and other floor openings, both exterior and interior, shall be designed to resist a load of at least two hundred (200) pounds applied in any direction at any point of the top rail, and also a vertical and a horizontal thrust of fifty (50) pounds per lineal foot applied at the top railing. The concentrated load and distributed loads need not be assumed to act concurrently. Railings and guards of grandstands and similar assembly structures shall be capable of resisting a lateral force of fifty (50) pounds per lineal foot and sustaining a vertical load of one hundred (100) pounds per lineal foot.

710.4 CONSTRUCTION LOADS AND ERECTION STRESSES: Provision shall be made for temporary construction and wind loads which may occur during the erection of the building; and all structural members and connections shall be designed and erected so as to prevent overstressing during construction.

710.5 The following requirements shall apply only to schoolhouses:

710.51 TEMPERATURE LOADS: The design of enclosed buildings more than two hundred fifty (250) feet in plan dimension shall provide for the forces and/or movements resulting from an assumed expansion corresponding to a change in temperatures of $40^{o}$ F. For exterior exposed frames, arches or shells regardless of plan dimensions, the design shall provide for the forces and/or movements resulting from an assumed expansion and contraction corresponding to an increase or decrease in temperature of $50^{o}$ F. For determining required anchorage for piping, the forces shall be determined on the basis of temperature variations for the specific service conditions. Friction forces in expansion bearings shall be considered.

SECTION 711.0 ROOF LOADS

The structural supports of roofs shall be designed to resist wind and where applicable, snow and earthquake loads in addition to the dead load of the construction and the appropriate live loads specified in Table 7-1.

711.1 SNOW LOAD as provided in section 712.0.

711.12 WIND LOAD as provided in section 715.0.

711.13 EARTHQUAKE LOAD as provided in section 718.0.

711.2 MINIMUM ROOF LOADS: Ordinary roofs, either flat, pitched or curved, shall be designed for the live loads as specified in Table 7-3.

TABLE 7-3 MINIMUM ROOF LIVE LOADS*

| ROOF SLOPE | TRIBUTARY LOADED AREA in SQUARE FEET for ANY STRUCTURAL MEMBER | | |
|---|---|---|---|
| | 0 to 200 | 201 to 600 | Over 600 |
| Flat or rise less than 4 inches per foot<br>Arch or dome with rise less than 1/8 of span | 20 | 16 | 12 |
| Rise 4 inches per foot to less than 12 inches per foot<br>Arch or dome with rise 1/8 of span to less than 3/8 of span | 16 | 14 | 12 |
| Rise 12 inches per foot and greater<br>Arch or dome with rise 3/8 of span or greater | 12 | 12 | 12 |

*In pound-force per square foot of horizontal projection.

711.3 OVERHANGING EAVES: In other than one and two-family dwellings and except where framing of overhang is a continuation of the roof framing, overhanging eaves, cornices and other roof projections shall be designed for a minimum uniformly distributed live load of sixty (60) pounds per square foot.

711.4 PONDING: Roofs shall be designed for the maximum possible depth of water that may be ponded thereon as determined by the relative levels of roof deck and overflow weirs, scuppers, edges or serviceable drains in combination with the deflected structural elements.

711.5 SPECIAL PURPOSE ROOFS: When used for incidental promenade purposes, roofs shall be designed for a minimum live load of sixty (60) pounds per square foot; and one hundred (100) pounds per square foot when designed for roof gardens or assembly uses.

711.51 LANDSCAPED ROOFS: Where roofs are to be landscaped, the design live load shall be the sum of the appropriate uniform live load and the landscaping load shall be considered as a dead load and shall be computed on the basis of saturation of the soil.

## SECTION 712.0 SNOW LOAD

The basic snow loads to be assumed in the design of buildings or other structures are given in figure 7-1 of the reference standards of this article.

712.1 DESIGN SNOW LOAD: The map snow loads of figure 7-1 shall be used as the basis for deriving design snow loads for all buildings. Where exceptional conditions can be cited as applying to a particular region, the snow load requirements may be altered by the building official upon approval by the State Building Code Commission.

712.2 ROOF SNOW LOADS: The minimum snow loads for the design of ordinary and multiple series roofs, either flat, pitched or curved, shall be determined from figures 7-2a, 7-2b, 7-2c, 7-3a, 7-3b, 7-4 as applicable. The analysis incorporating snow loading shall be based on the conditions providing the most unfavorable loading result.

## SECTION 713.0 WIND LOAD

The structural frame of all buildings, signs, tanks or other exposed structures or parts of structures shall be designed to resist the horizontal pressures due to wind in any direction, both inwardly and outwardly, allowing for suction on the leeward side, as provided in sections 714 to 716 inclusive.

713.1 TORSIONAL RESISTANCE: The structural frame of all buildings and structures subjected to wind or other lateral loads shall be designed to resist the torsional moment due to eccentricity of the resultant load with respect to the center of rigidity of the structure.

SECTION 714.0 WIND ON VERTICAL SURFACES

The total wind pressures on vertical surfaces of ordinary buildings and structures to be considered in the design of primary members shall be in conformity with the following tables:

| Exposure A | Pressure P | | | |
|---|---|---|---|---|
| Height (ft.) | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
| Less than 30 | 10 | 10 | 10 | 12 |
| 30 | 10 | 10 | 12 | 14 |
| 50 | 10 | 12 | 14 | 17 |
| 100 | 12 | 16 | 19 | 23 |
| 150 | 14 | 18 | 23 | 27 |
| 200 | 16 | 21 | 27 | 34 |
| 250 | 18 | 23 | 30 | 36 |
| 300 | 20 | 26 | 33 | 40 |
| 350 | 22 | 28 | 35 | 44 |
| 400 | 23 | 30 | 38 | 46 |
| 450 | 25 | 31 | 40 | 49 |
| 500 | 26 | 33 | 42 | 52 |
| 550 | 27 | 35 | 44 | 55 |
| 600 | 28 | 36 | 46 | 58 |
| 650 | 29 | 38 | 47 | 59 |
| 700 | 30 | 40 | 50 | 62 |
| 750 | 31 | 41 | 52 | 65 |
| 800 | 32 | 42 | 54 | 66 |

Exposure A: Centers of large cities and very rough, hilly terrain.

| Exposure B | Pressure P | | | |
|---|---|---|---|---|
| Less than 30 | 10 | 13 | 17 | 21 |
| 30 | 13 | 17 | 21 | 26 |
| 50 | 16 | 19 | 25 | 31 |
| 100 | 19 | 25 | 31 | 39 |
| 150 | 22 | 28 | 36 | 44 |
| 200 | 23 | 31 | 40 | 50 |
| 250 | 26 | 34 | 43 | 53 |
| 300 | 27 | 36 | 45 | 56 |

| Exposure B | | Pressure P | | |
|---|---|---|---|---|
| Height (ft.) | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
| 350 | 28 | 38 | 48 | 59 |
| 400 | 30 | 40 | 51 | 63 |
| 450 | 31 | 41 | 52 | 65 |
| 500 | 32 | 43 | 55 | 66 |
| 550 | 34 | 44 | 56 | 68 |
| 600 | 35 | 45 | 57 | 71 |
| 650 | 36 | 47 | 60 | 74 |
| 700 | 37 | 48 | 61 | 75 |
| 750 | 38 | 50 | 62 | 76 |
| 800 | 39 | 51 | 64 | 80 |

Exposure B: Suburban areas, towns, city outskirts, wooded areas and rolling terrain.

| Exposure C | | Pressure P | | |
|---|---|---|---|---|
| Less than 30 | 14 | 20 | 26 | 34 |
| 30 | 21 | 27 | 35 | 43 |
| 50 | 23 | 31 | 40 | 50 |
| 100 | 30 | 36 | 45 | 57 |
| 150 | 33 | 39 | 51 | 62 |
| 200 | 34 | 43 | 53 | 66 |
| 250 | 35 | 47 | 56 | 68 |
| 300 | 36 | 48 | 58 | 72 |
| 350 | 38 | 49 | 61 | 75 |
| 400 | 39 | 51 | 62 | 76 |
| 450 | 40 | 52 | 63 | 79 |
| 500 | 41 | 53 | 65 | 80 |
| 550 | 42 | 54 | 67 | 83 |
| 600 | 43 | 55 | 69 | 85 |
| 650 | 44 | 56 | 70 | 86 |
| 700 | 45 | 57 | 71 | 87 |
| 750 | 46 | 58 | 72 | 88 |
| 800 | 46 | 59 | 73 | 90 |

Exposure C: Flat open country, open flat coastal belts and grasslands.

Zone 1 consists of the Counties of Berkshire, Franklin, Hampshire and Hampden.

Zone 2 consists of the County of Worcester.

Zone 3 consists of the Counties of Middlesex, Suffolk, Norfolk, Plymouth and Bristol.

Zone 4 consists of the Counties of Essex, Barnstable, Dukes and Nantucket.

714.1 DISTRIBUTION OF WIND FORCES: The total wind pressure (section 714.0) shall be distributed between opposite walls, two-thirds (2/3) as normal pressure on the windward side and one-third (1/3) as normal outward suction on the leeward side.

714.2 EXTERIOR SECONDARY WALL FRAMING AND WALL PANELS: Internal wind pressure or suction of thirty (30) percent of the prescribed pressures in section 714.1 shall be assumed to occur simultaneously with the external pressures in section 714.3 and 714.4.

714.3 AN EXTERNAL PRESSURE or suction to be considered in the design of secondary wall framing and wall panels and sheathing and their connections shall be one and one-half (1 1/2) times those in accordance with section 714.0 except at corners of all walls.

714.4 AT CORNERS OF ALL WALLS, the external suction to be considered in the design of secondary wall framing and wall panels and sheathing and their connections shall be two (2) times those in accordance with section 714.0. The suction shall be assumed to act on a vertical strip of width one-tenth (1/10) the least width of the building.

714.5 ROOFS OVER NON-ENCLOSED STRUCTURES: Roofs over non-enclosed structures shall be designed to resist wind loads in accordance with standard engineering practice and the reference standards of this article.

715.0 WIND LOAD ON ROOFS

The external wind pressures and suctions specified in sections 715.1 and 715.2 shall be considered in the design of primary roof framing and trusses.

External wind pressures and suctions to be considered in the design of secondary roof framing, purlins, roof panels and sheathing and their connections shall be one and one-half (1 1/2) times those determined in accordance with those sections. Internal pressures to be considered in the design of secondary roof framing and roof panels and sheathing and their connections shall be those specified in section 714.2 for wall elements.

715.1 PITCHED ROOFS: External wind forces on roofs, assumed to be acting upon primary roof framing members shall be not less than the following-listed fractions of the values specified in section 714.0, and shall be based on the average height of the roof eave above grade, the slope of the roof at the location under consideration and the ratio of sidewall height to building width.

EXTERNAL WIND PRESSURE ON ROOFS

| Ratio of Sidewall Height to Building Width | FLAT ROOFS | WINDWARD SLOPE OF ROOFS LESS THAN 1:12 | 1:12 to 4.05:12 | 405:12 to 6:12 | 6:12 to 12:12 | LEEWARD SLOPE ALL SLOPES |
|---|---|---|---|---|---|---|
| 0.2 | -.60 | -.60 | -.06 | .12 | .19 | -.50 |
| 0.4 | -.60 | -.60 | -.33 | .01 | .09 | -.50 |
| 0.6 | -.60 | -.60 | -.49 | -.20 | -.06 | -.50 |
| 0.8 | -.60 | -.60 | -.57 | -.30 | -.18 | -.50 |
| 1.0 or more | -.60 | -.60 | -.60 | -.39 | -.28 | -.50 |

For all roof surfaces having a slope greater than 12:12 the same wind forces as for vertical surfaces shall be assumed.

715.2 CURVED ROOFS: The external wind forces assumed to be acting upon the primary framing members in the windward quarter of curved roofs shall be not less than the wind pressure specified in section 714.0 multiplied by the rise-to-span ratio of the entire roof arch, and shall be considered as acting as an inward acting pressure. An external suction of not less than seven-tenths (7/10) of the pressure specified in section 714.0 shall be assumed to be acting upon the center half of all arch roofs and an external suction of not less than six-tenths (6/10) of such pressures shall be assumed to be acting upon the leeward quarter of all such roofs. All wind pressures acting upon curved roofs shall be considered as acting normal to the chord of the curved section under consideration.

715.3 TEST DETERMINATION: With the approval of the building official, wind force on a building may be based on shape coefficients obtained from wind tunnel tests of models or by other approved methods. Such shape coefficients shall include the full effect of openings in wall or roof surfaces. In such cases the velocity pressure "q" to be used at any height shall be taken as .77 P.

715.4 ANCHORAGE: Roof framing shall be anchored to wall framing and the walls to foundations so as to resist wind uplift and sliding in excess of seventy-five (75) percent of the dead load resistance.

715.5 UPLIFT ON EAVES: Overhanging eaves, cornices and other local projections shall be designed and constructed to withstand an upward pressure of 1.5 P.

SECTION 716.0 WIND LOADS ON SIGNS, TANK AND RADIO TOWERS, CHIMNEYS AND OTHER BUILDING APPURTENANCES

Minimum wind pressures to be used in the design of these and other building appurtenances shall be determined using the value of P as specified in section 714.0.

716.1 SIGNS AND TOWERS: The wind pressure on ground signs and towers other than radio and television towers, and their supports or portions thereof having seventy-five (75) percent or more of solid surface shall be assumed at 1.2 P and having less than seventy-five (75) percent of solid surface shall be 1.6 P of net exposed area of the structure normal to the direction of the wind.

716.2 ROOF STRUCTURES: The wind pressure on roof signs, tank towers, stacks, chimney and other exposed roof structures with plane surfaces shall be assumed at 1.6 P applied to the net projected area of the structure normal to the direction of the wind except as provided in sections 716.3 and 716.4.

716.3 SHIELDING EFFECT: No shielding effect of one element by another shall be considered when the distance between them exceeds four (4) times the projected smallest dimension of the windward element.

716.4 EFFECT OF SHAPE: The wind pressure on circular tanks, stacks or other circular structures shall be assumed at 0.7 P applied to the projected area; and for hexagonal or octagonal structures, 1.0 P.

716.41 SPECIAL SHAPES: For special shaped structures such as spheres, guys, cables, solid girders, the design wind pressure shall be determined as provided for in section 715.3.

SECTION 717.0 OVERTURNING AND SLIDING

The overturning moment due to the wind load on all structures shall not exceed seventy-five (75) percent of the moment of stability resulting from the dead load of the building, unless the building or structure is anchored to resist the excess overturning moment and the excess horizontal shear over sliding friction.

SECTION 718.0 EARTHQUAKE LOAD

Provisions of section 718 reflect informed judgments regarding the probable intensities of future earthquake ground motions in this region, and their associated probabilities of occurrence. The objective of these provisions is to protect life safety by limiting structural failure.

718.1 GENERAL

a) every building or structure and every portion thereof shall be designed and constructed to resist stresses produced by lateral forces as provided in this section, except detached one and two-family dwellings and minor accessory buildings. Stresses shall be calculated as the effect of a force applied horizontally at each floor or roof level or to building parts above the foundation. The force shall be assumed to come from any horizontal direction.

b) every building or structure and every portion designed and constructed to resist stresses produced by lateral forces as provided in this section shall be constructed and inspected in accordance with the rules and regulations promulgated by the State Building Code Commission.

718.2 DEFINITIONS: The following definitions apply only to the provisions of this section.

BOX SYSTEM: a structural system where the vertical load is carried by bearing walls and structural framing and where the lateral stability and lateral force resisting system consists of shear walls or braced frames.

BRACED FRAME: a vertical truss or its equivalent which is provided to resist lateral forces in which the members are subjected primarily to axial stresses.

CLASS A SOIL: includes all the classes of soil and rock enumerated in section 723.4.

CLASS A SOIL SITE:

a) a site composed exclusively of Class A soil, or

b) a site where Class A soil overlies or includes Class B soil, provided that the depth below foundation level to the uppermost Class B soil and the cumulative thickness of Class B soil meet the criteria in Figure 7-9.

CLASS B SOIL: includes all classes of soil not qualifying as Class A soil.

CLASS B SOIL SITE: any site which does not meet the criteria for Class A soil site.

DUAL BRACING SYSTEM: consists of a moment resisting space frame and shear walls which meet the following design criteria:

a) the space frame and shear walls shall resist the total lateral force in accordance with their relative rigidities considering the interaction of the shear walls and space frame.

b) the shear walls acting independently of the resisting portions of the space frame shall resist the total lateral force.

c) the resisting space frame shall have the capacity to resist not less than twenty-five (25) percent of the total lateral force.

FOUNDATION LEVEL: the lowest of any of the following:

a) the bottom of any spread or combined footing or foundation mat;

b) the bottom of any pile cap;

c) the top of any pier or caisson.

LATERAL FORCE RESISTING SYSTEM: that part of the structural system to which the total lateral forces prescribed in section 718.4 are assigned.

LIQUEFACTION: a term used to describe a group of phenomena occurring in saturated cohesionless sandy and silty soils consisting of a large decrease in effective stress (total stress minus pore pressure) accompanied by large deformations under either static or cyclic loading. The term cyclic mobility should also be included within the scope of the definition of liquefaction.

MOMENT-RESISTING SPACE FRAME: a space frame designed to carry all vertical loads and in which the members and joints are capable of resisting design lateral forces by bending moments.

SHEAR WALL: a wall designed to resist lateral forces parallel to the wall.

SPACE FRAME: a three-dimensional structural system composed of interconnected members, other than bearing walls, designed to function as a complete self-contained laterally stable unit with or without the aid of horizontal diaphragms or floor bracing systems.

718.3 SYMBOLS AND NOTATIONS: The following symbols and notations apply only to the provisions of this section:

C = Numerical coefficient for base shear as specified in section 719.4.

$C_p$ = Numerical coefficient as specified in section 718.4 and as set forth in Table 7-3b.

D = The dimension of the building in feet in a direction parallel to the applied forces.

$D_s$ = The plan dimension of the vertical lateral force resisting system in feet.

$F_i F_n$
$F_x$ = Lateral force applied to level $i$, $n$, or $x$, respectively.

$F_p$ = Lateral force on the part of the structure and in the direction under consideration.

$F_t$ = That portion of V considered concentrated at the top of the structure, at the level $n$. The remaining portion of the total base shear V shall be distributed over the height of the structure including level $n$ according to Formula (18-5).

$h_i h_n$
$h_x$ = Height in feet above the base to level $i$, $n$, or $x$, respectively.

K = Numerical coefficient as set forth in Table 7-3A.

Level $i$ = Level of the structure referred to by the subscript $i$.

Level $n$ = That level which is uppermost in the main portion of the structure.

Level $x$ = That level which is under design consideration.

M = Overturning moment at the base of the building or structure.

$M_x$ = The overturning moment at level $x$.

N = Total number of stories above exterior grade.

T = Fundamental period of vibration of the building or structure in seconds in the direction under consideration.

V = Total lateral load or shear at the base.

$$V = F_t + \sum_{i=1}^{n} F_i$$

where $i$ = 1 designates first level above the base.

W = Total dead load including the partition loading where applicable.

EXCEPTION: W shall be equal to the total deal load plus

twenty-five (25) percent of the floor live load in storage and warehouse occupancies; the snow load shall also be included.

$w_i$ = That portion of W which is located at or is assigend to level
$w_x$ $i$ or $x$ respectively.

$W_p$ = The weight of a part or portion of a structure.

$\gamma t$ = Total unit weight.

718.4 MINIMUM EARTHQUAKE FORCES FOR STRUCTURES: The provisions of this section are applicable only to buildings and structures meeting the requirements of section 718.5. All other buildings and structures shall be designed in accordance with section 718.7.

718.41 TOTAL LATERAL FORCE: Every structure shall be designed and constructed to withstand minimum total lateral seismic forces assumed to act nonconcurrently in the direction of each of the main axes of the structure in accordance with the following formula:

$$V = 1/3\ KCSW$$

a) C FACTOR

The value of C shall be determined in accordance with the following formula:

$$C = \frac{0.05}{\sqrt[3]{T}}$$

For all one and two-story buildings or structures the value of C shall be not less than 0.10. For other buildings the maximum value of C need not exceed 0.10.

EXCEPTIONS:

1) C exceeds 0.10 where indicated in Table 7-3b.

2) Buildings or structures which have highly irregular shapes, large differences in lateral resistance or stiffness between different stories or other unusual structural features affecting seismic response shall be designed in accordance with section 718.7.

T is the fundamental period of vibration of the structure in seconds in the direction under consideration. Properly substantiated technical data for establishing the period T may be submitted. In the absence of such data, the value for T for buildings shall be determined by the following formula:

$$T = \frac{0.05h_n}{\sqrt{D}}$$

EXCEPTION: In all buildings in which the lateral force resisting system consists of a moment-resisting space frame which resists one hundred (100) percent of the required lateral forces and which frame is not enclosed by or adjoined by more rigid elements which would tend to prevent the frame from resisting lateral forces:

$$T = 0.10\ N$$

b) K FACTOR

All buildings shall be designed with a horizontal force factor K = 1 except buildings which have a lateral force resisting system listed in Table 7-3A.

TABLE 7-3A HORIZONTAL FORCE FACTOR "K" FOR BUILDINGS OR OTHER STRUCTURES[1]

| TYPE OF ARRANGEMENT OF RESISTING ELEMENTS | VALUE OF K |
|---|---|
| Buildings with a box system as defined in section 718.2 | 1.33 |
| Buildings with a dual bracing system as defined in section 718.2 | 0.80 |
| Buildings with a momemt resisting space frame designed to resist the total required lateral force | 0.67 |
| Elevated tanks plus full contents, on four or more cross-braced legs and not supported by a building[2] | 3.00[3] |
| Structures other than buildings and other than those set forth in Table 7-3b | 2.00 |

Note 1: Where wind load would produce higher stresses, this load shall be used in lieu of the loads resulting from earthquake forces.

Note 2: The minimum value of "KC" shall be 0.12 and the maximum value of "KC" need not exceed 0.25.

Note 3: The tower shall be designed for an accidental torsion of five (5) percent as specified in section 718.43. Elevated tanks which are supported by buildings or do not conform to type or arrangement of supporting elements as described

above shall be designed in accordance with section 718.45 using "$C_p$" = 2.

c) S FACTOR

For a Class A soil site, S = 1. For a Class B soil site, S = 1.5. Intermediate values of S may be used, if justified by the results of adequate studies by a qualified registered professional engineer.

718.42 DISTRIBUTION OF LATERAL FORCE

a) VERTICAL DISTRIBUTION

The total lateral force V shall be distributed in the height of the structure in the following manner:

$$F_t = .004V\left(\frac{h_n}{D_s}\right)^2$$

$F_t$ need not exceed 0.15 V and may be considered as 0 for values $\left(\frac{h_n}{D_s}\right)$ of 3 or less, and

$$F_x = \frac{(V - F_t)\ w_x h_x}{\sum_{i=1}^{n} w_i h_i}$$

EXCEPTION: One and two-story buildings shall have uniform distribution.

At each level designated as $x$, the force $F_x$ shall be applied over the area of the building in accordance with the mass distribution on that level.

b) HORIZONTAL DISTRIBUTION

Total shear in any horizontal plane shall be distributed to the various elements of the lateral force resisting system in proportion to their rigidities considering the rigidity of the horizontal bracing system or diaphragm.

718.43 HORIZONTAL TORSIONAL MOMENTS: Provisions shall be made for the increase in shear resulting from the horizontal torsion due to an eccentricity between the center of mass and the center of rigidity. Negative torsional shears shall be neglected. Where the vertical resisting elements depend on diaphragm action for shear distribution at any level, the shear-resisting elements shall be capable of resisting a torsional moment assumed to be equivalent to the story shear acting with an eccentricity of not less than five (5) percent

of the maximum building dimension at that level.

718.44 OVERTURNING: Every building or structure shall be designed to resist the overturning effects caused by the wind forces and related requirements specified in section 717.0 or the earthquake forces specified in this section, whichever governs.

At any level the incremental changes of the design overturning moment, in the story under consideration, shall be distributed to the various resisting elements in the same proportions as the distribution of the shears in the resisting system. Where other vertical members are provided which are capable of partially resisting the overturning moments, a redistribution may be made to these members if framing members of sufficient strength and stiffness to transmit the required loads are provided.

Where a vertical resisting element is discontinuous, the overturning moment carried by the lowest story of that element shall be carried down as loads to the foundation.

718.45 LATERAL FORCE ON PARTS OR PORTIONS OF BUILDINGS OR OTHER STRUCTURES: Parts or portions of buildings or structures and their anchorage shall be designed for lateral forces in accordance with the following formula:

$$F_p = 1/3 C_p W_p$$

The values of $C_p$ are set forth in Table 7-3b unless a greater value is required by the basic seismic formula V = 1/3 KCSW. The distribution of these forces shall be according to the gravity loads pertaining thereto.

TABLE 7-3B HORIZONTAL FORCE FACTOR "C" FOR PARTS OR PORTIONS OF BUILDINGS OR OTHER STRUCTURES

| PART OR PORTION OF BUILDINGS | DIRECTION OF FORCE | VALUE OF $C_p$ |
|---|---|---|
| Exterior bearing and nonbearing walls, interior bearing walls and partitions, interior nonbearing walls and partitions over 10 feet in height, masonry or concrete fences over 6 feet in height | Normal to flat surface | 0.20 |
| Cantilever parapet and other cantilever walls, except retaining walls | Normal to flat surface | 1.00 |
| Exterior and interior ornamentations and appendages | Any direction | 1.00 |
| When connected to, part of, or housed within a building: towers, tanks, towers and tanks plus contents, storage racks over 6 feet in height plus contents, chimneys, smokestacks and penthouses | Any direction | 0.20[1, 2] |
| When resting on the ground, tank plus effective mass of its contents | Any direction | 0.10 |
| Floors and roofs acting as diaphragms[4] | Any direction | 0.10 |
| Connections for exterior panels or for elements complying with section 718.64 | Any direction | 2.00 |
| Connections for prefabricated structural elements other than walls, with force applied at center of gravity of assembly[5] | Any horizontal direction | 0.30 |

NOTES FOR TABLE 7-3B

Note 1: When located in the upper portion of any building where the "$h_n/D$" ratio is five-to-one (5/1) or greater the value shall be increased by fifty (50) percent.

Note 2: "$W_p$" for storage racks shall be the weight of the racks plus contents. The value of "$C_p$" for racks over two (2) storage support levels in height shall be .16 for the levels below the top two levels.

Note 3: For purposes of determining the lateral force, a minimum ceiling weight of five (5) pounds per square foot shall be used.

Note 4: Floors and roofs acting as diaphragms shall be designed for a minimum value of "$C_p$" of ten (10) percent applied to loads tributary from that story unless a greater value of "$C_p$" is required by the basic seismic formula $V = 1/3\ KCSW$.

Note 5: The "$W_p$" shall be equal to the total load plus twenty-five (25) percent of the floor live load in storage and warehouse occupancies.

718.46 LATERAL FORCE ON FOUNDATIONS: Provision shall be made for transmission of the base shear, acting in any direction, between structure and soil or rock, by means of

a) lateral soil pressure against foundation walls, footings, grade beams and pipe caps;

b) lateral soil pressure against piles, piers, or caissons;

c) batter piles, or;

d) side or bottom friction on walls or footings, or;

e) combinations of the foregoing.

Lateral pressure may not be more than one-third (1/3) the passive pressure. Bottom friction may not be relied upon where a building overlies Class B soil and is supported upon piles, piers or caissons. Even if not relied upon to transmit the base shear, foundation walls shall comply with the provisions of section 718.68.

718.5 DESIGN REQUIREMENTS

718.51 CONCRETE: Design and construction of earthquake resisting reinforced concrete framing members and their connections shall conform to the provisions of section 842.1 and of reference standard ACI 318-71 (except Appendix A), and to the special requirements of this section.

a) FLEXURAL MEMBERS OF MOMENT RESISTING SPACE FRAMES

Web reinforcement shall be required throughout the length of each flexural member. The minimum area of such web reinforcement shall be 0.15 percent of the product of the width of the web and the spacing of the web reinforcement along the longitudinal axis of the member.

Where stirrups are used as web reinforcement, the first stirrup shall be located two (2) inches from the face of the support and the next six (6) stirrups shall be spaced not over one-fourth (1/4) of the depth of the member.

Lapped splices located in a region of tension or reversing stress shall be confined by at least two stirrups at each splice.

b) COLUMNS OF MOMENT RESISTING SPACE FRAMES

The spacing of ties at the ends of tied columns shall not exceed four (4) inches for a distance equal to the maximum column dimension but not less than one-sixth (1/6) of the clear height of the column, nor less than eighteen (18) inches, from the face of the joint. The first such tie shall be located two (2) inches from the face of the joint. Joints

of exterior and corner columns shall be confined by lateral reinforcement through the joint. Such lateral reinforcement shall consist of spirals or ties as required at the ends of columns.

c) EARTHQUAKE RESISTING SHEAR WALLS AND BRACED FRAMES

Shear walls and braced frames shall be designed by the strength design method except that the alternate design method of reference standard ACI 318-71 may be used, provided that the factor of safety in shear is equivalent to that achieved with the strength design method. The formulas for required strength U, as provided in reference standard ACI 318-71, shall be modified to:

$$U = 1.4\ (D + L) + 1.4E$$

$$U = 0.9D + 1.4E$$

except that 2.E shall be used in the calculation of shear stresses in shear walls of buildings without a moment resisting space frame capable of carrying all vertical loads and lateral forces.

1) SHEAR WALLS

a) Special vertical boundary elements shall be provided at the edges of concrete shear walls in buildings with a dual bracing system as defined in section 718.2. These elements shall be composed of concrete encased structural steel elements of A36, A440, A441, A572 (except Grades 60 and 65) or A588 Grades A, B, or C, or shall be concrete reinforced as required for columns with special transverse reinforcement as desribed in Item 3) below for the full length of the element. The boundary vertical elements and such other similar vertical elements as may be required shall be designed to carry all the vertical stresses resulting from the wall loads in addition to tributary dead and live loads and from the design lateral forces. Horizontal reinforcing in the walls shall be fully anchored to the vertical elements.

b) Similar confinement of horizontal and vertical boundaries at wall openings also shall be provided unless it can be demonstrated that the unit compressive stresses at the opening have a load factor two (2) times that given by the formulae in this subsection for required strength U.

c) Wall reinforcement required to resist wall shear shall

be terminated with not less than a ninety (90) degree bend plus a twelve (12) bar diameter extension beyond the boundary reinforcing at vertical and horizontal end faces of wall sections. Wall reinforcement terminating in boundary columns shall be fully anchored into the boundary elements.

2) BRACED FRAMES

a) Reinforced concrete members of braced frames subject primarily to axial stresses shall have transverse reinforcement as specified in 3) below through the full length of the member. Tension members shall additionally meet the requirements for compressive members.

b) In buildings without a moment resisting space frame capable of carrying all vertical loads and the total required lateral force, all members in braced frames shall be designed for 1.25 times the force determined in accordance with section 718.4. Connections for these members are not permitted the thirty-three (33) percent stress increase for earthquake.

3) TRANSVERSE REINFORCEMENT

Where transverse reinforcement is required by the provisions of this section, the amount of such reinforcement shall be not less than that specified below.

The volumetric ratio of spiral reinforcement shall be not less than that specified for reinforced concrete columns, nor less than

$$0.12\ f'_c/f_{yh}$$

Rectangular hoop reinforcement shall be spaced not more than four (4) inches apart and shall have a total cross-sectional area not less than the greater of

$$A_{sh}=0.30\ s_h h_c f'_c/f_{yh}\ (A_g/A_{ch}-1)$$

or

$$A_{sh}=0.12\ s_h h_c f'_c/f_{yh}$$

Single or overlapping hoops may be provided to meet this requirement.

Supplementary cross ties of the same size and spacing as hoops using 135-degree minimum hooks engaging the periphery hoop and secured to a longitudinal bar may

be used. Supplementary cross ties or legs of overlapping hoops shall be spaced not more than fourteen (14) inches on center transversely.

718.52 STEEL: Design and construction of earthquake resisting steel framing members and their connections shall conform to the provisions of section 827 and of reference standard AISC 1969 and to the special requirements of this section.

a) MOMENT-RESISTING SPACE FRAMES

1) GENERAL

Design and construction of steel framing in moment-resisting space frames shall conform to the provisions of section 827.0 and the requirements of this section.

2) DEFINITIONS

a) JOINTS: The joint is the entire assemblage at the intersections of the members.

b) CONNECTIONS: The connection consists of only those elements that connect the member to the joint.

3) CONNECTIONS

Each beam or girder moment connection to a column shall be capable of developing in the beam the full plastic capacity of the beam or girder.

EXCEPTION: The connection need not develop the full plastic capacity of the beam or girder if it can be shown that adequately ductile joint displacement is provided with a lesser connection.

4) LOCAL BUCKLING

Members in which hinges will form during inelastic displacement of the frames shall comply with the requirement for "plastic design sections".

5) SLENDERNESS RATIOS

The effective length "kl" used in determining the slenderness ratio of an axially loaded compression member in the moment-resisting space frame depends on its own bending stiffness for the lateral stability of the building, even if bracing or shear walls are provided.

6) NONDESTRUCTIVE WELDING TESTING

Welded connections between primary members of the moment-resisting space frame shall be tested by nondestructive

methods for compliance with the Code and job specifications. A program for this testing shall be established by the person responsible for structural design. As a minimum, this program shall include the following:

a) All complete penetration groove welds contained in joints and splices shall be tested one hundred (100) percent either by ultrasonic testing or by radiography.

EXCEPTION: The nondestructive testing rate for an individual welder may be reduced to twenty-five (25) percent subject to the concurrence of the design engineer of record, provided the reject rate is demonstrated to be five (5) percent or less of the welds tested for the welder. A sampling of at least forty (40) completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over three (3) feet in length, each twelve (12) inch increment shall be considered as one weld. For evaluating the reject rate for continuous welds greater than one (1) inch thick, each six (6) inches of length shall be considered one (1) weld.

b) Partial penetration groove welds when used in column splices shall be tested either by ultrasonic testing or radiography as required by the design engineer of record.

b) BRACED FRAMES

1) All members in braced frames of K=1.0 and K=1.33 buildings shall be designed for 1.25 times the force determined in accordance with section 718.4. Connections for these members are not permitted the thirty-three (33) percent stress increase for earthquake.

718.53 MASONRY: Masonry shall be subject to the provisions and reference standards of Article 8.

718.54 TIMBER: Design and construction of earthquake resisting timber structures shall conform to the provisions of section 851 supplemented by the reference standards of Article 8 pertaining to Lumber and Construction and the Timber Construction Manual (second Edition 1974) by the American Institute of Timber Construction, and to the requirements of this section.

a) DIAPHRAGMS

Lumber and plywood diaphragms may be used to resist wind or horizontal earthquake forces.

Design of diaphragms shall conform to the accepted engineering practice as presented in the Timber Construction Manual.

b) Axial and shear forces produced in wood members by wind or earthquake shall be transferred by positive connections and adequate anchorage. Uplift or horizontal displacement of seated connections shall be prevented by positive anchors. Toenailing or nails subject to withdrawal are not acceptable for connections resisting such forces or displacements.

Sheathing materials may be used as tension ties provided the tension force does not provide cross-grain bending or cross-grain tension in the peripheral members or other framing members to which the sheathing connects.

718.55 PREFABRICATED CONSTRUCTION: All structural elements within the structure which are considered to resist seismic forces or movement and/or are connected so as to participate with the structural system shall be designed in accordance with the provisions of this Code in accordance with "Accepted Engineering Practice Standards" (ACI 318-71 for Precast Concrete). Connections shall accommodate all design forces and movement without loss of load carrying capacity of the interconnected members and shall conform to section 718.57.

718.56 OTHER MATERIALS OR METHODS OF CONSTRUCTION: Materials other than concrete, steel, clay masonry, concrete block masonry and wood and structural systems other than structural steel, reinforced concrete, reinforced masonry, wood frame or heavy timber shall not be relied on to resist lateral forces and deformations in building structures unless it can be demonstrated to the building official that the structure can safely withstand lateral distortion eight (8) times that computed for the lateral forces specified in section 718.4. The building official shall require drawings and calculations submitted by a registered professional engineer to verify the requirements of this provision.

718.57 CONNECTIONS

a) Connections with transfer forces between members which resist seismic forces in flexure shall be designed for the required forces and also shall either:

1) Develop the full plastic moment of the member

OR

2) Be capable of deforming to form a reversible plastic hinge.

b) Members which are part of the lateral force resisting system and resist seismic motion by direct axial force shall have connections designed to develop the axial capacities of the members.

c) Connections of structural members, which are not part of the lateral force resisting system, to supporting members shall be designed to resist the required seismic forces without reliance on frictional forces.

d) Column splices, base plate anchors and other types of connections that act primarily in bearing shall be designed to resist the required forces, and also shall be capable of resisting the forces resulting from the full seismic loading combined with two-thirds (2/3) of the dead load forces acting concurrently.

e) Connections between diaphragms and resisting shear walls and bracing shall be designed for twice the computed force.

718.6 OTHER DESIGN REQUIREMENTS

718.61 LATERAL FORCE RESISTING SYSTEM: Rigid elements that are assumed not to be part of the lateral force resisting system may be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design.

718.62 MOMENT RESISTING SPACE FRAMES: Moment resisting space frames may be enclosed by or adjoined by more rigid elements which would tend to prevent the space frame from resisting lateral forces where it can be shown that the action or failure of the more rigid elements will not impair the vertical and lateral load resisting ability of the space frame.

718.63 BUILDING SEPARATIONS: All portions of structures shall be designed and constructed to act as an integral unit in resisting horizontal forces unless separated structurally by a distance sufficient to avoid contact under deflection from seismic action or wind forces.

718.64 SETBACKS: Buildings having setbacks wherein the plan dimension of the tower in each direction is at least seventy-five (75) percent of the corresponding plan dimension of the lower part may be considered as a uniform building without setbacks for the purpose of determining seismic forces.

For other conditions of setbacks the tower shall be designed as a separate building using the larger of the seismic coefficients at the base of the tower determined by considering the tower as either a separate building for its own height or as part of the overall structure. The resulting total shear from the tower shall be applied at the top of the lower part of the building which shall be otherwise considered separately for its own height.

EXCEPTION: Nothing in this subsection shall be deemed to prohibit the submission of properly substantiated technical data for establishing the lateral design forces by a dynamic analysis in accordance with section 718.7

718.65 COMBINED VERTICAL AND HORIZONTAL FORCES: In computing the effect of seismic force in combination with vertical loads, gravity load stresses induced in members by dead load plus design live load, except roof live load, shall be considered.

718.66 EXTERIOR ELEMENTS: Precast, nonbearing, non-shear wall panels, parapets, or other elements which are attached to, or enclose the exterior, shall accommodate movements of the structure resulting from lateral forces or temperature changes. The concrete panels or other elements shall be supported by means of poured-in-place concrete or by mechanical fasteners in accordance with the following provisions:

a) Connections and panel joints shall allow for a relative movement between stories of not less than two (2) times story drift caused by wind or seismic forces; or one quarter (1/4) inch whichever is greater.

b) Connections shall have sufficient ductility and rotation capacity so as to preclude fracture of the concrete or brittle failures at or near welds. Inserts in concrete shall be attached to, or hooked around reinforcing steel, or otherwise terminated so as to effectively transfer forces to the reinforcing steel.

c) Connections to permit movement in the plane of the panel for story drift may be properly designed sliding connections using slotted or oversize holes or may be connections which permit movement by bending of steel.

718.67 MINOR ALTERATIONS: Minor structural alterations may be made in existing buildings and other structures, but the resistance to lateral forces shall be not less than that before such alterations were made, unless the building as altered meets the requirements of this section of the Code.

718.68 DRIFT: Lateral deflections or drift of a story relative to its adjacent stories shall be considered in accordance with accepted practice. Lateral deflection of diaphragms shall be considered in addition to the deflection of vertical bracing elements.

Rigid elements that are assumed not to be part of the lateral force resisting system may be incorporated into buildings provided that the effect of the action of the system is considered and provided for in the design. In addition, the effects of the drift on such rigid elements themselves and on their attachment to the building structure shall be considered.

718.69 INTERCONNECTIONS OF FOUNDATIONS: Pile, pier and caisson caps shall be interconnected by ties when the caps overlie Class B soil. Each tie shall carry by tension or compression a horizontal force equal to ten (10) percent of the larger pile, pier or caisson cap loading, unless it can be demonstrated that equivalent restraint

can be provided by other means. At sites where footings are underlain at shallow depths by cohesionless granular soils, the blow counts of which only slightly exceed the criteria given in Figure 7-10, adequate consideration shall be given to the lateral and vertical movements of footings that may occur during the design earthquake specified in section 718.7.

718.70 RETAINING WALLS: Retaining walls shall be designed to resist at least the superimposed effects of the total static lateral soil pressure, excluding the pressure caused by any temporary surcharge, plus an earthquake force of $0.045\gamma_t H^2$ (Horizontal backfill surface). Surcharges which are applied over extended periods of time shall be included in the total static lateral soil pressure and their earthquake lateral force shall be computed and added to the force of $0.045\gamma_t H^2$. The earthquake force from the backfill shall be distributed as an inverse triangle over the height of the wall. The point of application of the earthquake force from an extended duration surcharge shall be determined on an individual case basis. If the backfill consists of loose saturated granular soil, consideration shall be given to the potential liquefaction of the backfill during the seismic loading.

718.71 DYNAMIC ANALYSIS: Any building or structure is deemed to have complied with the provisions of section 718 if a qualified registered engineer determines that there is negligible risk to life safety if the building or structure experiences an earthquake with a peak acceleration of 0.12g and a frequency content similar to that implied by the appropriate response spectrum in Figure 7-10. A copy of the studies upon which the determination may be based upon shall be filed with the building official. Such a determination may be based upon

a) a dynamic analysis, based upon generally acceptable procedures, together with evidence that the building or structure can safely withstand the computed displacements and distortions;

b) a comparison of the building or structure with similar buildings or structures having similar foundations and subsoil conditions, that have withstood a similar actual earthquake; or

c) other accepted procedures.

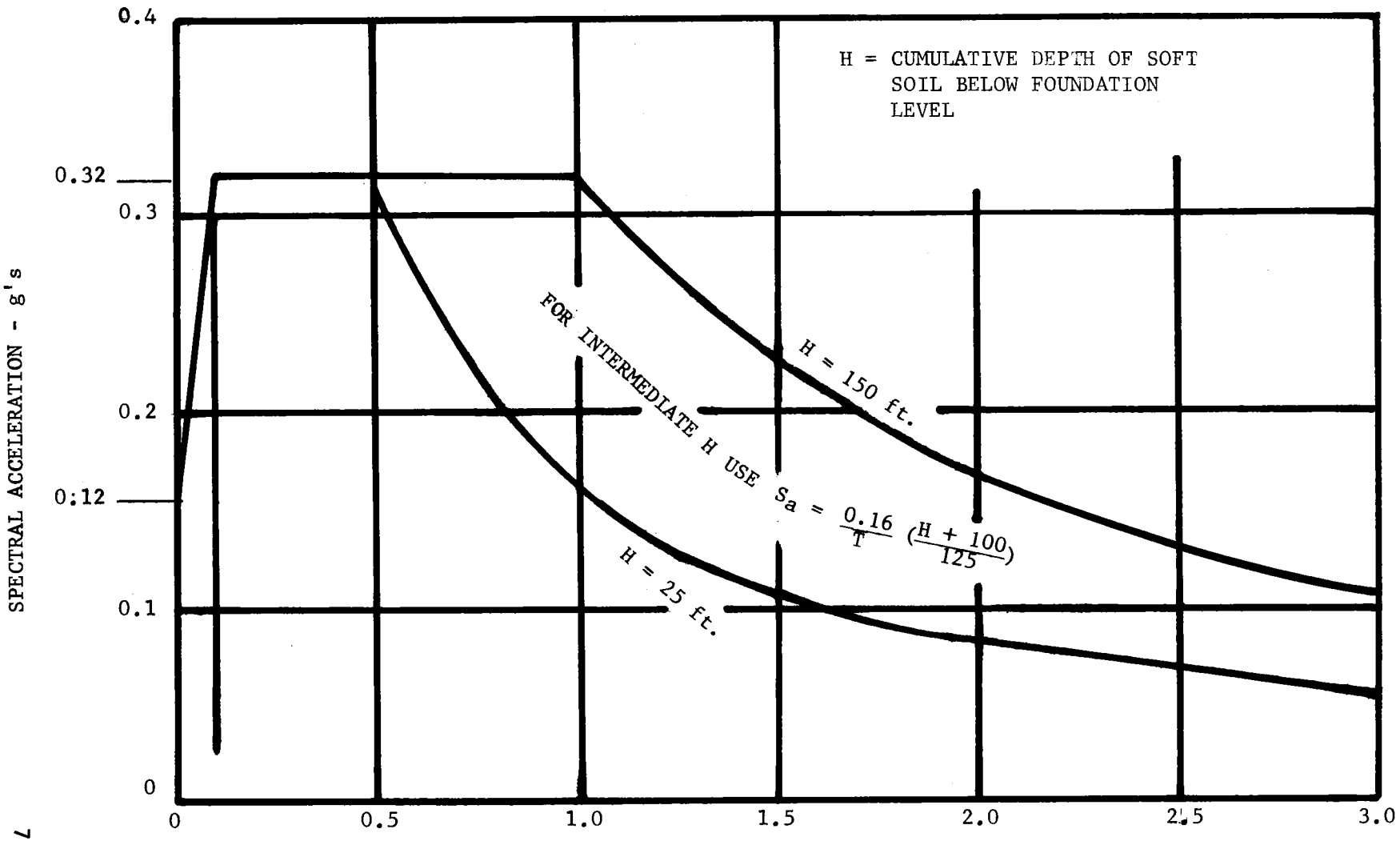



FIGURE 7-10 DESIGN RESPONSE SPECTRUM

SECTION 719.0 COMBINED LOADING

The structural frame of all buildings shall be investigated for the combined effect of lateral and vertical loading and the individual members of the frame shall be proportioned as follows:

719.1 WITH EARTHQUAKE: For combined stresses due to earthquake load together with dead, live and snow loads, the allowable working stress for the structural material may be increased thirty-three and one-third (33 1/3) percent.

719.2 WITH WIND: For combined stresses due to wind load together with dead, live and snow loads, the allowable working stress for the structural material may be increased thirty-three and one-third (33 1/3) percent.

719.3 MINIMUM SECTION: The section determined for the combined loadings herein specified shall be compared with that required for dead, live and snow loads only, and the section of greatest strength shall determine that to be used in the structure.

SECTION 720.0 LIVE LOAD REDUCTION

In all buildings and structures except places of assembly, the design live loads may be reduced on columns, piers, walls, trusses, girders and foundations as herein specified; but in no case shall a reduction be applied to the roof live load.

720.1 LIVE LOADS 100 POUNDS OR LESS: For live loads of one hundred (100) pounds or less per square foot, the design live load on any member supporting one hundred fifty (150) square feet or more may be reduced at the rate of eight-hundredths (0.08) percent per square foot of area supported by the members; except that no reduction shall be made for areas to be occupied as places of public assembly. The reduction shall exceed neither R as determined by the following formula, nor sixty (60) percent:

$$R = 23 (1 + D/L)$$

R = reduction in percent
D = dead load per square foot of an area supported by the member
L = design live load per square foot of area supported by the member.

720.2 LIVE LOADS MORE THAN 100 POUNDS: For live loads exceeding one hundred (100) pounds per square foot, no reduction shall be made, except that the design live loads on columns may be reduced twenty (20) percent.

## SECTION 721.0 ALLOWABLE WORKING STRESSES

721.1 CONTROLLED MATERIALS: All structures controlled by the provisions of section 128.0, and all other materials subject to control in the building regulatory system, shall be identified as to manufacture, grade, and whatever other specifications as may be necessary to conform with the requirements for design and analysis of such controlled structures or materials.

721.2 ORDINARY MATERIALS: The use of ordinary materials without selection and without controlled design and supervision, or when the material is not identified as to strength and stress grade, shall be limited to the average unit working stresses prescribed in the reference standards of this article.

721.3 NEW MATERIALS: For materials which are not specifically provided for in the Basic Code, the working stresses shall be established by tests as provided in sections 703 and 803.

## SECTION 722.0 LIGHT WEIGHT METALS

Aluminum and other light weight metals and their alloys may be used in the design and construction of buildings and structures only after special approval of the building official, subject to the determination of the physical properties by tests as prescribed in article 8 and in accordance with the provisions of section 834, and provided that plans and calculations are submitted by a registered professional engineer or architect.

## SECTION 723.0 BEARING VALUE OF SOILS

All applications for permits for the construction of new buildings or structures, and for the alteration of a permanent structure which require changes in foundation loads and distribution, shall be accompanied by a statement describing soil in all bearing strata, including sufficient records and data to establish their character, nature and load bearing capacity. Such records shall be certified by a qualified registered professional engineer or architect.

723.1 SATISFACTORY FOUNDATION MATERIALS: Satisfactory bearing strata to provide structural support shall be considered to include the following, provided they are of a standard consistent with engineering applications: natural strata of rock, gravel, sand, inorganic silt, inorganic clay, or combinations of these materials. Compacted fills when designed and placed under the supervision of a qualified registered professional engineer or architect and certified by him as meeting the design requirements, may be accepted by the building official. Other conditions of unsatisfactory bearing materials which are altered under

the supervision of a qualified registered professional engineer or architect and certified by him as meeting the design requirments may be accepted by the building official. Sites involving medium and fine sands, inorganic silt and compacted fills are subject to the additional special requirements in section 723.3.

723.11 LOADING INTERACTION: Wherever bearing strata are subject to interaction from other loadings or strata reactions, such conditions shall be incorporated in the evaluation of the design bearing capacity of the support strata.

723.12 BEARING CAPACITY FOR LIGHT WEIGHT STRUCTURES: Light weight structures and accessory structures such as garages and sheds may be founded on normally unacceptable bearing strata, providing such material is certified by a qualified registered professional engineer or architect as being satisfactory for the intended use.

723.13 PROTECTION OF BEARING STRATA: Bearing strata which may be adversely affected by conditions within the structure, such as evaporation and shrinkage due to excess heat, shall be adequately protected.

723.2 BEARING VALUES: The maximum pressure on soils under foundations shall not exceed values specified in table 7-4, except when determined in accordance with the provisions of section 725.0 or when modified by specific sections of this article.

TABLE 7-4 PRESUMPTIVE BEARING CAPACITY OF FOUNDATION MATERIALS

| CLASS OF MATERIAL** | TONS PER SQUARE FOOT* |
|---|---|
| 1. Massive crystalline bedrock including granite, diorite, gneiss, trap rock, and dolomite (hard limestone) | 60 |
| 2. Foliated rock including limestone, schist and slate in sound condition | 40 |
| 3. Sedimentary rock including hard shales, sandstones, and thoroughly cemented conglomerates | 20 |
| 4. Soft or broken bedrock (excluding shale) and soft limestone | 20 |
| 5. Compacted, partially cemented gravels, and sand and hardpan overlying rock | 10 |
| 6. Gravel, well-graded sand and gravel mixtures | 6 |
| 7. Loose gravel, compact coarse sand | 4 |
| 8. Loose coarse sand and sand and gravel mixtures and compact fine sand (confined) | 2 |

TABLE 7-4 (cont.)

| | | |
|---|---|---|
| 9. | Loose medium sand (confined) | 1 |
| 10. | Loose fine sand | (+)<br>(+) |
| 11. | Hard clay | 4 |
| 12. | Medium stiff clay, stiff varved silt | 2 (t) |
| 13. | Soft clay, soft broken shale | 1 (t) |
| 14. | Soft inorganic silt, preloaded material, shattered shale, or any natural deposit of unusual character not provided for herein | (+)<br>(+) |
| 15. | Disturbed bed varved silt | 0 |
| 16. | Compacted granular fill | +<br>(2-5+) |

* The allowable bearing pressure given in this section, or when determined in accordance with the provisions of section 727 will assure that the soils will be stressed within limits that lie safely below their strength. However, such allowable bearing pressure for Classes 9 to 12, inclusive, do not assure that the settlements will be within the tolerable limits for a given structure.

t Alternatively, the allowable bearing pressure shall be computed from the unconfined compressive strength of undisturbed samples, and shall be taken as 1.50 times that strength for round and square footings, and 1.25 times that strenth for footings with length-width ratios of greater than four (4); for intermediate ratios interpolation may be used.

\+ Value to be fixed by the building official in accordance with
\+ sections 725.0 and 726.0.

** The allowable bearing pressure may be increased by one-third (1/3).

723.21 CLASSIFICATION OF BEARING MATERIALS: The terms used in this section shall be interpreted in accordance with generally accepted engineering nomenclature. In addition, the following more specific definitions are used for bearing materials in the area:

a) ROCKS

SHALE: a soft, fine-grained sedimentary rock.

SLATE: a hard, fine-grained metamorphic rock of sedimentary origin.

CONGLOMERATE: a hard, well-cemented metamorphic rock consisting

of fragments ranging from sand to gravel and cobbles set in a fine-grained matrix (locally known as Puddingstone).

b) GRANULAR MATERIALS

GRAVEL: a mixture of mineral grains at least seventy (70) percent (by weight) of which is retained on a No. 4 mesh sieve and possessing no dry strength.

SAND: a mixture of mineral grains at least seventy (70) percent (by weight) of which passes a No. 4 mesh sieve and which contains not more than fifteen (15) percent (by weight) passing a No. 200 mesh sieve.

COARSE SAND: a sand at least fifty (50) percent (by weight) of which is retained on a No. 20 mesh sieve.

MEDIUM SAND: a sand at least fifty (50) percent (by weight) of which passes a No. 20 mesh sieve and at least fifty (50) percent (by weight) is retained on a No. 60 mesh sieve.

FINE SAND: a sand at least fifty (50) percent (by weight) of which passes a No. 60 mesh sieve.

WELL-GRADED SAND AND GRAVEL: a mixture of mineral grains which contains between twenty-five (25) percent and seventy (70) percent (by weight) passing a No. 4 mesh sieve, between ten (10) and forty (40) percent (by weight) passing a No. 20 mesh sieve, and containing not more than eight (8) percent (by weight) passing a No. 200 mesh sieve.

c) COHESIVE MATERIALS

GLACIAL TILL: a very dense, heterogeneous mixture ranging from very fine material to coarse gravel and boulders and generally lying over bedrock. It can be identified from geological evidence and from the very high penetration resistance encountered in earth boring and sampling operations.

CLAY: a fine-grained, inorganic soil possessing sufficient dry strength to form hard lumps which cannot readily be pulverized by the fingers.

HARD CLAY: an inorganic clay requiring picking for removal, a fresh sample of which cannot be molded by pressure of the fingers.

MEDIUM CLAY: an inorganic clay which can be removed by spading, a fresh sample of which can be molded by a substantial pressure of the fingers.

SOFT CLAY: an inorganic clay, a fresh sample of which can be molded with slight pressure of the fingers.

INORGANIC SILT: a fine-grained inorganic soil consisting chiefly of grains which will pass a No. 200 mesh sieve and possessing sufficient dry strength to form lumps which can easily be pulverized with the fingers.

NOTE: Dry strength is determined by drying a wet pat of soil and breaking it with the fingers.

d) COMPACTED GRANULAR FILL: a fill consisting of gravel, sand-gravel mixtures, coarse or medium sand, crushed stone, or slag, containing not more than eight (8) percent (by weight) passing a No. 200 mesh sieve and having no plasticity, shall be considered satisfactory bearing material when compacted in nine (9) inch thick layers, measured before compaction, with adjustment of water content as necessary to achieve required compaction by applying to each layer a minimum of four (4) coverages of one of the following:

1) a vibratory roller with a steel drum with minimum weight of two (2) tons with a speed not exceeding one and one-half (1 1/2) miles per hour;

2) a rubber-tired roller having four (4) wheel abreast and weighted to a total load of not less than thirty-five (35) tons;

3) with the treads of a crawler type tractor with total load of not less than thirty-five (35) tons;

4) other types of materials, compaction equipment, and procedures as may be approved by the building official on the basis of sufficient evidence that they will achieve compacted fills having satisfactory properties.

The building official will require a competent inspector, qualified by experience and training and satisfactory to him, to be on the project at all times while fill is being placed and compacted. The inspector shall make an accurate record of the type of material used, including grain-size curves, thickness of lifts, type of compacting equipment and number of coverages, the use of water and other pertinent data.

Whenever the building official or the inspector questions the suitability of a material, or the degree of compaction achieved, bearing tests shall be performed on the compacted material in accordance with the requirements of section 725.0. A copy of all these records and test data shall be filed with the building official.

e) PRELOADED MATERIALS

1) The building official may allow the use of certain otherwise unsatisfacoty natural soils and uncompacted fills for the support of one (1) story structures, after these materials have been preloaded to effective stresses not less than one hundred and fifty (150) percent of the effective stresses which will be induced by the structure.

2) The building official may require the loading and unloading of a sufficiently large area, conducted under the direction of a competent engineer, approved by the building official, who shall submit a report containing a program which will allow sufficient time for adequate consolidation of the material, and an analysis of the preloaded material and of the probable settlements of the structure.

723.3 LIQUEFACTION: The earthquake liquefaction potential of saturated medium and fine sands shall be evaluated on the basis of figures 7-7 and 7-8. If the standard penetration resistances, N, in all strata of medium and fine sand lie above the applicable curve in figure 7-7, the sands at the site shall not be considered subject to liquefaction. If strata not meeting the above criterion exist, but if the total thickness of these non-complying strata and the depth to the top of the uppermost of the non-complying stratum meet the requirements in figure 7-8 the site shall also be satisfactory from the standpoint of liquefaction. For pressure-injected footings, the ten (10) foot thickness of soil immediately below the bottom of the driven shaft shall not be considered subject to liquefaction.

Compacted granular fills shall not be considered subject to liquefaction provided they are systematically compacted to at least ninety-three (93) percent of maximum dry density as determined in accordance with laboratory test designation ASTM D1557, or a relative density of at least sixty (60) percent in the case of granular soil having less than ten (10) percent by weight passing the No. 200 sieve.

For sites not meeting the above criteria, and for sites involving saturated inorganic non-plastic silts, studies by a qualified registered professional engineer shall be made to determine that the structure loads can be safety supported. Such studies might include:

a) detailed investigations to establish that the soils at the site are actually not subect to liquefaction during the design earthquake as specified in section 718.7.

b) providing foundations that will not fail if liquefaction occurs.

c) replacing or densifying the liquefaction susceptible soils such that liquefaction will not occur.

723.4 CLASS A AND CLASS B SOILS: For purposes of determining earthquake forces as specified in sections 718.4 and 718.7 Class A soil includes the following classes from Table 7-4: massive igneous rocks and conglomerate; slate, shale in sound conditions, glacial till; gravel or well-graded sand and gravel, if dense to very dense; coarse sand, if dense to very dense; medium sand, if dense to very dense; fine sand, if dense to very dense; medium and hard clay; and compacted granular fill provided that fill soils are systematically compacted throughout under the continuous inspection by a qualified registered professional engineer.

SECTION 724.0 SUBSURFACE EXPLORATIONS

724.1 WHERE REQUIRED: Borings, tests, drill holes, core borings or any combination shall be required for all structures except the following unless specifically required by the building official;

a) one and two-family dwellings and their accessory buildings.

b) structures less than 35,000 cubic feet in gross volume.

The borings or tests shall be adequate in number of depth and so located to accurately define the nature of any subsurface material necessary for the support of the structure.

When it is proposed to support the structure directly on bedrock, the building official shall require rock cores or core borings to be made into the rock, or shall require other evidence satisfactory to prove that the structure shall be adequately founded on bedrock.

724.2 SOIL SAMPLES AND BORINGS REPORTS: Samples of the strata penetrated in test borings or test pits, representing the natural disposition and conditions at the site, shall be available for examination of the building official. Wash or bucket samples shall not be accepted. Duplicate copies of the results obtained from all completed and uncompleted borings plotted to a true relative elevation and to scale and of all test results or other pertinent soil data shall be filed with the building official.

SECTION 725.0 BEARING TEST AND SETTLEMENT ANALYSES

Whenever the allowable bearing pressure on bearing materials, or the load bearing capacity of single piles or groups of piles is in doubt, the building official may require load tests and/or settlement analyses to be made at the expense of the applicant and the results analyzed under the direction of a qualified registered professional engineer.

725.1 APPROVAL OF TEST METHOD: The apparatus and procedure used shall be approved by the building official before they are used. A complete record of the test results together with a soil profile shall be filed by the qualified registered professional engineer who shall have a fully-qualified representative on the site during all test operations.

725.2 LOADING EQUIPMENT: The load shall be applied by direct weight or by means of a recently-calibrated jack. Each load shall be maintained constant for the required period with an accuracy of plus or minus three (3) percent.

725.21 AREA: For bearing materials of classes 1 to 5 inclusive, the load area shall be not less than one (1) square foot and for other classes, not less than four (4) square feet.

725.3 LOADING PROCEDURE: The application of the test load shall be in steps equal to not more than one-half (½) the contemplated design load, to at least twice the contemplated design load, except as provided in section 725.7. The unloading shall be in at least two (2) steps: to the design load and then to zero (0) load. During the loading cycle the contemplated design load and twice the contemplated design load shall be maintained constant for at least twenty-four (24) hours and until the rate of settlement or rebound does not exceed two hundredths (.02) of an inch per twenty-four hours. The load for all other load steps including the zero (0) load at the end of the test shall be maintained constant for a period of not less than four (4) hours. Sufficient readings for each load step shall be made to define properly the time-deflection curve.

725.4 MEASUREMENTS: Observation of vertical movement shall be made so that the data will accurately define the progress of vertical displacement during the test.

725.5 ADDITIONAL REQUIREMENTS FOR SOIL BEARING TESTS: Bearing tests shall be applied at the elevations of the proposed bearing surfaces of the structure; except that the load may be applied directly on the surface of compacted granular material, class 14. The excavation immediately surrounding an area to be tested shall be made no deeper than one (1) foot above the plane of application of the test. The test plate shall be placed with uniform bearing. For the duration of the test, the material surrounding the test area shall be protected effectively against evaporation and frost action.

725.6 DETERMINATION OF DESIGN LOAD: The proposed design load shall be allowed provided that the requirements of section 725 are fulfilled and the settlements under the design load and twice the design load do not exceed three-eighths (3/8) of an inch and one (1) inch, respectively.

725.7 ADDITIONAL REQUIREMENTS FOR PILE LOAD TESTS: A single pile shall be load tested to not less than twice the design load. When two (2) or more piles are to be tested as a group, the total load shall be not less than one and one-half (1½) times the design load for the group.

Provided that the load-settlement curve shows no sign of failure and provided that the permanent settlement of the top of the pile after removal

of all load at the completion of the test does not exceed one-half (½) inch, the maximum design load shall be the load allowed in this part for the type of pile or one-half (½) of the maximum applied load, whichever is less.

Whenever the soil conditions are such that substantial driving resistance and/or significant support of the pile test load is derived from soil strata overlying the intended bearing stratum this support shall be removed or the results of the pile test shall be analyzed so as to evaluate the actual support furnished by the bearing stratum.

725.8 APPLICATION OF PILE LOAD TEST RESULTS: The results of the load test can be applied to other piles within the area of substantially similar sub-soil conditions as that for the test pile; and providing the performance of the test pile has been satisfactory and the remaining piles are of the same type, shape and size as the test pile; and are installed using the same methods and equipment and are driven into the same bearing strata as the load tested pile to an equal or greater penetration resistance.

725.9 SETTLEMENT ANALYSIS: Whenever a structure is to be supported by medium or soft clay (materials of classes 11 and 12) or other materials which may be subject to settlement or consolidation, the settlements of the structure and of neighboring structures due to consolidation shall be given careful consideration, particularly if the subsurface material or the loading is subject to extensive variation. The building official may require a settlement analysis to be made by a qualified registered professional engineer in case the live and dead loads of the structure, as specified in this article, minus the weight of the excavated material, induce a maximum stress greater than three hundred (300) pounds per square foot at midheight of the underlying soft clay layer.

725.91 SETTLEMENT ANALYSIS COMPUTATIONS: The settlement analysis will be based on a computation of the new increase in stress that will be induced by the structure and realistically appraised live loads, after deducting the weight of excavated material under which the clay was fully consolidated. The effects of fill loads within the building area or fill and other loads adjacent to the building shall be included in the settlement analysis. The appraisal of the live loads may be based on surveys of actual live loads of existing buildings with similar occupancy. The soil compressibility shall be determined by a qualified registered professional engineer and approved by the building official.

## SECTION 726.0 ALLOWABLE FOUNDATION PRESSURE

The maximum allowable pressures on foundation materials shall be in accordance with section 723.0 and as modified herein.

726.1 ROCK FOUNDATIONS: Where subsurface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which it is proposed to construct foundations, a sufficient number of borings shall be made to a depth of not less than ten (10) feet below the level of the footings to provide assurance of the soundness of the foundation bed and its bearing capacity.

726.2 BEARING PRESSURE ON ROCK: The tabulated bearing pressures for rocks of Classes 1 and 3, inclusive, shall apply where the loaded area is on the surface of sound rock. Where the loaded area is below such surface these values may be increased ten (10) percent for each foot of additional depth, but shall not exceed three (3) times the tabulated values.

726.3 BEARING PRESSURES FOR CLASSES 4 TO 9, INCLUSIVE: The allowable bearing pressures for materials of Classes 4 to 9, inclusive, may exceed the tabulated values by five (5) percent for each foot of depth of the loaded area below the minimum required in section 727 but shall not exceed twice the tabulated values. For areas of foundations smaller than three (3) feet in least lateral dimension, the allowable design bearing pressures shall be one-third (1/3) of the allowable bearing pressures multiplied by the least lateral dimension in feet.

726.4 BEARING PRESSURES ON CLAY: The tabulated bearing pressures for Classes 10 to 12, inclusive, shall apply only to pressures directly under individual footings, walls, and piers; and in case structures are founded on or are underlain by deposits of these classes, the total load over the area of any one bay or other major portion of the structure, minus the weight of all materials removed, divided by the area, shall not exceed one-half (½) the tabulated bearing pressures.

726.5 VERTICAL PRESSURES: The computed vertical pressure at any level beneath a foundation shall not exceed the allowable bearing pressures for the material at that level. Computation of the vertical pressure in the bearing materials at any depth below a foundation shall be made on the assumption that the load is spread uniformly at an angle of sixty (60) degrees with the horizontal; but the area considered as supporting the load shall not extend beyond the intersection of sixty (60) degree planes of adjacent foundations.

726.6 DISTURBANCE OF BEARING MATERIALS: Whenever the bearing materials are disturbed from any cause, for example, by the inward or upward flow of water and/or by construction activities, the extent of the disturbance shall be evaluated by a registered professional engineer and appropriate remedial measures taken, satisfactory to the building official.

SECTION 727.0 SPREAD FOUNDATIONS

Except when erected upon sound bedrock or when protected from frost, foundation walls, piers and other permanent supports of all buildings and structures shall extend a minimum of four (4) feet below finished grade; except as provided in section 727.21. Spread footings of adequate size shall be provided when necessary to properly distribute the load within the allowable bearing pressure of the soil.

727.1 DEPTH OF SPREAD FOUNDATIONS: The bottom surface of any footing resting on material of classes 4 to 15, inclusive, shall be at least eighteen (18) inches below the lowest ground surface or the surface of a floor slab bearing directly on the soil immediately adjacent to the footing.

727.2 LIGHT STRUCTURES: One-story structures without masonry walls and not exceeding eight hundred (800) square feet in area may be founded on a layer of satisfactory bearing material not less than three (3) feet thick, which is underlain by highly compressible material, provided that the stresses induced in the unsatisfactory material by the live and dead loads of the structure and the weight of any new fill, within or adjacent to the building area, will not exceed two hundred and fifty (250) pounds per square foot.

727.21 GRADE BEAMS: Grade beams of all structures may extend not more than two (2) feet below the adjoining surface exposed to natural freezing if the underlying soil to a depth of at least four (4) feet beneath the surface, and extending at least four (4) feet outside the building is sand, gravel, cinders, or other granular materials containing nor more than five (5) percent (by weight) passing a No. 200 mesh sieve.

727.22 ISOLATED FOOTINGS: Footings on granular soil of classes 5 to 16 inclusive in table 7-4 shall be so located that the line drawn between the lower edges of adjoining footings shall not have a steeper slope than thirty (30) degrees with the vertical, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner.

## SECTION 728.0 FOOTING DESIGN

728.1 DESIGN LOADS: The loads to be used in computing the pressure upon bearing materials directly underlying foundations shall be the live and dead loads of the structure, as specified in section 820 including the weight of the foundations and of any immediately overlying material, but deducting from the resulting pressure per square foot the total weight of a one (1) square foot column of soil, including the water in its voids, which extends from the lowest immediately adjacent surface of the soil to the bottom of the footing, pier or mat. Foundations shall be constructed so as to resist the maximum probable hydrostatic pressures.

728.2 PRESSURE DUE TO LATERAL LOADS: Where the pressure on the bearing material due to wind or other lateral loads is less than one-third (1/3) of that due to dead and live loads, it may be neglected in the foundation design. Where this ratio exceeds one-third (1/3), foundations shall be so proportioned that the pressure due to combined dead, live, wind loads, and other lateral loads shall not exceed the allowable bearing pressures by more than one-third (1/3).

728.3 EARTHQUAKE LOADS: Special provision shall be made in the foundation design to comply with the provisions of section 718.

728.4 VIBRATORY LOADS: Where machinery or other vibrations may be transmitted through the foundations, consideration shall be given in the design of the footings to prevent detrimental disturbances of the soil.

728.5 ECCENTRIC LOADS: Eccentricity of loadings in foundations shall be fully investigated, and the maximum pressure on the basis of straight-line distribution shall not exceed the allowable bearing pressures.

SECTION 729.0 TIMBER FOOTINGS (DELETED)

SECTION 730.0 STEEL GRILLAGES

Structural steel grillage foundations shall have at least six (6) inches of concrete cover below the bottom of the steel and shall have at least four (4) inches of concrete cover above the steel and between the sides of the steel and the adjacent soil.

SECTION 731.0 UNREINFORCED CONCRETE FOOTINGS

731.1 CONCRETE STRENGTH: Concrete in unreinforced foundation footings shall be so proportioned as to develop an ultimate compressive strength of not less than two thousand (2,000) pounds per square inch at twenty-eight (28) days.

731.2 PLACEMENT: No concrete for foundations shall be poured through water. When placed under or in the presence of water, the concrete shall be deposited by approved and properly operated equipment which insures minimum segregation of the mix and negligible turbulence of the water.

731.3 DIMENSIONS: In unreinforced concrete footings, the edge thickness shall be not less than twelve (12) inches for footings on soil or rock; except for wood frame buildings up to two (2) stories in height, these thicknesses may be reduced to eight (8) inches.

731.4 PROTECTION: Concrete footings shall be protected from freezing during construction and for a period of not less than five (5) days thereafter, and in no case shall water be allowed to flow through the deposited concrete.

SECTION 732.0 MASONRY UNIT FOOTINGS

732.1 DIMENSIONS: Masonry unit footings shall be laid in type M or S mortar complying with section 816 and the depth shall be not less

than twice the projection beyond the wall, pier or column; and the width shall be not less than eight (8) inches wider than the wall supported thereon.

732.2 OFFSETS: The maximum offset of each course in brick foundation walls stepped up from the footings shall be one and one-half (1 1/2) inches if laid in single courses, and three (3) inches if laid in double courses.

## SECTION 733.0 REINFORCED CONCRETE FOOTINGS

733.1 DESIGN: Reinforced concrete foundations shall comply with section 842 and the applicable reference standards therein listed for the design of reinforced concrete.

733.2 PILE CAPS: The minimum distance from the edge of the cap to the nearest pile surface shall be six (6) inches and there shall be at least two (2) inches of concrete between the top of the pile and the steel reinforcement of the cap. The pile caps shall extend not less than three (3) inches below the pile cutoff.

733.3 PROTECTION: When the concrete is deposited directly against the ground, the reinforcement shall have a minimum cover of three (3) inches, at all other surfaces of foundation concrete, the reinforcement shall have a minimum cover of two (2) inches.

## SECTION 734.0 FLOATING FOUNDATIONS

The design of floating foundations shall include a settlement analysis in accordance with the provisions of section 725.9.

## SECTION 735.0 PILE FOUNDATIONS

735.1 SITE INVESTIGATION: In addition to the provisions of section 724.0, the building site shall be investigated for all conditions which might promote deterioration of pile foundations, and approved protective measures meeting the requirements of section 736.0 shall be taken to prevent corrosion or other destructive action from deleterious conditions.

735.2 SPACING: The minimum center-to-center spacing of piles shall be not less than twice the average diameter of a round pile, nor less than one and three-quarter (1 3/4) times the diagonal dimension of a rectangular pile. When driven to or penetrating into rock, the spacing shall be not less than twenty-four inches. When receiving principal support from end-bearing on materials other than rock or through frictional resistance, the spacing shall be not less than thirty (30) inches.

735.3 WALLS: All piles in wall foundations shall be staggered about the center line of the wall at a minimum distance of one-half (1/2) the top diameter therefrom. A foundation wall restrained laterally so as to ensure stability both during and after construction may be supported by a single row of piles.

735.4 ISOLATED COLUMNS: An isolated column when supported by piles shall rest upon not less than three (3) piles, at least one (1) of which is offset; except that for one (1) story buildings an isolated column may rest upon two (2) piles when its axis is not more than one and one-half (1 1/2) inches off the line connecting the centers of the two (2) piles; or upon a single pile when other than wood or wood-composite piles are used and its axis is not more than one and one-half (1 1/2) inches off the center of the pile, provided the top of the pile is laterally supported.

735.5 MINIMUM DIMENSIONS: Piles of uniform cross section shall have a minimum outside nominal dimension of ten (10) inches except as provided in section 739.2. Tapered concrete piles shall have a minimum butt diameter at cutoff of twelve (12) inches and a diameter of not less than eight (8) inches measured one (1) foot above the tip.

735.6 SPLICES: Splices shall be avoided insofar as practicable. Where used, splices shall be such that the resultant vertical and lateral loads at the splices are adequately transmitted. Splices shall be so constructed as to provide and maintain true alignment and position of the component parts of the pile during installation and subsequent thereto. The ends of each section of steel pipe or other steel elements shall be cut perpendicular to the axis and bearing surfaces shall be true-fitted with milled or ground faces or by flame cutting or other approved method. Splices shall develop one hundred (100) percent of the strength of pile section in whatever state of stress.

735.7 JETTING: Jetted piles shall be driven to the required load resistance as determined by the application of the approved pile driving formula in section 737.21, after the flow of jet water has stopped.

735.8 PRECAUTIONS: When piles have been damaged in driving, or driven in locations and alignment other than those indicated on the plans, or that have capacities less than required by the design, the affected pile groups and pile caps shall be investigated and if necessary, the pile groups or pile caps shall be redesigned or additional piles shall be driven to replace the defective piles. Piles shall be driven to embedment in the supporting stratum, as determined by borings.

735.9 PILE HEAVE: Adequate provision shall be made to observe pile heave, and where heaving of one-half (1/2) inch or more occurs, corrective measures shall be taken to ensure that the pile is adequate for its design use.

735.10 RECORDS: The owner shall engage a competent inspector, qualified by experience and training and satisfactory to the building official to be present at all times while piles are being driven and to inspect all work in connection with the piles. The inspector shall make an accurate record of the material and the principal dimensions of each pile, of the weight and fall of the ram, the type, size, and make of hammer, the number of blows per minute, the energy per blow, the number of blows per inch for the last six (6) inches of driving, together with the grades at point and cutoff. A copy of these records shall be filed in the office of the building official.

## SECTION 736.0 CORROSION PROTECTION

Where boring records, previous experience, or site investigations indicate any condition which might promote deterioration or possible deleterious action on pile materials due to soil constituents, changing water levels or other causes, such pile materials shall be adequately protected as stated herein.

736.1 PRESERVATIVE TREATMENTS: The preservative treatment of timber piles shall comply with the provisions of section 738.0 and the reference standards of this article.

736.2 STEEL AND STEEL-CONCRETE PILES: At locations where steel and steel-concrete piles will be in contact with any material which is corrosive to the steel, one of the following procedures shall be used for protection, or any other method which will satisfy the requirements of the building official:

a) remove all objectionable material.

b) effectively protect the steel surface from pile cutoff grade to a grade fifteen (15) feet below the bottom of the objectionable material by means of:

   1) cathodic protection as approved by the building official; or

   2) an approved encasement of not less than three (3) inches of dense concrete; or

   3) an effective protective coating subject to the approval of the building official; or

   4) providing an excess thickness of one-eighth (1/8) inch beyond design requirements on all exposed surfaces.

## SECTION 737.0 ALLOWABLE PILE LOADS

The allowable load on piles shall be determined by the applicable formulas complying with accepted engineering practice and as stated

herein. The maximum load capacity shall be limited by the supporting capacity as obtained from bearing upon or embedment in bearing materials as defined in sections 723 and 726, but in no case shall the load exceed the capacity of the pile designed in accordance with the provisions of section 737.1 and the requirements of article 8 for the construction materials involved.

737.1 LATERAL SUPPORT OF AXIALLY LOADED PILES: The length of a pile below the ground surface shall be considered as a plain column with continuous lateral support. The length above the ground surface shall be designed as an unsupported column in accordance with the provisions of section 746.

737.2 DETERMINATION OF ALLOWABLE LOAD: In the absence of capacities based on load tests, except for the type of piles covered in sections 740.2 and 742.0, the load on a single pile shall not exceed the higher of the two (2) values determined in accordance with sections 737.2 and 737.22, nor the maximum loads on piles as provided in section 737.23.

737.21 DRIVING FORMULA:

a) Where the design load capacity of the pile does not exceed fifty (50) tons, the allowable load may be computed by means of the following driving formula:

$$R = 2E/(S + C)$$

where

R = allowable pile load in pounds
E = energy per blow in foot pounds
S = penetration of last blow or average penetration of last few blows experienced in inches
C = Constant equal to 1.0 for drop hammer and 0.1 for steam or air hammer.

b) When the design load capacity of a pile exceeds fifty (50) tons the required driving resistance shall be increased above that required by the driving formula in section 737.21a, based on load tests or past experience under similar conditions.

c) The value of "s" must be determined with the hammer operating at one hundred (100) percent of the rated number of blows per minute for which the hammer is designed.

d) Any driving resistance developed in strata overlying the bearing material shall be discounted.

e) If the driving of the pile has been interruped for more than one (1) hour, the value of "s" shall not be determined until

the pile is driven at least an additional twelve (12) inches, except when it encounters refusal on or in a material of classes 1 to 5 inclusive.

f) When the constant tapered portion of a pile, including a timber pile, is driven through a layer of gravel, sand or hard clay (classes 6 to 10 inclusive, and class 14) exceeding five (5) feet in thickness, and through an underlying soft stratum, the bearing capacity shall not be determined in accordance with the driving formula, unless jetting is used during the entire driving of the tapered portion of the pile through the layer of gravel, sand, hard clay or class 14 material, or unless a hole is pre-excavated through said layer for each pile.

737.22 FRICTION FORMULA IN CLAY: The allowable load on a pile stopped in inorganic clay may be based on a friction value of five hundred (500) pounds per square foot of embedded pile surface for a design load not to exceed twenty-two (22) tons, or on a friction value determined from pile load tests. The embedded length shall be the length of the pile below the surface of the inorganic clay, or below the surface of immediately-overlying satisfactory bearing material. The area of embedded pile surface shall be computed by multiplying the embedded length by the perimeter of the smallest circle or polygon that can be circumscribed around the average section of the embedded length of the pile. The method of determining the allowable load described in this paragraph shall not be used for a pile in which the drive-pipe is withdrawn or for piles which are driven through the clay to or into firmer bearing materials.

In case these piles are in clusters the allowable load shall be computed for the smaller of the following two (2) areas: (1) the sum of the embedded pile surfaces of individual piles; (2) the area obtained by multiplying the perimeter of the polygon circumscribing the cluster at the surface of the satisfactory bearing material by the average embedded length of pile.

737.23 JACKED PILES: The allowable load on a single pile installed by jacking shall not exceed one-half (1/2) the load applied to the pile at the completion of jacking, provided that the final load is kept constant for a period of four (4) hours and that the settlement during that period does not exceed one-twentieth (1/20) of an inch.

737.3 NEGATIVE FRICTION: Where a pile or a group of piles is placed in subsiding fill or soil, the effect of the downward frictional forces shall be given consideration in the design.

737.4 LIMITING LOAD: Where weaker materials underlie the bearing material into which the piles are driven, the allowable pile load shall be limited by the provision that the vertical pressures in such underlying materials produced by the loads on all piles in a foundation shall not exceed the allowable bearing pressures of such materials as

established by analysis, applying accepted principles of soil mechanics. Piles or pile groups shall be assumed to transfer their loads to the underlying materials by spreading the load uniformly at an angle of sixty (60) degrees with the horizontal, starting at a polygon circumscribing the piles at the top of the satisfactory bearing material in which they are embedded; but the area considered as supporting the load shall not extend beyond the intersection of the sixty (60) degree planes of adjacent piles or pile groups.

737.41 PILE LOAD LIMITATION: The allowable load on a pile shall not be limited to the load obtained by multiplying its point area by the allowable bearing pressure given in section 723.0.

737.42 LIQUEFACTION DURING EARTHQUAKE: The requirements of section 723.3 shall be considered in the design of pile foundations. If pile tips lie above soil which does not meet the criteria in figures 7-7 and 7-8, special studies shall be made by a qualified registered professional engineer or architect to ensure safety during the design earthquake specified in section 718.7.

SECTION 738.0 TIMBER PILES

738.1 SPECIES: Piles shall be of type I species, type II species or other species approved for such use by the building official.

a) type I species shall include southern yellow pine, oak, Douglas fir and other woods of similar strength and physical characteristics.

b) type II species shall include Norway pine, spruce and other woods of similar strength and physical characteristics.

738.2 QUALITY REQUIREMENTS: The quality of all round timber piles shall at least conform to class A and B, round timber piles listed in the reference standards of this article.

Round timber piles shall be cut above the ground swell, have a continuous taper from the point of butt measurement to the tip and be free from decay, red heart or insect attack. All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile or swell surrounding the knot. A straight line from the center of the butt to the center of the tip shall lie entirely within the body of the pile. The axis of a wood pile shall not deviate from a straight line more than one (1) inch for each ten (10) feet of length. Short crooks shall not deviate more than two and one-half (2 1/2) inches in five (5) feet. Spiral grain shall not exceed one-half (1/2) of a complete twist in any twenty (20) feet of length; unsound or cluster knots are prohibited and splits and shakes are limited.

738.3 MINIMUM DIMENSIONS:

a) piles shall be of adequate size to resist the applied loads without having to endure compressive stress parallel with the grain in excess of the following:

1) six hundred (600) pounds per square inch for type I species of wood or four hundred twenty-five (425) pounds per square

inch for type II species of wood on the pile cross section located at the surface of the bearing stratum for piles driven into materials of classes 6 through 10.

2) three hundred sixty (360) pounds per square inch for type I species of wood or two hundred fifty-five (255) pounds per square inch for type II species of wood on the pile cross section at the tips of piles driven to bearing on materials of classes 1 through 5.

b) the piles shall measure at least six (6) inches in diameter at the tip and at least ten (10) inches in diameter at the cutoff, with these measurements being taken under the bark.

c) all piles shall be driven in one (1) piece except as provided in section 744.0 for composite piles.

738.4 CUTOFF: The tops of all timber piles shall be cut off in a horizontal plane; and if not treated by an approved preservative process, the cutoff shall be below mean low water level or lowest ground water level, and shall be subject to the building official's approval. He may require the owner to install and maintain in good condition at least one (1) ground water observation well within the building, which shall be accessible to the building official.

738.5 TREATED PILES: Timber piles pressure-treated with creosote or creosote-coal-tar solution, and conforming to the requirements of this section, may be cut off above permanent ground water level when used for the support of buildings not exceeding two (2) stories in height.

738.51 TREATMENT: Creosoted wood piles of southern yellow pine, Douglas fir, red oak or Norway pine shall be creosoted under pressure in accordance with the reference standards of this article to a final net retention of not less than twenty (20) pounds per cubic foot of creosote for piles exposed to sea water and not less than twelve (12) pounds of creosote per cubic foot for piles for other normal exposure. The tops of such piles at cutoff shall be given three (3) coats of hot creosote, followed by a coat of coal-tar pitch; and the cutoff shall be made in sound wood and be encased not less than three (3) inches in the concrete pile cap.

738.52 CERTIFICATION: Before any treated piles are driven, the building official shall be furnished with certification by a licensed testing laboratory, certifying that piles were free of decay, were properly peeled and otherwise prepared before treatment; and that the method of treatment, the chemical composition and the amount of retention of the preservative conform to the requirements of this section.

738.6 MAXIMUM LOAD ON WOOD PILES: The load on a wood pile shall not exceed the allowable load specified in section 737. For timber piles driven into material of classes 6 through 10, the area at the surface

of the bearing stratum shall be used to compute the allowable load. The maximum load on a timber pile shall not exceed thirty-five (35) tons.

738.7 PRECAUTIONS IN DRIVING: To avoid damage to the pile, the size of the hammer shall be such that the driving energy in foot-pounds per blow shall not exceed numerically the point diameter of the pile in inches multiplied by fifteen hundred (1500). The total driving energy in foot-pounds for six (6) inches of penetration shall for all types of hammers be numerically no greater than the point diameter in inches times thirty-two thousand (32,000) for type I species of wood or times twenty-two thousand (22,000) for type II species of wood. For the last inch of penetration, the energy in foot-pounds shall not exceed numerically the point diameter in inches multiplied by six thousand (6,000). In any case, driving shall be stopped immediately when abrupt high resistance to penetration is encountered. Any sudden decrease in driving resistance shall be investigated with regard to the possibility of breakage of the pile; and if such sudden decrease in driving resistance cannot be correlated to boring data, and if the pile cannot be removed for inspection, it shall be considered adequate reason for rejection of the pile.

## SECTION 739.0 PRECAST CONCRETE PILES

739.1 CONCRETE STRENGTH: No precast concrete pile shall be driven before the concrete has attained a compressive strength of not less than four thousand (4,000) pounds per square inch based on tests of cylinders cast from the same batches and cured under the same conditions as the pile concrete. These piles shall be so proportioned, cast, cured, handled and driven as to resist without significant cracking the stresses induced by handling and driving as well as by loads.

739.2 DESIGN: The piles shall be designed and reinforced in accordance with the applicable reinforced concrete regulations cited in section 842.0. If for any reason the pile is injured, or the reinforcement is exposed, its use shall be condemned. The lateral reinforcement at both ends of the pile shall be spaced sufficiently close to resist impact stresses due to driving and in no case more than three (3) inches on center. When driven to or into bearing materials of classes 1 to 5 inclusive, or through materials containing boulders, they shall have metal tips of approved design. The minimum lateral dimension of a precast concrete pile shall be ten (10) inches.

739.3 LIMITATION OF LOAD: The load on a precast concrete pile shall not exceed the allowable load specified in section 737 nor twenty-five (25) percent of the twenty-eight (28) day strength of the concrete, but not exceeding twelve hundred (1200) pounds per square inch. For prestressed concrete piles twenty-five (25) percent of the effective prestress in the concrete after losses shall be deducted from twenty-

five (25) percent of the twenty-eight (28) day strength or twelve hundred (1200) pounds, whichever is less, in computing the maximum pile load.

739.4 PROTECTION: A minimum covering of two (2) inches of concrete shall be provided over all reinforcements, except that for piles to be exposed to sea water and other severe environments, a three (3) inch protective covering shall be furnished in the zone of such exposure.

739.5 MINIMUM SPACING: The minimum spacing center-to-center of precast concrete piles shall be two and one-half (2 1/2) times the square root of the cross-sectional area at the butt.

739.6 SPLICES: One splice shall be permitted in precast concrete piles.

## SECTION 740.0 CAST-IN-PLACE CONCRETE PILES

In this section a distinction is made between poured-concrete piles and compacted-concrete piles. A poured-concrete pile is formed by pouring concrete into a driven casing that is permanently installed in the ground. A compacted-concrete pile is formed by placing concrete having a zero (0) slump, in small batches, and compacting each batch. All cast-in-place concrete piles shall be so made and placed as to ensure the exclusion of all foreign matter and to secure a well-formed unit of full cross-section. The minimum strength of concrete for cast-in-place piles shall be three thousand (3000) pounds per square inch. While placing the concrete the casing or drive-pipe shall contain not more than three (3) inches of water.

### 740.1 POURED CONCRETE PILES

740.11 DESIGN: The shape of the pile may be cylindrical, or conical, or a combination thereof, or it may be a succession of cylinders of equal length, with the change in diameter of adjoining cylinders not exceeding one (1) inch.

740.12 LOADING: The load on poured-concrete piles shall not exceed the allowable load specified in 737 nor twenty-five (25) percent of the twenty-eight (28) day strength of the concrete, but not exceeding eleven hundred (1100) pounds per square inch, when applied to the cross-sectional area computed on the following bases:

a) For metal-cased piles driven to and into materials of classes 1 to 4 inclusive, using the diameter measured one (1) foot above the point, except that when the rock is immediately overlain by a bearing stratum consisting of one (1) or a combination of bearing materials of classes 5, 6 and 7, using the diameter at the surface of the bearing stratum.

b) For metal-cased piles, driven through compressible materials including classes 11, 12, 13 and 15 and into a bearing stratum consisting of one (1) or a combination of bearing materials of classes 5 to 10 inclusive, using the diameter at the surface of the bearing stratum.

740.13 INSTALLATION: Immediately before filling with concrete, the inside of the casing shall be thoroughly cleaned to the bottom and subjected to a visual examination. The casing shall be subject to the following limitations:

a) the diameter shall not vary more than twenty (20) percent from the specified value;

b) the point of the casing shall not deviate more than ten (10) percent of the length of the pile from the design alignment; and

c) the casing shall not deviate by more than four (4) percent of the length of the casing from the straight line connecting the mid-points of the ends of the casing. Any other condition which may affect the design performance shall be duly noted and evaluated subject to the requirements of the building official. No casing or drive-pipe shall be filled with concrete until all casings or drive-pipes within a radius of seven (7) feet, or within the heave range, whichever is greater, have been driven to the required resistance.

740.2 COMPACTED CONCRETE PILES

740.21 LOADING: The load on compacted concrete piles shall be limited by the provisions of section 737.41 except that the circumscribing polygon shall start at the junction of the shaft and the enlarged base, and the bearing area shall be taken at planes six (6) feet or more below said junction; and the allowable load on a compacted concrete pile shall not exceed one hundred twenty (120) tons.

740.22 INSTALLATION: The installation of such piles shall fulfill the following-listed requirements:

a) The drive-pipe used for installing the piles shall be not less than twenty (20) inches outside diameter for piles which have an allowable load of eighty-five (85) tons or greater, and not less than sixteen (16) inches outside diameter for piles which have an allowable load of less than eighty-five (85) tons. For loads less than fifty (50) tons, smaller drive casings may be used subject to the approval of the building official.

b) The enlarged base of the pile shall be formed on or in bearing materials of classes 1 to 9 inclusive. The class 9 material (fine sand) shall have a maximum of six (6) percent by weight

finer than the No. 200 mesh sieve and shall be non-plastic.

c) The concrete in the base shall have a minimum compressive strength at twenty-eight (28) days of four thousand (4,000) pounds per square inch, shall be of zero (0) slump, and shall be placed in batches not to exceed five (5) cubic feet in volume.

d) The last batch of concrete shall be driven into the enlarged base with not less than twenty-five (25) blows, each of not less than one hundred and forty thousand (140,000) foot pounds. For lower allowable loads, the required number of blows on the last batch shall vary in proportion to the allowable load. On the basis of test data, and subject to approval by the building official, the hammer blow energy may be reduced, in which case the number of blows on the last batch shall vary inversely with the energy delivered per blow.

e) During injection of the last five (5) cubic feet the level of concrete in the drive casing shall be not more than six (6) inches above the bottom of the casing.

f) As the drive-pipe is being withdrawn, not less than two (2) blows of at least forty thousand (40,000) foot-pounds each shall be applied to compact each batch of concrete in an uncased shaft.

g) An uncased shaft shall not be formed through inorganic clay or inorganic silt unless a hole is made through such soil by a non-displacement method, at least equal to the inside diameter of the drive-pipe unless the individual piles are located more than nine (9) feet apart and outside the heave range. Compacted concrete piles shall have cased shafts when spaced closer than nine (9) feet apart and when installed through inorganic clay or inorganic silt.

h) An uncased shaft shall not be formed through peat or other organic soils.

i) The permanent metal casing shall be fastened to the enlarged base in such a manner that the two (2) will not separate. The concrete may be placed in the metal casing in the same manner as for poured-concrete piles. No metal casing shall be filled with concrete until after all piles within a radius of at least nine (9) feet have been driven. The stresses in metal-cased shafts shall not exceed eleven hundred (1100) pounds per square inch on the concrete, and in addition, nine-thousand five hundred (9,500) pounds per square inch on the steel casing, provided that its wall thickness is at least two-tenths (2/10) of an inch. When required by soil conditions, allowance shall be made for corrosion as specified in section 738.

740.23 SPACING: The center-to-center spacing of piles shall be not less than three (3) times the shaft diameter and not less than three and one-half (3 1/2) feet.

## SECTION 741.0 CONCRETE-FILLED PIPE PILES

741.1 INSTALLATION: Immediately before filling with concrete, the inside of the casing shall be thorough cleaned to the bottom and subjected to a visual inspection. The casing shall be subject to the following limitations:

a) the diameter shall not vary more than twenty (20) percent from the specified value;

b) the point of the casing shall not deviate more than ten (10) percent of the length of the pile from the design alignment; and

c) the casing shall not deviate by more than six (6) percent of the length of the casing from the straight line connecting the mid-points of the ends of the casing. Any other condition which may affect the design performance shall be duly noted and evaluated subject to the requirements of the building official. Concrete shall not be placed through water; except that the building official may approve the use of a properly operated tremie or pumped concrete in still water, provided the pipe is proven to be free of other material.

741.2 STEEL PIPE: All steel pipe shall conform to the applicable standards listed in the reference standards of this article for welded and seamless steel pipe and tubes, and for hot-rolled carbon steel sheets. The yield point used in the design of steel casings shall be that of the fabricated element as determined by test.

741.3 DESIGN: The load on concrete-filled pipe piles shall not exceed the allowable load determined in accordance with section 737.0, nor a load computed on the basis of stress in concrete at twenty-five (25) percent of the twenty-eight (28) day strength, but not exceeding eleven hundred (1100) pounds per square inch, and stress in the steel at nine thousand (9,000) pounds per square inch; nor shall the load carried by the steel on this basis exceed one-half (1/2) the total load on the pile.

741.4 MINIMUM THICKNESS: The minimum wall thickness of all load-bearing pipe, tubes and shells shall be one-tenth (1/10) inches. When required by soil conditions, allowance shall be made for corrosion as specified in section 736.

741.5 SPLICES: All splices of the steel section shall be welded to one hundred (100) percent of the strength of the pipe and otherwise shall comply with section 735.6 and shall be designed to insure true

alignment of the pipe and uniform transmission of load from one (1) pipe length to another.

## SECTION 742.0 CONCRETE-FILLED PIPE WITH STEEL CORE (DRILLED-IN-CAISSONS)

742.1 CONSTRUCTION: These units shall consist of a shaft section of concrete-filled pipe extended to and firmly seated in bedrock of classes 1 or 2 with an uncased socket drilled into the bedrock which is filled with cement grout. The steel core shall be centered in the shaft and shall extend through the cement grout to the bottom of the socket.

742.2 STEEL SHELL: The steel shell shall be seamless or welded steel pipe with a minimum yield point of thirty-three thousand (33,000) pounds per square inch, fitted with an approved cutting shoe and structural cap, or with other approved means of transmitting the superstructure load. The minimum diameter for drilled caissons shall be twenty-four (24) inches and minimum shell thickness five-sixteenths (5/16) inches. Steel shall be protected under the conditions specified in section 738. Splices shall be welded to develop one hundred (100) percent of the strength of the pipe.

742.3 CONCRETE FILL: The concrete fill of caissons shall be controlled concrete with a minimum compressive strength of four thousand (4,000) pounds per square inch at twenty-eight (28) days. It shall be so placed that it shall fill completely the space between the steel core and the pipe. In case the socket cannot be kept free from inflow of water, the pipe shall be filled to its top with clean water before placing the cement grout. The details of the design and installation, including the cleaning and inspection of the socket, the placement of concrete under water or in the dry, the method of centering the steel core, and all other phases of the work shall be submitted to the building official for approval.

742.4 ROCK SOCKET: A socket, approximately the inside diameter of the pipe, shall be made in bedrock of classes 1 or 2 to a depth that will assure load transfer when computed for a bearing on the bottom surface of the socket in accordance with sections 725 and 728 acting together with a bond stress on the perimeter surface of the socket of one hundred (100) pounds per square inch. Before placement of concrete the socket and pipe shall be thoroughly cleaned and the rock inspected by a qualified registered professional engineer.

742.5 STEEL CORE: The steel core shall consist of a structural steel member. The mating ends of the sections shall be spliced so to safely withstand the stresses to which they may be subjected. The minimum clearance between structural core and shell shall be two (2) inches. When such cores are installed in more than one (1) length, they shall be assembled to develop the full compressive strength of the section.

742.6 DRIVING PRECAUTIONS: No drilled caissons shall be driven more than two (2) percent of the length out of plumb.

742.7 SPACING: The minimum center-to-center spacing shall be not less than two and one-half (2 1/2) times the outside diameter of the steel shell.

742.8 ALLOWABLE LOAD: The load on concrete-filled pipe piles with steel cores shall not exceed the allowable load determined in accordance with the provisions of section 744.4 nor that computed on the basis of eleven hundred (1100) pounds per square inch on the area of the concrete plus nine thousand (9,000) pounds per square inch on the net area of the steel pipe plus sixteen thousand (16,000) pounds per square inch on the area of the steel core.

SECTION 743.0 STRUCTURAL STEEL PILES

743.1 STEEL: Steel sections may be of any type of steel permitted by the provisions of the reference standards of this article.

a) Rolled structural steel piles shall be of H form, with flange projection not exceeding fourteen (14) times the minimum thickness of metal in either flange or web and with total flange width at least eighty-five (85) percent of the depth of the section. No section shall have a nominal thickness of metal less than four-tenths (4/10) inch, nor a nominal depth in the direction of the web of less than eight (8) inches.

b) The use of built-up sections or sections of other than H form will be permitted if the several components of the section are adequately connected to develop the strength of the adjacent components and if the ratio of width to thickness of the component parts does not exceed the values for conventional H sections.

c) The tips of all steel H piles having a thickness of metal less than five-tenths (5/10) inches which are driven to end bearing on rock of class 1 through 3 by an impact hammer, shall be reinforced. The installation of all steel H piles by impact hammer to end bearing on rock of classes 1 through 3 shall be conducted so as to terminate driving directly when the pile reaches refusal on the rock surface.

d) Structural caps shall be rigidly attached to the pile section and shall be designed to transfer the full load into the piles; except that when the pile extends into the footing sufficiently to develop the full load by bond, or to permit the use of mechanical devices to develop the full load by shear, structural caps shall not be required.

743.2 SPLICES: If piles are spliced, the splice shall develop one hundred (100) percent of the strength of the section.

743.3 PROTECTION: Structural steel piles shall be protected under the conditions specified in section 736 or due allowance shall be made for corrosion as therein specified.

743.4 ALLOWABLE LOAD: The load on such piles shall not exceed the allowable load determined in accordance with section 737, nor a load based on stress of eleven thousand (11,000) pounds per square inch on the cross-section.

## SECTION 744.0 COMPOSITE PILES

744.1 DESIGN: A composite pile shall consist of a combination of not more than two (2) of any of the different types of piles provided for in this part. The pile shall fulfill the requirements for each type, and in addition the provisions of this section. The requirements of section 740.13 shall apply to the entire length of a pipe-shell composite pile.

744.2 LIMITATION OF LOAD: The allowable load on composite piles shall be that allowed for the weaker of the two (2) sections. For wood-composite piles the allowable load shall not exceed eighty (80) percent of that allowed for the wood section alone. Wood-shell composite piles shall not be used for support of buildings exceeding two (2) stories in height.

744.3 SPLICES: Splices between concrete sections and steel or wood sections shall be designed to prevent separation of the sections both before and after the concrete portion has set, and to insure the alignment and transmission of the total pile load. Splices shall be designed to resist uplift due to upheaval during driving of adjacent piles and shall develop the full compressive strength and not less than fifty (50) percent of the strength in tension and bending of the weaker section.

744.4 SPACING: The center-to-center spacing shall be governed by the larger of the spacings required in this part for the types composing the pile.

## SECTION 745.0 SPECIAL PILES AND CAISSONS

Types of piles or caissons not specifically covered by the provisions of this Code may be permitted subject to the approval of the building official, provided sufficient test data, design and construction information are filed by a qualified registered professional engineer certifying that the pile or caisson installation is adequate to fulfill the design requirements.

## SECTION 746.0 LATERAL SUPPORT

746.1 SURROUNDING MATERIALS: Any soil other than water or fluid soil including strata of soil not meeting the criterion in figure 7-7, shall be deemed to afford sufficient lateral support to permit the

design of any type of pile as a short column. When piles are driven through soil which will be removed subsequent at the completion of the foundation, the resistance offered by such material shall not be considered to contribute to the lateral supporting capacity.

746.2 COLUMN ACTION: The portion of a pile or pier that is not laterally supported shall be designed as a column in accordance with section 842 and taking into consideration the conditions of end fixity.

## SECTION 747.0 FOUNDATION PIERS

A foundation pier is here defined as a structural member which extends to a satisfactory bearing material, and which may be constructed in an excavation that afterwards is backfilled by an approved method, or by filling the excavation with concrete, or which may be built by sinking an open or pneumatic caisson.

747.1 MANNER OF CONSTRUCTION: The manner of construction shall be by non-displacement methods and shall permit inspection of the bearing material in place.

747.2 BASE ENLARGEMENT: The bases of foundation piers may be enlarged by spread footings, pedestals or belled bottoms.

747.21 BELLED BASES: Bell-shaped bases shall have a minimum edge thickness of four (4) inches. The bell roof shall slope not less than sixty (60) degrees with the horizontal unless the base is designed in accordance with section 841 or 842.

747.3 DESIGN OF PIERS: Foundation piers may be designed as concrete columns with continuous lateral support. The unit compressive stress in the concrete at the least cross section shall not exceed twenty-five (25) percent of the twenty-eight (28) day strength of the concrete nor eleven hundred (1100) pounds per square inch.

747.31 When the center of the cross section of a foundation pier at any level deviates from the resultant of all forces more than one-sixtieth (1/60) of its height, or more than one-tenth of its diameter, it shall be reinforced as provided in section 842. The restraining effect of the surrounding soil may be taken into account.

747.4 PLACEMENT: With approval of the building official, concrete may be placed through still water by means of a properly operated tremie or pumped concrete.

747.5 INSPECTION: The owner shall engage a competent inspector, qualified by experience and training and satisfactory to the building official, to be present at all times while foundation piers are being installed, to inspect and approve the bearing soil and the placing of the concrete. The inspector shall make a record of the type of

bearing soil upon which the pier rests, of the dimensions of the pier, and of the class of concrete used in its construction. A copy of these records shall be filed in the office of the building official.

## SECTION 748.0 DESIGN REQUIREMENTS FOR FLOODPLAINS AND COASTAL HIGH HAZARD AREAS

748.1 STRUCTURAL REQUIREMENTS: Where a structure is located in an area designated by the authority having jurisdiction as a floodplain area or coastal high hazard area, such a structure shall be designed to retain its structural integrity and stability for the anticipated flood conditions and to minimize flood damage. Any such structure, including one and two-family dwellings, shall have plans submitted by a registered professional engineer or architect showing only those provisions necessary in the construction of the structure to meet the following performance requirements:

a) structures shall be anchored to prevent movement or collapse.

b) approved flood resistant materials and equipment shall be used.

c) coastal high hazard area structures must be anchored to piles and have space below lowest floor free of construction.

d) non-residential structures built with any occupiable space below the level designated by the authority having jurisdiction as the one hundred (100) year flood level, shall be designed to be floodproof.

748.2 ELEVATION OF STRUCTURES IN FLOODPLAINS: The building official shall maintain for public inspection and furnish upon request a record of elevations in relation to mean sea level, of the lowest floor (including cellar as defined in the Basic Code) of all new or substantially altered structures located in the special flood hazard areas. Where the lowest floor is below grade on one or more sides, the elevation of the floor immediately above shall also be provided.

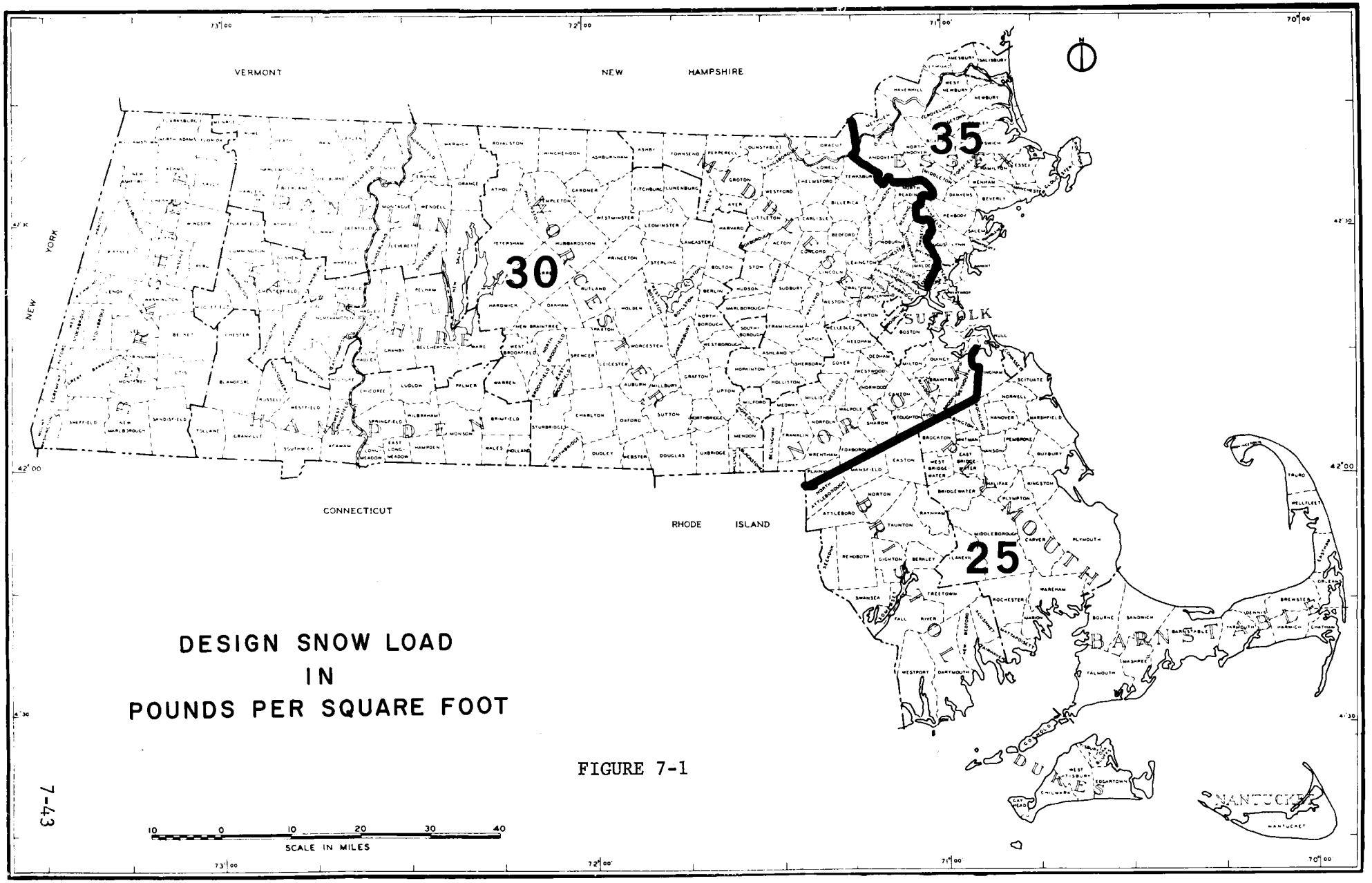
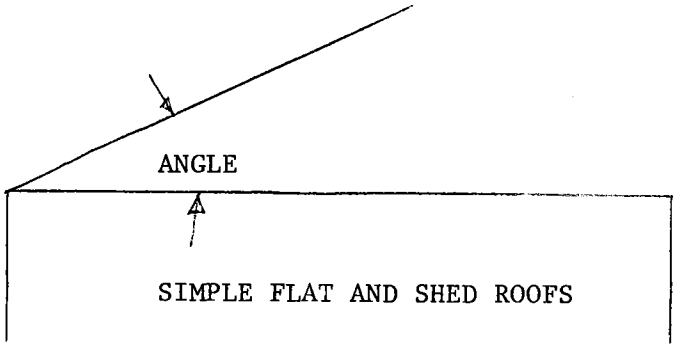

VERMONT
NEW HAMPSHIRE
NEW YORK
CONNECTICUT
RHODE ISLAND
35
30
25
ESSEX
MIDDLESEX
WORCESTER
SUFFOLK
NORFOLK
PLYMOUTH
BRISTOL
BARNSTABLE
DUKES
NANTUCKET
HAMPDEN
HAMPSHIRE
FRANKLIN
BERKSHIRE
DESIGN SNOW LOAD
IN
POUNDS PER SQUARE FOOT
10 0 10 20 30 40
SCALE IN MILES

FIGURE 7-1




| ANGLE | SLOPE | DESIGN SNOW LOAD (lbs/ft$^2$) | | |
|---|---|---|---|---|
| MAP SNOW LOAD (lbs/ft$^2$) | | 25 | 30 | 35 |
| 0-20 | FLAT TO 4/12 | 25 | 30 | 35 |
| 20-30 | 4/12 TO 7/12 | 25 | 30 | 35 |
| 30-40 | 7/12 TO 10/12 | 20 | 24 | 28 |
| 40-50 | 10/12 TO 14/12 | 15 | 18 | 21 |
| 50-60 | 14/12 TO 20/12 | 10 | 12 | 14 |
| 60-70 | 20/12 TO 33/12 | 5 | 6 | 7 |
| 70-90 | 33/12 TO VERTICAL | 0 | 0 | 0 |

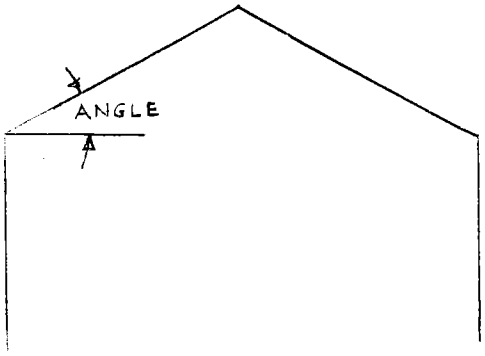
FIGURE 7-2a

DESIGN SNOW LOADS

CASE I

CASE II

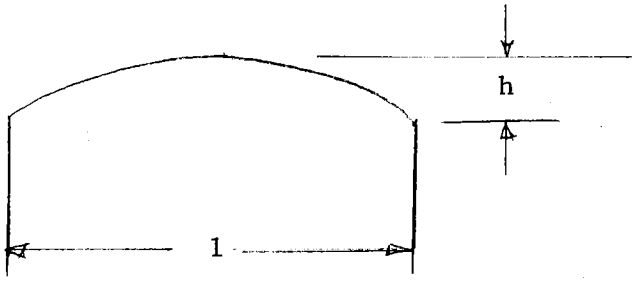
FOR ANGLES > 20°
USE CASES I & II



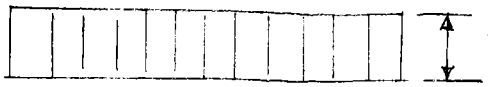

SIMPLE GABLE AND HIP ROOFS

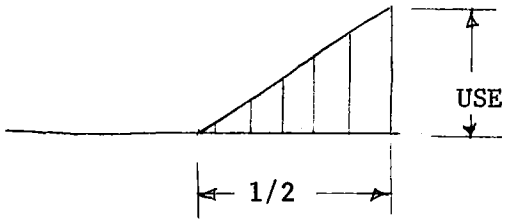
| ANGLE | SLOPE | CASE I | | | CASE II | | |
|---|---|---|---|---|---|---|---|
| MAP SNOW LOAD (lbs/ft²) | | 25 | 30 | 35 | 25 | 30 | 35 |
| | | DESIGN SNOW LOAD (lbs/ft²) | | | | | |
| 0 - 20 | FLAT to 4/12 | 25 | 30 | 35 | N/A | N/A | N/A |
| 20 -30 | 4/12 to 7/12 | 25 | 30 | 35 | 25 | 30 | 35 |
| 30 - 40 | 7/12 to 10/12 | 20 | 24 | 28 | 25 | 30 | 35 |
| 40 - 50 | 10/12 to 14/12 | 15 | 18 | 21 | 20 | 23 | 26 |
| 50 - 60 | 14/12 to 20/12 | 10 | 12 | 14 | 12 | 15 | 18 |
| 60 - 70 | 20/12 to 33/12 | 5 | 6 | 7 | 8 | 11 | 14 |
| 70 - 90 | 33/12 to vertical | 0 | 0 | 0 | 0 | 0 | 0 |

FIGURE 7-2b




SIMPLE ARCH AND CURVED ROOFS

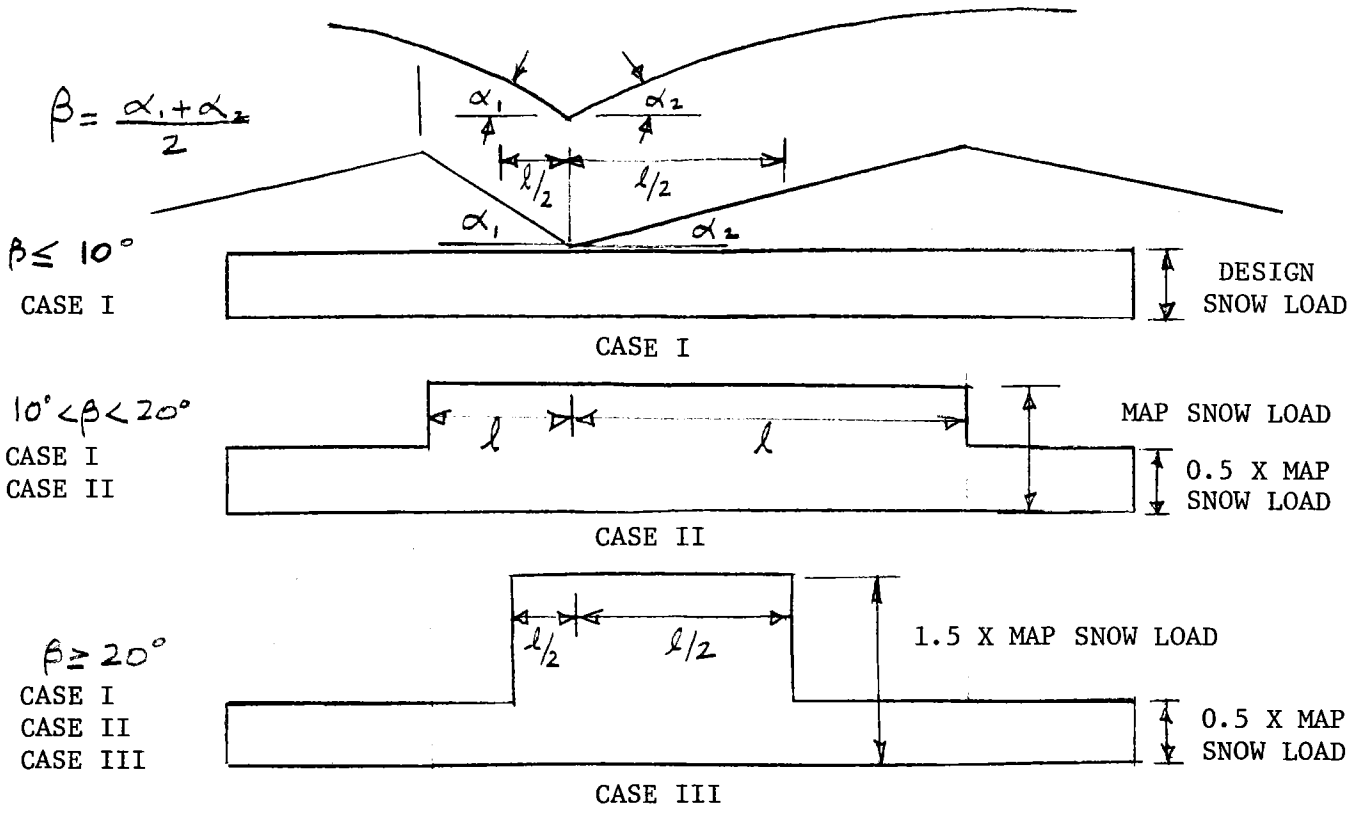
CASE I  USE MAP SNOW LOAD

CASE II  USE 2 X MAP SNOW LOAD

FOR $\frac{h}{\ell} \leq \frac{1}{10}$ USE CASE I ONLY

FOR $\frac{h}{\ell} > \frac{1}{10}$ USE CASE I AND II

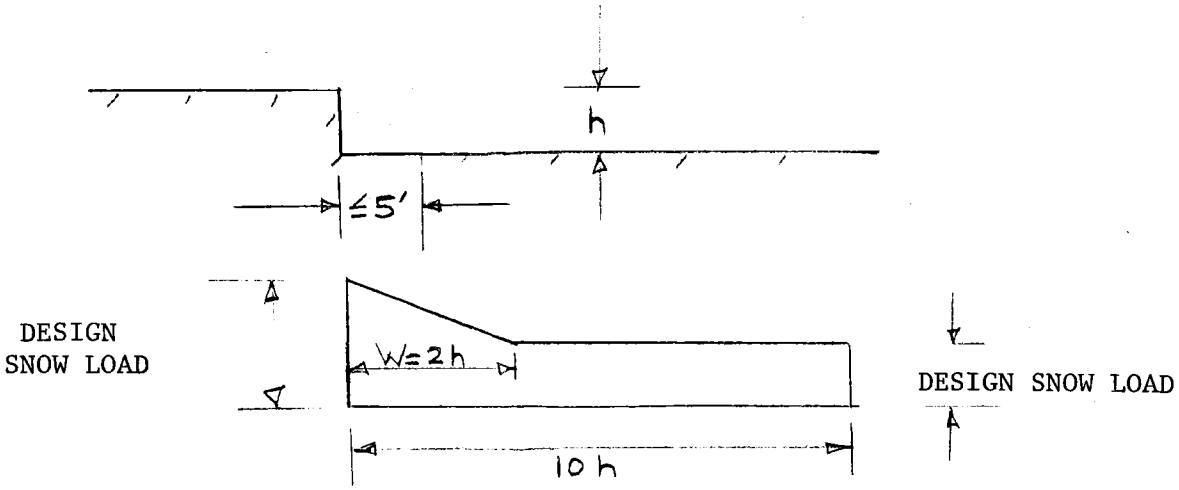
FIGURE 7-2c




VALLEY AREAS OF TWO-SPAN
AND MULTIPLE SERIES SLOPED OR CURVED ROOFS

| ANGLE | SLOPE | CASE I | | |
|---|---|---|---|---|
| MAP SNOW LOAD (lbs/ft$^2$) | | 25 | 30 | 35 |
| | | DESIGN SNOW LOAD (lbs/ft$^2$) | | |
| 0 to 10 | FLAT to 2/12 | 25 | 30 | 35 |
| 10 to 20 | 2/12 to 4.5/12 | 25 | 30 | 35 |
| 20 to 30 | 4.5/12 to 7/12 | 25 | 30 | 35 |
| 30 to 40 | 7/12 to 10/12 | 25 | 30 | 35 |
| 40 to 50 | 10/12 to 14/12 | 20 | 24 | 28 |
| 50 to 60 | 14/12 to 20/12 | 10 | 12 | 14 |
| 60 to 70 | 20/12 to 33/12 | 5 | 6 | 7 |
| 70 to 90 | 33/12 to vertical | 0 | 0 | 0 |

FIGURE 7-3a




LOWER LEVEL OF MULTI-LEVEL ROOFS
(WHEN UPPER ROOF IS PART OF SAME BUILDING OR
ON AN ADJACENT BUILDING NOT MORE THAN 5 FEET AWAY)

| MAP SNOW LOADS (lbs/ft$^2$) | 25 | 30 | 35 | |
|---|---|---|---|---|
| H IN FEET | DESIGN SNOW LOAD (lbs/ft$^2$) | | | W IN FEET |
| 0 - 1.5 | 25 | 30 | 35 | 10 |
| 1.5 - 2.0 | 30 | 30 | 35 | 10 |
| 2.0 - 2.5 | 38 | 38 | 38 | 10 |
| 2.5 - 3.0 | 45 | 45 | 45 | 10 |
| 3.0 - 3.5 | 53 | 53 | 53 | 10 |
| 3.5 - 4.0 | 60 | 60 | 60 | 10 |
| 4.0 - 4.5 | 70 | 70 | 70 | 10 |
| 4.5 - 5.0 | 75 | 75 | 75 | 10 |
| 5.0 - 6.0 | 75 | 90 | 90 | W = 2h |
| 6.0 - 15.0 | 75 | 90 | 105 | W = 2h |
| 15.0 | 75 | 90 | 105 | 30 |

FIGURE 7-3b

Design for:

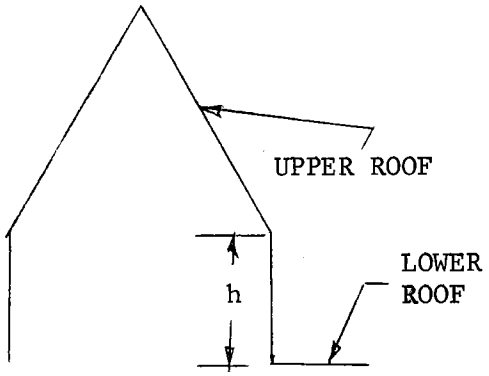
1. UPPER ROOF LOAD AS REQUIRED FOR LOADS APPLICABLE TO SINGLE-LEVEL ROOFS

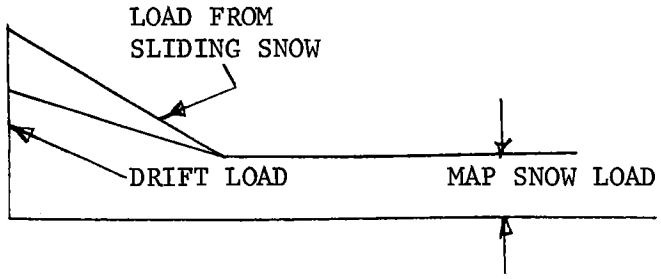
   PLUS

2. LOWER ROOF LOAD AS REQUIRED FOR LOADS APPLICABLE TO MULTI-LEVEL ROOFS

   PLUS

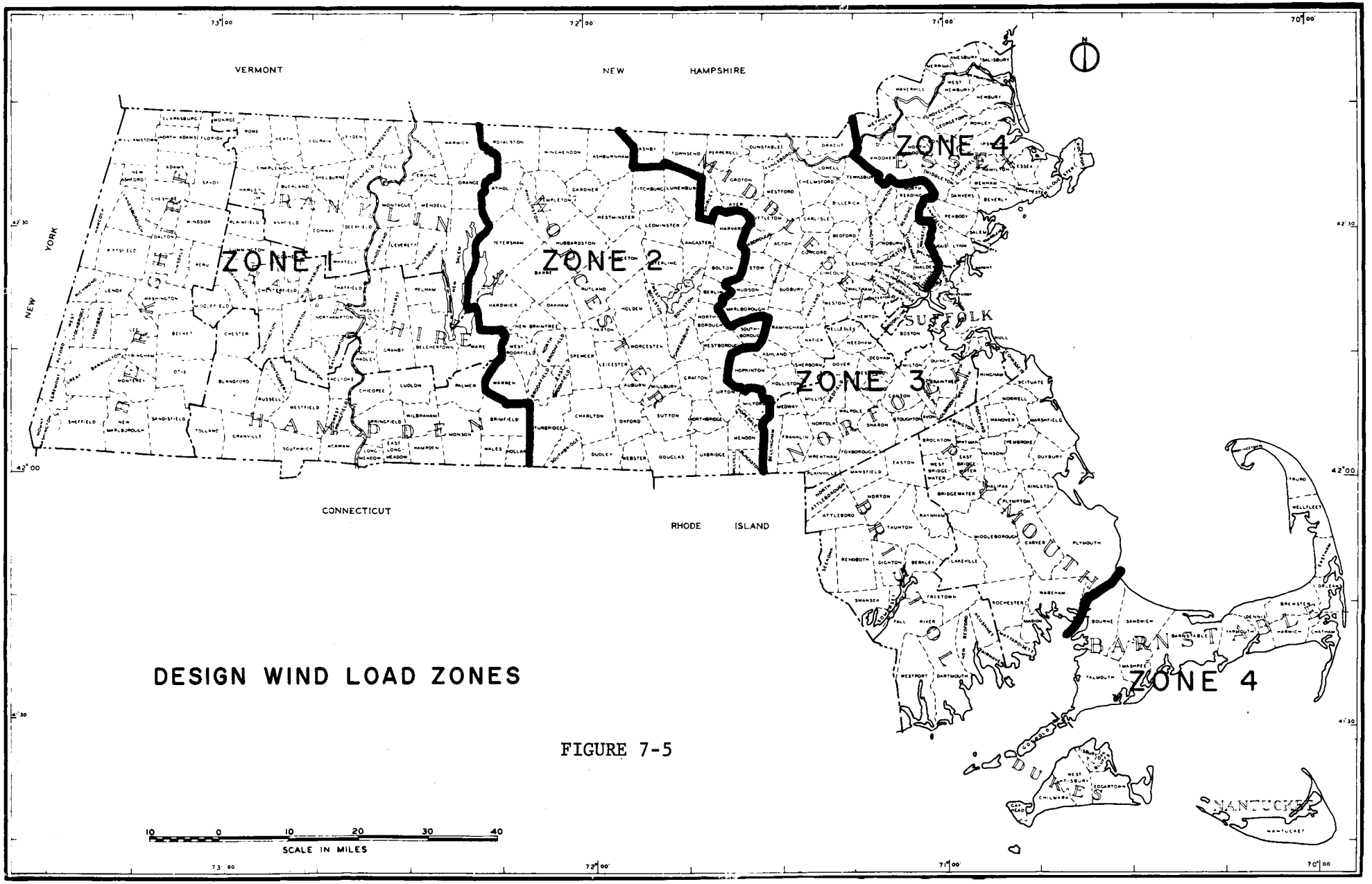
3. 50% OF UPPER ROOF LOAD CONSIDERED AS LOADED ONTO LOWER ROOF DUE TO SLIDING




ROOFS SUBJECT TO SNOW LOAD
FROM SLIDING

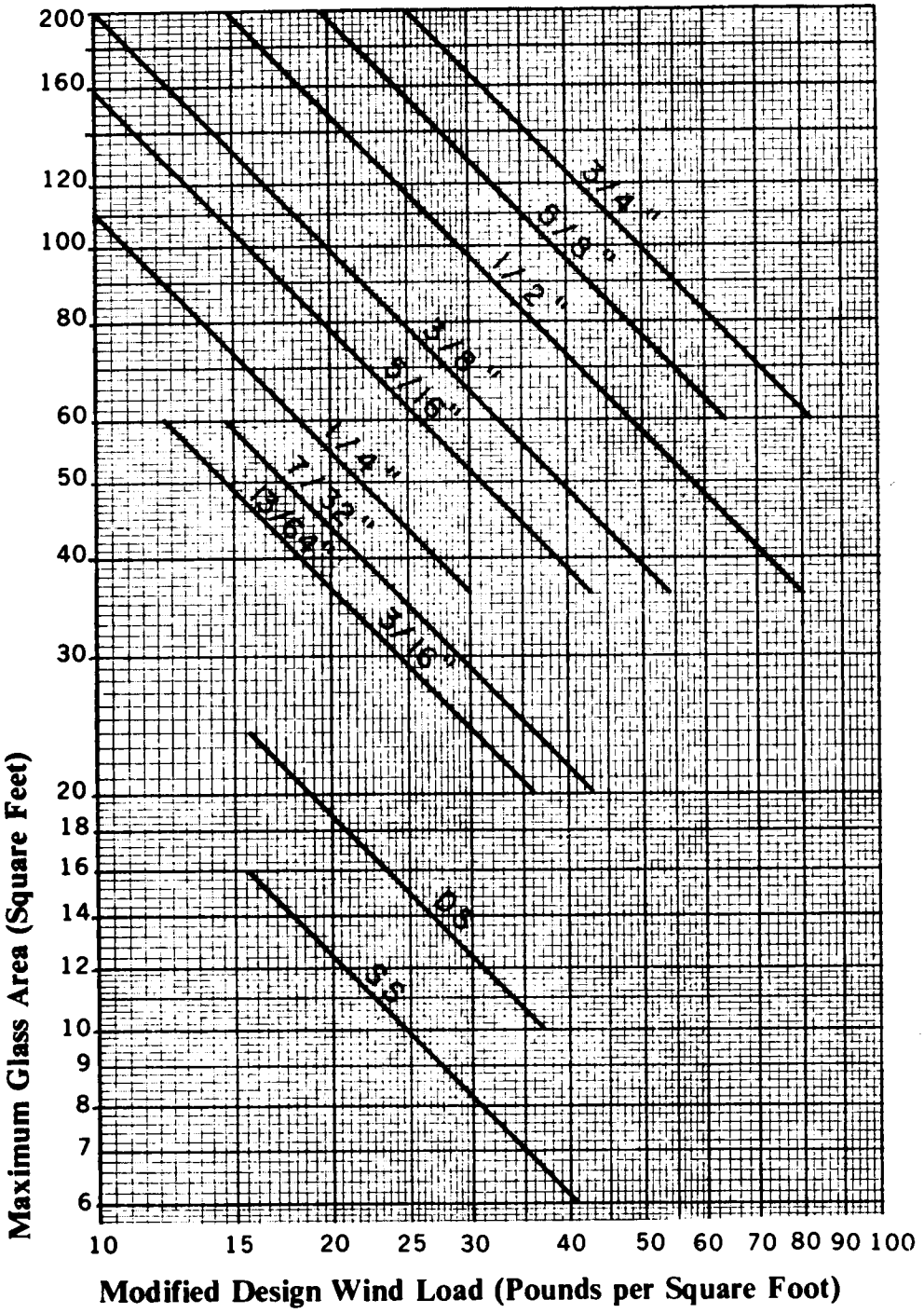
FIGURE 7-4




# DESIGN WIND LOAD ZONES

FIGURE 7-5

**Required Nominal Thickness of Glass**




This chart is based on minimum thicknesses allowed in Federal Specification DD-G-451b

Design Factor - 2.5

FIGURE 7-6

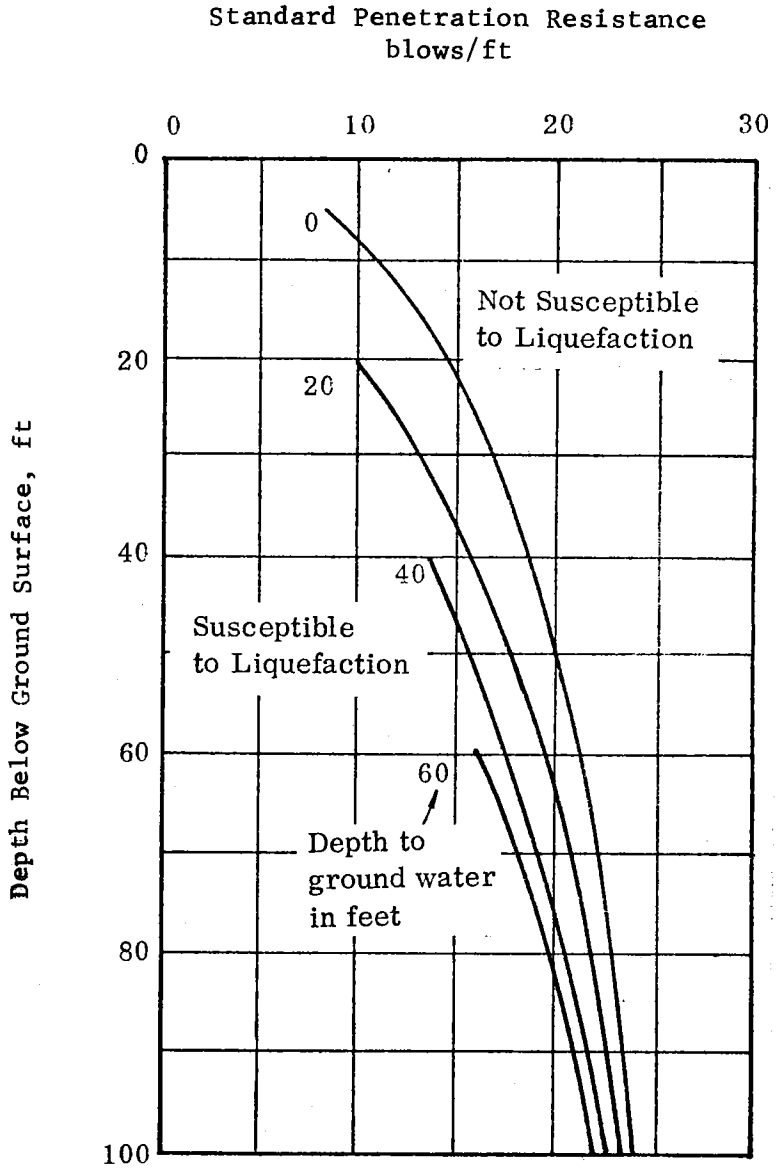



FIGURE 7-7

Penetration Resistance Requirements for
Medium and Fine Sands Subjected to Earthquakes for
Safety Against Liquefaction

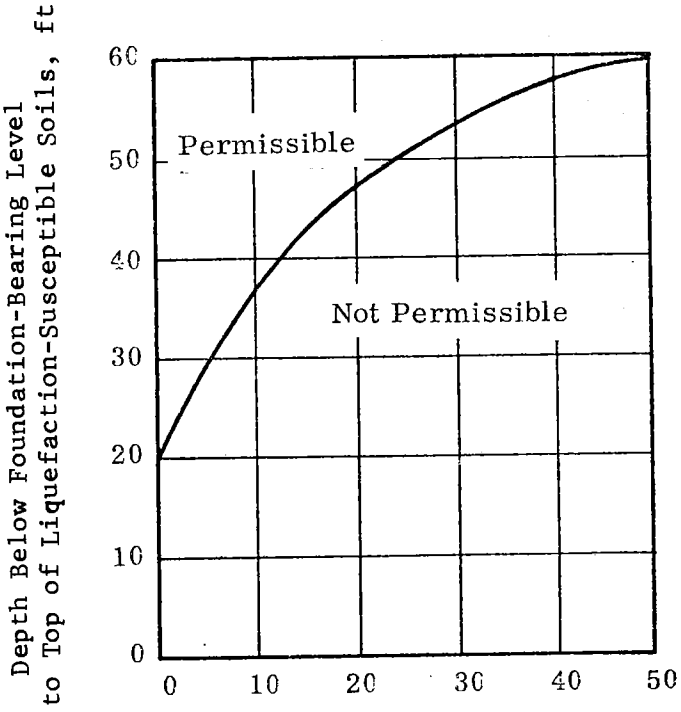



FIGURE 7-8

Permissible thicknesses and depths of soils that are susceptible to liquefaction.

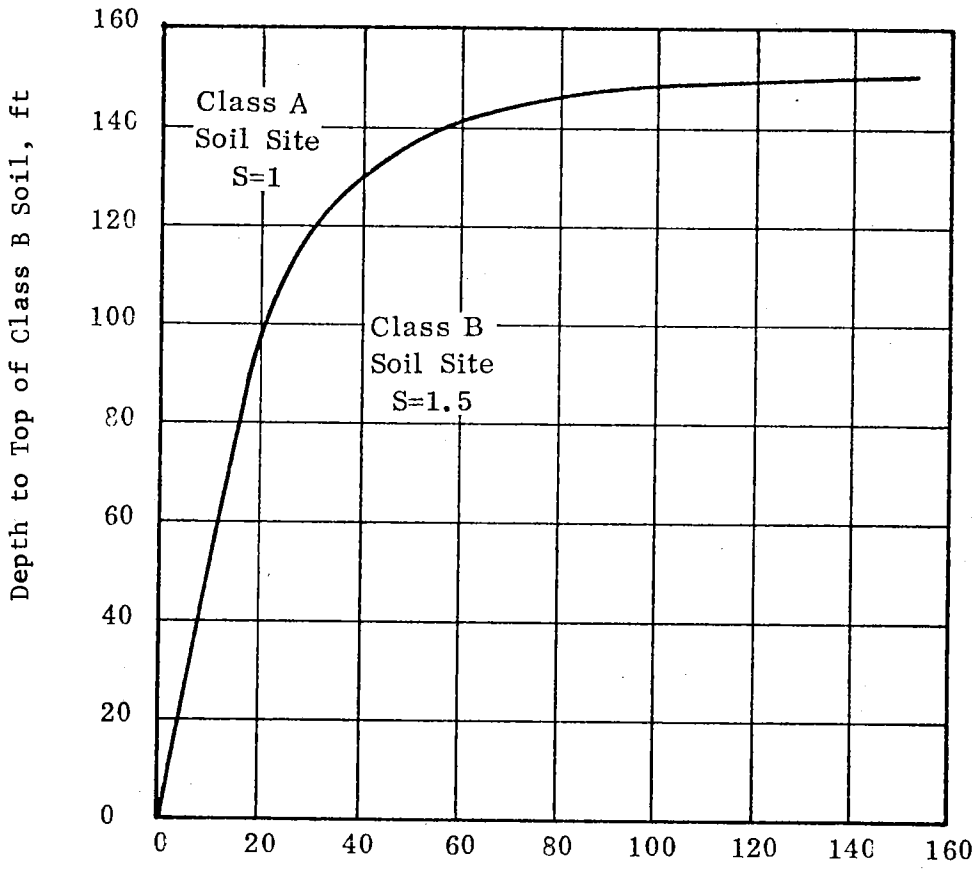



FIGURE 7-9

Determination of Soil Factor S

| | | | |
|---|---|---|---|
| AASHO | | 1965 | Standard Specifications for Highway Bridges |
| ASCE | Paper No. 3269 | 1961 | Wind Forces on Structures--1961 Transactions of the American Society of Civil Engineers, Vol. 126, Part II |
| ASTM | A252 | 1971 | Specification for Welded and Seamless Steel Pipe Piles |
| ASTM | D25 | 1970 | Standard Specification for Round Timber Piles |
| AWPA | C1 | 1972 | Standard for the Preservation Treatment of all Timber Products by Pressure Processes |
| AWPA | C3 | 1972 | Standard for the Preservative Treatment of Piles by Pressure Processes |
| AWPA | M2 | 1967 | Standard for Inspection of Treated Timber Products |
| AWPA | M4 | 1962 | Standard for the Care of Pressure-Treated Wood Products |
| ANSI | A58.1 | 1972 | Building Code Requirements for Minimum Design Loads in Buildings and Other Structures |

ARTICLE 8-PART A

MATERIAL AND TESTS

SECTION 800.0 SCOPE

The provisions of this article shall govern the quality, workmanship and requirements for all materials and methods and the minimum specifications for enclosure walls and wall thickness hereafter used in the construction of buildings and structures. All materials and methods of construction shall be subject to the approval of the State Building Code Commission and shall follow those requirements of accepted engineering practice and material and test standards as specified in the reference standards of this article as approved by the State Building Code Commission.

800.1 ACCEPTED ENGINEERING PRACTICE: The quality, use and installation of all materials and devices, and the methods of building construction shall be controlled by the standards of accepted engineering practice as approved by the State Building Code Commission and listed in the references of this article.

800.2 MATERIAL AND TESTS: All materials, devices, methods of construction, and tests shall be subject to the approval and control of the State Building Code Commission for use in the Commonwealth of Massachusetts.

800.3 USED MATERIALS: The use of all second-hand materials which meet the minimum requirements of the Basic Code for new materials shall be permitted.

800.4 CONTROL OF CONSTRUCTION MATERIALS: The use of construction materials in all structures covered by section 128.0, and all personnel and laboratories involved in the control, inspection and testing of such structures shall be subject to the rules and regulations of the State Building Code Commission administered through their provisions and under their direction by the Construction Materials Safety Board.

800.41 CONSTRUCTION MATERIALS SAFETY BOARD: The Board will review applications for registration for licensing of individuals and laboratories responsible for inspection, control and testing of construction material, and report to the State Building Code Commission their recommendations. The Board will collect information and review cases where disciplinary action against an existing license, whether an individual, laboratory or firm, has been proposed and make recommendations to the State Building Code Commission. The Commission will issue applications, receive payment of registration and licensing fees, and maintain records for the efficient dispatch of the duties of the Board. The Board shall submit to the Commission reports from time to time as requested by the Commission, but at least annually.

800.42 TESTING AND EVALUATION GROUP: The State Building Code Commission shall establish and maintain a Testing and Evaluation Group, who will have the responsibility of administering and directing, under the supervision of the Commission, the testing and controls for evaluating individual applicants and laboratories wishing to become registered and licensed as required under section 128.9.

SECTION 801.0 DEFINITIONS

ARCHITECTURAL TERRA COTTA: plain or ornamental hard-burned plastic clay units, larger in size than brick, with glazed or unglazed ceramic finish.

ASHLAR FACING: facing of solid rectangular units larger in size than brick of burned clay or shale, natural or cast stone, with sawed, dressed and squared beds and mortar joints.

ASHLAR MASONRY: masonry composed of bonded, rectangular units, larger in size than brick, with sawed, dressed or squared beds and mortar joints.

BRICK: a solid masonry unit of clay or shale, usually formed into a rectangular prism while plastic and burned or fired in a kiln.

BUTTRESS: a projecting part of a masonry wall built integrally therewith to furnish lateral stability which is supported on proper foundations.

CALCIUM-SILICATE BRICK (sand lime brick): a building unit made of sand and lime.

CERAMIC SURFACE UNIT: (see tile).

CLAY MASONRY UNIT: a building unit larger in size than a brick composed of burned clay, shale, fireclay or mixtures thereof.

COLD-FORMED STEEL CONSTRUCTION: that type of construction made up entirely, or in part, of steel structural members cold-formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

CONCRETE: a mixture of cement, aggregates and water, of such proportions and manipulation as to meet specific requirements.

CONCRETE BRICK: a solid masonry unit having a shape approximating a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

CONCRETE MASONRY UNIT: a building or unit or block larger in size than twelve (12) by four (4) by four (4) inches made of cement and suitable aggregates.

FLOOR FILL: the fill between the structural floor arch or slab and the finished flooring:

FLOOR FILLING: the type of short-span floor construction in fireproof and fireresistive buildings installed between structural steel framing to serve as a combination structural floor slab or arch and fireproof protection of the framing.

FLOOR FINISH: the finish placed on top of the floor arch, slab or other structural floor element.

HOLLOW BRICK: a masonry unit of clay or shale whose net cross-sectional area in any plane parallel to the bearing surface is not less than sixty (60) percent or more than seventy-five (75) percent of its gross cross-sectional area measured in the same plane.

HOLLOW MASONRY UNIT: a masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than seventy-five (75) percent of its gross cross-sectional area measured in the same plane.

MASONRY: a built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with mortar; or monolithic concrete. Reinforced concrete is not classed as masonry.

MORTAR: a plastic mixture of approved cementitious materials, fine aggregates and water used to bond masonry or other structural units.

NOMINAL DIMENSIONS.

-LUMBER: a dimension that may vary from actual dimensions as provided in American Lumber Standard listed in the references standards of this article.

-MASONRY: a dimension that may vary from actual masonry dimensions by the thickness of a mortar joint but not to exceed one-half (½) inch.

PRESERVATIVE TREATED WOOD: wood treated by a recognized pressure impregnation process to increase its durability.

REINFORCED CONCRETE: concrete in which reinforcement other than that provided for shrinkage or temperature changes is combined in such manner that the two materials act together in resisting forces.

RUBBLE

-COURSED RUBBLE: masonry composed of roughly shaped stones fitting approximately on level beds and well bonded.

-RANDOM RUBBLE: masonry composed of roughly-shaped stones laid without regularity of coursing but well bonded and fitted together to form well defined joints.

-ROUGH OR ORDINARY RUBBLE: masonry composed of unsquared field stones laid without regularity of coursing but well bonded.

-RUBBLE MASONRY: masonry composed of roughly shaped stones.

SOLID MASONRY: masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar, or consisting of plain concrete.

SOLID MASONRY UNIT: a masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is seventy-five (75) percent or more of its gross cross-sectional area measured in the same plane.

STEEL JOIST: any secondary steel member of a building or structure made of hot or cold-formed solid or open-web sections, or riveted or welded bar, strip or sheet steel members or slotted and expanded or otherwise deformed rolled sections.

STRUCTURAL CLAY TILE: a hollow masonry unit composed of burned clay, shale, fireclay or mixtures thereof and having parallel cells.

STRUCTURAL STEEL MEMBER: any primary or secondary member of a building or structure consisting of a rolled steel structural shape other than formed steel, light gage steel or steel joist members.

TILE: a ceramic surface unit, usually relatively thin in relation to facial area, made from clay or a mixture of clay and other ceramic materials, called the body of the tile, having either "glazed" or "unglazed" face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristics.

WALL: (see also sections 201.0 and 901.0.)

-CAVITY WALL: a wall built of masonry units or of plain concrete, or a combination of these materials, arranged to provide an air space within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

-COMPOSITE WALL: a wall built of a combination of two (2) or more masonry units of different materials bonded together, one forming the back-up and the other facing elements.

-FACED WALL: a wall in which the masonry facing and backing are so bonded as to exert common action under load.

-HOLLOW WALL: a wall built of masonry units so arranged as to provide an air space within the wall, and in which the facing and backing of the wall are bonded together with masonry units.

-VENEERED WALL: a wall having a facing of masonry or other weather-resisting noncombustible materials securely attached to the backing, but not so bonded as to exert common action under load.

## SECTION 802.0 BASIC CLASSIFICATION OF CONSTRUCTION MATERIALS

All materials and methods used in the design and construction of buildings and structures shall be classified as controlled materials and ordinary materials as defined in sections 721.1 and 722.2. The design and construction shall be based on the assumptions, limitations and methods of stress determination of recognized design procedures.

## SECTION 803.0 TESTS

All structural units and assemblies shall be tested as approved by the State Building Code Commission and in accordance with those approved standards listed in the references of this article.

803.1 STRENGTH TESTS: To determine the safe uniformly distributed working load, when not capable of design by accepted engineering analysis, or to check the adequacy of the structural design of an assembly when there is reasonable doubt as to its strength or stability, every system of construction, sub-assembly or assembled unit and its connections shall be subjected to strength tests prescribed in the Basic Code, or to such other tests as approved by the State Building Code Commission, that simulate the loads and conditions of application that the completed structure will be subjected to in normal use.

803.11 STRENGTH TESTS FOR GLASS: The working strength of glass for any location in which it is required to withstand specific loads shall be determined as provided in the reference standards of this article.

803.2 DURABILITY AND ENDURANCE TESTS: Whenever specific conditions in a particular case warrant, and such information is otherwise unavailable, the building official may require a specific material to be subject to sustained and repetitive loading to determine its resistance to fatigue, and to tests for durability and weather resistance.

803.3 MAINTENANCE TEST: When reasonable doubt exists as to the quality of approved materials, or excessive variation exists in the quality or standards of materials, the building official may require verification of quality standards before approving further use. The building official may also submit such approved materials to the State Building Code Commission for review of approval.

803.4 PROOF TESTING: Whenever there is sufficient evidence that the stability or structural safety of a completed building or structure or part thereof will not meet approved engineering or other standards cited in this code, the building official may require a load test of the building unit or portions of the structure in question under the supervision of a qualified registered professional engineer or architect. Such existing structure or part thereof shall be subjected to a superimposed load equal to two (2) times the design live load, or to a load causing a stress equal to eighty (80) percent of the yield point in the most highly stressed element. The test load shall be left in place for a period of twenty-four (24) hours. If during the test, or upon removal of the test load, the structure shows evidence of failure, the building official shall order the reinforcement or modifications deemed necessary to insure adequacy of the structure for the rated capacity; or in lieu thereof, he may specify a reduced working load to which the structure shall be limited. The structure shall be considered to have successfully met the test requirements if the total deflection does not exceed the theoretical deflection computed by accepted engineering formulae. When the total deflection is greater than such theoretical value, the structure shall be considered safe for the design load, if it recovers seventy-five (75) percent of the maximum deflection within twenty-four (24) hours after removal of the test load.

803.5 TESTS OF SERVICE EQUIPMENT AND DEVICES: Tests of service equipment and devices are covered in the sections appropriate to their use.

803.6 FIRE TESTS: In the determination of flash points, combustibility, flameresistance and fireresistance of construction materials and methods, all tests shall be conducted in conformity to section 903 and 904 and the applicable standards listed in appendices G and H.

803.7 PREFABRICATED CONSTRUCTION TESTS. Prefabricated assemblies or sub-assemblies not capable of design by accepted engineering analysis, shall meet all the requirements and tests for at-site construction. The floor panels and other prefabricated units shall be assembled to form an integrated test specimen constructed as in practice, of not less than three (3) units in width with two (2) longitudinal joints; and when designed on the assumption of a simple span, such units shall be tested with flat end supports.

803.8 TEST SPECIMENS: The selection and construction of all test specimens and the details of test procedure herein required shall conform to the recognized test procedures as approved by the State Building Code Commission according to the reference standards of this article. All test specimens and constructions shall be truly representative of the materials, workmanship and details to be normally applied in practice. When structural or fireresistive properties of the material are dependent upon adequate curing, the age of the specimen shall be not less than seven (7) nor more than twenty-eight (28) days, unless otherwise approved by the State Building Code Commission.

803.9 CONDUCT OF LOAD TESTS: Load tests, when required, shall be performed under the supervision of a qualified registered professional engineer or architect. A thorough analysis of the conditions of loading shall be made to ensure that the results reflect an accurate evaluation of the existing stresses.

## SECTION 804.0 CONDITIONS OF ACCEPTANCE

When the strength or deflection of a member or assembly cannot be accurately determined by analysis, its evaluation may be based on the results of physical tests as established in these provisions. This section shall apply only to members and assemblies which have not been incorporated into a structure. In-place construction shall be evaluated by the provisions of section 803.4.

804.1 TEST LOAD FACTOR:

a) The test specimen shall sustain for a period of twenty-four (24) hours, without visible damage other than hairline cracks, its own weight, plus a superimposed test load equal to the dead load to be added at the site plus one hundred fifty (150) percent of the design live load.

b) After completion of the test required by section 804.1.a. and removal of all superimposed loads, the recovery of deflection within twenty-four (24) hours shall be at least seventy-five (75) percent of the deflection due to the superimposed loads.

c) The test specimen shall sustain without collapse its own weight, plus a superimposed test load equal to fifty (50) percent of its weight plus one hundred fifty (150) percent of the dead load to be added at the site, plus two hundred fifty (250) percent of the design live load.

804.2 WORKING LOAD DEFLECTION: The deflection properties of the member of assembly under working loads shall conform to the applicable requirements of this Code and the reference standards, as well as to any special requirements of the job specifications. Such deflections may be predicted on the basis of short-time tests, plus a suitable allowance, approved by the building official, for the effects of shrinkage, creep, and relaxation.

804.3 WALL AND PARTITION ASSEMBLIES: Bearing wall and partition assemblies shall sustain the load test both with and without window framing.

804.4 CONCENTRATED LOAD TESTS: When not capable of design all floor constructions in the use classification groups specified in table 7-2 shall be subjected to the concentrated loads therein prescribed when such loading exceeds in stress effect the uniformly distributed load specified for such uses in table 7-1;

804.5 PUNCTURE PENETRATION TESTS: All finish floor constructions in which light gage metal or other thin materials are used as the structural floor shall withstand the application of a two hundred (200) pound concentrated load applied to the top surface on an area of one (1) square inch at any point or points of the construction designated by the building official.

SECTION 805.0 APPROVALS

805.1 APPROVAL: All materials devices, methods of construction and tests shall be subject to the approval and control of the State Building Code Commission for use in the Commonwealth of Massachusetts.

805.2 HERETOFORE APPROVED MATERIALS: The use of any material already fabricated or of any construction already erected, which conformed to requirements or approvals heretofore in effect, shall be permitted to continue, if not detrimental to life, health or safety of the public.

SECTION 806.0 MASONRY CONSTRUCTION UNITS

806.1 IDENTIFICATION: The materials which are recognized as being acceptable as masonry for the purposes of this Code are as follows: Brick, Structural Clay Tile, Glazed Masonry Units, Concrete Units, Gypsum Units, Structural Glass Block Units, Architectural Terra Cotta, Natural Stone, Cast Stone, Mortar for Masonry. A material designated to be used as masonry not so included by this article, shall be subject to approval and classification by the State Building Code Commission.

806.2 NOMINAL DIMENSIONS: Dimensions and thickness specified in the Basic Code are nominal dimensions; actual dimensions may vary from the prescribed minimum in accordance with accepted tolerances in the building industry.

806.3 SECOND-HAND UNITS: Brick and other second-hand masonry units may be reused subject to the approval of the building official as to quality, condition and compliance with the requirements for new masonry units. The unit shall be good, whole, sound material, free from cracks and other defects that would interfere with its proper laying or use; and shall be cleaned free from old mortar before reuse.

SECTION 807.0 BRICK UNITS

All clay, shale and sand-lime brick shall be selected of the appropriate grade specified in the reference standards of this article. The minimum grade permitted for brick in contact with the ground and subject to water, frost and freezing action shall be grade SW; when subject to frost without danger of water saturation, grade MW; and when not subject to weathering or when used as back-up in exterior walls or for interior construction, grade NW. Underburned clay brick shall not be used in isolated brick piers, nor in a bearing wall which is more than forty (40) feet in height. Brick for fire protection, fireresistive walls or fire stopping shall be of grade MW or better.

SECTION 808.0 STRUCTURAL CLAY TILE UNITS

808.1 LOAD BEARING WALL TILE: Structural clay load bearing wall tile shall be classified for physical quality as grade LBX or grade LB and shall be in conformance with the reference standards of this article.

808.2 FLOOR TILE: Structural clay floor tile shall be classified for physical quality as grade FT1 or grade FT2 and shall conform to the reference standards of this article.

808.21 ARCHES: Structural clay floor tile used in floor and roof arches shall be at least grade FT2.

808.3 FIREPROOFING AND NON-LOAD BEARING PARTITION TILE: Structural clay non-load bearing tile, used for partitions, fireproofing, and furring shall be classified as grade NB and shall conform to the reference standards of this article.

808.31 FIRERESISTANCE: Structural clay tile in fire resistive construction shall be of grade NB or better, and shall conform to the requirements of Table 2-5.

808.4 EXPOSURE: Any structural clay tile exposed to the weather shall be at least of grade LBX.

SECTION 809.0 GLAZED MASONRY UNITS

Structural clay load-bearing facing tile, facing brick, and other solid masonry units made from clay, shale, fire-clay, or mixtures thereof having a finish consisting of a ceramic glaze shall be in conformance with the reference standards of this article.

SECTION 810.0 CONCRETE UNITS

Concrete units as classified in this Code shall include concrete bricks, solid load bearing units, hollow load bearing units and hollow non-load bearing units of concrete made from Portland cement, water and suitable aggregates, such as sand gravel, crushed stone, bituminous or anthracite cinders, expanded clay or shale and blast furnace slag. The materials shall conform to the specific reference standards herein noted except that cinder aggregate for concrete blocks shall contain not more than twenty (20) percent of combustible matter.

810.1 HOLLOW LOAD BEARING UNITS: Hollow load bearing concrete units shall conform to the reference standards of this article and when used unprotected below grade or unprotected against the weather by stucco, brick or other approved facings or veneers shall be grade U; when used protected below grade or protected exterior subject to frost action, grade P or better; for interior and protected exterior use not subject to frost action, grade G or better.

810.2 HOLLOW NON-LOAD BEARING UNITS: Hollow non-load bearing concrete units shall conform to the reference standards of this article and may be used in non-load bearing interior partitions and non-load bearing exterior walls where effectively protected from the weather.

810.3 SOLID LOAD BEARING UNITS: Solid load bearing units shall conform to the reference standards of this article and when used unprotected below grade or unprotected against the weather by stucco, brick or other approved facings or veneers shall be grade U; when used protected below grade or protected exterior subject to frost action, grade P or better; for interior and protected exterior use not subject to frost action, grade G or better.

810.4 CONCRETE BRICK: Concrete brick shall conform to the reference standards of this article and when exposed to severe frost action shall be grade U; when exposed to moderate frost action shall be grade P or better; and when used in backup or interior masonry, or where effectively protected against moisture penetration, grade G or better.

810.5 CONCRETE FIREPROOFING AND FURRING UNITS: Concrete units may be used for fireproofing or furring when graded for weathering according to this section except that the exterior use of hollow non-load bearing units shall not be permitted for fireproofing purposes. All non-load bearing units shall be clearly marked to distinguish them from load bearing units.

810.6 CONCRETE FLOOR TILE

810.61 STRUCTURAL FILLERS: Structural concrete filler-block or tile when included in strength calculations in ribbed floor construction shall have webs and shells not less than one (1) inch thick and shall develop an average compressive strength on the net area not less than that of the rib concrete.

810.62 OTHER FILLERS: Removable tile and permanent fillers which are not included in strength calculations shall be of adequate strength to insure integrity of the unit and safety in handling as approved by the building official.

## SECTION 811.0 GYPSUM UNITS

A gypsum building unit in the form of tile or block for use in non-load bearing construction in the interior of buildings and for the protection of columns, elevator shafts, etc., against fire shall conform to the reference standards of this article.

811.1 USE: Gypsum tile or block shall not be used in load bearing masonry, in masonry exposed to weather or soil, nor in masonry exposed to frequent or continuous wetting. Gypsum partition tile or block shall not be used for partitions to receive Portland cement plaster, ceramic tile, marble or structural glass wainscots unless self-furring metal lath is placed over the gypsum tile.

## SECTION 812.0 STRUCTURAL GLASS BLOCK UNITS

Solid or hollow approved structural glass blocks shall not be used in fire walls, party walls or fire-division walls, or for load-bearing construction. All mortar-bearing surfaces of the block shall be precoated or prepared to insure adhesion between mortar and glass.

## SECTION 813.0 ARCHITECTURAL TERRA COTTA

All approved architectural terra cotta units shall be formed with a strong, homogeneous body of hard-burned, weather-resisting clay which gives off a sharp, metallic ring when struck and shall meet the strength and durability requirements of accepted engineering practice. All units shall be formed to engage securely with and anchor to the structural frame or masonry wall, and shall conform to the reference standards of this article.

## SECTION 814.0 NATURAL STONE

Natural stone for masonry shall be sound and free from loose or friable inclusions; and shall meet the strength, fireresistance, durability and impact resistance for the intended use in accordance with accepted engineering practice.

## SECTION 815.0 CAST STONE

All approved cast stone shall be fabricated of concrete or other approved materials of required strength, durability and fireresistance for the intended use and shall conform to the reference standards of this article.

## SECTION 816.0 MORTAR FOR MASONRY

816.1 MATERIALS: All Portland, natural and masonry cements, quicklime and hydrated lime for use in masonry mortar and concrete shall meet the minimum strength and durability requirements of the standards listed in the references of this article.

816.2 MORTAR TYPES AND PROPORTIONS: Mortar for masonry construction shall conform to one (1) of the following types and shall be mixed to a consistent workability in the specified proportions measured by volume with clean fresh water free from harmful amounts of acids, alkalis, oils or organic materials; and with approved aggregates composed of hard, strong, durable mineral particles well-graded from fine to coarse, free from injurious amounts of acid, alkalis, oils, saline, organic and

other deleterious substances in accordance with accepted engineering practice. Masonry mortars shall have a flow after suction of not less than seventy (70) percent and shall conform to the reference standards of this article.

MORTAR PROPORTIONS (Parts By Volume)

| Mortar Type | Portland Cement | Masonry Cement | Hydrated Lime or Lime Putty Min. | Hydrated Lime or Lime Putty Max. | Damp Loose Aggregate |
|---|---|---|---|---|---|
| M | 1 | - | - | ¼ | |
| | 1 | 1 | - | - | |
| S | 1 | - | ¼ | ½ | |
| | ½ | 1 | - | - | |
| N | 1 | - | ½ | 1¼ | not less than 2¼ and not more than 3 times the sum of the volumes of the cements and limes used. |
| | - | 1 | - | - | |
| O | - | 1 | - | - | |
| | 1 | - | 1¼ | 2½ | |

816.3 TYPES OF MORTAR PERMITTED: Unit masonry shall be laid in mortar of the following types:

| TYPE OF MASONRY | TYPES OF MORTAR PERMITTED |
|---|---|
| Masonry in contact with earth | M or S |
| Grouted and filled cell masonry | M or S |
| Masonry above grade or interior masonry: | |
| Piers of solid units | M, S or N |
| Piers of hollow units | M or S |
| Walls of solid units | M, S, N or O |
| Walls of hollow units | M, S or N |
| Cavity walls and masonry bonded hollow walls | |
| Design wind pressure exceeds 20 psf | M or S |
| Design wind pressure 20 psf or less | M, S or N |
| Glass block masonry | S or N |
| Nonloadbearing partitions and fireproofing | M, S, N, O or Gypsum |
| Gypsum partition tile or block | Gypsum |
| Fire brick | Refractory air-setting mortar |
| Linings of existing masonry, above or below grade | M or S |
| Masonry other than above | M, S or N |

816.4 SPECIAL MORTARS: other special masonry mortars in place of the mortar types listed in section 816.2 may be approved provided they develop the minimum compressive strengths specified for the respective mortars they replace. The strength classification of a special mortar or special mix may be determined by compressive strength tests with the materials and in the proportions representative of those to be used in actual practice. In no case shall the allowable unit working stresses in the masonry be more than one-fourth (¼) the average ultimate compressive strength of the assembled test samples.

816.5 GYPSUM MORTAR: Gypsum mortar shall be composed of one (1) part of unfibered calcined neat gypsum to not more than three (3) parts sand by weight. Only gypsum mortar shall be used with gypsum tile and block units. Gypsum shall conform to the reference standards of this article.

816.6 MORTARS FOR CERAMIC WALL AND FLOOR TILE: Mortars for installing ceramic wall and floor tile shall be of the following composition measured by volume:

| | | |
|---|---|---|
| Walls: | Scratch coat | 1 cement: 1/3 hydrated lime: 4 sand |
| | Setting bed and Leveling coat | 1 cement: 1/2 hydrated lime: 4 sand |
| Floors: | Setting bed | 1 cement: 5 sand |
| Ceilings: | Scratch coat and setting bed | 1 cement: 1/2 hydrated lime: 3 sand |

or other mortars of comparable adhesive strength and durability, in accordance with the reference standards of this article.

816.61 DRY-SET PORTLAND CEMENT MORTARS: Dry-set Portland cement mortars to be used in the installation of ceramic tile shall be in accordance with standard specification for dry-set Portland cement mortar listed in the reference standards of this article.

816.7 ORGANIC ADHESIVES: Organic adhesives to be used in installing ceramic tile shall have a shear bond strength in accordance with commercial standard for adhesives for installations of clay tile listed in the reference standards of this article.

## SECTION 817.0 CONCRETE AGGREGATES

817.1 AGGREGATE QUALITY: Concrete aggregates shall conform to the reference standards of this article for organic impurities, soundness, mortar strength, durability, weather resistance, fire resistance, and wearing qualities.

817.2 FIRERESISTANCE: Coarse aggregate in concrete shall be rated in respect to the fireresistance of concrete made therewith on the basis of performance in fire test on building elements such as columns, floors, partitions and wall conducted in accordance with standard fire test specifications applicable to such test. Protective coverings of encasements of concrete for steel in fireresistive construction shall likewise be selected on the basis of performance in applicable standard fire tests. All concrete constructions shall meet the requirements of article 9 as regulated by the provisions of table 2-5.

817.21 GRADE 1 CONCRETE: Grade 1 concrete shall mean concrete made with aggregates such as blast-furnace slag, burned clays, and calcareous, igneous, and most silicate crushed stones and gravels and shales, as well as any other aggregates performing as required by the Basic Code for the appropriate construction when tested in accordance with standard methods of fire tests of building construction and materials listed in the reference standards of article 9.

817.22 GRADE 2 CONCRETE: Grade 2 concrete shall mean concrete made with aggregates such as cinders and crushed stones and gravels composed essentially of quartz and quartzite cherts as well as any other aggregates performing as required by the Basic Code for the appropriate construction when tested in accordance with standard methods of fire tests of building construction and materials listed in the reference standards of article 9.

817.3 SIZE OF AGGREGATES: Fine aggregates shall conform to the reference standards of this article and shall be well-graded from fine to coarse. Coarse aggregates shall not exceed one-fifth (1/5) of the narrowest dimensions between sides of the form nor three-quarters (3/4) of the minimum clear spacing between reinforcing bars and shall conform to the reference standards of this article.

817.4 SPECIAL AGGREGATES: Special aggregates, including among others, perlite, vermiculite and other processed mica, pumice, lava, tufa, volcanic glass, slag, coke, expanded clay and shale used in concrete and plaster construction shall meet all requirements of the approved rules and shall be classified in their respective fireresistant grades as determined by test. When used for fire protection purposes only, the building official may waive mortar strength requirements for such aggregates providing the concrete is shown by test to have adequate strength for the intended use.

## SECTION 818.0 READY-MIX CONCRETE

818.1 CONTROL: Ready-mix concrete for use in ordinary or in controlled materials procedure shall conform to section 842 for reinforced concrete and to the applicable standards listed in the reference standards of this article.

818.2 TRANSPORTATION: Ready-mixed concrete shall be transported in approved conveyances which insure delivery of the concrete at the site in a plastic, workable and unhardened state. The maximum amount of concrete hauled in an agitator shall not exceed the approved rating of the conveyance; and the period of delivery shall not exceed the time in which loss of plasticity may occur and generally not more than one and one-half (1½) hours after the mixing of cement and water.

818.3 ORDINARY MATERIALS PROCEDURE: When ready-mix is used under the ordinary materials procedure, either the cement content in bags per yard of concrete together with the maximum permissible slump shall be specified. The cement factor and water cement ratio shall conform to the provisions of the reference standards of this article.

## SECTION 819.0 STRUCTURAL WOOD GLUES

819.1 QUALITY OF GLUE: Glues used in structural assemblies of built-up or laminated lumber sections shall develop the full strength of the wood, shall not produce decomposition or deleterious chemical reaction in the wood structure, shall not be attractive to vermin and shall conform to the reference standards of this article.

819.2 MANUFACTURERS' REQUIREMENTS: Approved structural glues shall be handled, mixed and applied as prescribed by the manufacturer and the gluing shall be done only in accordance with the timber construction standards listed in the reference standards of this article.

819.3 TYPES OF GLUE: Structural glues shall be classified as dry use and wet use in conformance with the reference standards of this article.

## SECTION 820.0 INTERIOR LATHING AND PLASTERING

All interior lathing and plastering shall conform to the standards of accepted engineering practice for lathing, furring and accessories and gypsum and Portland cement plastering listed in the reference standards of this article except as may otherwise be provided in this article for specific materials.

820.1 INSTALLATION

820.11 INSPECTION: The building official shall be notified not less than twenty-four (24) hours in advance of all plastering work, and no plaster shall be applied until after the lathing or other plaster base has been inspected and approved by him.

820.12 WEATHER PROTECTION: When plastering work is in progress, the building or structure shall be temporarily enclosed and in freezing weather the enclosure shall be heated to protect the plaster from injury.

SECTION 821.0 EXTERIOR LATHING AND STUCCO

All exterior lathing, plastering and stucco work shall be installed of Portland cement or other approved mortar, as provided in the reference standards of this article or as provided in this Code for specific materials.

821.1 REINFORCEMENT: All stucco work shall be reinforced with approved metal lath or wire fabric except when applied directly to a masonry or concrete base, or when installed on a masonry base which is protected with bituminous surfacing.

821.2 MINIMUM WEIGHT: Metal lath, expanded metal and wire reinforcing fabric shall weigh not less than the following:

| Type of Reinforcement | Minimum U.S. Gage | Maximum Mesh inches | Minimum Weight Pounds per Square Yard |
|---|---|---|---|
| Metal lath ..... | - | - | 3.4 |
| Expanded metal ..... | - | - | 1.8 |
| Woven wire ..... | 18 | 1 | 1.74 |
| Woven wire ..... | 17 | 1¼ | 1.41 |
| Woven wire ..... | 16 | 2 | 1.47 |
| Welded wire ..... | 18 | 4 sq. in. | 0.67 |
| Welded wire ..... | 17 | 4 sq. in. | 0.82 |
| Welded wire ..... | 16 | 4 sq. in. | 1.10 |

821.3 CORROSION RESISTANCE: All metal lath and stucco reinforcing fabric shall be protected with a zinc, or other approved rust-resistive coating or rust-inhibitive paint, or shall be manufactured from approved corrosion-resistive alloys.

821.4 SHEATHING: Except in back-plastered construction, the studs shall be covered with approved sheathing complying with section 855; or not less than No. 18 U.S. gage galvanized wire shall be stretched horizontally at six (6) inch centers and shall be covered with not less than fourteen (14) pound waterproof felt or paper before applying the reinforced stucco; or an approved paper-backed wire fabric may be used of not less than No. 14 U.S. gage galvanized wire with stiffening ribs not more than five (5) inches on centers to which is attached a double layer of fibrous waterproof backing. The mesh opening shall not exceed two by two (2x2) inches.

821.5 BACK PLASTERED CONSTRUCTION; In back-plastered construction, when spacing of studs exceeds sixteen (16) inches, approved horizontol noncombustible cross-furring at not more than sixteen (16) inch centers shall be first applied; unless approved stiffened lath is used and the frame is adequately stiffened as provided in section 855.

821.6 APPLICATION ON MASONRY BASE: When applied directly to masonry or monolithic concrete, the surfaces shall be roughened, hacked or bush-hammered to provide bond, or a preparatory dash coat of Portland cement grout shall be applied. The dash coat shall be kept damp for at least two (2) days after application and before applying succeeding stucco coats.

821.7 PROTECTION.

821.71 FROM FREEZING: At all times during application and for a period of not less than forty-eight (48) hours after application of each coat, provision shall be made to keep stucco work above fifty (50) degrees F.

821.72 FROM MOISTURE: Stucco shall be kept a sufficient height above ground surfaces as provided in section 855 and all sills, coping and projecting courses shall be flashed and provided with drips as therein specified.

821.73 FROM RAPID DRYING: Stucco shall be protected from heat, sun, and wind for the first forty-eight (48) hours to prevent premature drying.

## SECTION 822.0 PLASTERING MATERIALS

All sand, quick-lime, hydrated lime, hair binder, gypsum, keene and Portland cements, pozzuolanic cements and aggregates and other materials used in plastering shall be stored, protected and applied in accordance with the reference standards of this article.

822.1 SPECIAL CEMENTS AND PLASTERS: Approved cements used in plastering may have admixtures of approved plasticity agents added in the manufacturing process or when mixing plaster at the site in the approved proportions. All premixed special plasters, cements and aggregates shall be packaged and identified with the approved label.

822.2 LIME PLASTER: Lime and hydrated lime plasters for use in base and finish coats shall be applied in accordance with the reference standards of this article and the manufacturers' specifications.

822.3 GYPSUM PLASTER: All gypsum plaster shall comply with the reference standards of this article.

822.4 GYPSUM PLASTERS WITH SPECIAL AGGREGATES: When gypsum is used with manufactured aggregates in place of natural sand for plaster, the mixture shall be proportioned and applied in accordance with the manufacturer's recommendations and the reference standards of this article.

## SECTION 823.0 PLASTER BASES

823.1 FIBER BOARDS: Approved fiber boards used as plaster bases shall comply with section 824. The surface of such boards shall be of a rough,

fibrous texture to insure mechanical and suction bond; and the boards shall meet the bond and strength tests specified in the reference standards of this article.

823.2 GYPSUM LATH: Except when greater thickness is required for fireresistance under the provisions of article 9, or as herein specified, gypsum lath used for plastering shall be not less than three-eighths (3/8) inches thick and shall comply with the reference standards of this article.

823.3 PERFORATED GYPSUM LATH: Where required to provide specified time-temperature performance, perforated gypsum lath shall be not less than three-eighths (3/8) inches thick. The openings shall be equivalent to three-quarter (3/4) inch diameter holes for each sixteen (16) square inches of lath surface; or the lath shall be perforated as determined by full size tests for load, strength and fireresistance ratings.

823.4 METAL LATH: The dimensions and sizes of expanded, ribbed and sheet metal lath shall comply with the reference standards of this article; and shall be fabricated from not less than No. 30 U.S. gage steel sheets. It shall be manufactured from copperbearing steel, coated with rust-inhibitive paint after cutting, or cut from zinc-coated steel sheets.

823.5 WIRE LATH: All types of wire lath shall comply with the reference standards of this article; and shall be fabricated from woven or welded wire of not less than No. 19 W & M gage with not more than two and one-half (2½) meshes to the inch. Woven or welded wire reinforcement shall be coated with zinc or rust-inhibitive paint.

823.6 PAPER-BACKED LATH: Expanded metal or wire lath backed with integral approved paper shall be fabricated from the minimum gages and weights specified in sections 823.4 and 823.5.

823.7 COMBUSTIBLE LATH: Wood lath shall be erected horizontally on walls and partitions and ceiling lath shall run in one direction only; but in neither case shall it extend through cross-partitions from room to room. Wood lath shall be not less than one (1) inch wide nor less than five-sixteenths (5/16) inches thick and shall comply with all the requirements of accepted engineering practice. The lath joints shall be staggered so that not more than seven (7) laths occur in any one continuous break.

## SECTION 824.0 FIBER BOARDS

Insulating boards manufactured with wood or other vegetable fibers used as building boards for sheathing, roof decks, plaster bases, interior wall and ceiling finish, roof insulation or sound deadening, shall be vermin proof, resistant to rot-producing fungi and water-repellent and shall meet the strength and durability tests specified in the reference standards listed in this article.

824.1 JOINTING: To insure tight-fitting assemblies, edges shall be manufactured square or shiplapped, beveled, tongue-and-grooved or U-jointed; and shall be installed in accordance with the reference standards of this article.

824.2 PLASTER BASE: When used as a plaster base, fiber boards shall be permitted in fireresistive construction complying with the test provisions of article 9, except where specifically prohibited in fireproof (type 1) and noncombustible (type 2) construction.

824.3 ROOF INSULATION: When used as roof insulation in all types of construction, fiber boards shall be protected with an approved type of roof covering.

824.4 WALL INSULATION: When installed and firestopped to comply with article 9, fiber boards may be used for wall insulation in all types of construction. In firewall and fire division construction, unless treated to be noncombustible, the boards shall be cemented directly to the masonry or other combustible veneer anchored to the base without intervening air spaces.

824.5 DRY WALL CONSTRUCTION: Where fireresistance ratings are required, provisions shall be made for interlocking, lapping or otherwise protecting the joints between adjacent boards to insure smoke and flame tightness.

824.6 INSULATING ROOF DECK: When used as roof decking in open beam construction fiber board insulating roof deck shall have a minimum nominal thickness not less than one (1) inch.

## SECTION 825.0 PLYWOOD

825.1 QUALITY: All plywood when used structurally shall meet the performance standards and all other requirements of the reference standards of this article for the type, grade and identification index or species group of plywood involved, and shall be so identified by an approved agency. Working stresses shall conform to the standards of accepted engineering practice in conformance with the reference standards of this article.

825.2 TYPES: Plywood for interior use may be either of the moisture resistant or exterior type; plywood for exterior use shall be of the exterior waterproof type. Exterior plywood may be applied directly to the framing as a siding, provided it has a nominal thickness of three-eighths (3/8) inch. Joints shall occur over framing members, unless wood or plywood sheathing is used or joints are lapped horizontally a minimum of one and one-half (1½) inches or otherwise made waterproof to the satisfaction of the building official. If plywood is used as lapped siding without sheathing, the wall framing to which it is attached shall be diagonally braced.

825.3 SPANS: The maximum spans for plywood roof sheathing and subflooring shall be limited by the allowable stresses and deflections for the design live load but shall have not less than the identification index listed in the reference standards of this article, provided it is continuous over two (2) or more spans and laid with face grain perpendicular to the supports.

825.31 VERTICAL MAXIMUM STUD SPACING: Stud spacing for vertical sheathing and for use in stress-skin panel or other prefabricated constructions shall be determined by accepted engineering analysis or by the tests prescribed for prefabricated assemblies in section 803.

825.32 The allowable span for plywood combination subfloor underlayment shall conform to the reference standards of this article.

## SECTION 826.0 WALLBOARDS AND SHEATHING

826.1 SHEATHING: Sheathing of particleboard, gypsum, processed fiber and other approved materials shall conform to the reference standards of this article. When used in frame construction, they shall meet requirements of section 855.1 and 855.2. When required to meet fire-resistance ratings, the assembled construction shall comply with table 2-5 for structural elements and article 9 for trim and finishes.

826.2 WALLBOARDS: Wall board of particleboard, gypsum, processed fiber and other approved materials shall conform to the reference standards of this article. When required to meet fireresistance ratings, the assembled construction shall comply with table 2-5 for structured elements and article 9 for trim and finishes.

## SECTION 827.0 STRUCTURAL STEEL CONSTRUCTION

Structural steel construction used in all buildings and structures shall be fabricated from materials of uniform quality, free from defects that would vitiate the strength or stability of the structure. Workmanship, design, fabrication, transportation and erection shall conform to accepted engineering practice as defined by the reference standards of this article.

827.1 PLANS: Design plans drawn to appropriate scale show the size, section and relative locations of all structural members with floor levels, column centers and all offsets fully dimensioned; and the design loads shall be clearly indicated for all parts of the building or structure.

827.2 IDENTIFICATION: Structural steel that is required to have a minimum yield point greater than thirty-six thousand (36,000) pounds per square inch shall at all times in the fabricator's plant, be marked, segregated, or otherwise handled so that the separate alloys and tempers are positively identified, and after completion of fabrication, shall be marked to identify the alloy and temper. Such markings shall be affixed to completed members and assemblies or to boxed or bundled shipments of multiple units prior to shipment from the fabricator's plant.

827.3 SHOP DRAWINGS: Shop drawings, giving complete information necessary for the fabrication of the component parts of the structure, including the types of material, the location, type and size of all rivets, bolts and welds, shall be prepared in advance of the actual fabrication. They shall clearly distinguish between shop and field rivets, bolts and welds. Shop drawings shall be made in conformity with the best modern practice and with due regard to safety, speed and economy in fabrication and erection.

827.4 WELDING: All welded construction shall be designed by qualified registered professional engineers and shall be supervised by qualified registered professional engineers and qualified technicians licensed and registered by the State Building Code Commission. Welds shall be made by welders, tackers, and welding operators who are licensed and registered by the State Building Code Commission to perform the type of work required, as prescribed in the reference standards of this article.

827.5 PAINTING: All painting shall comply with the specifications for design, fabrication and erection of structural steel for buildings listed in the reference standards of this article.

SECTION 828.0 FORMED STEEL CONSTRUCTION

828.1 DESIGN: The design of all light gage and formed steel members and assembled wall, floor and roof panels, used alone or in combination with other structural members, or with component materials, shall be based on allowable unit stresses and maximum deflections in conformance with the reference standards of this article.

828.2 SECONDARY STRUCTURAL SYSTEM: Formed steel floor, wall and roof systems may be designed and constructed to resist all vertical and horizontal moments and shears resulting from lateral forces. Such members, when designed to transmit horizontal shears due to wind or other lateral forces, shall be connected to the supporting structure so as to adequately resist all primary and secondary stresses. When concrete topping or other approved decking is installed in a manner to insure composite action of the assembly, the strength of the composite member may be included in the calculations.

828.3 PROTECTION.

828.31 SHOP COAT: All individual structural members and assembled panels of light gage and formed steel construction, except where fabricated of approved corrosion-resistive metallic steel or of steel having a corrosion-resistive or other approved coating, shall be protected against corrosion with an acceptable shop coat of paint, enamel, or other approved protection.

828.32 FIELD COAT: After erection where directly exposed to the weather, except when encased in concrete made of non-corrosive aggregates, or where fabricated of approved corrosion-resistive steel, or of galvanized or otherwise adequately protected steel, individual structural members and assembled panels of light gage and formed steel construction shall be given an additional coat of acceptable protection.

828.33 SIDING: Exposed siding or sheathing shall be fabricated of approved corrosion-resistive steel or otherwise protected at the ground level for sufficient height above grade as determined by the depth of average snowfall in the locality, but in no case for a height of less than eight (8) inches.

828.34 PROTECTION AT EXTERIOR WALLS: Floor or roof construction which extends into an exterior wall shall be adequately waterproofed and protected from the weather to prevent corrosion.

828.4 TESTS: When not capable of design by accepted engineering analysis, the building official shall require tests of the individual or assembled structural units and their connections as prescribed in sections 803 and 804. At least three (3) specimens truly representative of the construction to be used in practice shall be subjected to the prescribed test and the mean of the results shall determine the safe working value; provided that any individual test varying more than ten (10) percent from the mean value shall cause rejection of the series.

## SECTION 829.0 OPEN WEB STEEL JOISTS

Steel joists may be used as secondary members in floor and roof construction, other than around stairwells, shafts and other floor openings. The materials, design and construction methods shall conform with the reference standards of this article.

### 829.1 DESIGN.

829.11 LOADS AND STRESSES: Connections of all members shall be designed with the minimum possible eccentricity and all secondary stresses shall be included with primary stresses in the design. In buildings subject to heavy concentrations or moving loads, the construction shall be designed to resist the vertical and lateral components of such loads in addition to the live and dead loads specified in article 7.

829.12 PARTITIONS: The joists shall be designed to support the dead load of partitions wherever they occur in addition to all other imposed dead and live loads.

829.2 PROTECTION: Painting of steel joists shall be in accordance with the requirements of section 828 for formed steel construction; or the joist shall be dipped in an approved hot asphalt, or shall be protected by painting, dipping or spraying with approved cold asphalt at the place of manufacture.

829.3 HEIGHT AND AREA LIMITATIONS: When the main structural frame is designed to resist all horizontal and vertical moments and shears due to lateral forces, and the secondary system consists of steel joists which are attached to the supporting beams and girders of the frame as specified in the standards, steel joist construction of the required fireresistance may be used in all buildings within the height limits of table 2-6.

829.4 TESTS: When not subject to accepted engineering analysis as regulated by the standard for steel joist construction, the assembly shall meet the load test requirements specified in sections 803 and 804.

## SECTION 830.0 REINFORCING STEEL

Metal reinforcement for reinforced concrete, reinforced gypsum, concrete, reinforced brickwork and reinforced hollow block construction shall comply with the reference standards of this article.

830.1 IDENTIFICATION: All reinforcing bars shall be rolled with raised symbols or letters impressed on the metal identifying the manufacturing mill. When required by the building official, the grade of material shall be identified by satisfactory mill tests. All bundles or rolls of cold-drawn steel wire reinforcement and of one-quarter (¼) inch rounds shall be securely tagged to identify the manufacturer and the grade of steel.

830.2 HIGH YIELD STEELS: When the yield point of reinforcing bar steel is fifty thousand (50,000) pounds per square inch or more, the building official shall approve tension stresses in bending and compression stresses in vertical column reinforcement not more than forty (40) percent of the minimum yield point, and in conformity with the reference standards of this article. Such stresses shall be not more than thirty-thousand (30,000) pounds per square inch except when pre-stressed reinforcement is used.

830.3 COLUMN REINFORCEMENT

830.31 STRUCTURAL STEEL SECTIONS: The allowable unit stress on structural steel column sections shall conform with the provisions of the reference standards of this article.

830.32 CAST IRON SECTIONS: All cast iron used as reinforcement in combination with concrete shall be of pit-cast water pipe grade complying with the reference standards of this article; and the allowable unit stress shall be not more than ten thousand (10,000) pounds per square inch.

830.4 TESTS: When unidentified reinforcement is approved for use under ordinary material procedure, not less than three (3) tension and three (3) bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work.

## SECTION 831.0 CAST STEEL CONSTRUCTION

831.1 MATERIALS: Carbon steel casting for building construction shall be cast from open hearth or basic oxygen steel conforming to the requirements of the reference standards of this article. All castings shall be free from injurious blow holes or other defects which would impair the structural strength.

831.2 HIGHER STRENGTH CAST STEEL: Higher strength cast steel may be used when approved under controlled material procedures.

831.3 WELDING CAST STEEL: Cast steel designed for use in welding shall be of weldable grade complying with the approved rules.

## SECTION 832.0 CAST IRON CONSTRUCTION

832.1 MATERIALS: Cast iron for building construction shall be a good foundry mixture providing clean, tough, gray iron, free from serious blow holes, cinder spots and cold shuts; conforming to the reference standards of this article.

832.2 LIMITATIONS OF USE: Cast iron columns shall not be used where subject to eccentric loads which produce a net tension in the section, nor in any part of a structural frame which is required to resist stress due to wind. Cast iron columns shall not be used in the primary structural frames of buildings whose height exceeds one hundred (100) feet or twice the width at the ground level. Cast iron shall not be used for columns required to have four (4) hour fireresistive protection. Cast iron columns supporting a floor shall not be longer than seventy (70) times the least radius of gyration or twenty-four (24) times the outside diameter or least side. Cast iron columns supporting roof loads only shall not be longer than ninety-six (96) times the least radius of gyration or thirty (30) times the outside diameter or least side; cast iron columns shall not be smaller than six (6) inches in outside diameter or side.

832.3 MULTI-STORY COLUMNS: Cores of superimposed columns shall be of the same dimensions above and below a splice. When a column of smaller diameter is superimposed over one of larger diameter, the larger column shall be tapered down to the smaller diameter over a length of not less than six (6) inches.

832.4 THICKNESS OF METAL: The minimum thickness of cast iron shall be not less than herein specified:

832.41 COLUMNS: In columns, the metal shall be not less than one-twelfth (1/12) the smallest dimension of the cross-section and in no case less than three-quarter (3/4) inch.

832.42 BASES AND BRACKETS: In bases and flanges, the metal shall be not less than one (1) inch thick reinforced with fillets and brackets;

832.43 LINTELS: In lintels, the metal shall be not less than three-quarter (3/4) inches thick and shall be limited to use on spans of not more than six (6) feet.

832.5 INSPECTION: No cast iron column shall be erected in place before it has been inspected and approved by the building official. The use of any cast iron column in which blow holes or imperfections reduce the effective area of the cross-section more than ten (10) percent shall be prohibited. Where required by the building official, three-eighth (3/8) inch round inspection holes shall be drilled in the section to expose the thickness of metal for inspection purposes.

## SECTION 833.0 SPECIAL STEELS

833.1 IDENTIFICATION: Silicon, nickel and other corrosion-resistive alloy and high strength steels with minimum yield points in excess of thirty-six thousand (36,000) used in the design and construction of buildings and structures shall conform to the standards of accepted engineering practice. Every such special steel shall be marked or otherwise identified to clearly distinguish it from all other classes of steel.

833.2 DESIGN AND WORKMANSHIP: Design and fabrication methods shall conform to the requirements of the approved rules.

## SECTION 834.0 LIGHT WEIGHT METAL ALLOYS

Aluminum and other approved light weight metals and alloys shall be used for structural purposes in buildings and structures in accordance with the reference standards of this article.

## SECTION 835.0 MASONRY WALL CONSTRUCTION

835.1 DESIGN: All masonry construction shall comply with the provisions of this article governing quality of materials and manner of construction; and shall be of adequate strength and proportions to support all superimposed loads within working stresses prescribed in the Basic Code and the reference standards of this article.

835.2 Wetting of Brick: Brick (clay or shale) shall be wetted when laid unless their gain in weight resulting from partial immersion flatwise in one-eighth (1/8) inch of water for one (1) minute is less than twenty-five thousandths (0.025) ounce per square inch of immersed area.

835.3 PRECAUTIONS AGAINST FREEZING: All masonry shall be protected against freezing for not less than forty-eight (48) hours after installation; and shall not be constructed below twenty-eight (28) degrees F. on rising temperatures or below thirty-six (36) degrees F. on falling temperatures, without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing. No frozen materials shall be used nor shall frozen masonry be built upon.

835.4 INCORPORATION OF COMBUSTIBLES: No lumber or other combustible materials, except nailing blocks and ornamental timber to an extent permitted by the chasing restrictions of section 838 and the provisions of section 900.2 shall be incorporated in masonry walls, except as approved for combustible aggregates or component materials after fire test.

## SECTION 836.0 BONDING OF WALLS

Walls of solid, composite and hollow masonry and cavity and other hollow walls shall be bonded in accordance with accepted engineering practice.

836.1 RUBBLE STONE WALLS: All stones in rubble masonry shall be laid on their natural bed and the walls shall be bonded with not less than one (1) through bond stone for each nine (9) superficial square feet of area.

836.2 BUTTRESSES AND PIERS: All buttresses shall be bonded into the wall by a masonry bond. The piers and buttresses shall have sufficient strength and stability with sufficient bonding or anchorage between the walls and the supports to resist wind pressure and suction.

836.3 INTERSECTION WALLS AND PARTITIONS: Masonry walls and partitions shall be securely anchored or bonded at points where they intersect by one (1) of the following methods:

a) walls may be bonded by laying at least fifty (50) percent of the units at the intersection in true masonry bond with alternate units having a bearing of not less than three (3) inches upon the unit below, or they may be anchored with not less than three-sixteenths (3/16) inch corrosion-resistant metal wire ties or joint reinforcement at vertical intervals not to exceed two (2) feet, or by other equivalent approved anchorage.

b) where walls are carried up separately the intersection shall be toothed or blocked with eight (8) inch maximum offsets and shall be provided with approved metal anchors at vertical intervals of not more than four (4) feet or, when approved, blocking may be eliminated and rigid steel anchors shall be provided, spaced not more than two (2) feet apart vertically.

c) interior nonloadbearing walls may be bonded or anchored as required by 1 or 2 above or they may be anchored at their intersection, at vertical intervals of not more than two (2) feet, with at least twenty-two (22) gage corrosion-resistant corrugated metal ties seven-eights (7/8) inch in width, or other equivalent approved method of anchorage.

836.4 ERECTING PRECAUTIONS: Where hollow walls decrease in thickness, a course of solid masonry or of concrete-filled units, or a continuous bearing plate shall be interposed between the thicker and thinner sections. No wall shall be built up more than twenty-five (25) feet in advance of other walls of the same building or structure unless supported independently at each floor; and all walls shall be temporarily braced during erection.

## SECTION 837.0 LATERAL BRACING OF WALLS

All masonry walls shall be laterally supported by horizontal bracing of floor and roof framing or vertical bracing of columns, buttresses or crosswalls at vertical or horizontal intervals. All masonry walls shall be subject to the provisions of the reference standards of this article. Where applicable, masonry walls shall be subject to control as specified in Section 128.0. All such structures shall ensure that provision is made to transfer wind pressures and other lateral forces to the foundation.

SECTION 838.0 CHASES AND RECESSES IN BEARING WALLS

838.1 WHERE PERMITTED: Chases and recesses shall be prohibited in any wall less than twelve (12) inches thick or in the required area of piers and buttresses; except that eight (8) inch walls where permitted in residential buildings and the apron under window openings may be chased not more than four (4) inches in depth. Vertical chases adjacent to bearings of beams or lintels, vertical chases wider than twelve (12) inches and all horizontal chases shall be proportioned on the basis of stress analysis and such calculations shall be submitted by a qualified registered professional engineer or architect.

838.2 MAXIMUM SIZE: The maximum permitted depth of a chase in any wall shall be not more than one-third (1/3) the wall thickness, and the maximum length of a horizontal chase or the maximum horizontal projection of a diagonal chase shall not exceed four (4) feet except as provided in section 838.5; and except further that the length of the apron below window sills in all walls may equal the width of the window opening; and such aprons in eight (8) inch walls may be chased not more than four (4) inches in depth when waterproofed. The aggregate area of recesses and chases in any wall shall be not more than one-fourth (1/4) of the area of the face of the wall in any one story.

838.3 FIRERESISTIVE LIMITATIONS: It shall be unlawful to have chases or recesses which reduce the thickness of material below the minimum specified in article 9 for fire walls, fire divisions, fire partitions or required fire-protective covering of structural members.

838.4 HOLLOW WALLS: When chases and recesses are permitted in hollow walls and walls constructed of hollow blocks or tile, they shall be built-in with the wall. It shall be unlawful to cut chases in such walls after erection.

838.5 CONTINUOUS CHASES: Horizontal chases for the bearing of reinforced concrete floor and roof slabs may be continuous, provided anchors are installed above and below the floor construction to resist the bending and uplift in the wall due to flexure of the slab.

SECTION 839.0 CORBELED AND PROJECTED MASONRY

839.1 LIMITATIONS: No wall less than twelve (12) inches thick shall be corbeled except to support firestopping around floor framing; and except that eight (8) inch foundation walls may be corbeled to support brick-veneer frame and ten (10) inch cavity walls as provided in section 871. The maximum total horizontal projection of corbels shall be not more than one-half (1/2) the thickness of the wall. The maximum projection of one (1) unit shall neither exceed one-half (½) the depth of the unit nor one-third (1/3) its width at right angles to the face which is offset.

839.2 HOLLOW WALLS: Corbeling of hollow masonry or masonry built of hollow units shall be supported on at least one full course of solid masonry.

839.3 MOLDED CORNICES: Unless structural support and anchorage is provided to resist the overturning moment, the center of gravity of all projecting masonry or molded cornices shall lie within the middle third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

840.0 BEARING ON HOLLOW UNIT WALLS

840.1 BEARING DETAILS: Concentrated loads shall be supported upon a solid construction of solid masonry, concrete, or masonry of hollow units with cells filled with mortar, grout, or concrete and of sufficient height to distribute safely the loads to the wall, pilaster, or column, or other adequate provisions shall be made to distribute the loads.

840.11 JOIST BEARING: Solid construction for support under joists shall be at least two and one-quarter (2¼) inches in height, and joists supported on such construction shall extend into the masonry at least three (3) inches.

840.12 BEAM BEARING: Solid construction for support under beams, girders, or other concentrated loads shall be at least four (4) inches in height and the bearing of beams shall extend into the masonry at least three (3) inches.

840.2 CLOSURE TILE: All open cells in tiles or blocks at wall ends and at openings shall be filled solidly with concrete for a length of not less than twelve (12) inches, or reversed closure tile shall be used.

SECTION 841.0 PLAIN CONCRETE

Plain concrete is concrete cast in place and not required to be reinforced for structural purposes except with respect to shrinkage and temperature. Such concrete shall be subject to the reference standards of this article and, where applicable, subject to control by section 128.0.

841.1 LIMITATIONS: Plain concrete in loadbearing masonry or where exposed to soil or where used for fireresistive purposes, shall be of such proportions as to have a strength of at least fifteen hundred (1500) pounds per square inch and where exposed to wetting or freezing at least two thousand (2,000) pounds per square inch.

## SECTION 842.0 REINFORCED CONCRETE

842.1 Concrete materials, design, construction, inspection and testing involved in structures and parts thereof included in the categories of section 128.1 shall be subject to the control provisions of section 128.0 and shall conform to the reference standards of this article. In addition, any other structures or parts thereof, required by the building official to be subject to section 128.0 shall be subject to the same control as outlined in that section.

842.2 EMBEDDED MECHANICAL FACILITIES: Plumbing and heating piping and electrical conduits may be embedded in reinforced concrete floor and wall construction and in column fireproofing as provided in section 914.3. Piping for radiant heating purposes may be embedded in the structural floor or wall slabs, or may be installed in a separate concrete layer placed in addition to the required fireproof covering, as approved by the building official. In any case, the required area of reinforcement shall be provided in addition to such piping; and the conduits, pipes or other embedded mechanical facilities shall be so placed as to leave the strength and fireresistance of the construction undiminished.

## SECTION 843.0 STRUCTURAL CINDER CONCRETE

843.1 AGGREGATES: Approved cinder aggregates where permitted for use in structural and fireproofing concretes shall consist of clean, well burned cinders, containing a maximum of thirty-five (35) percent of unburned carbon and not more than one and one-half (1½) percent of sulphur nor more than a total of five (5) percent of volatile materials.

843.2 CINDER CONCRETE PROPORTIONS: Structural cinder concrete shall be mixed in the proportions of one (1) part Portland cement and not more than seven (7) parts of fine and coarse aggregate measures separately with a compressive strength of not less than eight hundred (800) pounds per square inch at twenty-eight (28) days' age.

## SECTION 844.0 SHORT SPAN FLOOR FILLING

For spans not exceeding ten (10) feet between steel flanges, the safe supporting capacity of concrete floor and roof slabs built as fireproof floor filling between steel beams shall be determined by the provisions of the reference standards of this article or in accordance with the approved rules for stone and light weight aggregate concrete and other approved fireresistive floor filling.

## SECTION 845.0 CONCRETE-FILLED PIPE COLUMNS

Concrete-filled pipe columns shall be manufactured from standard extra strong, or double extra strong steel pipe and tubing, filled with concrete.

845.1 DESIGN: The safe supporting capacity of concrete-filled pipe columns shall be computed in accordance with good engineering practice or determined by test. Where computed, the calculations and design shall be submitted by a qualified registered professional engineer or architect with his seal and signature. Where determined by test, such testing shall be done by an approved licensed registered facility.

845.11 CONCRETE: The concrete shall be designed in accordance with the reference standards of this article and shall be placed to ensure complete filling without voids.

845.2 CONNECTIONS: All caps, base-plates and connections shall be of approved types and shall be positively attached to the shell and anchored to the concrete core. Welding of brackets without mechanical anchorage shall be prohibited. When the pipe is slotted to accommodate webs of brackets or other connections, the integrity of the shell shall be restored by welding to insure hooping action of the composite section.

845.3 REINFORCEMENT: To increase the safe load supporting capacity of concrete-filled pipe columns, the steel reinforcement shall be in the form of rods, structural shapes or pipe embedded in the concrete core with sufficient clearance to insure the composite action in the section, but not nearer than one (1) inch to the exterior steel shell. All strucutral shapes used as reinforcement shall be milled to insure bearing on cap and base plates.

845.4 FIRERESISTIVE PROTECTION; Pipe columns shall be of such size or so protected as to develop the required fireresistance ratings specified in table 2-5. When an outer steel shell is used to enclose the fireproof covering, it shall not be included in the calculations for strength of the column section.

## SECTION 846.0 PNEUMATIC CONCRETE

Construction methods for mortar or concrete deposited pneumatically (shotcrete) shall conform to the reference standards of this article. Such mortar or concrete deposited pneumatically shall be applied only with the approval of the building official and shall be protected and cured to prevent the temperature falling below fifty (50) degrees F. or from loss of moisture at the surface. Reinforcement for pneumatic mortar shall be adequate to meet structural requirements and shall consist of round bars or mesh not less than No. 12 U.S. gage in diameter, spaced not less than two (2) nor more than four (4) inches either way, with a gross area of not less than two-tenths (0.2) percent of the cross-sectional area of the mortar layer.

846.1 GENERAL REQUIREMENTS: Pneumatically placed concrete shall consist of a mixture of fine aggregate and cement pneumatically applied by suitable mechanism, and to which water is added immediately prior to discharge from the applicator. Except as specified in the following sections, pneumatically placed concrete shall conform to the requirements of the Basic Code for reinforced concrete.

846.11 PROPORTIONS: The proportion of cement to aggregate, in loose dry volume, shall not be less than one (1) to four and one-half (4½).

846.12 WATER: The water content at the time of discharge, including moisture in the aggregate, shall not exceed three and one-half (3½) gallons per sack of cement.

846.13 MIXING: The cement and aggregate shall be thoroughly mixed prior to the addition of water. At the time of mixing the aggregate shall contain not less than three (3) percent moisture.

846.2 REBOUND: Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of pneumatically placed concrete. Rebound may be reused if it conforms to the requirements for aggregate, provided the amount of rebound material used shall not exceed twenty-five (25) percent of the total aggregate in any batch.

846.3 JOINTS: Unfinished work shall not be allowed to stand for more than thirty (30) minutes unless all edges are sloped to a thin edge. Before placing addtional material adjacent to previously applied work, these sloping edges shall be cleaned and wetted.

846.4 DAMAGE: Any pneumatically placed concrete which subsides after placement shall be removed.

## SECTION 847.0 MINIMUM CONCRETE DIMENSIONS

The protection of reinforced concrete structural elements in buildings of fireproof (types 1-A and 1-B) construction shall be adequate to meet the fire and strength tests of the Basic Code; but in no case less than the minimum dimensions established by the standards of accepted engineering practice. Any floor finish not placed monolithically with floor slabs, shall not be included in the calculations for structural strength, unless calculations submitted by a registered professional engineer or architect are submitted to justify incorporation of the floor finish as part of the structural element.

## SECTION 848.0 REINFORCED GYPSUM CONCRETE

Reinforced gypsum concrete for use in buildings and structures shall consist of a mixture of calcined gypsum and water, with or without the

addition of wood chips, shavings, fiber or other approved aggregates. The wood aggregates and gypsum shall be pre-mixed at the mill, requiring only the addition of water at the job or site. The manufacture, design and construction shall comply with the requirements of the standards of accepted engineering practice listed in the reference standards of this article.

848.1 LIMITATIONS OF USE: Gypsum concrete shall not be used where exposed directly to the weather or where subject to frequent or continuous wetting. To prevent saturation or freezing, protection from the weather and from contact with moisture shall be furnished during shipment and storage of prefabricated units, and after erection or pouring at the site.

## SECTION 849.0 REINFORCED BRICKWORK

All systems of brick masonry reinforced with steel in grouted mortar joints for use in the design and construction of buildings and structures shall conform to the requirements of this section and the standards of accepted engineering practice listed in the reference standards of this article. Reinforced brickwork shall be used only when design specifications are submitted by a registered professional engineer or architect and, where applicable, shall be subject to the control of section 128.0.

849.1 DESIGN: The formulae and assumptions used in the design or reinforced masonry shall be those contained in the reference standards of this article.

## SECTION 850.0 REINFORCED HOLLOW BLOCK CONSTRUCTION

Walls constructed of hollow block or other hollow unit masonry and reinforced with steel rods grouted solidly into the cells shall be designed and constructed in accordance with reference standards of this article; and plans and specifications shall be submitted by a registered professional engineer or architect. When applicable, the control of section 128.0 shall apply.

## SECTION 851.0 LUMBER AND TIMBER CONSTRUCTION

851.1 DESIGN: Structural lumber and timber and its fastenings shall be adequately designed and assembled to safely sustain all imposed loads. When stress-grade lumber is used and properly identified and controlled, working stresses may be in accordance with the accepted engineering practice standards listed in the reference standards of this article. All lumber used for load supporting purposes shall be

identified by the grade mark of a lumber grading inspection agency approved by the State Building Code Commission. Grading practices and the identification shall be in accordance with rules published by an agency approved by the Commission. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by an approved lumber grading or inspection agency may be accepted by the building official for precut, remanufactured, or rough sawn lumber; also for sizes larger than three (3) inches nominal thickness.

851.2 MINIMUM DIMENSIONS.

851.21 SIZES OF STRUCTURAL MEMBERS: All lumber sizes specified in the Basic Code are nominal sizes. Nominal sizes may be shown on the plans. Computations to determine the required size of members shall be based on the net dimensions (actual sizes).

851.22 STRUCTURAL POSTS: All isolated structural posts shall have a minimum dimension of four (4) inches.

851.3 FABRICATION.

851.31 CONNECTIONS: All connections shall be fabricated with approved timber connectors, bolts, lag screws, spikes, nails or gluing or other approved connecting devices in accordance with accepted engineering practice. Bolted connections shall be snugged up tightly without crushing wood fibers under the washers. All nailed connections shall meet the minimum requirements of the reference standards of this article.

851.32 CAMBERING: Trusses and long span girders shall be designed with sufficient camber or other provision shall be made to compensate for excessive deflection.

851.33 CUTTING AND NOTCHING: It shall be unlawful to notch, cut or pierce wood beams, joists, rafters or studs in excess of the limitations herein specified unless proven safe by structural analysis, or suitably reinforced to transmit all calculated loads. Notches in the top or bottom of joists shall not exceed one-sixth (1/6) the depth of the member and shall not be located in the middle one-third (1/3) of the span. Notches located closer to the supports than three (3) times the depth of the member shall not exceed one-fifth (1/5) the depth. Holes bored or cut into joists for piping or electrical cables shall not be closer than two (2) inches to the top or bottom of the joist and the diameter of the hole shall not exceed one-third (1/3) the depth of the joist. In studs of bearing walls or partitions, notches or bored holes made to receive piping, electrical conduit, air conditioning or heating duct work or for other fabricating purposes shall not be cut or bored more than one-third (1/3) the depth of the stud. When the stud is cut or bored in excess of one-third (1/3) its depth it shall be reinforced to be equal in load carrying capacity to a stud notched not more than one-third (1/3) its depth.

851.4 TRIMMER AND HEADER BEAMS: When determined necessary by stress analysis, trimmer and header beams shall be hung in approved metal or other approved noncombustible stirrups or hangers, unless supported on a masonry wall or girder. All such beams shall be spiked together.

851.5 BEARING AND ANCHORAGE ON GIRDERS: All members framing into girders shall be anchored or tied to secure continuity. The ends of all wood beams or joists resting on girders shall bear not less than four (4) inches or shall be supported in approved metal stirrups, hangers or on wood clips or ribbon strips. Beams framing from opposite sides shall lap at least six (6) inches and be bolted or spiked together; and when framing end to end, they shall be secured together by metal ties, straps or dogs.

851.6 MAINTENANCE: All connections in the joints of timber trusses and structural frames shall be inspected periodically and bolts and other connectors shall be maintained tight.

## SECTION 852.0 HEAVY TIMBER TYPE CONSTRUCTION

852.1 WOOD: All structural wood members sawn or glued laminated used in heavy timber type construction shall be stress-grade timbers identified as to grade strength by approved manufacturing, testing, or inspection agencies or bureaus. All structural timber members shall have the minimum dimensions specified in section 217.1 for type 3-A construction.

852.2 OTHER STRUCTURAL MATERIALS: Structural steel or reinforced concrete members may be substitued for timber in any part of the structural frame, protected to develop the required fireresistance specified in table 2-5, but not less than three-quarter (3/4) hour fireresistance. Structural members supporting walls shall be protected to afford the same fireresistance rating as the wall supported.

852.3 COLUMNS: Columns shall be continuous or superimposed throughout all stories by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or be timber splice plates affixed to the columns by means of metal connectors housed within the contact faces, or by other approved methods. Girder or trusses supporting columns shall have at least three-quarter (3/4) hour fireresistance.

852.4 FLOORS: The planks shall be laid so that no continuous line of joints will occur except at points of support and so that they are not spiked to supporting girders. Flooring shall not extend closer than one-half (½) inch to walls to provide an expansion joint, but the joint shall be covered at top or bottom to avoid flue action.

852.5 BEAMS AND GIRDERS.

852.51 WALL AND GIRDER SUPPORTS: Wall plate boxes of self-releasing type or approved hangers shall be provided where beams and girders enter

masonry. An air space of one-half (½) inch shall be provided at the top, end and sides of the member unless approved durable or treated wood is used. Where intermediate beams are used to support a floor, they shall rest on top of the girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they may be supported by approved metal hangers into which the ends of the beams shall be closely fitted. Wood beams and girders supported by walls required to have a fireresistance rating of two (2) hours or more shall have not less than four (4) inches of solid masonry between their ends and the outside face of the wall and between adjacent beams. Adequate roof anchorage shall be provided.

852.52 COLUMN CONNECTIONS: Where intermediate beams are used to support a floor, they shall rest on top of the girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they may be supported by approved metal hangers into which the ends of the beams shall be closely fitted.

## SECTION 853.0 WOOD FRAME CONSTRUCTION

The exterior walls, interior partitions, floors and roofs of wood frame construction shall be designed, braced and constructed to develop adequate strength and rigidity to resist all vertical and lateral forces due to both dead and live loads without exceeding the stresses allowed in this section for the various grades and species of wood. Standard balloon, braced, platform, and post and beam types of construction shall be acceptable framing methods. Sizes of wood members stated in this section are nominal sizes, materials, design, and construction methods shall meet the requirements in those applicable sections of the reference standards of this article.

### 853.1 WOOD-STUD FRAME.

853.11 BEARING WALLS: Posts and studs in bearing walls and partitions shall be designed as columns, with due allowance for lateral support furnished by sheathing, intermediate bracing, horizontal bridging, wall coverings and the floor and roof assemblies. The walls shall be fabricated in such a manner as to provide adequate support for the material used to enclose the building and to provide for transfer of all lateral loads to the foundation, in accordance with section 804.3.

853.12 NON-BEARING WALLS: Studs in non-bearing walls and partitions shall not be spaced more than forty-eight (48) inches on centers unless otherwise approved after test as an integrated assembly, and may be erected with the long dimension parallel to the wall.

853.13 BRACING: In buildings more than one(1) story in height and where necessary for strength in one (1) story buildings, the corner posts shall be the equivalent of not less than three (3) pieces of two (2) by four (4) inch studs, braced by not less than one (1) piece of one (1) by

four (4) inch continuous diagonal brace let into the studs. Bracing may be omitted when diagonal wood sheathing or plywood panels are used, or other sheathing specified in section 853.2 is applied vertically in panels of not less than four (4) feet by eight (8) feet in area with approved nailing complying with the reference standards of this article. Ledger or ribbon boards used in support joists shall be not less than one (1) by four (4) inches in size, cut into and securely nailed to each stud.

853.14 MORTISE AND TENON FRAMING: Where mortise and tenon framing is used, the vertical members of the frame shall be not less than four (4) by six (6) inches in size and shall be designed as a column.

853.15 MULTIPLE STORIES: When the frame is more than one (1) story in height and studs and posts are not continuous from sill to roof, the members shall be secured together with approved clips, splices or other connections to insure a continuous, well integrated structure. Sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistive materials equivalent to No. 20 U.S. gage steel sheets for two (2) inch framing members and not less than No. 18 U.S. gage for three (3) inch structural members. For four (4) inch and larger members, column splices and beam and girder supports shall comply with section 854.

853.16 FRAMING OVER OPENINGS: Headers, double joists, trusses or other approved assemblies of adequate size to transfer all superimposed loads to the vertical member shall be provided over all window and door openings in bearing walls and partitions.

853.2 WALL SHEATHING: Except as provided in section 853.3 for weather boarding or when stucco construction complying with section 821.5 is used, all enclosed buildings shall be sheathed with one of the materials of the following nominal thickness or any other material of equal strength and durability approved by the building official.

| | |
|---|---|
| Reinforced cement mortar | 1 inch |
| Wood sheathing | 5/8 inch |
| Particleboard | 3/8 inch |
| Plywood | 5/16 inch |
| Gypsum sheathing | 1/2 inch |
| Fiber boards | 1/2 inch |

853.21 PAPER-BACKED LATH SHEATHING: In one- and two-family dwellings and one (1) story commercial buildings with brick or similar veneers the sheathing may consist of a layer of paper-backed lath complying with section 821.4 with a one (1) inch intermediate space which shall be mortar filled as each course of veneering is applied.

853.3 EXTERIOR WEATHER BOARDING, VENEERS AND CONDENSATION: To secure weather-tightness in framed walls and other unoccupied spaces, the exterior walls shall be faced with an approved weather-resisting covering

properly attached to resist wind and rain. The cellular spaces shall be so ventilated as not to vitiate the firestopping at roof, attic and roof levels or shall be provided with interior non-corrodible vapor-type barriers complying with the approved rules; or other means shall be used to avoid condensation and leakage of moisture. The following materials shall be acceptable as approved weather coverings of the nominal thickness specified:

| | |
|---|---|
| Brick masonry veneers | 2 inches |
| Stone veneers | 2 inches |
| Clay tile veneers | 1/4 to 1 inch |
| Stucco or exterior plaster | 3/4 inch |
| Precast stone facing | 5/8 inch |
| Wood siding (without sheathing) | 1/2 inch |
| Wood siding (with sheathing) | 3/8 inch |
| Protected fiber board siding | 1/2 inch |
| Wood shingles | 3/8 inch |
| Exterior plywood (without sheathing) | See sec. 825.2 |
| Exterior plywood (with sheathing) | 5/16 inch |
| Asbestos shingles | 5/32 inch |
| Aluminum Cement boards | 1/8 inch |
| Aluminum clapboard siding | .024 inch |
| Formed steel siding | 29 gage |
| Hardboard siding | 1/4 inch |

853.31 MASONRY VENEERS: See section 860.0.

853.32 METAL VENEERS: See section 860.0.

853.33 HEIGHT OF VENEERS: See section 860.0.

853.34 NAILING: All weatherboarding and wall and roof coverings shall be securely nailed with aluminum, copper, zinc, zinc-coated or other approved corrosion-resistive nails in accordance with the nailing schedule in the reference standards of this article, or the approved manufacturer's standards.

Shingles and other weather coverings shall be attached with appropriate standard shingle nails to furring strips securely nailed to studs, or with approved mechanically-bonding nails except when sheathing is wood not less than one (1) inch nominal thickness or plywood not less than five-sixteenths (5/16) inch thick.

Wood shingles or shakes attached with approved corrosion-resistive annular grooved nails may be applied over fiberboard shingle backer and fiberboard sheathing when the installation is in accordance with the approved manufacturer's standards. Wood shingles or shakes and asbestos shingles or siding may be nailed directly to nail base fiberboard sheathing not less than one-half (½) inch nominal thickness with approved corrosion-resistive annular grooved nails when the installation is in accordance with the approved manufacturer's standards.

853.4 FOUNDATION ANCHORAGE: When required to resist wind uplift, walls sills shall be anchored to the foundation walls or piers at corners and at intermediate intervals of not more than eight (8) feet with one-half (½) inch bolts. The bolts shall be imbedded in the masonry foundation to a depth of not less than eight (8) inches in placed concrete, and not less than fifteen (15) inches in unit masonry. Sill plates shall be at least equivalent to a two (2) by six (6) inch member.

853.5 AT-GRADE PROTECTION.

853.51 WOOD FRAMING: All exterior wood framework of buildings whether structural or non load-bearing shall be supported on approved foundation walls at least eight (8) inches above the finished grade.

853.52 METAL SIDING: Exposed metal siding or sheathing shall be protected from corrosion at the ground level by supporting the foundation channel at sufficient height above grade on the concrete apron or other approved water-resisting foundation.

853.6 FLOORS.

853.61 BRIDGING: Except as hereinafter noted, in all floor, attic and roof framing, there shall be not less than one (1) line of bridging for each eight (8) feet of span. The bridging shall consist of not less than one (1) by three (3) inch lumber, double-nailed at each end, or of equivalent metal bracing of equal rigidity. A line of bridging shall also be required at supports where adequate lateral support is not otherwise provided.

Midspan bridging is not required for floor, attic or roof framing in one- and two-family dwellings (use group L-3) and multi-family dwellings (use group L-2) except when the joist depth exceeds twelve (12) inches nominal and/or when the minimum uniformly distributed live load exceeds forty (40) pounds per square foot.

853.62 FLOORING: The flooring of wood frame construction shall be of adequate strength and stiffness to support required loads and, where necessary for strength and for lateral support of the building, subflooring shall be provided.

853.7 ROOFS.

853.71 TYPES OF DECKING AND SHEATHING: Roof deck sheathing shall consist of not less than one (1) inch boards or plywood of the thickness specified in section 825.3, or other approved materials of equivalent strength and rigidity. When open-deck sheathing is used on pitched roofs, it shall consist of not less than one (1) by four (4) inch roofers spaced not more than six (6) inches on centers or material of equivalent strength and rigidity.

853.72 WOOD SHINGLES: Wood shingles and handsplit shakes complying with the reference standards of this article may be used for roof covering where permitted in section 928.3, and may be installed on tight decking or on spaced roof boards.

853.8 FLASHING: Approved corrosion-resistive flashing shall be provided at top and sides of all exterior window and door openings in such manner as to be leakproof. Similar flashings shall be installed at the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings; under and at the ends of masonry, wood or metal copings and sills; continuously above all projecting wood trim; at wall and roof intersections; under built-in gutters; at junction of chimneys and roofs; in all roof valleys and around all roof openings. When veneers of natural or artificial stone are used, fourteen (14) pound felt or paper shall be attached to the sheathing with flashing wherever necessary to prevent moisture penetration behind the veneer.

853.9 INTERIOR FINISH: In all habitable spaces, interior wall and partition surfaces shall be finished with materials which do not exceed the combustible limitations of section 904.0 and are of adequate strength to resist a horizontal force of not less than five (5) pounds per square foot.

SECTION 854.0 STRESS SKIN PANELS

854.1 INTEGRATED ASSEMBLIES: Approved panels or other integrated assemblies fabricated of dimension lumber with wood stress-coverings glued thereto, or consisting of structural units of metal-covered or molded plywood or other approved plastics, formed and molded into prefabricated load-bearing members shall be permitted for use in floors, roofs, walls, partitions and ceilings when designed in accordance with the reference standards of this article or meeting the test requirements of sections 803, 804, and 805.

854.2 SPLICES: Splices and connections between panels shall be weathertight and of sufficient strength to resist two and one-half (2½) times the design live load to which they will be subjected in normal use. The fastenings of covering assemblies to structural studs, ribs or joists shall provide rigidity equivalent to approved gluing. Nailing shall not be acceptable for that purpose.

854.3 MOLDED PLYWOOD UNITS: Structural units of plywood or other approved plastics of similar combustible characteristics formed and molded into prefabricated load-bearing members shall conform to the approved rules and shall be identified by the approved label. The design shall be based on accepted engineering analysis confirmed by the tests prescribed in sections 803 and 804.

## SECTION 855.0 STRUCTURAL GLUED LAMINATED TIMBER AND BUILT-UP WOOD CONSTRUCTION

Buildings and structures may be designed and erected of glued laminated structural members or of composite members of plywood and dimension lumber.

855.1 STRUCTURAL GLUED LAMINATED TIMBER: Structural glued laminated timber elements shall be manufactured in conformity with the provisions of the reference standards of this article.

855.2 GLUED LUMBER MEMBERS: Built-up beam and column sections consisting of one or more webs with glued lumber flanges and stiffeners, shall be designed in accordance with approved engineering analysis.

855.21 GLUING SURFACES: In glued lumber constructions, the surfaces to be glued shall be clean, plane and sound to provide a controlled glue line. The surfaces shall be free of wax, grease, oil or any other release agents to ensure full strength bonding.

SECTION 856.0 ENCLOSURE WALLS: All buildings, except as may be provided for miscellaneous structures designed for special uses, shall be enclosed on all sides with independent or party walls of frame, masonry or other approved construction. Such walls shall be constructed to afford the fireresistance specified in table 2-5 and as required in the Basic Code for location, use and type of construction.

856.1 EXTERIOR WALL POCKETS: In exterior walls of all buildings and structures, wall pockets or crevices in which moisture may accumulate shall be avoided or protected with adequate caps or drips, or other approved means shall be provided to prevent water damage.

856.2 EXCEPTIONS: The provisions of this article shall not be deemed to prohibit the omission of exterior walls for all or part of a story of a building in accordance with the provisions of section 906.1.

856.3 GLASS PANELS.

856.31 CONDITIONS OF USE: Glass, where used in exterior walls and for doors shall be subject to the provisions of this section. Glass subject to the requirements of human impact shall be identified by a permanent marking on each piece of glass so used.

856.32 SUPPORT FOR GLASS PANELS: Glass shall be firmly held in place, and the supports designed to resist any wind or impact load to which it may be subject. Where unusual conditions of support exist, they shall be designed and specified by a registered professional engineer or architect.

856.33 GLASS REQUIREMENTS: Unless otherwise stated herein, glass shall meet the requirements of the reference standards of this article for the applicable type, size, thickness and quality.

856.34 THICKNESS OF GLASS: Thicknesses of glass panels shall be chosen as provided in section 803.11.

856.35 DEFLECTION OF SUPPORT: The deflection of members supporting glass panels under the design wind load shall not exceed L/175 where L is the span of the supporting member. In no case shall such deflection exceed three-quarters (3/4) inch.

856.36 JALOUSIES: In jalousie windows and doors regular plate, float, sheet or rolled glass thickness shall be not less than three-sixteenths (3/16) inch; glass length shall not be more than forty-eight (48) inches; glass edges shall be smooth. Other types of glass may be used subject to the approval of the building official.

856.37 PANELS SUBJECT TO HUMAN IMPACT LOADS: Glass in prime and storm doors, interior doors, fixed glass panels that may be mistaken for means of egress or ingress, or in similar locations wherein one or more of the following criteria apply, shall meet the requirements set forth in table 8-1, or by comparative tests, shall be proven to produce equivalent performance:

a) Openings are located in regularly occupied spaces.
b) Lowest point of panel is less than eighteen (18) inches above finished floor.
c) Minimum dimension of panel is larger than eighteen (18) inches.

SECTION 857.0 PROTECTION OF WALL OPENINGS

857.1 FIRE-PROTECTED OPENINGS: Openings in exterior walls when required to be fire-protected shall comply with the provisions of article 9.

TABLE 8-1
REQUIREMENTS FOR GLASS PANELS SUBJECT TO IMPACT LOADS

| Glass Type | Individual Opening Area | Requirements |
|---|---|---|
| Regular plate, sheet or rolled (annealed) | Over 6 square feet | Not less than 3/16 inch thick. Must be protected by a push-bar or protective grille firmly attached on each exposed side, if not divided by a muntin. |
| Regular plate, sheet or rolled (annealed) surface sandblasted, etched, or otherwise depreciated | Over 6 square feet | Not less than 7/32 inch thick. Must be protected by a push-bar or protective grille attached on each exposed side. |
| Regular plate, sheet or rolled (annealed) obscure | Over 6 square feet | Not less than 3/16 inch thick. Must be protected by a push-bar or grille firmly attached on each exposed side. |
| Laminated | Over 6 square feet | Not less than 1/4 inch thick. Shall pass impact test requirements of reference standard RS 8-75. |
| Full-tempered | Over 6 square feet | Shall pass impact test requirements of reference standard RS 8-75. |
| Wired | Over 6 square feet | Not less than 7/32 inch thick. Shall pass impact test requirements of reference standard RS 8-75. |
| All unframed glass doors (swinging) | | Shall be fully-tempered glass and pass impact test requirements of reference standard RS 8-75. |

NOTES:

1) Glass less than single strength (SS) in thickness shall not be used.
2) If short dimension is larger than twenty-four (24) inches, glass must be double strength (DS) or thicker.

857.2 AREA OF OPENINGS: All openings facing on a street, yard, court, or public space which are required for light and ventilation shall comply with the provisions of article 5.

857.3 STRUCTURAL STRENGTH.

857.31 AGAINST WIND FORCES: In all buildings required to resist wind pressure under the provisions of article 7, exterior window openings shall be designed to resist the specified factored wind load.

857.32 SASH OR FRAMES: The glass, or other approved glazing material shall be of adequate thickness or shall be provided with steel frames or otherwise reinforced to resist the wind loads specified in article 7 blowing both inwardly and outwardly.

## SECTION 858.0 FIRE ACCESS PANELS

Completely enclosed buildings, without exterior openings in the enclosure walls, or without ready access for the purpose of fighting fire, shall be provided with access panels as required herein. Access panels shall be not less than thirty-two (32) inches by forty-eight (48) inches in size.

858.1 MULTI-STORY BUILDINGS: In all exterior walls of the building required to have thirty (30) foot wide open space adjacent thereto (see sections 307.1 and 308.1), each floor below a height of seventy (70) feet shall be provided with access panels spaced not more than fifty (50) feet apart in each story.

858.2 SINGLE-STORY BUILDINGS: In one (1) story buildings not more than seventy (70) feet in height:

a) roof vents shall be provided, spaced not more than one hundred twenty-five (125) feet apart; and

b) grade level doors, or fire access panels shall be provided spaced not more than one hundred twenty-five (125) feet apart in all exterior walls of the building required to have thirty (30) foot wide open space adjacent thereto (see sections

858.3 CONSTRUCTION OF ACCESS PANELS: Construction access panels

a) shall have a sill height of not more than thirty-six (36) inches; and

b) shall be readily identifiable from the outside; and

c) shall be readily openable from the outside or shall be glazed with plain flat glass.

858.4 LOCATION: Wherever practicable, one access opening in each story shall provide access to a stairway, or where there is no stairway at the exterior wall, one access opening in each story shall be located as close as practicable to a stairway.

858.5 EXEMPTIONS: The provisions of this article shall not apply to any story that is completely protected by an automatic sprinkler system conforming to the construction requirements of article 12.

SECTION 859.0 STRUCTURAL GLASS BLOCK WALLS

859.1 EXTERIOR WALL PANELS: The maximum dimensions of glass block wall panels in exterior walls when used singly or in multiples forming continuous bands of structural glass blocks between structural supports shall be twenty-five (25) feet in length and twenty (20) feet in height between structural supports and expansion joints; and the area of each individual panel shall be not more than two hundred and fifty (250) square feet. Intermediate structural supports shall be provided to support the dead load of the wall and all other superimposed loads. When individual panels are more than one hundred and forty-four (144) square feet in area a supplementary stiffener shall be provided behind the panels, anchored thereto and to the structural supports.

859.2 JOINT MATERIALS: Glass blocks shall be laid up in type S or N mortar with approved galvanized or other noncorrosive metal wall ties in the horizontal mortar joints of exterior panels. The sills of glass block panels shall be coated with approved asphaltic emulsion, or other elastic waterproofing material previous to laying the first mortar course and the perimeter of the panels shall be caulked to a depth of not less than one-half (½) inch with nonhardening caulking compound on both faces; or other approved expansion joints shall be provided. When laid up in joint materials other than mortars herein defined, no single panel shall be more than one hundred (100) square feet in area nor more than ten (10) feet in either length or height.

859.3 WIND AND EARTHQUAKE LOADS: Exterior wall panels shall be held in place in the wall opening to resist both the internal and external pressures due to wind and earthquake loads specified in sections 713.0 and 719.0.

859.4 INTERIOR WALL PANELS: Structural glass blocks shall not be used in fire walls or party walls or for load-bearing construction. Such blocks shall be erected with mortar in metal frames or reinforcement as provided in this section for exterior walls or other approved joint materials, except that wood strip framing may be used in partitions not required to be fireresistive.

859.5 FIRERESISTANCE RATING: Nothing herein contained shall be construed to prohibit the use of glass blocks in an opening protective assembly or nonbearing partition or wall when required to afford a specific fireresistance, provided approval of the building official is secured after satisfactory time-temperature performance under the prescribed test procedure of article 9.

859.6 ACCESS PANELS: Access panels shall be provided in exterior glass block walls for the fire department use to comply with section 858.0

SECTION 860.0 WALL FACINGS AND VENEERS

860.1 BACKING SURFACES FOR VENEERS: Veneers for other than frame buildings, shall be attached only to substantial, rigid, noncombustible surfaces which are plumb, straight and of true plane; and no wood backing surfaces shall be used except in frame construction. The backing shall provide sufficient rigidity, stability and weather resistance; and the veneer shall be installed and anchored as required in the Basic Code for the specific material.

860.2 VENEER THICKNESS: No materials used for nonbearing veneers on masonry walls shall have less than the following thickness:

| | |
|---|---|
| Ceramic veneer (architectural terra cotta - anchored type) | 1 inch |
| Brick | 2 inches |
| Stone (natural) | 2 inches |
| Stone (cast artificial) | 1-1/2 inches |
| Clay tile (structural) | 1-3/4 inches |
| Clay tile (flat slab) | 1/4 to 1 inch |
| Marble slabs | 1 inch |
| Precast stone facing | 5/8 inch |
| Structural glass | 11/32 inch |
| Aluminum clapboard siding | .024 inch |
| Metal (approved corrosion-resistive) | 28 U.S. Gage |

Masonry or other approved noncombustible materials used as facing on bearing walls or partitions shall not be considered to have structural value and shall be excluded in the determination of required wall thickness.

860.3 MASONRY VENEERS: Veneers of unit masonry shall be attached to the wood frame with at least twenty-two (22) gage corrosion-resistive, corrugated metal ties not less than seven-eighths (7/8) inch in width at vertical intervals of not more than sixteen (16) inches and horizontal intervals of not more than thirty-two (32) inches.

860.4 METAL VENEERS: Veneers of metal shall be fabricated from approved corrosion-resistive materials or shall be protected front and back with porcelain enamel or shall be otherwise treated to render the metal resistant to corrosion. Such veneers shall be not less than No. 29 gage in thickness mounted on wood or metal furring strips or approved sheathing on the frame construction.

860.5 HEIGHT OF VENEERS: The height and length of veneer areas shall be unlimited, except as required to control expansion and contraction. When attached to wood frame structures as provided in section 860.3, the veneer shall be supported on footings or foundation walls.

860.6 VENEER OR MASONRY: Veneer attached to masonry or concrete backing shall not be limited in height other than by compressive stresses. Veneer shall be securely attached to the masonry or concrete in an approved manner.

## SECTION 861.0 STRUCTURAL GLASS VENEERS

861.1 DIMENSIONS: The minimum thickness of glass veneer shall be eleven thirty-seconds (11/32) inch and the area of individual panels shall not exceed ten (10) square feet, with a maximum length of four (4) feet. The edge of each unit shall be ground square with a slight arris; and all exposed, external corners and angles shall be rounded to a radius of not more than three-sixteenths (3/16) inch.

861.2 CONSTRUCTION.

861.21 BACKING SURFACE: The glass veneer shall be set in mastic cement on a float coat of one (1) inch thick cement mortar reinforced with wire lath attached to noncombustible furring spaced not more than twelve (12) inches on centers.

861.22 SUPPORT OF VENEER: The base course of glass units shall be supported on a corrosion-resistive metal frame anchored to the backing and caulked with a waterproof compound at grade.

861.3 REINFORCEMENT: Metal reinforcing of cold formed corrosion-resistive angles of not less than No. 16 U.S. gage or other approved reinforcement shall be provided in all horizontal joints anchored into the masonry wall with expansion or toggle bolts.

861.4 EXPANSION JOINTS: Expansion joints shall be provided at ends and intermediate sections caulked with an approved waterproofing compound as required by the approved rules. Where necessary for watertightness, exposed edges shall be protected with corrosion-resistive metal or other approved noncombustible flashing.

861.5 OTHER LOADS: No signs, awning brackets or other loads shall be hung directly from glass veneers, but shall be supported on framing anchored to or otherwise supported by the masonry wall, free from contact with glass.

## SECTION 862.0 THIN STONE AND TILE VENEERS

862.1 SIZE OF UNITS: In localities subject to frost and freezing temperatures, tile and terra cotta units shall be frost-proof and shall not be more than two hundred and eighty-eight (288) square inches in area; and where not subject to frost action, the size of the tile may be increased not more than fifty (50) percent in area.

862.2 CONSTRUCTION: One (1) inch thick marble, granite, terra cotta, and similar materials; or ceramic tile facing one-quarter (¼) to one (1) inch in thickness shall be set in accordance with the applicable standards listed in the reference section of this article.

## SECTION 863.0 METAL VENEERS

863.1 MATERIALS: Veneers of metal shall be fabricated from approved corrosion-resistive alloys, or shall be covered front and back with approved porcelain enamel, or otherwise treated to render the metal resistant to corrosion.

863.2 CONSTRUCTION: The metal veneer shall be securely attached to the masonry or supported on approved metal framing protected by painting, galvanizing or other approved protection, or on wood studs and furring strips, treated with an approved preservative process.

863.3 WATERPROOFING: All joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

863.4 GROUNDING METAL VENEERS: Grounding of metal veneers on all buildings shall comply with the requirements of the Massachusetts State Electrical Code.

## SECTION 864.0 PLASTIC VENEERS

Veneers of approved weather-resisting non-combustible plastics shall be erected and anchored on a foundation coat, waterproofed or otherwise protected from moisture adsorption and sealed with a coat of mastic or other approved waterproof coating in accordance with the approved rules.

## SECTION 865.0 THICKNESS OF SOLID MASONRY WALLS

All masonry walls shall be of a thickness conforming to the reference standards of this article and subject to the maximum stresses, combined or direct as provided in this Code or in the reference standards.

## SECTION 866.0 THICKNESS OF PANEL WALLS

866.1 SOLID PANEL WALLS: Panel, apron or spandrel walls as defined in the Basic Code supported at vertical intervals not exceeding thirteen (13) feet in height, shall not be limited in thickness, provided they meet the fireresistive requirements of article 9 and table 2-5, and are constructed of approved noncombustible weather-resisting materials of adequate strength to resist the wind loads specified in sections 713 and 714.

866.2 HOLLOW PANEL WALLS: Unless constructed of the materials and thickness specified by the accepted engineering standards for masonry, hollow panel walls shall be tested and approved in the assembled unit as constructed in normal practice to develop the required fireresistance ratings specified in table 2-5 for exposure on both faces.

866.3 WEATHER RESISTANCE: When the construction as tested and approved for fireresistance does not possess the required weather resistance, it shall be covered on the exterior with approved corrosion-resistive metal facings or other approved noncombustible weather-resisting veneers.

866.4 ANCHORAGE: All panel walls shall be anchored to the structural frame to insure adequate lateral support and resistance to wind and to earthquake forces where subject to seismic disturbances.

## SECTION 867.0 THICKNESS OF PARAPET WALLS

All masonry exterior walls shall be constructed with parapet walls extending not less than two (2) feet above the roof, except in one- and two-family dwellings and structures where the roof overhangs the wall, or in places where such walls are capped with cornices or gutters; and except as required for fire walls in section 907 or as herein specifically provided.

867.1 MINIMUM THICKNESS AND HEIGHT: Parapet walls shall be of the same thickness as the wall below; but in no case shall the required thickness exceed twelve (12) inches, nor shall the height be more than four (4) times the thickness unless laterally supported by non-combustible bracing or buttresses.

867.2 PARTY WALLS WITH FLAT ROOFS: Parapet walls erected between two (2) structures in residential use groups, with flat roofs not more than forty (40) feet in height, need not extend more than six (6) inches above the roof.

867.3 PARTY WALLS WITH PITCHED ROOFS: Party walls in buildings and structures in residential use groups, the roofs of which slope at an angle of thirty (30) degrees or more from the horizontal, may stop at the level of the top of the roof boards, provided no combustible material passes through the wall, and the junction of roof and walls is completely weatherproofed and firestopped.

867.4 COPING: The top of all parapet walls exposed to the weather shall be coped with approved noncombustible and weather-resisting materials.

## SECTION 868.0 FOUNDATION WALLS

868.1 DESIGN: Foundation walls shall be designed to resist frost action and to support safely all vertical and lateral loads as provided in article 7 and shall extend to a minimum depth of four (4) feet below grade. The maximum stresses due to combined load shall be within the

868.1 DESIGN: Foundation walls shall be designed to resist frost action and to support safely all vertical and lateral loads as provided in article 7 and shall extend to a minimum depth of four (4) feet below grade. The maximum stresses due to combined load shall be within the values specified for the materials used in the construction. Unless properly reinforced, tensile stresses shall not exceed those permitted in plain masonry.

868.2 MINIMUM THICKNESS: The thickness of foundation wall shall be not less than the thickness of the wall supported and the minimum thickness shall be limited for the various materials of construction as herein specified. Eight (8) inch foundation walls shall be permitted under brick-veneered frame and under ten (10) inch cavity walls when the total height of wall supported including gables is not more than twenty (20) feet;

868.21 REINFORCED CONCRETE: When reinforced concrete is required to resist all stresses, foundation walls shall be not less than eight (8) inches thick.

868.22 HOLLOW AND SOLID MASONRY AND MASS CONCRETE: The thickness of masonry foundation walls shall not be less than shown in the following table for the type of foundation and superstructure construction used. The combined height of eight (8) inch foundation wall and the wall supported shall not exceed thirty-five (35) feet.

THICKNESS OF FOUNDATION WALLS

| Foundation Wall Construction | | Maximum Depth Below Grade (feet) Note 1.2 | | |
|---|---|---|---|---|
| Type | Thickness (inches) | Frame | Masonry Veneer | Masonry |
| Hollow masonry | 8 | 4 (6) | 4.5 (6) | 5 (7) |
| | 10 | 5 (7) | 5.5 (7) | 6 (7) |
| | 12 | 7 | 7 | 7 |
| Solid masonry | 8 | 5 (7) | 5.5 (7) | 6 (7) |
| | 10 | 6 (7) | 6 (7) | 6.5(7) |
| | 12 | 7 | 7 | 7 |
| Mass concrete | 8 | 7 | 7 | 7 |

Note 1. Depth below grade may be increased up to those shown in parentheses where such increase is warranted by soil conditions and local experience and is required by the building official.

Note 2. Where height of unbalanced fill (height of finish grade above basement floor or inside grade) exceeds seven (7) feet, foundation wall thickness shall be determined by structural analysis as required in section 869.1.

868.23 HOLLOW UNIT WALLS: Foundation walls of approved hollow masonry units shall be provided with not less than four (4) inches of solid masonry at girder bearings or shall be strengthened with buttresses;

868.24 RUBBLE STONE: Foundation walls of rough or random rubble stone shall be not less than sixteen (16) inches thick;

868.25 BONDING: All foundation walls shall be bonded as required for superstructure walls in section 836.

868.3 INCREASED THICKNESS WITH DEPTH: When any foundation wall, other than a wall that is designed as a retaining wall, extends more than twelve (12) feet below the top of the first floor beams, the thickness of the wall shall be increased four (4) inches for each additional twelve (12) feet or fraction thereof in depth.

868.4 CORBELS ON EIGHT INCH WALLS: Where an eight (8) inch wall is corbeled, the top corbel course shall be a full header course of headers at least six (6) inches in length, extending not higher than the bottom of the floor framing. The maximum projection of one (1) unit shall neither exceed one-half (½) the depth of the unit nor one-third (1/3) its width at right angles to the face which is offset.

868.5 LATERAL STABILITY: Foundation walls of buildings and structures which serve as retaining walls shall conform to the applicable requirements of section 869 or shall be strengthened with buttresses or additional wall thickness to resist lateral soil and hydrostatic pressure when subjected thereto.

## SECTION 869.0 RETAINING WALLS

Walls built to retain or support the lateral pressure of earth or water or other superimposed loads shall be designed and constructed of approved masonry, reinforced concrete, steel piling or other approved materials within the allowable stresses of accepted engineering practice.

869.1 DESIGN: Retaining walls shall be designed to resist the pressure of the retained material including both dead and live load surcharges to which they may be subjected, and to insure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls meeting the requirements of section 128.1 shall be subject to control as provided in section 128.0.

869.2 HYDROSTATIC PRESSURE: Unless drainage is provided, the hydrostatic head of water pressure shall be assumed equal to the height of the wall.

869.3 COPING: All masonry retaining walls other than reinforced concrete walls shall be protected with an approved coping.

## SECTION 870.0 ISOLATED PIERS

Isolated masonry piers shall be bonded as required for solid walls of the same thickness and shall be provided with adequate means for distributing the load on the top of the pier.

## SECTION 871.0 WATERPROOFING

The exterior structural elements of all buildings herein specified shall be waterproofed in accordance with the approved rules.

871.1 STEEL FRAME: Exterior steel columns and girders before embedment in masonry of the required fireresistance specified in table 2-5 shall be protected from moisture by approved waterproofing material, a parging coat of cement mortar or by a minimum of eight (8) inches of weather-tight masonry.

871.2 CHASES: The backs and sides of all chases in exterior walls with less than eight (8) inches of approved masonry to the exterior surface shall be insulated and waterproofed.

871.3 FOUNDATIONS: Exterior wall below grade and the cellar floors of all buildings for institutional and residential uses (use groups H and I) enclosing habitable or occupiable rooms or spaces below grade shall be made watertight, and when necessary shall be reinforced to withstand water pressure as prescribed in sections 710 and 869. The basement walls of buildings in the residential use groups and the walls of all habitable and occupiable rooms and spaces below grade shall be protected with not less than one-coat application of approved waterproofing paint, or a one-half (½) inch parging coat of Portland cement mortar or other approved dampproof covering.

871.4 TYPES OF WATERPROOFING: The processes and methods used to render building, structures or parts thereof watertight as herein required shall comply with accepted engineering practice covering types of waterproofing.

## SECTION 872.0 RATPROOFING

All buildings and strucutres and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work; or in which feed, food or foodstuffs are stored, prepared, processed, served or sold shall be constructed rat and vermin-proof in accordance with the provisions of this section.

872.1 GRADE PROTECTION.

872.11 APRON: When required for protection against rodents, all exterior walls at and near grade shall be constructed or assembled of component materials, or chemically or otherwise treated to render the construction rat or vermin-proof. When not provided with a continuous masonry foundation wall, a masonry or reinforced concrete apron, not less than four (4) inches in thickness or of other approved noncombustible, water-resisting and rat-proofing material of required strength, shall be installed around the entire perimeter of the building.

872.12 HEIGHT OF APRON: The apron shall extend sufficiently above grade to provide for the average snow fall in the locality, but not less than eight (8) inches above, nor less than twenty-four (24) inches below grade level; and, if serving as a foundation bearing wall, to sufficiently greater depth to assure protection from frost action as required in section 727. When the superstructure walls are not constructed of masonry, the spaces between studs shall be filled to a height of two (2) feet above grade with concrete or other material indestructible by rats.

872.2 GRADE FLOORS: Where continuous concrete grade floor slabs are provided, no open spaces shall be left between slab and walls, and all openings in the slab shall be protected.

872.3 OPENING PROTECTION.

872.31 WALL OPENINGS: Openings in the apron required for ventilation or other purposes shall be guarded with corrosion-resistive rodent-proof shields of not less than No. 22 U.S. gage perforated steel sheets, or No. 20 B & S gage aluminum or No. 16 U.S. gage expanded metal or wire mesh screens, with no more than one-half (½) inch mesh openings.

872.32 SLAB OPENINGS: Access opening in grade floor slabs shall be protected with concrete, masonry, metal or other corrosion-resistive noncombustible covers of adequate strength to support the floor loads.

872.33 PIPES AND CONDUITS: All openings for pipe, conduit, cable and similar purposes at or near grade shall have snugly-fitted collars to eliminate all open spaces.

## SECTION 873.0 PROTECTION AGAINST DECAY AND TERMITES

The expression "approval" as used in the following statements means approval in accordance with the procedure established by the Basic Code.

873.1 WHERE CONDITIONS ARE FAVORABLE TO DECAY.

873.11 WOOD IN CONTACT WITH THE GROUND: All wood in contact with the ground and supporting permanent structures shall be approved treated wood.

873.12 UNTREATED WOOD: Untreated wood may be used where entirely below ground water level or continuously submerged in fresh water and may be used in contact with the ground for detached accessory buildings not intended for human occupancy, for temporary structures and for fences.

873.2 WOOD JOISTS OR THE BOTTOM OF WOOD STRUCTURAL FLOORS: When wood joists or the bottom of wood structural floors without joists are closer than eighteen (18) inches, or wood girders are closer than twelve (12) inches, to exposed ground located within the periphery of the building over crawl spaces or unexcavated areas, they shall be approved durable or treated wood. Ventilation shall be provided as required in section 508.0.

873.3 SILLS: All sills which rest on concrete or masonry exterior walls and are less than six (6) inches from exposed earth shall be of approved durable or treated wood.

873.31 SLEEPERS AND SILLS: Sleepers and sills on a concrete or masonry slab which is in direct contact with earth shall be of approved durable or treated wood.

873.32 POSTS OR COLUMNS: Posts or columns in cellars shall be supported by piers projecting at least two (2) inches above the finish floor and separated therefrom by an approved impervious barrier except when approved durable or treated wood is used. Posts or columns used in damp locations below grade shall be of approved durable or treated wood.

873.33 WALL POCKETS: Ends of wood girders entering masonry or concrete walls shall be provided with a one-half (½) inch air space on top, sides and end unless approved durable or treated wood is used.

873.34 CLEARANCE BETWEEN WOOD SIDING: Clearance between wood siding and earth on the exterior of a building shall be not less than six (6) inches.

873.4 WOOD USED IN A RETAINING WALL: Wood used in a retaining wall shall be approved durable or treated wood except as follows:

a) when the wall is not more than two (2) feet in height and is located on the property line.
b) when the wall is not more than four (4) feet in height and is separated from the property line by a minimum distance equal to the height of the wall.
c) a retaining wall of durable wood shall not exceed six (6) feet in height. A wood retaining wall shall be separated from any permanent building by a minimum distance equal to the height of the wall.

873.5 WHERE APPROVED DURABLE OR TREATED WOODS ARE REQUIRED: Where approved durable or treated woods are required in this Code, the building official may require identification by an approved mark or certificate of inspection.

873.6 PRESSURE TREATMENT: Where pressure treatment of wood members is required by the Basic Code, preservatives and methods of treatment shall conform to the standards for pressure treatment and preserving of lumber listed in the reference standards of this article.

## SECTION 874.0 FIRE PROTECTION AND FIRESTOPPING

To prevent the free passage of flame through concealed spaces or openings in event of fire, provision shall be made to trim all combustible framing away from sources of heat, to provide effective fire barriers against the spread of fire between all subdivisions and all stories of the building, to provide adequate fire separation against exterior exposure, and to firestop all vertical and horizontal draft openings as specified herein.

874.1 BEAM SEPARATION IN ORDINARY CONSTRUCTION (types 3-B and 3-C): All wood and other combustible floor, roof and other structural members framing into masonry walls shall be cut to a bevel of three (3) inches in the depth and shall project not more than four (4) inches into the wall; and the distance between embedded ends of adjacent beams or joists entering into the wall from opposite sides shall be not less than four (4) inches.

874.2 GIRDER SEPARATION IN HEAVY TIMBER CONSTRUCTION (type 3-A): Wood girders framing into walls shall have at least (8) inches of masonry between their ends and the outside face of walls and at least eight (8) inches of masonry between adjacent beams entering the wall from opposite sides. The girders shall be fire-cut, supported in pockets or in self-releasing metal boxes, or otherwise supported to minimize destruction of the wall in the event of fire.

874.3 FLUES AND CHIMNEYS: Combustible framing shall be trimmed not less than two (2) inches away from all flues, chimneys and fireplaces, and six (6) inches away from flue openings.

874.4 FIREPLACES: Hearths of noncombustible construction and fireboards, mantels and other combustible trim shall comply with section 1012 governing fireplace construction.

874.5 CONCEALED ROOF SPACES: Concealed roof spaces enclosed by combustible ceiling and roof construction shall be subdivided into areas of not more than three thousand (3000) square feet as provided in section 316.

874.6 EXTERIOR CORNICES: Exterior cornices where permitted of combustible construction in section 926, or when erected with combustible frames shall be firestopped at maximum intervals of twenty (20) feet. If noncontinuous, they shall have closed ends, with at least four (4) inches separation between adjoining sections.

874.7 WALL FURRING: In masonry wall construction (types 3-A, 3-B, and 3-C) and in frame construction (types 4-A and 4-B) where walls are furred, the space between the inside of the furring and the face of the wall for the full depth of the combustible floor or roof joists shall be firestopped.

874.8 COMBUSTIBLE TRIM AND FINISH: The space behind combustible trim and finish where permitted under the Basic Code and all other hollow spaces where permitted in fireresistive construction shall be back-filled with noncombustible materials or firestopped as required in section 921.0.

874.9 FIRESTOPPING: Firestopping meeting the requirements of section 921 shall be provided in stud walls and partitions at each floor level and between the ceiling of the top story and roof space; in all furred spaces of frame walls and studded off spaces of masonry walls at maximum intervals of eight (8) feet; at the top and bottom and at least once in the middle of each run of stairs; in concealed wall pockets for sliding doors; at openings for pipes, belts, shafting, chutes and conveyors passing through combustible floors or partitions with close-fitting noncombustible caps or metal shutters or other approved noncombusitble means; and in all other locations that would permit the free travel of flame.

## SECTION 875.0 THERMAL INSULATING MATERIALS

Insulating batts, blankets, fills or similar types of materials, including vapor barriers and breather papers or other coverings, which are a part of the insulation, incorporated in construction elements shall be installed and used in a manner that will not increase the fire hazard characteristics of the building or any part thereof.

875.1 INSTALLATION IN TYPE 1 AND TYPE 2 CONSTRUCTION: Such materials when exposed as installed in building of fireproof or noncombustible (types 1 or 2) construction shall qualify as noncombustible materials when tested in accordance with section 904.

875.2 INSTALLATION IN TYPE 3 AND TYPE 4 CONSTRUCTION: Such materials, when exposed as installed in attic spaces in buildings of ordinary or frame (types 3 or 4) construction may be of noncombustible or approved combustible material when tested in accordance with section 904.

875.3 FACINGS AND COVERINGS: Vapor barriers, breather papers or other coverings of insulating materials, when installed adjacent to or not more than one and one-half (1½) inches from the unexpected surface of ceiling or sidewall interior finish, or when installed in completely enclosed wall, ceiling joist or rafter spaces, fire-stopped as required in section 874.0 are not required to have a flameresistance rating.

| | | | |
|---|---|---|---|
| ACI | 318 | 1971 | Building Code Requirements for Reinforced Concrete |
| AITC | 103-65 | 1965 | Standard for Structural Glued-Laminated Timber |
| ANSI | A 42.1 | 1964 | Specifications for Gypsum Plastering |
| ANSI | A 42.2 | 1971 | Specifications for Portland Cement Stucco |
| ANSI | A 42.3 | 1971 | Specifications for Portland Cement Plastering |
| ANSI | A 42.4 | 1967 | Specifications for Interior Lathing and Furring |
| ANSI | A 42.5 | 1960 | Standard Specifications for Lime-Cement Stucco |
| ANSI | A 97.1 | 1965 | Specifcations for Gypsum Wallboard Finishes |
| ANSI | A 108.5 | 1967 | Tile, Ceramic, Installed in Dry-Set Portland Cement Mortar |
| ANSI | A 118.1 | 1972 | Standard Specifications for Dry-Set Portland Cement Mortar |
| ANSI | A 118.3 | 1969 | Standard Specifications for Epoxy, Chemical Resistant, Water Cleanable Tile-Setting and Grouting |
| ANSI | Z 97.1 | 1972 | United States Standard Performance Specifications and Methods of Test for Transparent Safety Glazing Material Used in Buildings |
| ASTM | C 5 | 1968 | Specifications for Quicklime for Structural Purposes |
| ASTM | C 6 | 1968 | Specifications for Normal Finishing Hydrated Lime |
| ASTM | C 10 | 1970a | Specifications for Natural Cement |
| ASTM | C 22 | 1950 | Specifications for Gypsum |
| ASTM | C 28 | 1968 | Specifications for Gypsum Plasters |
| ASTM | C 33 | 1971a | Specifications for Concrete Aggregates |
| ASTM | C 34 | 1970 | Specifications for Structural Clay Load Bearing Wall Tiles |
| ASTM | C 35 | 1970 | Specifications for Inorganic Aggregates for Use in Gypsum Plaster |

| | | | |
|---|---|---|---|
| ASTM | C 36 | 1970,1973 | Specifications for Gypsum Wallboard |
| ASTM | C 37 | 1969 | Specifications for Gypsum Lath |
| ASTM | C 52 | 1972 | Specifications for Gypsum Partition Tile or Block |
| ASTM | C 55 | 1971 | Specifications for Concrete Building Brick |
| ASTM | C 56 | 1971 | Specifications for Structural Clay Non-Load Bearing Tile |
| ASTM | C 57 | 1957 | Specifications for Structural Clay Floor Tile |
| ASTM | C 61 | 1964 | Specifications for Keene's Cement |
| ASTM | C 62 | 1969 | Specifications for Building Brick (Solid Masonry Units Made From Clay or Shale) |
| ASTM | C 73 | 1972 | Specifications for Sand-lime Building Brick |
| ASTM | C 79 | 1967 | Specifications for Gypsum Sheathing Board |
| ASTM | C 90 | 1970 | Specifications for Hollow Load Bearing Concrete Masonry Units |
| ASTM | C 91 | 1971 | Specifications for Masonry Cement |
| ASTM | C 94 | 1971,1972 | Specifications for Ready-Mixed Concrete |
| ASTM | C 126 | 1971 | Specifications for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units |
| ASTM | C 129 | 1971 | Specifications for Hollow Non-Load Bearing Concrete Masonry Units |
| ASTM | C 144 | 1970 | Specifications for Aggregate for Masonry Mortar |
| ASTM | C 145 | 1971 | Specifications for Solid Load Bearing Concrete Masonry Units |
| ASTM | C 150 | 1972 | Specifications for Portland Cement |
| ASTM | C 206 | 1968 | Specifications for Special Finishing Hydrated Lime |
| ASTM | C 207 | 1968 | Specifications for Hydrated Lime for Masonry Purposes |

## Reference Standards - Article 8 Part A

| | | | |
|---|---|---|---|
| ASTM | C 208 | 1966 | Specifications for Structural Insulating Board Made From Vegetable Fibers |
| ASTM | C 216 | 1971 | Specifications for Brick, Facing (Solid Masonry Units Made From Clay of Shale) |
| ASTM | C 270 | 1971 | Specifications for Mortar for Unit Masonry (Tentative) |
| ASTM | C 330 | 1969 | Specifications for Lightweight Aggregates for Structural Concrete (Tentative) |
| ASTM | C 331 | 1969 | Specifications for Lightweight Aggregates for Concrete Masonry Units (Tentative) |
| ASTM | C 332 | 1966 | Specifications for Lightweight Aggregates for Insulating Concrete |
| ASTM | C 476 | 1971 | Specifications for Mortar and Grout for Reinforced Masonry |
| ASTM | C 595 | 1968 | Specifications for Blended Hydraulic Cements |
| ASTM | C 652 | 1970 | Specifications for Hollow Brick (Solid Masonry Units Made from Clay or Shale) |
| Federal Specification | DD-G-00451b D.F. 2.5 | | Glass Thickness Specifications |
| USDC | CS 181 | 1952 | Adhesive-Water Resistant Organic, for Installation of Clay Tile |
| U.S. Product Standard | PS-1 | | Specifications for Plywood |
| Vermiculite Institute | | 1963 | Standard Specifications for Vermiculite Plastering |

1.0 GLASS DESIGN CRITERIA - The required nominal thickness of glass shall be determined from the chart within this reference standard. The modified design wind load to be used for entering the chart shall be determined by dividing the appropriate general design wind load of section 713.0 by the relative resistance value for the glass type involved. For this purpose, the relative resistances to wind load for equal thicknesses of glass shall be assumed as follows:

| 2.0 GLASS TYPE | RELATIVE RESISTANCE |
|---|---|
| Regular Plate or Sheet | 1.0 |
| Laminated | 0.6 |
| Wired Glass | 0.5 |
| Heat Strengthened | 2.0 |
| Fully-Tempered | 4.0 |
| Rough-Rolled Plate | 1.0 |
| Sandblasted | 0.4 |
| Factory Fabricated Double Glazing (Use only the thickness of the thinner of the two lights) | 1.5 |

## Reference Standards - Article 8 Part B

| | | | |
|---|---|---|---|
| ACI | 318 | 1971 | Building Code Requirements for Reinforced Concrete |
| ACI | 506 | 1966 | Recommended Practice for Shotcreting |
| ACI | 525 | 1963 | Minimum Requirements for Thin-Section Precast Concrete Construction |
| AISC | | 1969 | Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings |
| AISI | | 1968 | Specification for the Design of Cold-Formed Steel Structural Members |
| AITC | PS 56-73 | 1973 | Structural Glued-Laminated Lumber |
| AITC | 200-73 | 1973 | Inspection Manual |
| AA | | 1969 | Aluminum Construction Manual |
| APA | | 1967 | Design and Fabrication of Flat Plywood Stressed Skin Panels |
| ASTM | A 27 | 1971 | Specifications for Mild-To-Medium Strength Carbon-Steel Castings for General Application |
| ASTM | A 48 | 1971 | Specifications for Gray Iron Castings |
| ASTM | A 148 | 1971 | Specifications for High-Strength Steel Castings for Structural Purposes |
| ASTM | A 377 | 1966 | Specifications for Cast Iron Pressure Pipe |
| ASTM | C 31 | 1966 | Making and Curing Concrete Compression and Flexure Test Specimens in the Field |
| ASTM | C 143 | 1966 | Test for Slump of Portland Cement Concrete |
| ASTM | C 172 | 1968 | Sampling Fresh Concrete |
| ASTM | D 2277 | 1972 | Specifications for Fiberboard Nail-Base Sheathing (Tentative) |
| AWS | D1.0-69 | 1969 | Code for Welding in Building Construction |
| NCMA | | 1971 | Specification for the Design and Construction of Load Bearing Concrete Masonry. Where conflict arises between this reference standard and the Basic Code, the more stringent requirements of the two shall apply. |

## Reference Standards - Article 8 Part B

| | | | |
|---|---|---|---|
| NFoPA | | 1970 | Maximum Spans for Joists and Rafters in Residential Construction |
| NFoPA | | 1970 | Wood Structural Design Data |
| NFoPA | | 1973 | National Design Specification for Stress-Grade Lumber and its Fastenings. |
| BIA | | 1969 | Structural Clay Products Institute Recommended Building Code Requirements for Engineered Brick Masonry. Where conflict arises between this reference standard and the Basic Code, the more stringent requirements of the two shall apply. |
| SJI-AISC | | 1972 | Standard Specifications and Load Tables for Open Web Steel Joists, J-Series and H-Series |
| SJI-AISC | | 1972 | Standard Specifications and Load Tables for Long-Span Steel Joists, LJ-Series and LH-Series |
| ANSI | A59.1 | 1954 | Specifications for Reinforced Gypsum Concrete |
| USDC | CS 31 | 1952 | Wood Shingles (Red Cedar, Tidewater, Red Cypress and California Redwood) |

Reference Standards - Article 8 Part C

| | | | |
|---|---|---|---|
| ACI | 525 | 1963 | Minimum Requirements for Thin-Section Precast Concrete Construction |
| AWPA | C 1 | 1972 | Standard for the Preservative Treatment of all Timber Products by Pressure Processes |
| AWPA | C 2 | 1972 | Standard for the Preservative Treatment of Lumber, Timbers, Bridge Ties and Mine Ties by Pressure Processes |
| AWPA | C 3 | 1972 | Standard for the Preservative Treatment of Piles by Pressure Processes |
| AWPA | C 4 | 1972 | Standard for Preservative Treatment of Poles by Pressure Processes |
| AWPA | C 9 | 1972 | Standard for the Preservative Treatment of Plywood by Pressure Processes |
| AWPA | M 2 | 1962 | Standard Instructions for the Inspection of Preservative Treatment of Wood |
| AWPA | M 4 | 1962 | Standard for the Case of Pressure-Treated Wood Products |
| ANSI | A 94.1 | 1961 | Specifications for Interior Marble |
| ANSI | A 94.2 | 1961 | Specifications for Thin Exterior Marble Veneer (Two Inches and Less in Thickness) |
| ANSI | A 94.3 | 1961 | Specifications for Thin Exterior Marble in Curtain or Panel Walls |
| ANSI | A 108.1 | 1967 | Specifications for (Including Requirements of Related Divisions) Installation of Glazed Ceramic Wall Tile in Cement Mortars |
| ANSI | A 108.2 | 1967 | Specifications for (Including Requirements of Related Divisions) Installation of Ceramic Mosaic Tile in Cement Mortars |
| ANSI | A 108.3 | 1967 | Specifications (Including Requirements of Related Divisions) for Installation of Quarry Tile and Pavers in Cement Mortars |
| ANSI | A 108.5 | 1967 | Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar |

Recommended Nailing Schedule

| Building Element | Nail Size and type | Number and location |
|---|---|---|
| Stud to sole plate | 8d common | 4 Toe-nail |
| Stud to cap plate | 16d common | 2 Toe-nail |
| Double studs | 10d common | 12"o.c. Direct |
| Corner studs | 16d common | 24"o.c. Direct |
| Sole plate to joist or blocking | 16d common | 16"o.c. |
| Double cap plate | 16d common | 16"o.c. Direct |
| Cap plate laps | 16d common | 2 Direct |
| Ribbon strip - 6" or less | 10d common | 2 each Direct bearing |
| Ribbon strip - 6" or more | 10d common | 3 each Direct bearing |
| Roof rafter to plate | 8d common | 3 Toe-nail |
| Roof rafter to ridge | 16d common | 2 Toe-nail |
| Jack rafter to hip | 10d common | 3 Toe-nail |
| Floor joists to studs | 10d common | 5 Direct or |
| (No ceiling joists) | 10d common | 3 Direct |
| Floor joists to studs (With ceiling joists) | 10d common | 2 Direct |
| Floor joists to sill or girder | 8d common | 3 Toe-nail |
| Ledger strip | 16d common | 3 each Direct joist |
| Ceiling joists to plate | 16d common | 3 Toe-nail |
| Ceiling joists to parallel rafters | 16d common | 3 Direct |
| Ceiling joists (laps over partition) | 16d common | 3 Direct |
| Collar beam | 10d common | 3 Direct |
| Bridging to joists | 8d common | 2 each Direct end |
| Diagonal brace (to stud and plate) | 8d common | 2 each Direct bearing |
| Tail beams to headers | 20d common | 1 each End |
| (When nailing permitted) | | 4 sq. ft. floor area |
| Header beams to trimmers | 20d common | 1 each End |
| (When nailing permitted) | | 8 sq. ft. floor area |
| 1" roof decking (6" or less in width) | 8d common | 2 each Direct rafter |
| 1" roof decking (over 6" in width) | 8d common | 3 each Direct rafter |
| 1" sub-flooring (6" or less) | 8d common | 2 each Direct joist |
| 1" sub-flooring (8" or more) | 8d common | 3 each Direct joist |
| 2" sub-flooring | 16d common | 2 each Direct joist |
| 1" wall sheathing (8" or less in width) | 8d common | 2 each Direct stud |
| Plywood roof and wall sheathing | 6d common | 6"o.c. Direct edges and 12"o.c. intermediate |
| (1/2 or less (5/8" or greater) | 8d common | 6"o.c. Direct edges and 12"o.c. intermediate |

Recommended Nailing Schedule

| Building Element | Nail Size and type | Number and location |
|---|---|---|
| (5/16", 3/8" or 1/2")... | 16 ga. galvanized wire staples, 3/8" minimum crown; length of 1" plus plywood thickness | 4"o.c. edges and 8"o.c. intermediate |
| (5/8") ..... | Same as immediately above | 2-1/2"o.c. edges and 5"o.c. intermediate |
| Plywood subflooring: | | |
| (1/2") ..... | 6d common or 6d annular oredges and 10"o.c. spiral thread | 6"o.c. Direct intermediate |
| (5/8", 3/4") ..... | 8d common or 6d annular or spiral thread | 6"o.c. Direct edges and 10"o.c. intermediate |
| (1", 1-1/8") ..... | 10d common or 8d ring shank or 8d annular or spiral thread | 6"o.c. Direct edges and 6"o.c. intermediate |
| (1/2") ..... | 16 ga. galvanized wire staples | 4"o.c. edges and 7"o.c. intermediate |
| (5/8") ..... | 3/8" minimum crown, 1-5/8" length | 2-1/2"o.c. edges and 4"o.c. intermediate |
| Built up girders and beams .. | 20d common | 32"o.c. Direct |
| Continuous header to stud ... | 8d common | 4 Toenail |
| Continuous header-two pieces. | 16d common | 16"o.c. Direct |
| 1/2" Fiberboard sheathing ... | 1-1/2" galvanized roofing nail or 6d common nail or 16 gage staple, 1-1/8" long with minimum crown of 7/16" | 3"o.c. exterior edge 6"o.c. intermediate |
| 25/32" Fiberboard sheathing.. | 1-3/4" galvanized roofing nail or 8d common nail or 16 gage staple, 1-1/2" long with minimum crown of 7/16" | 3"o.c. exterior edge, 6"o.c. intermediate |
| Gypsum sheathing ..... | 12 gage 1-1/4" large head corrosion-resistive | 4"o.c. on edge, 8"o.c. intermediate |
| Shingles-wood ..... | No. 14 B&S corrosion-resistive | 2 each bearing |
| Weather boarding ..... | 8d corrosion- | 2 each bearing |

PLYWOOD ROOF SHEATHING
DOUGLAS FIR, WESTERN LARCH, SOUTHERN PINE
AND
GROUP 1 SHEATHING GRADES WESTERN SOFTWOOD PLYWOOD

| Panel Identification Index (2) (roof span "/floor span") | Roof | | | | Floor |
|---|---|---|---|---|---|
| | Maximum Span (Inches) | | Load (psf) | | |
| | Edges Blocked(3) | Edges Unblocked | Total Load | Live Load | Maximum Span(5) (Inches) |
| 12/0 | 12 | 12 | 130 | 100 | 0 |
| 16/0 | 16 | 16 | 75 | 55 | 0 |
| 20/0 | 20 | 20 | 55 | 45 | 0 |
| 24/0 | 24(6) | 24 | 60 | 45 | 0 |
| 30/12 | 30 | 26 | 55 | 40 | 12(7) |
| 32/16 | 32 | 28 | 50(4) | 40 | 16(8) |
| 36/16 | 36 | 30 | 50(4) | 35(4) | 16(8) |
| 42/20 | 42 | 32 | 45(4) | 35(4) | 20(8) |
| 48/24 | 48 | 36 | 40(4) | 40 | 24 |

1. These values apply for Structural I and II, Standard Sheathing and C-C grades only. Spans shall be limited to values shown because of possible effect of concentrated loads.

2. Identification index appears on all panels in the construction grades listed in footnote (1).

3. Edges may be blocked with lumber or other approved type of edge support.

4. For roof live load of forty (40) psf or total load of fifty-five (55) psf, decrease spans by thirteen (13) percent or use panel with next greater identification index.

5. Plywood edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is twenty-five thirty-seconds (25/32) inch wood strip. Allowable uniform load based on deflection of one three-sixtieth (1/360) of span is one hundred (100) psf.

6. 1/2 inch Structural I, when continuous over one (1) support, may be laid with face grain parallel to supports provided all panel edges are blocked or other approved type edge support is provided, the spacing of the supports does not exceed twenty-four (24) inches on center, and the live load does not exceed thirty (30) pounds per square foot. For other grades, a thickness of five-eighths (5/8) is required.

7. May be sixteen (16) inches, if twenty-five thirty-seconds (25/32) inch wood strip flooring is installed at right angles to joists.