

NORTH CAROLINA UNIFORM RESIDENTIAL BUILDING CODE



**Prepared by
NORTH CAROLINA BUILDING INSPECTOR'S ASSOCIATION
1968 Edition with Amendments
thru December 10, 1985
Adopted by
NORTH CAROLINA BUILDING CODE COUNCIL**

North Carolina State Building Code

VOLUME I-B

RESIDENTIAL

(1 and 2 Family Dwellings)

*Adopted by the North Carolina Building Code Council
in accordance with Act of the General Assembly of 1957, Chapter 1138
(G.S. 143-136 through 143-143)
Adopted March 12, 1968*

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FORWARD

This Residential Building Code applies to all Cities and Counties in accordance with Section G.S. 143-138b. (Effective January 1, 1972)

The 1958 recommended Residential Building Code was prepared by the North Carolina Building Inspector's Association and was endorsed at their annual meeting held in Charlotte on April 29-30, 1957. Members of the Dwelling Code Committee were as follows: Mr. Bernard Manley, former City Building Inspector, Asheville and Mr. A.R. Strange, City Building Inspector, High Point, Co-Chairman; Mr. J.B. Bell, Assistant Chief Building Inspector, Hickory; Mr. E.H. Johnson, City Building Inspector, Durham; Mr. W.B. Gunter, Assistant City Building Inspector, Durham; and K.E. Church, Engineer, N.C. State Insurance Department.

The original 1958 Edition gained wide use in North Carolina, having been adopted locally by all of the towns and counties which were enforcing regulations on dwellings. The Association hopes that all cities and counties will utilize this new edition and cooperate with the Association on future amendments.

This 1968 edition contains all previous amendments to the 1964 Edition and the major revisions adopted by the Association at the annual meeting in Greensboro on June 19, 1967. Members of this Code Committee were as follows: Mr. Freeman Hill, Chairman, High Point; Mr. John Parham, Durham; Mr. W.H. Jamison, Charlotte; Mr. James Prillaman, Asheboro; Mr. Amos Speas, Winston-Salem; Mr. A.H. Rowan, Wilmington; and Mr. T.O. Mullins, State Department of Insurance, Raleigh.

Acknowledgement is made of valuable suggestions and information which was contributed by the technical staffs of the North Carolina League of Municipalities, North Carolina Chapter American Institute of Architects, N.C. Home Builders Association, Carolinas Branch of Associated General Contractors, the National Lumber Manufacturers Association, National Board of Fire Underwriters, National Bureau of Standards, North Carolina Fire Insurance Rating Bureau, Brick and Tile Service, North Carolina Concrete Masonry Association.

This Building Code is endorsed by the following Agencies and Organizations: North Carolina Building Inspectors' Association, North Carolina Building Code Council, North Carolina League of Municipalities, North Carolina Department of Insurance, North Carolina Chapter American Institute of Architects, Carolinas Branch of Associated General Contractors, North Carolina Fire Insurance Rating Bureau, North Carolina Society of Engineers and N.C. Home Builders Association.

The Building Inspectors' Association would welcome any proposed amendments to this Code. The Association hopes that cities and counties utilizing this Code will submit their proposed amendments through the Association for adoption to promote uniformity.

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**NORTH CAROLINA UNIFORM (MINIMUM)
RESIDENTIAL BUILDING CODE**

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ARTICLE I. GENERAL

SECTION 1. Citation of code; to what structures applicable.

The following provisions shall constitute and be known as the uniform residential building code and shall be cited as such and provides for matters relating to construction, alteration, repair or removal of buildings or structures, erected or to be erected in the state. The provisions of this code shall apply only to residence buildings, duplexes, or structures hereafter erected , and to any alterations to existing buildings but does not apply to apartment or multi-family houses constructed, altered, repaired or used as a residence for three or more families.

SECTION 2. Application, plans and permits.

Before the erection, construction or alteration of any building or structure, or part of same, there shall be submitted to the Building Inspector, by the owner or authorized agent, an application on appropriate blanks to be furnished by the Building Inspector, containing a detailed statement of the specifications, and accompanied by a full and complete copy of all necessary plans of such proposed work. Each application for a building permit shall be accompanied by a plat, drawn to scale, showing accurate dimensions of the lot to be built upon, accurate dimensions of the building to be erected and its location on the lot. If it shall appear to the Building Inspector that the provisions of this code and the State building laws have been complied with, and all requirements of fees has been paid, he will then issue the building permit. A copy of the plans as approved by the Building Inspector shall be kept at the building during the progress of the work and shall be open to inspection by the Building Inspector. Plans and specifications submitted to the Building Inspector shall be kept in files in his office or returned to the owner. It shall be within the discretion of the Building Inspector to issue permits for minor construction work without plans and specifications.

SECTION 3. Schedule of Building Permit Fees.

Schedule for building permit fees to be regulated by each City, Town or County.

SECTION 4. Contractor's Bond or Liability Insurance.

Contractor's Bond or Liability insurance to be regulated by each City, Town or County.

SECTION 5. Power of Building Inspector.

The local building inspector has the right at all reasonable hours, for the purpose of examination, to enter into and upon all buildings and premises in their jurisdiction (See GS 153A-364 & 160A-424). As building progresses the inspector shall make as many inspections as may be necessary to satisfy him that the building is being constructed according to the provisions of this law (See GS 160A-420). The local inspector shall have the right to enter any dwelling, store, or other building and premises to inspect same without molestation from anyone (See GS 160-143).

ARTICLE I - GENERAL

SECTION 6. Unsafe buildings condemned.

(a) Section 153A0366 & 160A-426 of the N.C. General Statutes.

“**UNSAFE BUILDING CONDEMNED.** Every building which shall appear to the Inspector to be especially dangerous to life because of its liability to fire or in case of fire by reason of bad conditions of walls, overloaded floors, defective construction, decay or other causes shall be held to be unsafe, and the Inspector shall fix a notice of dangerous character of the structure to a conspicuous place on the exterior wall of said building. No building now or hereafter built shall be altered, repaired or moved, until it has been examined and approved by the Inspector as being in good and safe condition to be alters as proposed, and the alteration, repair or change so made shall conform to the provisions of the law.”

(b) G.S. 153A-367 & 160A-427

If any person shall remove any notice which has been affixed to any building by the local Inspector of any City or Town, which notice shall state the dangerous character of the building, he shall be guilty if a misdemeanor, and be fined not less than \$10.00 nor more than \$50.00 for each offense.

SECTION 7. Punishment for allowing unsafe building to stand.

Section 160A-428 & 431, 153A-368 & 371 of the North Carolina General Statutes.

If the owner of any building which has been condemned as unsafe and dangerous to life by any local inspector, after being notified by the inspector in writing of the unsafe and dangerous character of such building, shall permit the same to stand or continue in that condition, he shall be guilty of a misdemeanor and shall pay a fine of not less than ten nor more than fifty dollars for each day such building continues after such notice.

SECTION 8. Frame buildings within fire limits.

Section 160A-436 & 437, 153A-375 of the North Carolina General Statutes.

Within the fire limits of cities and towns where this article applies, as established and defined, no frame or wooden building shall be hereafter erected, altered, repaired, or moved except upon the permit of the building inspector, approved by the Insurance Commissioner.

SECTION 9. Minimum Room Sizes.

Living or principal room shall not be less than 150 square feet; the first bedroom 100 square feet, and all other bedrooms not less than 70 square feet.

Kitchen and dining room combination shall be not less than 100 square feet.

SECTION 10. Light and Ventilation and Ceiling Heights.

(1) Light and Ventilation

- a. For the purpose of providing adequate light and ventilation, each habitable room shall have a window or windows with a total glazed area of no less than 8 square feet or 8 percent of the floor area, whichever is greater. Windows shall be so arranged that at least one half of the glazed area is openable, unless the room is otherwise properly ventilated.
- b. In bathrooms, containing more than one water closet, window area shall be at least 3 square feet of glazed area. Where adequate windows cannot be provided, metal ducts with at least 72 square inches open area and extending from the ceiling through the roof, or mechanical ventilation to the outside, shall be provided.
- c. All type vents shall extend to the exterior of the building and be vented to the outside air by an approved type vent.

Revised
12-13-83

d. An Alcove opening off a habitable room may be included as part of that room in determining the window area required, provided that a portion of the common wall between the habitable room and the alcove, is open and unobstructed.

For the purpose of determining light and ventilation requirements, any room may be considered as a portion of an adjoining room when one-half (1/2) of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or twenty-five (25) square feet – whichever is greater.

(2) Ceiling Heights

Revised
12-14-82

Every habitable room shall be not less than 7 feet wide in any part and shall contain not less 70 square feet of net floor area. Such rooms shall have a clear height of not less than 7 feet 6 inches for at least 60 square feet of net floor area or 50% of the net floor area whichever is greater. (Note: The 70 square feet minimum area does not apply to the minimum room sizes specified in Section 9).

ARTICLE II. RESIDENTIAL CONSTRUCTION

SECTION 11. Excavation.

- (1) Excavation for all foundations shall extend to solid ground. Upon excavation, if other than solid ground is encountered, the footings shall be redesigned, and details of same shall be submitted to the Building Inspector for approval.
- (2) Footings shall meet all of the following criteria:
 - (a) Depth of excavation of trenches for walls, piers and footings shall be carried below the frost line.
 - (b) The bottom of footings shall be a minimum of 12 inches below finished grade.
 - (c) The bottom of the footings shall be constructed on undisturbed soil or on controlled fill minimum of 90% compaction according to “Standard Proctor Density” – ASTM-D 698-70.
- (3) Basementless Space. Ground level shall be at least 18 inches below bottom floor joists and 12 inches below girders. Where it is necessary to provide access for maintenance and repairs in the underfloor space, ground level shall be not less than 2 feet below bottom of joists. There shall be at least 18 inches by 24 inches access door to the crawl space. Where the interior ground level is below outside finish grade, adequate precautionary measures shall be taken to assure positive drainage at all times. Remove all debris, sod, tree stumps, and other organic material and provide a smooth surface free of pockets. In all cases the access door and crawl space leading to mechanical equipment shall be of sufficient size to remove and replace the mechanical equipment installed in the crawl space.

SECTION 12. Footings.

(1) General: The area of footings shall be sufficient to distribute the superimposed loads uniformly and shall bear on undisturbed earth or piles; or shall be adequately reinforced where they cross or bear on filled trenches or other similar disturbed soil conditions. When soil conditions prevent sharp cut trenches side forms shall be used. Where changes in elevation of footing occur, the footing shall be stepped, with a minimum distance between steps of two feet. The steps shall be poured continuous with the footing, and shall be equal in thickness to the footing.

(2) Materials.

Revised
9-10-85

a. Construct footings of cast-in-place concrete having a specified compressive strength (f 'c), at 28 days, of not less than 2,500 PSI or of masonry units laid in Type M or S mortar. Concrete masonry units shall be Grade N complying with ASTM C55, C90, or C145. Clay masonry units shall conform to ASTM C62 Grade SW. The cores, if any, in concrete masonry unit footings shall be vertical and shall be filled solidly with Type M or S mortar. Long dimension of masonry units shall be perpendicular to the foundation wall laid in running bond (continuous joints parallel to the wall are not permitted). Masonry footings shall be laid on a leveling bed of sand or mortar.

b. Pile foundations: See State Building Code, Volume 1.

(3) Dimensions: Footing dimensions shall be limited as follows:

a. Minimum Thickness:

Revised
3-12-85

Material	1-2 Story		2 Story (with basement)	
	Wall	Pier	Wall	3 story Pier
Poured Concrete	6 in.	8 in.	8 in.	12 in.
Masonry	8 in.	12 in.	12 in.	12 in.

Column, Post and Chimney footings same as pier footings.

b. Width or Area:

Project footing at least 3 inches from face of loadbearing wall*, pier, column, post or chimney and in no case more than one-half the footing thickness unless reinforced. (*Curtain wall footing may be poured integral with pier footing).

Minimum area 2.5 square feet under free standing piers, columns, post or chimney.

(4) Modifications of the above requirements may be made is such modifications are fully detailed and noted on drawings and are approved by the Building Inspector.

(5) Around the basement walls below grade, footing drain tile or other approved methods, shall be used and shall be covered with 12 inches porous material such as gravel, etc. with provisions for draining water away from the building by connecting tile to dry well, storm sewer, or by other approved means.

SECTION 13. Concrete and Masonry.

(1) General:

- Revised
3-12-85
- a. Second hand material shall not be used unless such material conforms to these requirements and have been thoroughly cleaned.
 - b. All masonry shall be supported on masonry, concrete, or steel. Nonstructural four inch veneer, maximum (9) feet in height, may be supported on steel angles attached directly to the studs in accordance with the following:
 - 1. Minimum size of angle shall be 6" x 4" x 1/4" with the longer leg placed in the vertical.
 - 2. Maximum stud spacing of 16" on center.
 - 3. Install two 3/8" x 3" lag screws per stud, with the screws placed no closer than 2" from the horizontal leg of angle.
 - 4. Studs shall be of either Group 1 or Group 2 species.
 - c. Whenever the temperature of the surrounding air is below 40^o all concrete when placed in the forms shall have a temperature of between 40 and 90 degrees F. and shall be maintained at a temperature of not less 50 degrees F. for at least 72 hours for normal concrete and 24 hours for high-early strength concrete, or for as much time as is necessary to secure proper rate of curing and designed compressive strength.
- Revised
9-10-85
- d. Protect concrete and masonry to prevent too rapid drying. Concrete shall be kept in a moist condition for at least 72 hours after placement.
 - e. All masonry shall be protected against freezing for at least 48 hours. Masonry exposed to weather shall not be laid when temperature is below 32 deg. Fahrenheit.
 - f. Concrete forms shall be tight, straight and plumb, and shall be rigidly braced to assure proper support of the concrete until set. Forms shall not be removed until concrete has thoroughly set.
 - g. Load shall not be placed on walls until sufficient strength has developed to support such loads.
- Revised
9-10-85
- h. Plain or reinforced concrete shall comply with Volume I of this Code.
 - i. Reinforced brick masonry shall be accepted in lieu of and under the same restrictions as reinforced concrete when designed and reinforced in accordance with RBM Lateral Force Design Handbook.
 - j. Masonry and concrete walls that meet or intersect shall be adequately bonded or tied together.

(2) Concrete:

a. Assumed strength of Concrete Mixes:

Water Content, U.S. Gallons per 94-lb. Sack of Cement	Assumed Compressive Strength at 28 days-psi
5	3750
6	3000
6 ¾	2500
7 ½	2000

b. Aggregate shall be clean and free from loam and other foreign matter.

Added
9-10-85

c. Normal weight aggregate concrete subject to weathering (i.e., freezing and thawing) and/or deicer chemicals, shall comply with the following Table:

MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE (f 'c)¹ SUBJECT TO WEATHERING AND/OR DEICER CHEMICALS

Type and/or Location of Concrete Element	Minimum Specified Compressive Strength (f 'c) ¹
Basement walls and foundations not exposed to the weather	2,500 ²
Basement slabs and interior slabs-on-grade	2,500 ²
Basement walls, foundation walls, exterior walls, and other vertical concrete surfaces exposed to the weather	3,000 ³
Garage floor slabs	3,000 ³

1. At 28 days, PSI.
2. Concrete in these locations which may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with footnote #3 below.
3. Concrete shall be air-entrained. Total air content (% by volume of concrete) shall be not less than 5% nor more than 7%.

(3) Mortar:

Masonry shall be laid in mortar of the types specified in Tables 1, 2 and 3.

TABLE 1 – TYPES OF MORTAR

Type	Average Compressive Strength 2 inch cubes at 28 days, psi
M	2500
S	1800
N	750
O	350

CONCRETE AND MASONRY

TABLE 2 – MORTAR PROPORTIONS BY VOLUME^a

Mortar Type	Portland Cement Cu. Ft.	Masonry Cement Cu. Ft.	Hydrated Lime or Lime Putty Cu. Ft.	Aggregate Measured in Damp Loose Condition Cu. Ft.
M	1 1	None 1-Type 2	¼ None	Not less than 2 ¼ and not more than 3 times the sum of the volume of cement and lime used.
S	1 ½	None 1-Type 2	Over ¼ to ½ None	
N	1 None	None 1-Type 2	Over ¼ to ½ None	
O	1 None	None 1-Type 1 ^b or Type 2 ^b	Over 1 to 2 None	

a. For the purpose of these specifications, the weight of one cubic foot of the respective materials used shall be considered to be as follows:

Portland Cement	94 pounds
Masonry Cement	Weight printed on bag
Hydrated Lime	40 pounds
Lime Putty (Quicklime)	80 pounds
Sand, damp and loose	80 pounds of dry sand

b. Masonry cement shall be of a quality at least equal to that required by ASTM masonry cement (C91-60)

TABLE 3 – TYPES OF MORTAR REQUIRED

Type of Masonry	Types of Mortar Permitted
Foundations: (below grade masonry)	
Footings	M or S
Walls of Solid Units	M, S or N
Walls of Hollow Units	M or S
Hollow Walls	M or S
Masonry Other Than Foundation Masonry	
Piers of Solid Masonry	M, S or N
Piers of Hollow Masonry	M or S
Walls of Solid Masonry	M, S, N or O
Walls of Hollow Masonry	M, S or N
Hollow Walls and Cavity Walls	
(a) Design Wind Pressure Exceeds 20 psf.	M or S
(b) Design Wind Pressure 20 psf. Or less.	M, S or N
Glass Block Masonry	M, S or N
Non-Bearing Partition and Fireproofing	M, S, N, O or Gypsum
Gypsum Partition Tile or Block	Gypsum
Fire Brick	Refractory Air Setting Mortar
Masonry Other Than Above	M, S or N

b. Hollow or solid units shall meet the following:

- (a) Load-bearing wall tile ASTM C 34-62
- (b) Non-load bearing tile ASTM C 56-62
- (c) Concrete hollow load-bearing units ASTM C 90-64T
- (d) Concrete hollow non-load bearing units ASTM C 129-64T
- (e) Solid load-bearing concrete masonry units ASTM C 145-64T

c. Stone

- (a) Cast Stone ACI 704-44
- (b) Natural stone shall be sound, free from friable inclusions and have sufficient strength, durability, resistance to impact and abrasion for the proposed use.

SECTION 14. Foundation Walls.

- (1) Wall Thickness: Foundation walls shall not be less in thickness than 8 inches or the wall supported with the following exceptions and height limitations.
- a. Solid masonry unit walls 8 inches thick shall not extend more than 5 feet below adjacent finished grade.
 - b. Cavity walls 10 inches thick and hollow masonry walls 8 inches thick shall not extend more than 4 feet below adjacent finished grade.
 - c. The combined height of 8 inch masonry foundation wall and the wall supported shall not exceed 30 feet at eaves and 35 feet at ridge in gable ends.
 - d. Foundation walls supporting brick veneer or cavity walls. Foundation walls of 8-inch thickness and conforming to the provisions of this section may be used as foundations for dwellings with walls of brick veneer on frame walls, or 10-inch cavity walls; provided that the dwelling is not more than 2 stories in height and the total height of the wall, including the gable, is not more than 25 feet. Foundation walls of 8-inch thickness supporting brick veneer or cavity walls shall be corbelled with solid units to provide a bearing the full thickness of the wall above unless adequate bearing is provided by a concrete floor slab. The total projection shall not exceed two inches with individual corbels projecting not more than 1/3 the depth (height) of the unit. The top corbel course shall be not higher than the bottom of floor joists and shall be a full header course of headers at least 6 inches in length.
 - e. Concrete. Foundation walls of cast-in-place reinforced or plain concrete shall be not less than 7 ½ inches thick; provided that when the basement floor does not exceed 4 feet below average grade level, walls may be 6 inches thick.
 - f. Rubble Stone. Foundation walls of rubble stone shall be at least 12 inches thick. Rough or random rubble shall not be used as foundations for walls exceeding 35 feet in height.
 - g. Foundation walls, supporting a maximum of one story frame construction, excluding brick veneer frame construction, and the total height of the wall, including the gable, is not more than 17 feet, may be constructed of 4" solid masonry subject to the following limitations:
 1. Maximum height of the wall above top of footing shall be 4'-0".
 2. Maximum spacing of pilasters shall be 4'-0" on center.
 3. Pilasters shall be minimum of 12" x 12" and bonded into the wall.
 4. Maximum height of unbalanced fill shall be 24".
 5. Full joist bearing with solid bridging shall be provided.
 6. Provide approved joist anchors at each pilaster.
- (2) Construction:
- a. Walls or piers supporting frame construction shall extend so that the wood construction is not less than 8 inches above outside finished grade.
 - b. Walls and piers of hollow masonry units shall be capped with minimum of 4 inches of solid masonry or poured concrete for dwellings not over one story; and not less than 8 inches for other dwellings.

Revised
9-10-85

- c. When constructed of hollow masonry jamb enclosure units shall be used at all openings and the sill shall be solid masonry or poured concrete.
- d. All-weather wood foundations are permitted when the following requirements are met.
 - 1. The foundation shall be designed, fabricated, and installed in accordance with the "All-Weather Wood Foundation Design and Installation Manual", revised January 1982, of the National Forest Products Association with the following exceptions.
 - (a) The minimum thickness of the stone layer under the footing shall be 12 inches.
 - (b) For design purposes, the maximum allowable soil bearing pressure shall be 2000 pounds per square foot and the lateral loads from the soil shall be based on a minimum equivalent-fluid weight of 40 pounds per cubic foot for sandy soils and 50 pounds per cubic foot for clayey soils or as determined by an Engineer registered in North Carolina who is experienced in soils engineering.
 - (c) Adequate anchorage shall be provided to transfer all wind and soil pressures into supporting soil.
 - (d) Foundation shall not be used for basements when the basement sump pit does not freely drain by gravity to grade or storm sewer. Sump pumps are not permitted.
 - 2. Design shall be performed by an Engineer registered in the State of North Carolina whose seal shall be affixed to all foundation drawings.
 - 3. Materials, fabrication and installation shall be inspected and a certificate of compliance furnished by either an Engineer registered in North Carolina or by an independent third party inspection agency approved by the North Carolina Building Code Council for this type service.

Revised
9-11-84

(3) Pier and Curtain Walls.

- a. Curtain walls 4 inch (nominal) minimum thickness between piers bonded into piers supported on concrete footings poured integrally with pier footing may be used for frame construction and for masonry veneer frame construction not more than 2 stories in height subject to the following limitations:
 - 1. Maximum height above footing:
 - Hollow Masonry: 18 times thickness of curtain wall.
 - Solid Masonry: 20 times thickness of curtain wall.
 - 2. Unbalanced fill placed against 4 inch curtain wall shall not exceed 24 inches for solid masonry or 16 inches for hollow masonry.
 - 3. Maximum pier Spacing: Under girder or sill supporting floor joist, 8 ft. on centers; under wall sill in line parallel to joist, 12 feet on centers.

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(4) Piers shall be Masonry or Poured Concrete.

- 1. Hollow Masonry: See Section 14(2)a. and b. this Code.
- 2. Maximum unsupported height shall not exceed 10 times least dimension for solid masonry or poured concrete and 4 times least dimension for hollow masonry.

FOUNDATION WALLS

3. Minimum Pier Sizes.

- a. Solid Masonry 8 x 12 inches
- b. Hollow Masonry 8 x 16 inches
- c. Poured Concrete 8 x 12 inches or 10 inches round when solid masonry units are of sufficient strength to permit the maximum working stresses (350 p.s.i. for Type S mortar) shown in Table 5 for allowable compressive stresses in Unit Masonry, Section 1403.2 of the North Carolina State Building Code, Volume I, the minimum pier size may be reduced to nominal 8 x 8 inches.

- (5) Basement retaining walls when constructed inside the main foundation walls shall have the top at least flush with adjacent inside grade and shall be not less than 6 inches thick for poured concrete; 8 inches thick for masonry units. The distance from the interior face of the main foundation walls to the interior face of the basement retaining walls shall be not less than the height of the basement retaining wall but in no case less than 3 feet 6 inches. The top of the adjacent grade shall not be below the top of the main foundation wall footings.
- (6) All foundation walls for porches or terraces, containing earth fill, shall not be less than 8 inches thick for masonry units, or not less than 6 inches thick for poured concrete with footing at least 6 inches thick with 3 inch projection on either side.
- (7) All masonry chimneys shall have footings of concrete which shall rest on solid ground, shall extend down to the level of footing of main foundation walls surrounding the area where the chimney is located, and where chimneys occur in outside walls or inside bearing walls, the footing shall be bonded with the wall footing.
- (8) Poured concrete or solid masonry bases extending not less than 8 inches above finish grade shall be constructed under wood column posts.

(9) Slab on Grade Floors:

- a. General: Construction shall be such that water or dampness will not penetrate slab.

Remove all debris, sod, tree stumps and other vegetable or organic material and provide a smooth surface free of pockets under slab area.

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Fill under slab shall be thoroughly tamped. Where the slab is cast against a masonry or concrete surface, provide a joint consisting of two layers of felt or equivalent.

b. Solid Concrete Slab.

- (a) Bed under slab shall be gravel, sand or crushed rock not less than 4" thick.

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- (b) Cover bed with 6 mil (.006 inch) polyethylene sheeting, or equivalent vapor barrier material, with edges lapped at least 6 inches and sealed or stapled and extended to top of slab.

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- (c) Wire mesh reinforcement minimum weight 20 pounds per 100 sq. ft. or synthetic fiber reinforcement not less than 1.5 pounds per cubic yard of concrete.

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- (d) Minimum concrete thickness 3 1/2 inches.

c. Tile and Concrete Slab.

- (a) On ground of uniform compaction place 3" partition tile flat on a level sand bed not to exceed 1" with adjacent tile units touching but with no mortar between.

- (b) Wet tile thoroughly immediately before pouring concrete cap.
- (c) Cap with 2 inches concrete.
- (d) Cover sand bed with 55 pound roll roofing or equivalent, with edges lapped and sealed and extend up to top of slab.

(10) Foundation Wall Vents:

Crawl spaces under buildings without basements shall be ventilated by approved mechanical means or by openings in the foundations walls. Openings will be arranged to provide cross-ventilation and shall be covered with corrosion resistant wire mesh of not less than 1/4-inch nor more than 1/2-inch in any dimension. Such wall openings shall have a net area of not less than two square feet for each 100 linear feet of exterior wall, plus 1/3 square foot for each 100 square feet of crawl space; provided, when an approved vapor barrier is installed over the ground surface, the specified net area of openings may be reduced 50 percent. Vents shall be so placed as to provide ventilation at all points and prevent dead air pockets.

SECTION 15. Exterior Masonry Walls.

- (1) a. Walls of Residence Buildings. In residence buildings not more than three stories in height, walls other than coursed or rough or random rubble stone walls may be of 8-inch thickness when not over 35 feet in height and the roof is designed to impart no horizontal thrust. Such walls in 1-story residence buildings, and 1-story private garages, may be of 6-inch thickness when not over 9 feet in height, except that the height to the peak of a gable may be 15 feet.
 - b. Cavity walls shall not exceed 35 feet in height. The cavity between wythes shall be not less than 2 inches (actual) nor more than 3 inches in width, and the minimum wythe thickness shall be not less than 4 inches, except where 3 inch thick wythes are specifically permitted. The backing wythe shall be at least as thick as the facing wythe.
 - (1) Where both the facing and backing wythes have a thickness or 4 inches, the height of such cavity walls shall not exceed 25 feet.
 - (2) Where both the facing and backing wythes are composed of solid masonry units, the wythes may be 3 inches thick, but the height of such cavity walls shall not exceed 20 feet.
 - c. Masonry bonded hollow walls shall not exceed 35 feet in height. The cavity between wythes shall not be less than 2 inches (actual) nor more than 4 inches in width, and the minimum wythe thickness shall not be less than 3 inches. The backing wythe shall be at least as thick as the facing wythe.

(2) Bonding:

General

The facing and backing of masonry walls and partitions shall be bonded in such a manner to provide for common action of the wythes of the material used. Bonding may be accomplished as follows:

(a) Bonding With Headers

Where *solid masonry, faced* or *composite* wall construction is bonded by means of masonry headers, no less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches into the backing. The distance between adjacent full-length headers shall not exceed 24 inches either vertically or horizontally. In walls in which a single header does not extend through the walls, headers from the opposite sides shall overlap at least 3 inches, or headers from opposite sides shall be covered with another header course overlapping the header below at least 3 inches.

(b) Bonding With Metal Ties

Where *solid masonry, cavity, faced* or *composite* wall construction is bonded with metal ties the ties shall be corrosion resistant 3/16 inch diameter metal ties or wire of equivalent stiffness embedded in the horizontal mortar joints. There shall be one metal tie for not more than each 3square feet of wall area. Ties in alternate courses shall be staggered, the maximum vertical distance between ties shall not exceed 24 inches, and the maximum horizontal distance shall not exceed 36 inches. Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls the ends of ties shall be bent to 90 degree angles to provide hooks not less than 2 inches long. Additional bonding ties shall be provided at all openings spaced not more than 3 feet apart around the perimeter and within 12 inches of the opening. Walls bonded in accordance with this Section shall conform to the allowable stress, lateral support, thickness (excluding cavity), height and mortar requirements for cavity walls unless the collar joint in such walls are filled with mortar.

Cavity walls shall be bonded in accordance with the requirements of subsection (b).

(c) Bonding With Hollow Masonry Units

Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 3feet, by lapping at least 4 inches over the unit below or by lapping with units at least 50 percent greater in thickness than the unit below at vertical intervals not exceeding 17 inches, or bonded with corrosion-resistant metal ties conforming to the requirements of Section b.

(d) Ashlar, Natural or Cast Stone

CONSTRUCTION: In ashlar masonry, bond stones uniformly distributed shall be provided to the extent of not less than 10 percent of the area of exposed faces.

Rubble stone masonry 24 inches or less in thickness shall have bond stones with a maximum spacing of 3 feet vertically and 3 feet horizontally and, if the masonry is of greater thickness than 24 inches, shall have one bond tone for each 6 square feet of wall surface on both sides.

(e) Masonry Bonded Hollow Walls

In masonry bonded hollow walls, the facing and backing shall be bonded so that not less than 4 percent of the wall surface of each face is composed of masonry bonding units extending not less than 3 inches into the backing. The distance between adjacent bonders shall not exceed 24 inches either vertically or horizontally.

Where the bonding units have a compressive strength of 4500 psi gross area, the facing and backing may be bonded so that not less than 2 percent of the wall area is composed of bonders.

(f) Stack Bond of Masonry Walls

Where masonry units are laid in stack bond, continuous prefabricated joint reinforcement or other steel bar or wire reinforcement shall be embedded in the horizontal mortar beds at vertical intervals not to exceed 16 inches. The longitudinal bar or wire of such reinforcement shall be corrosion resistant and not less than No. 9 gage and at least one longitudinal bar or wire shall be provided for each 6 inches of wall thickness or fraction thereof.

Exterior Masonry Walls

(g) Bonding With Prefabricated Joint Reinforcement

Where prefabricated joint reinforcement is used for the bonding of the facing and backing of stack bond, cavity, faced or composite, or other multi-wythe constructed masonry walls, there shall be one cross wire serving as a tie for not more than each 2 feet of wall area. The vertical spacing of the reinforcement shall not exceed 16 inches. Cross wires on prefabricated joint reinforcement shall be corrosion resistant and shall be not less than No. 9 gage.

- (3) Proper provision shall be made for adequate anchoring together of all intersecting concrete and masonry walls.
- (4) In walls constructed of hollow masonry units, that portion of the walls occurring under ends of girders shall be of solid masonry under the girder. Solid masonry material equivalent to at least 2 courses of brick shall be used under the ends of lintels over openings. At least 4 inches of solid masonry construction or other suitable bearing anchored to masonry walls shall be provided under all ceiling joists and roof rafters framing into masonry walls.
- (5) Masonry Veneering.
 - a. Materials used for masonry veneering shall be of not less than 1 5/8 inches in actual thickness for solid masonry units, and not less than 3 inches in actual thickness for hollow masonry unit.
 - b. In stone ashlar, each stone shall have a reasonably uniform thickness, but all stones need not necessarily be of same thickness.
 - c. Height. Masonry veneer shall not exceed 35 feet in height above foundations or other approved support.
 - d. Attachment of masonry veneering.

Masonry veneer on wood frame structures or wood or steel framing shall be anchored by corrosion-resistant metal ties spaced not farther apart than 16 inches vertically and 32 inches horizontally. Each tie shall be embedded in a stretcher course and be securely fastened to the structure.
 - e. Flashing. Corrosion-resistant flashing to prevent moisture from penetrating behind the veneer shall be provided over wall openings, or other places as may be required.
 - f. Provide a nominal one inch space between the veneer and the storm sheathing in all cases. The storm sheathing shall be covered with water-proof building paper or saturated asphalt felt. Water-proof building paper may be waived where water-proof sheathing materials are used.
 - g. Provide weepholes, approximately 4 feet O.C. by omitting mortar in vertical joints, at bottom course of veneer. Provide 30 pound asphalt-saturated felt or corrosion-resistant metal base flashing. Extend over top of foundation wall approximate outside face of wall and not less than 6 inches up on sheathing under sheathing paper. If sheathing paper is omitted, install under sheathing for a height of not less than 6 inches.
- (6) Joints between masonry units shall not be over 3/4 inch thick. All masonry joints in walls built of solid units shall be filled solid. All outside joints on the surface of the walls shall be weathered or tooled unless approved otherwise by the Building Inspector.

Exterior Masonry Walls

- (7) Supporting lintels or properly designed masonry arches which will adequately support the loads will be required in the heads of all openings in masonry and masonry veneered walls. This requirement applies to lintels for fireplaces. Lintels shall be installed before the masonry above is laid.
- (8) In masonry buildings, all exterior walls except cavity walls and hollow walls above basement which are to be plastered shall be furred with 2 inch thick furring tile or with one inch wood furring strips spaced 24 inches o.c. If the surface of exterior masonry walls is completely covered with an approved dampproofing material, the furring may be omitted. Where there is evidence of excessive moisture the wood furring strips shall be pressure treated with an approved preservative treatment process.

SECTION 16. Chimneys, Flues and Vents.

(1) Definitions:

- (a) Flue means a passageway for removing products of combustion solid, liquid or gas fuels.
- (b) Chimney means a vertical shaft of masonry enclosing one or more flues from heat producing equipment and fireplaces.
- (c) Smoke pipe means a pipe or breaching connecting a heating appliance and a flue.
- (d) Gas vent means a flue from gas appliances but not suitable for other fuels, constructed of non-combustible materials, insulated, with sealed joints; of a type approved by the Underwriter's Laboratories for Type B vents or the American Gas Association and should be labeled "This vent for use with appliances which burn gas only."
- (e) Draft hood means an indirect connection to a gas burning appliance that will prevent back-draft or excessive draft and allow escape of products of combustion in the event of stoppage of draft.

(2) Chimneys are required for fireplaces, and equipment burning solid and liquid fuels. They shall be constructed with fire-clay flue linings encased in not less than 4 inches of solid masonry. Flues for equipment burning solid or liquid fuels shall be not less than a nominal 8 inch flue, square or round. Flues from fireplaces shall be not less than 1/10" of the face area of the fireplace opening or the combined areas of fireplaces with 2 or more faces.

- (a) Masonry and mortar materials and construction shall conform to the other sections of this Code.
- (b) Where two flues adjoin each other in the same chimney with only flue lining separation between them, the joints of the adjacent flue linings shall be staggered at least 7 inches. Where more than two flues are located in the same chimney, masonry wythes at least 4 inches wide and bonded into the masonry walls of the chimney shall be built at such points between adjacent flue linings that there are not more than two flues in any group of adjoining flues without such wythe separation.
- (c) Chimneys and gas vents shall extend at least 2 feet above the highest point where they pass through the roof of a building and at least 2 feet higher than any portion of the building within 10 feet except that gas vents need not comply with this provision when equipped with a U.L. approved device which assures proper and effective venting when installed in accordance with manufacturer's recommendations.
- (d) Cap chimneys with brick, concrete, stone, terra cotta, or other non-combustible weather proof material.
- (e) Flue liners shall start from a point not less than 8 inches below the intake, or, in the case of fireplace, from the throat of the fireplace. They shall extend, as nearly vertically as possible, for the entire height of the chimney.
- (f) A fire clay or equivalent approved thimble is required to extend into and sealed to the flue lining.

(3) Gas vents shall be sized in accordance with N.F.P.A. standard No. 54.

- (a) Support vents rigidly to prevent settlement or disruption by physical damage.
- (b) Provide proper clearances from combustible materials.
- (c) Provide Weathertight connections at roof and with hood above vent.

(4) Breachings or smoke pipes from equipment burning solid or liquid fuels shall be not less than 18 inches from combustible materials, 12 inches from lath and plaster surfaces.

(a) Uninsulated stoves or heaters require the above clearances.

(b) In case of greater hazards the Building Inspector may also require the use of asbestos board to protect the construction.

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(5) Fireplaces shall have back wall and side walls of 6 inches thickness solid masonry or reinforced concrete, with lining of not less than 2 inch thickness firebrick or other refractory material, except when walls are of 12 inch thickness lining is not required. Combustible material shall not be placed within six inches of the edges of a fireplace opening. Combustible material above and projecting more than 1 ½ inches from the face of the fireplace opening shall have a minimum clearance of 12 inches above the opening. Woodwork, such as studs and paneling, shall not be placed within 4 inches of the back of masonry fireplaces.

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(a) Fireplace hearth extension shall be provided of approved noncombustible materials for all fireplaces. Where the fireplace opening is less than 6 sq. ft., the hearth extension shall extend at least 16 in. in front of, and at least 8 in. beyond each side of the fireplace opening. Where the fireplace opening is 6 sq. ft. or larger, the hearth extension shall extend at least 20 in. in front of, and at least 12 in. beyond each side of the fireplace opening. Where a fireplace is elevated above or overhangs a floor, the hearth extension shall also extend over the area under the fireplace. Wooden forms or centers used during the construction of hearth and hearth extension shall be removed when the construction is completed.

(b) Fireplaces shall have a minimum depth of 16 inches from face of fireplace, constructed with smoke shelf, smoke chamber full width of opening tapering up to the Clue.

(c) Ash dumps, when used, shall empty into fireproof compartment or pit which shall have a metal cleanout door. The cleanout door shall have a diameter of at least 5 inches.

(d) Masonry chimneys for low heat appliances shall be lined with approved fire clay flue liners not less than 5/8 of an inch thick, or with other approved liner of material that will resist without softening or cracking at temperature of 1800° F.

(e) Fire clay flue liners shall be installed ahead of the construction of the chimney as it is carried up, carefully bedded one on the other in Type M. Type S or fire clay mortar with close fitting joints left smooth on the inside.

(6) Prefabricated Flues, Chimneys, and Fireplaces.

(a) Prefabricated flues, chimneys, and fireplaces bearing the Underwriters' Laboratories label may be used under the conditions specified in the Laboratories listing provided such installation is made in accordance with the manufacturer's recommendation and is protected against mechanical injury. Precast concrete fireplaces not complying with Section 16(5) may be used, provided they:

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(1) have been tested in accordance with Underwriters Laboratory standards by an approved independent laboratory and listed by the same laboratory; and

(2) bear the label of an approved independent quality assurance agency to show compliance with the listing; and

(3) are installed in accordance with the conditions of the listing.

Chimneys, Flues and Vents

- (b) Chimneys specified in Section 16.2 or prefabricated chimneys with Underwriters' Laboratories label as specified above are required for:
- (1) all incinerators;
 - (2) all appliances which may be converted readily to the use of solid or liquid fuel;
 - (3) all boilers and furnaces except where the authority having jurisdiction approves the use of Type B Gas Vents;
 - (4) all other appliances except approved appliances which produce flue gas temperatures not in excess of 550°F. at the outlet of the draft hood when burning gas at the manufacturer's input rating.

NOTE: Where authorities approve the use of Type B Gas Vents, the Type B Vents and boilers and furnaces attached thereto shall bear approval of the American Gas Association or Underwriter Laboratories.

(In determining whether to permit the use of type B gas vents for venting boilers and furnaces having flue gas temperatures within the limit above specified, building officials should give consideration to the possibility of a change to solid or liquid fuel, and to the possibility of getting an approved chimney installed in case such a change is made. Where local conditions with respect to gas supply are such that change to other fuel is considered unlikely, or where arrangement can be made so that the building official will be notified of the change from gas to other fuel and so that the requirement for a chimney can then be enforced, it is suggested that the building official may safely permit the use of type B gas vents for venting heating boilers and furnaces having flue gas temperatures within the limit above specified).

SECTION 17. Dampproofing and Waterproofing.

In buildings hereafter erected, if by reason of dampness in the ground, the building inspector shall deem it necessary to do so, foundation walls in basement below the adjacent ground level shall be rendered waterproof or dampproof as conditions require by some approved process. Where the finished grade under the building is lower than the outside finished grade, adequate provisions must be made for drainage.

Note: This Section can be changed by each city, town or county to better meet local conditions.

SECTION 18. Structural Steel Members.

- (1) All steel structural members shall be designed, fabricated and erected in accordance with one of the appropriate following specifications:
 - (a) Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, Adopted April 7, 1963 by the American Institute of Steel Construction.
 - (b) Specification for the Design of Light Gage Cold-Formed Steel Structural Members, 1962 Edition, by American Iron and Steel Institute.
 - (c) Standard Specifications for Open Web Steel Joists, J- and H-Series, Effective March 1, 1965, and Standard Specifications for Longspan Steel Joists, W- and LH- Series, Effective July 1, 1966 both as adopted by the American Institute of Steel Construction and the Steel Joist Institute.
 - (d) Code for Welding in Building Construction, AWS D1.0-66, 1966 Edition, Adopted by the American Welding Society.
- (2) Loose shims between column caps and beams or girders will not be acceptable. Caps, when used, shall be securely anchored to beams or girders. The base of all columns shall be securely anchored by anchor bolts or embedded in concrete.

SECTION 19. Wood Construction – General.

- (1) All members shall be framed, anchored, tied, and braced to develop the strength and rigidity necessary for the purposes for which they are used.

Preparation, fabrication, and installation of wood members, connectors and mechanical devices for fastening thereof, shall conform to accepted standards of good workmanship.

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For those structural design requirements not covered herein, the National Design Specification - Wood Construction.198. National Forest Products Association shall be accepted as good practice.

The details specified herein are applicable to conventional arrangements of wood framing. Other methods may be used where adequacy has been established by engineering calculations or by structural tests.

- (2) All wood structural members shall be of sufficient size, to carry the dead and required live loads without exceeding the allowable working stresses as contained in the standard listed in Section 19 (1).

Where minimum sizes of lumber are shown herein, they shall be construed as meaning nominal sizes. American Softwood Lumber Standard, PS Q-70, dressed sizes shall be accepted as minimum net sizes conforming to nominal sizes. Computations to determine the required sizes of members shall be based on the net dimensions (actual size) and not on the nominal sizes.

For convenience, nominal sizes may be shown on the plan. If rough sizes of finished size is greater or smaller than American Softwood Lumber Standard, dressed sizes are to be used, computations may be predicted upon such actual sizes, provided they are specified on the plans or any statement appended thereto.

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- (3) Any wood, including sleepers, sills or sole plates resting on a concrete or masonry slab in direct contact with earth, whether on gravel or vapor barrier, shall be of approved durable or treated wood.

- (4) Where applicable as determined by end use, allowable working stresses may be determined by "Machine Stress Rating" as approved by the American Lumber Standards Committee.

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- (5) All lumber including end-joined lumber used for load supporting purposes shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the Board of Review of the American Lumber Standards Committee. Lumber that is treated, rough sawn, or pre-cut and lumber thicker than two inches may be identified by a certificate of inspection from an approved inspection bureau or agency in lieu of grade marking. All lumber members 2 inches and less in thickness shall contain not more than 19% moisture at the time of permanent incorporation in a building or structure.

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- (6) Protection Against Decay and Termites:

(a) In areas subject to termite damage, the following locations shall require the use of an approved species and grade of lumber, pressure preservatively treated in accordance with the standards in paragraph (f) or heartwood of Bald Cypress (Tidewater Red), Redwood, and Eastern Red Cedar.

1. Wood joists or the bottom of a wood structural floor when closer than eighteen (18) inches or wood girders when closer than twelve (12) inches to exposed ground in crawl spaces or unexcavated areas located within the periphery of the building foundation.

Wood Construction – General

2. All sills which rest on concrete or masonry exterior walls and are less than eight (8) inches from exposed ground.
 3. The ends of wood girders entering exterior concrete or masonry walls which have clearances of less than one-half (1/2) inch on the top, sides and ends.
 4. Wood siding on the exterior of a building having a clearance of less than six (6) inches from the ground.
- (b) Exposed Structural Lumber and Glued Laminated Timber. All structural lumber and glued laminated timber subjected to alternate wetting or drying, supporting frames, balconies, walkways, ramps, platforms, etc. shall be pressure treated with an approved preservative or an approved wood of natural resistance as heartwood of Redwood, Bald Cypress (Tide- water Red), Black Walnut, Black Locust or Cedar.
- (c) All lumber and plywood required to be preservatively treated in this code shall bear an approved "AWPB" Quality Mark or that of an independent inspection agency that maintains continuing control, testing, and inspection over the quality of the product as described in the quality control standards listed in paragraph (f).
- (d) The standards of the American Wood Preservers Bureau for preservatives shall be deemed as "approved" in respect to pressure-treated lumber. Other processes and methods of treatment shall be subject to approval by the building officials.
- (e) In those geographical areas where experience has demonstrated a need for greater protection, the requirements in the preceding items may be modified to the extent required by local conditions. (For guidance, see NFPA "Designing Wood Structures for Performance," WCD No.6).
- (f) AWPB LP22-1980- Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservatives for G round Contact Use.
- AWPB LP 3-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Light Hydrocarbon Solvent-Penta Solution for Above Ground Use.
- AWPB LP 4-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Volatile Hydrocarbon Solvent-Penta Solution for Above Ground Use.
- AWPB LP 44-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Volatile Hydrocarbon Solvent-Penta Solution for Ground Contact Use.
- AWPB LP 5-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Creosote or Creosote Coal-Tar Solutions for Above Ground Use.
- AWPB LP 55-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Creosote or Creosote Coal-Tar Solution for Ground Contact Use.
- AWPB LP 7-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Heavy Hydrocarbon Solvent-Penta Solution for Above Ground Use.
- AWPB LP 77-1978 - Softwood Lumber, Timber and Plywood Pressure Treated with Heavy Hydrocarbon Solvent-Penta Solution for Ground Contact Use.

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- (7) All structural-use panels shall conform to performance criteria for their end use, as well as to applicable qualification and quality assurance policies, as defined in Performance Standards and Policies for Structural-Use Panels dated November, 1982. Each panel shall be identified for end-use grade and exposure durability classification by the trademark of an approved testing and grading agency. Structural-use panels, when permanently exposed in outdoor applications, shall be classified Exterior, except that roof sheathing of Exposure 1 durability classification may be exposed to the outdoors on the underside. All structural-use panels other than panels marked PS 1 must be marked Exterior or Exposure 1.
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- (8) When field fabrication of pressure treated wood is necessary, the cut ends shall be treated in accordance with AWPA Standard M4-80.

SECTION 20. Wood Floors, Ceilings and Roofs.

- (1) All wood structural framing members shall be kept at least 2 inches away from the chimney masonry and all other wood shall be kept at least one inch away.

Note: Ends of wood girders may be supported on a corbeled shelf of a chimney.

- (2) Girders may be steel, solid wood, built-up wood , reinforced concrete or reinforced clay tile.
- (3) All joints of solid and the outside members of built-up wood girders shall be made over pier or column supports
- (4) The distance between supports under wood girders shall not exceed the following for load bearing conditions:

MAXIMUM SPAN FOR WOOD GIRDERS AND SILLS

Nominal Size in inches	Maximum Clear Span	
	1 Story Dwelling	1 ½ to 2 Story Dwelling
4 x 6	5 ft.	4 ft.
4 x 8	6 ft. 4 in.	5 ft. 6 in.
6 x 8	8 ft.	7 ft.
4 x 10	8 ft.	7 ft.
6 x 10	9 ft.	8 ft.

Maximum Spans of Wood Girders Supporting Non-Load Bearing Partition:

Nominal Girder Size	Houses Up to 26 Ft. Wide	Houses 26-32 Ft. Wide
4 x 6	5 ft. 6 in.	
4 x 8	7 ft. 6 in.	7 ft. 0 in.
4 x 10	9 ft. 0 in.	8 ft. 6 in.
6 x 8	9 ft. 0 in.	8 ft. 6 in.
6 x 10	11 ft. 6 in.	10 ft. 6 in.
6 x 12	12 ft. 0 in.	11 ft. 6 in.

Note: These tables are based upon normal conditions for the readily available timber sizes. For other loadings consult the attached Appendix A.

- (5) Where floor joists frame into the side of wood girders, the joists shall be supported on metal joist hangers or on a bearing strip or ledger board on the side of the girders. Size of ledger shall be at least 2 x 2 inches. The notch in the end of the joist shall be not more than ¼ of the joist depth.
- (6) Ends of floor joists framing into masonry walls shall have not less than 4-inch bearing and shall have at least a 3-inch bevel or fire cut.

- (7) Each fourth joist in wood floor construction framing into masonry walls shall have a metal strap anchor applied on the side and near the bottom of the joist and shall extend into the masonry wall. Masonry walls running parallel to the floor joists above the first floor shall be tied to the floor construction with metal strap anchors spaced not over 6 feet apart and extending over and secured to at least 3 joists.
- (8) An extra joist shall be placed under non-load bearing partitions which run parallel to the floor joists.
- (9) Headers and trimmers shall be doubled except that headers 4 feet or less in length may be of single thickness provided the header is supported on not less than a 2 x 2 inch ledger boards and header is secured by spikes driven through one thickness of the trimmers into the ends of the header. Headers receiving more than four joists shall have ends supported in metal joist hangers.

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- (10) Ends of lapped joints shall rest on girders, beams or on bearing partitions, shall be lapped a minimum of 3 inches, and shall be securely nailed to the bearing member and to each other.
- (11) Where second story is framed out over the wall below and the second floor joists run parallel to the supporting wall, the supporting members of the overhang shall carry back at least 30 inches and frame into doubled floor joists. The maximum projection of the overhanging shall be 15 inches. Where framing is at right angle to the supporting wall, the joists shall extend continuous in one piece to form the overhang.

NOTE: This construction shall also apply to all projections carrying floor and roof loads which are not supported directly by a foundation unless adequate structural calculations are furnished to support such design.

- (12) Floor joists, having a depth to thickness ratio exceeding 6 and/or the design live load is in excess of forty (40) pounds per square foot, shall be supported laterally by bridging or blocking installed at intervals not exceeding eight (8) feet.
- (13) Hung Ceiling – In flat roof construction where the ceiling joists are hung from roof joists, the requirement for the roof joists shall be the same as for floor joists. Ceiling joists shall be a minimum of 2 x 4's of same spacing as roof joists and shall be supported from the roof joists with 1 x 4 inch hangers, spaced not more than 6 feet o.c. and securely nailed to sides of roof and ceiling joists.

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9-14-82

- (14) Maximum spans for floor joists shall be in accordance with the "Span Tables for Joists and Rafters", 1977 as published by the National Forest Products Association or may be designed in accordance with accepted engineering practice. [(1) National Design Specification- Wood Construction. 1982: (2) Wood Structural Design Data published by National Forest Products Association. 1978]

Wood Floors, Ceilings and Roofs

ALLOWABLE SPAN FOR PLYWOOD AND STRUCTURAL-USE PANEL FLOOR AND ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN PERPENDICULAR TO SUPPORTS¹

Revised
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Panel Span Rating*	Roof Maximum Span (Inches)		Loads ³ (PSF)		Floor Maximum Span ⁴ (Inches)
	Edges Blocked	Edges Unblocked			
12/0	12	12			0
16/0	16	16			0
20/0	20	20			0
24/0	24	20			0
24/0 ²	24	24			0
24/16	24	24			16
32/16 ⁵	32	28			16 ⁷
40/20 ⁸	40	32			20 ⁷
48/24	48	36			24

¹ Span shall be limited to values shown because of possible effect on concentrated loads. Edges may be blocked with lumber or other approved type of edge support.

² Applies to one-half (1/2) inch thickness.

³ For plywood loads see *APA Design Construction Guide – Residential & Commercial*. For Structural-Use Panel loads see section 20(16).

⁴ Sheathing 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 25/32" wood strip or 1 1/2" light weight concrete installed. Allowable uniform load based on deflection of 1/360 of span is 165 psf.

⁵ 32/16 Structural I, when continuous over one 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 inches (24 in) on center, and the total load does not exceed 30 pound per square foot. For other grades, a thickness of nineteen-thirty seconds (19/32") is required.

⁷ May be 24" if 25/32" wood strip flooring is installed at right angles to joints.

* The first numeral denotes spans for roofs and second numeral for floors.

Note: All plywood when used structurally (including among others, used for siding, roof and wall sheathing, subflooring, diaphragms, and built-up members) shall conform to the performance standards for its type in U.S. Products Standard PSI-83 for Softwood Plywood. Construction and Industrial. Each panel or member shall be identified for grade and glue type by the trademarks of an approved testing and grading agency. In addition, all plywood when permanently exposed in outdoor applications shall be of Exterior type, except that plywood roof sheathing exposed to the outdoors on the underside may be interior type bonded with exterior glue.

⁸ For Joist spaced 24" o.c. plywood sheathing with Span Rating numbers 42/20 or greater can be used for subfloor when supporting 1 1/2" lightweight concrete. The lightweight concrete fill must have a density of 100 pcf minimum.

NOTE: No foot note #6 included.

(15) Cutting of floor joists to facilitate the installation of piping and duct work will be permitted with the following limitations:

- (a) The top or bottom edges of joists may be notched not to exceed 1/6 of the joist depth but notching the top or bottom edge of joists will not be permitted in the middle third of any joist span.

- (b) If cutting of floor joist more than 1/6 of its depth is found necessary, a header the full depth of the joist shall be cut in to support the end of the joist.
 - (c) Where location of pipes necessitates passing through the joists, holes shall be drilled to receive the pipes. The diameter of the holes shall not be more than 1/2 inch greater than the outside diameter of the pipe and in no case greater than 2 inches. The edge of the holes shall not be located nearer than two inches from the top or bottom edge of the joists.
- (16) Subflooring . . . Used as a base for wood finish flooring.
- (a) Wood boards used as a base for wood finished flooring shall be square edged, at least 5/8" actual thickness and not more than 8" in width. Boards shall be laid diagonally, and the ends cut over and parallel to the joist. Boards less than 8" in width shall be double nailed; 8" boards shall be triple nailed.
 - (b) T&G Boards may be used for subflooring provided each board bears on at least two joists.
 - (c) Mat-Formed Wood Particleboard which has been tested and listed by an independent agency, association, or testing laboratory to show compliance with American National Standard ANSI A208.1-1979 and installed in accordance with the installation instructions of the National Particleboard Association may be used as sub-flooring. All particleboard must bear the mark of an independent agency, association or testing laboratory. Each panel shall be marked with: Manufacturer's name or trademark, ANSI Standard A208.1, the grade, density in pounds per inch foot, the thickness in fractions of an inch, and the inspection/testing agency.

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3-12-85

**ALLOWABLE SPANS FOR PLYWOOD COMBINATION
SUBFLOOR-UNDERLAYMENT¹**

Plywood Continuous Over Two or More Spans and
Face Grain Perpendicular to Support

Identification	Maximum Spacing of Joists (inches)			
Species Groups ²	16"	20"	24"	48"
1	1/2"	5/8"	3/4"	--
2,3	5/8"	3/4"	7/8"	--
4	3/4"	7/8"	1"	--
Span Rating ³	16 oc	20 oc	24 oc	48 oc

¹ Spans limited values shown because of possible effect of concentrated loads. Allowable uniform load based on deflection of 1/360 of span is 125 psf, at maximum span. Plywood edges shall be 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 25/32" wood strip. If wood strips are perpendicular to supports, thickness shown for 16" and 20" spans may be used on 24" spans.

² Applicable to all grades of sanded Exterior type plywood.

³ Applicable to Underlayment grade and C-C (Plugged).

Wood Floors, Ceilings and Roofs

ALLOWABLE SPANS FOR PARTICLEBOARD SUBFLOOR AND COMBINED SUBFLOOR-UNDERLAYMENT^{1,5}

Grade	Thickness (inches)	Maximum Spacing of Supports ^{2,3,4}	
		Subfloor	Combined Subfloor-Underlayment
2-M-W	21/32	16	16
	3/4	19.2	19.2
2-M-F	3/4	19.2	19.2
2-M-3	3/4	19.2	19.2

¹ All panels are continuous over two or more supports and the tongue-and-groove panels are installed with the long dimension perpendicular to supports.

² Uniform deflection limitation: 1/360th of the span under 100 psf minimum load.

³ Edges shall have tongue-and-groove joints or shall be supported with blocking.

⁴ A finish wearing surface is to be applied to the top of the panel.

⁵ Floor sheathing conforming with this table shall be deemed to meet the design criteria of Section 20(16).

(d) Structural-use sheathing panels as defined in Section 19(6) and applied in accordance with the provisions of the span table may be used as subflooring under structural finish flooring. When resilient flooring is applied directly to structural-use panel sub-floor, the panel shall be identified for single-floor use and shall be applied over joists spaced no farther apart than the rating indicated on the panel. Structural-use panels for single-floor use at rated spans of 24" or less support 85 psf floor live load plus 10 psf dead load at rates maximum span. Panels with rated span of 48" support 65 psf total load.

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3-12-85

(17) All subflooring except plywood shall be covered with building paper or deadening felt before laying the finish floor.

(18) Finished floor not less than 25/32 inches thick T&G may be used without a subfloor, provided the ends of the flooring boards are cut over the joists and the joists are not more than 16 inches on center.

Revised
3-12-84

(19) Floor coverings of linoleum, composition or rubber tile and carpeting on *single layer* wood construction may be applied *directly to* T & G wood flooring or plywood structural use panels in accordance with the table (page 23), . . . and either sanded or scraped smooth before covering is applied. *For two-layer floor construction; sheathing of lumber structural use panels or plywood, may be covered with a minimum thickness of 1/4" Underlayment grade, C-C (Plugged) or any grade of sanded Exterior type plywood.* In kitchens and bathrooms and other areas subject to dampness *plywood structural use panels shall be manufactured with exterior glue – including Interior type with exterior glue, Exterior type, Underlayment Exterior, Underlayment Interior with exterior glue, or Structural-use panels classified Exterior or Exposure 1.*

(a) Particleboard floor underlayment shall conform to Type 1-M-1 of the American National Standard ANSI A208.1-1979. Underlayment shall be not less than one quarter (1/4) inch in thickness and shall be installed in accordance with the installation instructions of the National Particleboard Association. Type 2-M-1 of the American National Standard shall be used for underlayment in areas susceptible to excessive moisture such as bathrooms, laundry rooms, etc.

- (b) Hardboard with a minimum thickness of 1/4" untempered service type manufactured in accordance with commercial standard CS251-63, and stamped in accordance with the recommendations of the American Hardboard Association.
 - (c) T&G Wood flooring not more than four inches in width and either sanded or scraped smooth before covering is applied.
- (20) The spans in the table are based upon maximum deflection of 1/360 of the Span based upon a plaster dead load of 10# per square foot of ceiling uniformly distributed.
- Note: Where the attic space above ceiling joists is unfinished and the space is suitable for finishing into future habitable rooms, the spans for the ceiling joists shall be figured the same as the floor joists. In all cases where attic is served by disappearing or fixed stairway, attic storage shall be assumed as a basis for determining minimum ceiling joist sizes.
- (21) Ceiling joists shall, wherever possible, serve as ties for rafters and shall be securely nailed to the rafters.
 - (22) A minimum clear opening of 14" x 24" for access into each attic space shall be provided to allow for inspection and repair.
 - (23) Collar beams of 1x6's or 2x4's shall be installed on at least each third pair of roof rafters and shall be double-nailed to the rafters. Maximum spacing of collar beams, 5 ft. o.c. Other approved methods of bracing roof may be used.
 - (24) Where ceiling joists serve as collar beams and occur above the midjoint of the rafter, adequate provision shall be made for tying the lower end of the rafter to the floor construction. Where the installation of this tie is not possible because of structural conditions, the rafter size shall be increased sufficiently to support the roof load without thrust or undue bending in the lower end and the size of the collar beams shall be not less than that of the rafters.
 - (25) Maximum spans for ceiling joist and rafters shall be in accordance with "Span Tables for Joist and Rafters", 1977 as published by the National Forest Products Association, or may be designed in accordance with accepted engineering practice. Spans may be reduced by continuous bracing when the loads are transferred to the foundation through bearing walls.
 - (26) Rafters shall be securely spiked to the wall plate. Opposing rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at all ridges and a valley rafter at all valleys. The depth of the ridge board and valley rafters shall be not less than at the cut end of the abutting rafters. Valley and hip rafters shall be not less than 2 inches thick.
 - (27) All openings in roof construction for dormer windows where there are no supporting partitions shall be framed double.
 - (28) Requirements for headers and trimmers for roof framing around chimneys shall be same as required for floors except that for a sloping roof where headers are less than 4 feet in length and the chimney is either at the ridge or the eaves, the trimmers may be single.
 - (29) Roof rafters shall be covered with one inch T&G roof sheathing not more than 8 inches in width, laid closed for tile, slate, asbestos-cement or asphalt shingles. All roof sheathing shall be securely nailed to rafters at each bearing.

Wood Floors, Ceilings and Roofs

Note: End matched (T&G) boards may be used for roof sheathing, provided no two adjoining boards break joints over the same rafter space and each board shall bear on at least two rafters. Approved sheathing other than wood may be used.

Mat-Formed Wood Particleboard which has been tested and listed by an independent agency, association, or testing laboratory to show compliance with American National Standard ANSI A208.1-1979 and installed in accordance with the installation instructions of the National Particleboard Association may be used as roof sheathing. All particleboard must bear the mark of an independent agency, association or testing laboratory. Each panel shall be marked with: Manufacturer's name or trademark, ANSI Standard A208.1, the grade, density in pounds per inch foot, the thickness in fractions of an inch, and the inspection/testing agency.

Structural-use sheathing panels as defined in Section 19(6) and applied in accordance with the provisions of the span table may be used as roof sheathing.

ALLOWABLE LOADS FOR PARTICLEBOARD ROOF SHEATHING^{1,2,4}

Grade	Thickness (inches)	Maximum On-Center Spacing of Supports (inches)	Live Load (lbs. per sq. foot)	Total Load (lbs. per sq. foot)
	3/8 ³	16	45	65
2-M-W	7/16 ³	16	105	105
AND	7/16 ³	24	30	40
2-M-F	1/2	16	110	150
	1/2	24	40	55

¹ Panels are continuous over two or more spans.

² Uniform load deflection limitation: 1/180th or the span under live load plus dead load and 1/240th of the span under live load only.

³ Edges shall be tongue-and-groove or supported with blocking or Edge clips.

⁴ Roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 20.

- (30) Trussed Roof Construction: 2" x 4" construction spaced 24" o.c. will be permitted if T&G #2 Kiln Dried or 3/8" plywood sheathing is used.
- (31) Crickets or chimney saddles shall be installed on the upper side of all chimneys that are not in contact with the ridge.
- (32) Floor joists shall be supported laterally at the ends by 2" solid blocks or diagonal struts except where the ends of joists are nailed to a beam (Wood or steel with attached nailer), header, band joists or to an adjoining stud.

SECTION 21. Exterior Walls.

- (1) Wood stud walls shall have corner post built up using:
 - (a) A 4 x 6 solid post with a 2 x 4 piece to form the interior corner.
 - (b) Two 2 x 4 pieces with a 2 x 6 member between; or
 - (c) Three 2 x 4 pieces arranged to form the interior lathing corner . . . excepting that at interior corners formed by interior partitions abutting exterior walls, the "ladder-backing" method with 2 x 4's used, a maximum of 24 inches on center spaced vertically may be used.

Interior corners utilizing one 2 x 4 piece and exterior corners utilizing two 2 x 4 pieces with back up cleats with 3/8 inch thick plywood or 1 inch thick lumber may be used and specially designed metal clips will be acceptable when supporting wall material not requiring solid blocking.
- (2) Studs shall be not less than 2 x 4's, wide face perpendicular to wall, spaced not more than 16 inches o.c. for plaster finish or 24 inches o.c. for wood ceiled or 3/8" laminated wood finish or 1/2" gypsum wallboard in one story dwelling or 16 inches o.c. for first floor wall framing in 1 1/2 and 2 story dwellings and 24 inches o.c. for second floor wall framing supporting ceiling and roof only.
 - (a) Studs may 2" x 6" spaced 24" O.C. in one-story and two-story dwellings provided that the floor joist, stud and roof frame members are in direct alignment one over the other and providing the minimum grade of the studs comply with Section 21(18).
- (3) All window and door openings shall have studs doubled on jambs. The inner stud shall be cut to receive the lintel or header over the opening and shall extend in one piece from lintel or header to bearing, except that at window, the sill plate may be cut into the inner stud but not more than 1/2 inch. Lintels or headers over all openings shall be 2 inch thick members, doubled set on edge, or solid timber.
- (4) Spans for lintels or headers for load bearing walls shall not exceed the following:

Exterior Walls

HEADERS – EXTERIOR OPENINGS

		Roof Construction		
Width of Structure	Header Size (on edge)	Roof joist with bearing partition Slope	Rafters with bearing partition	Trussed rafters Slope 3/12
		3/12 or less	Slope over 3/12	Rafters with bearing partition
		Braced rafters with bearing	Trussed rafters	Habitable space
		Slope over 3/12	Slope over 3/12 or less	
1 story and second floor of 2 story				
Up to 26 ft. wide	2-2x4s	3' 6"	3' 0"	2' 6"
	2-2x6s	6' 6"	5' 0"	4' 6"
	2-2x8s	8' 6"	7' 0"	6' 0"
	2-2x10s	11' 0"	8' 6"	8' 0"
	2-2x12s	13' 6"	10' 6"	9' 6"
1-1/2 or 2 story				
Up to 26 ft. wide	2-2x4s	2' 6"		
	2-2x6s	4' 6"	4' 0"	3' 6"
	2-2x8s	6' 0"	5' 6"	5' 0"
	2-2x10s	7' 6"	6' 6"	6' 0"
	2-2x12s	9' 0"	8' 0"	7' 6"
1 story and second floor of 2 story				
26 to 32 ft. wide	2-2x4s	3' 0"	2' 6"	
	2-2x6s	6' 0"	4' 6"	4' 0"
	2-2x8s	8' 0"	6' 0"	5' 6"
	2-2x10s	10' 0"	8' 0"	7' 0"
	2-2x12s	12' 0"	9' 6"	8' 6"
1-1/2 or 2 story				
26 to 32 ft. wide	2-2x4s			
	2-2x6s	4' 0"	3' 6"	3' 6"
	2-2x8s	5' 6"	5' 0"	4' 6"
	2-2x10s	7' 0"	6' 0"	5' 6"
	2-2x12s	8' 6"	7' 6"	7' 0"

Note: The above spans are based on allowable fiber stresses in bending as follows: For 2 x 4s, 800 psi; for 2 x 6s and larger, 1,200 psi. These allowable stresses are average values taking into consideration upgrading for doubling of members. Where 2 x 4s having allowable fiber stress exceeding 800 psi are used, the spans for 2 x 4s may be increased by 20 percent. Where conditions vary from these assumptions, design headers and studs in accordance with standard engineering practice.

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12-13-83

¹ Triple studs at jamb opening; header to bear on 2-2 x 4s.

- (5) In lieu of lintels, trussed construction may be used.
- (6) All bearing plates for roof rafters framing into masonry wall shall be bolted to the masonry walls with 1/2" bolts 12" long which shall be bedded firmly in the masonry and spaced not more than 6 feet apart.

- (7) All sills and girder on top of foundation walls and piers shall be leveled, shimmed up with slate chip or brick, and thoroughly bedded in cement mortar.
- (8) (a) Top plates on wood frame construction shall be not less than 2 x 4's doubled and shall lap at the corners. Cut the top members of the plate at all intersecting partitions to permit partition plate to lap and tie to exterior plate. All such laps shall be doubled-spiked. In non-load bearing walls, the single top plate may be used providing intersecting walls are tied together with at least the equivalent of a 1/8 inch by 1 1/2 inch by 6 inch metal plate or other approved methods.

The double 2 x 4 top plate is not required over window and door openings when header of appropriate size and grade of lumber is applied directly under the top plate. Single 2 x 4's can serve as nailers at door and window heads.

Top plate on wood frame construction may be 2 x 4 with 1" nominal plate on top when the bottom cord of trusses are directly over the load bearing stud below and the building is not over two stories high.

Top plate on wood frame construction may be a single 2 x 4 when the bottom chord of trusses or ceiling joists (ceiling joists and rafters must be tied together with (3) 16d or (5) 8d nails) are directly over the load bearing stud below, provided intersecting walls are tied together with at least the equivalent of a 1/8" x 1 1/2" x 6" metal plate or other approved methods. Top plate splices must occur within 4" of center space between studs and must be tied together with at least the equivalent of a 1/8" x 1 1/2" x 6" metal plate nailed with (6) 8d nails (3) on each side of the splice or other approved methods or must be tied together with a 2 x 4 block a full stud space long between studs underneath the plate and nailed to the plate with (6) 16d nails (3) on each side of the splice and (1) 16d common nail in each stud into block.

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- (b) An approved sheathing is required on all exterior walls of buildings of more than 1 story in height unless engineering data shows that it is not needed for post and beam construction except as tabulated in paragraph c below.

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12-14-82

- (c) If approved structural sheathing is not used on buildings of more than one story in height in 100 mph zone or less per figure 12B of Volume I, the following items are required:
 - (aa) For the first floor of two-story construction and the second floor of three-story construction, the maximum aspect ratio (length- width) shall not exceed two (2), and the minimum total length of interior partitions in each direction shall be not less than the least dimension of the structure, and the following shall be installed.
 - (1) **80 mph Zone:** Install minimum 1/2" thick gypsum wallboard throughout fastened to top plates, bottom plates, and all studs with 1 5/8" Gypsum Wallboard (GWP) nails at a maximum spacing of 8 inches. Install 1-1" x 4" let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 3-8d nails at each end and 2-8d nails at each stud.

Exterior Walls

(2) **90 mph Zone:** Install minimum, thick gypsum wallboard throughout fastened to top plates, bottom plates blocking, and all studs with 1 5/8" long (GWB) nails at a maximum spacing of 7 inches if all horizontal joints between studs are blocked with minimum 2" x 4" or at a maximum spacing of 4 inches if unblocked. Install 1-1" x 6" let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 5-8d nails at each end and 3-8d nails at each stud.

(3) **100 mph Zone:** Install minimum 1/2" thick wallboard throughout fastened to top plates, bottom plates, blocking, and all studs with 1 5/8" GWP nails at a maximum spacing of 4 inches and block all horizontal joints between studs with minimum 2" x 4". Install 1-1" x 6" let-in brace or knee brace near each end of each exterior wall (a minimum of 2 braces per wall) fastened with 5-8d nails at each end and 3-8d nails at each stud.

Let-in braces shall be notched into the face of the studs and plates, shall extend from top plate to bottom plate where possible, and shall be installed at approximately 45° where possible. Where let-in braces cannot be installed, knee braces top and bottom at approximately 45° extending across at least 3 stud spaces shall be notched into the face of the studs and plates. Interior partitions shall extend full height and be anchored to framing.

- (bb) For first floor of three-story construction and for those structures not complying with (aa) above, approved structural sheathing shall be applied on the first floor unless lateral load resistance is designed by an engineer and computations submitted to the building official.
- (cc) Story height in buildings complying with (aa) above shall be limited to 10 feet.
- (dd) 1/4 inch thick plywood paneling or 5/16 inch thick particleboard paneling may be used in lieu of gypsum wallboard in (aa) with same nailing and blocking requirements.

(9) When exterior walls are wood-sheathed diagonally with solid wood, the sheathing shall be applied at approximately 45 degrees and extend in opposite directions on each side adjoining at the corner and corner bracing will not be required.

Revised
3-12-85

(10) Except when plywood structural-use panels, diagonal sheathing, or approved structural insulation board is used, all external corners shall have diagonal 1 x 4 inch braces let into the top and bottom plates and the face of the studs at approximately 45 degrees and wherever possible shall extend from sill to plates. Braces shall be securely nailed to each stud and to sill and plate. Where openings occur near the corner, 1 x 4 inch knee braces shall be installed above and below the openings at approximately 45 degrees extending across not less than 3 stud spaces and shall be let into the face of the studs.

(11) Wood sheathing boards shall be not less than 5/8" actual thickness not more than 8" wide, applied solid with each board drawn up tight and double nailed at each stud for bear in point, for 8" boards triple nail. Jointing shall occur over the center of and parallel to studs.

Structural-use sheathing panels as defined in Section 19(6) with a rated wall span of 16" or roof span of 16" or 20" shall have a maximum stud spacing of 16"; panels with a rated wall or roof span of 24" shall have a maximum stud spacing of 24". Panels may be installed either vertically or horizontally.

Particleboard wall sheathing: See Table below:

ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING
 (Not Exposed to the Weather, Long Dimension or the Panel Parallel or Perpendicular to Studs)

Grade	Thickness (inches)	Stud Spacing (inches)	
		Siding Nailed to Studs	Sheathing Under Coverings Specified in Section 21(13) Parallel or Perpendicular to Studs
2-M-W	5/16	16	--
AND	3/8	24	16
2-M-F	7/16	24	24
2-M-1	3/8	16	--
2-M-2	1/2	16	16

Note: Endmatched (T&G) boards may be used for sheathing, provided no two adjoining boards break joints over the same stud space, and each board shall bear on at least two studs.

Plywood wall sheathing shall be a minimum of 5/16" on supports 16" on center. Face grain of outer plys may be parallel or perpendicular to studs.

- (12) Wood sheathing used in connection with stucco finish shall be applied horizontally and the frame shall be braced as described in Paragraph 10 above.
- (13) Where shingles are applied over other than wood sheathing boards or approved fiberboard nailbase sheathing 1 x 2 inch nailing strips shall be used, nailed to studs over the building paper, and space according to the shingle exposure.
- (14) All exterior finish shall be backed up with water-resisting building paper or saturated asphalt felt. Each lap shall be not less than 4 inch lap on the waterproof material around all openings. Water-proof building paper may be waived where water-proof sheathing materials are used.
- (15) All exterior openings in frame walls shall have a strip of waterproof paper or saturated asphalt felt installed behind the exterior trim.
- (16) Studs in exterior frame walls may run from sill to roof line, except where the length of stud exceeds 20 feet, in which case a 4 x 4 inch plate shall be provided at the second floor level or at the attic floor level. Studs shall be in continuous lengths without splicing. Floor joists supported on exterior frame walls shall bear on doubled 2 x 4 inch plates properly framed into studs or they shall bear on 1 x 6 inch ledger boards let into the face of the studs. Joists bearing on ledger boards shall be securely nailed to face of studs.
- (17) Wood studs in exterior walls shall bear on a sole plate at least 2 inches nominal thickness.
- (18) The minimum grade for Load Bearing Studs shall be No.3 Grade or Stud Grade. Utility and Standard Grade may be used in accordance with the following restrictions:
 - 1. Walls must be constructed in a composite system of an exterior panel consisting of material listed in paragraph 1706.2(d) of Volume I and interior panels consisting of gypsum board (1/2" thick or greater) or plywood. Panels shall be securely fastened to the studs and plates per Table 1704.1 of Volume I.

Exterior Walls

2. Construction is limited to one-story residence and the top story of multi-story wood residence.
 3. Construction is permitted within areas of the state with design winds of 80 MPH or less per Figure 12B of Volume I.
- (19) Plywood siding 5/16" and 7/16" thick applied direct to framing shall meet the special requirements for 303 Specialty Siding.
- (20) Particleboard siding used for covering the exterior of outside walls shall be one of the Exterior Type 2-M grades conforming to American National Standard ANSI-A208.1-1979 and shall be clearly marked "Exterior Bond". Particleboard panel siding shall be installed according to the installation instructions of the National Particleboard Association.

ALLOWABLE SPANS FOR EXPOSED PARTICLEBOARD PANEL SIDING¹

Grade	Stud Spacing (inches)	Minimum Thickness (inches)		
		Siding		Exterior Ceilings and Soffits
		Direct to Studs	Continuous Support	Direct to Supports
2-M-W	16	3/8	5/16	5/16
2-M-F	24	1/2	5/16	3/8
2-M-1	16	5/8	3/8	
2-M-2	24	3/4	3/8	

¹ Exterior bond will be clearly marked on panel.

SECTION 22. Interior Partitions.

- (1) Studs shall be not less than 2 x 4's, wide face perpendicular to wall, spaced not more than 16 inches o.c. for plaster finish or 24 inches o.c. for wood ceiled or 3/8" laminated wood finish or 1/2" gypsum wallboard in one story dwelling or 16 inches o.c. for first floor wall framing in 1 and 2 story dwellings and 24 inches o.c. for second floor wall framing supporting ceiling and roof only.

Note: Nonbearing partitions may be set the 2 inch way, with maximum spacing 24 inches o.c.

- (2) All openings in interior bearing partitions shall have jambs and head double-framed same as required for exterior openings. Openings in interior non-load bearing partitions can be single- framed.
- (3) The top plates of all bearing partitions shall be doubled. All partition plates shall lap at all intersecting partitions and at outside walls and shall be securely spiked.
- (4) When partitions frame on top of the joists or subfloor, the studs shall bear on a sole plate at least 2 inches nominal thickness. Sole Plates may be 1" nominal thickness when the wall studs are directly over the floor joist, (or girders), when they are non-load bearing.
- (5) Where nonbearing partitions run parallel to the second floor joists, a lathing member shall be placed above the partition plate and shall be wide enough to provide nailing surface for ceiling lath.
- (6) Wood bearing partitions in cellars or basements will not be acceptable unless a pressure treated sole plate is used.
- (7) No stud shall be cut more than half its depth to receive piping and duct work. If more depth is required, the partition studs shall be increased accordingly. Where the running of piping and duct work necessitates the cutting of plates, proper provision, acceptable to the Building Inspector shall be made for tying together and supporting all structural members affected by such cutting.
- (8) Corners for all rooms shall be framed solid for lath or other interior finish excepting that the "ladder-back" method of supporting 1/2 inch gypsum wallboard may be used (quarter point support for standard ceiling-height conditions). Corners for rooms may also be framed utilizing back up cleats of 3/8 inch thick plywood or 1 inch thick lumber and specially designed metal clips will be acceptable when supporting wall material not requiring solid backing.
- (9) All interior partitions connecting to masonry walls shall have the end stud anchored to the masonry with not less than three inch bolts in each story height.
- (10) All load bearing walls shall bear directly over girders, sills, beams or load bearing walls unless adequate structural calculations are furnished to support each design.
- (11) The minimum grade for interior non-load bearing studs shall be utility grade.
- (12) The minimum grade for interior load bearing studs shall be standard grade.
Exception: Utility grade may be used to support roof and ceiling loads only or one-story residence and the top story of multi-story residence.

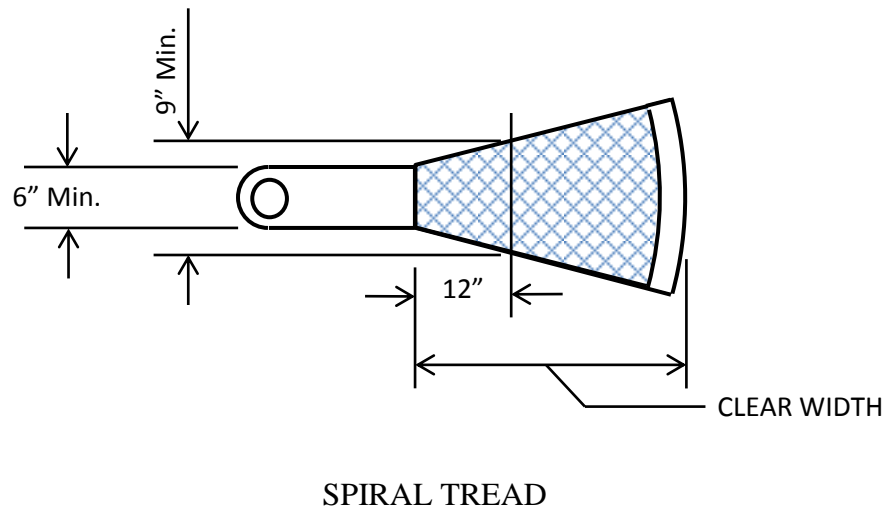
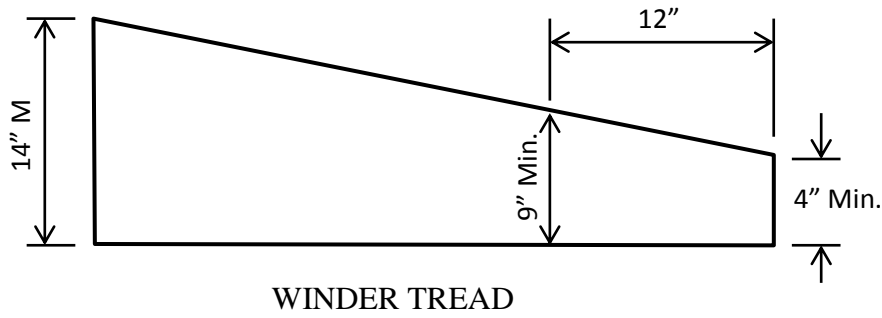
SECTION 23. Prefabricated Structures.

A prefabricated structure is one having floors, walls, ceilings, or roof composed of sections or panels of a varying size which have been fabricated prior to erection on the building foundation.

Where materials used in and the design of prefabricated structures are tested for strength and durability and the Building Inspector finds from such tests and otherwise that the strength of the materials used is sufficient to bear as great or greater loads and stresses as the dimensions of materials required in Sections 19, 20, 21, 22 of this code, then the said Building Inspector shall have authority to issue a permit for the erection and construction of such prefabricated structures.

SECTION 24. Stairs and Exits.

- (1) All stairways shall have not less than 6 ft. 8 in. continuous clear head room measured vertically from the front edge of the tread to a line parallel to the stair run.
- Revised 12-10-85 (2) Risers shall not be more than 8¼ inches high, and tread shall be so proportioned to riser that an easy run is obtained. The width of tread, including nosing, shall be not less than 10¼ inches and shall not extend beyond riser board more than 1 1/8 inches. Treads shall be of uniform width and risers of uniform height in any one flight of stairs. (Applies to all interior and exterior stairs)
- (3) Cutting and framing of all structural members such as stringers and landings shall be such that development of their full strength will not be impaired. Stringers shall have solid bearing at top and bottom. The minimum effective depth of wooden stair stringers shall be 3½ inches.
- Revised 12-13-83 (4) (a) Spirals and winders used as required exitways shall have a clear width or not less than 3 feet. Tread width shall be a minimum of nine (9) inches at a point twelve (12) inches from the side where the treads are narrower. Spiral stairway treads shall have a minimum width of six (6) inches. Winder treads shall have a minimum width of four (4) inches and an average width of not less than nine (9) inches. All risers shall be the same height for each story.
- (b) Spiral stairway, not used as required exitways or serving a mezzanine shall have a minimum width of twenty six (26) inches. All treads must be identical with a seven and one-half (7½) inch minimum clear tread depth at a point twelve (12) inches from the narrow edge.



Stairs and Exits

- (5) Open basement stairs shall have stringers not less than 2 inches thick. If treads are less than 1 1/8 inches thick, a third stringer shall be installed.
- Revised 9-11-84 (6) Each dwelling shall be provided with two (2) remotely located doors for means of egress, one of which shall be side hinged. When both doors open onto a porch, terrace, or platform 36" above adjacent finished grade, two remotely located stairways to grade shall be provided.
- (7) Every sleeping room, unless it has two exits, or one exit direct to outside shall have at least one outside window that can be opened without the use of tools to provide a clear opening not less than 16 inches in least dimension and 432 square inches in area, or if of fixed glass, must be at least 24 inches by 24 inches, with the bottom of the opening not more than 4 feet above the floor.
- Revised 12-13-83 (8) Every porch, terrace or entrance platform thirty-six (36) inches above adjacent finish grade shall be equipped with railings or guards not less than thirty (30) inches high. Handrails, continuous on all open sides of stairs exceeding 4 risers, leading to a platform, porch or terrace, shall be installed at least 30" high. Interior stairs exceeding 4 risers, open on both sides, including basement stairs, shall have a continuous handrail on one side and railing on open portion of other side. Stairs open on one side exceeding 4 risers shall have a continuous handrail on at least one side. Stairs, exceeding 4 risers, enclosed on both sides shall have a minimum of one continuous handrail.
- (9) Install a continuous, durable handrail around open sides of all exterior stairwells when step flight has total rise of 30" or more.
- (10) (a) Interior Stairs (except disappearing stairs) Main stairs, minimum width 2'-8" clear of handrail. Basement and Service Stairs, minimum width 2'-8" clear of handrail.
- (b) Exterior Stairs attached to dwelling: Stairs serving main and service entrance doors shall be not less than 36" in width. Basement stairs not less than 32" in width.

SECTION 25. Miscellaneous Construction Requirements.

- (1) Caulking will be required around all exterior openings in masonry or masonry veneer walls and at other intersections of wood and masonry where considered necessary to make weathertight.

Revised
9-8-81

- (2) Firestopping

Firestopping shall be installed in wood frame construction in the following locations:

- (a) In concealed spaces of stud walls and partitions including furred spaces at ceiling and floor levels.
- (b) At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.
- (c) In concealed spaces between stair stringers at the top and bottom of the run.
- (d) At openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels with noncombustible materials, except in the case of metal chimney installations as set forth in Section 2708, Volume 1- Factory-Built Chimneys.

Revised
3-12-85

Firestopping materials shall be noncombustible or, when of wood, shall consist of two (2) inch nominal lumber, or two (2) thicknesses of one (1) inch nominal lumber with broken lap joints, or one (1) thickness of twenty-three thirty seconds (23/32) inch plywood with joints backed by twenty- three thirty seconds (23/32) inch plywood and shall effectively fill all spaces for the entire width or depth of the framing or structural member.

Firestopping shall not be covered or concealed until inspected by the Building Official.

- (3) Draftstopping

Draftstopping shall be provided in wood frame construction in the following locations:

- (a) In single family dwellings, in floor-ceiling assemblies separating usable spaces into two (2) or more approximately equal areas with no greater than 500 sq. ft. Draftstopping shall be provided parallel to the main framing members.
- (b) In two (2) family dwellings, draftstopping shall be provided in the floor-ceiling assemblies above and in line with the tenant separation wall when the tenant separation wall does not extend to the floor sheathing above.
- (c) In attics of two (2) family dwellings above and in line with the tenant separation wall when the tenant separation wall does not extend to the roof sheathing above. Where flat roofs with solid joist construction are used, draftstopping over tenant separation walls is not required.

Ventilation of concealed roof spaces shall be maintained in accordance with Section 25 (6).

Draftstopping materials shall be not less than one-half (1/2) inch gypsum board, three-eighth (3/8) inch plywood or other approved materials adequately supported.

The integrity of all draftstop shall be maintained.

Draftstopping shall not be covered or concealed until inspected by the Building Official.

Miscellaneous Construction Requirements

- (4) Where showers occur over bathtubs, the walls above the tubs for a height of at least 6 feet from the bathroom floor shall be finished with a waterproof material. Recessed bathtubs shall be supported at the rim on metal supports or wood blocks securely anchored at the stud frame.
- (5) Main entrance doors shall be not less than 3 feet wide. All other exterior doors shall be not less than 2ft. 8 in. wide. All interior doors which provide access to habitable rooms shall be not less than 2 ft. 6 in. wide. All exterior doors and all interior doors which provide access to habitable rooms, bathrooms and toilet compartments and basement and service stairs shall be a minimum of 6'-8" in height.
- (6) Attic Ventilation.
 - (a) Attic spaces shall be ventilated in accordance with the following: For gabled roofs, screened louvers shall be provided and the net area opening shall be not less than 1/300 of the area of the ceiling below.
 - (b) For Hip roofs, ventilation shall be provided in the eave soffit and near the peak, the net area of the inlet shall be not less than 1/900 and that of the outlet 1/1600 of the area of the ceiling below.
 - (c) For Flat roofs, blocking and bridging shall be arranged so as not to interfere with the movement of air. Such roofs shall be ventilated along the overhanging eaves, with the net area of opening being not less than 1/250 of the area of the ceiling below.
- (7) Kitchen hood vents must be vented to the outside by a "B" labeled pipe or pipe having a 1 inch clearance from all combustible material. All vented type clothes dryers shall be vented to the outside by an approved type vent.
- (8) SAFETY GLASS: For safety, glass in doors, side lights, shower doors, tub enclosures and other openings subject to frequent exposure to accidental human impact, shall conform to the following requirements: All glass which exceeds six square feet in each individual opening area and which is less than 18 inches above the floor level shall be either full tempered, or wired, or laminated glass with a minimum thickness of 3/16 inch. In lieu of the above, regular plate, sheet, or rolled glass with a minimum thickness of 3/16 inch may be used provided a push bar or protective screen is firmly attached to each exposed side. When tempered, laminated, or other safety glass is used, it must be identified by the manufacturer's stamp. Glazed doors and openings not located in areas subject to frequent exposure to accidental human impact and glass whose least dimension is less than 18 inches are exempt from this requirement.

For information only on safety glass, you should see "Consumer Product Safety Standard for Architectural Glazing Materials (16 CFR Part 1201) effective July 6, 1977" by Consumer Product Safety Commission of the Federal Government
- (9) Ha11, Corridors and Vestibules shall have a minimum width of 36".
- (10) Access to all equipment (such as furnaces, appliances, controls, electric strip heaters, all dampers, electronic air cleaners, coils) shall have access door of sufficient size for equipment to be removed and installed without the removal of the door or trim. A suitable access opening (minimum 22 x 30) with a suitable passage (minimum 36" x 36") or as approved by the Building Official, shall be provided to all equipment installed in an attic and/or in an overhead storage area. There shall be a minimum 24" wide catwalk in attic from the access entrance to the control side of equipment. Permanent steps folding stairs, stairway or portable ladder shall be provided to serve access openings.

Miscellaneous Construction Requirements

- (11) Exterior non-bearing wall and fences shall be constructed in accordance with Volume I, General Construction.

SECTION 26. Roof Coverings.

- (1) A double starting row will be required on all shingle applications.
- (2) Asphalt saturated felt underlay shall be:
 - (a) Approximately 30 lbs. per 100 square feet under tile, asbestos cement shingle or slate roofs.
 - (b) Approximately 15 lbs. per 100 square feet under asphalt shingles or in lieu thereof, an asphalt saturated and coated building paper, weight approximately 10 lbs. per 100 square feet.
 - (c) No felt will be required under asphalt shingles when:
 1. On roof slopes of 7 in 12 or more, when package containers are stamped by the manufacturer showing approximate shipping weight of not less than 235 pounds per square; or
 2. When triple shingle thickness is obtained at all points.
- (3) Asphalt shingles shall bear Underwriters' Laboratories Class C label; shall be a size, including head lap and exposure, which when correctly applied, will provide a minimum of double thickness at all points.
- (4) Cutouts or vertical spacing not over $\frac{3}{4}$ inch in width may be disregarded in determining the number of shingle thicknesses obtained.
- (5) Outside the fire districts, dwellings not exceeding two stories in height, located not less than 15 feet from any property line, and with a minimum roof pitch of 4" in 12" may be roofed with approved labeled No. 1 wood shingles or handsplit shakes with a minimum butt thickness of $\frac{1}{2}$ ", securely fastened with rust resistant nails. Handsplit shakes shall be applied with a 36" starter strip of 30 pounds roofing felt at the eaves, and with an 18" strip of same felt interlaid between each course from a point twice the amount of exposure from the butt. All chimneys serving fireplaces shall be equipped with an approved spark arrester. Incinerators shall be equipped with spark arrestors complying with Section 2706.5 of Volume I.
- (6) Tile and asbestos-cement shingles shall be applied in accordance with recommendations of the manufacturer.
- (7) Slate shingles shall have an exposure not exceeding the following:

14-inch slate	not over 5½ inches to weather
16-inch slate	not over 6½ inches to weather
18-inch slate	not over 7½ inches to weather
- (8) For Flat roofs install built-up asphalt or "pitch" and gravel covering, including flashing, shall comply with requirements of the Underwriters' Laboratories, Inc. for Class B 3-ply covering, and shall be applied according to the manufacturers' directions. The minimum weight of each ply of felt shall be 14 lbs. per 100 square feet. Such roofs shall be surfaced with approximately 400 lbs. of roofing gravel or crushed stone or with 300 lbs. of crushed slag per 100 square feet of finished roof.
- (9) The top ply of felt and crushed stone or slag surfacing may be replaced with one layer of mineral surfaced cap sheet weighing not less than 85 lbs. per square.
- (10) Roofs will be considered flat, if the pitch is less than 3 inches in 12 inches. Approved type asphalt shingles to be used on Roof slopes of 2 in 12 or greater may be used provided they are installed in accordance with a reputable manufacturer's specifications.

Revised
9-14-82

Roof Coverings

- (11) Other types of roof coverings such as sheet metal, metal shingles, canvas, etc. may be used when the type and weight of the material and methods of application are approved by the Building Inspector.
- (12) Not more than one extra roof covering may be installed over the original roof.
- (13) Fire retardant treated red cedar wood shingles and shakes, for installation as U.L. labeled Class "C" prepared roof covering, shall be provided with an underlayment of at least one layer of U.L. labeled, Type 15 (15 lb.) asphalt organic felt.

SECTION 27. Sheet Metal Roofing and Flashing Material.

- (1) All built-in flashings and counter flashings where used over heads of openings, around chimneys, at intersection of roofs and walls, valleys and at horizontal and vertical intersections of stucco with other material shall be of corrosion-resisting metal.
- (2) All metals other than copper, lead and zinc shall be painted both sides before installation.

Note: For valleys in connection with asphalt shingle roofs, two thicknesses of mineral surface roll-roofing material cut from rolls weighing not less than 85 lb. per square may be used. Strips shall be not less than 18 inches wide.

- (3) The weight or gauge of sheet metal depends upon the use to which it is put.
The following minimums shall apply:
 - (a) Copper: flashing, gutters and downspouts 16-ounce.
 - (b) Tin: 30 lbs. black tin coating.
 - (c) Galvanized Sheet Metal: 28 gauge sheet with 1.25 ounce (total weight both sides) zinc coating per square foot.
 - (d) Zinc: As recommended by manufacturers.
 - (e) Lead: Sheet lead, 2½ pounds per square foot.
- (4) Flashing and counterflashing at parapet walls in connection with flat roofs may be of same material as roof covering. All flat roofs shall have a 45 degree cant strip at all roof intersections with parapet and vertical walls. Minimum width of face of cant strip shall be 2¼ inches.
- (5) All chimneys shall have corrosion-resisting metal counterflashing built in on all sides.
- (6) Where gutters and downspouts are installed, they shall be of corrosion-resisting metals. Solid wood gutters will be acceptable if inside surface is properly protected by two coats of pitch or three coats of lead and oil. Crickets shall be covered with corrosion- resisting sheet metal.
- (7) All requirements of this Section shall also apply to reroofing.

SECTION 28. Lathing.

(1) Metal lath shall not be less than the following:

(a) Expanded metal lath -

1. For stud walls, studs 16 inches o.c. or less; 2.5 pounds per square yard.
2. For ceilings, joists spacing up to 20 inches; 3.4 pounds per square yard or flat ribbed metal lath 2.75 lbs. per sq. yd.
3. For exterior stucco: 3.4 lbs. per square yard.

Note: Expanded metal lath used as base for interior plaster shall be either painted or galvanized.

(b) Woven galvanized wire lath, #18 gauge wire, weight 3.2 lbs. per square yard.

(c) Paper backed galvanized wire lath: Maximum wire spacing 2 inches o.c.

1. For interior plaster: Weight 2.3 lbs. per square yard.
2. For exterior stucco: Weight 3.1 lbs. per square yard.

Note: All metal lath used as base for exterior stucco shall be cut from zinc-coated sheet metal or fabricated from zinc-coated wire.

- (2) All external angle corners for interior plaster work shall have galvanized iron corner beads and all intersections of walls at corners and of walls with ceilings shall be lathed with metal lath corner strips not less than 6 inches wide - 3 inches on each surface.
- (3) Where metal lathing is used as base for stucco, the lath shall be held at least 3/8 inch away from sheathing by use of furring nails, wood furrings, or self-furring lath.
- (4) Where metal lath, except paper backed metal lath, is applied to solid wood surfaces such as wood beams, lintels, girders, etc. the surface shall be covered with waterproofed paper before the metal lath is applied. Furring nails or strips shall be provided for fastening of metal lath. All other lath shall be applied according to manufacturer's specifications.

SECTION 29. Plaster Work.

- (1) All interior plaster work when applied to metal lath base shall be 3-coat work and shall have a minimum thickness of 3/8-inch over the lath base.

Note – Work which provides for the scratch coat and brown coat to be applied as separate coats, but in one operation, shall be considered 3-coat work.

- (2) The scratch or first coat may be omitted when plaster is applied directly to masonry or gypsum lath.
- (3) All plaster shall be mixed and applied exactly according to manufacturer's directions.
- (4) All lime used for plastering shall be thoroughly slaked.
- (5) If hydrated lime or patent plasters are used, they shall be mixed and applied according to manufacturer's directions.
- (6) All walls and corners shall be plumb and straight.

SECTION 30. Stucco.

Note – See "Lathing" for application of stucco on metal lath.

- (1) Stucco shall have a base of Portland cement or other approved material.
- (2) First and second coats shall be composed of: 1 part Portland cement, 3 parts sand and hydrated lime equal to 10 per cent of cement. First coat shall be applied to a minimum thickness and scratched. Keep damp for at least three days, and then allow to dry. After scratch coat is dry, moisten thoroughly and evenly and immediately apply the second coat to at least ½ inch thickness and rod straight and true in every direction. Keep second coat damp for at least three days and then allow to dry thoroughly.
- (3) Third coat shall be applied of sufficient thickness to obtain desired finish texture and shall be protected from too rapid drying for at least three days.
- (4) Stucco applied to wood lath will not be acceptable.
- (5) No stucco shall be applied when the temperature is less than 40 degrees Fahrenheit.

SECTION 31. Plumbing Facilities.

- (1) Every residence or tenement hereafter erected shall contain at least one kitchen sink, one water closet, one lavatory and one bath tub or shower stall for each family and provision shall be made for furnishing hot water by the installation of approved heaters and storage tanks.

SECTION 32. Regulatory Codes and Ordinances.

The regulatory codes or ordinances enumerated in this section governing plumbing, electrical, heating, gas and air conditioning installations are hereby adopted as the minimum regulations for such installations within one and two family residences constructed, altered, or repaired and all plumbing, electrical, heating, gas and air conditioning installations for one and two family residences shall comply with the applicable codes cited below:

- | | |
|----------------------|---------------------------------|
| (1) Plumbing Code | N.C. State Plumbing Code |
| (2) Electrical Code | N.C. Electrical Code |
| (3) Heating Code | N.C. Heating Code |
| (4) Gas Code | N.C. Heating Code |
| (5) Air Conditioning | N. C. H eating Code |
| (6) Other | Title Ordinance Number and Date |

"A copy of the above codes which are adopted and all amendments thereto shall be kept on file in the office of the Building Inspector along with a copy of this Residential Building Code."

SECTION 33. Interpretation of the Code.

In interpreting the requirements or provisions of this Building Code, the decision of the Building Inspector shall be final. An appeal from the decision of the Building Inspector may be taken to the local board of appeals where authorized, the North Carolina State Building Code Council or to the courts as provided by law.

"The Building Inspector shall have the authority to permit the use of materials or methods of construction not specifically set forth within the Code. Provided, however, any such alternate materials or methods of construction is proved to the satisfaction of the Building Inspector to be at least equivalent of the requirements prescribed by this Code for safety, strength, quality and effectiveness including fire resistance."

The Residential Code Committee recommends that the Inspectors accept the approval of the Building Materials Approval Committee of the Buildings Officials Conference of America as an accepted standard under the provisions of Section 33 of The Residential Code.

SECTION 34. Validity: Penalty.

- (1) *Validity.* If any section or part of section of this chapter shall be declared unconstitutional for any reason, the remaining sections or parts of sections shall not be affected thereby.
- (2) *General Penalty.* To be established by each City or County.

SECTION 35. Automatic Smoke Detectors. (Adopted June 11, 1974, Effective January 1, 1975) Amended September 10, 1974.

- (1) In one and two family dwellings and in every dwelling unit within an apartment house, condominium and/or townhouse, an approved listed detector, sensing visible and invisible particles of combustion shall be provided and installed in accordance with the manufacturer's recommendation and listing. When actuated, the detector shall provide an audible alarm.
- (2) At least one listed detector shall be installed outside each sleeping area to warn occupants of the presence of any fire condition. Detectors shall have either a visible light to indicate operability or an audible trouble sign. Audible trouble signals shall be designed to operate at least every minute for seven consecutive days. The alarm signaling device shall emit not less than 85 decibels at 10 feet. Detectors shall be located on or near the ceiling and installed in accordance with the manufacturer's instructions. Detectors shall be electrically operated (non-plug-in) and the **primary source of power for detectors installed in new structures shall be taken from the house electrical current.**
- (3) **The effective date shall be January 1, 1975.** This shall be applicable to all units constructed after this date even though they are in the design stage between July 1, 1974 and January 1, 1975.

Revised
9-13-83

NOTE: Test Standards for Automatic Smoke Detectors – All automatic smoke detectors shall be tested in accordance with the applicable requirements of "Standard for Smoke Detectors, Single and Multiple Station, ANSI/UL 217. The testing and listing must be by a nationally recognized testing laboratory as provided in the definition of "LISTED" (see definitions).

SECTION 36. Efficient Energy Utilization in New Buildings. (Effective April 1, 1982)

1.1 General Requirements.

- (a) These insulation requirements apply to all new dwellings which are heated and/or cooled regardless of the type of fuel used (electric, oil, gas, or wood) as follows:
 - (1) All one- and two-family dwellings specified in Section 1 of Volume I-B.
 - (2) All new multiple-family dwellings (apartments and condominiums) three (3) stories and less in height specified in Section 400 of Volume I.
- (b) It is imperative that close attention be paid to workmanship in the installation of the materials specified if the full benefits of these requirements are to be realized.
 - (1) The vapor-resistant facing furnished on blanket and roll type insulation shall always face the interior of the structure. Insulation shall be wedged between pipes and electrical outlets and the external surface of the wall.
 - (2) If unfaced blankets or rolls are used a vapor barrier of at least 4 mil polyethylene or its equivalent shall be stapled to the studs or foil backed gypsum board shall be used on the interior wall.
 - (3) Voids shall not exist at the top or bottom of the stud cavity.
 - (4) All cracks around windows and doors shall be filled with insulation with a vapor barrier properly installed.
 - (5) Vapor barriers shall be carefully checked to assure that no tears exist and any tear shall be patched.
 - (6) The manufacturers' installation procedures for all shall be strictly adhered to.
- (c) On blanket and roll-type insulation furnished with a vapor resistant facing, the R-Value of the insulation shall be marked at three (3) foot intervals on the exposed facing.
- (d) For unfaced blankets and rolls, the manufacturer shall furnish sufficient identifying markings to indicate the insulation R-Value.
- (e) When the exterior sheathing or exterior siding of any insulated stud cavity wall has a permeance of less than 0.6 perm (ASTM Dry Cup Method) the interior vapor barrier shall be a minimum of 4 mil polyethylene or its equivalent with all penetrations sealed by either taping or caulking. Unless the sheathing manufacturer specifically requires moisture relief vents, no moisture vents are required.
- (f) The required thermal value of any one assembly, such as roof/ceiling, wall, or floor may be increased and the thermal value for other components decreased, provided the overall heat loss from the entire building envelope does not exceed the total resulting from conformance to the required thermal values.

1.2 Maximum "U" Values for Exterior Walls and Ceilings.

- (a) All buildings which are heated or mechanically cooled shall have sections exposed to the exterior or unheated spaces constructed to comply with the maximum "U" value shown in Tables A and B.

Efficient Energy Utilization in New Buildings

TABLE A – MAXIMUM “U” VALUES FOR CEILING AND WALL SECTIONS

Flat Roof Deck ¹	Masonry Wall Construction		Frame Wall Construction		Doors and Windows
	Ceilings	Walls	Ceilings	Walls	
“U”	“U”	“U”	“U”	“U”	
0.09	0.05	0.10	0.05	0.08	1.13 ²

¹ Indicates construction with rigid roof insulation and exposed structural system. Where ceiling cavity exists, use value of ceilings.

² In any room where 20% or more of the exterior wall is composed of windows and doors their maximum “U” Value shall be 0.65 (This will require insulating glass and doors or storm windows and doors). An exterior wall is any wall that faces to the outside of or is adjacent to any unconditioned space, such as: garages, carports, storage rooms, or porch areas. In any room that has two or more exterior walls, the total percentage of window and door area may be combined and used in any one of these walls.

(b) Blown or poured type loose fill insulation may be used in attic spaces where the slope of the roof is a minimum of 2½ feet in 12 feet and there is at least 30 inches clear head room at the roof ridge. (Clear headroom is defined as the distance from the top of the bottom chord of the truss or ceiling joists to the underside of the roof sheathing.)

(1) When soffit vents are installed, adequate baffling of the vent opening shall be provided to deflect the incoming air above the surface of the material and shall be installed at the soffit on a 60 degree angle from horizontal.

(2) Baffles shall be in place at the time of inspection.

(c) When loose fill insulation is proposed, the R-value of the material shall be determined in accordance with ASTM Standards C-687, C-236 and C-518.

(1) The "R" value shall be shown on the building plans together with the total number of bags required and net coverage per bag.

(2) Upon completion of the installation of insulation, an insulation certification card shall be furnished by the insulation applicator and posted at a conspicuous location within the structure.

(3) This certification shall indicate the R-value, minimum thickness, maximum net coverage and weight per square foot of the insulation installed.

(d) Minimum ventilation for roof/ceiling cavities shall conform to the following requirements. The required net free vent area may be reduced 50% if an approved vapor barrier is installed behind the ceiling finish material.

(1) Gabled Roofs – Screened louvers having a net free area of 1 square foot for each 300 square feet of ceiling area shall be provided at each gabled end.

(2) Hip Roofs – Screened soffit vents having a net free area of 1 square foot for each 900 square feet of ceiling area and screened outlet vents located near the roof peak having a net free area of 1 square foot for each 1600 square feet of ceiling area shall be provided.

(3) Flat Roofs – Screened openings having a net free area of 1 square foot for each 250 square feet of ceiling area shall be provided along with the overhanging eaves. Blocking and bridging shall be arranged so as not to interfere with the movement of air.

- (4) Cathedral ceilings with joist cavities shall have a screened soffit intake and a screened outlet at the roof ridge or at the intersection of the roof with a vertical surface. The intake and outlet openings shall each have a net free area of 1 square foot for each 250 square feet of roof surface. There shall be 1 inch minimum clearance between the bottom of the roof deck and the insulation.

1.3 Maximum "U" Values for Floors.

- (a) For floors over unheated basements, unheated garages, breezeways or ventilated crawl spaces with operable vents, the thermal value of the floor section shall not exceed the values shown in Table B. (A basement is considered unheated unless it is provided with a positive heat supply equivalent to at least 15% of the total calculated heat loss of the structure or is provided a positive heat supply to maintain a minimum temperature of 50°F.)

TABLE B – FLOOR SECTION MAXIMUM “U” VALUES¹

Structural Slab	Wood and Steel Framing
U	U
0.12	0.08

¹ U Value for heat flow down

- (b) Insulation may be omitted from floors over unheated areas if the crawl space foundation walls are insulated. (See Diagram 1 on page 104)
 - (1) The U value of insulated foundation walls from above a point 12 inches below grade or top of footing shall not exceed 0.17 (R = 5.88). ("Foundation wall insulation for underfloor supply plenums shall have a minimum of R-11. See Volume III, Section 609-L".)
 - (2) A minimum of 75 to 80% of the crawl space ground area shall be covered with a 6 mil polyethylene vapor barrier or its equivalent.
- (c) Crawl spaces under buildings without basements shall be ventilated by approved mechanical means or by openings in the foundation walls. Openings shall be arranged to provide cross-ventilation and shall be covered with corrosion resistant wire mesh of not less than ¼ inch nor more than ½ inch in any dimension. Such wall openings shall have a net free area of not less than 2 square feet for each 100 linear feet of exterior wall plus 1/3 square feet net free area for each 100 square feet of crawl space area. Where at least 75 to 80% of the crawl space ground surface is covered with a 6 mil polyethylene vapor barrier or its equivalent the areas specified above may be reduced 50 percent. It is recommended that a maximum of 80% of the crawl space ground surface be covered to prevent excessive drying of the flooring. Vents shall be so placed as to provide ventilation at all points and to prevent dead air pockets.
- (d) When used, crawl space ventilation openings shall not be covered with insulation. Vents shall be of the closeable type and insulation shall be attached to the closing device. When fuel burning equipment is located in crawl space, adequate means for combustion air shall be provided.
- (e) Basement walls below a point 12 inches below grade need not be insulated. Walls above a point 12 inches below grade shall be insulated in accordance with Table A.

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- (f) Slab-on-grade floors shall be insulated around the perimeter of the floor exposed to the outside with rigid insulation having a minimum "R" value of 3.75 and specifically designed and recommended by the manufacturer for this type application.
 - (1) The insulation may be installed vertically on the interior or the exterior of the foundation wall with the insulation extending 24 inches below the top of the slab. In areas where the frost line is deeper than 24 inches, the insulation shall extend to the frost line.
 - (2) Insulation may be installed downward to the bottom of the slab then horizontally beneath the slab for a total distance of 24 inches.
 - (3) Insulation extending above grade shall be protected from physical damage.
 - (4) With either method, the entire slab edge thickness exposed to the outside shall be insulated.

1.4 Weather Stripping of Exterior Door and Windows.

- (a) All doors and windows opening to the exterior or to unconditioned areas such as garages shall be fully weather-stripped, gasketed or otherwise treated to limit infiltration.
- (b) A non-hardening sealant shall be used to caulk around all window and door frames.

1.5 Conservation of Hot Water.

- (a) All shower heads shall be of the water conserving type. Maximum flow rate shall be 3 gpm per head.
- (b) Manufactured automatic electric, gas fired, and oil fired storage water heaters shall be tested, certified, and labeled by the manufacturer as having a performance efficiency equal to or exceeding ANSI/ ASHRAE/ IES 90A-1980 STANDARD – 1982 LEVELS.

2.0 Requirements for Non-Residential. (Effective January 1, 1978).

3602.1 For non-residential, see Vol. 1 Section 3202.

3.0 Material and Installation Requirements for Foamed in Place UREA-Based Thermal Insulation. (December 12, 1978).

3.1 General.

This Section applies to urea-based thermo-setting foam insulation for use in wall, partition and floor cavities in building construction. This material shall not be used in ceiling cavities.

3.2 Material Characteristics.

- (a) The material shall be certified by the manufacturer to meet the following requirements when tested in accordance with the applicable sections of HUD Materials Bulletin No. 74.

- (1) *Resin Properties*
 - Free aldehyde content – 1.0 percent maximum
- (2) *Curing Properties*
 - Setting Time
 - closed cavity – 20-60 seconds
 - open cavity – 10-60 seconds
 - Volume Resistivity of Fresh Foam-5000 ohms – centimeter minimum
 - Water Drainage – None

Shrinkage during curing – 4% maximum
Fungi Growth Inhibition – Maximum 10% of that in the content test frame

(3) *Dry Foam Properties*

Density – 0.70-0.9 pounds per cubic foot

Thermal Resistance – R=12 for 3 inches

Corrosiveness

Aluminum, copper & steel – No perforations

Galvanized steel – No pitting and maximum loss of mass of 0.01 ounce.

Water Absorption –

Floating Test – maximum 15% by volume

Droplet Test – minimum 1 hour

Surface Burning Characteristics – maximum 25 flame spread classification (in accordance with ASTM E-84.)

Ash Content – Maximum 2% of original foam volume

- (b) *Effective Thermal Resistance* – The effective thermal resistance values shall be certified as complying with the applicable section of HUD Materials Bulletin No. 74 and shall be supplied to the distributor and/or applicator by the manufacturer.

3.3 Installation Standards.

- (a) *Manufacturers' Recommendations* – Material shall be installed in strict accordance with the manufacturer's specific installation instructions. These instructions shall be provided to the distributor and/or applicator by the material manufacturer. Unless otherwise specified by the manufacturer, the materials entering the foaming gun shall be within the range of 59 to 86°F. During application and for a period of four (4) days after application the exterior surface of cavities to which foam is supplied shall be within the range of 23 to 86°F.
- (b) *Qualified Applicators* – The installation of this material shall be performed only by an applicator who has been trained by the foam manufacturer and carries a current certificate of qualification by the manufacturer and identification card issued by the manufacturer. Each manufacturer shall certify that all his approved applicators are properly trained, qualified and certified by him.
- (c) *Quality Control* – To assure quality control, the applicator shall use either resin shipped in a premixed liquid state by the manufacturer or equipment having quality control devices which will insure proper mixing of the material at the job site.
- (d) *Fire Protection* – All material exposed to the interior of a structure shall be protected in accordance with Section 719 of this Code. No portion of the installed material shall be exposed after construction is completed. Special precautions shall be taken to prohibit prolonged exposure of the installed material to direct sunlight, temperatures above 100°F, oils, solvents and acid vapors.
- (e) *Water Vapor* – Water present in the installed material shall be permitted to escape from a wall while the material dries in the cavity. In cases where the interior and exterior wall surfaces may restrict water vapor transmission other provisions shall be provided to allow the water vapor to escape.
- (f) *Vapor Barrier* – Prior to or immediately after foaming exterior walls a vapor barrier equivalent to 6 mil polyethylene shall be installed on the inner side of the wall. The vapor barrier shall not be allowed to bulge and shall be lapped 3 to 6 inches at all corners and seams. Cuts and breaks in the vapor barrier at doors, windows or other areas shall be properly repaired. When material used on the cold side of the wall has a permeability rating of 8 perms or less, vent plugs, vent strips or other suitable means shall be provided to allow cavity moisture to vent to the atmosphere.

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3.4 Material Labeling.

Each container of urea-based foaming materials shall bear labels listing the following minimum information:

- (1) Manufacturer's Name
- (2) Storage temperature and dates after which materials may not be used.
- (3) Statement that material is to be installed only by a licensed or qualified applicator.
- (4) Warning to avoid contact of material with eyes, nose and skin
- (5) Flame spread classification

3.5 Material Storage.

Unless specified otherwise by the manufacturer, urea-based foaming materials shall be stored in temperatures between 50 and 86°F.

**SECTION 37. Foam Plastics Insulation.
(Adopted September 10, 1974; Effective January 1, 1975).**

(1) General. Approved foam plastics shall be those which have a name spread rating of 200 or less and a smoke density rating no greater than 450 when tested in accordance with ASTM E-84-1790.

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(2) Specific Requirements. The following requirements shall apply to all uses of foam plastic in or on walls, ceilings or both and exterior entrance doors unless specifically approved. Such approval shall be based on acceptable diversified tests such as, but not limited to, tunnel tests conducted in accordance with ASTM E-84-1970, Standard Method of Test for Surface Burning Characteristics of Building Materials, full scale corner tests and an ignition temperature test.

(a) Foam plastic having a name spread of 75 or less may be used in the following locations:

(1) Within the cavity of a masonry or concrete wall.

(2) On the room side surface of conforming walls or ceilings provided the foam plastic is fully protected from the interior of the building by a thermal barrier of inch gypsum wallboard or other approved material having a finish rating of not less than 15 minutes installed so as to remain in place for the required period of time.

(3) Within the wall cavity of combustible non-fire resistive wall construction provided the protection is applied as described in item (b) above.

(4) Within the cavity of walls classified as combustible fire resistive construction provided fire tests are conducted in accordance with ASTM E-119-1971. Fire Tests of Building Construction and Materials, and the protection from the interior of the building is at least equivalent to that required in item (b) above.

Revised
6-14-83

(5) As siding backer board with a maximum thickness of one-half (½) inch provided it is separated from the interior of the building by two (2) inches of mineral fiber insulation or equivalent (or when applied as re-siding over existing wall construction).

Revised
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(b) Foam filled exterior entrance doors may be faced with wood, metal or aluminum.

(c) Foam plastic may be used as a roof covering if it is part of Class A, B or C roofing assembly.

NOTE: "Foam plastics" include "polystyrene foam" and "urethane foam" among others as described in NFPA No. 205 M-T-1973 entitled "Plastics in Building Construction", Chapter 4. The ½ inch gypsum wallboard or equivalent which is required to provide protection to persons in any room or space where "Foam plastics" are used in walls, ceilings or floors, must be mechanically fastened so as to remain in place for 15 minutes as specified in Section 37(2)(a)(2). This would require the wall, floor and ceiling construction to have at least a 15 minute fire resistance rating and require adequate furring strips to fasten the ½-inch gypsum wallboard.

Revised
9-14-82

(d) Foam plastic insulation may be used on the walls of crawl spaces with no covering applied to the insulation, provided the air in the crawl space is not circulated to other spaces of the building and the insulation is installed according to the insulation manufacturer's recommendations.

SECTION 38. Pier, Bulkheads, and Waterway Structures. North Carolina State Building Code Adopted September 11, 1979. (Same as Chapter XXX III Vol. I.)

1.0 General.

The intent of this Chapter is to provide minimum standards for the design, construction and maintenance of piers, bulkheads and waterway structures that are not covered by other existing codes or design standards. This Chapter exempts farm structures not on public waters, marine terminal or port facilities for berthing, mooring, docking and servicing ships, barges or tug boats which handle cargo of all types including bulks, liquids, fuels and passengers.

The design of piers, bulkheads and waterway structures is essential for the protection of life and property without causing adverse effects to the shoreline. These structures by their very nature result in some modification of physical environment and therefore require minimum design standards. The guidelines in this Chapter address minimum standards for foundations, design forces, structural integrity, material selection and utilization, and construction techniques.

2.0 Permits and Approvals.

The construction of any pier, bulkhead or waterway structure in the public waters of North Carolina or the placement of dredged materials in waters or wetlands, generally requires the owner to obtain a permit/permits prior to construction. A permit from the United States Army Corps of Engineers is generally required for all marine construction. In addition to the permit issued by the Corps of Engineers, additional permits may be required from municipal or county governments, local marine commissions, and the North Carolina Department of Natural Resources and Community Development. In cases of structures to be built on lakes operated by an electric utility for the generation of power, a permit from the operating utility is also required.

Permits and/or information may be obtained from:

1. Regulatory Functions Branch
Wilmington District, Corps of Engineers
Department of the Army
Wilmington, North Carolina
2. Permit Section
Division of Marine Fisheries
N. C. Department of Natural Resources and Community Development
3. County Dune Protection Officers
4. Local Building Inspectors

3.0 Minimum Design Loads.

3.1 General.

Every structure shall be of sufficient strength to support the imposed dead, live, wind and impact loads without exceeding the allowable stresses prescribed for the various materials elsewhere in this code. Adequate consideration shall be made for forces imposed by earth, water, docking and mooring.

3.2 Dead Loads.

The weight of the component parts of a structure shall be used in the design when it will influence the strength of the structural elements.

3.3 Live Loads.

Design live loads shall be the greatest load that will probably be imposed on the structure including superimposed loads on retained materials which exert horizontal loads on the structure. Where vehicles are allowed, use actual weight of vehicles and wheel loads as specified in the latest Edition of "Standard Specifications for Highway Bridges" of the American Association of State Highway and Transportation Officials. The Design load shall be posted at the dock or pier approach where vehicles are allowed. Minimum live loads are:

- A. FIXED PIER, DOCKS, CATWALKS – 30 lbs. per sq. ft. or 300 lbs concentrated load on any area 2 ft. square.
- B. FLOATING PIERS, DOCKS, FINGERS – 20 lbs. per sq. f t. or 300 lbs concentrated load on any area 2 feet square.

Under dead load, floating piers shall have a minimum of 15 inches freeboard. The pier shall have not more than six degrees tilt from the horizontal under uniform live loading on one-half of the pier width or under concentrated load of 600 lbs. applied to any side.

- C. BULKHEADS, SEAWALLS, REVETMENTS

Design loads shall be the greatest combinations of loads exerted on the structure. Consideration shall be given to horizontal loads exerted by superimposed loads on the retained earth and by inclined surface slopes.

3.4 Wind Loads.

As prescribed in Chapter 12, Vol. I.

3.5 Impact Loads.

As prescribed in Chapter 12 but not less than 1.25 times the kinetic energy exerted by a striking vessel or vehicle.

3.6 Water Loads.

Hydrostatic horizontal pressures along with the equivalent fluid pressure of soil and any surcharge thereon shall be considered.

Provide sufficient anchorage against uplift between all components and between the structure and its support of not less than 1.5 times the uplift force.

Wave forces shall be determined from wave record where available. Where no wave records are available the design wave shall be determined from probable wind speed, direction, fetch and water depth which will yield a critical wave. Forces shall then be calculated using current coastal engineering practice.

3.7 Earth Loads.

Lateral earth pressures shall be determined by considering the specific soil properties and applying earth pressure theories generally accepted for soil mechanics in engineering practice. Except for simple and inexpensive structures this normally requires the services of specialists in soil mechanics and/or foundations design. Adequate consideration shall be given for the effect of probable varying levels of ground water, tide and flood water. Pressures exerted by the earth shall be checked for dry, saturated and submerged conditions as applicable.

3.8 Erosion.

The effects of reasonably predictable erosion and wave induced scour shall be given ample consideration.

Pier, Bulkheads, and Waterway Structures

4.0 Engineered Designs.

- 4.1 Docks, Piers and Catwalks** used by the Public or intended for use by vehicles shall be designed by a Registered Professional Engineer or Registered Architect.
- 4.2 Bulkheads and Other Type Retaining Walls** used by the public having an exposed face above the ground or above mean low water of 5 feet or greater shall be designed by a Registered Professional Engineer or Registered Architect.
- 4.3 Ocean Front Retaining Walls, Bulkheads** and other-type retaining walls used by the public on the coastline of the Atlantic Ocean or adjacent inlets shall be designed by a Registered Professional Engineer or Registered Architect.

5.0 Materials

5.1 General

The quality of materials and fastenings used for load supporting purposes shall conform to good engineering practices. In areas subject to attack from wood borers such as termites, teredoes, or limnoria, the wood used shall be approved wood having natural resistance or shall be pressure treated with a preservative recommended by the American Wood Preservers Association for the specific application. Piling shall comply with applicable provisions of Chapter 13. Wood components shall comply with applicable provisions of Chapter 17. Concrete components shall comply with applicable provisions of Chapter 16. Steel components shall comply with applicable provisions of Chapter 15. In areas of severe Corrosion such as salty or brackish waters, all metal components shall be protected by coating, cathodic protection or be oversized accordingly to allow for the specific exposure. Aluminum bulkhead sheets or aluminum bulkhead or dock components shall be of proper alloy to resist corrosive elements in the adjacent water and soil. Galvanized bulkhead components and dock components shall be coated by the "Hot Dip" process to sufficient cover to provide corrosion protection equal to the degree of exposure of corrosive elements. Masonry used in bulkheads and dock work shall comply with Chapter 14.

In general, materials should be selected and adequately protected to afford a design life of at least 20 years for the facility.

No materials will be allowed except those specifically stated unless the design is sealed by a Registered Professional Engineer or Registered Architect.

6.0 Construction of Piers, Docks, Cat walks and Floating Docks.

6.1 Fixed Piers.

Fixed piers for coastal areas shall be supported by piling with tip penetration of not less than 8 feet dependent on the total applied load. Less penetration is approved only if other means of resisting flotation uplift is provided. Pier support by shallow piling, legs or columns with point bearing on rock shall have provisions for horizontal forces and overturn as well as flotation uplift.

Connections between piling or legs to cap beams, stringers, beams and deck shall have sufficient capacity to safely support all applied loads and provide transfer of the load to adjoining members. Maximum spans for pier joists shall be in accordance with the Span Table for Joists and Rafters, 1970 as published by the National Forest Products Association or may be designed in accordance with accepted engineering practice.

6.2 Metal Barrels Flotation Units.

The use of metal barrels not specifically designed for use as flotation devices is prohibited.

6.3 Decomposable Flotation Units.

Floating docks or piers using exposed polystyrene billets (or other foam material) shall be designed for 125% of tabulated loads herein to allow for deterioration from environmental effects.

6.4 Electrical Service.

All electrical service to marine structures shall be in accordance with the current edition of the National Electrical Code as adopted by the N. C. State Building Code Council.

6.5 Fuel Docks.

Fuel docks and other marine facilities handling flammable liquids shall comply with the National Fire Code, NFPA-30. All fuel installations shall be designed to prevent fuel spillage from entering the water. The fuel docks or floats shall be a separate structure from berths and shall be isolated to the extent that fire or explosion would have minimal opportunity to spread to or from the fuel dock to the berths. Storage tanks for public facilities shall be located a minimum distance of 50 feet from the dispenser with a shut-off valve at the tank.

6.6 Handrails.

For walkways, access piers, steps or ramps, personnel handrails or other safety provision shall be provided along the edges where the vertical drop to the mean low water level or mud line exceeds 6 (six) feet. Edges which have a primary function other than walks or access ways, such as docking frontage and swimming access shall not require railing. Railing shall be designed in accordance with Chapter 12 for balcony railing.

6.7 Maintenance of Public Structures.

The Building Inspector shall have the authority to condemn and close to the public any structure which is considered unsafe and it shall not be used by the public until the deficiencies are corrected. Before the structure is reopened to the public, a certification by a Registered Professional Engineer or Registered Architect shall be required.

Each owner will be responsible for the proper and satisfactory maintenance of any public structure covered by this section. All such structures shall be subject to inspection at any time by the Building Inspector.

7.0 Construction: Bulkheads, Seawalls and Revetments.

7.1 Bulkhead.

- (a) Bulkheads shall be constructed in a manner to be effective against erosion and provide for adequate bank stabilization. The bulkhead system may consist of either of the following combinations thereof: braced sheet pile walls with tie backs, king piles and horizontal panels, gravity walls, cantilever and counterfort retaining walls. Bulkhead walls shall be constructed to prevent passage of fine material through joints or cracks from the fill side to the stream side.

Pier, Bulkheads, and Waterway Structures

- (b) Local site conditions and performance of bulkheads in service should govern in selection of a system. The potential for erosion and scour at the mud line shall also be investigated, and appropriate compensating features shall be reflected in the construction. Bulkhead shall be terminated by either tying into adjoining structures or by extending the bulkhead line a minimum of 10 feet in a landward direction at an angle of not less than 45° to the shoreline in order to protect against end erosion or flanking by wave action. No structure shall be terminated without regard for end anchorage and stabilization. Sheet pile bulkheads with an exposed vertical height of 4 feet or greater shall be stabilized at the top by providing adequate anchorage, such as the use of batter piles or tie backs. Anchor blocks for tie backs shall be located landward of the soil wedge formed by the wall and a line projected on an angle measured from the horizontal and passing upward from the berm surface on the outward face. The angle shall be the internal friction angle of the material being retained. The tie back anchor shall be located no closer than twice the height of the exposed vertical surface of the wall. Sheet pile embedment shall be determined by analysis and design, but shall not be less than the length of pile exposed above ground. Cantilever and gravity wall bulkhead shall be founded on a firm foundation with special construction given to undermining and progressive instability.
- (c) Where public walkways, steps or ramps run adjacent to bulkheads, personnel handrails or other safety provisions shall be provided along the top of the wall where the vertical drop to the mean low water line or mud line exceeds 6 (six) feet. Handrails shall be designed in accordance with Chapter 12 for Balcony Railings.
- (d) Wood members used for permanent features shall be not less than 2 inches in nominal thickness. All steel bolts, rods and other hardware shall be hot dipped galvanized or protected with an equivalent system. Bolts, rods and other metal materials shall be no smaller than ½ inch in diameter or thickness. Threaded fasteners shall not be tightened directly against wood surfaces but used only in conjunction with standard ogee or flat washers.
- (e) Concrete, steel and cement asbestos bulkheads shall be constructed in such a manner to assure adequate performance. Connections shall be designed to resist the full applied load. Adequate attention shall be given to material protection against corrosion and concrete cover for reinforcing steel. Concrete shall have a 28 day minimum compressive strength of 3,000 psi. and shall be "air-entrained" type concrete.

7.2 Seawalls.

Seawalls may be constructed of concrete or stone rubble mound or other suitable materials. They shall be founded on a firm foundation and may require the use of piling or other suitable support. The face shall be shaped and supported to withstand the full force of the design wave. A provision shall be provided to prevent undermining and progressive instability by installing a sheet pile wall along the toe and/or by placing adequate stone rip rap protection.

7.3 Revetments.

- (a) Rigid revetments shall be founded on a firm foundation to prevent against undermining and progressive instability. Provisions should be made to provide for adequate toe protection by extending the face a minimum of two feet below the mid line plus a depth to compensate for known or anticipated scour. Additional protection may be needed in active areas and may consist of sheet piling along the toe and/or stone rip rap. An adequate pattern of weep holes shall be provided in the face to relieve hydrostatic pressure behind the wall. Joints shall be sealed to prevent loss of fines from the protected slope.

- (b) Flexible revetments may be utilized where foundations will produce minor consolidation and settlement. Adequate provisions shall be made to prevent migration of fine materials through the wall. The face shall not be steeper than 1.0 horizontal to 1.0 vertical. Flatter slopes may be needed for stability depending on the construction materials and site conditions. The face may consist of stone rip rap or individual interlocking concrete units or poured concrete. Toe protection provisions shall be provided as discussed for the rigid type. Flexible revetments must be porous enough to allow for water passage and thereby relieve hydrostatic pressure behind the face.

8.0 Construction of Groins and Jetties.

8.1 Groin.

(a) GENERAL

Groins are designed and constructed for the purpose of building or maintaining a protective beach by trapping littoral drift (beach materials) or to retard the recession of an eroding shoreline. The planning and design of a groin/groin system shall be based on wave height, period and direction, characteristics of beach material and beach slope.

(b) LOCATION

Groins shall extend landward a sufficient distance to prevent flanking.

(c) TYPES

Groins shall be either (1) very low, impermeable and nonadjustable or (2) impermeable and adjustable.

(d) GENERAL SPECIFICATIONS

Adjustable groins shall be maintained at elevations in accord with actual beach needs and development of desirable changes of the beach profile, and so as to avoid damage to adjacent beaches. In no case shall the top of such groins be set higher than 2 feet above the beach profile. Impermeable, nonadjustable groins shall not extend seaward beyond the mean low water line, and their top elevation shall not be higher than 6 inches above the beach profile. Considerations of the degree of beach protection to be provided by proposed groins, and the acceptability of such installations, will be based primarily on the following factors: direction and volume of littoral drift; wave force and direction; wind force and direction; land usage; type of bulkhead; type of groin; and spacing and lengths of groins. A complete coastal engineering study may be required before approval is given to the number, type, and length of groins. The design should account for the wave and current forces focused on the beach. The groin/groin system should not adversely modify the littoral drift, to the extent to cause severe erosion on the lee side of the structure.

8.2 Groin and Jetties.

There is no universal type of groin /groin system or jetty because of the wide variations in conditions at each location. It is incumbent on the owner of a groin or jetty type structure to recognize the legal implications of the coastal structure and to plan, design, construct and maintain the structure accordingly. It is thus prudent to seek the advice of a Registered Professional Engineer or Registered Architect with coastal engineering experience.

9.0 Definitions.

Basin, Boat – A naturally or artificially enclosed or nearly enclosed harbor area for docking and securing small craft.

Pier, Bulkheads, and Waterway Structures

Bulkhead – A vertical wall structure designed to retain shoreline materials and prevent erosion due to wave activity.

Bulkhead Line – The line formed along the shore by the most seaward elements of the bulkhead.

Catwalk – A narrow footway platform extending along-side a structure.

Datum, Plane – The horizontal plane to which soundings, ground elevations or water surface elevations are referenced.

Dock – A pier, wharf, or platform for the unloading of materials or living beings.

Fetch – The area in which waves are generated having a rather constant direction of speed.

Gangway – A narrow footway bridge extending from the shore usually to a floating structure.

Groin – A shore protection structure built (usually perpendicular to the shoreline) to trap littoral drift or retard erosion of the shore.

Groin System – A series of groins that function to protect a section of shoreline.

Jetty – A structure designed to protect and/or stabilize a navigation entrance.

King Pile – The primary structural member that supports horizontal panels to form a vertical wall sometimes used in bulkhead or groin construction.

Littoral Drift – The sedimentary material transported along the shore by waves and currents.

Longshore Transport – The movement of littoral drift (material) running parallel to the shoreline.

Pier – An elevated deck structure, usually pile supported, extending out into the water from the shore.

Pierhead Line – The limiting line to which any pier or dock structure can extend into the water.

Pile – A cylindrical timber, concrete or metal member embedded into the ground to support or brace a structure.

Pile, Sheet – A pile with a generally slender flat cross section to be embedded into the ground or seabed and meshed or interlocked with like members to form a diaphragm, wall or bulkhead.

Revetment – A flexible structure usually constructed of stone or concrete and placed on a bank slope to protect it against erosion by wave and current action.

Seawall – A massive structure built along and parallel to a shoreline for the purpose of protecting and stabilizing the shore against erosion resulting from heavy wave activity.

Wave, Design – A wave that is potentially most damaging to an economically feasible structure, a wave for which a structure is designed.

Added
9-10-85

SECTION 39. Coastal and Flood Plain Construction Standards. (Effective 1-1-86).

1.0 PURPOSE, APPLICATION, AND SCOPE

The requirements set forth in this section shall apply to all construction located within areas identified by governmental agency (state and federal) as coastal high hazard areas, ocean hazard areas, the regulatory flood plain areas, and all areas designated as 120 MPH wind zone by North Carolina's Building Code Council. (See Fig. 12B and Table 12F in Volume I)

2.0 DEFINITIONS

MSL: Mean sea level as defined by National Geodetic Vertical Datum.

Base Flood Elevation – The peak water elevation in relation to MSL expected to be reached during a design flood which is established by the Building Code Council as a flood having a one percent chance of being equaled or exceeded in any given year.

Coastal High Hazard Area – An area subject to coastal flooding and high velocity waters including storm wave wash, as shown by Federal Emergency Management Agency Maps and subject to the approval of the Building Code Council.

Ocean Hazard Area – An area, as identified by the North Carolina Coastal Resources Commission, and subject to approval by the Building Code Council, near the shoreline of the Atlantic Ocean which has been identified as subject to at least one of the following hazards: (A) Historical or predicted future trends of long term erosion, (B) erosion expected to occur during a coastal storm reaching the base flood elevation, or (C) shoreline fluctuations due to tidal inlets.

Flood Plain – Land below base flood elevation, which of record has in the past been flooded by storm water – surface runoffs, or tidal influx: and – as defined by the Corps of Engineers' maps, the Federal Emergency Management Agency maps or as approved by Building Code Council.

Regulatory Flood Plain – (Same as flood plain defined above)

3.0 PILING STANDARDS

- 3.1** All 1&2 family dwellings in areas identified as coastal high hazard areas or ocean hazard areas shall be constructed on a pile foundation of wood or concrete.
- 3.2 Concrete Piles.** Concrete piles may be used if made and installed in accordance with Chapter 13, Volume I.
- 3.3 Size of wood piles.** Round timber piles shall not be less than 8" in diameter at building level and have a minimum tip diameter of 6". Square timber piles shall not be less than 8" square, nominal. Piles supporting uncovered stairs, uncovered walkways and uncovered decks shall be 6" x 6" minimum, or if round, have a minimum tip diameter of 6". Piles supporting uncovered stairs, uncovered walkways and uncovered decks less than five (5) feet above grade may be 4" x 4" minimum.
- 3.4 Required depth of piles.** Pile tip shall extend to a depth of not less than 8 feet below the natural grade or finished grade of the lot whichever is lower. All pilings within the Ocean Hazard Area shall have a tip penetration of at least 5.0' below mean sea level or 16' below average original grade whichever is least. Structures within Ocean Hazard Areas which are placed upon the site behind a line 60 times the annual erosion rate away from the most seaward line of stable natural vegetation are exempt from this additional tip penetration requirement.

Revised
12-10-85

Coastal and Flood Plain Construction Standards

3.5 Spacing of wood piles. The maximum center-to-center spacing of wood piles shall not be more than 8 feet on center under load bearing sills, beams, or girders. However, for dwellings having more than two stories above piles or where the piling spacing exceeds 8' on center, the pile foundation shall be designed by a Registered Engineer or Licensed Architect. Pile spacing in the non-load bearing direction may be 12'.

Revised
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3.6 Tying and bracing of wood piles. If sills, beams, or girders are attached to the piling, a minimum of two-5/8" inch galvanized steel bolts per beam member shall be through bolted at each piling connection. Piling shall not be notched so that the cross-section is reduced below 50%. Sills, beams, or girders may be attached using 3/16" x 4" x 18" hot dip galvanized straps, 1 each side, bolted with two 1/2" inch galvanized through bolts. (See illustration.) Bracing of pile foundations is required where the clear height from ground to sill, beam, or girder exceeds 10' or the dwelling is more than one story above piles. A line of X bracing is defined as a row of piles with X bracing provided in at least 2 bays. A line of X bracing shall be provided at all exterior pile lines. Where the perimeter lines of X bracing exceed 40 feet, an additional line of X bracing shall be provided near the center of the building. (See illustration.) X bracing shall be with 2 x 10's through bolted with two-3/8" bolts each end. The Building Inspector may accept alternate bracing designs if they bear the seal of a Registered Engineer or Licensed Architect.

3.7 All wood piles shall be pressured treated to AWPA Standard C3. Note this standard requires 12 lbs. per cubic foot net retention if creosote is used; .8 lbs. per cubic foot net retention if waterborne preservatives are used. The Building Inspector may require certification from the manufacturer.

3.8 Piling may be placed by auger, jetting, or drop hammer. Piling shall receive a final set by drop hammer or other approved methods, acceptable to the Building Inspector to insure compaction of material at end bearing.

4.0 ELEVATION STANDARDS

4.1 The lowest structural member excluding pilings and bracing supporting the lowest habitable floor in the coastal high hazard area and ocean hazard area, shall be elevated above the base flood elevation plus wave height addition.

4.2 The wave height addition is determined by the flood water depth (D) under the building using the formula: (See Fig. 1)

$$\text{wave height addition} = 0.55 \times D$$

Where D = Base Flood elevation minus lowest finish grade elevation

or

other acceptable methods of wave height determination such as found in "Estimating Wave Heights" (FEMA TD-3) or the Corps of Engineers "Shore Protection Manual" (SPM).

4.3 The elevation of the first habitable floor of all structures in the Regulatory Flood Plain except in the coastal high hazard and ocean hazard areas shall be above the base flood elevation. (See 4.1 and 4.2 above)

4.4 Where walls are constructed below base flood elevation in Coastal High Hazard Area and Ocean Hazard Area, they shall be constructed in a manner to eliminate wave forces on the pilings.

5.0 CONSTRUCTION MATERIAL AND METHODS STANDARDS

5.1 The requirements of Section 5.2 through 5.8 are applicable in the Coastal High Hazard Area, the Ocean Hazard Area, and all areas defined as 120 MPH wind zone by the North Carolina Building Code Council. (See Fig. 12B and Table 12F Volume I)

5.2 Every rafter or roof truss shall be anchored to the bearing wall plate by metal ties. At the ridges, rafters shall have a minimum 1x6 collar or wind beam. Every third rafter shall be anchored vertically with minimum 1x6 from its midpoint to ceiling joists below.

5.3 Wood frame wall construction. Maximum stud spacing shall be 16" o.c., for 2x4's and 24" for 2x6's. Continuous 15/32" plywood sheathing shall fully overlap the top wall plate and continue down so that it overlaps the sill, beam, or girder at least 6". Note especially the nailing requirements found in Appendix B. The minimum height of the bottom panel shall be 4'. In lieu of the plywood system, 3/8" hot dip galvanized steel rods which provide a continuous tie from top wall plate down through the sill, beam, or girder may be installed in all exterior bearing walls – one no more than 2' from each corner and no more than 8' on center. Washer with a minimum dimension of 3 inches shall be used at each end of these 3/8 inch round rods.

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5.4 Equal or better methods of tying structures together and to foundations designed for a specific building by a Registered Engineer or Licensed Architect shall be accepted by the Building Inspector.

5.5 In the Coastal High Hazard Area and the Ocean Hazard Area, all metal connectors and fasteners outside of conditioned spaces shall be hot dip galvanized steel after fabrication and meet ASTM A153. Exposed metal connectors, such as tie-down straps on porches, decks, and areas under the structure shall be a minimum of 3/16" thick, and shall be hot dip galvanized after fabrication and meet ASTM A123 or ASTM A153. Metal connectors of approved equivalent corrosion resistant material may be accepted. See Table A.

5.6 (a) For masonry buildings, the roof structure, including rafters and joists shall be securely anchored to the footing by 3/8" steel rods not more than 8' apart, one of which shall be no more than 2' from each corner. All mortar used for masonry walls shall be type M or S.

(b) For masonry or wood frame buildings, all sills, beams or girders into which smaller joists are framed, which bear on masonry foundation walls or piers shall be anchored to the footing with 5/8" steel rods embedded at least 6" therein. Rods shall have a 10" hook.

(c) Where wood partitions and masonry walls join, the stud abutting the masonry shall be double and bolted to the masonry with three 1/2" galvanized bolts.

(d) Steel and wooden columns and posts, including porch columns shall be anchored with metal ties and bolts to their foundations and to the members which they support.

5.7 Roof Coverings

(a) Attaching devices shall be hot dip galvanized after fabrication or be of other suitable corrosion resistant material.

Coastal and Flood Plain Construction Standards

**Table A
Corrosion Resistance**

	Exposure Level		
	OPEN (exteriors, porches, under house)	VENTED/ENCLOSED (attics, floor trusses, enclosed crawl spaces and stud cavity)	CONDITIONED (heated/cooled living areas)
Nails, staples, screws	Hot dip galvanized	Hot dip galvanized	---
Nuts, bolts, washers, tie rods	Hot dip galvanized	Hot dip galvanized	---
Steel connection plates & straps (3/16" minimum thickness)	Hot dip galvanized after fabrication	Hot dip galvanized	---
Sheet metal connectors, wind anchors, joist hangers, steel joists & beams	Stainless steel	Hot dip galvanized after plate fabrication	Hot dip galvanized
Truss plates	Stainless steel	Hot dip galvanized after fabrication or Stainless steel within 6'-0" of a gable louver or soffit vent. Otherwise in accordance with TPI-78 of the Truss Plate Institute	Standard galvanized

(b) All butts or tabs on roof shingles shall be securely spotted or tabbed with a plastic fibrous, asphaltic cement, or anchored by clips or locks. The use of seal-o-matic roofing may be used as the equivalent of this requirement.

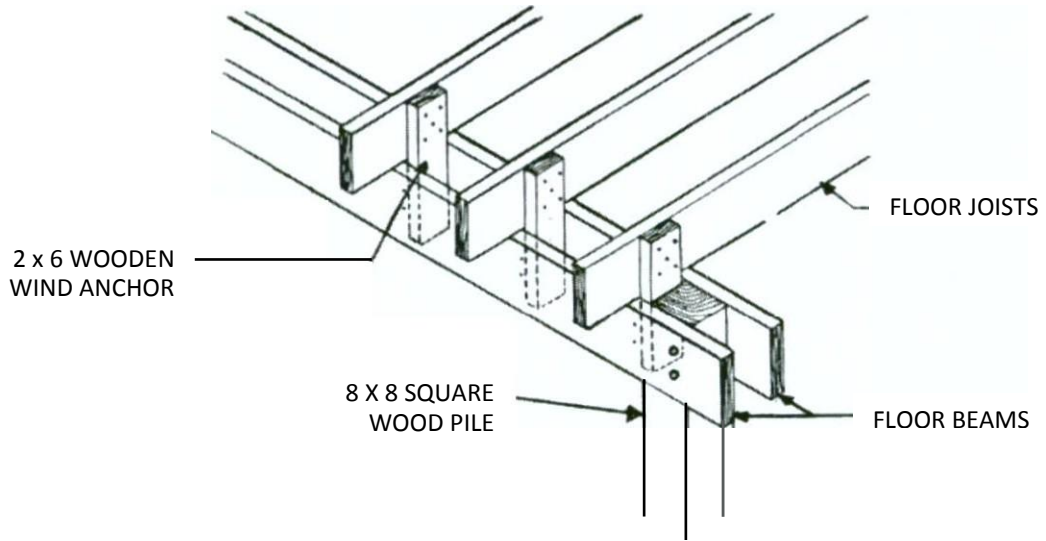
(c) Where two or more layers of roll or built-up roofing are applied, the deck shall be thoroughly mopped before the anchor sheet is nailed to the sheathing with sheet metal caps and nails not over 12" on center in each direction and 6" along edges and laps. Each additional sheet above the anchor sheet shall be thoroughly mopped and finished with corrosion resistant capping around edges of roof.

(d) All roof covering shall be Class A or Class B, or Class C asphalt covering.

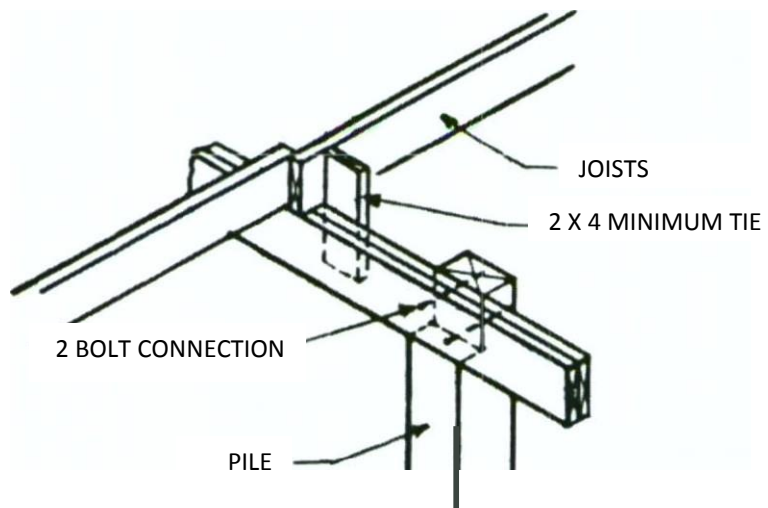
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5.8 Insulation. Insulation installed in floors in buildings elevated on pilings shall be held in place with plywood with exterior glue or other material approved by the Building Inspector.

5.9 Detached accessory structures and out buildings shall be bolted to their foundation or otherwise constructed so as to prevent overturning during high winds.



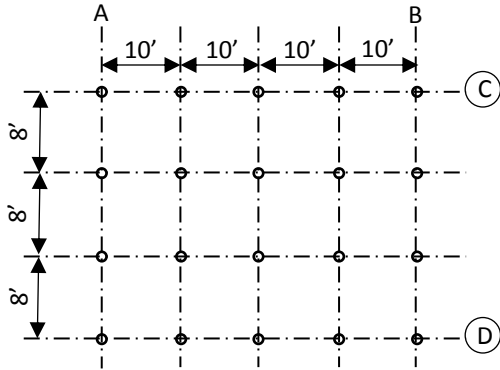
SPACED BEAM TIE DETAIL



SOLID BEAM TIE DETAIL

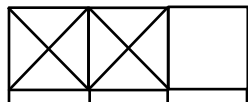
TYPICAL CONNECTIONS ON INTERIOR COLUMN LINES

Coastal and Flood Plain Construction Standards

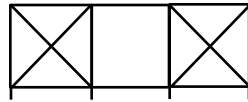


PILE PLAN

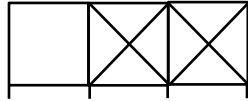
Note: Provide lines of x bracing along lines A, B, C, D.



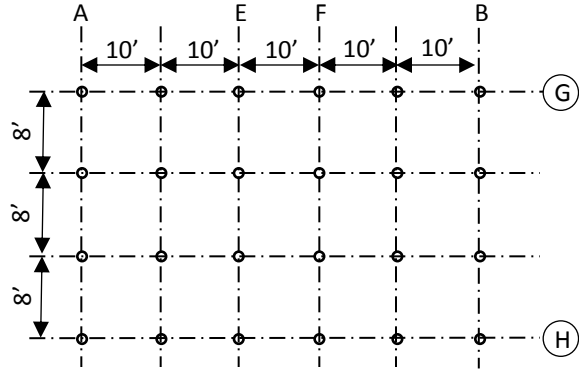
or



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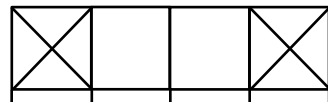


A, B, E, F

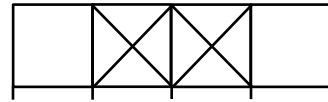


PILE PLAN

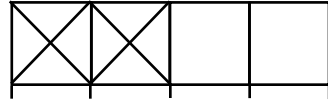
Note: Provide lines of x bracing along lines A, B, G, H and either along lines E or F.



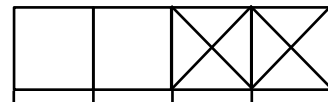
or



or



or



C and D

ELEVATIONS (showing possible arrangements of x bracing in line.) (G and H similar)

Coastal and Flood Plain Construction Standards

MAX. WAVE HEIGHT ELEVATION = BASE FLOOD ELEVATION + 0.55 x D (FLOOD DEPTH)

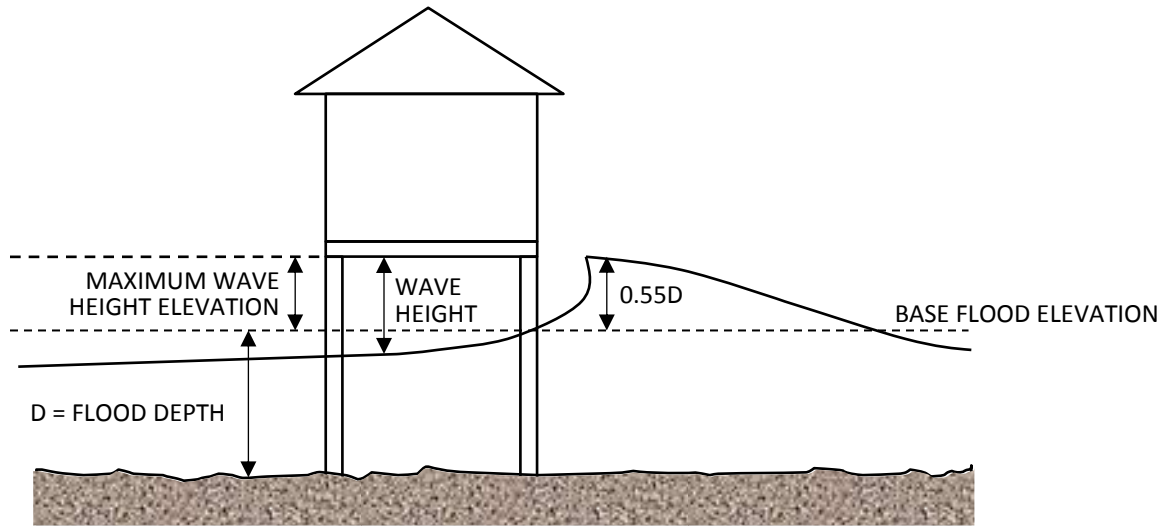


FIGURE 1
WAVE CONDITIONS ON PILING SUPPORTED BUILDING

ARTICLE III. DEFINITIONS

1. Unless otherwise expressly stated, the following terms shall, for the purpose of this code, have the meaning indicated in this section.
2. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.
3. Where terms are not defined in this section, they shall have their ordinarily accepted meanings or such as the context may imply.

Alteration as applied to a building or structure, means a change or re-arrangement in the structural parts or in the exit facilities; or an enlargement, whether by extending on a side or by increasing in height; or the moving from one location or position to another; the term "alter" in its various moods and tenses and its participle forms, refers to the making of an alteration.

Apartment means a room, or a suite of two or more rooms, in a residence building occupied as the home or residence of an individual, family or household.

Approved, as applied to a material, device or mode of construction, means approved by the building inspector under the provisions of this code, or by other authority designated by law to give approval in the matter in question.

Area, as applied to a form of construction, means an uncovered subsurface space adjacent to a building.

Area, as applied to the dimensions of a building, means the maximum horizontal projected area of the building at grade.

A. C. I. means American Concrete Institute.

A. I. A. means American Institute of Architects.

A. I. S. C. means the American Institute of Steel Construction.

A. S. A. means American Standards Association.

A. S. T. M. means the American Society for Testing Materials.

A. I. S. I. means American Iron and Steel Institute.

A. W. S. means American Welding Society.

S. J. I. means Steel Joist Institute.

Basement means a story with 50 per cent or more of its cubical contents below finished grade.

Brick means a solid masonry unit having a shape approximating a rectangular prism, usually not larger than 12 by 4 by 4 inches. A brick may be made of burned clay or shale, of lime and sand, of cement and suitable aggregates, or of fire clay or other approved materials.

Building Line means the line, established by law, beyond which a building shall not extend, except as specifically provided by law.

Building Inspector means the officer or other designated authority charged with the administration and enforcement of this code, or his duly authorized representative.

Concrete means a mixture of Portland Cement, fine aggregate, coarse aggregate, and water.

DEFINITIONS

Average Concrete – Concrete made from average materials, where no preliminary tests of the materials to be used are made, the water content per sack of cement shall not exceed the values outlined in Section 13,(2) a.

Controlled Concrete means a concrete where the materials are scientifically selected, graded and proportioned to give specified results.

Reinforced Concrete means a portland cement concrete in which steel is embedded in such a manner that the two materials act together in resisting forces.

Dead Load means the weight of walls, partitions, floors, roofs, and all other permanent construction of a building.

Fire Resistance Rating means the time in hours that the material or construction will withstand the standard fire exposure as determined by a fire test made in conformity with the "Standard Methods of Fire Test of Building Construction and Materials," ASTM E 119.

Gypsum Mortar when used in the laying of unit construction means a mixture of one part neat gypsum and not more than three parts of clean, sharp, well-graded sand by weight.

Habitable Room means a room occupied by one or more persons for living, eating or sleeping; and includes kitchens serving apartments or individual households, but does not include bathrooms, toilet compartments, laundries, serving and storage pantries, corridors, basement and other spaces that are not used frequently or during extended periods.

Height, as applied to a story, means the vertical distance from top to top of two successive tiers of floor beams or finished floor surfaces;

Height, as applied to a wall, means the vertical distance to the top measured from the foundation wall, or from a girder or other immediate support of such wall.

Hereafter means after the time that this code becomes effective.

Hollow Masonry Unit means a masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than 75 per cent of its gross cross-sectional area measured in the same plane.

Listed means equipment or materials included in a list published by a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

The means for identifying listed equipment may vary for each testing laboratory, inspection agency or other organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

NOTE: REFER TO NORTH CAROLINA GENERAL STATUTES 66-23 THROUGH 66-27 ENTITLED "ELECTRICAL MATERIALS, DEVICES, APPLIANCES AND EQUIPMENT."

Live load means all loads except dead loads.

Masonry means brick, stone, plain concrete, hollow block, solid block or other similar building units or materials, or combinations of them, bonded together with mortar. Reinforced concrete is not classed as masonry.

Multifamily House means a building occupied as the home or residence of individuals, families or households living independently of each other, of which three or more are doing cooking within their apartments; including tenement house, apartment house, flat.

Municipality means the governmental unit which has adopted this code under due legislative authority.

N.F.P.A. means National Forest Products Association.

Noncombustible as applied to a building construction material means a material which, in the form in which it is used, falls in one of the following groups (a) through (d). No material shall be classed as noncombustible which is subject to increase in combustibility or flame spread rating beyond the limits herein established, through the effects of age, moisture or other atmospheric conditions, as for example, various types of treated wood. Flame spread rating as used herein refers to rating obtained according to the method for fire hazard classification of Underwriters' Laboratories, Inc. For data on such ratings see Underwriters' Laboratories Fire Protection Equipment List under the heading Building Materials – Hazard Classification (Fire) (40 U8).

- (a) Materials no part of which will ignite and burn when subjected to fire. Examples: asbestos fiber, brick, clay tile, concrete, glass, gypsum, iron, portland cement, slate, steel, stone.
- (b) Materials having a structural base of noncombustible material, as defined in (a), with a surface not over 1/8-inch thick which has a flame spread rating not higher than 50. Examples: certain types of protected steel sheets, gypsum wall board.
- (c) Materials made up of noncombustible materials as defined in (a) together with combustible components in such form that cross- sections of the material in any plane present a similar composition, and having a surface flame spread rating not higher than 25 without evidence of continued progressive combustion. Examples: certain insulation materials as, blocks of cellular glass, boards of glass fiber, slabs of wood excelsior impregnated with portland cement.
- (d) Materials, other than as described in (b), made up of layers with no layer having a surface flame spread rating higher than 25 without evidence of continued progressive combustion. Examples: certain sandwich type materials.

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

Prefabricated means composed of sections or panels fabricated prior to erection on the building foundation.

Required means required by some provision of this code.

Roof means the roof slab or deck with its supporting members.

Roofing means the covering applied to the roof for weather resistance, fire resistance, or appearance.

Solid Masonry means masonry consisting of solid masonry units laid continuously with the joints between the units filled with mortar or consisting of plain concrete.

Solid Masonry Unit means a masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 per cent or more of its gross cross-sectional area measured in the same plane.

Stairway means one or more flights of stairs and the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one story to another in a building or structure.

DEFINITIONS

Story means that part of a building comprised between a floor and the floor or roof next above.

Structural Clay Tile means a hollow masonry unit composed of burned clay, shale, fireclay or mixture thereof and having parallel cells.

Structure means anything constructed or erected, the use of which requires location on the land, or attachment to something having a permanent location on the land.

Walls:

Bearing Wall means a wall which supports any vertical load in addition to its own weight;

Cavity Wall means a wall built of masonry units or of plain concrete, or a combination of these materials, so arranged as 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;

Curtain Wall means a non-bearing wall between columns or piers and which is not supported by girders or beams;

Faced Wall means a wall in which the masonry facing and backing are so bonded as to exert common action under load;

Foundation Wall means a wall below the first floor extending below the adjacent ground level and serving as support for a wall, pier, column or other structural part of a building;

Hollow Wall of Masonry means a wall built of masonry units so arranged as to provide an air space within the wall, and in which the inner and outer parts of the wall are bonded together with masonry units;

Non-bearing Wall means a wall which supports no load other than its own weight;

Panel Wall means a non-bearing wall built between columns or piers and wholly supported at each story;

Party Wall means a wall used or adapted for joint service between two buildings;

Veneered Wall means a wall having a facing which is not attached and bonded to the backing so as to form an integral part of the wall for purposes of load bearing and stability;

Written Notice shall be considered to have been served if delivered in person to the individual or to the parties intended, or if delivered at or sent by registered mail to the last address known to the party giving the notice;

Yard means a court that extends along the entire length of a lot line:

Zoning means the reservation of certain specified areas within a community or city for buildings and structures for certain purposes with other limitations such as height, lot coverage and other stipulated requirements.

APPENDIX A – LIVE AND DEAD LOADS

1. The tables included in this Code are based upon the following live and dead loads. Design for other conditions should likewise use these values.

A. Live Load Assumptions:

- (a) Live loads on floors shall be assumed as 40 pounds uniformly distributed. Allowance shall be made for concentrated loads.
- (b) Wind loads on pitched roof surfaces shall be assumed as 10 pounds per square foot. In localities that are subjected to sustained wind velocities greater than 50 MPH, the wind load shall be increased proportionately at the following rates:
- | | | |
|---------|-----|-----------|
| 60 MPH | Add | 5 Pounds |
| 70 MPH | Add | 10 Pounds |
| 80 MPH | Add | 15 Pounds |
| 90 MPH | Add | 23 Pounds |
| 100 MPH | Add | 30 Pounds |
- (c) Snow loads on roof surfaces shall be assumed as 10 pounds per square foot on roof surfaces. Localities subjected to more or less than 8 inches of snow shall be increased or decreased at the rate of 1.5 pounds per square foot.
- (d) Minimum combined loads on roof surfaces shall be assumed as 20 pounds per square foot; with allowances made for greater snow or wind loads and any other loads superimposed upon roof.

B. Dead Load Assumptions:

The following average weights of various materials were used as the basis for the dead loads in computing the span lengths in the tables:

Finished floor	2.5	lbs. per sq. ft.
Rough floor	2.5	lbs. per sq. ft.
Roof sheathing	2.5	lbs. per sq. ft.
Plaster and lath	10.0	lbs. per sq. ft.
½ inch Gypsum dry wall	2.0	lbs. per sq. ft.
Group 1 – Assumed as 2.5 lbs. per sq. ft. including:		
Shingles	2.5	lbs. per sq. ft.
Copper sheets	1.5	lbs. per sq. ft.
Copper tile	1.75	lbs. per sq. ft.
Three-ply ready roofing	1.00	lbs. per sq. ft.
Group 2 – Assumed as 8 lbs. per sq. ft. including:		
Five-ply felt and gravel	7.00	lbs. per sq. ft.
Slate, 3/16 inch	7 ¼	lbs. per sq. ft.
Roman tile	8	lbs. per sq. ft.
Spanish tile	8	lbs. per sq. ft.
Ludowici tile	8	lbs. per sq. ft.

Joists: The weight of the joists were based on assumed average weight of wood of 40 lbs. per cu. ft.

APPENDIX B – FASTENING SCHEDULE

Joint to sill or girder, toe nail	8d common	3
Bridging to joist, toe nail each end	8d common	2
Ledger strip	16d common	3 at each joist
1"x6" subfloor or less to each joist, face nail	8d common	2
Over 1"x6" subfloor to each joist, face nail	8d common	3
2" subfloor to joist or girder, blind and face nail	16d common	2
Sole plate to joist or blocking, face nail	16d common	16" o.c.
Top plate to stud, end nail	16d common	2
Stud to sole plate, toe nail	8d common	4
Doubled studs, face nail	16d common	24" o.c.
Doubled top plates, face nail	16d common	16" o.c.
Top plate, laps and intersections, face nail	16d common	2
Continuous header, two pieces	16d common	16" o.c. along each edge
Ceiling joists to plate, toe nail	8d common	3
Continuous header to stud, toe nail	8d common	3
Ceiling joists, laps over partitions, face nail	16d common	3
Ceiling joists to parallel rafters, face nail	16d common	3
Rafters to plate, toe nail	8d common	3
1-inch brace to each stud and plate, face nail	8d common	2
1"x8" sheathing or less to each bearing, face nail	8d common	2
Over 1"x8" sheathing to each bearing, face nail	8d common	3
Built-up corner studs	16d common	32" o.c. at top and bottom and staggered 2 ends and at each splice.
Built-up girders and beams	20d common	
2 each bearing	2-inch Planks	16d common
Plywood, Particleboard and Structural-Use Panel Subflooring		
1/2", 15/32"	6d common	6" o.c. edges and 10" o.c. intermediate
19/32", 3/4"	8d common	6" o.c. edges and 10" o.c. intermediate
1", 1-1/2"	10d common or 8d ring shank	6" o.c. edges and 6" o.c. intermediate
1/2", 15/32"	16 ga. Galvanized wire staples, 3/8" minimum crown	4" o.c. edges and 7" o.c. intermediate
19/32"	1-5/8" length	2-1/2" o.c. edges and 4" o.c. intermediate
Plywood, Particleboard and Structural-Use Panel Roof & Wall Sheathing		
1/2" or less	6d common	6" o.c. edges and 12" o.c. intermediate
5/8" or greater	8d common	6" o.c. edges and 12" o.c. intermediate
5/16", 1/2"	16 ga. Galvanized wire staples, 3/8" minimum crown. Length of 1" plus Sheathing thickness	4" o.c. edges and 8" o.c. intermediate
19/32", 3/4"		2" o.c. edges and 5" o.c. intermediate
1/2" Fiberboard Sheathing*	1-1/2" Galvanized roofing nail 6d common	3" o.c. edges and 6" o.c. at other bearing
25/32" Fiberboard Sheathing*	1-3/4" Galvanized roofing nail 8d common	3" o.c. edges and 6" o.c. at other bearing
1/2" Gypsum Sheathing	12 gage 1-1/4" Large Head Corrosion-Resistive	4" o.c. edges and 8" o.c. intermediate

* Fiberboard sheathing may be stapled using 16 gage galvanized staples 1-1/8" long for 1/2" sheathing and 1-1/2" long for 25/32" sheathing. Staples to have minimum crown of 7/16" and spaced 3" o.c. at edges and 6" o.c. at other bearing.

APPENDIX C – AUTHORITY FOR APPOINTMENT OF COUNTY BUILDING INSPECTORS

AN ACT TO AMEND G.S. 153-9 SO AS TO AUTHORIZE COUNTIES TO APPOINT A COUNTY BUILDING INSPECTOR.

The General Assembly of North Carolina do enact:

Section 1. G.S. 153-9 is amended by adding a new subsection immediately following subsection 51, to be designated as subsection 52, and to read as follows:

“52. County Building Inspectors. The board of county commissioners may appoint one or more building inspectors to serve at the will of the board, whose duties shall be: To enforce the State Building Code adopted under Article 9 of Chapter 143 of the General Statutes; to enforce any county building regulations adopted under G.S. 143-138(b) or 143-138(e); to enforce any county zoning ordinance or ordinances; to collect inspection fees determined by the board of county commissioners, which the board is hereby authorized to impose, and deliver same to the county treasurer; to furnish a surety bond for the faithful performance of his duties and the safeguarding of any public funds coming into his hands, approved as to amount, form, and solvency of sureties by the board of county commissioners; and to carry out such related duties as may be specified by the board of county commissioners.

In lieu of appointing a separate building inspector, the board of county commissioners may designate as county building inspector: (a) a building inspector of any other county or counties, with the approval of the board of county commissioners of such other county or counties; (b) a municipal building inspector of any municipality or municipalities within the county, with the approval of the municipal governing body; (c) the county fire marshal; (d) a county electrical inspector appointed under the provisions of G.S. 160-122; (e) a county plumbing inspector appointed under the provisions of G.S. 153-9 (47); or (f) any other person or persons whom they deem to be qualified.

The board of county commissioners may pay a building inspector a fixed salary or may in lieu thereof reimburse him for his services by paying over any inspection fees which he collects.

The board of county commissioners may enter into and carry appropriations for the special purpose of paying the salary or salaries of county building inspectors and any expenses pertaining to building inspections.

The board of county commissioners may enter into and carry out contracts with any municipality or municipalities within the county, or with any other county or counties, under which the parties agree to support a joint building inspection department. The board of county commissioners and the municipal governing body may make any necessary appropriations for such a purpose.

On official request of the governing body of any municipality within the county, the board of county commissioners may direct the county building inspector to exercise his powers within said municipality, and he shall thereupon be empowered to do so until such time as the municipal governing body officially withdraws its request.

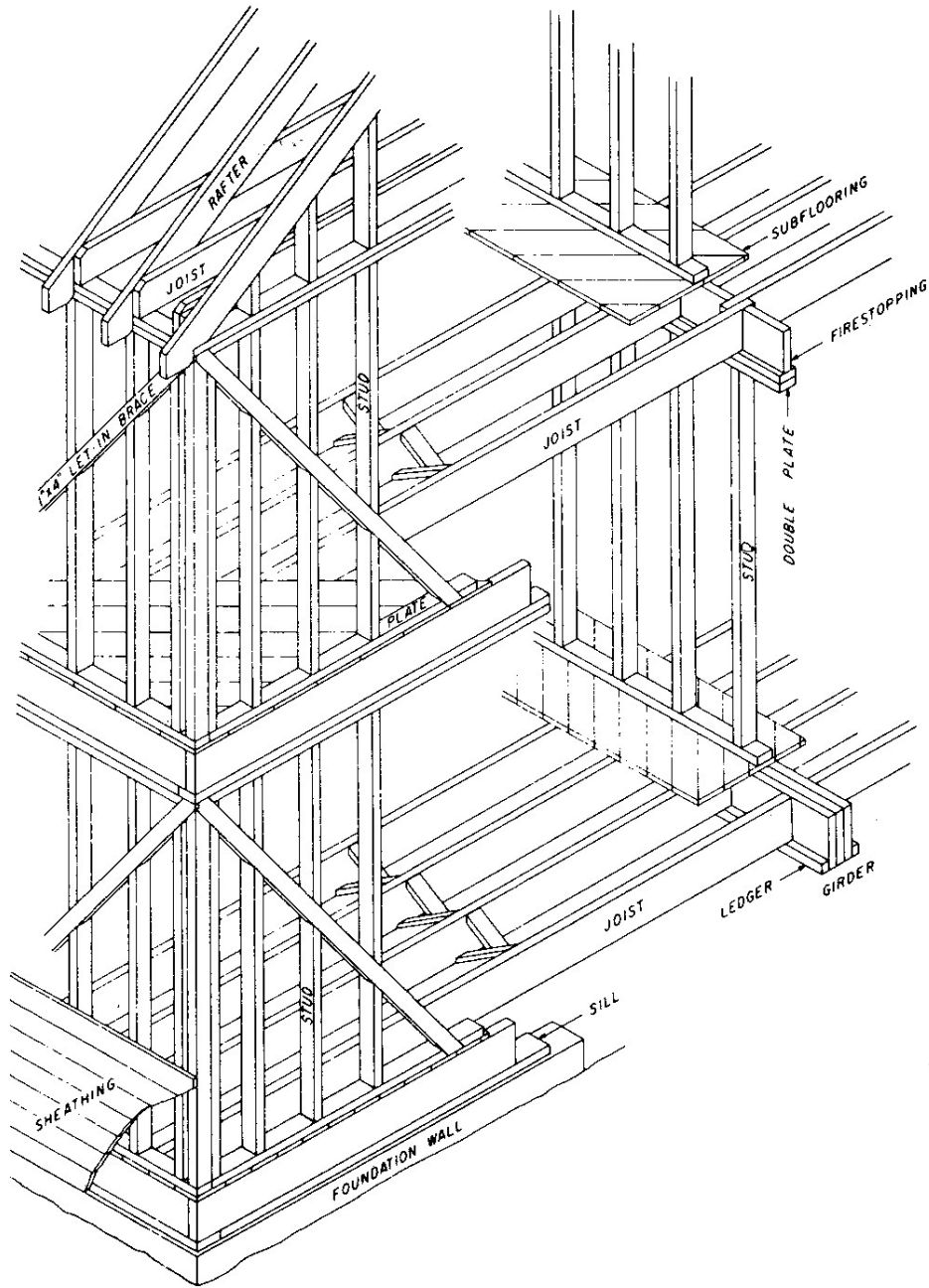
Sec. 1½. Provided this Act shall not apply to Harnett, and Lenoir counties.

Sec. 2. All laws and clauses of laws in conflict with this Act are hereby repealed.

Sec. 2(a). This Act shall not apply to Cherokee, Clay, Graham, Macon counties."

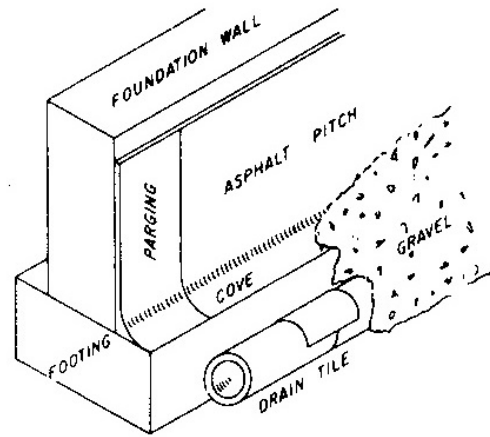
Appendix D: Deleted - Effective January 1, 1986.

APPENDIX E

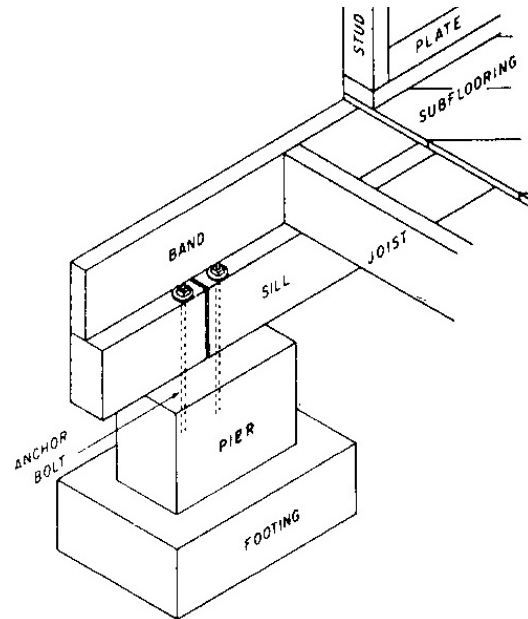


Platform frame construction

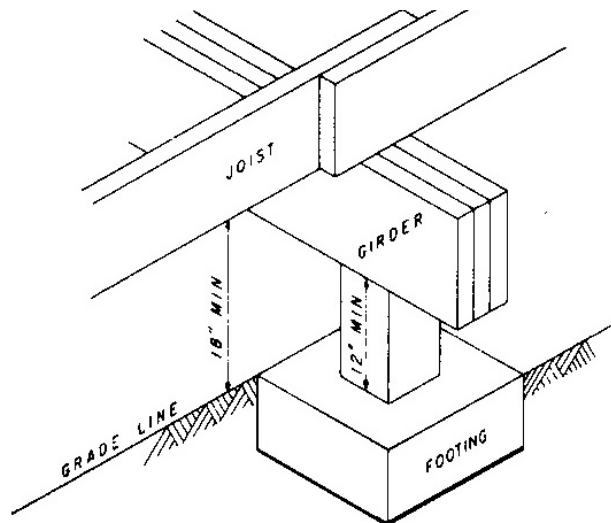
Continuous foundation wall and footing.



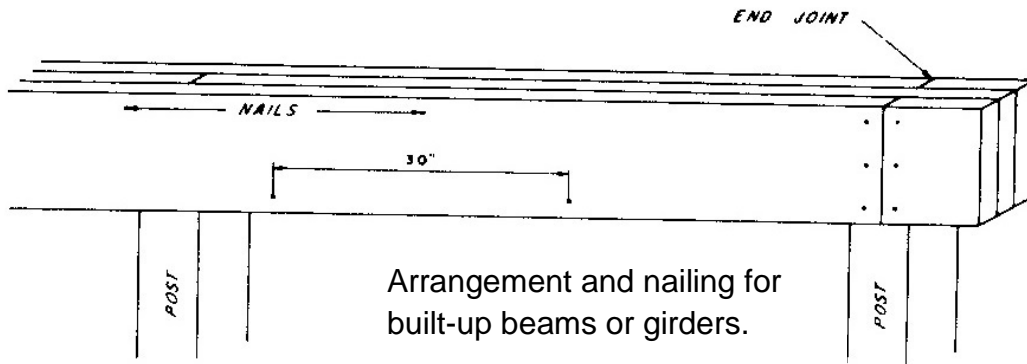
Pier foundation at exterior wall.



Clearance between earth and floor framing

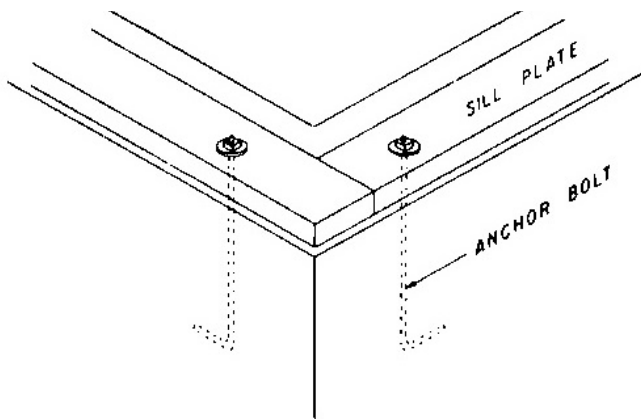
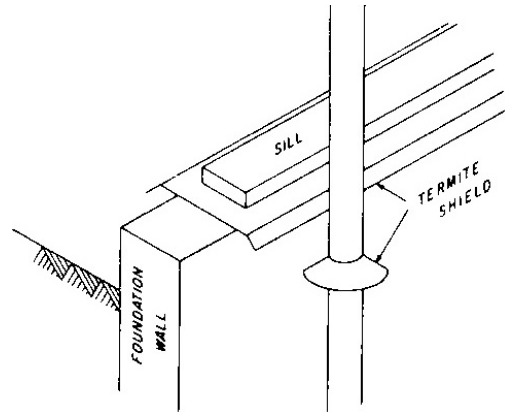


APPENDIX E



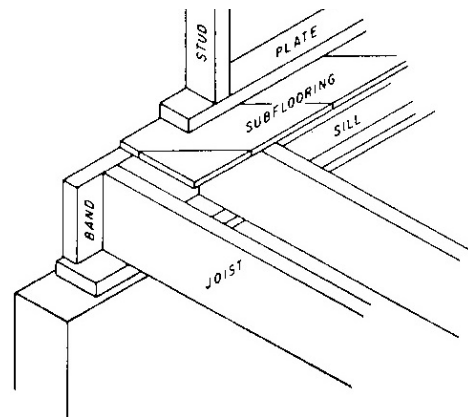
Arrangement and nailing for built-up beams or girders.

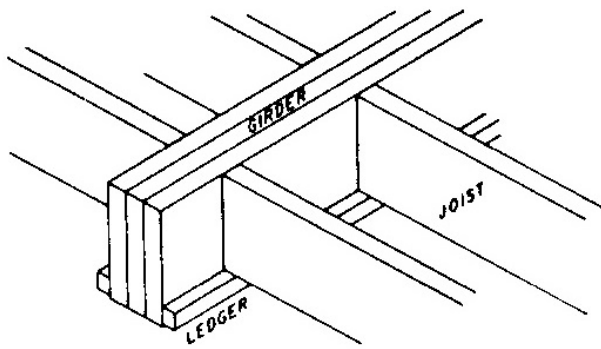
Installation of termite shields on exterior wall.



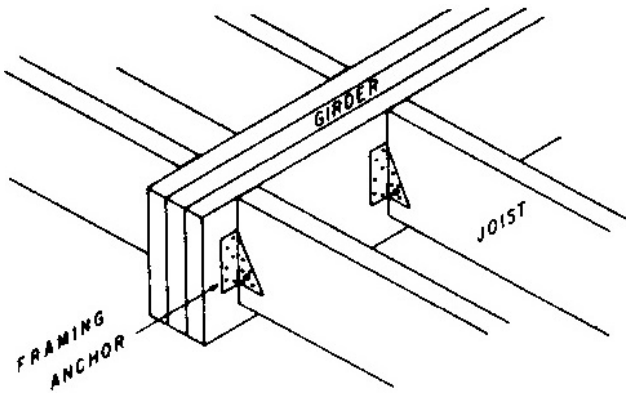
Anchorage of sill to continuous foundation wall.

First floor framing at exterior wall – platform frame construction

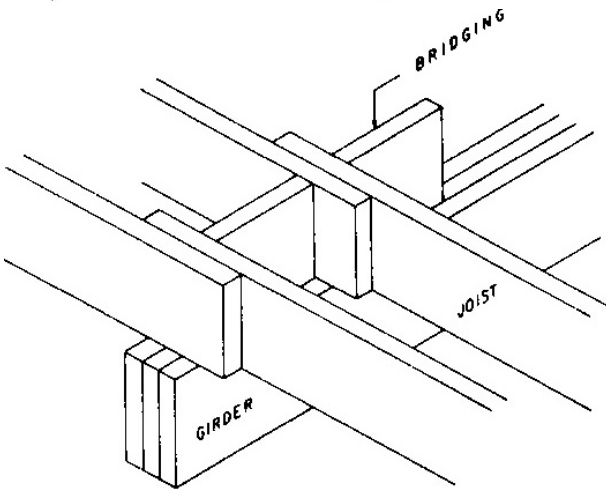




Joist framing into girder on ledger strip.

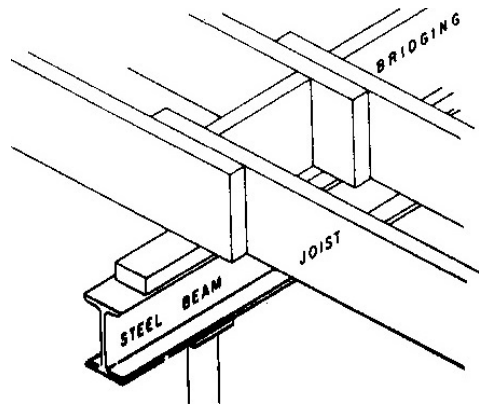


Joist framing into girder with framing anchors.



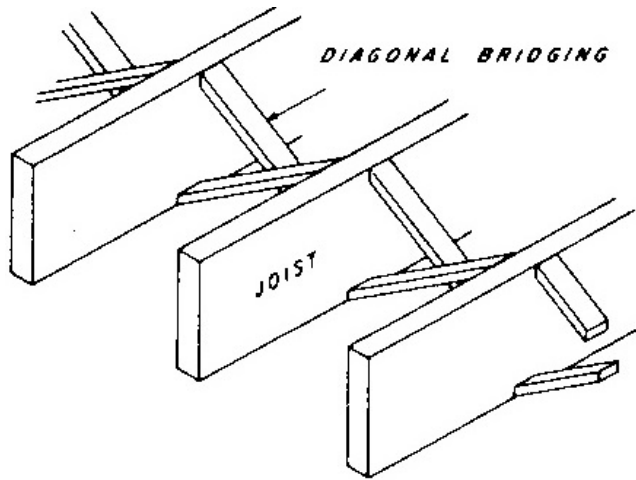
Joist resting on girder

Joist resting on steel beam.

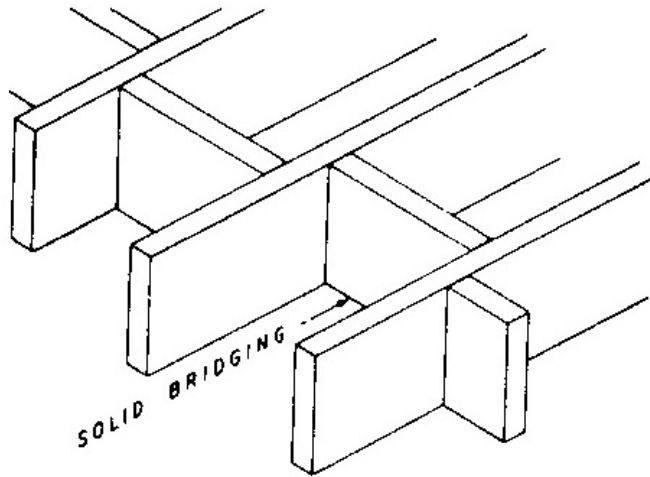


APPENDIX E

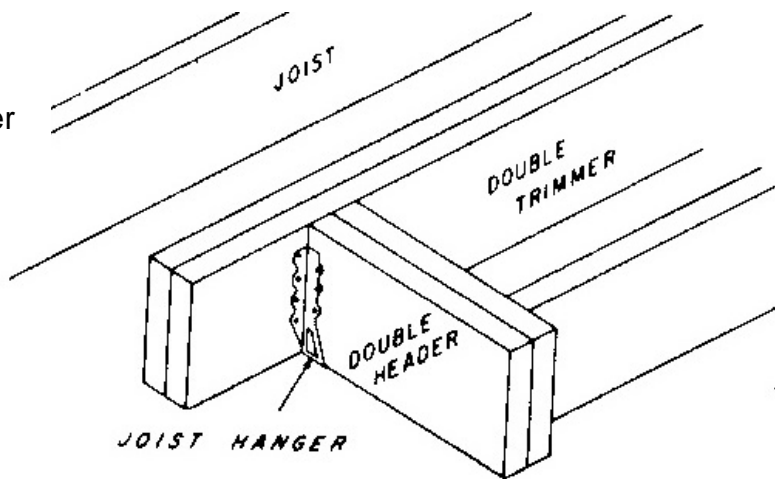
Diagonal bridging of floor joists.

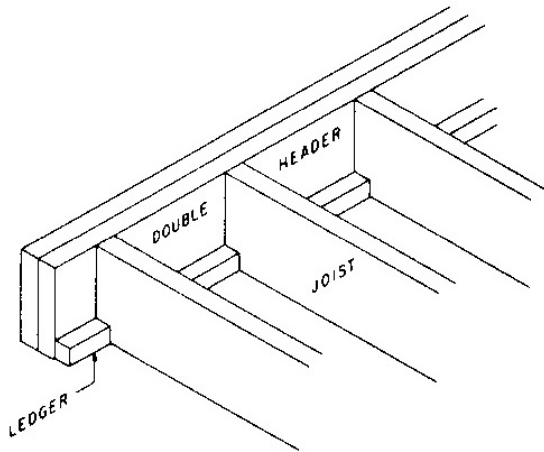


Solid bridging of floor joists.

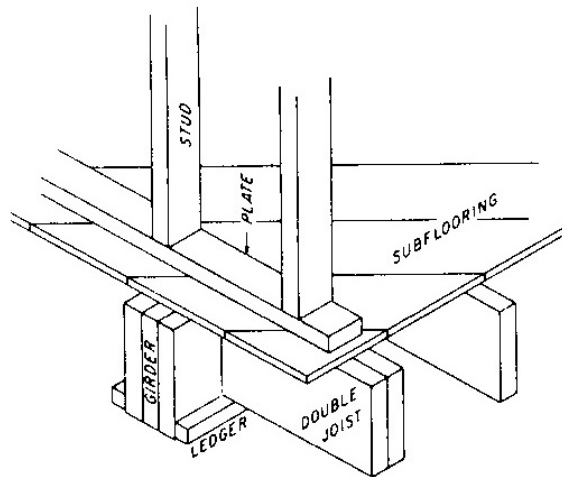


Framing of header to trimmer by joist hanger

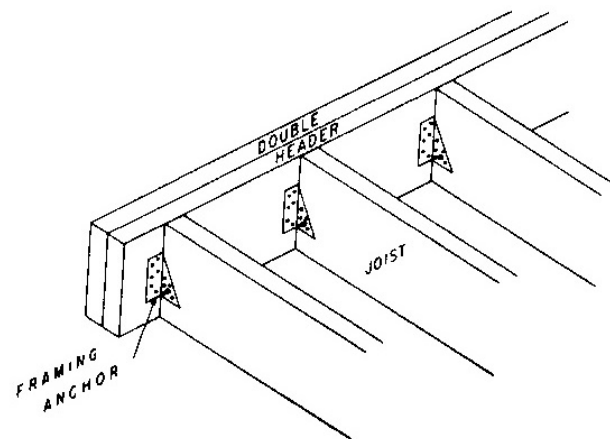




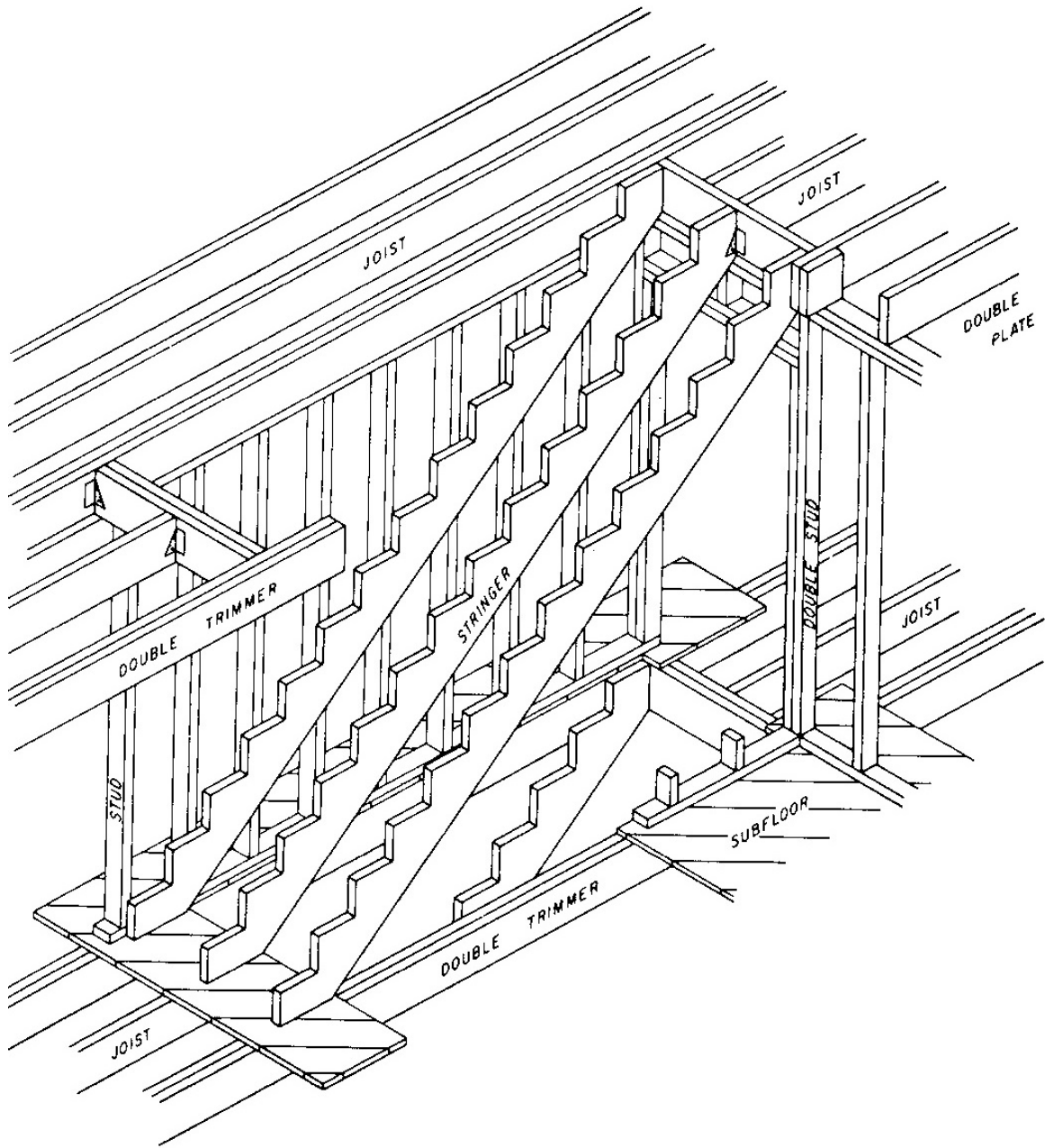
Framing of tail joists to header on ledger strip



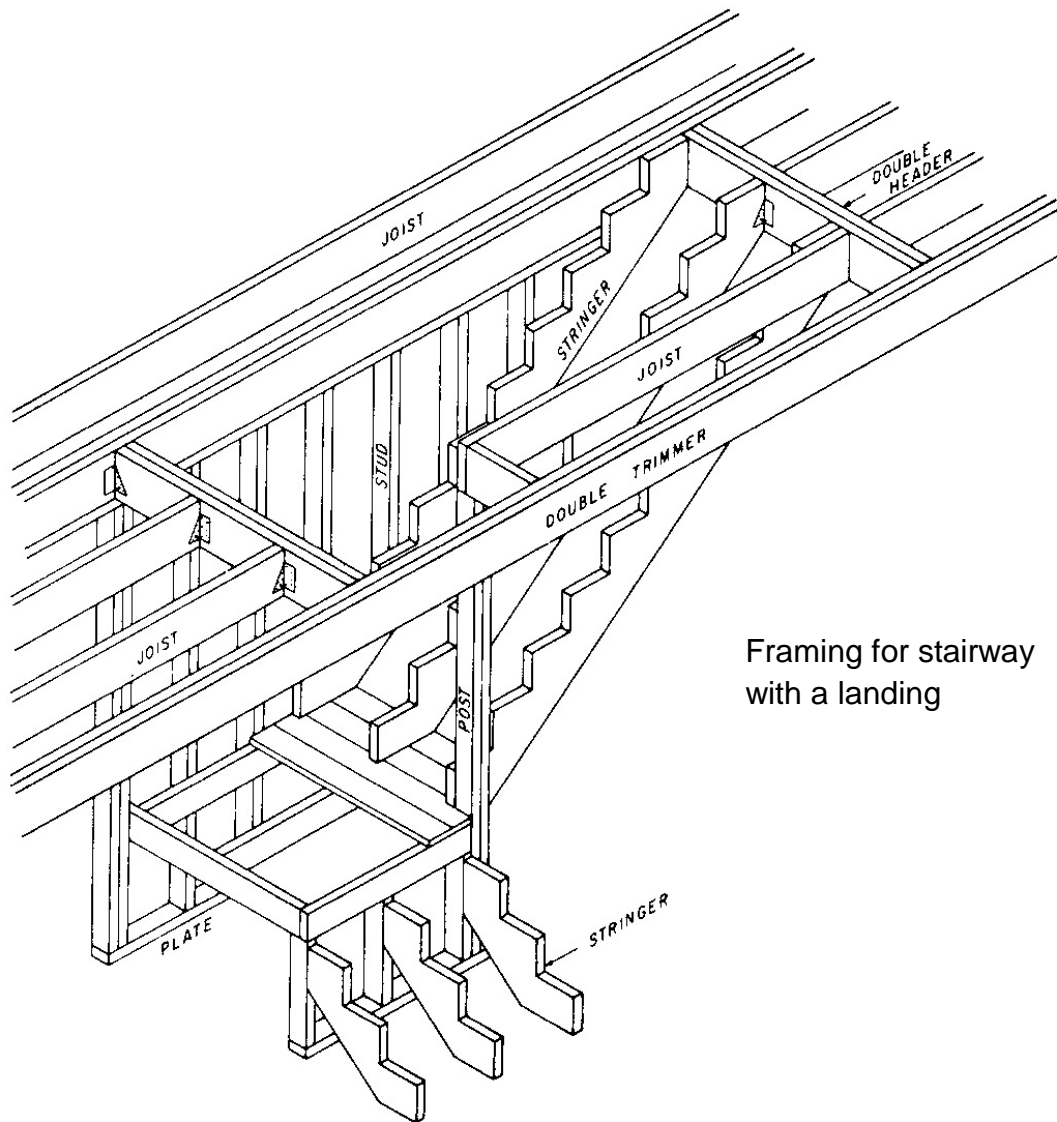
Double joists under non-bearing partitions.



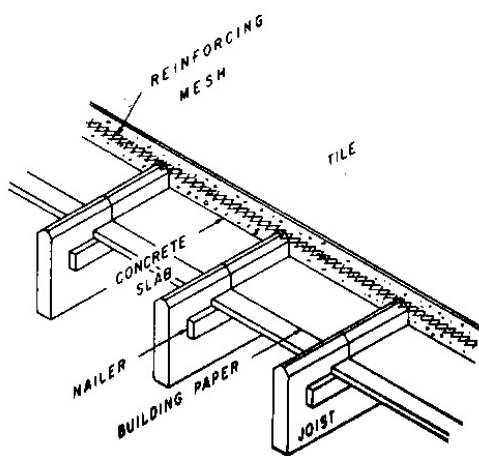
Framing of tail joists to header by framing anchors.



Interior stairway framing.



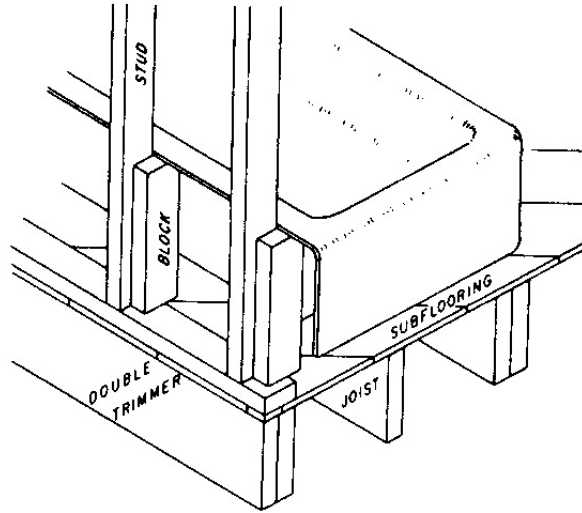
Framing for stairway with a landing



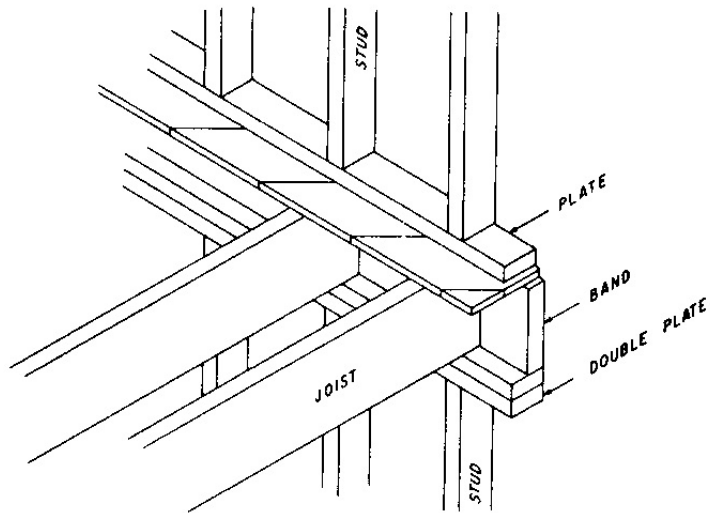
Bathroom floor construction for ceramic tile covering

APPENDIX E

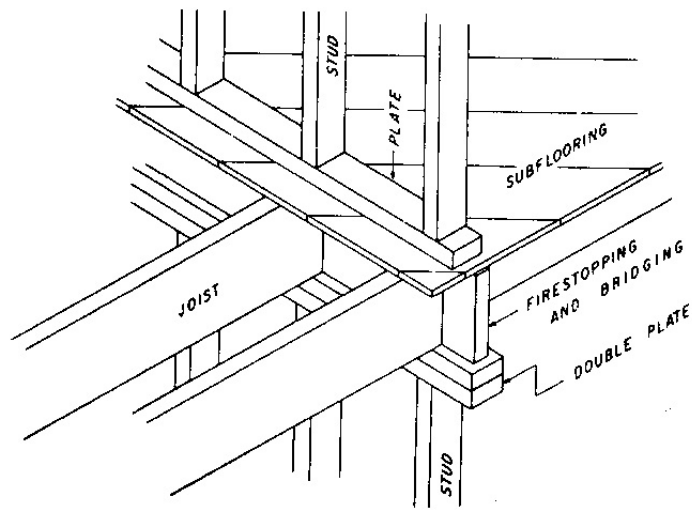
Support of bathtub
against wall framing.

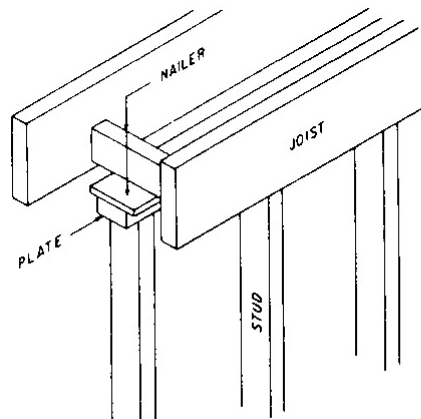


Second floor framing at
exterior wall –
platform frame construction.



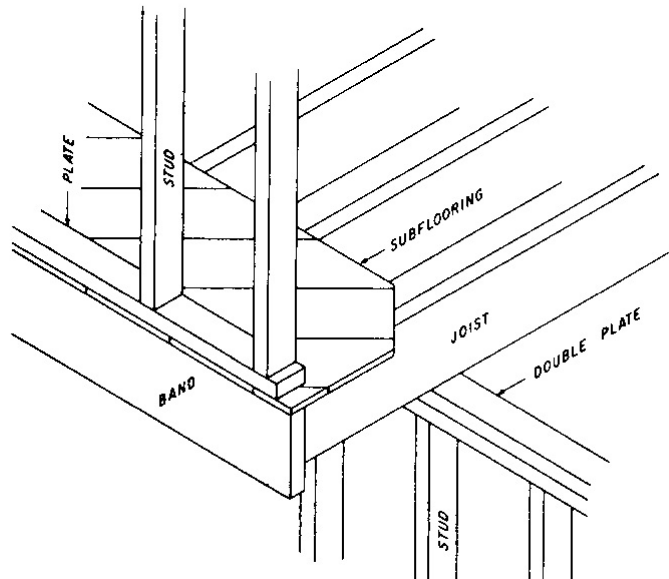
Second floor framing over
bearing partition –
platform frame construction.



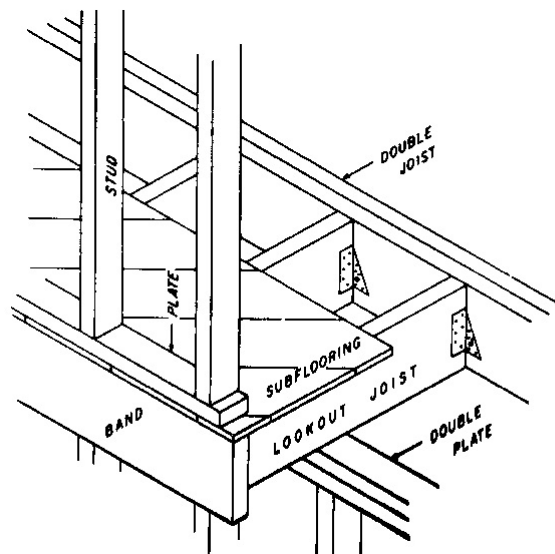


Attachment of non-bearing partition to floor framing.

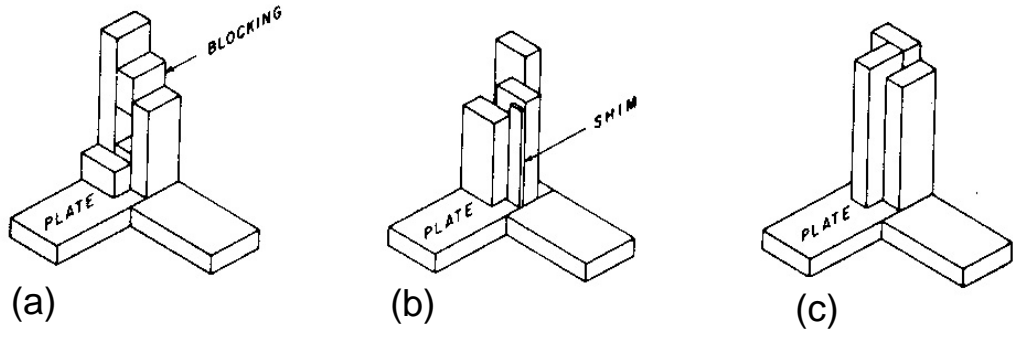
Overhang of exterior wall at second floor with joists at right angles to wall below.



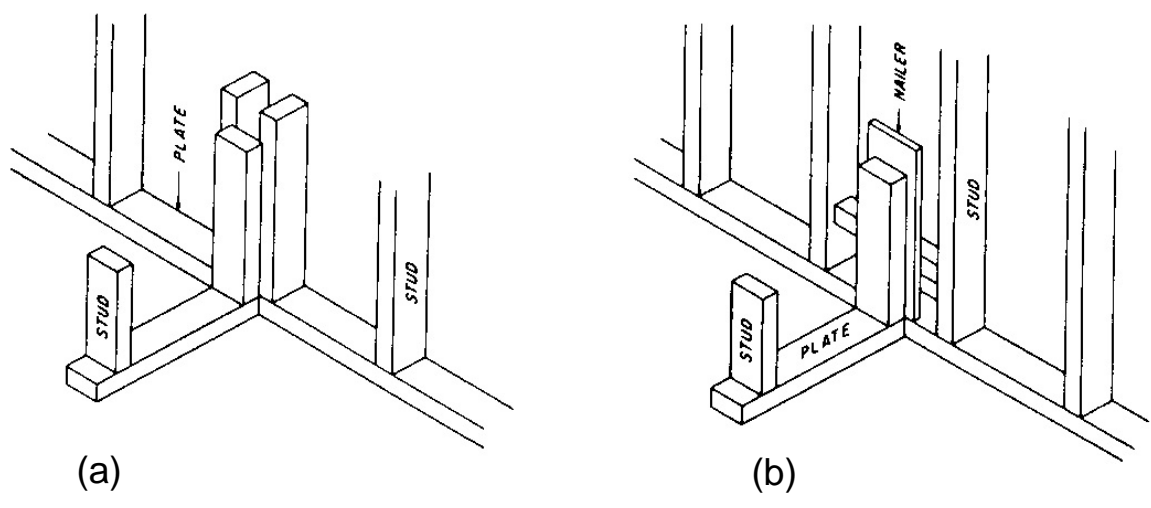
Overhang of exterior wall at second floor with joists parallel to wall below.



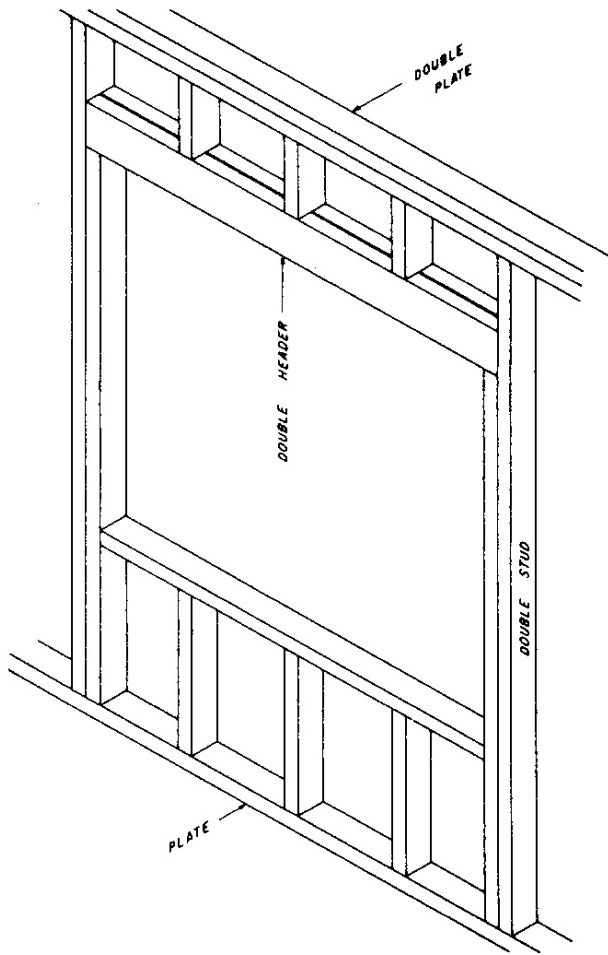
APPENDIX E



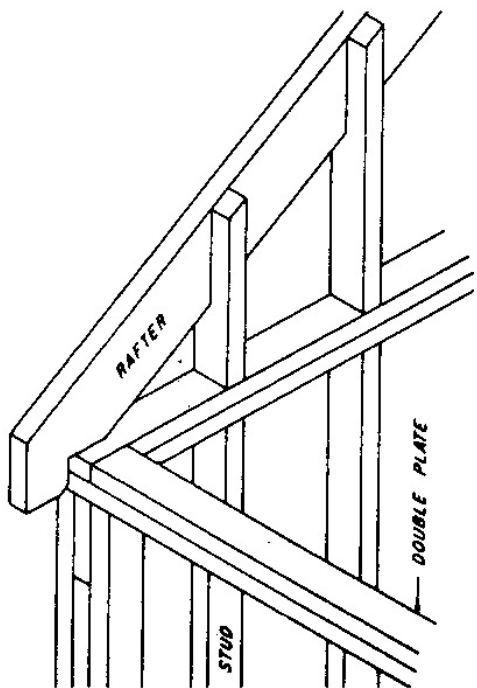
Assembly of studs at outside corner



Assembly of studs where partitions meet wall

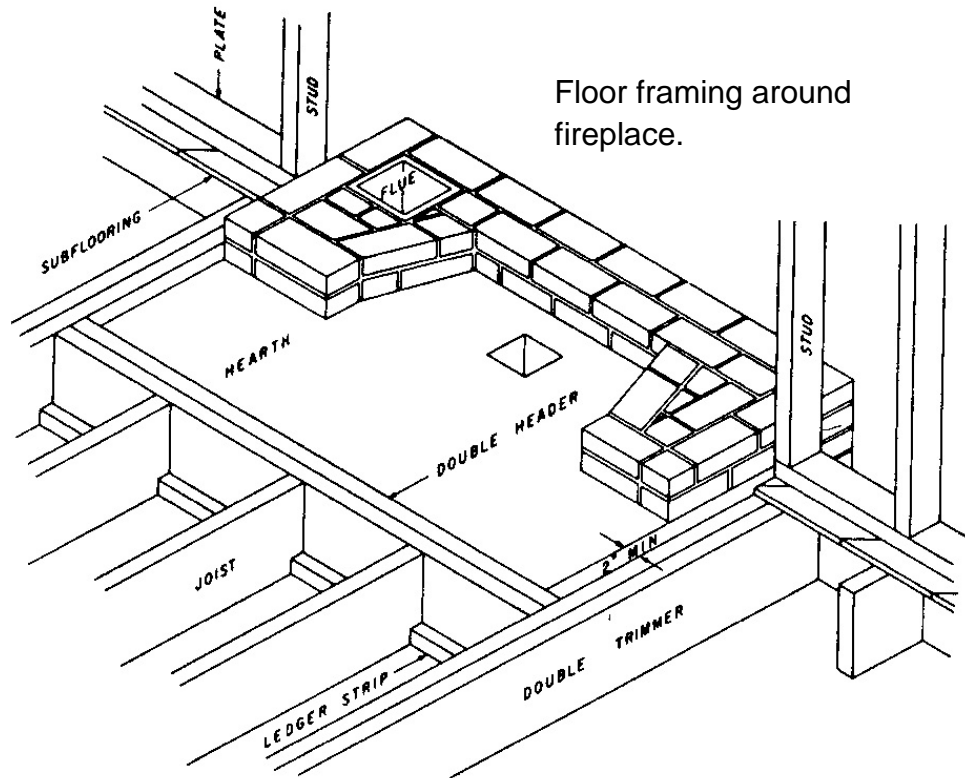


Framing around exterior wall opening using header and double studs.

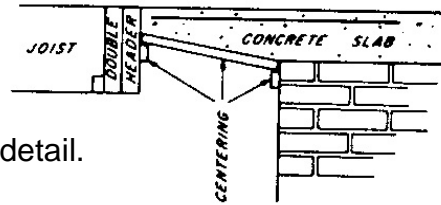


Exterior wall framing at gable end.

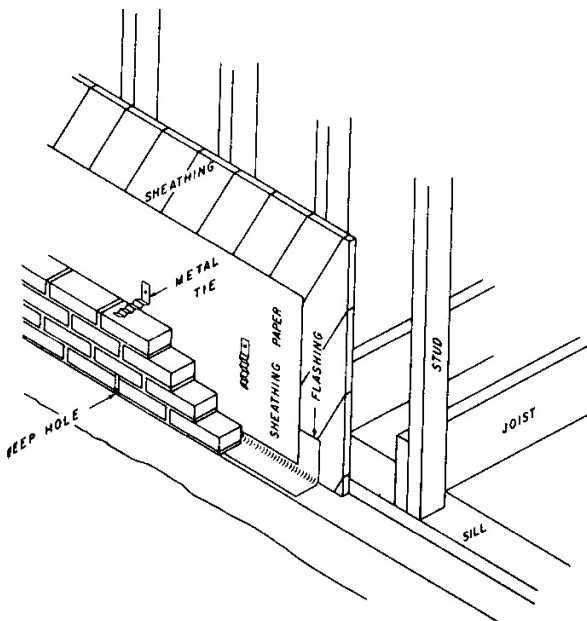
APPENDIX E



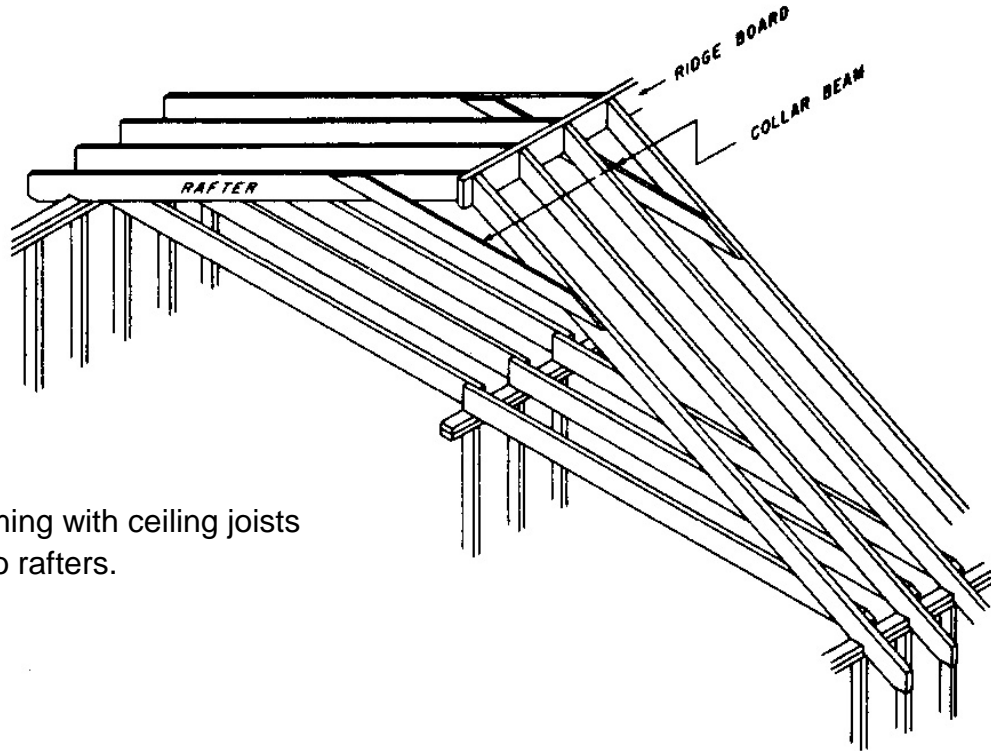
Floor framing around fireplace.



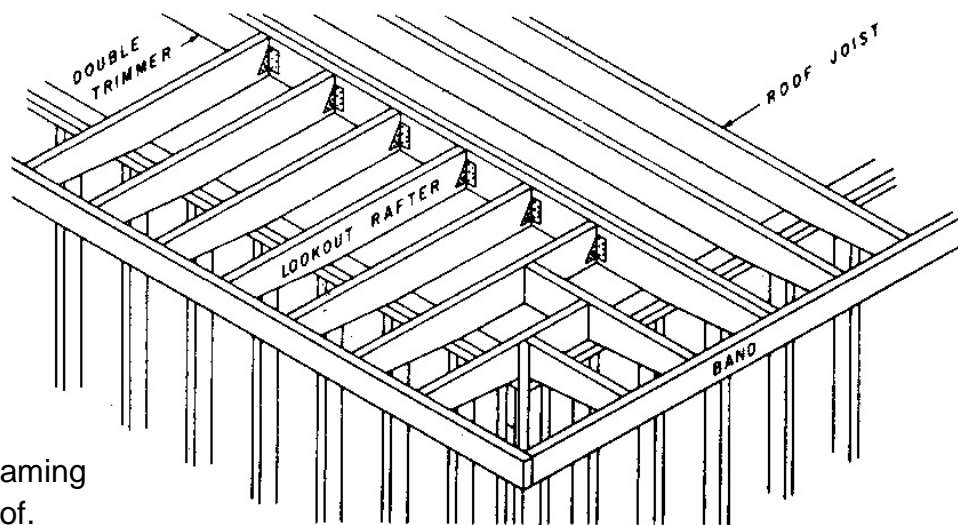
Hearth centering detail.



Application of masonry veneer over sheathing and wood framing.

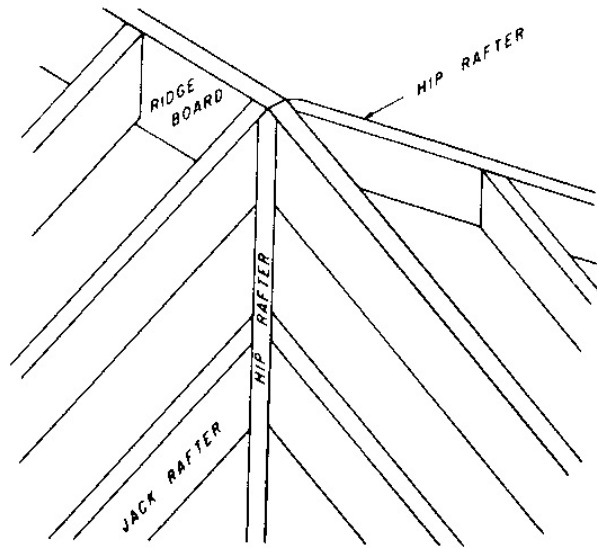


Roof framing with ceiling joists parallel to rafters.

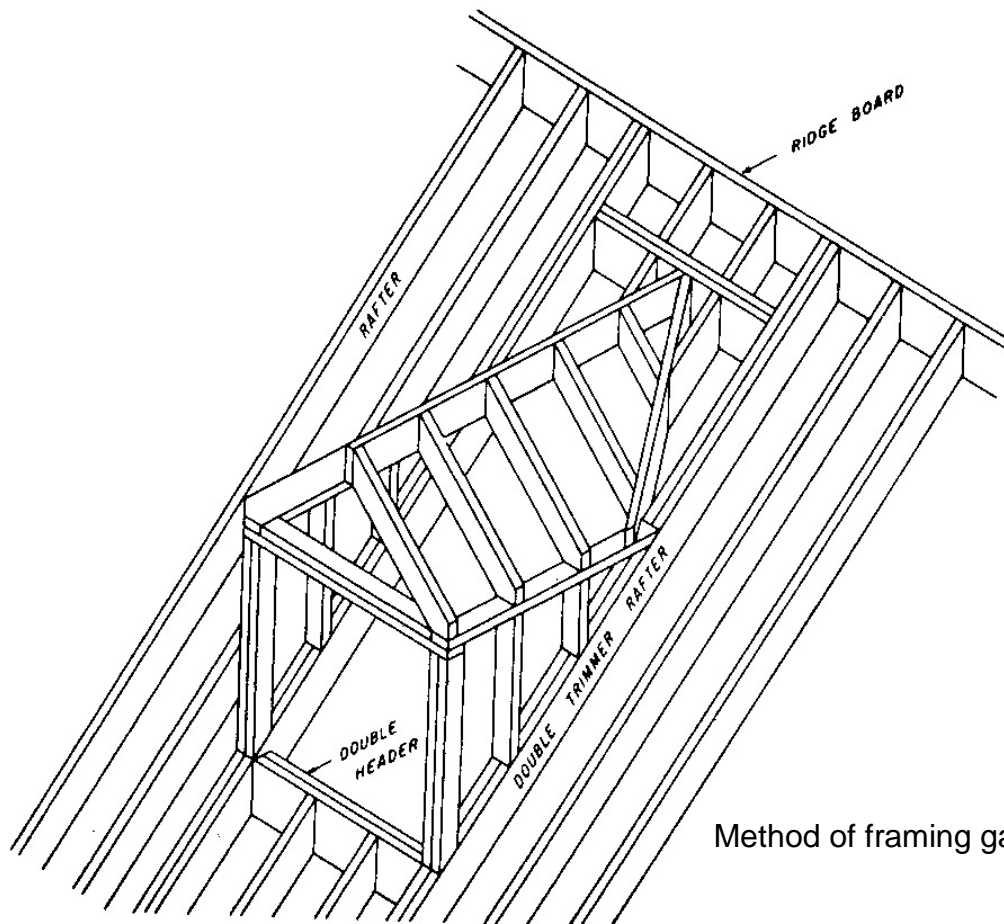


Corner framing for flat roof.

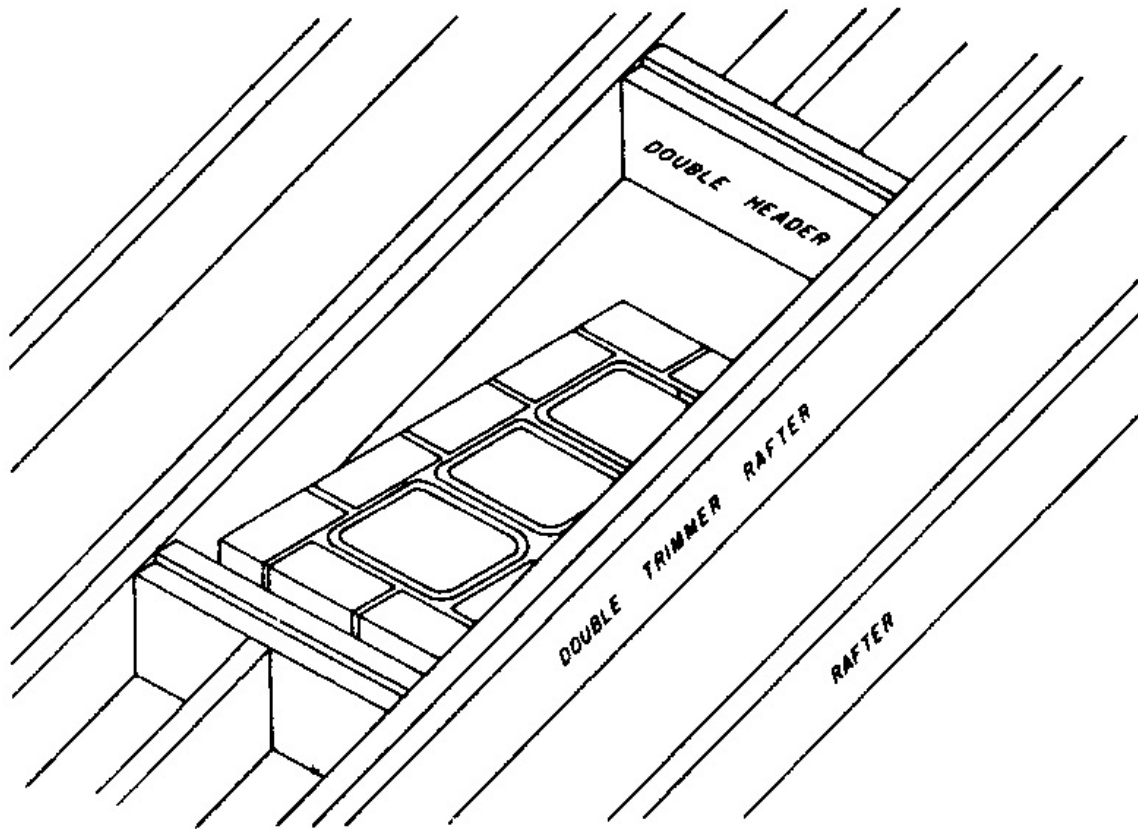
APPENDIX E



Roof framing at hip rafter.

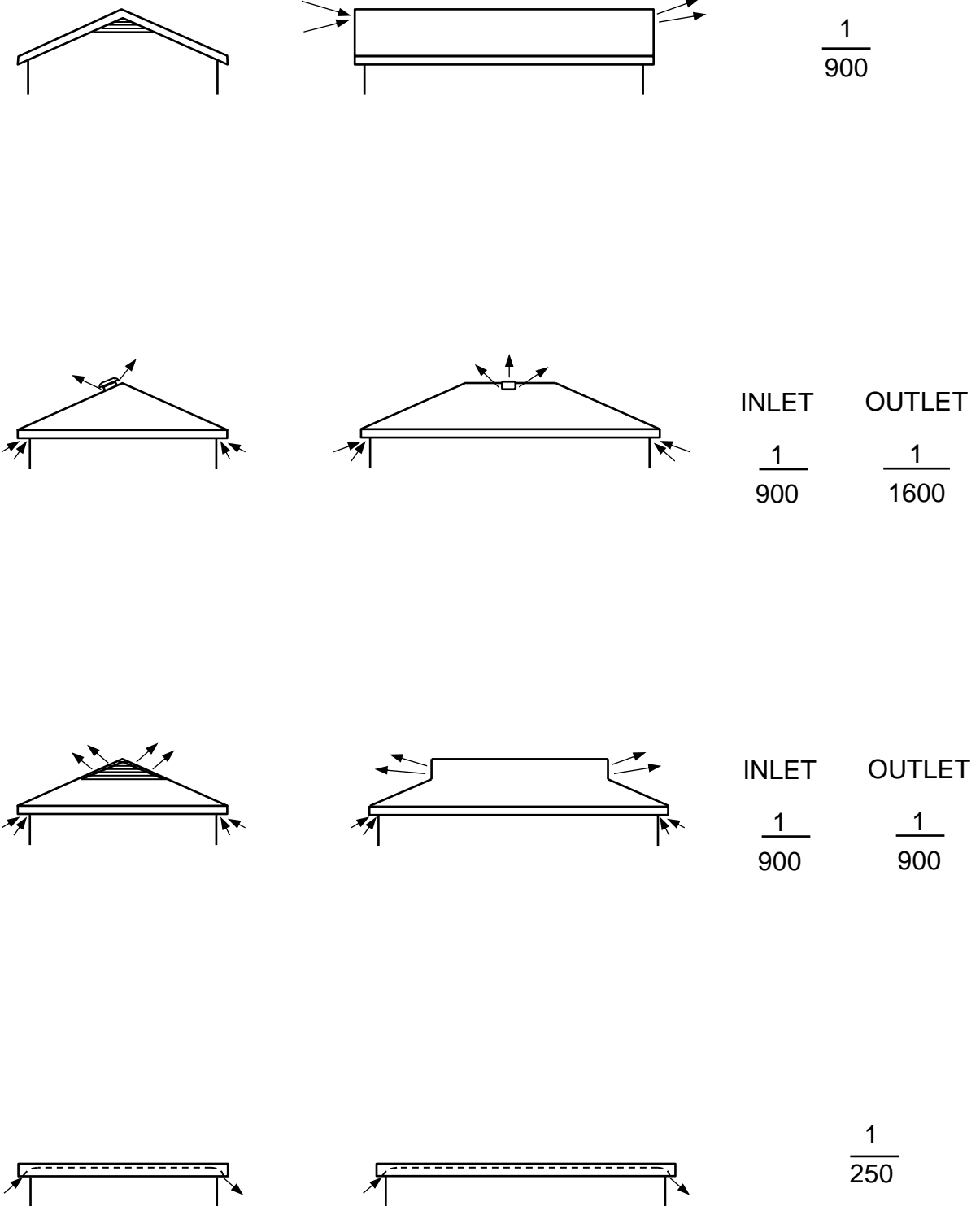


Method of framing gable dormer.



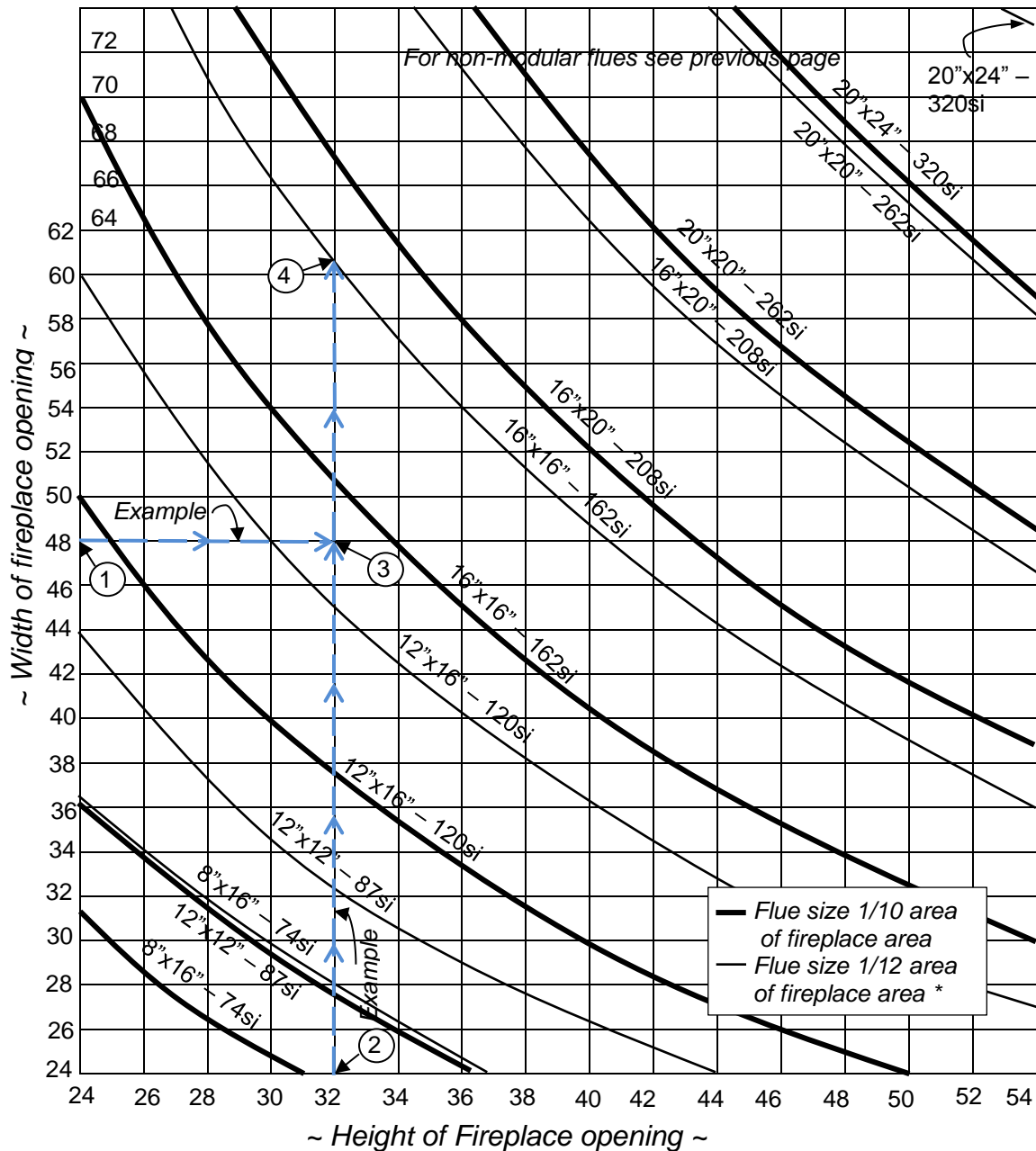
Roof framing around chimney masonry

APPENDIX E



Methods of ventilating roof spaces and amount of ventilation required.

APPENDIX F MODULAR FLUE SIZES for FIREPLACES



- Problem:** Find proper modular flue size (@ 1/12 fireplace area) for fireplace 48" wide and 32" high.
- Solution:**
- ① Find 48" fireplace width at left of chart.
 - ② Find 32" fireplace height at bottom of chart.
 - ③ Follow width line across and height line up until they intersect.
 - ④ Proper flue size will be nearest curve indicating 1/12 fireplace area above intersection (16" x 16")

Modular flues only made in rectangular sizes. If round flue is desired for modular chimney, use non-modular round flue.

Chart based on net flue areas. If flue is less than 20' high it is advisable to use next larger flue size unless the intersection 3 falls well below the fireplace area curve.

* Note: Fine lines are for 1/12 area of fireplace; this is not permitted by this Code.

APPENDIX G

2-2 x 12	Allowable Load Pounds Per Foot of Beam						
	Bm. Wt. #/Ft	10	15	20	25	30	40
	Plate Span	1/4" x 11 1/2"	3/8" x 11 1/2"	1/2" x 11 1/2"	5/8" x 11 1/2"	3/4" x 11 1/2"	1" x 11 1/2"
	6	3599	4603	5607	6611	7615	9622
	7	2641	3378	4114	4850	5586	7059
	8	2020	2582	3145	3707	4270	5395
	9	1594	2037	2481	2924	3367	4254
	10	1289	1647	2005	2364	2722	3438
	11	1063	1359	1654	1949	2244	2834
	12	892	1139	1386	1634	1881	2375
	13	758	968	1178	1388	1598	2018
	14	652	833	1013	1193	1374	1734
	15	567	723	880	1036	1193	1506
	16	497	634	771	908	1045	1318
	17	427 *	544 *	661 *	779 *	896 *	1130 *
	18	337 *	430 *	522 *	614 *	707 *	891 *
	19	270 *	343 *	416 *	490 *	563 *	710 *
	20	218 *	277 *	335 *	394 *	453 *	571 *
	21	177 *	225 *	272 *	320 *	367 *	462 *
	22	145 *	184 *	223 *	261 *	300 *	377 *
	23	120 *	152 *	183 *	214 *	246 *	309 *
	24	100 *	125 *	151 *	177 *	203 *	254 *

* Allowable Load Controlled by Deflection.

FITCH PLATE BEAMS

DESIGN VALUES

Steel: Fb = 20,000 psi; E = 29,000,000 psi
 Wood: f = 1200 psi; E = 1,760,000 psi
 Deflection: 1/360 Span or 1/2", whichever controls

2-2 x 6	Allowable Load Pounds Per Foot of Beam						
	Bm. Wt. #/Ft	5	7	10	12	15	18
	Plate Span	1/4" x 5 1/2"	3/8" x 5 1/2"	1/2" x 5 1/2"	5/8" x 5 1/2"	3/4" x 5 1/2"	1" x 5 1/2"
	6	827	1050	1273	1497	1720	2168
	7	606	770	932	1096	1259	1588
	8	463	587	711	836	960	1212
	9	365	463	560	658	755	953
	10	270 *	342 *	413 *	485 *	557 *	703 *
	11	201 *	255 *	308 *	362 *	415 *	524 *
	12	153 *	195 *	235 *	276 *	316 *	399 *

* Allowable Load Controlled by Deflection.

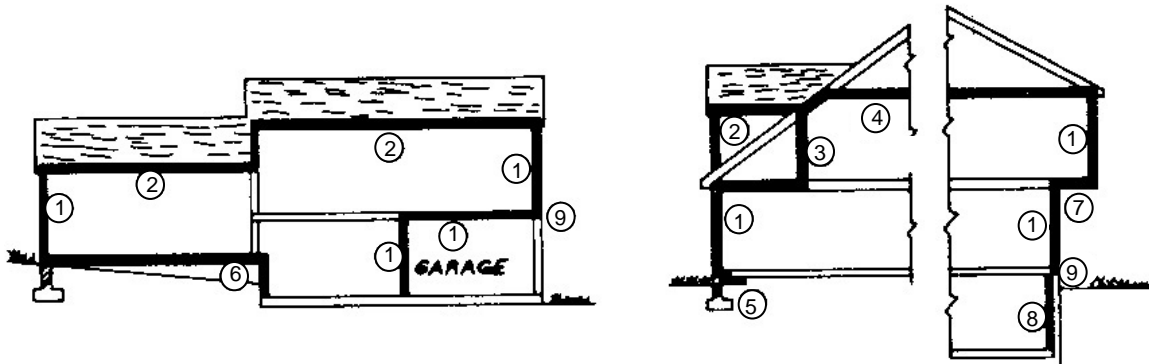
2-2 x 8	Allowable Load Pounds Per Foot of Beam						
	Bm. Wt. #/Ft	6	10	13	16	19	25
	Plate Span	1/4" x 7 1/2"	3/8" x 7 1/2"	1/2" x 7 1/2"	5/8" x 7 1/2"	3/4" x 7 1/2"	1" x 7 1/2"
	6	1529	1954	2380	2806	3232	4084
	7	1121	1433	1745	2057	2370	2994
	8	857	1095	1333	1571	1810	2286
	9	676	863	1050	1238	1426	1801
	10	546	697	848	1000	1151	1454
	11	450	574	699	823	948	1197
	12	377	481	585	689	793	1002
	13	301 *	383 *	466 *	549 *	632 *	798 *
	14	240 *	305 *	370 *	436 *	502 *	629 *
	15	194 *	246 *	299 *	351 *	404 *	510 *
	16	148 *	187 *	228 *	268 *	308 *	392 *

* Allowable Load Controlled by Deflection.

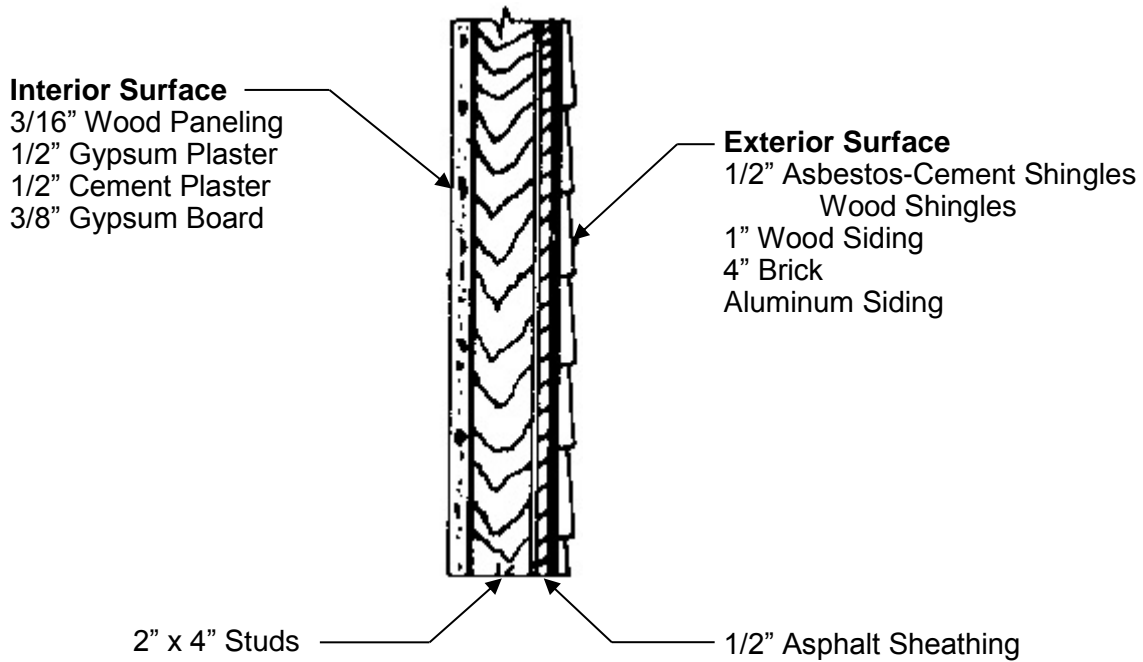
2-2 x 10	Allowable Load Pounds Per Foot of Beam						
	Bm. Wt. #/Ft	8	12	16	20	24	32
	Plate Span	1/4" x 9 1/2"	3/8" x 9 1/2"	1/2" x 9 1/2"	5/8" x 9 1/2"	3/4" x 9 1/2"	1" x 9 1/2"
	6	2455	3139	3824	4508	5193	6562
	7	1801	2303	2805	3307	3808	4812
	8	1377	1760	2144	2527	2910	3677
	9	1086	1388	1690	1992	2294	2898
	10	878	1122	1366	1610	1854	2341
	11	726	925	1126	1327	1528	1929
	12	607	775	944	1112	1280	1616
	13	516	659	802	944	1087	1372
	14	444	566	689	811	934	1179
	15	386	492	598	704	810	1023
	16	308 *	390 *	473 *	557 *	641 *	809 *
	17	240 *	303 *	368 *	433 *	498 *	628 *
	18	190 *	238 *	289 *	340 *	391 *	493 *
	19	152 *	190 *	230 *	270 *	310 *	391 *
	20	122 *	152 *	184 *	216 *	248 *	312 *

* Allowable Load Controlled by Deflection.

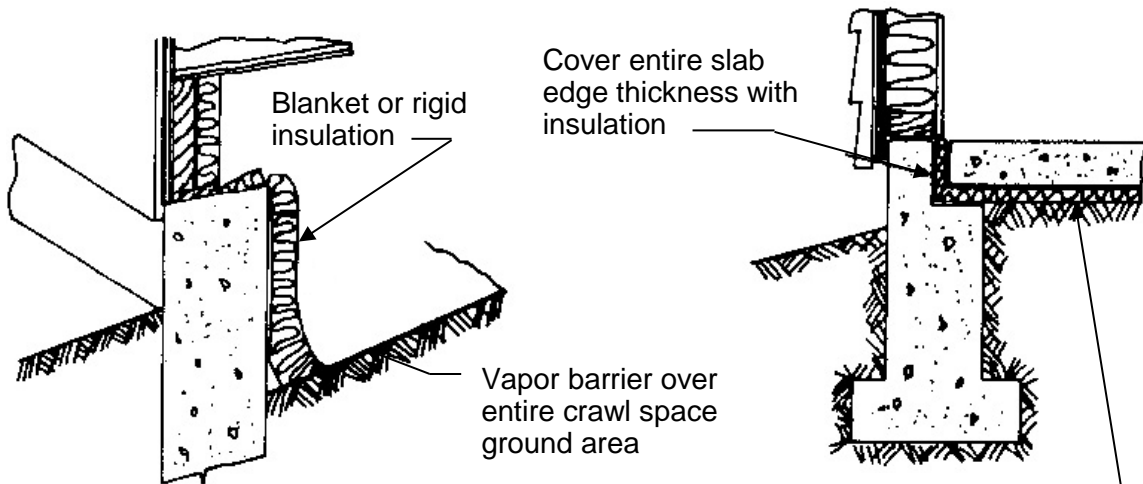
APPENDIX H



1. All exterior walls. Sections sometimes overlooked are the wall between living space and an unheated garage or storage room, dormer walls, and the portion of wall above the ceiling of an adjacent section of a split-level home. Be sure to insulate in narrow spaces between jambs and framing.
2. Ceilings with cold spaces above and dormer ceilings. An attic access panel can be insulated by stapling a piece of insulation to its top.
3. Knee walls when attic space is finished as living quarters.
4. Between collar beams, leaving open space above for ventilation.
5. Around the perimeter of a slab on grade.
6. Floors above crawl spaces.
7. Floors over an unheated or open space such as over a garage or a porch. The cantilevered portion of a floor.
8. Basement walls when below-grade space is finished for living purposes. Mineral fiber sill sealer between sill and foundation provides an effective wind infiltration barrier.
9. In back of band or header joists.



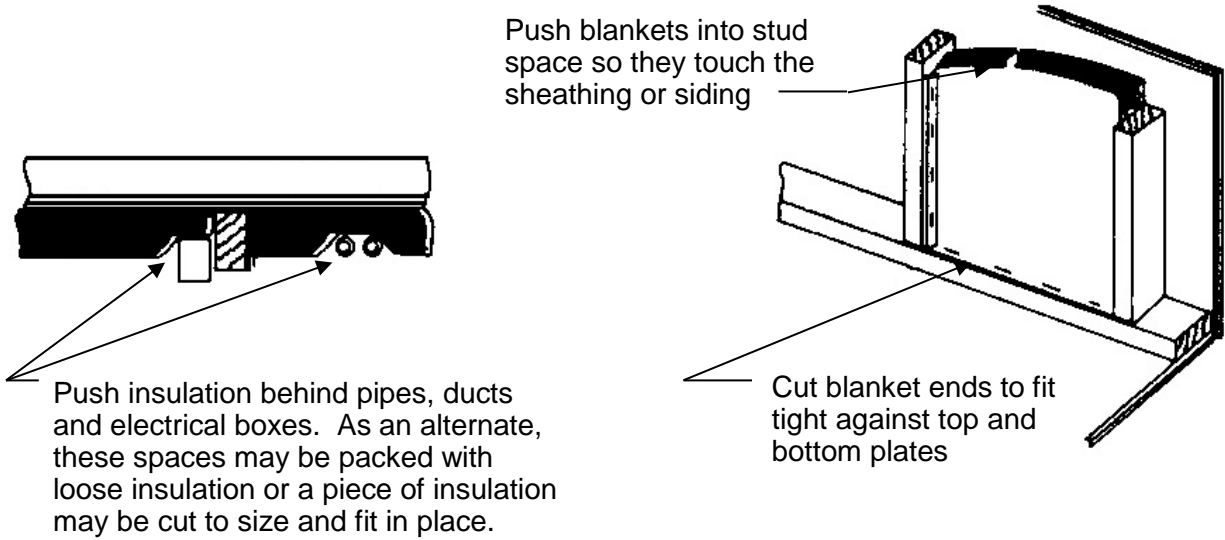
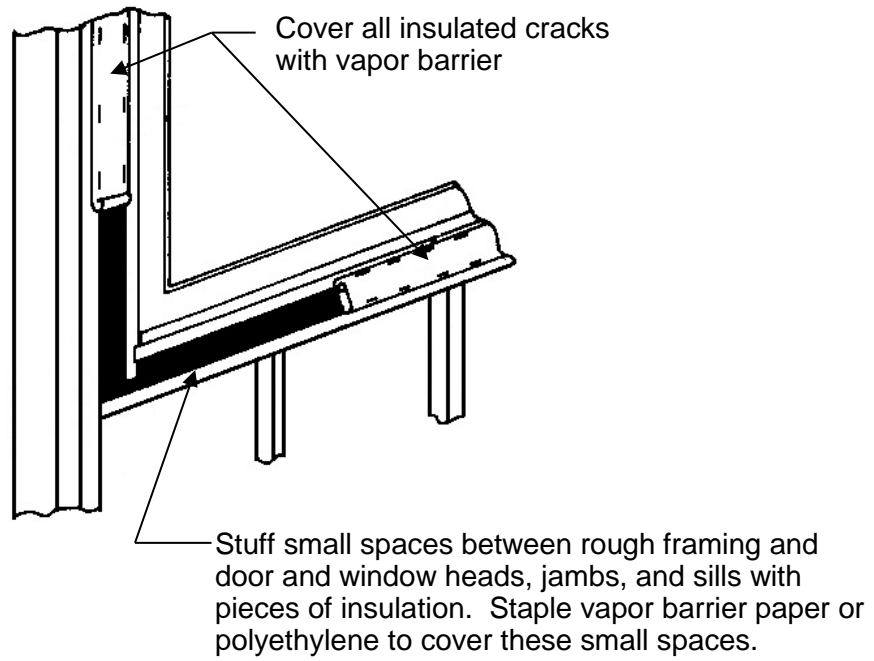
The addition of R-11 insulation between studs of the walls constructed with a combination of any of the materials shown above will provide a "U" value of 0.08 or more.

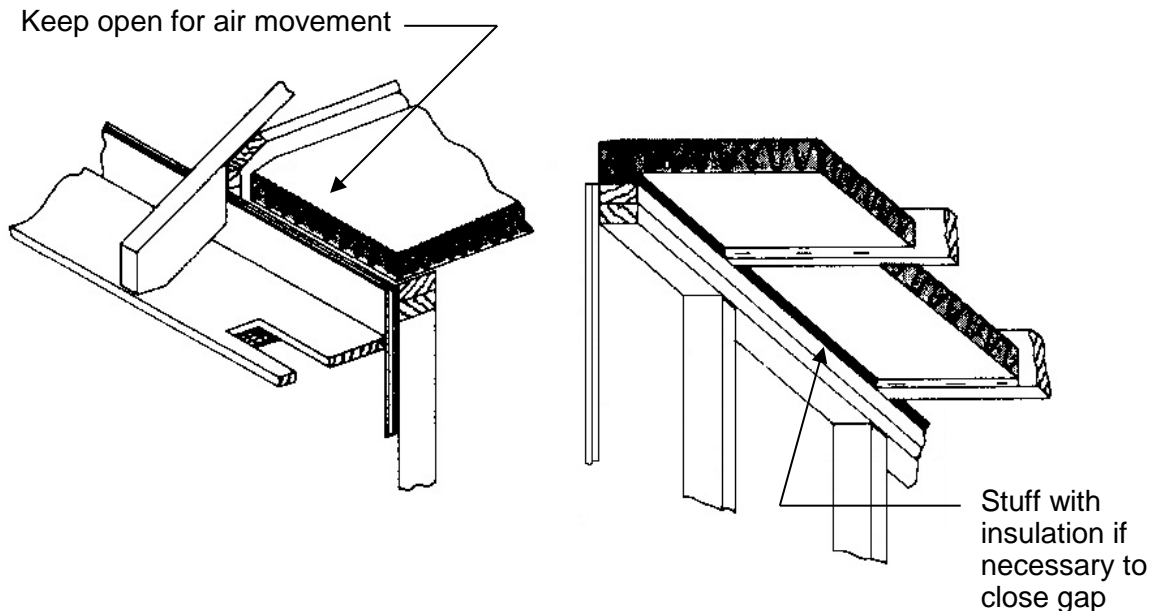


Foundation Wall Insulation
 (Unvented crawl spaces only)

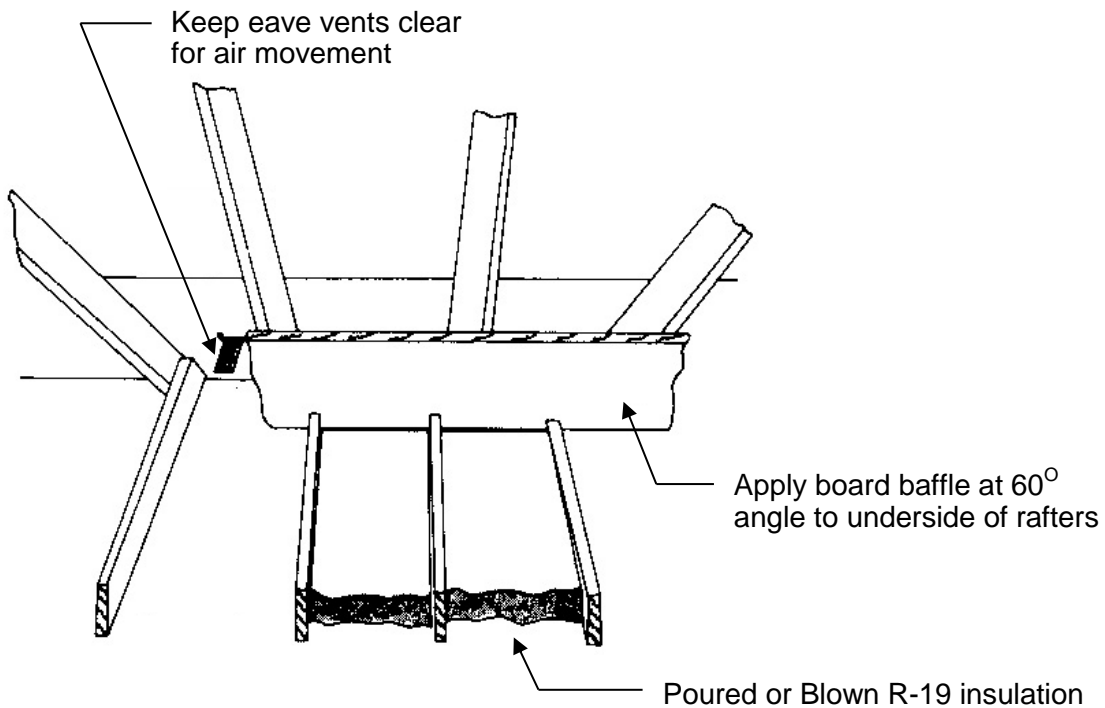
Slab on Grade Insulation

APPENDIX H





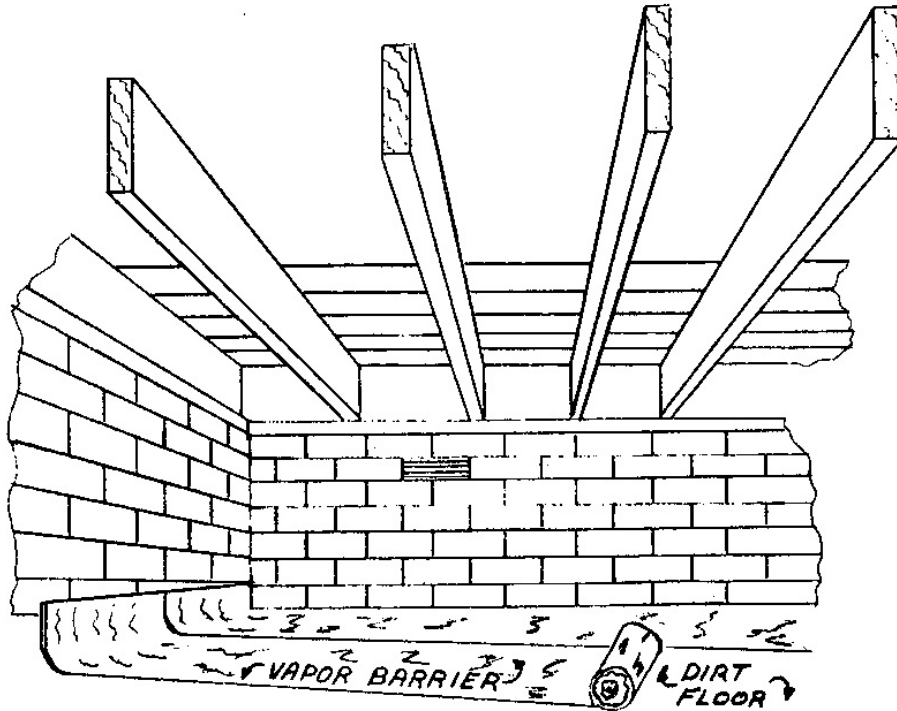
Staple flanges to the ceiling joists. Extend insulation entirely across the top plate, keeping the insulation as close as possible to the plate. If necessary, stuff the gap between blanket and plate with loose insulation. Do not block eave vents with insulation.



When installing poured or blown insulation in ceilings, it is important that insulation does not block air movement from eave vents to space above insulation.

DIAGRAM 1

STEM / FOUNDATION WALL



STEM WALL

