

**TEXAS DEPARTMENT OF  
INSURANCE**

**WINDSTORM  
RESISTANT  
CONSTRUCTION GUIDE**

28 TAC §§5.4007-5.4008

Originally Effective June 1, 1989  
Re-adopted Effective August 1, 1997  
with Amendments Effective April 1, 2001

Suggested methods of construction to meet building requirements outlined in the Texas Catastrophe Property Insurance Association's Plan of Operation. These guidelines are based on the wind load requirements contained in the Standard Building Code, 1973 Edition, and the Texas Catastrophe Property Insurance Association's Building Code for Windstorm Resistant Construction of June 29, 1971.

**Note:** The Texas Department of Insurance has developed Code Interpretations for the Windstorm Resistant Construction Guide. The Code Interpretations provide clarifications, guidance, and additional information to many sections of the Windstorm Resistant Construction Guide. The Code Interpretations are considered a part of the Windstorm Resistant Construction Guide. As such, they should be referenced whenever the prescription portions of the Windstorm Resistant Construction Guide are used.



# Table of Contents

<b>100 INTRODUCTION</b> .....	<b>1</b>
110 Scope .....	2
120 Building Specifications .....	3
130 Purpose .....	4
140 What The State Board of Insurance Will Inspect .....	5
150 Engineered Structures .....	6
160 Certification .....	7
170 Inspection Procedure .....	8
180 Time Limitations .....	10
190 Inspections .....	11
<b>200 BASIC DEFINITIONS</b> .....	<b>14</b>
210 Applicability .....	15
220 Wood Frame, Masonry, and Metal Constructions .....	16
230 Miscellaneous Construction .....	17
240 Additions .....	18
250 Repairs .....	19
260 Roofing and Re-roofing .....	20
<b>300 INLAND CONSTRUCTION GUIDELINES</b> .....	<b>21</b>
310 Wood Frame Construction-Inland .....	22
311 Foundation .....	22
312 Framing .....	36
313 Exterior Coverings .....	55
314 Mechanical and Exterior Equipment .....	57
320 Masonry Construction-Inland .....	58
321 Foundation .....	58
322 Masonry Walls .....	58
323 Exterior and Mechanical Equipment .....	64
330 Metal Construction-Inland .....	65
331 Manufactured Metal Structures .....	65
332 Other Metal Structures .....	65

<b>340 Miscellaneous Construction-Inland</b> .....	<b>66</b>
341 Pole Barns .....	66
342 Patio Covers .....	69
343 Boat Houses, Docks, and Piers (Over Water) .....	69
344 Mobile Homes and Manufactured Housing .....	69
345 Portable and Temporary Buildings .....	69
346 Other Miscellaneous Structures .....	70
<b>350 Additions-Inland</b> .....	<b>71</b>
<b>360 Renovation and Repair-Inland</b> .....	<b>72</b>
361 Foundation .....	72
362 Framing .....	73
363 Exterior Covering .....	73
364 Mechanical Equipment .....	73
<b>370 Roofing-Inland</b> .....	<b>74</b>
371 New Roofing .....	74
372 Re-roofing and Repairs .....	82
<b>400 SEAWARD CONSTRUCTION GUIDELINES</b> .....	<b>86</b>
<b>410 Wood Frame Construction-Seaward</b> .....	<b>87</b>
411 Foundation .....	87
412 Framing .....	101
413 Exterior Coverings .....	120
414 Mechanical and Exterior Equipment .....	122
<b>420 Masonry Construction-Seaward</b> .....	<b>123</b>
421 Foundation .....	123
422 Masonry Walls .....	123
423 Exterior and Mechanical Equipment .....	129
<b>430 Metal Construction-Seaward</b> .....	<b>130</b>
431 Manufactured Metal Structures .....	130
432 Other Metal Structures .....	130
<b>440 Miscellaneous Construction-Seaward</b> .....	<b>131</b>
441 Pole Barns .....	131
442 Patio Covers .....	134
443 Boat Houses, Docks, and Piers (Over Water) .....	134
444 Mobile Homes and Manufactured Housing .....	134
445 Portable and Temporary Buildings .....	134
446 Other Miscellaneous Structures .....	135
<b>450 Additions-Seaward</b> .....	<b>136</b>
<b>460 Renovation and Repair-Seaward</b> .....	<b>137</b>
461 Foundation .....	137
462 Framing .....	138
463 Exterior Covering .....	138
464 Mechanical Equipment .....	138
<b>470 Roofing-Seaward</b> .....	<b>139</b>
471 New Roofing .....	139
472 Re-roofing and Repairs .....	146
<b>APPENDIX</b> .....	<b>150</b>
<b>Appendix A. Windstorm Field Offices</b> .....	<b>151</b>
<b>GLOSSARY</b> .....	<b>152</b>

INDEX ..... 156

Index ..... 157

## List of Illustrations

Figure 1.	Wind Load Requirements.	3
Figure 2.	Minimum Reinforcement of Concrete Pilings	24
Figure 3.	Placement of Reinforcement in Concrete Pilings	24
Figure 4.	Minimum size of Pilings.	25
Figure 5.	Installation of Piles (Method 1)	26
Figure 6.	Installation Knee Braces (Method 1)	27
Figure 7.	Fastening Spliced Beam to Piling	28
Figure 8.	Piling Size, Bury Depth, and Beam to Piling Connection	30
Figure 9.	Use of Wood Framing Anchors	32
Figure 10.	Maximum Floor Joist Spans	33
Figure 11.	Pier and Beam Foundation	35
Figure 12.	Connecting Gable Studs to Rafter and Top Plate	38
Figure 13.	Maximum Rafter Spans	39
Figure 14.	Tying Rafters to Perpendicular Ceiling Joists	41
Figure 15.	Let-in Diagonal Corner Bracing	44
Figure 16.	Interior Wall Bracing an Exterior Wall	45
Figure 17.	Maximum Spans for Headers	46
Figure 18.	Anchorage of Headers	48
Figure 19.	Anchoring Post to Slab	50
Figure 20.	Tying Stories Together Using An Anchor	52
Figure 21.	Tying Stories Together Using Straps	53
Figure 22.	Tying Stories Together Using Plywood	54
Figure 23.	Nailing of Board Siding	55
Figure 24.	Solid Masonry Walls	60
Figure 25.	Hollow Masonry Walls	62
Figure 26.	Pole Barns-Fastening Schedule	66
Figure 27.	Pole Barns-Maximum Span of Horizontal Girts	66
Figure 28.	Stapling Roof Deck to Rafters	75
Figure 29.	Corrugated Metal Roofs-Purlins and Fasteners	79
Figure 30.	Minimum Reinforcement of Concrete Pilings	89
Figure 31.	Placement of Reinforcement in Concrete Pilings	89
Figure 32.	Minimum size of Pilings.	90
Figure 33.	Installation of Piles (Method 1)	91
Figure 34.	Installation of Knee Braces (Method 1)	92
Figure 35.	Fastening Spliced Beam to Piling	93
Figure 36.	Piling Size and Beam to Piling Connection	94
Figure 37.	Piling Size, Bury Depth, and Beam to Piling Connection	95
Figure 38.	Maximum Floor Joist Spans	96
Figure 39.	Use of Wood Framing Anchors	97
Figure 40.	Pier and Beam Foundation	100
Figure 41.	Connecting Gable Studs to Rafter and Top Plate	103
Figure 42.	Maximum Rafter Spans	104
Figure 43.	Tying Rafters to Perpendicular Ceiling Joists	106
Figure 44.	Let-in Diagonal Corner Bracing	109
Figure 45.	Interior Wall Bracing an Exterior Wall	110
Figure 46.	Maximum Spans for Headers	111
Figure 47.	Anchorage of Headers	113
Figure 48.	Anchoring Post to Slab	115
Figure 49.	Tying Stories Together Using an Anchor	117
Figure 50.	Tying Stories Together Using Straps	118

*First Printing*

Figure 51. Tying Stories Together Using Plywood .....	119
Figure 52. Nailing of Board Siding .....	120
Figure 53. Solid Masonry Walls .....	125
Figure 54. Hollow Masonry Walls .....	127
Figure 55. Pole Barns-Fastening Schedule .....	131
Figure 56. Pole Barns-Maximum Span of Horizontal Girts .....	131



**100 INTRODUCTION**

## 110 Scope

The 70th Texas Legislature passed House Bill 2012, (HB 2012), which implements certain inspection requirements for structures to be considered insurable property for windstorm and hail insurance through the *Texas Catastrophe Property Insurance Association (T.C.P.I.A.)*. All new construction, repairs, or additions which commenced on or after January 1, 1988, must be inspected or approved by the State Board of Insurance for compliance with the building specifications in the *T.C.P.I.A. Plan of Operation*, if the property is to be certified as insurable by the *T.C.P.I.A.* Participation in this program is not mandatory. However, property which has not been inspected and certified in accordance with the requirements of this inspection program will not be eligible for windstorm insurance through the *T.C.P.I.A.* House Bill 2012 applies only to structures located in the first tier of counties along the Texas Gulf Coast. These counties are:

1. ARANSAS
2. BRAZORIA
3. CALHOUN
4. CAMERON
5. CHAMBERS
6. GALVESTON
7. JEFFERSON
8. KENEDY
9. KLEBERG
10. MATAGORDA
11. NUECES
12. REFUGIO
13. SAN PATRICIO
14. WILLACY

**\*\*NOTE:**The above 14 counties are the only counties included in the Windstorm Inspection Program.

## 120 Building Specifications

The building specifications to be used by the Board for the inspection of property will remain the same as those applicable prior to the implementation of this program. For structures located seaward of the Intracoastal Waterway, the building specifications are contained in the *T.C.P.I.A.'s "Building Code for Windstorm Resistant Construction"*. This area shall be referred to as "seaward." The area inland of the Intracoastal Waterway, but still in one of the above counties, will be referred to simply as "inland." All structures located inland of the Intracoastal Waterway must meet minimum building standards as outlined in the *(Southern) Standard Building Code* as amended on May 8, 1973, with emphasis on Section 1205, which describes wind loads. The horizontal wind loads (in pounds per square foot) specified by the two codes are as follows:

Building Height In Feet	Horizontal Wind load	
	Inland	Seaward
Less than 30	25	35
31-50	35	45
51-99	45	55
100-499	50	70

Figure 1. Wind Load Requirements.

Exterior walls shall be capable of withstanding those horizontal loads, acting either inward or outward. The entire roof of all structures shall be designed to withstand loads acting outward normal to the roof surface equal to 1.25 times the horizontal load specified for the average height of the roof. Furthermore, roofs with slopes greater than 30 degrees (6.93 in 12) shall be designed to withstand pressures acting inward on the windward surface of the roof equal to the specified horizontal pressure for the average height of the roof. Finally, overhanging eaves, cornices, and roofs of partially open structures shall be able to resist upward forces equal to twice the specified horizontal loads.

This building guidelines manual contains one section for each of the above areas. Each section outlines one method a contractor may use to meet the building requirements of that particular area. Please be sure that the correct guidelines are being followed for the area in which the structure is located. Other methods may be used, provided they are either approved by the *State Board of Insurance Engineering Staff*, or are inspected and certified by a Texas registered professional engineer.

Many of the specific guidelines contained in this document were taken directly from the *1973 Standard Building Code*, as published by the *Southern Building Code Congress, International*.

## **130 Purpose**

This construction guide is intended as an aid to the builder in meeting the building codes established in the *T.C.P.I.A. Plan of Operation*. Specifically, it outlines a method or methods which will be accepted as meeting the wind loads prescribed by the applicable building code (refer to Section 120). Additional methods and materials may have to be used to comply with other areas of the applicable building code, as well as requirements of other authorities having jurisdiction, such as building codes adopted by local authorities and guidelines established by the federal government for flood insurance.

This guide is not intended to replace the assistance of a competent design professional. Furthermore, it must be noted that compliance with these guidelines does not assure protection of person or property from damage of any kind. This publication only contains minimum guidelines which, when followed, will meet the wind loads prescribed in the building specifications.

## **140 What The State Board of Insurance Will Inspect**

The State Board of Insurance will inspect all non-engineered structures. These include the following:

- A. all private dwellings, including townhouses, and garages or other structures pertinent to such dwellings;
- B. all agricultural structures;
- C. other one story structures having an area less than 5000 square feet and no clear unsupported span of greater than 24 feet;
- D. one story apartments or condominiums with 8 or fewer units per building and two story apartments or condominiums with 4 or fewer units per building.
- E. public work where the cost for the completed project is less than \$3000 (three thousand dollars).

If desired, a Texas registered professional engineer may inspect and certify a non-engineered structure. In this case, the State Board of Insurance will not have to inspect that particular structure.

The State Board of Insurance can only make inspections of a structure as it is being built (or repaired). Once construction is completed, a structure can only be certified if it is inspected by a Texas registered professional engineer.

When a structure is being moved, it presents a special situation. Structures which were built outside of the 14 county coastal area, and are being moved into the coastal area, can only be certified if they are inspected by a Texas registered professional engineer. Structures which were built in the 14 county coastal area prior to 1988, and are being moved to another site in the coastal area, may be certified by having either a Texas registered professional engineer or the State Board of Insurance inspect the new foundation and the anchorage of the structure to that foundation. In addition, any alterations which were made to the structure must be inspected and approved.

## **150 Engineered Structures**

*The Texas Engineering Practice Act* requires that certain structures be designed by a Texas registered professional engineer. These structures must also be inspected by a Texas registered professional engineer. Engineered structures will include:

**A. non-residential and non-agricultural structures:**

1. having an area greater than 5000 square feet;
2. having more than one story; or
3. having an unsupported clear span of greater than 24 feet

**B. public work** (work performed by the State, a county, city, town, school district, or other political subdivision) where the cost for the completed project exceeds \$3000

**C. apartments or condominiums:**

1. having over two stories;
2. having two stories and over four units; or
3. having one story and over eight units.

(A unit is defined as a group of rooms arranged as a private residence and permanently equipped for housekeeping.)

*The Texas Engineering Practice Act* also requires that repairs, alterations, or additions be designed by a registered professional engineer.

## **160' Certification**

To be eligible for insurance through the *T.C.P.I.A.*, all new structures, additions, or repairs, where construction started on or after January 1, 1988, must be inspected by either the State Board of Insurance or by a Texas registered professional engineer. The Board will accept certification by a Texas registered professional engineer on any structure. The engineer must submit certification on the **Building Certificate, Form WPI-2**. When a structure is inspected and certified by an engineer, no official inspections will be made by the Board, and no fees will be charged by the State Board of Insurance.

When a foundation is designed and inspected by an engineer, the fee required by the State Board of Insurance for the foundation inspection will be waived if a **Certificate of Foundation Design and Construction, WPI-10**, is submitted to the Board after the engineer's inspection. Slab on grade foundations which were designed by an engineer may either be inspected and certified by that engineer, or they may be inspected by the State Board of Insurance.

When two or more structures are present at the same address, each structure will require a separate certificate.

## 170 Inspection Procedure

The following is the procedure to follow when requesting certification through the Windstorm Inspection Program.

At the earliest possible date, the contractor or owner will notify the Windstorm Inspection Section of the State Board of Insurance, by Form WPI-1 or by letter, of the intention to build, add to, or repair a structure. Notification by letter must contain the same information required by Form WPI-1. A map of the structure's location should be submitted with the application for all the rural structures and structures with no permanent street address. Applications must be made for all structures, whether they are to be inspected by the State Board of Insurance or by a Texas registered professional engineer. The application or notification must be mailed to the following address:

Windstorm Inspections  
1 Republic Plaza  
333 Guadalupe, Suite 356  
Austin, TX 78701

Upon receipt of the notice, the information will be entered into our computer, and a file number will be assigned. The contractor or owner will be notified of the file number and of a toll free telephone number to call for the purpose of requesting an inspection. All inspections must be requested through this toll-free telephone line. The telephone line will be staffed during normal business hours, which are 8:00 am until 5:00 pm., Monday through Friday, except on State holidays. At all other times, the phone lines will be equipped with an answering machine. When leaving a message on the machine, be sure to provide the following information:

- A. the file number
- B. location of the structure (street address and town )
- C. requested date for inspection
- D. type of inspection requested
- E. any other pertinent information

*First Printing*

A Certificate of Compliance (Form WPI-8) will be issued when all inspections have been approved, and all fees have been paid. There is a fee of \$35.00 for each category of inspection, with a maximum fee of \$140.00. Fees may be paid one at a time during the course of construction, or all at once. A set of four coupons will be mailed to the owner or builder upon receipt of the application for inspection. The coupon (or coupons) must be mailed back to the State Board of Insurance when ever making a payment. Payments must be made by check or money order made payable to the State Board of Insurance. All payments should be mailed, along with the appropriate coupon, to the following address:

**State Board of Insurance  
Division 9999  
1110 San Jacinto Blvd.  
Austin, TX 78701-1998**

A certificate of compliance is automatically issued and mailed to the owner or contractor when all fees are paid and all inspections have been approved.

Please note that all coupons may not have to be used. For example, when a re-roof is inspected, please only send in the coupon for the final framing inspection along with the fee for only one inspection (\$35.00).

## **180 Time Limitations**

When a request for inspection is received in the Austin office of the State Board of Insurance, the proper field office will be notified, and that office shall conduct an inspection within 48 hours. The 48 hour period shall not include Saturdays, Sundays, or State holidays. Inspections shall be conducted in accordance with this procedure to the best of the Board's ability. Building progress will not be interrupted if the inspections are not made within the prescribed time period.

## 190 Inspections

Under normal circumstances, four (4) separate categories of inspections will be necessary to determine compliance with the applicable building construction requirements. Inspections must be requested prior to the installation of any type of covering which would impede inspections. In order to inspect all fastener patterns, the number of inspections may exceed four (4), but a charge will not be incurred for the extra inspections. The four categories shall be as follows:

1. **FOUNDATION** - Inspections for slab on grade foundations should be requested after placement of reinforcement, but prior to pouring of concrete. Inspections for piling foundations should be requested during driving of the pilings. Inspections for pier and beam foundations should be requested prior to the installation of floor members which would impede inspection. Due to the nature of pier and beam foundations, the contractor should contact the local field office prior to constructing this type of foundation.

The following are the major items which will be examined during the foundation inspection:

- Slab on Fill
  - a. Reinforcement of slab
  - b. Type of anchor bolts
  - c. Offsets for masonry or masonry veneer walls (proper brick ledge)
- Pier and Beam
  - a. Proper size and bury depth of piers
  - b. Reinforcement of piers
  - c. Reinforced concrete or grout fill in hollow masonry units
  - d. Embedment and type of anchor bolts
  - e. Anchorage of sills or beams to piers
  - f. Anchorage of floor joists to beams and/or sills
  - g. Floor joists within span
  - h. Treatment of beams with wood preservative.
- Piling
  - a. Embedment of pilings
  - b. Size and spacing of pilings
  - c. Concrete pilings properly reinforced
  - d. Anchorage of beams and stringers to piles
  - e. Size of beams, stringers and floor joists

*First Printing*

- f. Anchorage of floor joists to beams
- g. Height of lowest structural member

2. **ROUGH FRAMING** -Framing inspections should be requested prior to the installation of any type of covering which would keep the inspector from being able to verify the required connector or fastener patterns.

The following are the major items which will be examined during the rough framing inspection:

- a. Spacing of sole plate anchors in exterior and interior walls
- b. Washers proper size
- c. Treatment of or moisture barrier provided for sole plate
- d. Grade and seasoning of lumber
- e. Size and spacing of studs
- f. Spacing of framing anchors
- g. Anchorage of studs to plates (top and bottom)
- h. Anchorage of top plate to rafters and joists
- i. Lateral wall bracing
- j. Anchorage and spacing of wall braces
- k. Ceiling joist spans, sizes and spacing
- l. Roof joists or rafter spans
- m. Roof truss design, construction, and installation
- n. Bracing and anchoring of roof joists and rafters
- o. Roof decking type and application
- p. Installation of collar ties
- q. Construction of awnings, overhangs and porches
- r. Bracing of fireplace chimney
- s. Construction and anchorage of headers
- t. Anchorage of second story to the first story
- u. Construction of masonry walls

3. **FINAL FRAMING** -The final framing inspection should be requested prior to concealment of fastener patterns of exterior coverings and roof coverings. Re-roofing inspections will also fall into this category.

The following are the major items which will be examined during the final framing inspection:

- a. Knee braces installed, if required by design
- b. Attachments to foundation below flood level
- c. Alterations in structural members
- d. Type and fastening of wall sheathing or other exterior wall finish
- e. Type and spacing of masonry anchors
- f. Type and spacing of roof covering fasteners
- g. Roof felt and fasteners
- h. Roof pitch
- i. Venting of attic space
- j. Installation of windows
- k. Construction of window walls

4. **MECHANICAL INSPECTION**- The mechanical inspection should be requested when all outside mechanical equipment has been anchored, particularly air conditioner condensers. This inspection, and the fee, may be waived if the outside mechanical equipment is secured at the time of the final framing inspection.

The major item which will be examined during the mechanical equipment inspection is anchorage of exterior air conditioner equipment. However, anchorage of any other exterior equipment, such as floodlights, turbine vents, propane tanks, swimming pool filters, water cooling towers, and satellite dishes will also be inspected.

If you have any questions concerning the timing of inspections, or concerning the following construction guidelines, you are encouraged to contact the nearest field office. All necessary forms are available at the field offices, and some city building departments.

Upon completion of any inspection, the inspector will usually leave **Form WPI-7, the Field Form**, at the job site. The **Field Form** indicates whether an inspection was approved or not, and lists all deficiencies if the structure does not pass the inspection.

# ***200 BASIC DEFINITIONS***

## **210 Applicability**

This construction guide is intended to apply to non-engineered conventional type construction. Conventional construction generally refers to wood frame or masonry structures. This guide is not intended to apply to structures which are required to be designed by an engineer, or to structures which are so complex that they should be designed by an engineer.

## **220 Wood Frame, Masonry, and Metal Constructions**

Wood frame construction is defined as structures which have a frame of dimensional lumber, regardless of the exterior covering material. Masonry construction is defined as structures built of stone, brick, hollow tile, concrete block or tile, or other similar material, which are bonded together to form a wall which supports roof, floor, and horizontal loads. Metal construction is defined as structures which have the load-bearing members made of metal.

## **230 Miscellaneous Construction**

Structures which do not fall into the above categories will be defined as miscellaneous construction. This category will include structures such as, but not limited to, covered patios, boat houses, pole barns, and pump or well houses.

## **240 Additions**

Any increase in area or height of a structure is considered to be an addition. When additions are made to an existing structure, the addition and all parts of the original structure which become exposed or are connected to the addition must follow these minimum construction guidelines.

## **250 Repairs**

Any modification or reconstruction of a component of a structure will be considered a repair. All repairs to load-bearing structural members, both interior and exterior, must follow these minimum construction guidelines.

Renovation of historical structures presents a special situation. Generally, this type of repair is not made to comply with these construction guidelines. For this reason, a Texas registered professional engineer should be retained to inspect and certify the repairs.

## **260 Roofing and Re-roofing**

All roofing and re-roofing, regardless of extent, will be considered a repair for the purpose of this program. Therefore, all roofing and re-roofing must follow these minimum construction guidelines.

***300 INLAND CONSTRUCTION GUIDELINES***

## 310 Wood Frame Construction-Inland

### 311 Foundation

The foundation is possibly the most important part of a structure. It must be able to transfer all of the loads on a structure into the ground. Foundations may either be built to the following minimum guidelines or they may be designed and certified by a Texas registered professional engineer. Foundations shall be designed so that the overturning moment of the structure due to the wind load does not exceed 66-2/3 % of the moment of stability of the structure.

#### 311.1 Slab on Grade Foundation

##### 311.1(a) Anchorage

- Slab shall be reinforced.
- A minimum of 1/2 inch anchor bolts shall be embedded a minimum of 6 inches into the slab.
- Anchor bolts shall have a standard J or L hook at the end.
- Each anchor bolt shall have a washer with a minimum 1-3/8 inch diameter and minimum 1/8 inch thickness.
- For a one-story structure, minimum 1/2 inch anchor bolts shall be spaced a maximum of every 6 feet O.C., with an anchor bolt within 18 inches of ends or joints in sills or sole plates.
- For a two story structure, minimum 1/2 inch anchor bolts shall be spaced a maximum of every 4 feet O.C., with an anchor bolt within 18 inches of ends or joints in sills or sole plates.
- *S.B.C.C.I.* or *N.E.S. (C.A.B.O.)* listed sole plate anchor spaced 32 inches O.C. shall be deemed to be the equivalent of 1/2" anchor bolts spaced 6 feet on centers. Other spacing may be approved by the *State Board of Insurance Engineering Staff* for specific products. Please check with the local field office for details.
- Where joints occur in sills or sole plates, additional anchor bolts will not be required if a proper splice plate is used. The joint shall occur half way between the adjacent studs, and a 2 X 4 splice plate shall be applied over the entire length of the sole plate between the studs, and nailed to each side of the splice with a minimum of four 8d nails (8 nails, total).
- Interior load bearing walls shall also be anchored in an approved manner. (Refer to Section 312.3 for the definition of a load bearing wall.) One acceptable method is to anchor with a code-approved powder-actuated fastener every 2 feet (for a fastener with .170"-.177" shank diameter) or every 18 inches (for a fastener with .140"-.145" shank diameter). Fasteners shall have a minimum overall length of 3 inches. One fastener shall be placed 6 inches from the end of the sill plate. Other acceptable methods (for interior walls only) include the use of code approved drilled expansion or drilled chemical anchors every 6 feet, or the use of an *S.B.C.C.I.* or *N.E.S.* listed wood-to-concrete adhesive. When drilling holes for these types of anchors, extreme care must be taken to prevent damaging tendons in the slab.

### 311.1(b) Provisions for Masonry Veneer

- Where masonry veneer is to be applied, the foundation shall be constructed with a brick ledge.
- The brick ledge shall have a minimum depth of 1-1/2 inches.
- The width shall be wide enough to completely support the veneer and to provide a minimum of 1 inch between the veneer and the vapor barrier or sheathing on the wall.

### 311.2 Piling Foundation

These minimum specifications shall apply to structures of one and two stories only. For structures over two stories tall on pilings, please contact the local field office.

The design of a piling foundation is frequently determined by guidelines established for federal flood insurance. The homeowner or contractor should verify the base flood elevation before settling on a foundation design. This information should be available through local sources, such as the City, County, or Corps of Engineers. *The Federal Emergency Management Agency (F.E.M.A.)* should be contacted for further information regarding federal flood insurance.

There is one federal guideline which must be noted here because it can affect windstorm insurance. *F.E.M.A.* requires that enclosed space below the base flood elevation must be built with non-supporting breakaway walls which will collapse under wind and water loads without damaging the rest of the structure. Since these breakaway walls cannot be built to withstand the wind loads of the *Standard* and *T.C.P.I.A. Building Codes*, breakaway walls and any contents enclosed by breakaway walls will not be insured by the *T.C.P.I.A.*

#### 311.2(a) General Piling Requirements

- Pilings may be of either pressure treated wood, or precast reinforced or prestressed concrete.
- Wood pilings shall be square or round, and shall be installed as per Section 311.2(b) or Section 311.2(c).
- Precast reinforced or prestressed concrete piles shall also be installed as per Section 311.2(b) or Section 311.2(c).
- Pilings may be driven, jetted, or augered. Extreme care shall be taken when driving precast concrete pilings to prevent damage to the piling.
- Precast concrete pilings shall be reinforced as per Figures 2 and 3.

<b>MINIMUM REINFORCEMENT OF CONCRETE PILINGS-INLAND</b>			
<b>Height-(Top of Piling Above Grade)</b>			
<b>Size of Piling</b>	<b>7' or less</b>	<b>10' or less</b>	<b>12' or less</b>
<b>12" X 12"</b>	4-#8 w/#3 ties @12"	4-#11 w/#4 ties @12"	N/A
	8-#7 w/#3 ties @12"	8-#9 w/#3 ties @12"	N/A
	12-#6 w/#3 ties @12"	12-#8 w/#3 ties @12"	N/A
<b>16" X 16"</b>	4-#8 w/#3 ties @16"	4-#10 w/#3 ties @16"	4-#11 w/#4 ties @16"
	8-#6 w/#3 ties @12"	8-#8 w/#3 ties @ 16"	8-#9 w/#3 ties @16"
	N/A	12-#7 w/#3 ties @14"	N/A

The first two numbers represent the number and size of vertical reinforcing steel bars. The third and fourth numbers represent the size and vertical spacing of the horizontal tie bars (see figure below).

Figure 2. Minimum Reinforcement of Concrete Pilings

**PLACEMENT OF REINFORCEMENT IN CONCRETE PILINGS-INLAND**

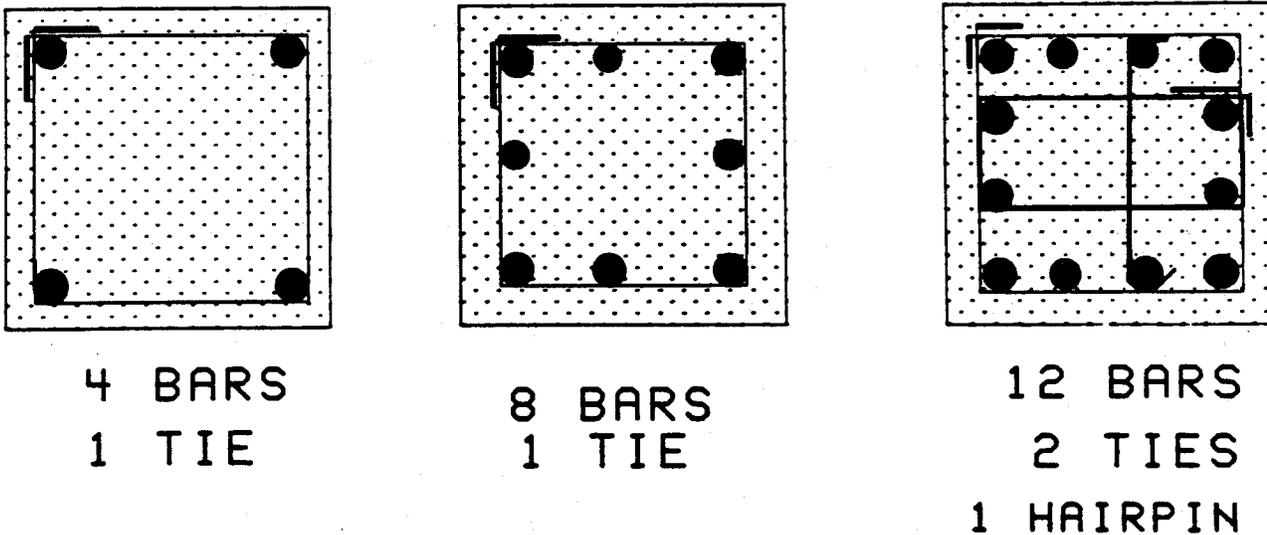


Figure 3. Placement of Reinforcement in Concrete Pilings

There are two general methods of piling design which will be acceptable. Method 1 (outlined in Section 311.2 (b)) may be used if there is no objection to the use of knee braces. Method 2 (outlined in Section 314.2(c)) may be used if knee braces are objectionable. One of these two methods shall be used. In all cases, the beams, stringers and floor joists shall comply with Section 311.2(d).

**311.2(b) Method 1**

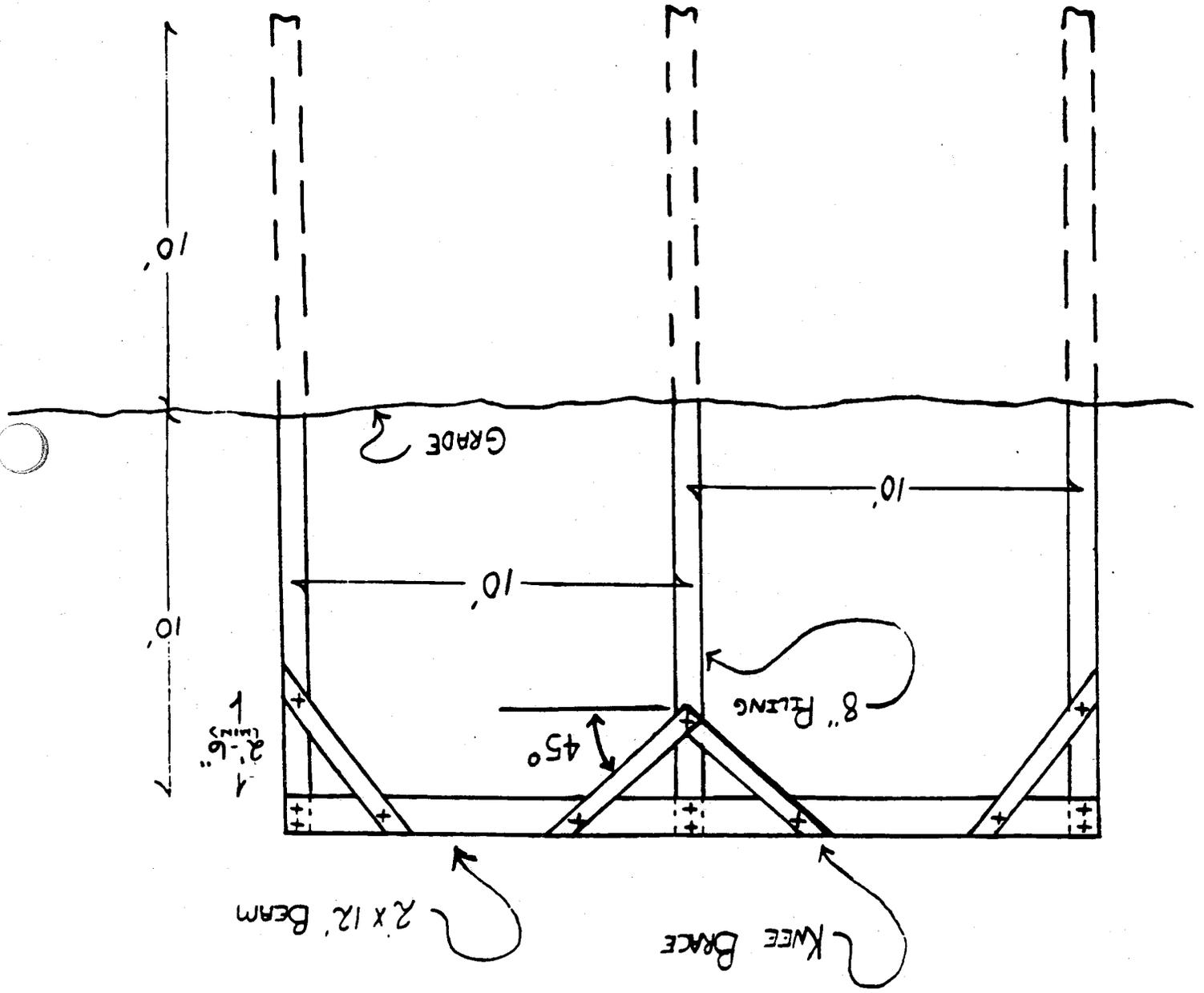
- The piling bury depth below grade shall be at least as deep as the distance the lowest floor framing members (usually beams and stringers) are above grade. The minimum depth of bury of a pile shall be 5 feet below grade.
- For one story structures, 10 feet shall be the maximum spacing between pilings.
- For two story structures, or structures elevated over 12 feet above grade level, 8 feet shall be the maximum spacing between pilings.
- Structures having an area greater than 1000 square feet shall have a minimum of four (4) pilings in a row.
- The size of pilings shall comply with the following table:

Height Above Ground (Grade to bottom of beam)	Min. Size of Piling (round or square)
less than 8 feet	8 inches
8 to 12 feet	10 inches
12 to 16 feet	12 inches

**Figure 4. Minimum size of Pilings.**

- Piling shall be notched and beams shall fully bear on piling. No more than one half the thickness of the piling may be notched.
- Beams or stringers shall be bolted to pilings with either two 3/4 inch bolts, three 5/8 inch bolts, or four 1/2 inch bolts. The spacing between bolts shall be a minimum of 3-1/2 inches, except where splices occur.
- Bolts, nuts, and washers shall be galvanized.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two 1/2 inch bolts. Bolts shall be spaced a minimum of 2-1/4 inches apart, and shall be located a minimum of 2 inches from the ends and edges of each beam.
- The distance between the bolts and the ends and edges of the beams shall be a minimum of four times the bolt diameter.
- Knee braces shall be provided for all pilings, extending in every available direction.
- Knee braces shall be pressure treated with a wood preservative, or wood of natural decay resistance.
- Knee braces shall extend at a 45 degree angle from the floor framing member down to a point on the piling which is one fourth the height of the piling down from the floor framing member.
- For knee braces up to 5 feet in length, the minimum size shall be 2 x 6 or 4 x 4 lumber.
- Knee braces over 5 feet in length shall have a minimum dimension of four inches.
- Knee braces shall be bolted (thru or lag) to the floor framing and the piling.
- Pilings which extend above grade less than 4 feet will not require knee braces.

Figure 5. Installation of Piles (Method 1)



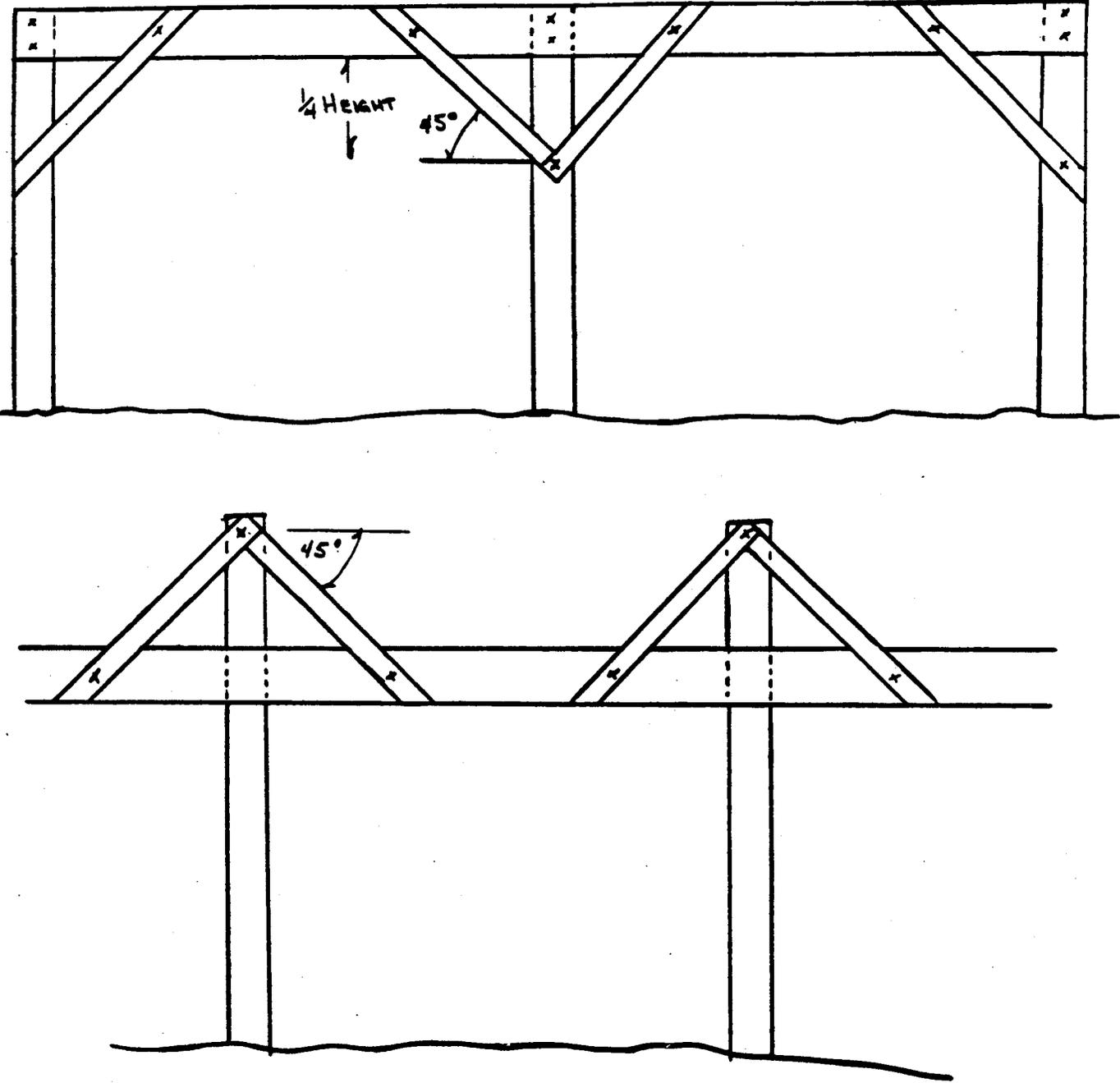
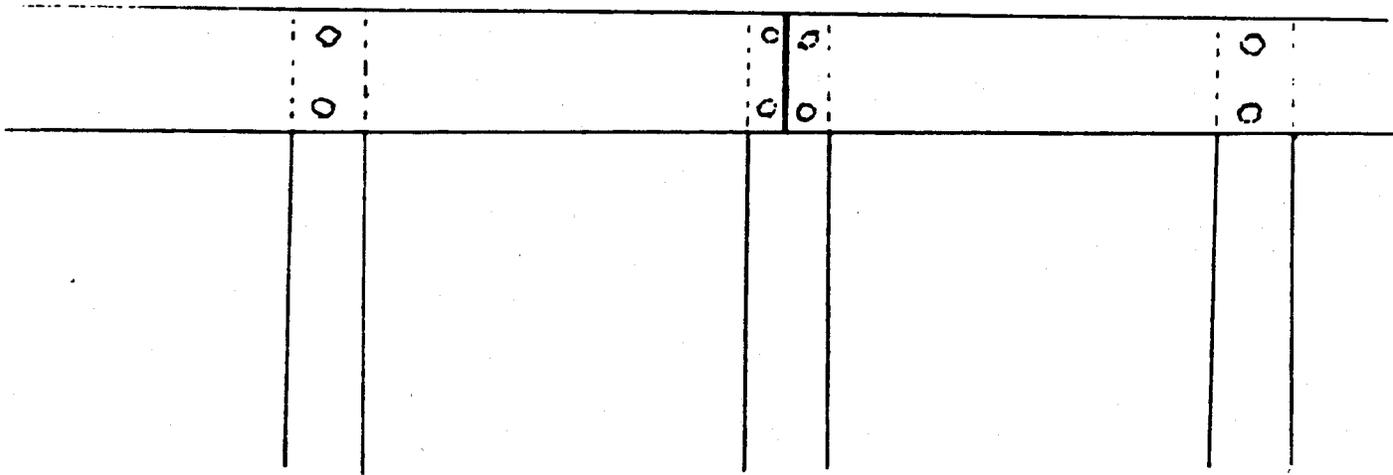


Figure 6. Installation Knee Braces (Method 1)



**Figure 7. Fastening Spliced Beam to Piling**

**311.2(c) Method 2**

This method will have different specifications depending upon whether the structure is located in an area subject to storm surge and wave action (V-zones) or an area not subject to storm surge and wave action (A-zone or other).

**1. Areas Subject to Storm Surge and Wave Action (V-Zones)**

- The maximum first floor elevation shall be 16 feet above mean sea level when using this method.
- Piles shall penetrate a minimum of 12 feet below mean sea level.
- There shall be a minimum of 4 piles in each row.
- The maximum spacing between piles shall be 8 feet.
- Piles shall have a minimum tip diameter of 10 inches (round or square).
- Pilings shall be notched and beams shall fully bear on pilings. No more than one half the thickness of each piling may be notched.
- For a one story structure, the beams shall be bolted to each piling with a minimum of two 1/2 inch bolts.
- For a two story structure, the beams shall be bolted to each piling with a minimum of two 5/8 inch bolts.
- Bolts, nuts, and washers shall be galvanized.
- Bolts shall be spaced a minimum of 3-1/2 inches apart and shall be located a minimum of 2 inches from the beam edge, except where splices occur.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two bolts. These bolts shall be 5/8 inch diameter for a two story structure having piles spaced farther than 8 feet apart. Two story structures with piles spaced 8 feet or closer and all one story structures shall use two 1/2 inch bolts in each side of the splice. Bolts shall be spaced a minimum of 2-1/4 inches apart and shall be located a minimum of 2 inches from the edges and end of each beam.

**2. Areas NOT Subject to Storm Surge and Wave Action (A-Zones)**

- The maximum first floor elevation shall be 8 feet above grade when using this method.
- There shall be a minimum of 4 piles in any one row.
- The minimum size and minimum depth of bury below grade of pilings and the minimum number and size of bolts per beam connection shall comply with Figure 8.

**PILING SIZE, BURY DEPTH, AND BEAM CONNECTION FOR AREAS  
NOT SUBJECT  
TO STORM SURGE AND WAVE ACTION-INLAND (A-Zone)**

**ONE STORY STRUCTURES**

<b><u>Maximum Spacing Between Pilings</u></b>	<b><u>Minimum Tip Diameter of Pile and Minimum Bury Depth Below Grade For Type of Soil</u></b>		<b><u>Minimum Beam Connection To Piling</u></b>
	<b><u>Sandy Soil</u></b>	<b><u>Clay Soil</u></b>	
8 Feet	8" Pile-12' Deep	10" Pile-12' Deep	2-1/2" Dia. Bolts
10 Feet	8" Pile-12' Deep	10" Pile-20' Deep	2-5/8" Dia. Bolts

**TWO STORY STRUCTURES**

<b><u>Maximum Spacing Between Pilings</u></b>	<b><u>Minimum Tip Diameter of Pile and Minimum Bury Depth Below Grade For Type of Soil</u></b>		<b><u>Minimum Beam Connection To Piling</u></b>
	<b><u>Sandy Soil</u></b>	<b><u>Clay Soil</u></b>	
8 Feet	8" Pile-12' Deep	10" Pile-20' Deep	2-5/8" Dia. Bolts
10 Feet	10" Pile-12' Deep	12" Pile-24' Deep	3-3/4" Dia. Bolts

**Figure 8. Piling Size, Bury Depth, and Beam to Piling Connection**

*First Printing*

- The piling shall be notched and beams shall fully bear on pilings. No more than one half the thickness of each piling may be notched. Bolts shall be spaced a minimum of 3 1/2 inches apart and shall be located a minimum of 2 inches from the beam edge except where splices occur.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two bolts. These bolts shall be 5/8 inch diameter for a two story structure having piles spaced farther than 8 feet apart. Two story structures with piles spaced 8 feet or closer and all one story structures shall use two 1/2 inch bolts in each side of the splice. Bolts shall be spaced a minimum of 2-1/4 inches apart and shall be located a minimum of 2 inches from the edges and end of each beam.
- Bolts, nuts, and washers shall be galvanized.

**311.2(d) Beams, Stringers, and Floor Joists**

- Beams and stringers shall be framed into the tops of pilings and shall consist of a minimum of two 2 x 12's, having a minimum grade of no. 2.
- Beams and stringers shall be pressure treated with a wood preservative.
- Splices in beams and stringers shall occur over a piling.
- Where floor joists are set on top of beams, every other floor joist shall be attached to the beam with an approved framing anchor.
- Where floor joists must be framed directly into beams, a joist hanger or ledger strip shall be provided. Floor joists shall be anchored against uplift.
- If floor joists are not continuous, the joint shall occur over a beam and there shall be a minimum of a 12 inch lap, securely nailed together. For lap lengths of less than 4 feet, each side of the lap on every other floor joist shall be fastened to the beam with an approved framing anchor. If laps are 4 feet or longer and are securely nailed, one framing anchor will be sufficient.
- Floor joists shall have a maximum spacing of 24 inches O.C.
- Floor joists shall have a maximum span in accordance with **Figure 10**.

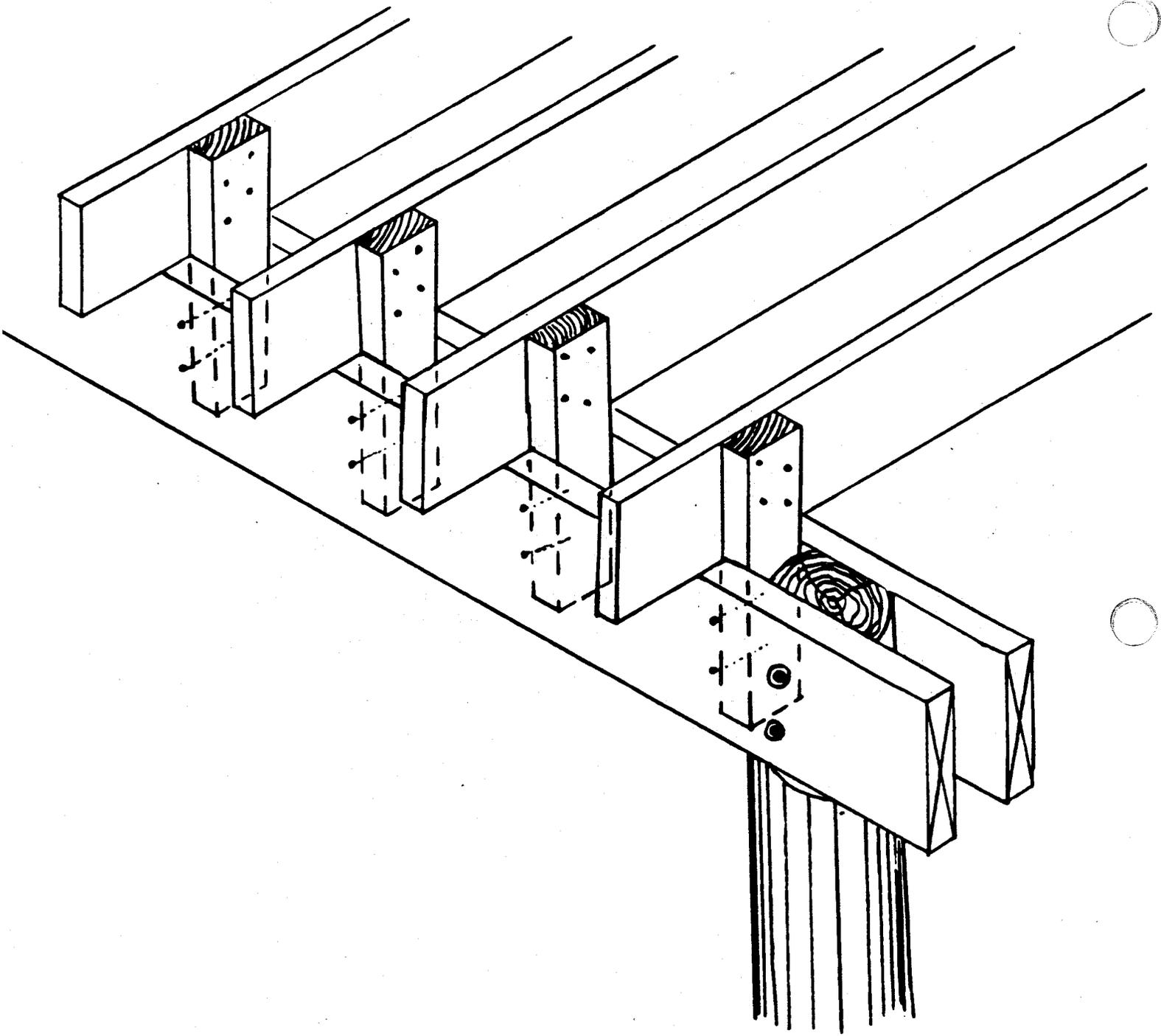


Figure 9. Use of Wood Framing Anchors

<b>MAXIMUM SPANS FOR FLOOR JOISTS-INLAND</b>					
<b>(Southern Pine or Douglas Fir)</b>					
<b>Size of Floor Joists</b>	<b>Spacing of Floor Joists</b>	<b>Grade of Lumber</b>			
		<b># 1</b>	<b># 2</b>	<b># 3</b>	
<b>2 X 6</b>	16" O.C.	9-11	9-9	8-1	
	19.2" O.C.	9-4	9-2	7-4	
	24" O.C.	8-8	8-4	6-7	
<b>2 X 8</b>	16" O.C.	13-1	12-10	10-3	
	19.2" O.C.	12-4	12-1	9-5	
	24" O.C.	11-5	11-0	8-5	
<b>2 X 10</b>	16" O.C.	16-9	16-5	13-1	
	19.2" O.C.	15-9	15-5	12-0	
	24" O.C.	14-7	14-0	10-9	

**Figure 10. Maximum Floor Joist Spans**

### 311.3 Pier and Beam Foundation

These guidelines apply to new one and two story structures on pier and beam type foundations.

- This type of foundation should not be used in areas subject to storm surge and wave action.
- Wood beams shall be pressure treated with a wood preservative or otherwise decay resistant.
- All piers shall have reinforcement tying the beam to the pier, and the pier to the footing. Reinforcement must resist both uplift and lateral forces.
- If hollow masonry units are used for piers, the cells shall be filled with steel reinforcement and grout.
- Beams shall be fastened to piers in such a manner as to provide anchorage equivalent to that required for sole plates to a slab foundation.
- Floor joists shall comply with the applicable portions of Section 311.2(d).
- The bottom of the footing pad shall be buried a minimum of 12 inches below grade.
- When the floor elevation is over 3 feet above grade, either pilings must be used, or the base of the footing must be buried below grade as deep as the height the floor framing members are above grade.
- Footing pads shall be a minimum of 4" thick and have minimum dimensions of 12" X 12".

*First Printing*

- Where hollow masonry piers are used to elevate a structure between three and eight feet, the following method may be used.

Subsurface support shall either be provided by:

1. A standard piling driven 12 feet deep with a reinforced concrete cap poured over and around the top of the piling, with additional anchorage provided by dowels in the top of the piling;
  - or
  2. A hole 12 feet deep, and a minimum of 12 inches in diameter, poured with reinforced concrete.
- Masonry piers are then built on top of this concrete. Hollow masonry units shall be vertically reinforced with a minimum of four no. 4 bars and completely filled with concrete. Vertical reinforcement in piers shall be lapped a minimum of 18 inches with the subsurface reinforcement. Beams at the top of piers shall be securely anchored to the steel reinforcement in the piers.
  - If it is impossible to anchor piers to footings, one alternate method would be to construct an additional anchor between each pier. This is accomplished by digging a 3' x 3' x 3' hole and filling it a minimum of 1 foot deep with reinforced concrete. Embed a corrosion-resistant length of angle iron, or 4" x 4" (minimum) treated lumber into the concrete. The angle iron shall have a 90 degree bend in the bottom, and the lumber shall have some type of dowel in the end, or some other method shall be provided to anchor the iron or lumber against uplift. The angle iron or wood post shall be fastened to the beam with a minimum of two 1/2 inch bolts, or shall be otherwise securely fastened. The remainder of the hole shall be filled back in. One of these anchors shall be installed between each pier, with a maximum spacing of 10 feet between each anchor.
  - Another alternate method which will be accepted when the structure is elevated less than three feet above grade is as follows. Dig a belled hole a minimum of 36 inches deep, a minimum of 24 inches wide at the bottom, and a maximum of 12 inches wide at the top. Place a treated wood or corrosion-resistant steel pier in the hole and fill the hole with concrete and reinforcement. The column shall have some type of dowel or horizontal protrusions near its bottom to anchor against uplift. The pier shall have a minimum width of 6 inches. The beam shall be securely anchored to the top of this pier. The maximum spacing between piers shall be 10 feet.
  - Small temporary buildings or portable buildings which have an area of less than 200 square feet and which are elevated less than 12 inches above grade may be anchored by the following method. Dig a 2' x 2' x 2' hole at each corner, fill the hole at least 1 foot deep with concrete, and embed a 1 1/2" x 1 1/2" x 1/4" angle iron or a 2 inch x 1/4 inch steel strap. Straps or anchors shall be corrosion-resistant. Straps or angles shall have a 90 degree bend at the bottom to anchor them against uplift. Straps or anchors shall be securely fastened to each corner of the building. Temporary or portable buildings having an area greater than 200 square feet shall be anchored by one of the previously outlined methods.
  - If none of these methods can be used, the installation of approved mobile home tie-downs may be accepted. Generally, 48 inch long tie-downs installed at each exterior pier as per their manufacturer's instructions with a minimum of one tie-down for each 6 feet of wall length, will be acceptable.
  - For small structures or structures which are relocated, alternate methods may be approved. Contact local field office.

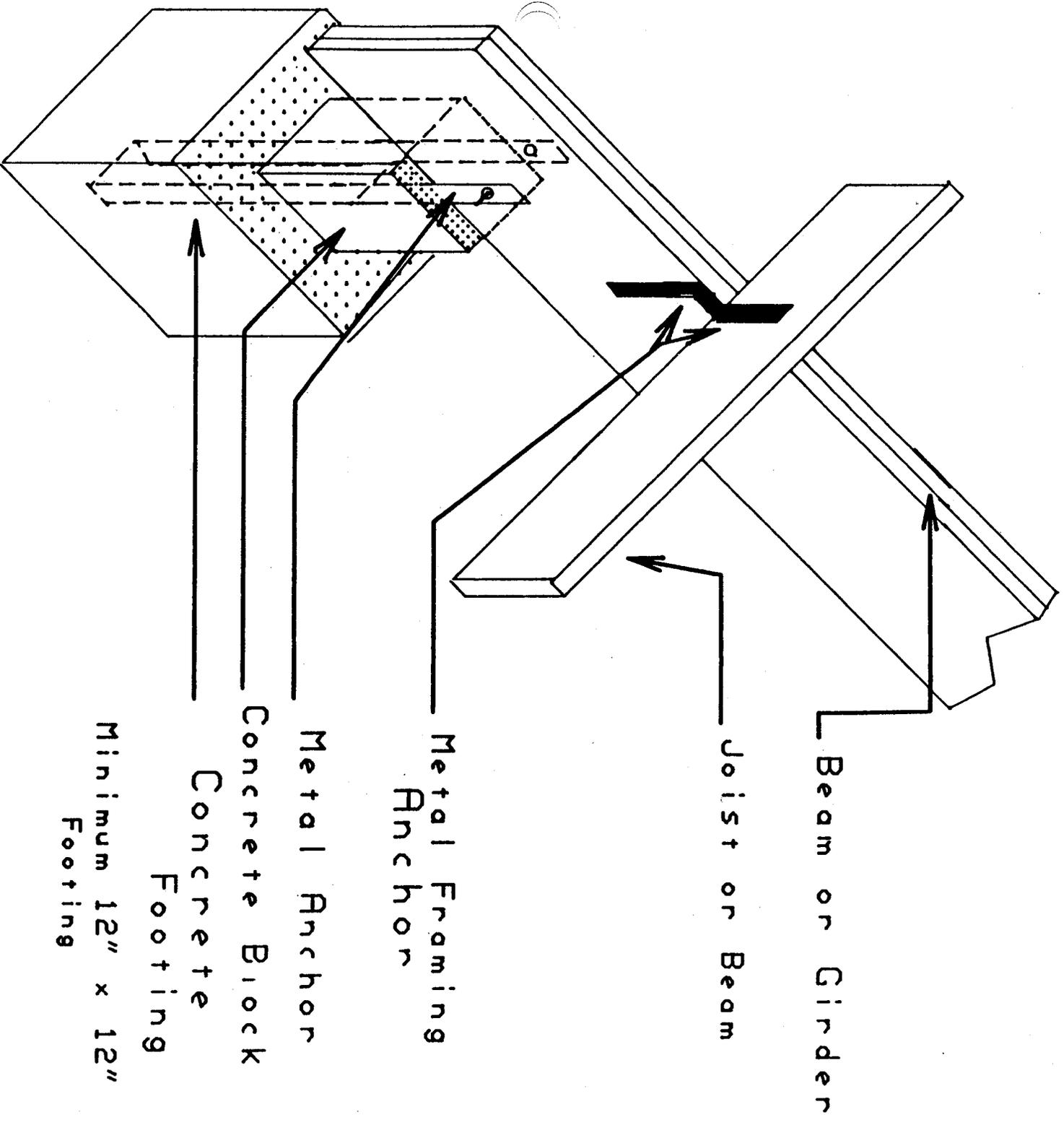


Figure 11. Pier and Beam Foundation

### 311.4 Bearing Wall Footings

Where bearing wall footings are used, they shall meet the following guidelines. This type of foundation should not be used in areas subject to storm surge and wave action.

- The base of the footing shall be buried a minimum of 12 inches below grade.
- The base of the footing shall have a minimum width of 12 inches for one story structures, 15 inches for two story structures, and 18 inches for three story structures, and a minimum thickness of 6 inches.
- 1/2 inch (minimum) anchor bolts, spaced a maximum of 6 feet O.C., shall be provided.
- An anchor bolt shall be located not more than 12 inches from each corner, and not more than 18 inches from the end joints in sills.
- Anchor bolts shall be embedded a minimum of 7 inches into a monolithic concrete bearing wall footing, and a minimum of 15 inches into a reinforced masonry unit wall footing.
- Masonry wall footings shall be reinforced and shall be securely anchored to the footing base.
- Floor joists shall comply with the applicable portions of Section 311.2(d).

## 312 Framing

### 312.1 Lumber

- All lumber shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the American Lumber Standards Committee.
- All lumber members 2 inches or less in thickness shall contain not more than 19 percent moisture content at the time of permanent incorporation into a building or structure. Permanent incorporation occurs when lumber is cut to size and nailed in place.
- If framing is found to have a moisture content higher than 19% at the time of the first framing inspection, that structure will not be able to be approved by our inspectors. The structure would still be able to be certified by a Texas registered professional engineer.
- Standard and utility grade lumber shall not be used for any load carrying purposes.
- All load bearing lumber shall be Southern Pine or Douglas Fir, or another species having equivalent or greater strength.

### 312.2 Fasteners

- All fasteners shall be U.S. manufactured hot dipped, electrically, or mechanically galvanized steel or stainless steel.
- Power and mechanically driven fasteners shall be manufactured by members of *The International Staple, Nail, and Tool Association*.

### 312.3 Wall Framing and Framing Anchors

- Sole plates for all exterior walls shall be of pressure treated lumber, or shall be provided with an approved vapor barrier beneath them.
- Except as noted below, all 2 x 4 studs shall be spaced a maximum of 16 inches O.C., and 2 x 6 studs shall be spaced a maximum of 24 inches O.C.

*First Printing*

- In three-story buildings, studs in the first story shall be not less than 3 x 4 inches or 2 x 6 inches, spaced a maximum of 16 inches O.C.
- Studs shall have a minimum grade of stud or #3.
- Studs shall be capped with double top plates. Joints in doubled top plates shall be staggered.
- The following connections shall have an approved corrosion resistant framing anchor (hurricane clip):
  1. Every other rafter to both plates of doubled top plate or to stud below.
  2. Every other stud to both plates of doubled top plate or to rafter above.
  3. Every other stud to the sole plate.
- At each of these connections, a framing anchor which is rated by its manufacturer to provide a minimum of 300 pounds uplift resistance shall be installed.
- Framing anchors shall be installed exactly as recommended by their manufacturer. Nails shall be corrosion resistant and of the size recommended by the manufacturer of the framing anchor. Unless recommended otherwise, there shall be a minimum of four nails in each member being clipped together.
- Framing anchors shall be located to form continuous lines of anchorage, from the rafter down to the sole plate. This means that framing anchors must be installed at the top and bottom of the same stud.
- Framing anchors may be constructed of pieces of lumber if an adequate number of nails are used and the nails are perpendicular to the direction of the load (in shear, not in withdrawal). Where framing anchors are of lumber, they shall be installed at every member, rather than at alternate members.
- At gable ends, at least every other gable stud shall be attached to the doubled top plate and the rafter with a framing anchor.
- Interior load bearing walls shall have 2 X 4 studs spaced 16 O.C. Load bearing walls are walls which are subject to either vertical or horizontal forces.
- Walls which are perpendicular to exterior walls and are used to brace those exterior walls (as specified in Section 312.6) are subject to horizontal loads and are classified as load bearing walls. Other interior walls which intersect exterior walls and are at least 6 feet long are also subject to horizontal loads (due to diaphragm action of the sheet rock even though normal wall bracing may not be present) and are classified as load bearing walls. These types of load bearing walls shall be anchored to the foundation as specified in Section 311.1(a) for at least the first 10 feet from the exterior wall.
- Walls which are used to brace rafters which would be overspanned without the braces are subject to vertical loads and are classified as load bearing walls. Where rafter braces are tied to interior load bearing walls, the stud on each side of the brace shall be anchored to the top plate and to the sole plate with a framing anchor as specified above. Where the brace falls directly over a stud, or a stud is added directly below the brace, the brace may be strapped directly to that stud, and only that stud need be anchored to the sole plate. The sole plate shall be anchored to the foundation as specified in Section 311.1(a) for a distance of at least 5 feet on each side of these studs. One standard anchor bolt or drilled or chemical anchor on each side of this location will be acceptable.
- Where rafter braces are tied to ceiling joists, the walls which these joists rest on and are anchored to are classified as load bearing walls. However, since the loads are smaller, no additional framing anchors on the studs or special anchorage of the sole plate will be necessary.
- Interior non-load bearing walls may have studs spaced up to 28 inches O.C. Non-load bearing walls are walls which are not subject to any horizontal or vertical forces and do not fall into any of the above categories.

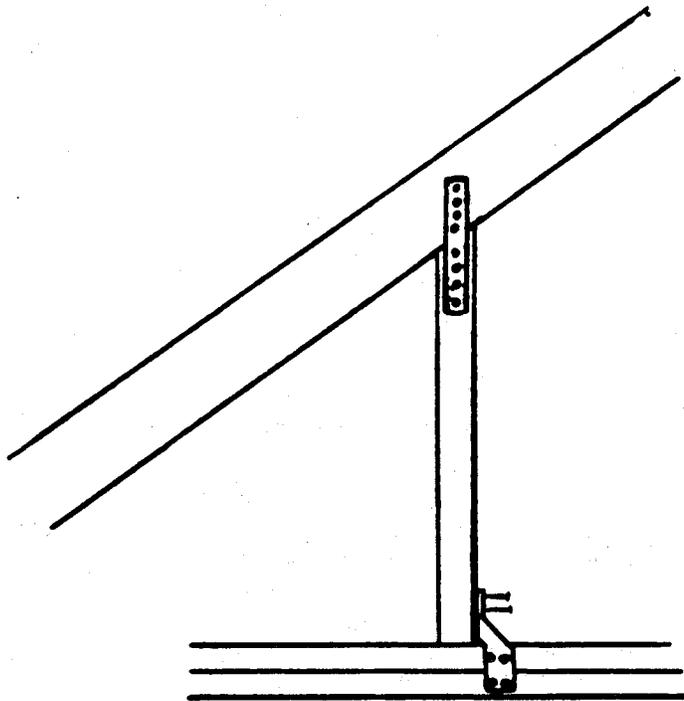
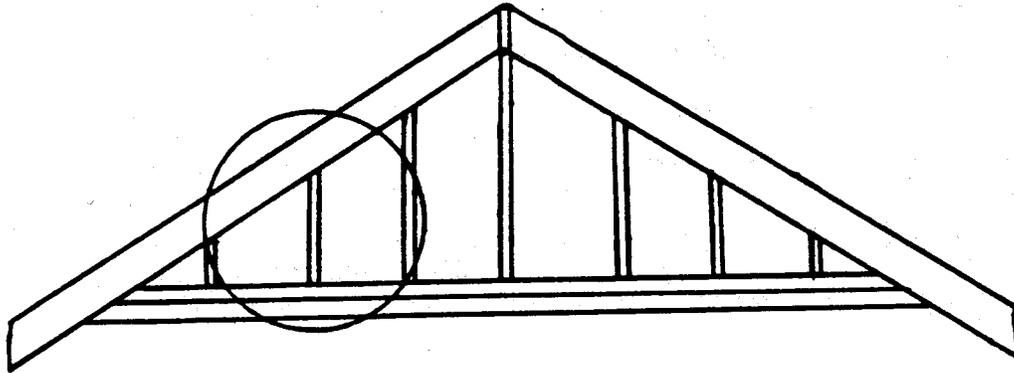


Figure 12. Connecting Gable Studs to Rafter and Top Plate

**312.4 Roof Framing Members (Rafters)**

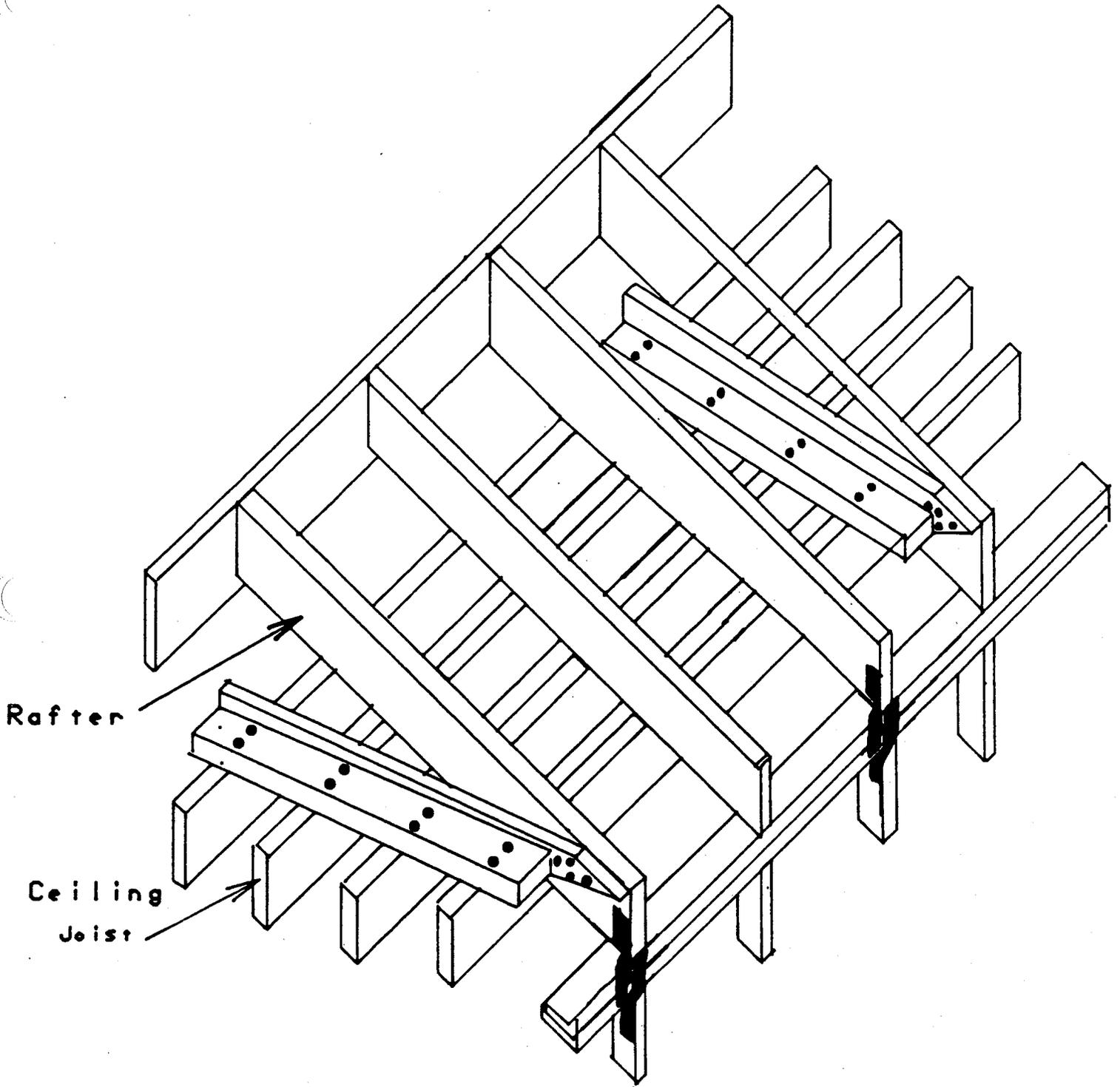
- Rafters shall be sized and spaced for a 31.25 pound per square foot uplift wind load for structures less than 30 feet high. The following table shall be used to size and space rafters.

<b><u>RAFTER SPAN TABLE-INLAND</u></b>				
<b><u>Rafter Size</u></b>	<b><u>Spacing (in O.C.)</u></b>	<b><u>#1 Grade</u></b>	<b><u>#2 Grade</u></b>	<b><u>#3 Grade</u></b>
<b>2 X 6</b>	12	13'-7"	13'-4"	12'-8"
	16	12'-4"	12'-1"	11'-0"
	19.2	11'-7"	11'-4"	10'-6"
	24	10'-9"	10'-7"	9'-5"
<b>2 X 8</b>	12	17'-10"	17'-6"	16'-9"
	16	16'-3"	15'-11"	15'-4"
	19.2	15'-4"	15'-0"	13'-10"
	24	14'-2"	13'-11"	12'-5"
<b>2 X 10</b>	12	22'-9"	22'-4"	21'-4"
	16	20'-8"	20'-3"	19'-5"
	19.2	19'-5"	19'-1"	17'-9"
	24	18'-1"	17'-9"	15'-9"

**Figure 13. Maximum Rafter Spans**

### *First Printing*

- Rafters on the windward side of roofs with slopes greater than 30 degrees (6.9 in 12) shall be sized and spaced to withstand an inward force of 25 pounds per square foot.
- At eaves and overhangs, rafters must be sized and spaced to resist a 50 pound per square foot uplift wind load, if less than 30 feet high.
- Rafters shall be spaced a maximum of 24 inches on center.
- If it is not possible to have rafters meet this span table, at least every third rafter shall be tied to joists or partitions directly below with a 1 x 6 or equivalent at midpoints of rafters 20 feet or less in length, or at third points of rafters over 20 feet in length. Rafter braces shall form as close as possible to a 90 degree angle with the rafters. Rafter braces shall be installed so as to resist uplift (nailed in shear or fastened with framing anchors at each end).
- Each ceiling joist which is used to brace a rafter shall be anchored against uplift at each end. This may be accomplished by nailing in shear to a rafter which is fastened to the top plate with a framing anchor, or fastening the ceiling joist directly to the top plate with a framing anchor. The framing anchors at one end of the ceiling joists may be omitted if a beam or strongback is run over the ceiling joists, and this beam is securely anchored to a load-bearing wall at each end. (Usually, at least one end is anchored to an exterior wall.) This paragraph applies when braces are tied directly to rafters and ceiling joists. When a strongback/purlin tie system is used, see the following paragraph.
- Where a strongback and/or purlin tie system is used, the following shall apply:
  - The purlins and strongbacks or ceiling joists shall be tied together using a minimum of a 1 x 6 or equivalent.
  - Rafters, purlins, ties, strongbacks, ceiling joists, and load-bearing walls shall be anchored against uplift at a minimum spacing of every third rafter.
  - Ceiling joists shall be anchored to a load-bearing wall or nailed in shear to rafters at both ends.
  - Load-bearing walls shall be properly anchored to the foundation as specified in Section 312.3.
- Ridge beams shall be sized at least one nominal size larger than the rafters.
- 1 x 6 collar beams (rafter ties) or their equivalent shall be installed between every other pair of rafters. Collar beams shall be located in the upper third of the roof height.
- Ceiling joists and rafters shall be nailed to each other where possible.
- Ceiling joists shall be continuous, or where they meet over interior partitions, shall be securely joined (minimum of three 16d nails) to provide a continuous tie across the building.
- In buildings 20 feet or more in width, where rafters cannot be nailed directly to ceiling joists because the joists are perpendicular to the rafters, the foot of at least every third rafter shall be tied to at least the first four adjacent ceiling joists with wood or metal ties attached to each joist.
- Where a plywood roof deck is not used (for example, on a wood shingle or metal roof), the ridge beam shall be braced at a 45 degree angle down to either a perpendicular end or interior wall top plate, or to a parallel exterior wall top plate, with the brace nailed to each rafter where they cross.



**Figure 14. Tying Rafters to Perpendicular Ceiling Joists**

### 312.5 Roof Framing Members (Trusses)

- All wood trusses shall be designed and certified by a Texas registered professional engineer.
- Roof trusses shall be designed to withstand the same wind pressures as rafters. For structures less than 30 feet high, these are 31.25 pounds per square foot uplift for all roofs, and 25 pounds per square foot inward force for the windward slope of roofs with a slope of greater than 30 degrees. Eaves and overhangs shall be designed to resist a 50 pounds per square foot uplift load.
- The contractor shall furnish a sealed truss certificate to the State Board of Insurance, preferably prior to installation. The certificate shall include the following information:
  1. The design wind uplift pressure in pounds per square foot. (and inward pressure, if applicable)
  2. The anchorage force required at each bearing point.
  3. The length, size, and grade of each piece of lumber in the truss.
  4. The location and type of any bracing which is necessary.
  5. A statement similar to the following: "This truss design meets or exceeds the *Texas Catastrophe Property Insurance Association* requirements for windstorm resistant construction. The windload used in this design is \_\_\_\_\_ PSF.
  6. The name and telephone number of the truss fabricator.
  7. The name and telephone number of the design engineer.
- The State Board of Insurance reserves the right to request additional information and supporting calculations.
- Trusses shall be braced and anchored as specified on the truss certificate.
- The truss installation packet shall be on the jobsite for the inspector.
- Trusses shall not be altered from their original design condition.
- Floor trusses generally need not be designed for uplift. When floor truss certificates are submitted, they shall clearly be identified as such.

### 312.6 Corner and Wall Bracing

- Corner bracing shall be accomplished by one of the following methods. When using methods 1, 2, or 3, one brace shall be installed for each 18 feet of wall with a minimum of one brace at each corner per wall. Staples may not be used to apply corner or wall bracing.
  1. Minimum 15/32 inch *APA* or *TECO* rated panels (plywood, waferboard, or OSB) nailed with 6d nails spaced 6 inches O.C. along each panel edge and 12 inches O.C. along each interior studs.
  2. 1 x 4 diagonal brace let in to studs, bottom plate, and lower plate of doubled top plate, and nailed with a minimum of two 8d nails at each intersection with a stud or plate. The brace shall be installed at a 45 degree angle and must fit tightly into the slots cut into the studs. If an opening prevents a single long brace from being installed, two shorter braces may be let in to the studs in a K pattern (see Figure 15).
  3. *S.B.C.C.I.* listed let-in type metal brace installed at a 45 degree angle and nailed as per the manufacturer's instructions.

*First Printing*

4. Diagonal wood board sheathing applied over the entire wall. Boards shall be a minimum of 5/8 inch thick and each board shall be nailed with two 8d nails at each stud crossing and three 8d nails at each end. Horizontal and vertical board sheathing are not a substitute for corner bracing.
  5. Shear walls (entire wall sheathed with plywood or siding) may also be used as corner bracing. Generally, if two complete sheets of approved sheathing or siding (no holes cut in them) are used for each required brace, sufficient strength will be achieved. Nailing should be with 8d nails spaced every 6 inches around the panel edges and every 12 inches along interior studs. Plywood or siding shall have a minimum thickness of 3/8". Consultation with the Engineering Staff or the local field office of the State Board of Insurance is recommended.
- In addition, exterior walls greater than 24 feet in length shall be braced by interior walls greater than 6 feet in length where they intersect the exterior wall. The brace shall be installed as close to the exterior wall as possible. All exterior walls shall have one such brace installed for each 10 feet in length over 24 feet, at a minimum (unless there are no intersecting walls). Any of the above methods may be used. At this location only, *S.B.C.I.* listed flat metal straps installed in a X pattern will also be accepted. These interior load bearing walls shall be anchored to the foundation as specified in Section 311.1(a).

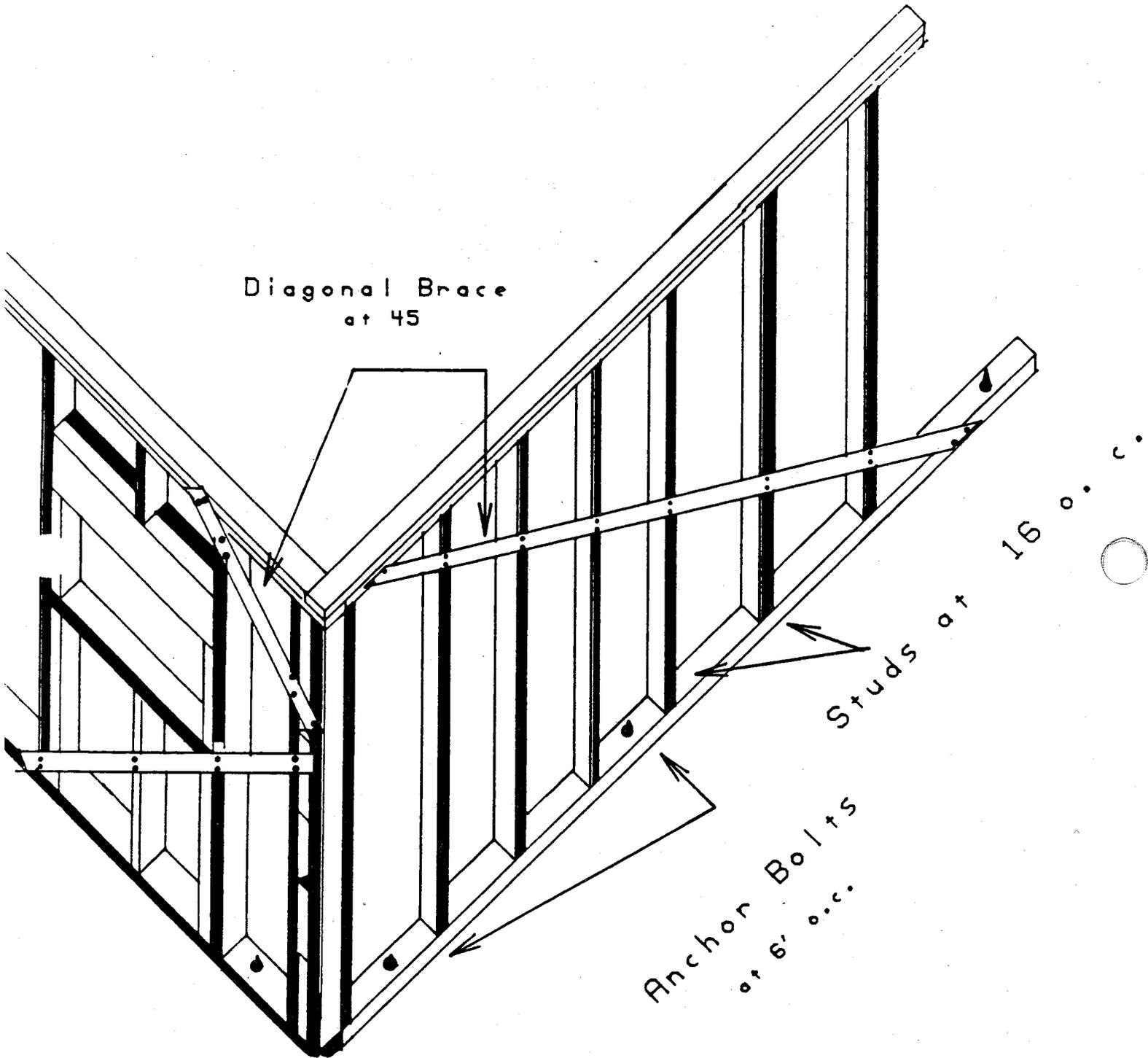


Figure 15. Let-in Diagonal Corner Bracing

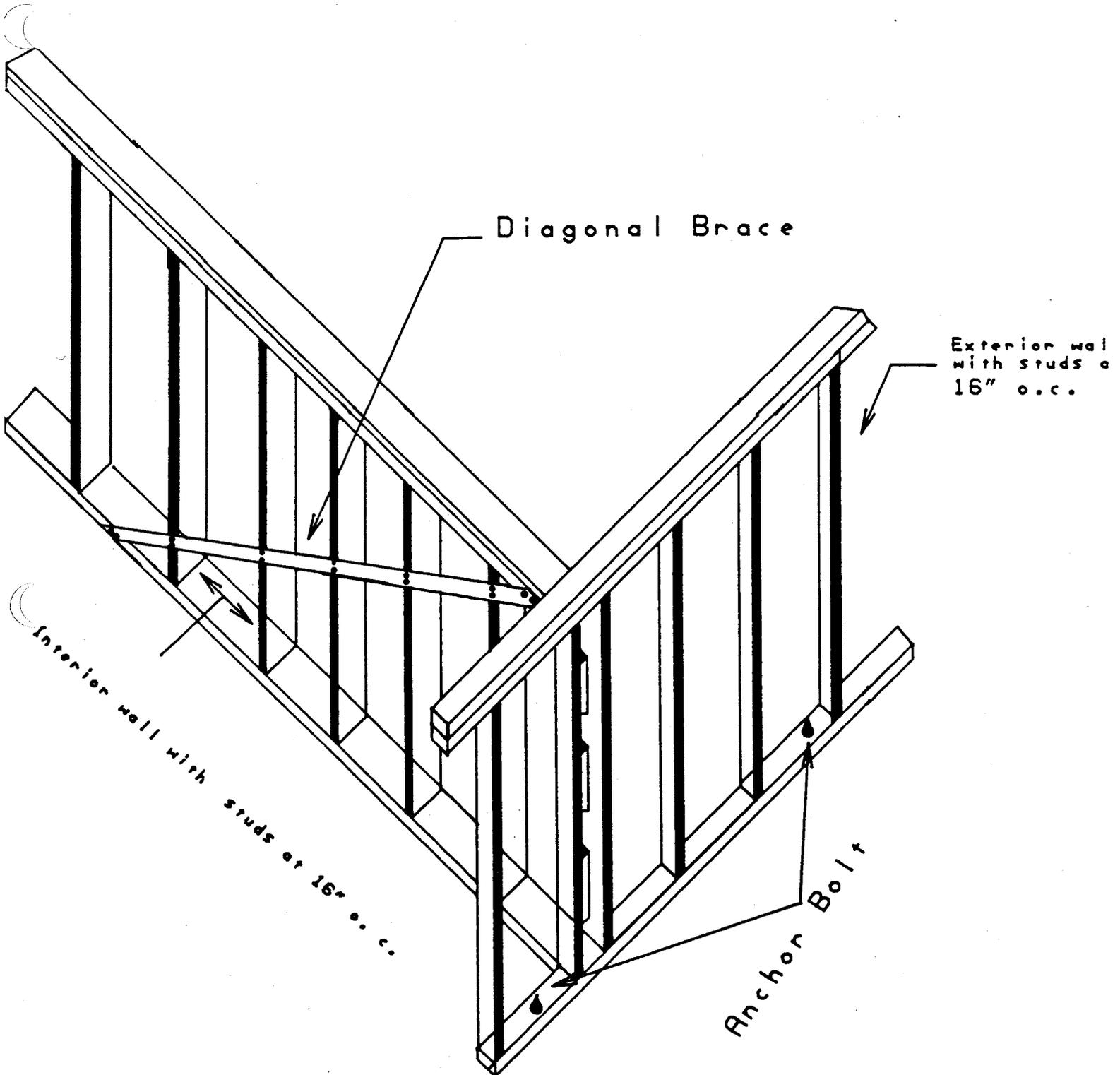


Figure 16. Interior Wall Bracing an Exterior Wall

**312.7 Framing Around Openings**

- Headers shall be provided over each opening in walls carrying vertical loads.
- Headers may be two pieces of nominal 2 inch lumber set on edge and nailed together or may be of solid lumber of equivalent size. Other types of beams may be used if they are equivalent. Wood trusses will be acceptable only if properly designed and installed.
- Size of headers in exterior walls shall comply with the following table:

<b><u>MAXIMUM ALLOWABLE SPANS FOR HEADERS</u></b> (No. 2 Lumber)	
Size of Header	Maximum Span
Double 2 X 4 or 4 X 4	4' - 0"
Double 2 X 6 or 4 X 6	6' - 0"
Double 2 X 8 or 4 X 8	8' - 0"
Double 2 X 10 or 4 X 10	10' - 0"
Double 2 X 12 or 4 X 12	12' - 0"

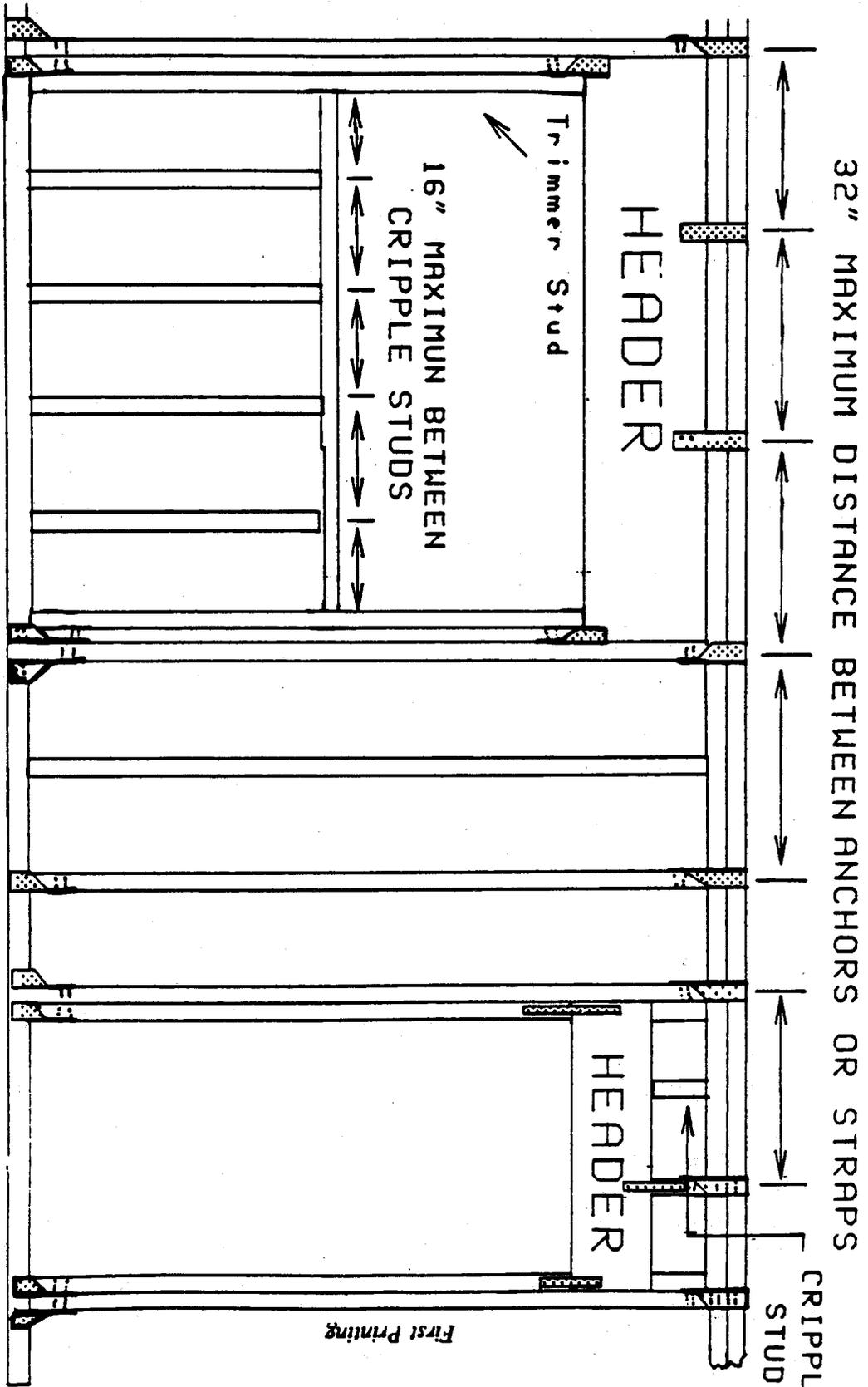
**Figure 17. Maximum Spans for Headers**

- Two 2 X 12's with a minimum 15/32" piece of plywood properly glued and nailed between them may span up to 14 feet.
- Two 2 X 12's with plywood sandwiched as above and either the entire interior or exterior wall sheathed in minimum 15/32" plywood may span up to 16 feet.
- Two 2 X 12's with plywood sandwiched as above and both the entire interior and exterior wall sheathed in minimum 15/32" plywood may span up to 18 feet.
- Special types of beams, such as glulam, flitch (steel sandwiched between lumber), box beam, truss, etc., will be acceptable if properly designed and installed.
- There shall be a wall stud directly on each side of the header. The wall stud shall be connected to the sole plate and doubled top plate with framing anchors installed as per Section 312.3.
- The header shall be nailed to the adjacent studs.
- Headers less than 6 feet long shall be supported upon a minimum of one header (trimmer) stud at each end, except headers less than 3 feet long may be supported by a framing anchor at each end.
- Headers longer than 6 feet in length shall be supported by a minimum of two header (trimmer) studs at each end.
- For headers 9' or less in length, one header (trimmer) stud on each end shall be anchored to the sole plate as per Section 312.3 and to the header with an approved framing anchor or strap.

*First Printing*

- For headers over 9' in length, both header (trimmer) studs at each end shall be anchored to the sole plate and the header as specified above.
- If the header does not extend completely to the double top plate, cripple studs shall be provided, spaced 16 inches O.C. with approved framing anchors or straps fastening every other stud to the top plates and the header.
- If the header extends completely to the double top plate it shall be fastened to the top plates every 32 inches with an approved framing anchor or strap.
- Headers located in load bearing interior walls which are subject to small uplift loads shall only be required to have one set of framing anchors installed at each end.
- Openings in non-load bearing partitions may be framed with single studs and headers.

Figure 18. Anchorage of Headers



### 312.8 Windows

- Wall framing around windows shall be adequate to hold the window in place.
- Headers above windows shall comply with Section 312.7.
- Windows shall be fastened using a minimum of a 4d box or common nails or a minimum of a 16 gauge staple having a minimum 1-1/2 inch leg length and minimum 7/16 inch crown width.
- Fasteners shall be spaced a maximum of 12 inches O.C. on all four sides of the window.
- Manufacturer's instructions shall be followed if they are more stringent than the above guidelines.
- Fasteners shall not be overdriven.
- Fasteners shall be galvanized steel or aluminum. Aluminum fasteners should be used with aluminum window frames.
- Check with field offices for very large or irregular windows.
- When the size or number of windows prevents normal guidelines from being followed, the structure will generally have to be designed by a professional engineer.

### 312.9 Awnings or Overhangs.

- Awnings or overhangs over 4 feet wide shall be securely anchored to the foundation using framing anchors, posts, and post anchors rated to withstand uplift.
- Awnings and overhangs shall be designed to withstand 50 pounds per square foot uplift force.
- The uplift anchorage per post may be calculated using the following formula:

L = length of overhang

W = width of overhang

P = number of posts used.

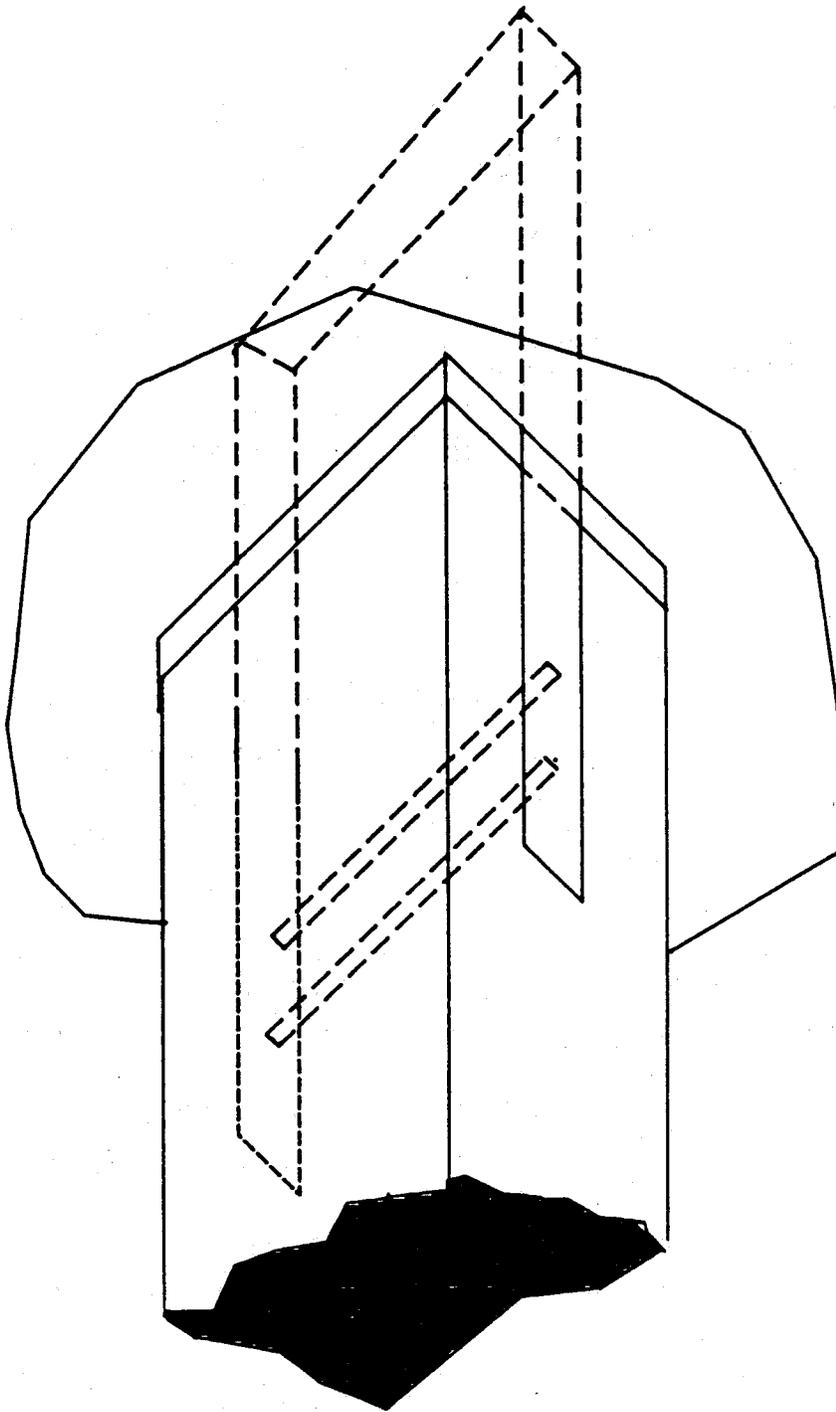
$$\text{Anchorage required per post} = \frac{L \times W \times 28}{P}$$

Or in plain English, the anchorage required per post is equal to the length of the awning times the width of the awning times 28 and that total divided by the number of posts intended to be used.

- An approved anchor shall be used at the top and bottom of each post or column. This anchor shall be rated for UPLIFT an amount at least as great as the calculated anchorage.
- Where two entire sides of the awning or overhang are supported by walls, the uplift anchorage per post may be calculated using the following formula:

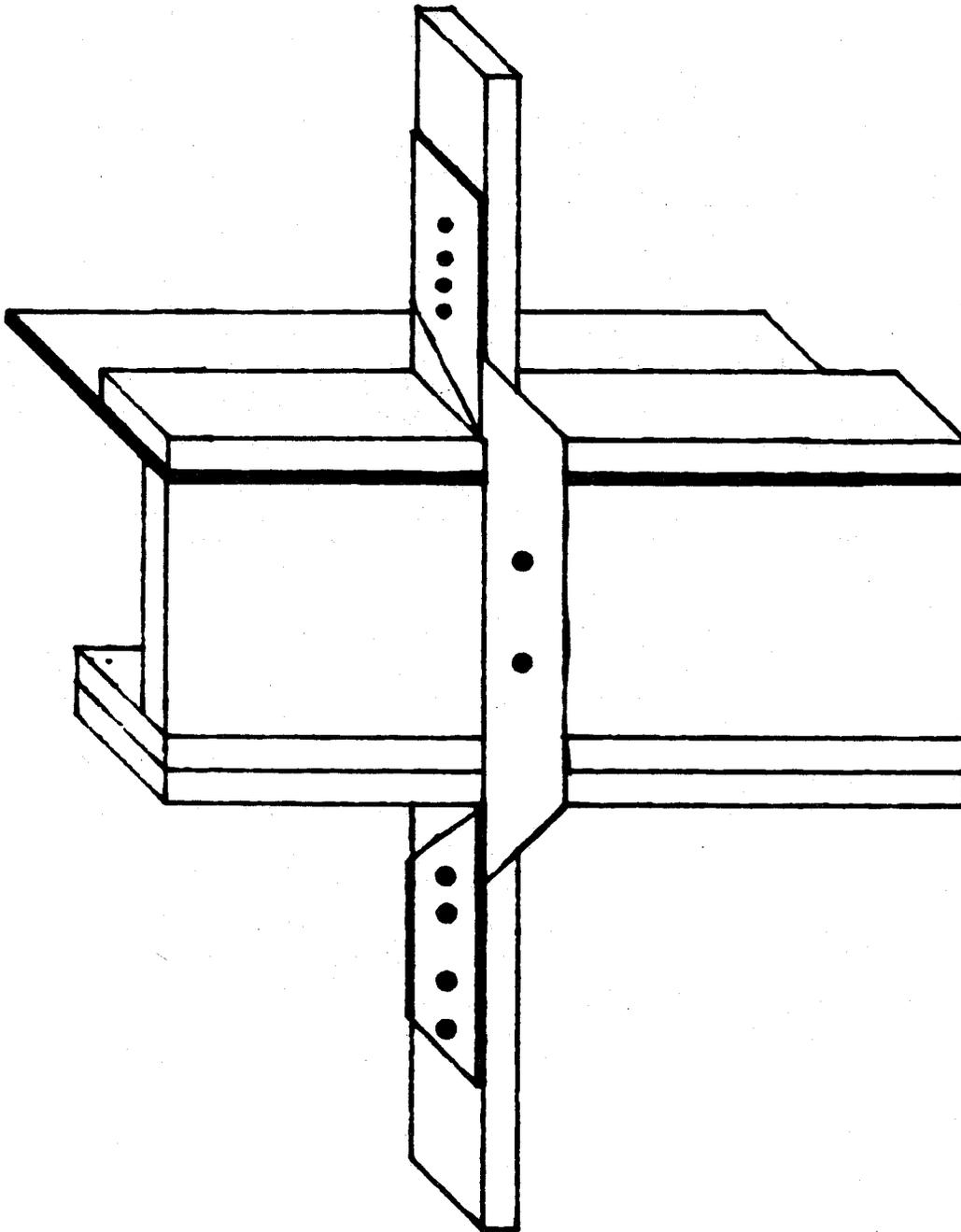
$$\text{Anchorage required per post} = \frac{L \times W \times 17}{P}$$

Figure 19. Anchoring Post to Slab



### 312.10 Two Story Wood Framing

- Two story structures shall have continuous anchorage from the studs of the top floor through the sole plate, flooring, band joist or joist header, and doubled top plate, to the studs of the lower floor.
- This is best accomplished by a single connector known as a floor tie anchor, which fastens directly to the studs of the upper and lower floors and connects them together. As an alternate, connectors known as hold down, anchor down, or tie down anchors will be accepted when anchors are bolted to the upper and lower studs, and then bolted together. When one of the above mentioned anchors is used, and that anchor is rated to provide a minimum of 1000 pounds anchoring force, one such anchor or set of anchors shall be installed as per the manufacturer's recommendation on every fourth pair of studs. Normal framing anchors are not required at locations where these anchors are used, but shall be installed at the top of upper studs being anchored in this way, and at the top and bottom of the second stud over from the stud being anchored in this way.
- An acceptable alternative to these anchors is to tie the floors together using a flat metal strap from stud across the band joist or joist header. When an approved metal strap is rated by its manufacturer to provide a minimum of 500 pounds anchorage, one such strap shall be installed as per the manufacturer's recommendations across every other pair of studs. There shall be a sufficient number of nails into the studs (not counting nails in band joist or joist header) to develop the rated strength. Straps shall be galvanized or otherwise corrosion resistant.
- Another acceptable method will be to use lag bolts to bolt the sole plate and top plates to the joist header or band joist. Lag bolts shall be a minimum of 3/8 inch in diameter and a minimum of 4 inches long where bolting through a sole plate and a minimum of 5 inches long where bolting through a doubled top plate. These lag bolts shall be spaced a maximum of 2 feet O.C., and shall be installed with a minimum of a one inch washer.
- A fourth method which will be accepted uses sheets of plywood to tie the floors together. The walls are completely sheathed in plywood, with the sheets staggered such that alternate sheets extend a minimum of 18 inches above the sole plate of the upper wall and the adjacent sheet extends a minimum of 18 inches below the top plate of the lower wall. See Figure 22. Plywood shall have a minimum thickness of 15/32 inch, and shall be nailed to the framing with 8d nails spaced every 4 inches along each stud within the first 18-20 inches from each plate, and along each plate, and nailed as for regular wall sheathing for the remainder of the wall.
- All of the above methods are in addition to the required nailing of the sole plate and top plates to the joist header or band joists using a minimum of 16d nails spaced 16 inches O.C.
- In addition to exterior walls having to be tied down, interior walls which carry uplift loads from the roof shall also be anchored down. Two ways this may be accomplished are as follows:
  1. Use a minimum of 3/8 inch lag bolts, minimum of 4 inches long, spaced a maximum of 4 feet O.C., to bolt the sole plate through the floor deck to a floor joist below,
  - or
  2. Cut small holes in the floor deck and use a strap over the sole plate to connect it to a floor joist below, also at 4 feet O.C.



**Figure 20. Tying Stories Together Using An Anchor**

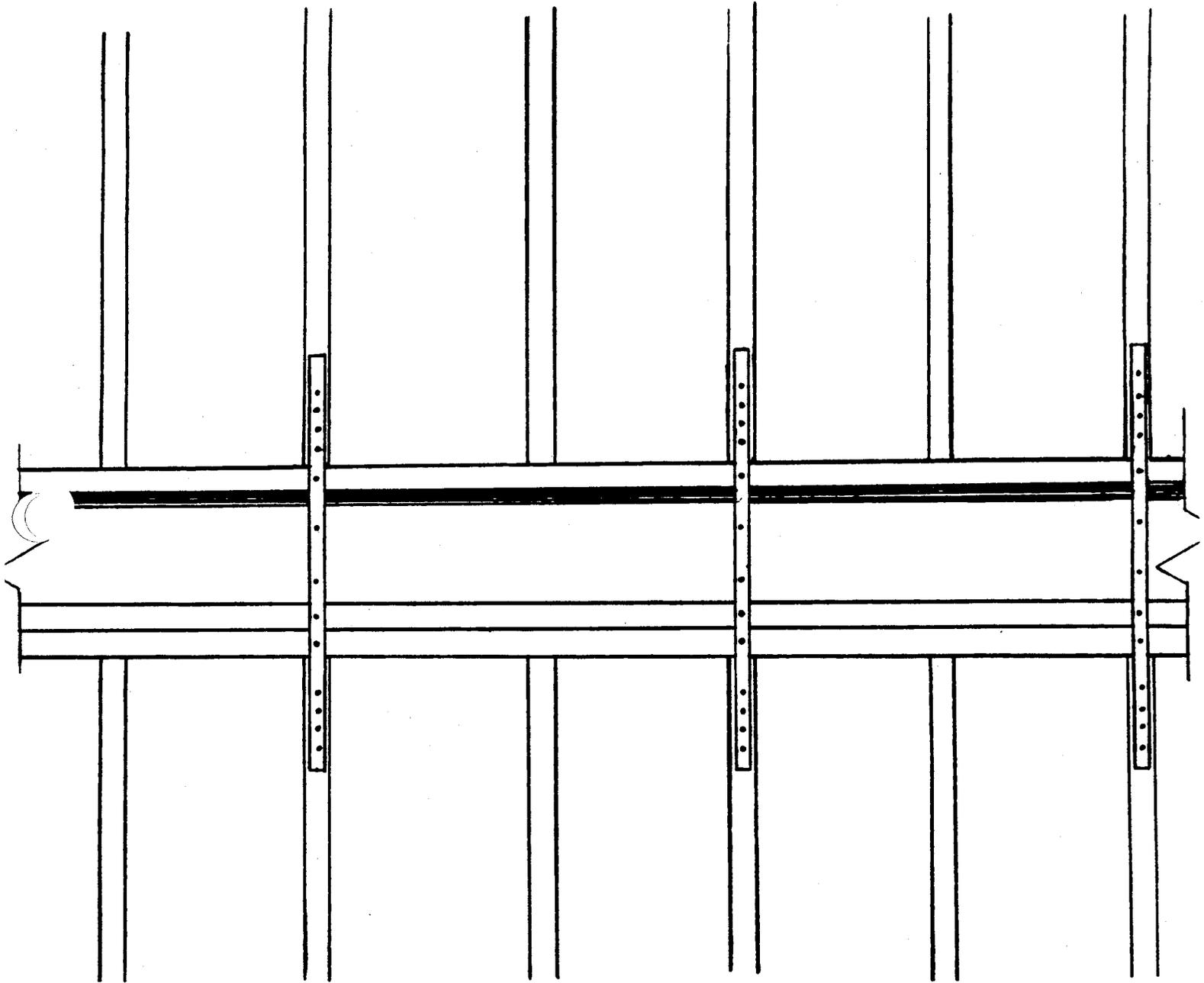


Figure 21. Tying Stories Together Using Straps

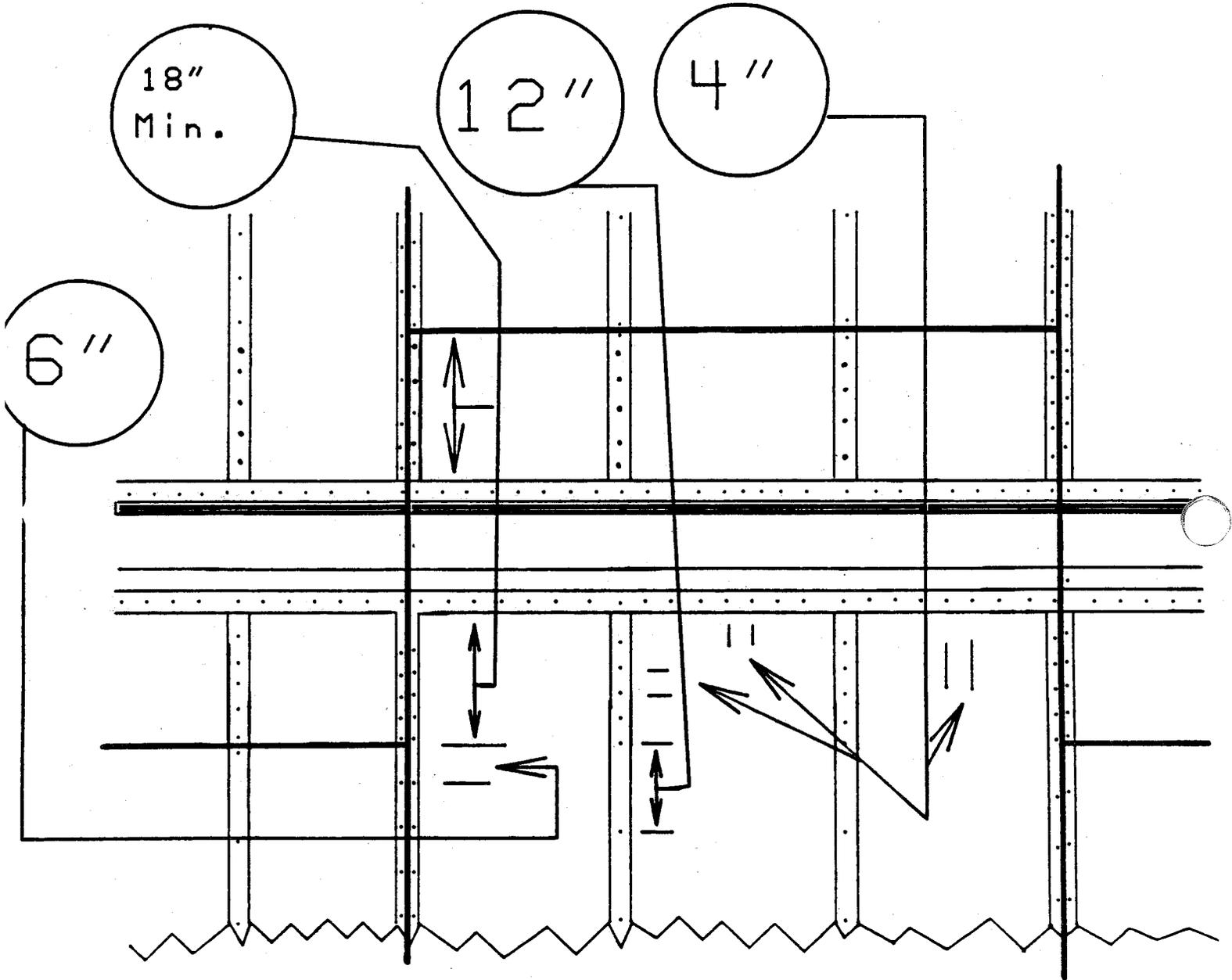


Figure 22. Tying Stories Together Using Plywood

**312.11 Notches and Holes in Joists**

- Notches on the ends of joists shall not exceed one fourth the depth.
- Holes bored for pipes or cable shall not be within two (2) inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one third the depth of the joist.
- Notches for pipes in the top or bottom of joists shall not exceed one sixth the depth of the joist and shall not be located in the middle third of the span.

**313 Exterior Coverings**

**313.1 Plywood Panel Siding (including 303 and T-111)**

- All siding must be properly rated by an approved agency for the application being used.
- Siding 1/2 inch thick or less shall be nailed to studs with 6d nails.
- Siding thicker than 1/2 inch shall be nailed to studs using 8d nails (this will include T-111).
- Nails shall be spaced every 6 inches along all panel edges and every 12 inches along all interior studs.
- Nails shall be hot dipped galvanized, stainless steel, aluminum, or electrically or mechanically galvanized steel with plating which meets or exceeds the thickness requirements of *ASTM A641 Class 2 coatings*.
- Building paper shall be installed if panels are applied directly to studs unless panel edges are shiplapped, battened, or caulked.
- Different sizes and spacing of fasteners may be required if the siding is being used as a shear wall.

**313.2 Lap Siding**

- Lap siding shall be fastened to each stud with 8d nails in compliance with the following table:

<u><b>NAILING OF BOARD SIDING-INLAND</b></u>	
<b>Width of Board</b>	<b>8d Nails Per Stud</b>
1 x 8 or less	Two Per Stud
Over 1 x 8	Three Per Stud

**Figure 23. Nailing of Board Siding**

- The recommendation of the siding manufacturer shall be followed if additional nailing is specified.

### **313.3 Brick Veneer or Stone Veneer**

- This section applies to non-load bearing brick or stone veneer only.
- Brick veneer shall be applied over properly rated solid wall sheathing (plywood, fiberboard, insulating board, etc.).
- Waterproof building paper shall be applied over the wall sheathing unless sheathing is water repellent.
- A moisture barrier such as flashing or felt shall be applied to at least the lowest 12 inches of the wall studs and shall extend under the brick starter course a minimum of one inch.
- Weep holes shall be provided in the bottom course of bricks at least every 4 feet.
- Provide a minimum 1 inch air space between masonry and wall sheathing.
- Masonry shall be tied to the wood framing with corrosion-resistant metal brick ties. Brick ties shall be spaced a maximum of 16 inches vertically along each stud when studs are spaced 16" O.C., and 12 inches vertically along each stud when studs are spaced 24" O.C.
- Veneer ties shall be minimum 22 gauge corrugated sheet metal, minimum number 6 gauge wire with a minimum of 2 inch hook embedded in mortar, or other equivalent fastener.
- Mortar shall be placed on sheet metal veneer ties to prevent wall from collapsing inward.
- Wall sheathing beneath brick veneer shall be applied in the same manner as for plywood siding, except that 16 gauge galvanized staples with a minimum 7/16 inch crown width and 2 inch leg lengths may be substituted for 6d nails, and 14 or 15 gauge galvanized staples with 7/16" crown width and 2 inch leg length may be substituted for 8d nails, where the sheathing is not used as a shear wall.

### **313.4 Stucco.**

- Stucco shall be applied over properly rated plywood wall sheathing, or other solid wall type, such as masonry.
- Building paper shall be applied over the wall sheathing.
- Lath for stucco must be galvanized or other approved corrosion resistant material.
- Lath shall be fastened with 8d galvanized nails, driven and clinched over, or 1 1/2 inch shingle nails with heads larger enough to prevent the lath from slipping over the nail head. Nails shall be spaced a maximum of 16 inches along each stud. As an alternate galvanized 16 gauge staples with a minimum 1 1/2 inch leg length and 7/16 inch crown width, spaced every 6 inches horizontally and vertically, may be used to fasten lath.
- The finished stucco shall have a minimum thickness of 5/8 inch.

### **313.5 Vinyl, Aluminum, and Steel Siding.**

Vinyl, aluminum, and steel siding shall be installed as per the manufacturer's recommendation for high wind areas. Contractor shall furnish manufacturer's specification upon request. Documentation by testing may be required. Contact the local field office for approved types and applications.

### **313.6 Attic Vents**

For gabled and hipped roofs, ventilation shall be provided to furnish cross ventilation of each separate space with weather protected vents. Flat roofs shall be ventilated along the overhanging eaves. Equal vent areas should be placed on opposite sides of the structure to allow cross-ventilation.

### **313.7 Roof Decking and Roof Covering**

Refer to Section 370, Roofing, for requirements applicable to roof decking and roof covering.

## ***314 Mechanical and Exterior Equipment***

### **314.1 Exterior Air Conditioner Equipment**

- All exterior air conditioning equipment shall be securely fastened to either the adjacent structure or to a suitable pad or platform.
- Square units shall be fastened at a minimum of four locations. Round units shall be fastened at a minimum of three locations.
- Concrete pads shall weigh a minimum of 90 pounds. If all sides and the top of the air conditioner unit are not open, a heavier pad will be required.
- The unit shall be secured to the pad with cast in place anchor bolts, powder actuated fasteners, or drilled anchor bolts. A minimum of 22 gauge galvanized steel straps may also be used to anchor units to pads.
- If the air conditioner unit is to rest on a cantilevered platform built on to an elevated structure, the cantilever beams shall extend under (or into) the structure a minimum of twice as far as the beams extend out. Beams shall be securely nailed or fastened to floor joists or other suitable structural members.
- Wood platforms built to stand alone will also be accepted if they are properly constructed to withstand wind loads and are adequately anchored to the ground.
- In all cases, air conditioner units must be correctly bolted to their platform.
- Air conditioner equipment on top of built-up roofs shall be securely fastened to a platform or blocking which is, a a minimum, embedded in hot asphalt, or anchored in another approved method.

### **314.2 Other Exterior Equipment**

All other exterior equipment, such as floodlights, turbine vents, propane tanks, swimming pool filters, and water cooling towers, shall be sufficiently anchored to the structure or an adequate foundation to resist applicable wind loads.

## 320 Masonry Construction-Inland

The following will apply to one and two story rectangular masonry structures.

### 321 Foundation

- Masonry structures shall only be constructed on slab-on-grade type foundations.
- Slab shall be reinforced.
- 1/2 inch diameter (no. 4 bar) tie-downs shall be embedded a minimum of 6 inches into the footing and shall have a standard 90 degree hook in each end.
- Tie-downs shall be spaced as per Section 322.
- When tie-downs are spliced, foundation tie-downs shall lap wall tie-downs a minimum of 15 inches.

### 322 Masonry Walls

#### 322.1 General Requirements

- Masonry units shall have a minimum nominal thickness of 8 inches, except 6 inch solid masonry blocks may be used for walls a maximum of 8 feet high.
- Type M or S mortar shall be used.
- A bond beam of the size specified shall be provided at all floor levels and at the roof level.
- Vertical tie-downs consisting of a minimum of one no. 4 bar shall be provided, and shall be spaced as per Section 322.2 or 322.3.
- Tie-downs shall be embedded a minimum of 6 inches into the top bond beam with a 90 degree hook in the end. The bond beam tie-down and the wall tie-down shall be lapped a minimum of 15 inches.
- Corner cells of one-story walls shall have one tie-down in them. Corner cells of two-story walls shall have two no. 4 bars in them or one bar each in the two cells nearest the corner.
- Cells or cavities containing tie downs shall be completely filled with grout.
- If stack bond is used, a minimum of 9 gauge joint reinforcement shall be placed in every other course.

**322.2 Solid Masonry**

- Bond beams shall be cast in place and shall have a minimum width of 5-1/2 inches (or width of wall) and a minimum height of 8 inches.
- Bond beams shall be reinforced with two #5 (5/8") bars (one each top and bottom, located 1-1/2 inches from the top and bottom of bond beam).
- Vertical tie-downs shall be spaced a maximum of 8 feet apart, with tie-downs spaced as evenly as possible if closer spacing is used.
- Vertical tie-downs may be spaced up to 11 feet apart if 12 inch high bond beams are used, with reinforcement as above.

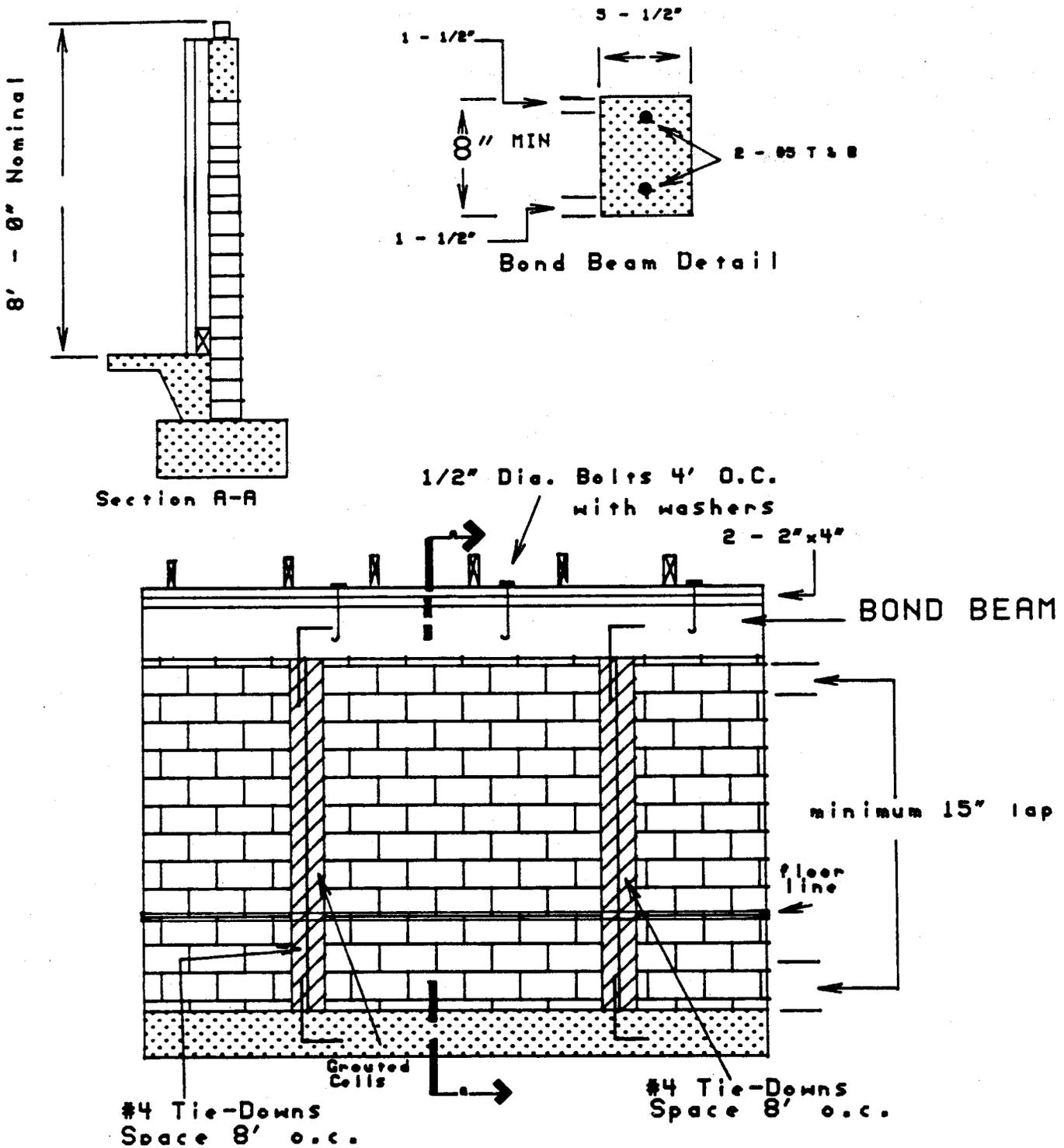


Figure 24. Solid Masonry Walls

### **322.3 Hollow Masonry**

- Bond beams shall be filled masonry units having a width of 7-5/8 inches and a height of 7-5/8 inches at a minimum.
- Bond beams shall be reinforced with two no. 5 (5/8") bars (one each at top and bottom of filled portion of masonry unit, with top bar 1-1/2 inches below the top of bond beam).
- As an alternate, two no. 4 bars may be substituted for EACH no. 5 bar (4 bars total required).
- Vertical tie-downs shall be spaced a maximum of 4 feet apart, with tie-downs spaced as evenly as possible if closer spacing is used.
- Vertical tie-downs may be spaced a maximum of 8 feet apart if the bond beam consists of two filled masonry units, with one no. 5 bar in the bottom of the lower filled masonry unit, and another no. 5 bar 1 1/2 inches from the top in the top filled masonry unit (or two no. 4 bars in each of those locations - 4 in all). When the bond beam consists of two filled masonry units, the upper and lower units shall be tied together.

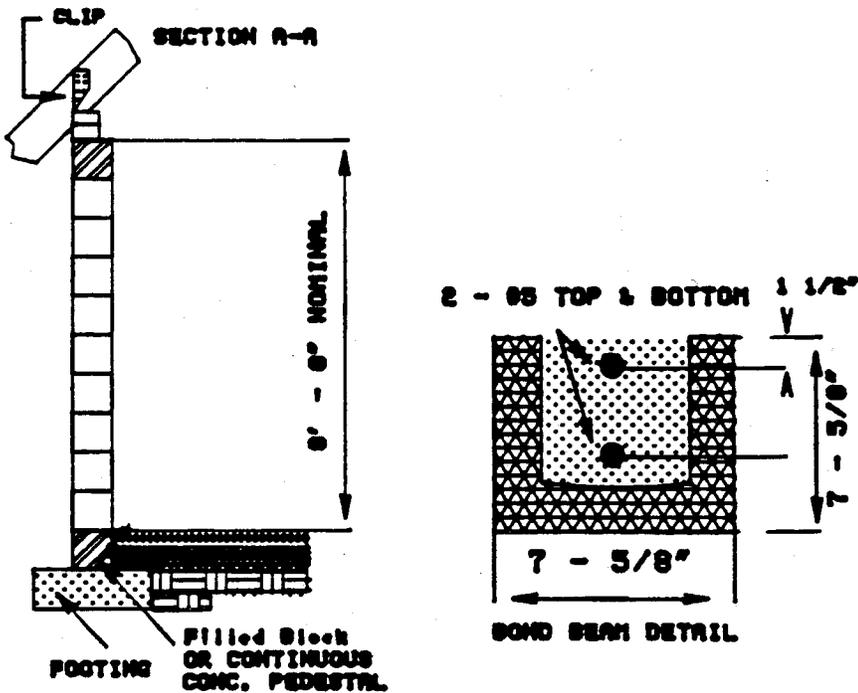
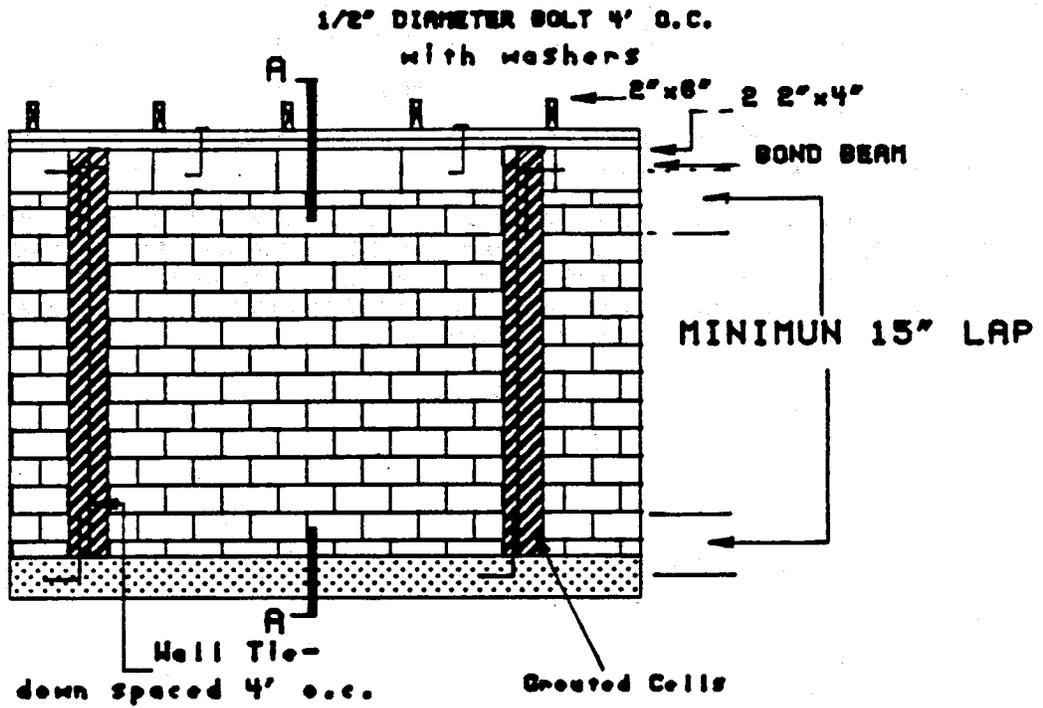


Figure 25. Hollow Masonry Walls

### 322.4 Roof Framing to Exterior Wall Masonry Connections.

Roof framing members shall be anchored to the exterior masonry wall bond beam by one of the following methods. Anchors and ties shall be so arranged as to form continuous ties between opposite masonry walls.

#### 322.4(a) Top Plate Bolted to Exterior Wall

- The top plate shall be bolted to the bond beam with 1/2 inch bolts embedded a minimum of 6 inches into the bond beam.
- A minimum of 1-3/8 inch diameter by 1/8 inch thick washers shall be used.
- The top plate shall consist of one 2 x 6 or two 2 x 4's bolted every 48 inches to the bond beam below.
- At least one beam, joist, rafter, or truss in every 4 feet and every trimmer shall be anchored to the top plate (or both plates) with an approved corrosion-resistant framing anchor (hurricane clip). Refer to Section 312.3. Depending upon the design, every truss may have to be anchored to the top plate.
- Beams, joists, girders, or other concentrated loads shall have at least 4 inches of bearing on the top plate.

#### 322.4(b) Roof Framing Members Connected Directly to Bond Beam at Exterior Wall

- At least one beam, joist, rafter, or truss in every 4 feet and every trimmer and girder shall be anchored to the bond beam using manufactured fasteners approved for such use. Fasteners shall be rated to provide a minimum of 500 pounds resistance to uplift. Fasteners shall also be capable of resisting lateral loads. Fasteners shall be installed as per the manufacturer's recommendations. Depending upon the design, every truss may have to be anchored to the bond beam.
- Beams, joists, girders, or other concentrated loads shall have at least 4 inches of bearing on solid masonry wall.

### 322.5 Other Roof Framing Connections

- Where beams, girders, joists, rafters and trimmers rest on interior walls and columns, they shall be anchored in conformance with either Section 322.4(a) or Section 322.4(b). Where interior walls have no bond beam on top, framing members may be anchored using 1/2 inch bolts or straps embedded a minimum of 15 inches into the masonry.
- Each end of a trimmer, beam, or joist that is supported by a girder shall be supported or tied in an approved manner to such girder or to the trimmer, beam, or joist correspondingly supported from the opposite side of such girder.
- Where roof joists or beams run parallel to masonry walls, the walls shall be tied to at least the first 4 adjacent joists or beams with metal ties securely fastened to each joist or beam and embedded in the wall. The maximum spacing of these ties shall be 8 feet for residential structures and 6 feet for other structures.

### **322.6 Floor Framing Members**

- At least one floor joist, beam, or other floor framing member in every 6 feet shall be anchored to the masonry wall with an approved metal anchor. These members shall provide continuous ties across the structure to the opposite masonry wall.
- When floor joists or beams run parallel to masonry walls, the walls shall be tied to at least the first 4 adjacent joists or beams with metal ties securely fastened to each joist or beam and embedded in the wall. The maximum spacing of these ties shall be 8 feet for residential structures and 6 feet for other structures.

### **322.7 Openings**

- Masonry above any openings shall be supported by either a well buttressed arch, a masonry bond beam, or a lintel of corrosion-resistant metal.
- Openings 6 to 12 feet wide shall have reinforcement consisting of one no. 5 bar on each side in the masonry. Openings larger than 12 feet wide shall have two no. 5 bars or one no. 7 bar located on each side in the masonry. Cavities or cells containing reinforcement shall be completely filled with grout. Bars shall be lapped with tie-downs in the bond beam and the foundation.

### **322.8 Masonry Veneer**

- Masonry veneer shall not be assumed to carry any load other than its own weight.
- Masonry veneer shall be tied to the masonry wall using corrosion-resistant metal ties spaced a maximum of 16 inches O.C. vertically and horizontally.
- Veneer ties shall be 22 gauge (or greater) corrugated sheet metal, or number 6 gauge (or greater) wire.
- Ties shall be embedded in the mortar of both the wall and the veneer.
- Mortar shall be placed on sheet metal ties to prevent the veneer from collapsing inward.

## ***323 Exterior and Mechanical Equipment.***

All exterior and mechanical equipment which is exposed shall be anchored in conformance with Section 314.

## **330 Metal Construction-Inland**

### ***331 Manufactured Metal Structures***

Manufactured metal buildings and other structures shall be designed by a Texas registered professional engineer for the wind loads specified in the introduction. Refer to **Section 140** to determine what types of metal buildings the State Board of Insurance will inspect. The contractor shall furnish a certificate of design and installation instructions to the State Board of Insurance. Installation instructions shall be followed exactly. The foundation is considered to be part of the structure, and therefore must be part of the original approved design. Installation of mechanical and exterior equipment shall comply with **Section 314**. The local field offices or the engineering staff may be contacted for further information.

### ***332 Other Metal Structures***

Other metal structures should be designed with the aid of a professional designer. Submittal of design calculations for approval will be required in most cases, or certification by a Texas registered professional engineer will be required.

## 340 Miscellaneous Construction-Inland

This section deals with several miscellaneous types of construction.

### 341 Pole Barns

This section applies to structures which have a frame consisting of vertical poles set in the ground and horizontal girts fixed to the poles. It is intended to apply only to such structures having a height less than 20 feet.

- Poles shall be treated with an approved wood preservative.
- Poles shall be buried a minimum of 5 feet, with concrete poured around the entire buried portion of the pole.
- Poles shall be spaced a maximum of 10 feet apart.
- Spacing of girts shall conform to **Figure 27**.
- Fastening of girts to poles and of plywood siding to girts shall comply with **Figure 26**.
- Girts may be fastened using either nails, through bolts with washers, or lag bolts with washers.
- The remainder of the structure shall comply with any applicable portion of **Section 310, Wood Frame Construction**.

*Note:* Figure References **26** and **27** pertain to the figures on the following pages.

**Figure 26. Pole Barns-Fastening Schedule**

**Figure 27. Pole Barns-Maximum Span of Horizontal Girts**

Center To Center Spacing of Girts	FASTENING											
	Girts To Poles				FASTENING				Plywood Siding To Girts			
	Minimum Nail Size	Minimum Washer Size	Minimum Thru Bolt Diameter	1/4" Dia	Minimum Lag Bolt Dia	5/16" Dia	3/8" Dia	7/16" Dia	1/2" Dia	Maximum Spacing Between Fasteners 6d Nails	8d Nails	16 Ga. Staples 1 1/2" Minim Leg Length
8"	2-20d or 3-16d or 3-12d	5/8"	1/4"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	24"	24"	24"
10"	3-20d or 3-16d or 4-12d	3/4"	1/4"	3"	3"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	24"	24"	16"
12"	3-20d or 4-16d or 4-12d	1"	1/4"	3"	3"	3"	3"	3"	2 1/2"	24"	24"	16"
14"	4-20d or 4-16d	1"	1/4"	3"	3"	3"	3"	3"	3"	16"	24"	16"
16"	4-20d	1"	1/4"	4"	3"	3"	3"	3"	3"	16"	16"	12"
18"	4-20d	1 1/4"	5/16"	N/A	4"	3"	3"	3"	3"	16"	16"	12"
20"	N/A	1 1/4"	5/16"	N/A	4"	3"	3"	3"	3"	16"	16"	10"
22"		1 1/2"	5/16"	N/A	4"	3"	3"	3"	3"	16"	16"	8"

First Printing

Staples shall have a minimum 7/16" crown width. Nails shall be staggered to avoid splitting of the wood. Where one or more sides are open, the following shall apply:

1. Maximum fastener spacings for fastening siding to girts shall be reduced one-half
2. Bolt diameters shall be increased a minimum of 1 inch.
3. Nails shall not be used.

# POLE BARNs

(All Four Sides Closed)

## MAXIMUM SPAN OF HORIZONTAL GIRTS (DISTANCE BETWEEN POLES)

Center to Center Spacing of Girts	Size and Grade of Lumber								
	2 X 4			2 X 6			2 X 8		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
8"	10'-0"	10'-0"	7'-11"	10'-0"	10'-0"	9'-4"	10'-0"	10'-0"	10'-0"
10"	10'-0"	9'-7"	7'-1"	10'-0"	10'-0"	8'-4"	10'-0"	10'-0"	9'-7"
12"	9'-6"	8'-9"	6'-5"	10'-0"	10'-0"	7'-7"	10'-0"	10'-0"	8'-9"
14"	8'-9"	8'-1"	5'-11"	10'-0"	9'-4"	7'-1"	10'-0"	10'-0"	8'-1"
16"	8'-3"	7'-7"	5'-7"	9'-7"	8'-9"	6'-7"	10'-0"	10'-0"	7'-7"
20"	7'-4"	6'-9"	5'-0"	8'-7"	7'-10"	5'-11"	9'-11"	8'-11"	6'-9"
22"	7'-0"	6'-5"	4'-9"	8'-2"	7'-5"	5'-7"	9'-5"	8'-6"	6'-5"
24"	6'-8"	6'-2"	4'-6"	7'-10"	7'-1"	5'-4"	9'-0"	8'-2"	6'-2"

*Maximum spans shall be reduced 30% (multiplied by 0.7) for with one or more open sides.*

*Interpolation (averaging) is permissible.*

First Printing

### ***342 Patio Covers***

Manufactured metal patio covers, awnings, and covered walkways shall be treated in the same manner as metal buildings. These structures shall be designed to meet the wind loads specified in the Introduction.

- The contractor shall furnish a certificate of design and installation instructions to the State Board of Insurance.
- Installation instructions shall be followed exactly.
- Structures which are not designed for the proper wind loads will not be approved.
- Wood patio covers shall comply with Section 312.9.

### ***343 Boat Houses, Docks, and Piers (Over Water)***

Boat houses, docks, piers, and other structures built over water are specifically excluded from the T.C.P.I.A. Windstorm insurance policy. However, for an additional cost they may be added to the policy. Therefore, if these structures are to be insured, they must be inspected and approved by the State Board of Insurance, and they should be built to the following guidelines.

- Pilings which support boat houses, docks, and piers shall be buried a depth below the ground (ocean floor or channel bottom) at least equal to the height the lowest structural member is above that ground level.
- The minimum bury depth shall be 5 feet.
- The remainder of the structure may be built by either conventional framing or pole type framing (similar to the pole barn). All applicable previous guidelines shall be followed.
- Walkways or other structures which connect structures built over water to the main structure should be constructed so that if the structure over water should be destroyed by flooding, the part connected to the main structure will break away without causing damage.

### ***344 Mobile Homes and Manufactured Housing***

- Mobile homes and manufactured housing do not fall in the scope of the State Board of Insurance Windstorm Inspection program. Please contact the T.C.P.I.A. concerning coverage for these types of structures.
- A mobile home is defined as a structure, transportable in one or more sections, which is eight body feet or more in width, and is 32 body feet or more in length, which is built on a permanent chassis and is designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein.

### ***345 Portable and Temporary Buildings***

- Portable and temporary buildings shall be anchored by one of the methods outlined in Section 311.3.
- Conventionally framed portable and temporary buildings shall follow the guidelines set forth in Section 312.

*First Printing*

- Metallic portable and temporary buildings shall follow the guidelines set forth in **Section 330**.
- Roofing of portable and temporary buildings shall follow the guidelines set forth in **Section 370**.
- Mechanical and exterior equipment for portable and temporary buildings shall follow the guidelines set forth in **Section 314**.

### ***346 Other Miscellaneous Structures***

Any other type or shape of structure not covered here or elsewhere should either be built to all other applicable guidelines, or should be designed and inspected by a Texas registered professional engineer.

## **350 Additions-Inland**

- All additions constructed after January 1, 1988, must be inspected and approved by the State Board of Insurance or a Texas registered professional engineer in order to maintain the insurability of the existing structure.
- The construction of additions shall comply with the applicable portions of this manual.
- Where new additions are attached to the existing structure and rely upon that structure for support, the two structures shall be securely anchored at the point of connection.
- The portions of the existing structure which carry loads from the addition should be constructed in accordance with the recommendations of this manual. Also, any portions of the existing structure which becomes exposed due to the addition should be made to comply with Section 312.3. The remainder of the existing structure will not be required to meet the construction guidelines unless it is altered in some way.
- When a second story is being added to an existing single story structure, the addition and any other structural components of the existing structure which carry loads from the addition shall comply with all applicable previous guidelines. The second story shall be securely anchored to the first story. Additional pilings or other supports will have to be installed if the original structure is not adequate to support the new addition.
- When a patio or porch is added to a structure, all applicable guidelines shall be followed. Please note that this will require the foundation of a porch, especially an elevated porch, to be built to the same guidelines as for a normal foundation.

## **360 Renovation and Repair-Inland**

All repairs to any load-bearing portion of a structure or to any exterior component of a structure shall be inspected in order to maintain the insurability of the entire structure, except as noted in Section 361. Renovations and repairs shall comply with the following guidelines.

### **361 Foundation**

#### **361.1 Slab on Grade Foundation**

- All but minor repairs of a slab on grade foundation shall be certified by a Texas registered professional engineer.

#### **361.2 Piling Foundation**

- Unless previous guidelines outlined in Section 311.2 can be followed exactly, renovation or repair of a piling foundation shall be certified by a Texas registered professional engineer.

#### **361.3 Pier and Beam Foundation**

- When repairing piers or beams, previous guidelines should be followed. If it is impossible to provide continuous anchorage from beam through pier to footing, alternate methods may be approved. Two of these are as follows:
  1. Construct an anchor between each pier. (Maximum of 8 feet apart). This is accomplished by digging a 3' x 3' x 3' hole and filling it a minimum of 1' deep with concrete. Embed a corrosion resistant length of angle iron or 4" x 4" (minimum) treated lumber into the concrete and fasten it to the beam with a minimum of two 1/2 inch bolts. The angle iron or lumber shall be securely anchored to resist uplift. Fill in hole over concrete.
  2. Approved mobile home tie-down system may also be used. At least one tie-down should be installed at each pier around the perimeter of the structure, with a minimum of one for each six feet of length of each wall.
- When replacing or repairing less than 25% of piers or beams on structures constructed prior to June 1, 1972, guidelines will not have to be followed as long as the member is being replaced with an equivalent member.
- Contact local field office or State Board of Insurance engineering staff for approval if other methods are to be used.

### ***362 Framing***

All framing repairs and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

### ***363 Exterior Covering***

All exterior covering repair and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

### ***364 Mechanical Equipment***

All mechanical equipment related repair and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

## **370 Roofing-Inland**

### ***371 New Roofing***

#### **371.1 Composition Shingle Roof**

A new composition shingle roof shall be applied in the following manner.

##### **371.1(a) Roof Deck**

- Roof decking shall be *APA (American Plywood Association)* or *TECO (TECO Products and Testing Company)* rated sheathing or properly graded wood boards laid to form a solid wood deck.
- Board decking shall have a minimum nominal thickness of 1 inch.
- End joints between boards shall be located over the centers of rafters, and each end shall be nailed with the proper number of nails.
- Board decking shall be 1 X 4 or 1 X 6 lumber.
- Board decking shall be nailed with two 8d galvanized nails at each support.
- Sheathing panels shall have a minimum rating of 24/16. This corresponds to a minimum thickness of 15/32 inch for plywood, and 7/16 inch for waferboard or oriented strand board. For this type of deck, 24 inches O.C. shall be the maximum spacing of rafters or roof trusses.
- End joints shall occur over the center of rafters.
- End joints of adjacent courses shall be staggered.
- Roof sheathing panels shall be oriented with their long dimension across the rafters.
- There shall be a 1/8 inch space maintained between the panels.
- Panel roof decking shall be nailed with galvanized 8d nails 6 inches O.C. along the edges of the panel, and 12 inches O.C. along all interior supports.
- As an alternate, the following table may be followed if galvanized staples are used:

<b>STAPLING OF PLYWOOD ROOF DECK TO RAFTERS</b>				
<b>(Inland of Intracoastal Waterway Only)</b>				
<u>Gauge</u>	<u>Minimum Staple Size</u>		<u>Fastener Pattern</u>	
	<u>Leg Length</u>	<u>Crown Width</u>	<u>Edges</u>	<u>Interior Supports</u>
14	2-1/8"	7/16"	6" O.C.	12" O.C.
15	2-1/2"	7/16"	6" O.C.	12" O.C.
16	1-1/2"	7/16"	4" O.C.	4" O.C.

*NOTE: Longer leg length will have to be used if plywood is thicker than 1/2 inch.*

**Figure 28. Stapling Roof Deck to Rafters**

- Fasteners shall not be overdriven.

**371.1(b) Underlayment**

- For roof slopes of 4 in 12 or greater; decking shall be covered with a minimum of one layer of 15 pound felt.
- For roof slopes less than 4 in 12, the decking shall be covered with a minimum of two layers of minimum 15 pound felt.
- Felt shall only be applied when the deck is dry.
- Felt shall be lapped 2 inches along the top and bottom, and 4 inches along the ends when applied in a single layer.
- Felt shall be lapped 18-19 inches along the top and bottom and 4 inches along the ends when two layers are applied.
- Felt shall be fastened down with enough nails or staples to hold it down until the shingles can be applied. Aluminum caps may be used only if aluminum nails are used.

**371.1(c) Composition Shingles**

- Composition shingles shall be applied as per the manufacturer's published specifications for high wind areas. The 1973 Standard Building Code defines the area within 125 miles of the coast as a high wind area. For the purpose of this program, this will only apply to the 14 coastal counties listed in the introduction of this construction guide.
- If the manufacturer does not specify an application for high wind areas, each shingle shall be fastened using six nails, or staples. All nails shall be installed on the original nailing line. The fastener nearest the right and left edge shall be installed in the location specified by the manufacturer. For three-tab shingles, the remaining nails shall be placed on the nailing line, one on each side of the cut out which separates the tabs. For no-cutout or random-tab (dimensional) type shingles, the remaining four nails shall be evenly spaced along the nailing line. This requirement shall not apply to interlocking-type shingles.

### *First Printing*

- Other products or fastening methods will be accepted if supporting test data from an approved testing laboratory is submitted to the State Board of Insurance. Testing criteria shall comply with the wind loads specified in Section 120.
- Fasteners shall be roofing nails or staples, as specified by the manufacturer.
- Fasteners shall be galvanized steel or other corrosion resistant material.
- Fasteners shall have adequate penetration into the roof deck, but **MUST NOT BE OVER-DRIVEN**. Overdriven fasteners will **NOT** be approved.
- Fasteners shall be driven in straight, not at an angle.
- Roofing nails shall be 11 or 12 gauge nails with large heads (3/8 inch to 7/16 inch in diameter). Nails shall be long enough to penetrate through the shingle and felt and at least 3/4 inch into the roof deck lumber or completely through the plywood roof deck. *The Asphalt Roofing Manufacturer's Association* recommends 1 1/4 inch long nails for asphalt shingles over new wood decks.
- Staples shall be minimum 16 gauge, with a minimum crown width of 15/16 inch. Staple legs shall be long enough to penetrate at least 3/4 inch into a plywood roof deck or roof decking lumber (generally 1 1/4 inch long).
- Staples shall be driven with the crown parallel to the length of the shingle.
- If a metal drip edge is placed around the perimeter of the roof, it shall be securely fastened to the deck with galvanized nails spaced 10 inches O.C, or galvanized 16 gauge staples with a minimum 1-1/2 inch leg length, spaced 6 inches O.C.

### **371.2 Wood Shingle or Shake Roof**

A new wood shingle or shake roof shall be applied in the following manner.

#### **371.2(a) Spaced Boards**

- Wood shingles or shakes should be applied to spaced board sheathing, although solid sheathing may also be accepted.
- Spaced boards shall have a minimum nominal thickness of one inch.
- Spaced boards shall be nailed to the rafters with two 8d galvanized nails at each intersection.
- Rafters shall be spaced a maximum of 24 inches on center.
- Spacing of boards will depend upon the shingle exposure.
- Nailing of solid sheathing shall comply with Section 371.1(a).

#### **371.2(b) Wood Shingles or Shakes**

Wood shingles or shakes shall be installed as per the manufacturer's recommendation. The following are some general guidelines to follow unless otherwise recommended.

- The exposure used must provide a minimum of three layers of shingles over all areas of the roof.
- Leave approximately 1/4 inch to 3/8 inch gap between adjacent shingles and 3/8 inch to 5/8 inch gap between adjacent shakes to allow for expansion.

### First Printing

- Each overlapping course shall cover the gaps in the course below, with the gaps in the overlapping course being at least 1-1/2 inches from the gaps in the lower course.
- Fasten each shingle or shake with two corrosion resistant nails. These nails should be located 1 to 1-1/2 inches above the butt line of the overlapping course, and no more than 3/4 inch in from each side of the shingle or shake.
- When applying wood shakes, an 18 inch strip of 30 pound felt is placed over the top third of each course of shakes.

### 371.3 Tile Roofs

Due to the fact that different brands of roofing tiles are made from different materials, there can be no single approved method for applying tile roofs. Each manufacturer must submit test reports or other approved justification for their particular recommended method of application.

The following are two acceptable methods of installing *Lifetile* tile roofs. The first is based on a test report submitted by *Lifetile*. The second method is based on a procedure accepted by the *Southern Building Code Congress* through the *National Evaluation Service*. One of these two methods shall be used to apply *Lifetile* tile roofs. These methods do not apply to any other brands of tile roofing.

#### 371.3(a) Method 1

The following requirements are taken from a test report submitted by *Lifetile* and apply to *Lifetile* tile roofs only. Installation of other brands of tile will require submittal of test reports to justify installation method.

- A solid roof deck shall be applied as per Section 371.1(a), except that the additional weight of a tile roof may require stronger roof sheathing and larger roof framing members.
- A minimum of one layer of 30 pound felt shall be applied to the roof deck.
- 1 x 2 pressure treated pine battens shall be installed with galvanized 6d nails spaced 8 inches O.C. Cedar battens are not acceptable.
- The eave closures and valley flashing shall be attached to the deck with galvanized 6d nails spaced 12 inches O.C.
- The eave closures shall be bedded to the felt with roofing cement.
- Any vent-stack boots shall be bedded to the felt with roofing cement and sealed to the surrounding tiles with mortar.
- Rake tiles (tiles at edges of gable roofs) shall be nailed with two 10d annular ring shank copper nails and sealed to the adjoining tiles with mortar. Clips may also be used as a substitute for mortar.
- Tiles at hips and ridges shall be sealed with mortar.
- Tiles at valleys shall be sealed to adjoining tiles with roofing cement.
- Where nails are in contact with mortar, nails shall be 10d copper annular ring shank nails with a 9/16 inch diameter by 1/8 inch thick rubber washer.
- Where nails are not in contact with mortar, nails shall be 10d annular ring shank galvanized steel roofing nails with a 9/16 inch diameter by 1/8 inch thick rubber washer.
- The number of nails used depends on the type of tile being installed.

*First Printing*

*España Mission Tile* (or similar S-type concrete roof tile, having approximate dimensions of 17" x 12-3/8" x 1/2" thick) shall be nailed to the battens with one nail per tile.

*Colonial Slate Tile* (or similar flat concrete roof tile having approximate dimensions of 17" x 12-3/8" x 1/2" thick) shall be nailed to the battens with two nails per tile.

**371.3(b) Method 2 (Alternate)**

- Foreign particles shall be cleaned from all interlocking areas of tiles.
- Cracked or broken tiles shall not be installed.
- Solid roof decking and roof framing shall be installed as per previous guidelines.
- Battens shall be installed whenever the roof sheathing is less than 3/4 inch thick. Battens shall also be installed when the roof pitch is below 3:12 or exceeds 7:12.
- Battens shall be 1 X 2 pressure treated pine. Cedar battens are not acceptable.
- Battens shall be installed with 8d corrosion resistant steel nails into each rafter (maximum of 24 inches O.C.).
- On pitches below 2:12, tiles are considered decorative and shall be installed over an approved roof covering, such as built-up or roll roofing.
- On pitches of 2:12 to 3:12, an approved built-up roof consisting of two plies of 15 pound felt hot mopped between layers shall be installed over the solid roof sheathing. Then nominal 3/8 inch redwood lath strips are installed vertically from eave to ridge at 24 inches O.C. and nailed to the deck. Then the entire deck is top mopped. Then 1 X 2 horizontal battens are installed and fastened at each intersection to the vertical strips with one 8d corrosion resistant steel nail. When nailing tiles, the nails shall penetrate the batten but not the roof membrane.
- On pitches of 3:12 to 4:12, underlayment shall be one layer of Type 40 asphalt-coated base sheet. Either counterbattens shall be installed as above, or 2 inch square shims cut from asphalt shingles shall be placed between the batten and the deck where nailing at 24 inches O.C.
- On pitches of 4:12 or greater, underlayment shall be a minimum of one layer of 30 pound felt, installed with a minimum of 2 inches head lap and 4 inches end lap. Batten ends shall be separated 1/2 inch every 4 feet for drainage, or asphalt shims must be installed as above.
- Valley flashing shall be a minimum 28 gauge corrosion resistant metal, extending at least 11 inches from the valley center line each way. Flashing end laps shall not be less than 4 inches.
- Flashing shall be installed with galvanized 6d nails spaced a maximum of 12 inches O.C.
- Openings through tile for vents, pipes, skylights, chimneys, etc. shall be adequately weatherproofed with flashing. Flashing for *España, Capri, or Sentry Classic* tiles shall be of lead, aluminum, or other approved flexible material and shall be formed to the contours of the tile.
- When installing *España Mission, Capri, Chateau, and Sentry Classic* styles of tile, "Lifetile Weatherblock Strip", mortar, or roofers cement shall be used at ridge, hip, and wall intersections to provide a weather block. For these tiles, an eave closure strip shall also be installed by nailing to the deck with galvanized 6d nails spaced 12 inches O.C., and bedding the strip to the felt with approved roofers cement.
- Slate or shake styles require no weather block.
- Nails shall be a minimum of 11 gauge corrosion resistant box or roofing nail of sufficient length to penetrate into batten and deck a minimum of 3/4 inch. (Exception: on pitches of less than 4:12, nails shall only penetrate batten.)
- Copper nails shall be used where the nails are in contact with mortar.

*First Printing*

- The heads of all tiles shall be nailed to the battens.
- All rake tiles shall be nailed with two nails.
- The noses of all eave course tiles shall be fastened with a special *Lifetile "XRP Grip Clip."*
- The noses of all ridge, hip, and rake tiles shall be set in a bead of approved roofer mastic.

**371.4 Corrugated Metal Roofs**

Corrugated metal roofs may be applied over purlins or over a solid wood deck.

**371.4(a) Corrugated metal roofing applied over a solid wood roof deck.**

- The solid wood deck shall be applied as per Section 371.1(a).
- Metal roofing shall be a minimum of 26 gauge thickness.
- Metal sheets shall be installed with a minimum of 8 inches end lap and 1-1/2 corrugations side lap.
- Fasten using lead washers and galvanized drive screws, deformed shank nails, or wood screws spaced 16 inches O.C. each way for 24 gauge metal and 12 inches O.C. each way for 26 gauge metal.
- Fasteners shall be spaced 10 inches O.C. along edges of sheets.

**371.4(b) Corrugated metal roofing applied to wood purlins.**

- Metal roofing shall be a minimum of 26 gauge thickness.
- The maximum spacing of purlins shall be as per Figure 29.
- Metal sheets shall be installed with a minimum of 8 inches end lap and 1-1/2 corrugations side lap.
- Fasten using lead washers and galvanized drive screws, deformed shank nails or wood screws spaced as per Figure 29.

<b><u>MAXIMUM PURLIN AND FASTENER SPACING FOR CORRUGATED METAL ROOFS</u></b>		
<b><u>Gauge</u></b>	<b><u>Max. Purlin Spacing</u></b>	<b><u>Max. Fastener Spacing (Along Each Purlin)</u></b>
24	18	8
26	16	6

**Figure 29. Corrugated Metal Roofs-Purlins and Fasteners**

### **371.5 Manufactured Metal Roofing**

- Manufactured metal roofing, similar to that used on metal buildings, shall be installed as per the manufacturer's recommendation.
- Documentation and/or certification from the manufacturer may be required. Documentation shall clearly show the installation method to be used and the wind loads that method will withstand.

### **371.6 Steel Deck Roofing for Concrete or Insulation Decks.**

- The steel deck shall be fastened by placing washers in the valleys of the deck along the steel framing members, and then plug welding through the middle of the washers onto the steel framing member below.
- Welds shall be located in every other valley along each joist and at the side laps. Adjacent deck units shall be fastened together at the center of span with self-drilling screw fasteners.
- The washers used shall be at least three times the thickness of the steel deck, and shall have an outside diameter of at least 3/4 inch.
- Other types of fastening may be used if substantiated by tests from an approved testing laboratory.

### **371.7 Built-up Roofing**

This section applies when built-up roofing is applied to a wood roof deck.

- The wood deck shall be applied as per Section 371.1(a). Other types of decks shall be as per the manufacturer's recommendation.
- The first layer of roofing felt shall be either one layer of minimum 30 pound felt lapped 2 inches, or 2 layers of 15 pound felt lapped 18 inches.
- The first layer shall be fastened to the deck with galvanized nails and tin caps or the equivalent.
- When the appearance of the underside of the deck is unimportant, the anchor sheet shall be fastened down using 1 inch nails spaced 8 inches O.C. along the laps and 16 inches O.C. both ways in the area between the laps, or as specified by the roofing manufacturer.
- When the underside of the roof deck is exposed, the alternative is to fasten the anchor sheet down with 1-1/4 inch nails spaced 8 inches O.C. along all rafters and 3/4 inch nails spaced 16 inches O.C. both ways in the area between the rafters, or as specified by the roofing manufacturer.
- Each additional sheet or ply above the anchor sheet shall be mopped into place with hot asphalt or hot coal tar pitch.
- Coal tar pitch shall be used only on flat roofs.
- For residential structures, a minimum of 3 plies shall be mopped over the base sheet.
- Where vertical surfaces intersect the roof, the built-up roof covering shall extend up the vertical surface to completely seal the joint created in the roof.
- A cant strip shall be placed at the intersection between the roof and parapet wall or any other long vertical surface. This provides a transition for the built-up roof plies from a horizontal direction to a vertical direction.
- A minimum of 50% of the gravel or stone placed over the top ply shall be anchored down.
- Proper sized gravel (3/8" to 5/8") shall be used.

- Specific requirements of the roofing manufacturer shall be followed if they differ from those outlined here.

### **371.8 Roll Roofing**

- Roll roofing shall only be applied to roofs with slopes of 1 in 12 or greater when using the concealed nail method.
- Roll roofing shall be applied using the lap cement or asphalt plastic cement recommended by the manufacturer.
- Roll roofing shall be applied using the concealed nail method when roofing is fastened with nails.
- 9 inch wide strips of roll roofing shall be placed along all eaves and rakes, positioning them to overhang the deck 1/4 to 3/8 inches.
- Roofing nails with large heads and lengths long enough to fully penetrate the roof deck shall be used.
- Fasten the strips with rows of nails located 1 inch and 8 inches from the roof edge and spaced 4 inches O.C. in each row.
- For the first course, position a full width strip of roll roofing so that it covers the edge strips (end and lower edge of roll roofing and edge of strips flush along eaves and rakes).
- Starting at one end, fasten the upper edge with nails spaced 4 inches O.C. and slightly staggered.
- Nails shall be located so that the next course will overlap them a minimum of 1 inch (generally not more than 2 inches, and never less than 3/4 inch from the top edge of the sheet).
- Lift the lower edge of the first course and cover the edge strips with cement according to the manufacturer's specifications.
- On all cementing, apply the cement in a continuous but not excessive layer over the full width of the lap.
- Press the lower edge and rake ends of the first course firmly into the cement-covered edge strips. Work from one side of the sheet to the other to avoid wrinkling or bubbling.
- Using a roller, apply pressure uniformly over the entire cemented area.
- End laps shall be 6 inches wide and cemented over the full lap area with the recommended cement.
- Nail the underlying sheet in rows 1 inch and 5 inches from the end of the sheet, with nails spaced 4 inches O.C. and slightly staggered.
- End laps in succeeding courses in the field shall not line up with one another.
- The second course shall be positioned so that it overlaps the first course at least 3 inches or as specified by the roofing manufacturer.
- Fasten the upper edge to the deck, cement the laps, and finish installing the sheet in the same manner as the first course.
- The same procedure shall be followed for each successive course.
- Nails shall not be applied within 18 inches of the rake until cement has been applied to the edge strip and the overlying strip has been pressed down.
- All hips and ridges shall be covered with 12 inch by 36 inch strips of roll roofing, with 6 inch laps and two nails at each lap.

- The entire length of these strips at hips and ridges shall be cemented to the roll roofing below.
- Specific requirements of the roofing manufacturer shall be followed if they differ from those outlined here. The contractor shall be prepared to show written instructions if different methods are to be used.

### 371.9 Other Roofing Systems

Other roofing systems, not previously mentioned, will be acceptable provided they have been certified by *Underwriter's Laboratories Class* as 30, 60, or 90, or certified by *Factory Mutual* as I-60 or I-90, or tested by another testing laboratory approved by the State Board of Insurance, and certified able to withstand 31.25 pounds per square foot uplift. Complete test reports, including method of installation, shall be submitted.

## 372 Re-roofing and Repairs

### Important Notes:

1. Fasteners for re-roofing shall be galvanized or other corrosion-resistant nails only. Staples are not allowed for re-roofing unless all old roofing is removed and a completely new roof is installed.
2. When re-roofing, care shall be taken to ensure that the existing deck and other members are not damaged. Re-roofing over a damaged roof deck or roofing member will not be accepted. Replacement of damaged members shall comply with previous guidelines.

### 372.1 Re-roofing a Composition Shingle Roof

- A maximum of one layer of composition shingles may be applied over a single layer of existing composition shingles.
- All existing shingles shall be removed if there are two or more layers of shingles already present.
- The manufacturer's recommendation for re-roofing shall be followed.
- One layer of 15 pound felt shall be applied over the existing shingle roof. Felt shall be adequately fastened to hold it down until the shingles can be applied.
- Felt may be omitted if and only if all of the following three conditions are met:
  1. Existing shingles and deck must provide an adequate nailing surface.
  2. Existing shingles must be in a satisfactory condition so that new shingles can lay flat.
  3. Butts of new shingles must be butted directly against tabs of existing shingles.

The inspector's judgement shall be final as to whether felt is required. Consultation with the inspector prior to re-roofing is suggested if any questions exist regarding felt application.

- Shingles rated by *Underwriter's Laboratories* as being "wind resistant" shall be used when re-roofing over an existing roof.
- Each shingle shall be applied as per Section 371.1(c).
- Fasteners shall be galvanized or corrosion resistant roofing nails which have sufficient length to penetrate into roof deck lumber a minimum of 3/4 inch or completely through the plywood roof deck. Most manufacturers recommend a 1-1/2 to 2 inch long nail for this use.

### 372.2 Re-roofing a Wood Shingle Roof

When re-roofing a wood shingle roof, the owner has three main choices. A new wood shingle roof may be desired, in which case Section 372.2(a) shall be followed. On the other hand, a new composition shingle roof may be preferred. Ideally, the wood shingles should be removed and replaced with composition shingles, following the guidelines in Section 372.2(b). However, if only one layer of wood shingles are present, a single layer of composition shingles may be placed over the wood shingles if the guidelines of Section 372.2(c) are followed. Please note that composition shingles may not be placed over a wood shake roof.

#### 372.2(a) Replacing wood shingles or shakes with same.

- All shingles shall be removed.
- All loose or protruding nails shall be removed or driven completely into the boards.
- Any loose shingles which are not to be replaced shall be renailed in a new location.
- New shingles may be applied to existing spaced boards, if the boards are in satisfactory condition.
- Boards shall be fastened to each rafter with two 8d galvanized nails
- Application shall follow the guidelines set forth in Section 371.2.

#### 372.2(b) Replacing Wood Shingles or Shakes with Composition Shingles.

- All wood shingles or shakes shall be removed.
- All old nails shall be removed or driven completely into the boards.
- Composition shingles shall be applied to a solid wood deck using the guidelines in Sections 371.1(b) and 371.1(c).
- A solid wood decking may be accomplished by one of the following methods:
  1. Replace all damaged boards. Fill in the spaces between the boards with boards of the same thickness. Fasten boards with two 8d nails in each rafter.
  2. Nail plywood decking directly to spaced boards. Boards shall have two 8d nails in each rafter, and decking shall be nailed to boards with one 8d nail in each board along each rafter, or the equivalent.
  3. Remove all spaced boards and nails. Nail plywood decking to rafters with galvanized 8d nails spaced 6 inches O.C. along plywood edges and 12 inches O.C. along interior rafters.

#### 372.2(c) Placing composition shingles over wood shingles.

- A single layer of composition shingles may be applied over a single layer of wood shingles.
- Composition shingles may not be placed over wood shakes.
- Composition shingles rated by *Underwriter's Laboratories* as being "wind resistant" shall be used.
- All loose wood shingles shall be renailed in a new location.
- All hip and ridge shingles shall be removed.
- Badly curled or warped shingles shall be split and the segments shall be renailed.

### *First Printing*

- Any missing shingles shall be replaced, or the holes otherwise filled in.
- A 30 pound layer of felt shall be applied over the wood shingles.
- Composition shingles shall be applied using a minimum of 2 inch galvanized roofing nails, ensuring that all fasteners penetrate into boards.
- Shingles shall be fastened as per Section 371.1(c).

### **372.3 Re-roofing a Built-up Roof.**

When re-roofing a built-up roof, the owner has two choices. The preferable choice would be to tear off the existing roof and install a completely new roof. The alternative is to recover the existing roof. The decision on which to choose must be based on a complete survey of the existing roof assembly, the underlying deck, and the support structure.

#### **372.3(a) Complete Tear-Off**

- This method is preferable because it allows the inspection of the existing deck and the correction of any damaged or decayed areas, and drainage can be improved as needed.
- After repairing of any damaged areas of the roof deck, proceed with the roof as if it were a new application.
- New flashing shall be installed if needed.

#### **372.3(b) Recover of existing roof.**

- A roof shall not be recovered if there is more than one built-up roof membrane system in place.
- A single roof may be recovered if the original roofing system is securely anchored to the deck and is not badly deteriorated, and where the deck and insulation are in good condition and do not contain moisture.
- If the existing roof system is gravel surfaced, all loose gravel shall be swept off. All surfaces shall be free of dirt, dust, and debris. Priming may be required. When installing a new roof over embedded aggregate, a separator material shall be used. This material could be rigid insulation, a venting base felt, or other base felt, as recommended by the manufacturer.
- If ply felts are to be installed directly to the old roof, all existing gravel shall be removed.
- All wet or deteriorated insulation shall be removed and replaced with new material.
- Prior to the application of any material, the insulation shall be vented by making random cuts in the existing membrane.
- All buckles, ridges, folds, blisters, etc. shall be cut out and a smooth, even surface provided.
- New flashing shall be installed if needed.
- The roof shall then be recovered as if it were a new roof, including installing new flashing.

### **372.4 Re-roofing Roll Roofing**

- A single layer of roll roofing may be re-roofed in much the same manner as built-up roofing. Manufacturer's specifications for the re-roofing product shall be followed.

### **372.5 Other Re-roofing Systems**

Other types of re-roofing will be acceptable provided they have been certified by *Underwriter's Laboratories* as Class 30, 60, or 90, or certified by *Factory Mutual* as 1-60 or 1-90, or tested by another testing laboratory approved by the State Board of Insurance, and certified able to withstand 31.25 pounds per square foot uplift. Complete test reports, including method of installation, shall be submitted.

***400. SEAWARD CONSTRUCTION  
GUIDELINES***

## 410 Wood Frame Construction-Seaward

### 411 Foundation

The foundation is possibly the most important part of a structure. It must be able to transfer all the loads on a structure into the ground. Foundations may either be built to the following minimum guidelines or they may be designed and certified by a Texas registered professional engineer. Foundations shall be designed so that the overturning moment of the structure due to the wind load does not exceed 66-2/3 % of the moment of stability of the structure.

#### 411.1 Slab on Grade Foundation

##### 411.1(a) Anchorage

- Slab shall be reinforced.
- A minimum of 1/2 inch anchor bolts shall be embedded a minimum of 6 inches into the slab.
- Anchor bolts shall have a standard J or L hook at the end.
- Anchor bolts shall be galvanized or otherwise corrosion resistant.
- Each anchor bolt shall have a washer with a minimum 1-3/8 inch diameter and minimum 1/8 inch thickness.
- For a one-story structure, minimum 1/2 inch anchor bolts shall be spaced a maximum of every 6 feet O.C., with an anchor bolt within 18 inches of ends or joints in sills or sole plates.
- For a two story structure, minimum 1/2 inch anchor bolts shall be spaced a maximum of every 4 feet O.C., with an anchor bolt within 18 inches of ends or joints in sills or sole plates.
- Where joints occur in sills or sole plates, additional anchor bolts will not be required if a proper splice plate is used. The joint shall occur half way between the adjacent studs, and a 2 X 4 splice plate shall be applied over the entire length of the sole plate between the studs, and nailed to each side of the splice with a minimum of four 8d nails (8 nails, total).
- Interior load bearing walls shall also be anchored in an approved manner. (Refer to Section 412.3 for the definition of a load bearing wall.) One acceptable method is to anchor with a code approved powder-actuated fastener every 2 feet (for a fastener with .170 - .177" shank diameter or every 18 inches (for a fastener with .140 - .145" shank diameter). Fasteners shall have a minimum overall length of 3 inches. One fastener shall be placed 6 inches from the end of the sill plate. Code approved drilled expansion or drilled chemical anchors installed every 6 feet will also be accepted on interior walls. When drilling holes for these types of anchors, extreme care should be taken to prevent damaging tendons in the slab.

##### 411.1(b) Provisions for Masonry Veneer

- Where masonry veneer is to be applied, the foundation shall be constructed with a brick ledge.

- The brick ledge shall have a minimum width of 5-1/2 inches and a minimum depth of 1-1/2 inches.
- The width shall be wide enough to completely support the veneer and to provide a minimum of 1 inch between the veneer and the vapor barrier or sheathing on the wall.

#### 411.2 Piling Foundation

These minimum specifications shall apply to structures of one and two stories only. For structures over two stories tall on pilings, please contact the local field office.

The design of a piling foundation is frequently determined by guidelines established for federal flood insurance. The homeowner or contractor should verify the base flood elevation before settling on a foundation design. This information should be available through local sources, such as the City, County, or Corps of Engineers. *The Federal Emergency Management Agency (F.E.M.A.)* should be contacted for further information regarding federal flood insurance.

There is one federal guideline which must be noted here because it can affect windstorm insurance. *F.E.M.A.* requires that enclosed space below the base flood elevation must be built with non-supporting breakaway walls which will collapse under wind and water loads without damaging the rest of the structure. Since these breakaway walls cannot be built to withstand the wind loads of the *Standard* and *T.C.P.I.A. Building Codes*, breakaway walls and any contents enclosed by breakaway walls will not be insured by the *T.C.P.I.A.*

##### 411.2(a) General Piling Requirements

- Pilings may be of either pressure treated wood, or precast reinforced or prestressed concrete.
- Wood pilings shall be square or round, and shall be installed as per Section 411.2(b) or Section 411.2(c).
- Precast reinforced or prestressed concrete piles shall also be installed as per Section 411.2(b) or Section 411.2(c).
- Pilings may be driven, jetted, or augered. Extreme care shall be taken when driving precast concrete pilings to prevent damage to the piling.
- Precast concrete pilings shall be reinforced as per Figure 30.

<b>MINIMUM REINFORCEMENT OF CONCRETE PILINGS-SEAWARD</b>			
<b>Height-(Top of Piling Above Grade)</b>			
<b>Size of Piling</b>	<b>7' or less</b>	<b>10' or less</b>	<b>12' or less</b>
<b>12" X 12"</b>	4-#10 w/#3 ties @12"	N/A	N/A
	8-#8 w/#3 ties @12"	N/A	N/A
	12-#7 w/#3 ties @12"	N/A	N/A
<b>16" X 16"</b>	4-#8 w/#3 ties @16"	4-#11 w/#4 ties @16"	8-#11 w/#4 ties @16"
	8-#7 w/#3 ties @14"	8-#9 w/#3 ties @ 16"	12-#9 /#3 ties @16"
	12-#6 W/#3 ties @ 12"	12-#8 w/#3 ties @16"	N/A

The first two numbers represent the number and size of vertical reinforcing steel bars. The third and fourth numbers represent the size and vertical spacing of the horizontal tie bars (see figure below).

Figure 30. Minimum Reinforcement of Concrete Pilings

**PLACEMENT OF REINFORCEMENT IN CONCRETE PILINGS-SEAWARD**

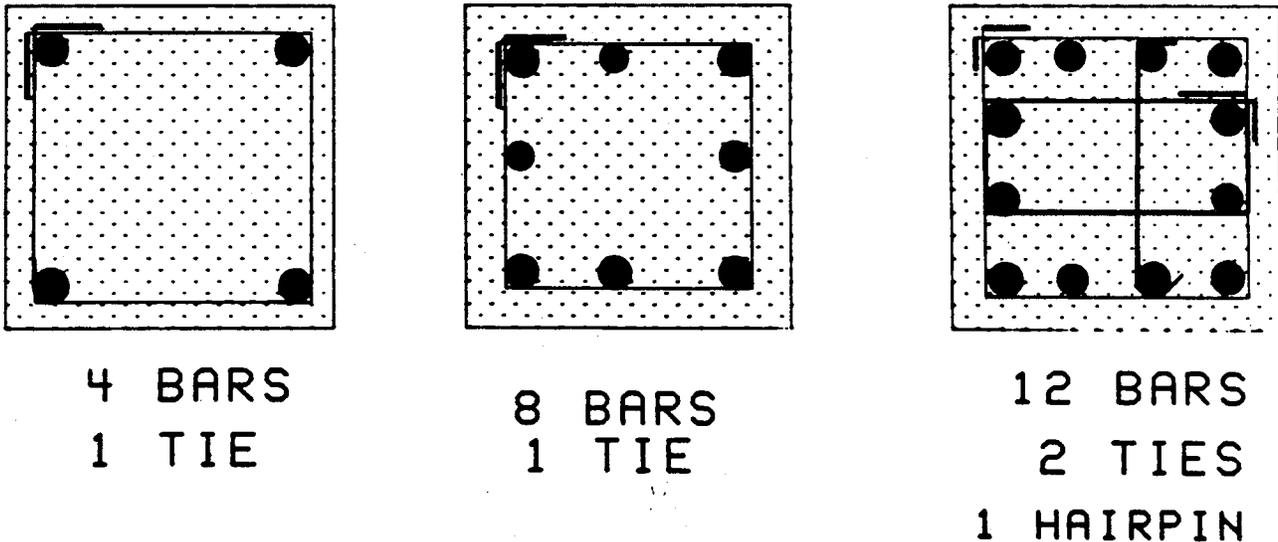


Figure 31. Placement of Reinforcement in Concrete Pilings

There are two general methods of piling design which will be acceptable. Method 1 (outlined in Section 411.2 (b)) may be used if there is no objection to the use of knee braces. Method 2 (outlined in Section 411.2(c)) may be used if knee braces are objectionable. One of these two methods shall be used. In all cases, the beams, stringers and floor joists shall comply with Section 411.2(d).

**411.2(b) Method 1**

- The piling bury depth below grade shall be at least as deep as the distance the lowest floor framing members (usually beams and stringers) are above grade. The minimum depth of bury of a pile shall be 5 feet below grade.
- For one story structures, 10 feet shall be the maximum spacing between pilings.
- For two story structures, or structures elevated over 12 feet above grade level, 8 feet shall be the maximum spacing between pilings.
- There shall be a minimum of 4 pilings in a row.
- The size of pilings shall comply with the following table:

Height Above Ground (Grade to bottom of beam)	Min. Size of Piling (round or square)
less than 8 feet	8 inches
8 to 12 feet	10 inches
12 to 16 feet	12 inches

**Figure 32. Minimum size of Pilings.**

- Piling shall be notched and beams shall fully bear on piling. No more than one half the thickness of the piling may be notched.
- Beams or stringers shall be bolted to pilings with either two 3/4 inch bolts, three 5/8 inch bolts, or four 1/2 inch bolts.
- Bolts, nuts, and washers shall be galvanized.
- The spacing between bolts shall be a minimum of 3-1/2 inches, except where splices occur.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two 1/2 inch bolts. Bolts shall be spaced a minimum of 2-1/4 inches apart, and shall be located a minimum of 2 inches from the ends and edges of each beam.
- The distance between the bolts and the ends and edges of the beams shall be a minimum of four times the bolt diameter.
- Knee braces shall be provided for all pilings, extending in every available direction.
- Knee braces shall be pressure treated with a wood preservative, or wood of natural decay resistance.
- Knee braces shall extend at a 45 degree angle from the floor framing member down to a point on the piling which is one fourth the height of the piling down from the floor framing member.
- For knee braces up to 5 feet in length, the minimum size shall be 2 x 6 or 4 x 4 lumber.
- Knee braces over 5 feet in length shall have a minimum dimension of four inches.
- Knee braces shall be bolted (thru or lag) to the floor framing and the piling.
- Pilings which extend above grade less than 4 feet will not require knee braces.

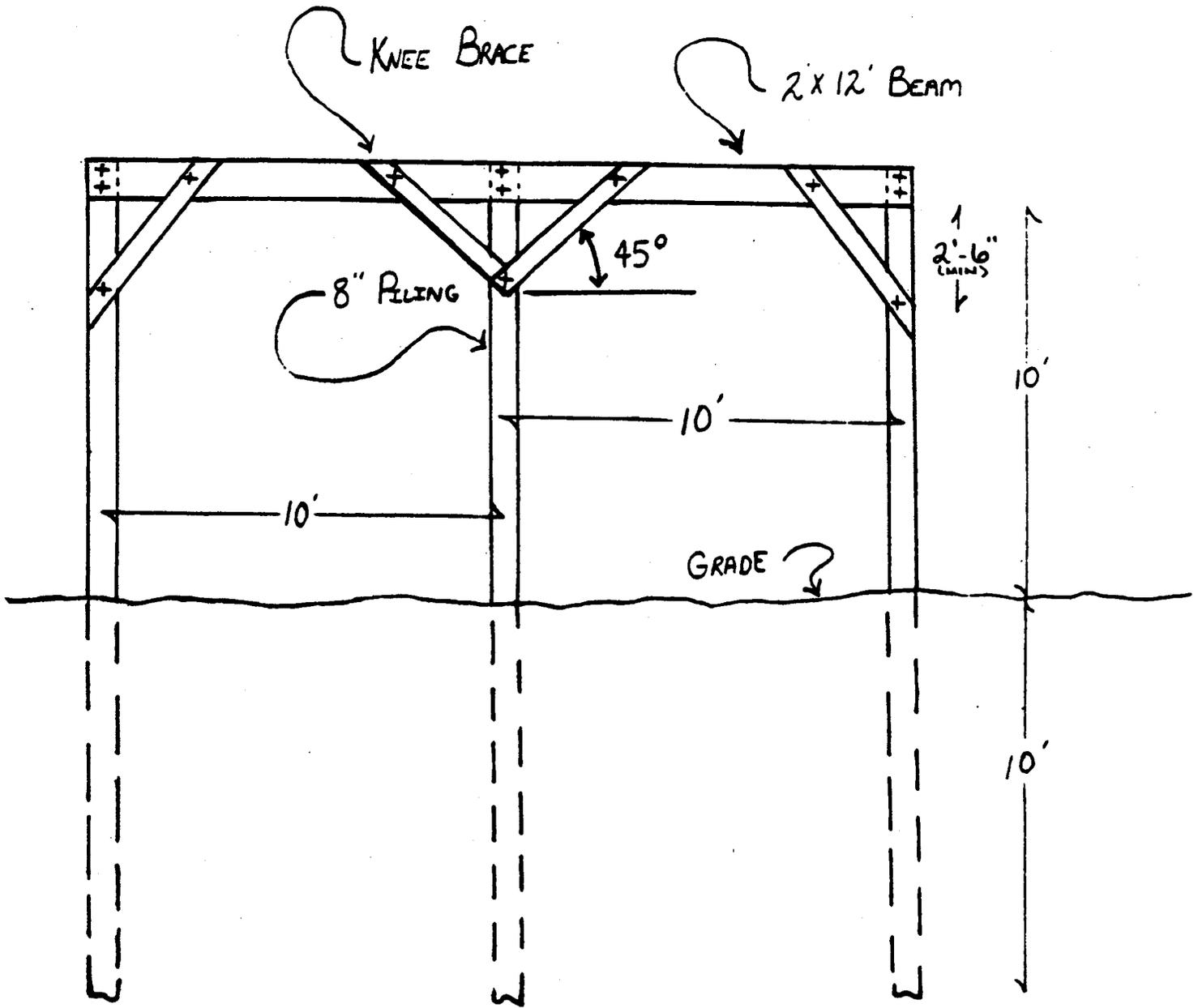


Figure 33. Installation of Piles (Method 1)

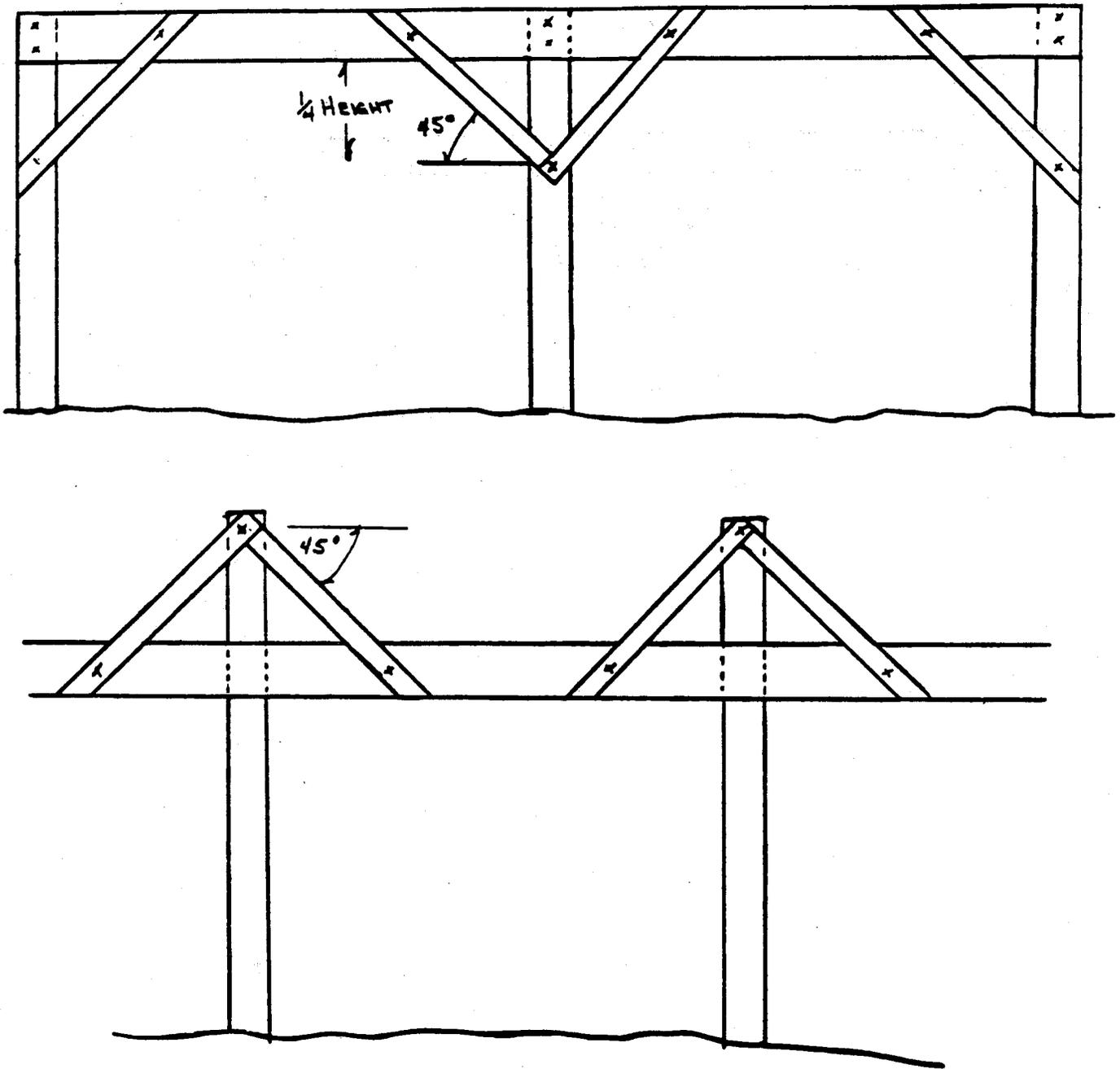
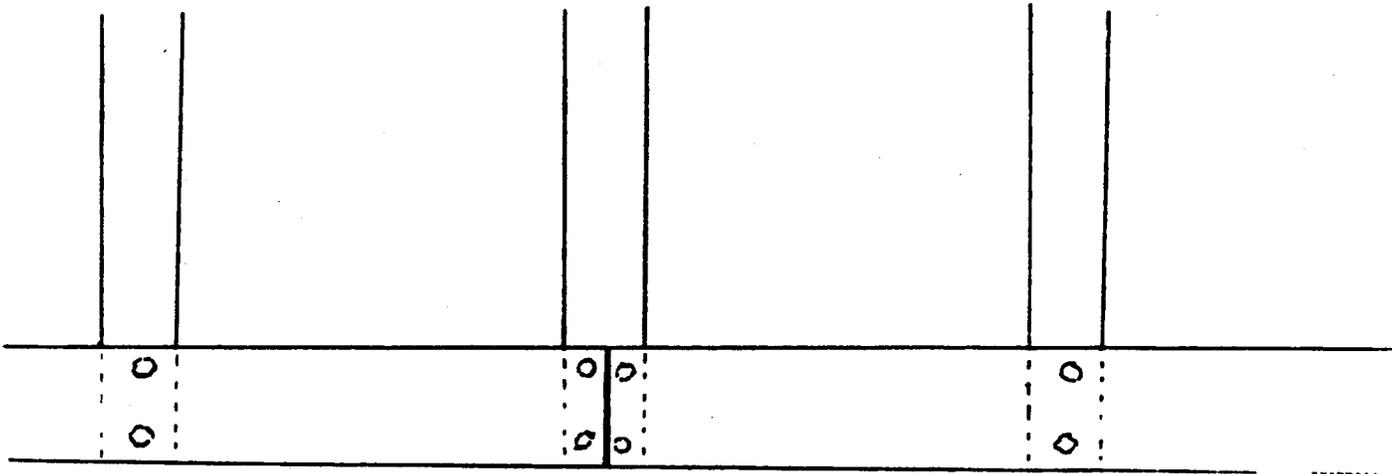


Figure 34. Installation of Knee Braces (Method 1)

Figure 35. Fastening Spliced Beam to Piling



**411.2(c) Method 2**

This method will have different specifications depending upon whether the structure is located in an area subject to storm surge and wave action (V-zones) or an area not subject to storm surge and wave action (A-zone or other).

**1. Areas Subject to Storm Surge and Wave Action (V-Zones)**

- The maximum first floor elevation shall be 16 feet above mean sea level when using this method.
- Piles shall penetrate a minimum of 12 feet below mean sea level.
- There shall be a minimum of 4 piles in each row.
- The maximum spacing between piles shall be 8 feet.
- Piling size and beam to piling connection shall comply with **Figure 36**.

<b>ROUND OR SQUARE PILING SIZE AND BEAM TO PILING CONNECTION FOR AREAS SUBJECT TO STORM SURGE AND WAVE ACTION-SEAWARD (V-Zone)</b>			
<u>Height of Structure</u>	<u>Minimum Tip Diameter of Piling</u>	<u>Beam Connection to Piling</u>	
		<u>Continuous Beam</u>	<u>Spliced Beam</u>
One Story	10 inches	2-1/2" bolts	2-1/2" bolts each side
Two Story	12 inches	2-3/4" bolts	2-1/2" bolts each side

**Figure 36. Piling Size and Beam to Piling Connection**

- Pilings shall be notched and beams shall fully bear on pilings. No more than one half the thickness of each piling may be notched.
- Bolts shall be spaced a minimum of 3-1/2 inches apart and shall be located a minimum of 2 inches from the beam edge, except where splices occur.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two bolts, sized as per **Figure 36**. Bolts shall be spaced a minimum of 2-1/4 inches apart and shall be located a minimum of 2 inches from the edges and end of each beam.
- Bolts, nuts, and washers shall be galvanized.

**2. Areas NOT Subject to Storm Surge and Wave Action (A-Zones)**

- The maximum first floor elevation shall be 8 feet above grade when using this method.
- There shall be a minimum of 4 piles in any one row.
- The minimum size and minimum depth of bury below grade of pilings and the minimum number and size of bolts per beam connection shall comply with the following figure.

<b>MINIMUM PILING SIZE, BURY DEPTH, AND BEAM CONNECTION FOR AREAS NOT SUBJECT TO STORM SURGE AND WAVE ACTION-SEAWARD (A-Zone)</b>			
<b>ONE STORY STRUCTURES</b>			
<b>Maximum Spacing Between Pilings</b>	<b>Minimum Tip Diameter of Pile and Minimum Bury Depth Below Grade For Type of Soil</b>		<b>Minimum Beam Connection To Piling</b>
	<b>Sandy Soil</b>	<b>Clay Soil</b>	
8 Feet	8" Pile-12' Deep	10" Pile-12' Deep	2-1/2" Dia. Bolts
10 Feet	8" Pile-12' Deep	10" Pile-20' Deep	2-3/4" Dia. Bolts
<b>TWO STORY STRUCTURES</b>			
<b>Maximum Spacing Between Pilings</b>	<b>Minimum Tip Diameter of Pile and Minimum Bury Depth Below Grade For Type of Soil</b>		<b>Minimum Beam Connection To Piling</b>
	<b>Sandy Soil</b>	<b>Clay Soil</b>	
8 Feet	10" Pile-12' Deep	10" Pile-20' Deep	2-3/4" Dia. Bolts
10 Feet	10" Pile-12' Deep	12" Pile-24' Deep	3-7/8" Dia. Bolts

**Figure 37. Piling Size, Bury Depth, and Beam to Piling Connection**

- The piling shall be notched and beams shall fully bear on pilings. No more than one half the thickness of each piling may be notched. Bolts shall be spaced a minimum of 3-1/2 inches apart and shall be located a minimum of 2 inches from the beam edge, except where splices occur.
- Where beams are spliced, the splice shall occur over a pile. Each beam end shall be fastened to the pile with two bolts. These bolts shall be 5/8 inch diameter for a two story structure having piles spaced farther than 8 feet apart. Two story structures with piles spaced 8 feet or closer and all one story structures shall use two 1/2 inch bolts in each side of the splice. Bolts shall be spaced a minimum of 2-1/4 inches apart and shall be located a minimum of 2 inches from the edges and end of each beam.
- Bolts, nuts, and washers shall be galvanized.

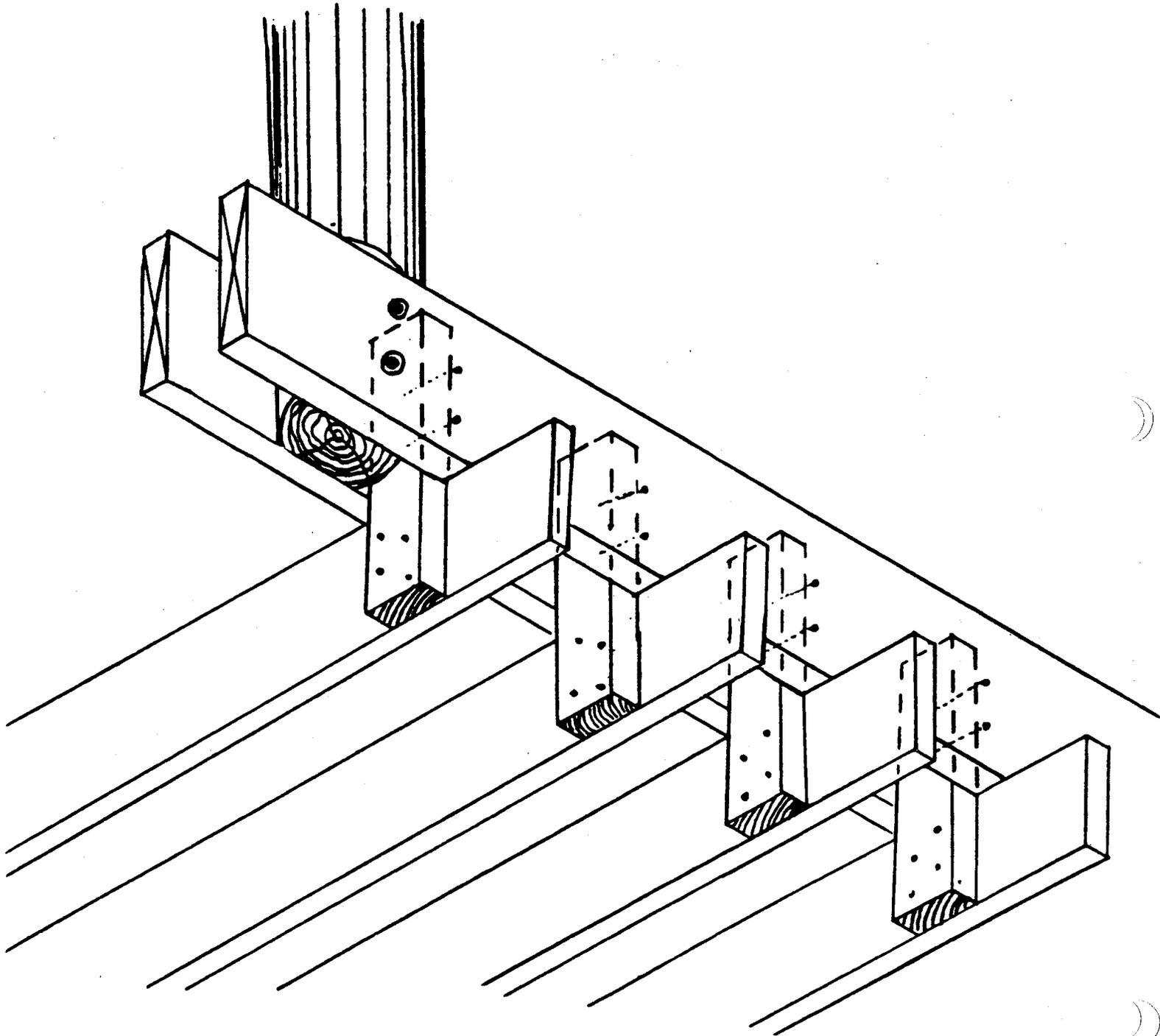
**411.2(d) Beams, Stringers, and Floor Joists**

- Beams and stringers shall be framed into the tops of pilings and shall consist of a minimum of two 2 x 12's, having a minimum grade of no. 2.
- Beams and stringers, and shall be pressure treated with a wood preservative.
- Splices in beams and stringers shall occur over a piling.
- Where floor joists are set on top of beams, every other floor joist shall be attached to the beam with an approved framing anchor.
- Where floor joists must be framed directly into beams, a joist hanger or ledger strip shall be provided. Floor joists shall be anchored against uplift.
- If floor joists are not continuous, the joint shall occur over a beam and there shall be a minimum of a 12 inch lap, securely nailed together. For lap lengths of less than 4 feet, each side of the lap on every other floor joist shall be fastened to the beam with an approved framing anchor. If laps are 4 feet or longer and are securely nailed, one framing anchor will be sufficient.
- Floor joists shall have a maximum spacing of 24 inches O.C.
- Floor joists shall have a maximum span in accordance with the following table:

<b>MAXIMUM SPANS FOR FLOOR JOISTS-SEAWARD</b>				
<b>(Southern Pine or Douglas Fir)</b>				
<b>Size of Floor Joists</b>	<b>Spacing of Floor Joists</b>	<b>Grade of Lumber</b>		
		<b># 1</b>	<b># 2</b>	<b># 3</b>
<b>2 X 6</b>	16' O.C.	9-11	9-9	8-1
	19.2' O.C.	9-4	9-2	7-4
	24' O.C.	8-8	8-4	6-7
<b>2 X 8</b>	16' O.C.	13-1	12-10	10-3
	19.2' O.C.	12-4	12-1	9-5
	24' O.C.	11-5	11-0	8-5
<b>2 X 10</b>	16' O.C.	16-9	16-5	13-1
	19.2' O.C.	15-9	15-5	12-0
	24' O.C.	14-7	14-0	10-9

**Figure 38. Maximum Floor Joist Spans**

Figure 39. Use of Wood Framing Anchors



First Printing

### 411.3 Pier and Beam Foundation

These guidelines apply to new one and two story structures on pier and beam type foundations.

- This type of foundation should not be used in areas subject to storm surge and wave action.
- Wood beams shall be pressure treated with a wood preservative or otherwise decay resistant.
- All piers shall have reinforcement tying the beam to the pier, and the pier to the footing. Reinforcement must resist both uplift and lateral forces.
- If hollow masonry units are used for piers, the cells shall be filled with steel reinforcement and grout.
- Beams shall be fastened to piers in such a manner as to provide anchorage equivalent to that required for sole plates to a slab foundation.
- Floor joists shall comply with all applicable portions of Section 411.2(d).
- The bottom of the footing pad shall be buried a minimum of 12 inches below grade.
- When the floor elevation is over 3 feet above grade, either pilings must be used, or the base of the footing must be buried below grade as deep as the height the floor framing members are above grade.
- Footing pads shall be a minimum of 4" thick and have minimum dimensions of 12" X 12".
- Where hollow masonry piers are used to elevate a structure between three and eight feet, the following method may be used.

Subsurface support shall either be provided by:

1. A standard piling driven 12 feet deep with a reinforced concrete cap poured over and around the top of the piling, with additional anchorage provided by dowels in the top of the piling;
- or
2. A hole 12 feet deep, and a minimum of 12 inches in diameter, poured with reinforced concrete.
- Masonry piers are then built on top of this concrete. Hollow masonry units shall be vertically reinforced with a minimum of four no. 4 bars and completely filled with concrete. Vertical reinforcement in piers shall be lapped a minimum of 18 inches with the subsurface reinforcement. Beams at the top of piers shall be securely anchored to the steel reinforcement in the piers.
  - If it is impossible to anchor piers to footings, one alternate method would be to construct an additional anchor between each pier. This is accomplished by digging a 3' x 3' x 3' hole and filling it a minimum of 1 foot deep with reinforced concrete. Embed a corrosion-resistant length of angle iron, or 4" x 4" (minimum) treated lumber into the concrete. The angle iron shall have a 90 degree bend in the bottom, and the lumber shall have some type of dowel in the end, or some other method shall be provided to anchor the iron or lumber against uplift. The angle iron or wood post shall be fastened to the beam with a minimum of two 1/2 inch bolts, or shall be otherwise securely fastened. The remainder of the hole shall be filled back in. One of these anchors shall be installed between each pier, with a maximum spacing of 10 feet between each anchor.
  - Another alternate method which will be accepted when the structure is elevated less than three feet above grade is as follows. Dig a belled hole a minimum of 36 inches deep, a minimum of 24 inches wide at the bottom, and a maximum of 12 inches wide at the top. Place a treated wood or corrosion-resistant steel pier in the hole and fill the hole with concrete and reinforcement. The column shall have some type of dowel or horizontal protrusions near its bottom to anchor against uplift. The pier shall have a minimum width of 6 inches. The beam shall be securely anchored to the top of this pier. The maximum spacing between piers shall be 10 feet.

*First Printing*

- Small temporary buildings or portable buildings which have an area of less than 200 square feet and which are elevated less than 12 inches above grade may be anchored by the following method. Dig a 2' x 2' x 2' hole at each corner, fill the hole at least 1 foot deep with concrete, and embed a 1 1/2" x 1 1/2" x 1/4" angle iron or a 2 inch x 1/4 inch steel strap. Straps or anchors shall be corrosion-resistant. Straps or angles shall have a 90 degree bend at the bottom to anchor them against uplift. Straps or anchors shall be securely fastened to each corner of the building. Temporary or portable buildings having an area greater than 200 square feet shall be anchored by one of the previously outlined methods.
- If none of these methods can be used, the installation of approved mobile home tie-downs may be accepted. Generally, 48 inch long tie-downs installed at each exterior pier as per their manufacturer's instructions with a minimum of one tie-down for each 5 feet of wall length, will be acceptable.
- For small structures or structures which are relocated, alternate methods may be approved. Contact local field office.

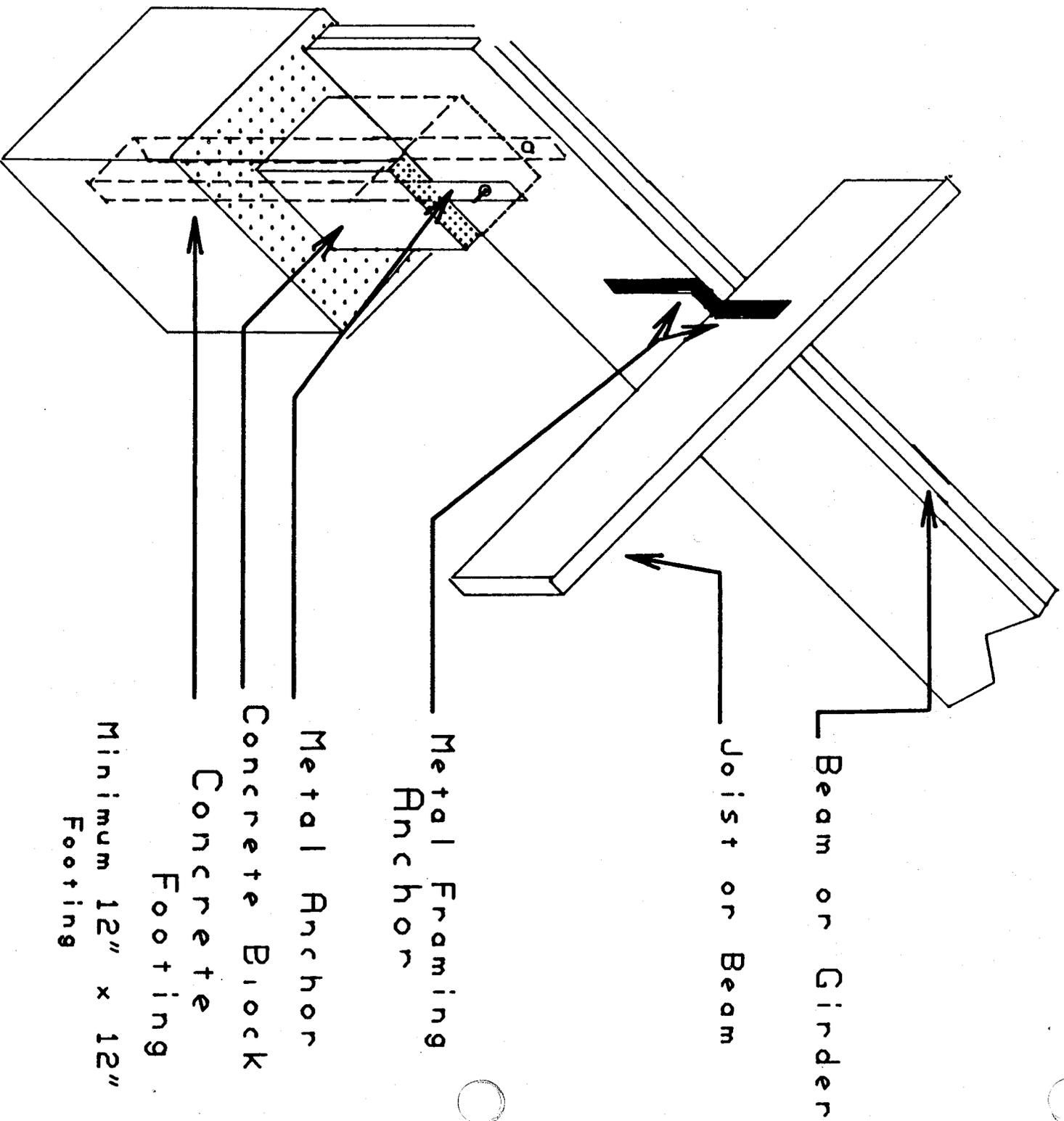


Figure 40. Pier and Beam Foundation

#### 411.4 Bearing Wall Footings

Where bearing wall footings are used, they shall meet the following guidelines. This type of foundation should not be used in areas subject to storm surge and wave action.

- The base of the footing shall be buried a minimum of 12 inches below grade.
- The base of the footing shall have a minimum width of 12 inches for one story structures, 15 inches for two story structures, and 18 inches for three story structures, and a minimum thickness of 6 inches.
- 1/2 inch (minimum) anchor bolts, spaced a maximum of 6 feet O.C., shall be provided.
- An anchor bolt shall be located not more than 12 inches from each corner, and not more than 18 inches from the end joints in sills.
- Anchor bolts shall be embedded a minimum of 7 inches into a monolithic concrete bearing wall footing, and a minimum of 15 inches into a reinforced masonry unit wall footing.
- Masonry wall footings shall be reinforced and shall be securely anchored to the footing base.
- Floor joists shall comply with the applicable portions of Section 411.2(d).

### 412 Framing

#### 412.1 Lumber

- All lumber shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the American Lumber Standards Committee.
- All lumber members 2 inches or less in thickness shall contain not more than 19 percent moisture content at the time of permanent incorporation into a building or structure. Permanent incorporation occurs when lumber is cut to size and nailed in place.
- If framing is found to have a moisture content higher than 19% at the time of the first framing inspection, that structure will not be able to be approved by our inspectors. The structure would still be able to be certified by a Texas registered professional engineer.
- Standard and utility grade lumber shall not be used for any load carrying purposes.
- All load bearing lumber shall be Southern Pine or Douglas Fir, or another species having equivalent or greater strength.

#### 412.2 Fasteners

- All fasteners shall be U.S. manufactured hot dipped, electrically, or mechanically galvanized steel or stainless steel.
- Staples are not acceptable seaward of the Intracoastal Waterway.
- Power and mechanically driven fasteners shall be manufactured by members of *The International Staple, Nail, and Tool Association*.

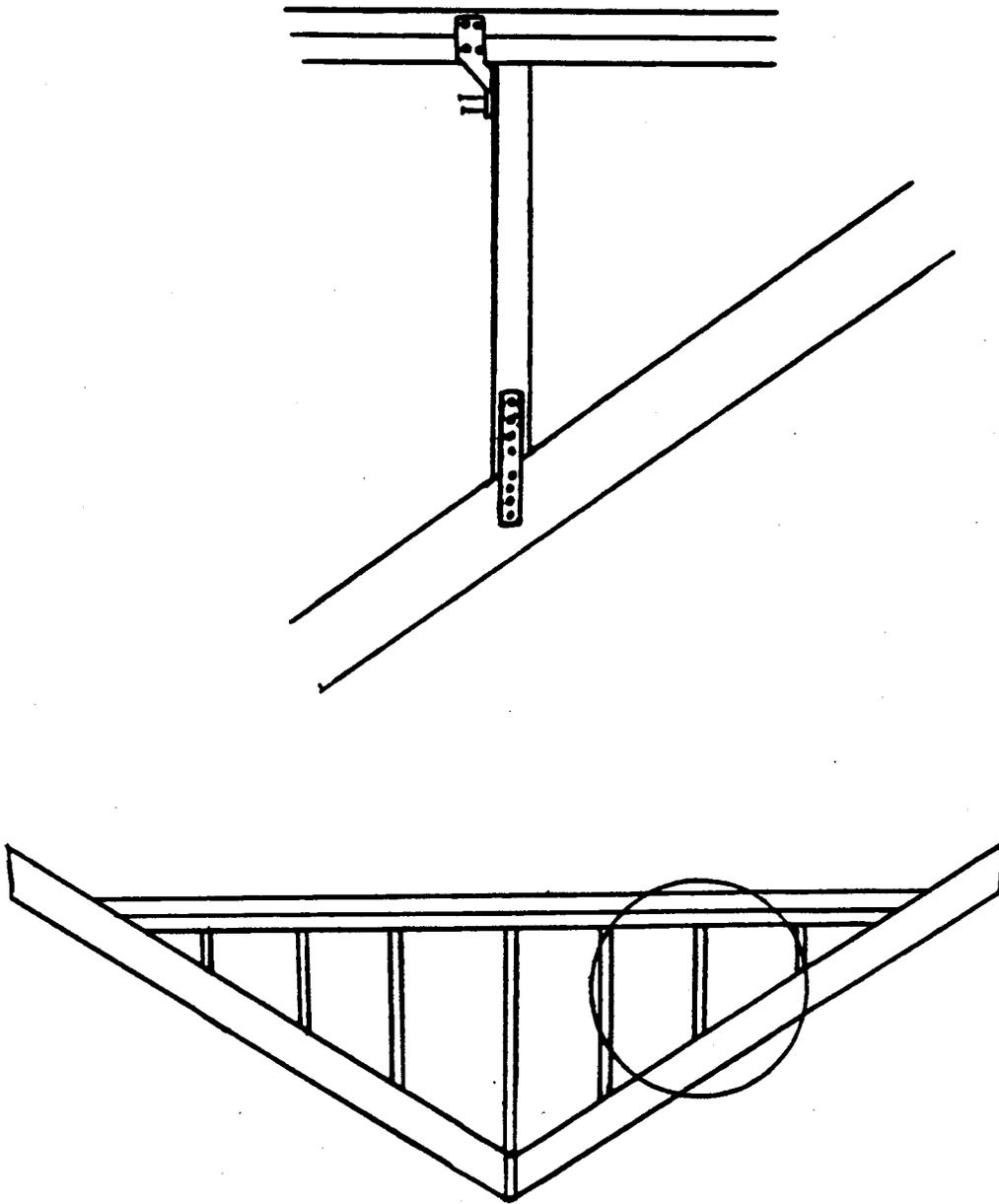
#### 412.3 Wall Framing and Framing Anchors

- Sole plates for all exterior walls shall be of pressure treated lumber.
- Except as noted below, all 2 x 4 studs shall be spaced a maximum of 16 inches O.C., and 2 x 6 studs shall be spaced a maximum of 24 inches O.C.

*First Printing*

- In three-story buildings, studs in the first story shall be not less than 3 x 4 inches or 2 x 6 inches, spaced a minimum of 16 inches O.C.
- Studs shall have a minimum grade of stud or #3.
- Studs shall be capped with double top plates. Joints in doubled top plates shall be staggered.
- The following connections shall have an approved corrosion resistant framing anchor (hurricane clip):
  1. Every other rafter to both plates of doubled top plate or to stud below.
  2. Every other stud to both plates of doubled top plate or to rafter above.
  3. Every other stud to the sole plate.
- At each of these connections, a framing anchor which is rated by its manufacturer to provide a minimum of 300 pounds uplift resistance shall be installed.
- Framing anchors shall be installed exactly as recommended by their manufacturer. Nails shall be corrosion resistant and of the size recommended by the manufacturer of the framing anchor. Unless recommended otherwise, there shall be a minimum of four nails in each member being clipped together.
- Framing anchors shall be located to form continuous lines of anchorage, from the rafter down to the sole plate. This means that framing anchors must be installed at the top and bottom of the same stud.
- Framing anchors may be constructed of pieces of lumber if an adequate number of nails are used and the nails are perpendicular to the direction of the load (in shear, not in withdrawal). Where framing anchors are of lumber, they shall be installed at every member, rather than at alternate members.
- At gable ends, at least every other gable stud shall be attached to the doubled top plate and the rafter with a framing anchor.
- Interior load bearing walls shall have 2 X 4 studs spaced 16 O.C. Load bearing walls are walls which are subject to either vertical or horizontal forces.
- Walls which are perpendicular to exterior walls and are used to brace those exterior walls (as specified in Section 412.6) are subject to horizontal loads and are classified as load bearing walls. Other interior walls which intersect exterior walls and are at least 6 feet long are also subject to horizontal loads (due to diaphragm action of the sheet rock even though normal wall bracing may not be present) and are classified as load bearing walls. These types of load bearing walls shall be anchored to the foundation as specified in Section 411.1(a) for at least the first 10 feet from the exterior wall.
- Walls which are used to brace rafters which would be overspanned without the braces are subject to vertical loads and are classified as load bearing walls. Where rafter braces are tied to interior load bearing walls, the stud on each side of the brace shall be anchored to the top plate and to the sole plate with a framing anchor as specified above. Where the brace falls directly over a stud, or a stud is added directly below the brace, the brace may be strapped directly to that stud, and only that stud need be anchored to the sole plate. The sole plate shall be anchored to the foundation as specified in Section 411.1(a) for a distance of at least 5 feet on each side of these studs. One standard anchor bolt or drilled or chemical anchor on each side of this location will be acceptable.
- Where rafter braces are tied to ceiling joists, the walls which these joists rest on and are anchored to are classified as load bearing walls. However, since the loads are smaller, no additional framing anchors on the studs or special anchorage of the sole plate will be necessary.
- Interior non-load bearing walls may have studs spaced up to 28 inches O.C. Non-load bearing walls are walls which are not subject to any horizontal or vertical forces and do not fall into any of the above categories.

Figure 41. Connecting Gable Studs to Rafter and Top Plate



**412.4 Roof Framing Members (Rafters)**

- Rafters shall be sized and spaced for a 43.75 pound per square foot uplift wind load for structures less than 30 feet high. The following table shall be used to size and space rafters.

<b><u>RAFTER SPAN TABLE-SEAWARD</u></b>				
<b><u>Rafter Size</u></b>	<b><u>Spacing (in O.C.)</u></b>	<b><u>#1 Grade</u></b>	<b><u>#2 Grade</u></b>	<b><u>#3 Grade</u></b>
<b>2 X 6</b>	12	12'-2"	11'-11"	11'-4"
	16	11'-0"	10'-9"	10'-1"
	19.2	10'-4"	10'-2"	9'-2"
	24	9'-7"	9'-4"	8'-3"
<b>2 X 8</b>	12	16'-0"	15'-8"	15'-0"
	16	14'-6"	14'-3"	13'-4"
	19.2	13'-8"	13'-4"	12'-1"
	24	12'-8"	12'-5"	10'-9"
<b>2 X 10</b>	12	20'-5"	20'-0"	19'-2"
	16	18'-6"	18'-2"	16'-11"
	19.2	17'-5"	17'-1"	15'-5"
	24	16'-2"	15'-10"	13'-10"

**Figure 42. Maximum Rafter Spans**

- Rafters on the windward side of roofs with slopes greater than 30 degrees (6.9 in 12) shall be sized and spaced to withstand an inward force of 35 pounds per square foot.
- At eaves and overhangs, rafters shall be sized and spaced to resist a 70 pound per square foot uplift windload, if less than 30 feet high.
- Rafters shall be spaced a maximum of 24 inches on center.
- If it is not possible to have rafters meet this span table, at least every third rafter shall be tied to joists or partitions directly below with a 1 x 6 or equivalent at midpoints of rafters 16 feet or less in length, or at third points of rafters over 16 feet in length. Rafter braces shall form as close as possible to a 90 degree angle with the rafters. Rafter braces shall be installed so as to resist uplift (nailed in shear or fastened with framing anchors at each end).
- Each ceiling joist which is used to brace a rafter shall be anchored against uplift at each end. This may be accomplished by nailing in shear to a rafter which is fastened to the top plate with a framing anchor, or fastening the ceiling joist directly to the top plate with a framing anchor. The framing anchors at one end of the ceiling joists may be omitted if a beam or strongback is run over the ceiling joists, and this beam is securely anchored to a load-bearing wall at each end. (Usually, at least one end is anchored to an exterior wall.) This paragraph applies when braces are tied directly to rafters and ceiling joists. When a strongback/purlin tie system is used, see the following paragraph.

*First Printing*

- Where a strongback and/or purlin tie system is used, the following shall apply:

The purlins and strongbacks or ceiling joists shall be tied together using a minimum of a 1 x 6 or equivalent.

Rafters, purlins, ties, strongbacks, ceiling joists, and load-bearing walls shall be anchored against uplift at a minimum spacing of every third rafter.

Ceiling joists shall be anchored to a load-bearing wall or nailed in shear to rafters at both ends.

Load-bearing walls shall be properly anchored to the foundation as specified in Section 412.3.

- Ridge beams shall be sized at least one nominal size larger than the rafters.
- 1 x 6 collar beams (rafter ties) or their equivalent shall be installed between every pair of rafters. Collar beams shall be located in the upper third of the roof height.
- Ceiling joists and rafters shall be nailed to each other where possible.
- Ceiling joists shall be continuous, or where they meet over interior partitions, shall be securely joined (minimum of three 16d nails) to provide a continuous tie across the building.
- In buildings 20 feet or more in width, where rafters cannot be nailed directly to ceiling joists because the joists are perpendicular to the rafters, the foot of at least every other rafter shall be tied to at least the first four adjacent ceiling joists with wood or metal ties attached to each joist.
- Where a plywood roof deck is not used (for example, on a wood shingle or metal roof), the ridge beam shall be braced at a 45 degree angle down to either a perpendicular end or interior wall top plate, or to a parallel exterior wall top plate, with the brace nailed to each rafter where they cross.

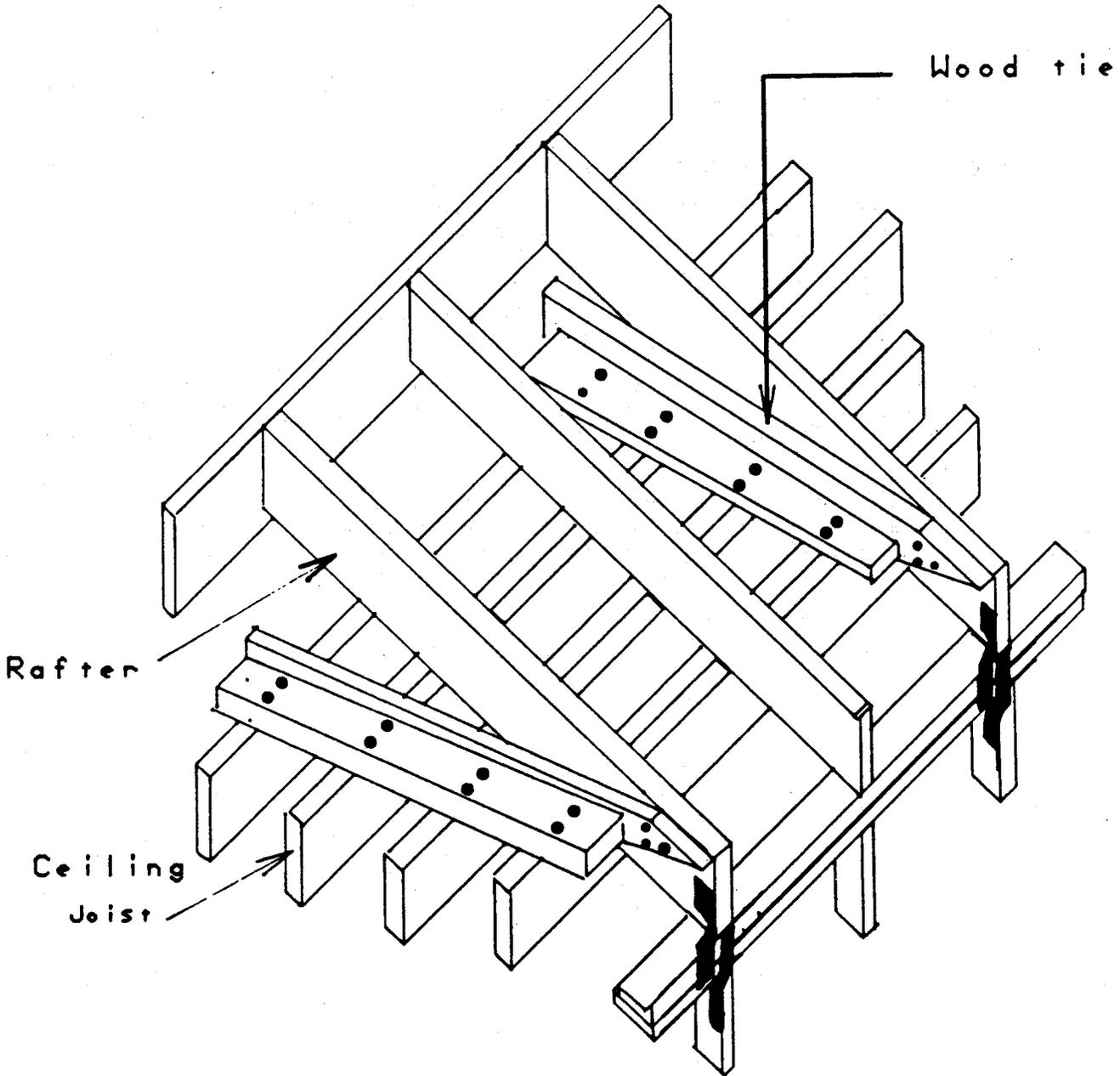


Figure 43. Tying Rafters to Perpendicular Ceiling Joists

#### 412.5 Roof Framing Members (Trusses)

- All wood trusses shall be designed and certified by a Texas registered professional engineer.
- Roof trusses shall be designed to withstand the same wind pressures as rafters. For structures less than 30 feet high, these are 43.75 pounds per square foot uplift for all roofs, and 35 pounds per-square foot inward force for the windward slope of roofs with a slope of greater than 30 degrees. Eaves and overhangs shall be designed to resist a 70 pounds per square foot uplift load.
- The contractor shall furnish a sealed truss certificate to the State Board of Insurance, preferably prior to installation. The certificate shall include the following information:
  1. The design wind uplift pressure in pounds per square foot. (and inward pressure, if applicable)
  2. The anchorage force required at each bearing point.
  3. The length, size, and grade of each piece of lumber in the truss.
  4. The location and type of any bracing which is necessary.
  5. A statement similar to the following: "This truss design meets or exceeds the *Texas Catastrophe Property Insurance Association* requirements for windstorm resistant construction. The windload used in this design is \_\_\_\_\_ PSF.
  6. The name and phone number of the truss fabricator
  7. The name and phone number of the design engineer.
- The State Board of Insurance reserves the right to request additional information and supporting calculations.
- Trusses shall be braced and anchored as specified on the truss certificate.
- The truss installation packet shall be on the jobsite for the inspector.
- Floor trusses generally need not be designed for uplift. When floor truss certificates are submitted, they shall clearly be identified as such.

#### 412.6 Corner and Wall Bracing

- Corner bracing shall be accomplished by one of the following methods. When using methods 1, 2, or 3, one brace shall be installed for each 18 feet of wall with a minimum of one brace at each corner per wall.
  1. Minimum 15/32 inch *APA* or *TECO* rated plywood nailed with 8d nails spaced 6 inches O.C. along each panel edge and 12 inches O.C. along each interior studs. Non-veneer panels are not acceptable seaward of the Intracoastal waterway.
  2. 1 x 4 diagonal brace let in to studs, bottom plate, and lower plate of doubled top plate, and nailed with a minimum of two 8d nails at each intersection with a stud or plate. The brace shall be installed at a 45 degree angle and must fit tightly into the slots cut into the studs. If an opening prevents a single long brace from being installed, two shorter braces may be let in to the studs in a K pattern See Figure 44.
  3. Diagonal wood board sheathing applied over the entire wall. Boards shall be a minimum of 5/8 inch thick and each board shall be nailed with two 8d nails at each stud crossing and three 8d nails at each end. Horizontal and vertical board sheathing are not a substitute for corner bracing.

*First Printing*

4. Shear walls (entire wall sheathed with plywood or siding) may also be used as corner bracing. Generally, if two complete sheets of approved sheathing or siding (no holes cut in them) are used for each required brace, sufficient strength will be achieved. Nailing should be with 8d nails spaced every 6 inches around the panel edges and every 12 inches along interior studs. Plywood or siding shall have a minimum thickness of 3/8 inches. Consultation with the Engineering Staff or the local field office of the State Board of Insurance is recommended.
- In addition, exterior walls greater than 24 feet in length shall be braced by interior walls greater than 6 feet in length where they intersect the exterior wall. The brace shall be installed as close to the exterior wall as possible. All exterior walls shall have one such brace installed for each 10 feet in length over 24 feet, at a minimum (unless there are no intersecting walls). Any of the above methods may be used. At this location only, *S.B.C.C.I.* listed flat metal straps installed in a X pattern will also be accepted. These interior load bearing walls shall be anchored to the foundation as specified in **Section 411.1(a)**.

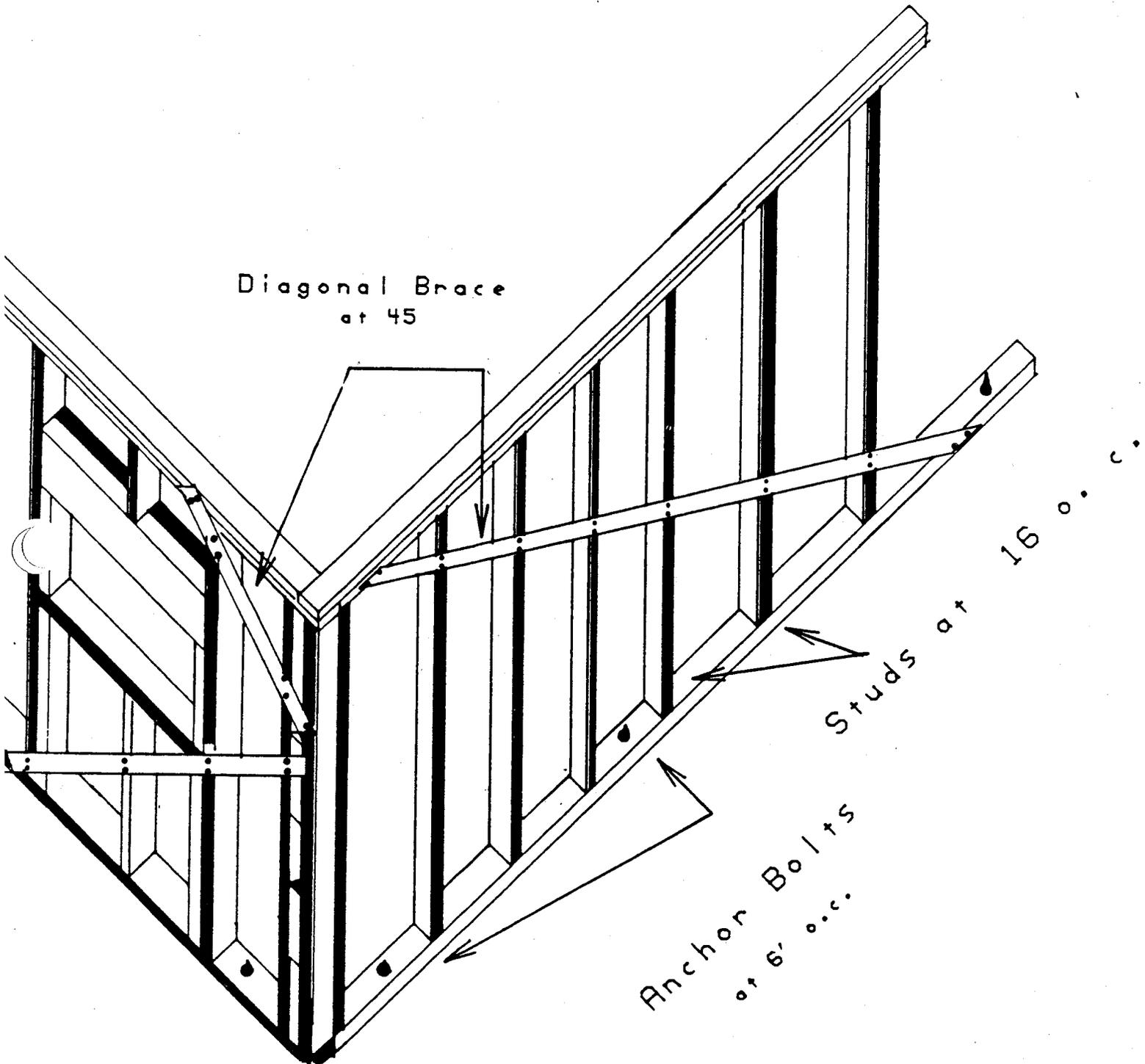


Figure 44. Let-in Diagonal Corner Bracing

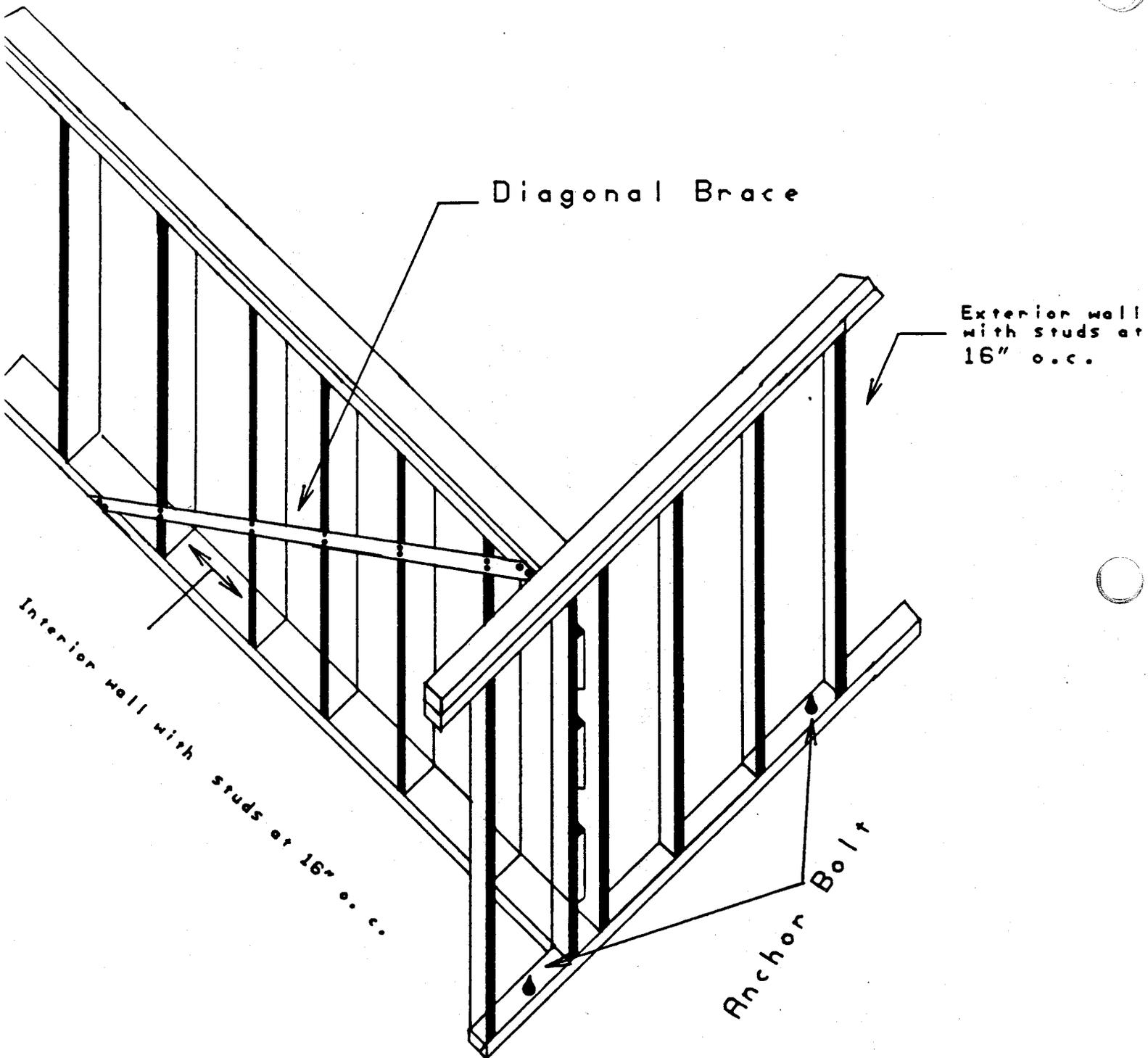


Figure 45. Interior Wall Bracing an Exterior Wall

**412.7 Framing Around Openings**

- Headers shall be provided over each opening in walls carrying vertical loads.
- Headers may be two pieces of nominal 2 inch lumber set on edge and nailed together or may be of solid lumber of equivalent size. Other types of beams may be used if they are equivalent. Wood trusses will be acceptable only if properly designed and installed.
- Size of headers in exterior walls shall comply with the following table:

<b><u>MAXIMUM ALLOWABLE SPANS FOR HEADERS-SEAWARD</u></b> (No. 2 Lumber)	
Size of Header	Maximum Span
Double 2 X 4 or 4 X 4	4' - 0"
Double 2 X 6 or 4 X 6	6' - 0"
Double 2 X 8 or 4 X 8	8' - 0"
Double 2 X 10 or 4 X 10	10' - 0"
Double 2 X 12 or 4 X 12	12' - 0"

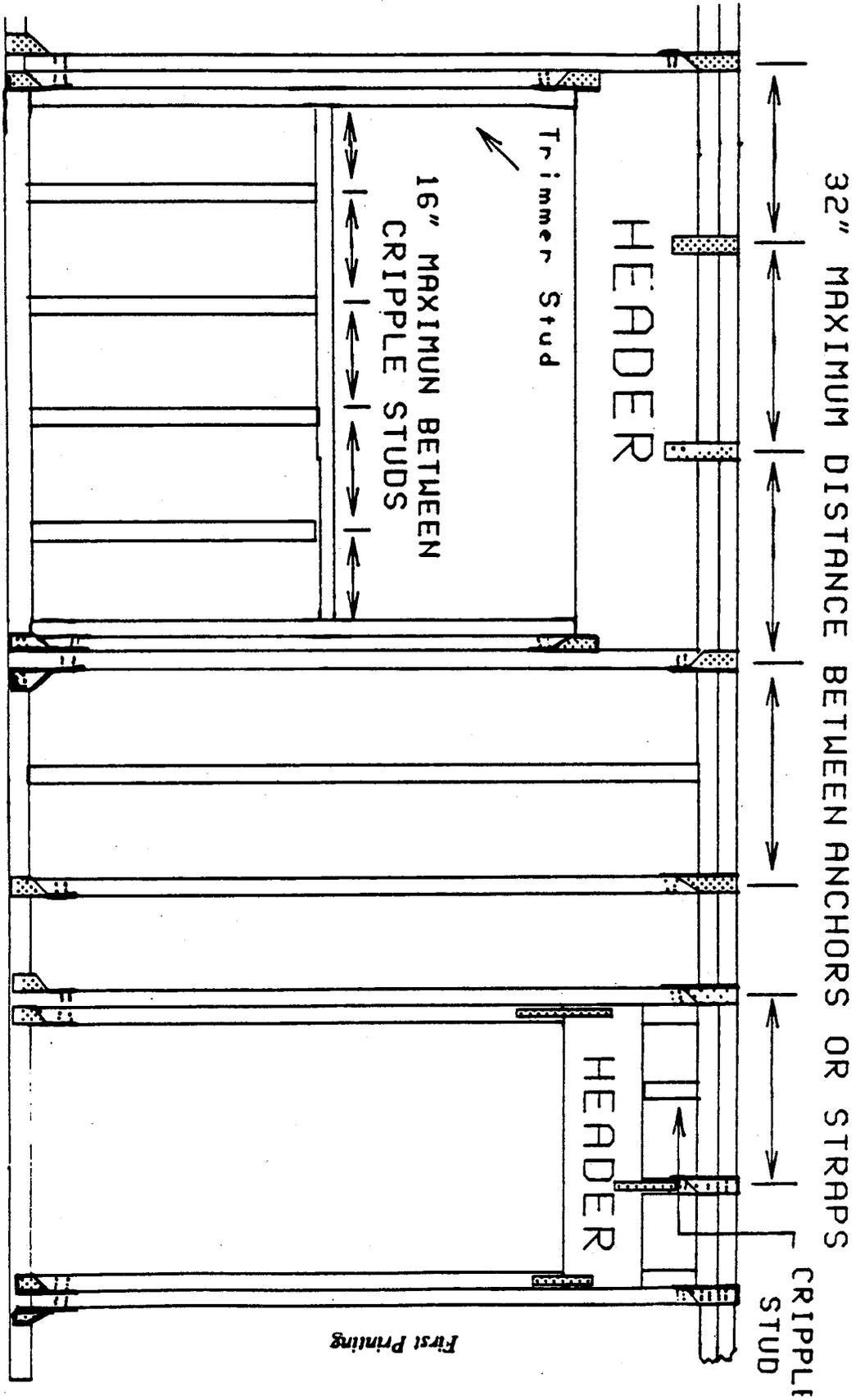
**Figure 46. Maximum Spans for Headers**

- Two 2 X 12's with a minimum 15/32" piece of plywood properly glued and nailed between them may span up to 14 feet.
- Two 2 X 12's with plywood sandwiched as above and either the entire interior or exterior wall sheathed in minimum 15/32" plywood may span up to 16 feet.
- Two 2 X 12's with plywood sandwiched as above and both the entire interior and exterior wall sheathed in minimum 15/32" plywood may span up to 18 feet.
- Special types of beams such as glulam, flitch (steel sandwiched between lumber), boxbeam, truss, etc., will be acceptable if properly designed and installed.
- There shall be a wall stud directly on each side of the header. The wall stud shall be connected to the sole plate and doubled top plate with framing anchors installed as per Section 412.3.
- The header shall be nailed to the adjacent studs.
- Headers less than 6 feet long shall be supported upon a minimum of one header (trimmer) stud at each end, except headers less than 3 feet long may be supported by a framing anchor at each end.
- Headers longer than 6 feet in length shall be supported by a minimum of two header (trimmer) studs at each end.
- For headers 9' or less in length, one header (trimmed) stud on each end shall be anchored to the sole plate as per Section 412.3 and the header with an approved framing anchor or strap.

*First Printing*

- For headers over 9' in length, both header (trimmer) studs at each end shall be anchored to the sole plate and the header as specified above.
- If the header does not extend completely to the double top plate, cripple studs shall be provided, spaced 16 inches O.C. with approved framing anchors or straps fastening every other stud to the top plates and the header.
- If the header extends completely to the double top plate it shall be fastened to the top plates every 32 inches with an approved framing anchor or strap.
- Headers located in load bearing interior walls which are subject to small uplift loads shall only be required to have one set of framing anchors installed at each end.
- Openings in non-load bearing partitions may be framed with single studs and headers.

Figure 47. Anchorage of Headers



First Printing

#### 412.8 Windows

- Wall framing around windows shall be adequate to hold the window in place.
- Headers above windows shall comply with Section 412.7.
- Windows shall be fastened using a minimum of a 4d box or common nails or a minimum of a 16 gauge staple having a minimum 1-1/2 inch leg length and minimum 7/16 inch crown width.
- Fasteners shall be spaced a maximum of 12 inches O.C. on all four sides of the window.
- Manufacturer's instructions shall be followed if they are more stringent than the above guidelines.
- Fasteners shall not be overdriven.
- Fasteners shall be galvanized steel or aluminum. Aluminum fasteners should be used with aluminum window frames.
- Check with field offices for very large, or irregular windows.
- When the size or number of windows prevents normal guidelines from being followed, the structure will generally have to be designed by a professional engineer.

#### 412.9 Awnings or Overhangs.

- Awnings or overhangs over 4 feet wide shall be securely anchored to the foundation using framing anchors, posts, and post anchors rated to withstand uplift.
- Awnings and overhangs shall be designed to withstand 70 pounds per square foot uplift force.
- The uplift anchorage per post may be calculated using the following formula:

L = length of overhang

W = width of overhang

P = number of posts used.

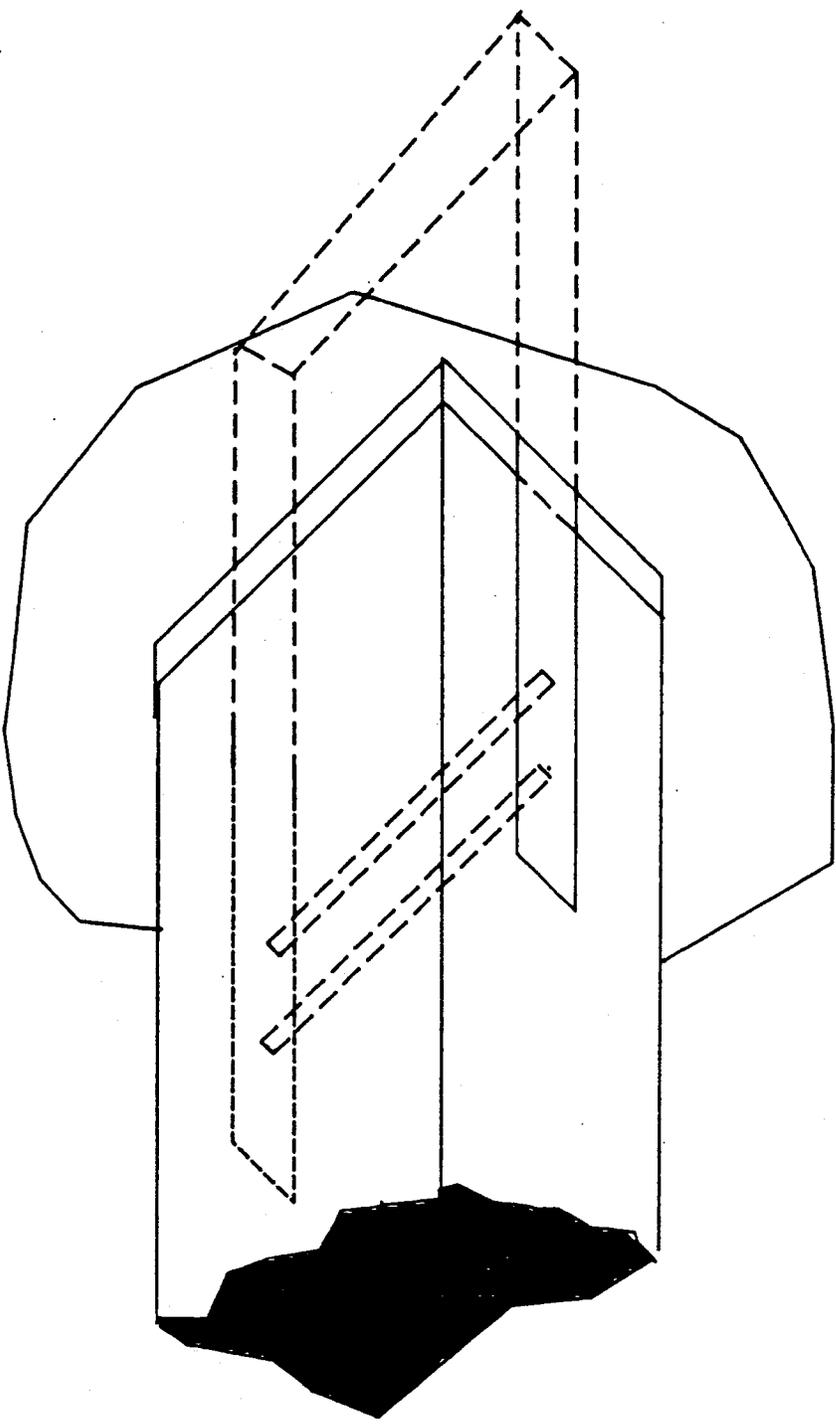
$$\text{Anchorage required per post} = \frac{L \times W \times 41}{P}$$

Or in plain English, the anchorage required per post is equal to the length of the awning times the width of the awning times 41 and that total divided by the number of posts intended to be used.

- An approved anchor shall be used at the top and bottom of each post or column. This anchor shall be rated for UPLIFT an amount at least as great as the calculated anchorage.
- Where two entire sides of the awning or overhang are supported by walls, the uplift anchorage per post may be calculated by using the following formula:

$$\text{Anchorage required per post} = \frac{L \times W \times 24}{P}$$

Figure 48. Anchoring Post to Slab



First Printing

## 412.10 Two Story Wood Framing

- Two story structures shall have continuous anchorage from the studs of the top floor through the sole plate, flooring, band joist or joist header, and doubled top plate, to the studs of the lower floor.
- This is best accomplished by a single connector known as a floor tie anchor, which fastens directly to the studs of the upper and lower floors and connects them together. As an alternate, connectors known as hold down, anchor down, or tie down anchors will be accepted when anchors are bolted to the upper and lower studs, and then bolted together. When one of the above mentioned anchors is used, and that anchor is rated to provide a minimum of 1000 pounds anchoring force, one such anchor or set of anchors shall be installed as per the manufacturer's recommendation on every fourth pair of studs. Normal framing anchors are not required at locations where these anchors are used, but shall be installed at the top of upper studs being anchored in this way, and at the top and bottom of the second stud over from the stud being anchored in this way.
- An acceptable alternative to these anchors is to tie the floors together using a flat metal strap from stud across the band joist or joist header. When an approved metal strap is rated by its manufacturer to provide a minimum of 500 pounds anchorage, one such strap shall be installed as per the manufacturer's recommendations across every other pair of studs. There shall be a sufficient number of nails into the studs (not counting nails in band joist or joist header) to develop the rated strength. Straps shall be galvanized or otherwise corrosion resistant.
- Another acceptable method will be to use lag bolts to bolt the sole plate and top plates to the joist header or band joist. Lag bolts shall be a minimum of 1/2 inch in diameter and a minimum of 4 inches long where bolting through a sole plate and a minimum of 5 inches long where bolting through a doubled top plate. These lag bolts shall be spaced a maximum of 2 feet O.C., and shall be installed with a minimum of a one inch washer.
- A fourth method which will be accepted uses sheets of plywood to tie the floors together. The walls are completely sheathed in plywood, with the sheets staggered such that alternate sheets extend a minimum of 18 inches above the sole plate of the upper wall and the adjacent sheet extends a minimum of 18 inches below the top plate of the lower wall. See Figure 51. Plywood shall have a minimum thickness of 15/32 inch, and shall be nailed to the framing with 8d nails spaced every 4 inches along each stud within the first 18-20 inches from each plate, and along each plate, and nailed as for regular wall sheathing for the remainder of the wall.
- All of the above methods are in addition to the required nailing of the sole plate and top plates to the joist header or band joists using a minimum of 16d nails spaced 16 inches O.C.
- In addition to exterior walls having to be tied down, interior walls which carry uplift loads from the roof shall also be anchored down. Two ways this may be accomplished are as follows:
  1. Use a minimum of 3/8 inch lag bolts, minimum of 4 inches long, spaced a maximum of 4 feet O.C., to bolt the sole plate through the floor deck to a floor joist below,
  - or
  2. Cut small holes in the floor deck and use a strap over the sole plate to connect it to a floor joist below, also at 4 feet O.C.

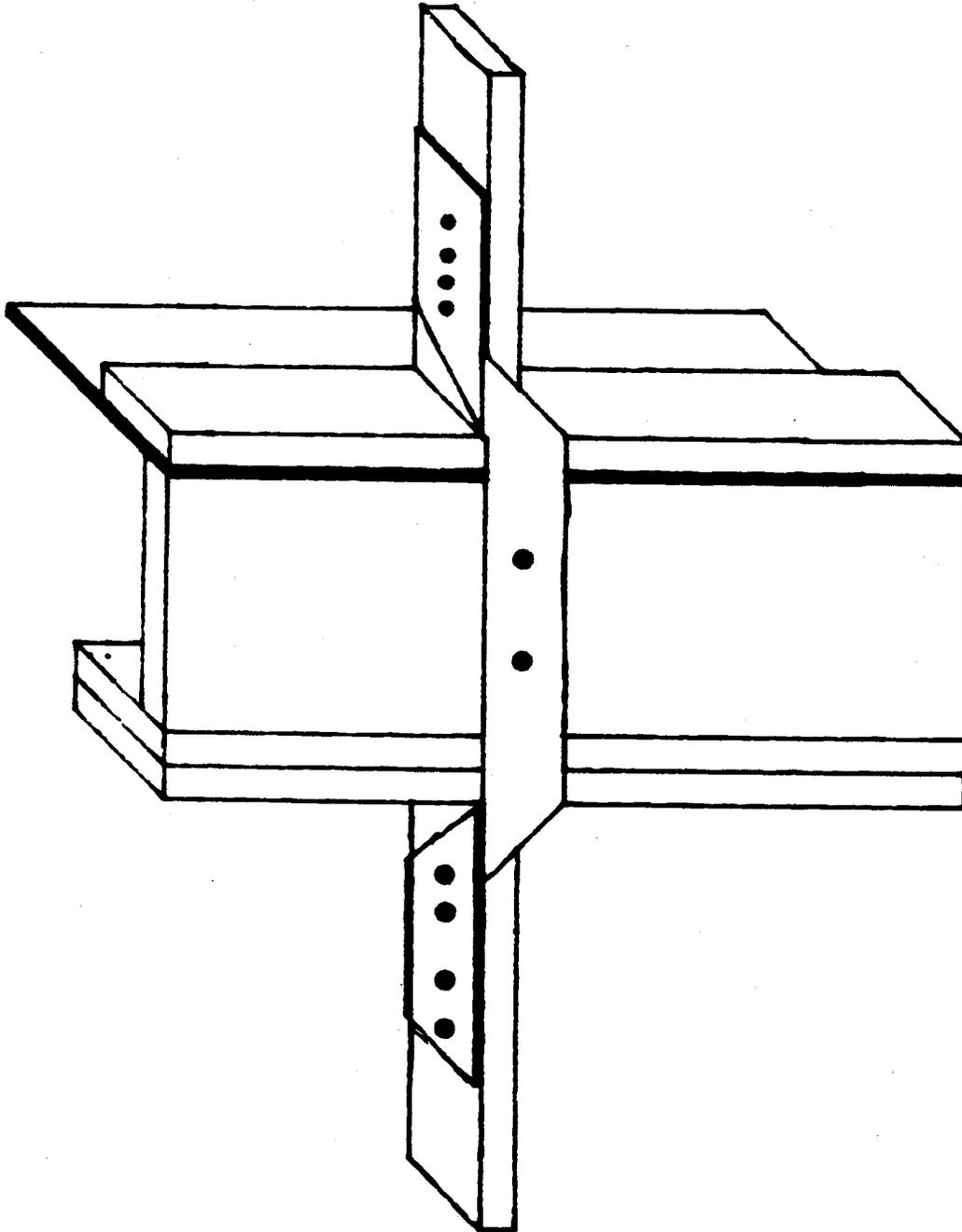


Figure 49. Tying Stories Together Using an Anchor

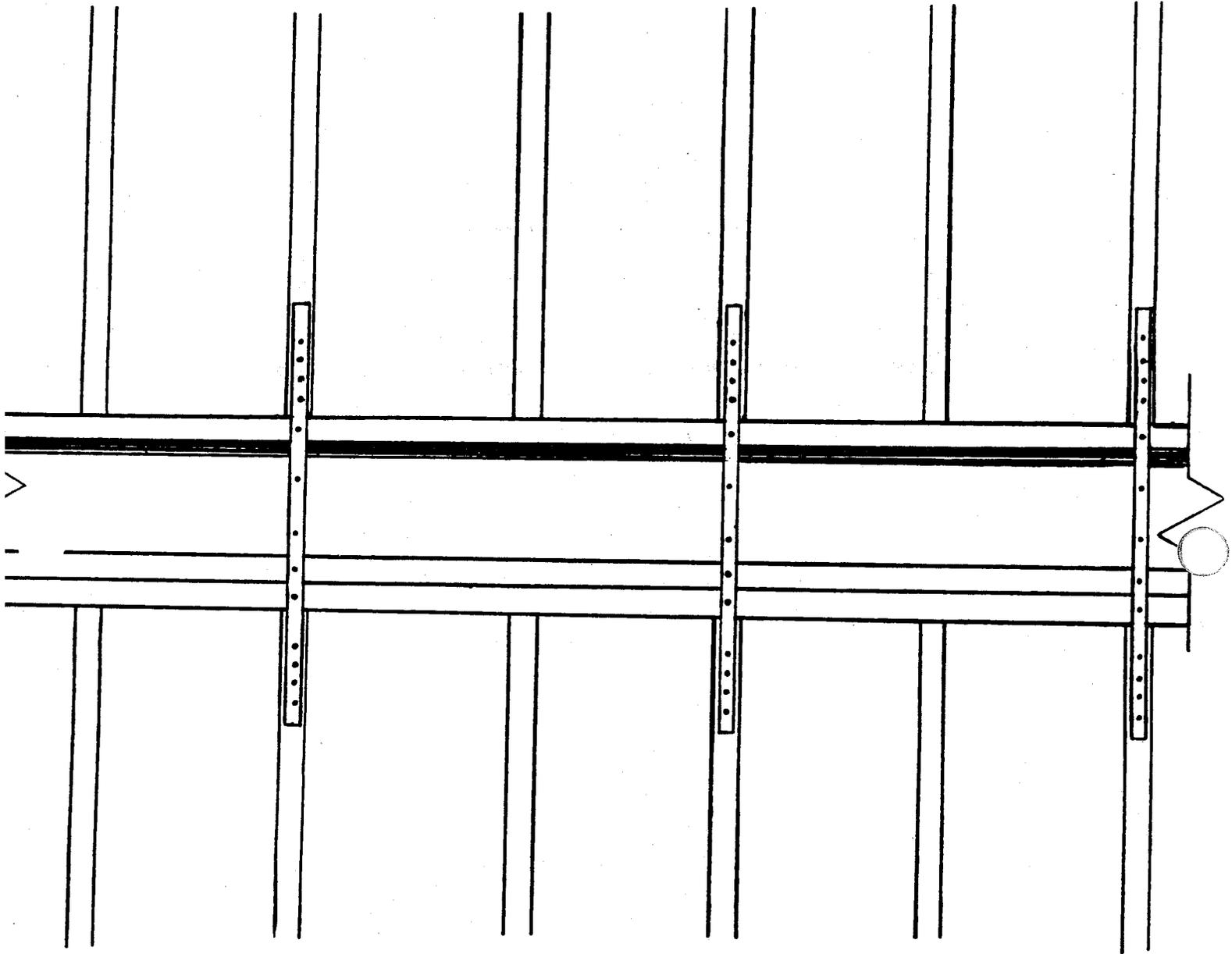


Figure 50. Tying Stories Together Using Straps

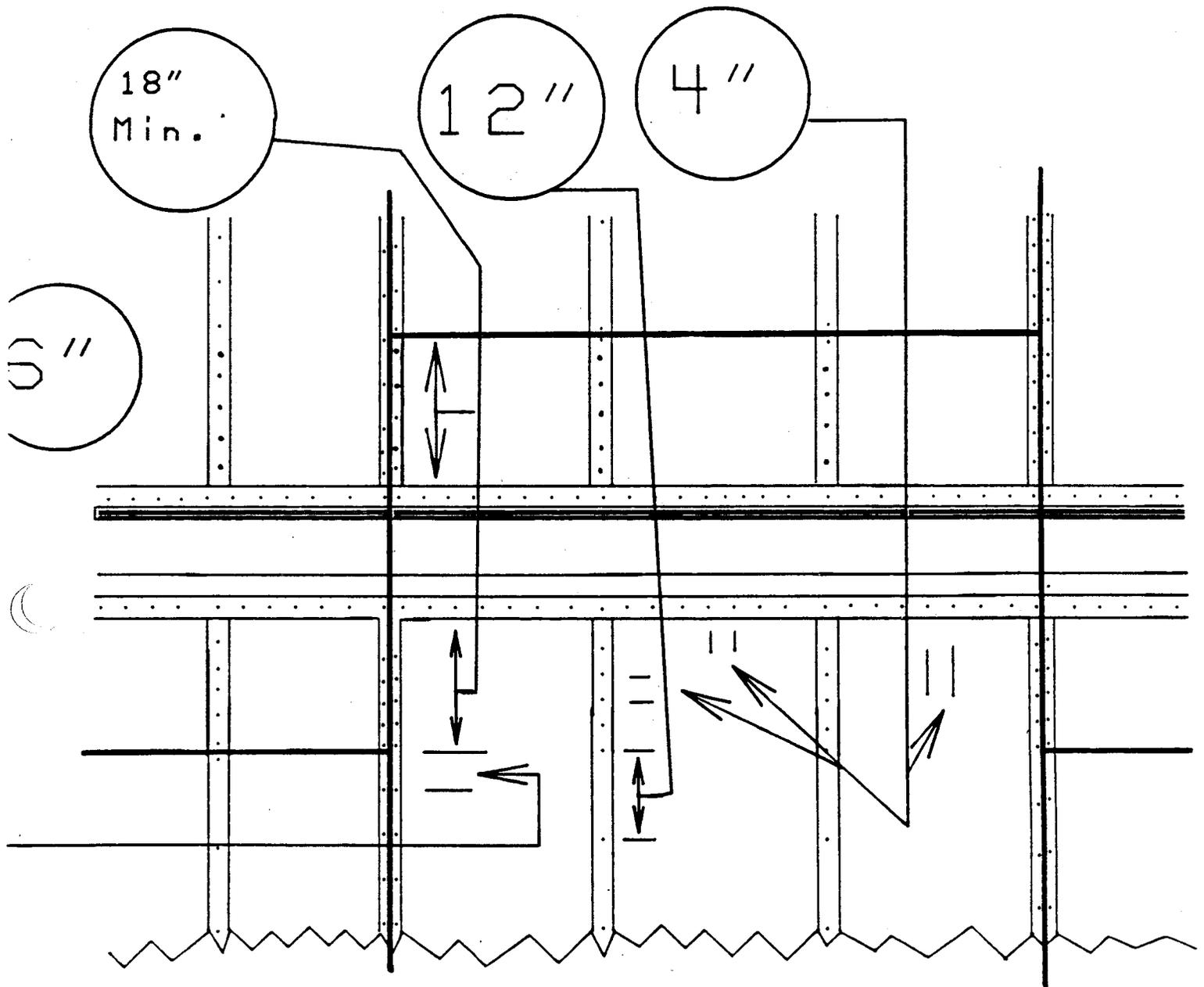


Figure 51. Tying Stories Together Using Plywood

### 412.11 Notches and Holes in Joists

- Notches on the ends of joists shall not exceed one fourth of the depth.
- Holes bored for pipes or cable shall not be within two (2) inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one third the depth of the joist.
- Notches for pipes in the top or bottom of joists shall not exceed one sixth the depth of the joist and shall not be located in the middle third of the span.

## 413 Exterior Coverings

### 413.1 Plywood Panel Siding (including 303 and T-111)

- All siding must be properly rated by an approved agency for the application being used.
- Siding 1/2 inch thick or less shall be nailed to studs with 6d nails.
- Siding thicker than 1/2 inch shall be nailed to studs using 8d nails (this will include T-111).
- Nails shall be spaced every 6 inches along all panel edges and every 12 inches along all interior studs.
- Nails shall be hot dipped galvanized, stainless steel, aluminum, or electrically or mechanically galvanized steel with plating which meets or exceeds the thickness requirements of *ASTM A641 Class 2 coatings*.
- Building paper shall be installed if panels are applied directly to studs unless panel edges are shiplapped, battened, or caulked.
- Different sizes and spacing of fasteners may be required if the siding is being used as a shear wall.

### 413.2 Lap Siding

- Lap siding shall be fastened to each stud with 8d nails in compliance with the following table:

<b><u>NAILING OF BOARD SIDING-SEAWARD</u></b>	
Width of Board	8d Nails Per Stud
1 x 8 or less	Two Per Stud
Over 1 x 8	Three Per Stud

**Figure 52. Nailing of Board Siding**

- The recommendation of the siding manufacturer shall be followed if additional nailing is specified.

### **413.3 Brick Veneer**

- This section applies to non-load bearing brick veneer only.
- Brick veneer shall be applied over properly rated solid wall sheathing (plywood, fiberboard, insulating board, etc.).
- Waterproof building paper shall be applied over the wall sheathing unless sheathing is water repellent.
- A moisture barrier such as flashing or felt shall be applied to at least the lowest 12 inches of the wall studs and shall extend under the brick starter course a minimum of one inch.
- Weep holes shall be provided in the bottom course of bricks at least every 4 feet.
- Provide a minimum 1 inch air space between masonry and wall sheathing.
- Masonry shall be tied to the wood framing with corrosion-resistant metal brick ties. Brick ties shall be spaced a maximum of 12 inches vertically along each stud when studs are spaced 16" O.C., and 9 inches vertically along each stud when studs are spaced 24" O.C.
- Veneer ties shall be minimum 22 gauge corrugated sheet metal, minimum number 6 gauge wire with a minimum of 2 inch hook embedded in mortar, or other equivalent fastener.
- Mortar shall be placed on sheet metal veneer ties to prevent wall from collapsing inward.
- Wall sheathing beneath brick veneer shall be applied in the same manner as for plywood siding.

### **413.4 Stucco.**

- Stucco shall be applied over properly rated plywood wall sheathing or other solid wall type such as masonry.
- Building paper shall be applied over the wall sheathing.
- Lath for stucco must be galvanized or other approved corrosion resistant material.
- Lath shall be fastened with 8d galvanized nails, driven and clinched over, or 1 1/2 inch shingle nails with heads larger enough to prevent the lath from slipping over the nail head. Nails shall be spaced a maximum of 16 inches along each stud.
- The finished stucco shall have a minimum thickness of 5/8 inch.

### **413.5 Vinyl, Aluminum, and Steel Siding.**

Vinyl, aluminum, and steel siding shall be installed as per the manufacturer's recommendation for high wind areas. Contractor shall furnish manufacturer's specification upon request. Documentation by testing may be required. Contact the field office for approved types and applications.

### **413.6 Attic Vents**

For gabled and hipped roofs, ventilation shall be provided to furnish cross ventilation of each separate space with weather protected vents. Flat roofs shall be ventilated along the overhanging eaves. Equal vent areas should be placed on opposite sides of the structure to allow cross-ventilation.

### **413.7 Roof Decking and Roof Covering**

Refer to Section 470, Roofing, for requirements applicable to roof decking and roof covering.

## **414 Mechanical and Exterior Equipment**

### **414.1 Exterior Air Conditioner Equipment**

- All exterior air conditioning equipment shall be securely fastened to either the adjacent structure or to a suitable pad or platform.
- Square units shall be fastened at a minimum of four locations. Round units shall be fastened at a minimum of three locations.
- Concrete pads shall weigh a minimum of 90 pounds. If all sides and the top of the air conditioner unit are not open, a heavier pad will be required.
- The unit shall be secured to the pad with cast in place anchor bolts, powder actuated fasteners, or drilled anchor bolts. A minimum of 22 gauge galvanized steel straps may also be used to anchor units to pads.
- If the air conditioner unit is to rest on a cantilevered platform built on to an elevated structure, the cantilever beams shall extend under (or into) the structure a minimum of twice as far as the beams extend out. Beams shall be securely nailed or fastened to floor joists or other suitable structural members.
- Wood platforms built to stand alone will also be accepted if they are properly constructed to withstand wind loads and are adequately anchored to the ground.
- In all cases, air conditioner units must be correctly bolted to their platform.
- Air conditioner equipment on top of built-up roofs shall be securely fastened to a platform or blocking which is at a minimum embedded in hot asphalt, or anchored in another approved method.

### **414.2 Other Exterior Equipment**

All other exterior equipment, such as floodlights, turbine vents, propane tanks, swimming pool filters, and water cooling towers, shall be sufficiently anchored to the structure or an adequate foundation to resist applicable wind loads.

## 420 Masonry Construction-Seaward

The following will apply to one and two story rectangular masonry structures.

### 421 Foundation

- Masonry structures shall only be constructed on slab-on-grade type foundations.
- Slab shall be reinforced.
- 1/2 inch diameter (no. 4 bar) tie-downs shall be embedded a minimum of 6 inches into the footing and shall have a standard 90 degree hook in each end.
- Tie-downs shall be spaced as per Section 422.
- When tie-downs are spliced, foundation tie-downs shall lap wall tie-downs a minimum of 15 inches.

### 422 Masonry Walls

#### 422.1 General Requirements

- Masonry units shall have a minimum nominal thickness of 8 inches, except 6 inch solid masonry blocks may be used for walls a maximum of 8 feet high.
- Type M or S mortar shall be used
- A bond beam of the size specified shall be provided at all floor levels and at the roof level.
- Vertical tie-downs consisting of a minimum of one no. 4 bar shall be provided, and shall be spaced as per Section 422.2 or 422.3.
- Tie-downs shall be embedded a minimum of 6 inches into the top bond beam with a 90 degree hook in the end. The bond beam tie-down and the wall tie-down shall be lapped a minimum of 15 inches.
- Corner cells of one-story walls shall have one tie-down in them. Corner cells of two-story walls shall have two no. 4 bars in them or one bar each in the two cells nearest the corner.
- Cells or cavities containing tie downs shall be completely filled with grout.
- If stack bond is used, a minimum of 9 gauge joint reinforcement shall be placed in every other course.

#### 422.2 Solid Masonry

- Bond beams shall be cast in place and shall have a minimum width of 5-1/2 inches (or width of wall) and a minimum height of 8 inches.

*First Printing*

- Bond beams shall be reinforced with two #5 (5/8") bars (one each top and bottom, located 1-1/2 inches from the top and bottom of bond beam).
- Vertical tie-downs shall be spaced a maximum of 8 feet apart, with tie-downs spaced as evenly as possible if closer spacing is used.
- Vertical tie-downs may be spaced up to 11 feet apart if 12 inch high bond beams are used, with reinforcement as above.

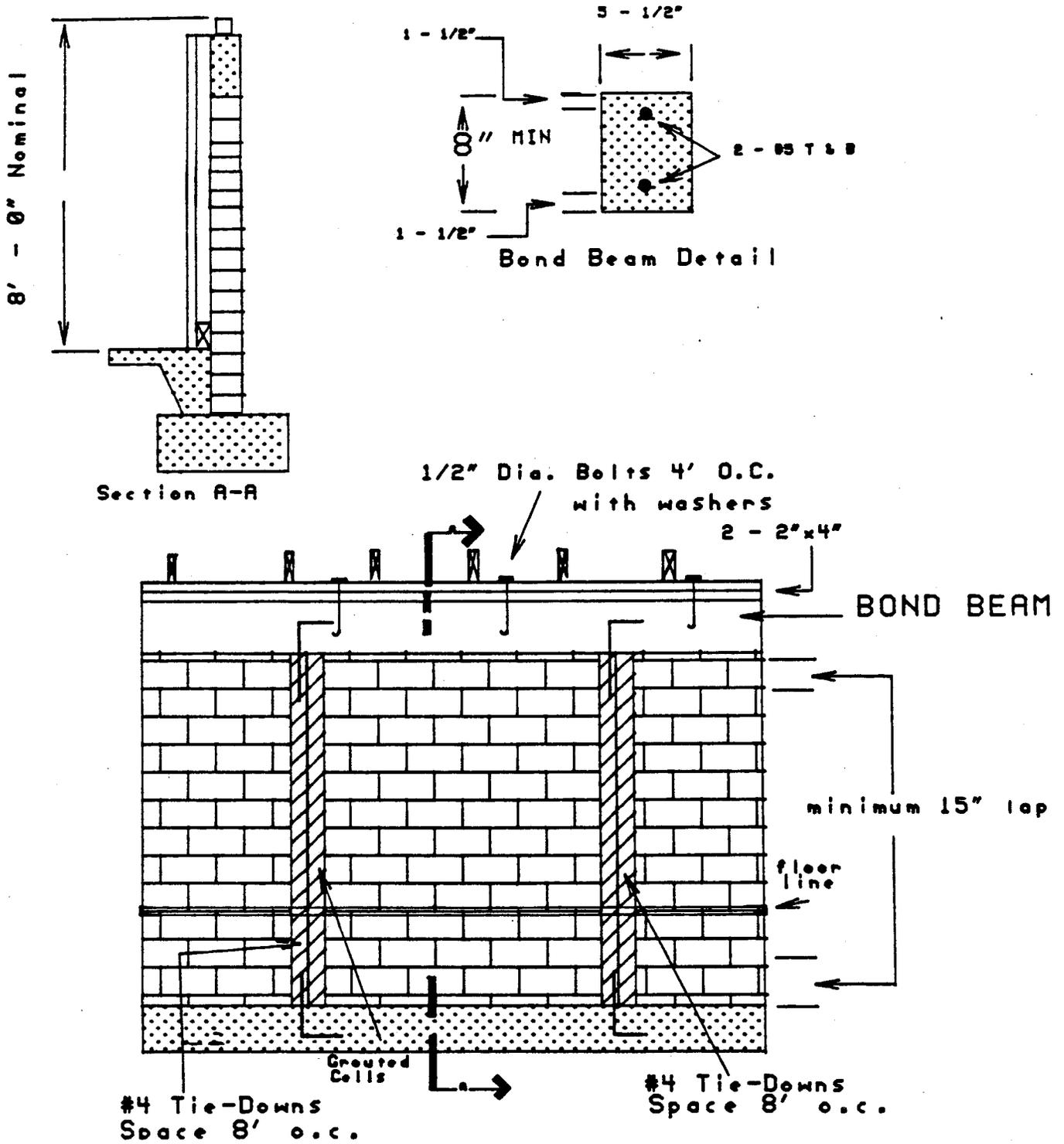


Figure 53. Solid Masonry Walls

### **422.3 Hollow Masonry**

- Bond beams shall be filled masonry units having a width of 7-5/8 inches and a height of 7-5/8 inches at a minimum.
- Bond beams shall be reinforced with two no. 5 (5/8") bars (one each at top and bottom of filled portion of masonry unit, with top bar 1-1/2 inches below the top of bond beam).
- As an alternate, two no. 4 bars may be substituted for EACH no. 5 bar (4 bars total required).
- Vertical tie-downs shall be spaced a maximum of 4 feet apart, with tie-downs spaced as evenly as possible if closer spacing is used.
- Vertical tie-downs may be spaced a maximum of 8 feet apart if the bond beam consists of two filled masonry units, with one no. 5 bar in the bottom of the lower filled masonry unit, and another no. 5 bar 1 1/2 inches from the top in the top filled masonry unit (or two no. 4 bars in each of those locations - 4 in all). When the bond beam consists of two filled masonry units, the upper and lower units shall be tied together.

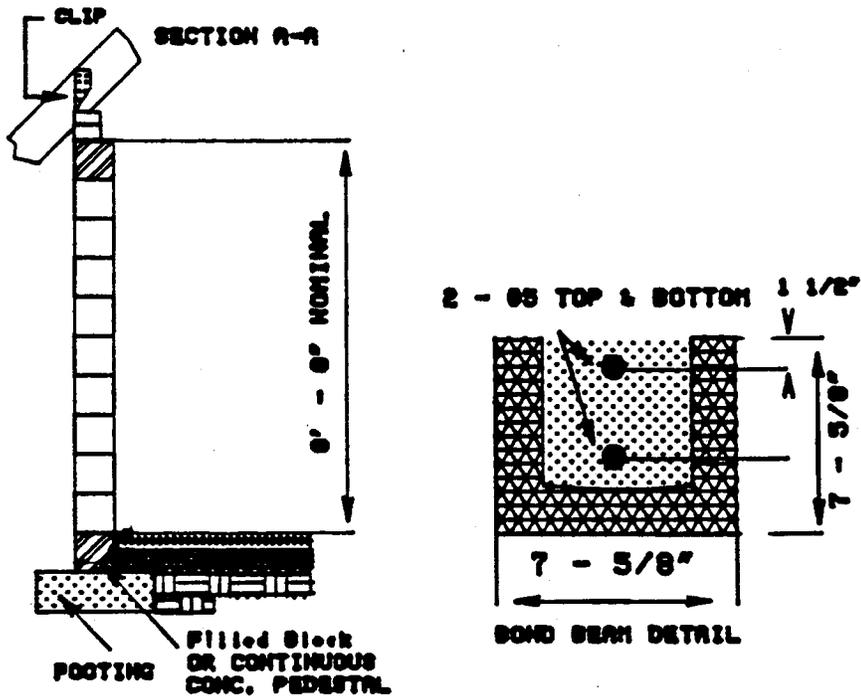
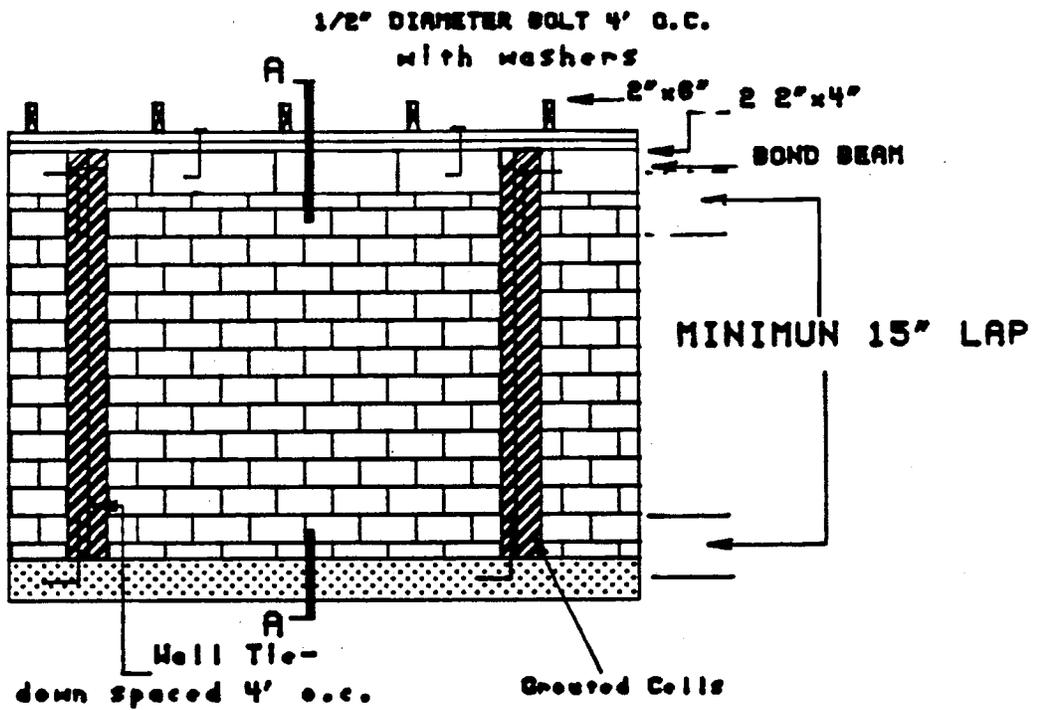


Figure 54. Hollow Masonry Walls

#### 422.4 Roof Framing to Exterior Wall Masonry Connections.

Roof framing members shall be anchored to the exterior masonry wall bond beam by one of the following methods. Anchors and ties shall be so arranged as to form continuous ties between opposite masonry walls.

##### 422.4(a) Top Plate Bolted to Exterior Wall

- The top plate shall be bolted to the bond beam with 1/2 inch bolts embedded a minimum of 6 inches into the bond beam.
- A minimum of 1-3/8 inch diameter by 1/8 inch thick washers shall be used.
- The top plate shall consist of one 2 x 6 or two 2 x 4's bolted every 48 inches to the bond beam below.
- At least one beam, joist, rafter, or truss in every 4 feet and every trimmer shall be anchored to the top plate (or both plates) with an approved corrosion-resistant framing anchor (hurricane clip). Refer to Section 412.3. Depending upon the design, every truss may have to be anchored to the top plate.
- Beams, joists, girders, or other concentrated loads shall have at least 4 inches of bearing on the top plate.

##### 422.4(b) Roof Framing Members Connected Directly to Bond Beam at Exterior Wall

- At least one beam, joist, rafter, or truss in every 4 feet and every trimmer and girder shall be anchored to the bond beam using manufactured fasteners approved for such use. Fasteners shall be rated to provide a minimum of 500 pounds resistance to uplift. Fasteners shall also be capable of resisting lateral loads. Fasteners shall be installed as per the manufacturer's recommendations. Depending upon the design, every truss may have to be anchored to the bond beam.
- Beams, joists, girders, or other concentrated loads shall have at least 4 inches of bearing on solid masonry.

#### 422.5 Other Roof Framing Connections

- Where beams, girders, joists, rafters and trimmers rest on interior walls and columns, they shall be anchored in conformance with either Section 422.4(a) or Section 422.4(b). Where interior walls have no bond beam on top, framing members may be anchored using 1/2 inch bolts or straps embedded a minimum of 15 inches into the masonry.
- Each end of a trimmer, beam, or joist that is supported by a girder shall be supported or tied in an approved manner to such girder or to the trimmer, beam, or joist correspondingly supported from the opposite side of such girder.
- Where roof joists or beams run parallel to masonry walls, the walls shall be tied to at least the first 4 adjacent joists or beams with metal ties securely fastened to each joist or beam and embedded in the wall. The maximum spacing of these ties shall be 8 feet for residential structures and 6 feet for other structures.

#### 422.6 Floor Framing Members

### *First Printing*

- At least one floor joist, beam, or other floor framing member in every 6 feet shall be anchored to the masonry wall with an approved metal anchor. These members shall provide continuous ties across the structure to the opposite masonry wall.
- When floor joists or beams run parallel to masonry walls, the walls shall be tied to at least the first 4 adjacent joists or beams with metal ties securely fastened to each joist or beam and embedded in the wall. The maximum spacing of these ties shall be 8 feet for residential structures and 6 feet for other structures.

#### **422.7 Openings**

- Masonry above any openings shall be supported by either a well buttressed arch, a masonry bond beam, or a lintel of corrosion-resistant metal.
- Openings 6 to 12 feet wide shall have reinforcement consisting of one no. 5 bar on each side in the masonry. Openings larger than 12 feet wide shall have two no. 5 bars or one no. 7 bar located on each side in the masonry. Cavities or cells containing reinforcement shall be completely filled with grout. Bars shall be lapped with tie-downs in the bond beam and the foundation.

#### **422.8 Masonry Veneer**

- Masonry veneer shall not be assumed to carry any load other than its own weight.
- Masonry veneer shall be tied to the masonry wall using corrosion-resistant metal ties spaced a maximum of 12 inches O.C. vertically and 16 inches O.C. horizontally.
- Veneer ties shall be 22 gauge (or greater) corrugated sheet metal, or number 6 gauge (or greater) wire.
- Ties shall be embedded in the mortar of both the wall and the veneer.
- Mortar shall be placed on sheet metal ties to prevent the veneer from collapsing inward.

### ***423 Exterior and Mechanical Equipment.***

All exterior and mechanical equipment which is exposed shall be anchored in conformance with Section 414.

## **430 Metal Construction-Seaward**

### ***431 Manufactured Metal Structures***

Manufactured metal buildings and other structures shall be designed by a Texas registered professional engineer for the wind loads specified in the introduction. Refer to **Section 140** to determine what types of metal buildings the State Board of Insurance will inspect. The contractor shall furnish a certificate of design and installation instructions to the State Board of Insurance. Installation instructions shall be followed exactly. The foundation is considered to be part of the structure, and therefore must be part of the original approved design. Installation of mechanical and exterior equipment shall comply with **Section 414**. The local field offices or the engineering staff may be contacted for further information.

### ***432 Other Metal Structures***

Other metal structures should be designed with the aid of a professional designer. Submittal of design calculations for approval will be required in most cases, or certification by a Texas registered professional engineer may be required.

## 440 Miscellaneous Construction-Seaward

This section deals with several miscellaneous types of construction.

### 441 Pole Barns

This section applies to structures which have a frame consisting of vertical poles set in the ground and horizontal girts fixed to the poles. It is intended to apply only to such structures having a height less than 20 feet.

- Poles shall be treated with an approved wood preservative.
- Poles shall be buried a minimum of 5 feet, with concrete poured around the entire buried portion of the pole.
- Poles shall be spaced a maximum of 10 feet apart.
- Fastening of girts to poles and of plywood siding to girts shall comply with **Figure 55**.
- Spacing of girts shall conform to **Figure 56**.
- Girts may be fastened using either nails, through bolts with washers, or lag bolts with washers.
- The remainder of the structure shall comply with any applicable portion of **Section 410, Wood Frame Construction**.

*Note:* Figure References 55 and 56 pertain to the figures on the following pages.

**Figure 55. Pole Barns-Fastening Schedule**

**Figure 56. Pole Barns-Maximum Span of Horizontal Girts**

**POLE BARNs**  
(All Sides Closed)

Center To Center Spacing of Girts	FASTENING									
	Girts To Poles			Lag Bolt Length				Plywood Siding To Girts		
	Minimum Washer Size	Minimum Thru Bolt Diameter	1/4" Dia	5/16" Dia	3/8" Dia	7/16" Dia	1/2" Dia	6d Nails	8d Nails	16 Ga. Staples 1 1/2" Minim Leg Length
8"	3/4"	1/4"	3"	3"	3"	2 1/2"	2 1/2"	24"	24"	20"
10"	1"	1/4"	3"	3"	2 1/2"	3"	3"	22"	24"	16"
12"	1"	1/4"	4"	3"	3"	3"	3"	18"	22"	14"
14"	1 1/4"	5/16"	N/A	4"	3"	3"	3"	16"	20"	12"
16"	1 1/4"	5/16"	N/A	4"	4"	3"	3"	16"	18"	10"
18"	1 1/4"	5/16"	N/A	4"	4"	4"	3"	14"	16"	8"
20"	1 1/2"	5/16"	N/A	4"	4"	4"	3"	14"	16"	8"
22"	1 1/2"	5/16"	N/A	4"	4"	4"	4"	10"	12"	7"
24"	1 1/2"	5/16"	N/A	4"	4"	4"	4"	10"	12"	7"

- *These sizes and spacings have no factor of safety built in. Larger fasteners and closer fastener spacing should be used for additional strength.*
- *Staples shall have a minimum 7/16" crown width.*
- *Nails shall be staggered to avoid splitting of the wood.*
- *Where one or more sides are open, the following shall apply:*
  1. *Maximum fastener spacings for fastening plywood to girts shall be reduced one-half*
  2. *Bolt diameters shall be increased a minimum of 1/8" (2/16")*
  3. *Lag bolt lengths shall be increased a minimum of 1 inch.*

## POLE BARNs

(All Four Sides Closed)

### MAXIMUM SPAN OF HORIZONTAL GIRTS (DISTANCE BETWEEN POLES)

Center to Center Spacing of Girts	Size and Grade of Lumber								
	2 X 4			2 X 6			2 X 8		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
8"	9'-10"	9'-0"	6'-8"	10'-0"	10'-0"	7'-10"	10'-0"	10'-0"	9'-1"
10"	8'-9"	8'-1"	6'-0"	10'-0"	9'-4"	7'-0"	10'-0"	10'-0"	8'-1"
12"	8'-0"	7'-4"	5'-5"	9'-4"	8'-6"	6'-5"	10'-0"	9'-9"	7'-4"
14"	7'-4"	6'-10"	5'-0"	8'-8"	7'-10"	6'-0"	10'-0"	9'-1"	6'-10"
16"	7'-0"	6'-4"	4'-8"	8'-1"	7'-4"	5'-6"	9'-4"	8'-5"	6'-4"
20"	6'-2"	5'-8"	4'-2"	7'-3"	6'-7"	5'-0"	8'-4"	7'-6"	5'-8"
22"	5'-11"	5'-5"	4'-0"	6'-11"	6'-3"	4'-8"	7'-11"	7'-2"	5'-5"
24"	5'-7"	5'-2"	3'-9"	6'-7"	6'-0"	4'-6"	7'-7"	6'-11"	5'-2"

*Maximum spans shall be reduced 30% (multiplied by 0.7) for with one or more open sides.*

*Interpolation (averaging) is permissible.*

First Printing

## ***442 Patio Covers***

Manufactured metal patio covers, awnings, and covered walkways shall be treated in the same manner as metal buildings. These structures shall be designed to meet the wind loads specified in the Introduction.

- The contractor shall furnish a certificate of design and installation instructions to the State Board of Insurance.
- Installation instructions shall be followed exactly.
- Structures which are not designed for the proper wind loads will not be approved.
- Wood patio covers shall comply with Section 412.9.

## ***443 Boat Houses, Docks, and Piers (Over Water)***

Boat houses, docks, piers, and other structures built over water are specifically excluded from the T.C.P.I.A. Windstorm insurance policy. However, for an additional cost they may be added to the policy. Therefore, if these structures are to be insured, they must be inspected and approved by the State Board of Insurance, and they should be built to the following guidelines.

- Pilings which support boat houses, docks, and piers shall be buried a depth below the ground (ocean floor or channel bottom) at least equal to the height the lowest structural member is above that ground level.
- The minimum bury depth shall be 10 feet.
- The remainder of the structure may be built by either conventional framing or pole type framing (similar to the pole barn). All applicable previous guidelines shall be followed.
- Walkways or other structures which connect structures built over water to the main structure should be constructed so that if the structure over water should be destroyed by flooding, the part connected to the main structure will break away without causing damage.

## ***444 Mobile Homes and Manufactured Housing***

- Mobile homes and manufactured housing do not fall in the scope of the State Board of Insurance Windstorm Inspection program. Please contact the T.C.P.I.A. concerning coverage for these types of structures.
- A mobile home is defined as a structure, transportable in one or more sections, which is eight body feet or more in width, and is 32 body feet or more in length, which is built on a permanent chassis and is designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein.

## ***445 Portable and Temporary Buildings***

- Portable and temporary buildings shall be anchored by one of the methods outlined in Section 411.3.
- Conventionally framed portable and temporary buildings shall follow the guidelines set forth in Section 412.

*First Printing*

- Metallic portable and temporary buildings shall follow the guidelines set forth in Section 430.
- Roofing of portable and temporary buildings shall follow the guidelines set forth in Section 470.
- Mechanical and exterior equipment for portable and temporary buildings shall follow the guidelines set forth in Section 314.

### ***446 Other Miscellaneous Structures***

Any other type or shape of structure not covered here or elsewhere should either be built to all other applicable guidelines, or should be designed and inspected by a Texas registered professional engineer.

## **450 Additions-Seaward**

- All additions constructed after January 1, 1988, must be inspected and approved by the State Board of Insurance or a Texas registered professional engineer in order to maintain the insurability of the existing structure.
- The construction of additions shall comply with the applicable portions of this manual.
- Where new additions are attached to the existing structure and rely upon that structure for support, the two structures shall be securely anchored at the point of connection.
- The portions of the existing structure which carry loads from the addition should be constructed in accordance with the recommendations of this manual. Also, any portions of the existing structure which becomes exposed due to the addition should be made to comply with Section 412.3. The remainder of the existing structure will not be required to meet the construction guidelines unless it is altered in some way.
- When a second story is being added to an existing single story structure, the addition and any other structural components of the existing structure which carry loads from the addition shall comply with all applicable previous guidelines. The second story shall be securely anchored to the first story. Additional pilings or other supports will have to be installed if the original structure is not adequate to support the new addition.
- When a patio or porch is added to a structure, all applicable guidelines shall be followed. Please note that this will require the foundation of a porch, especially an elevated porch, to be built to the guidelines as for a normal foundation.

## 460 Renovation and Repair-Seaward

All repairs to any load-bearing portion of a structure or to any exterior component of a structure shall be inspected in order to maintain the insurability of the entire structure, except as noted in Section 461. Renovations and repairs shall comply with the following guidelines.

### 461 Foundation

#### 461.1 Slab on Grade Foundation

All but minor repairs of a slab on grade foundation shall be certified by a Texas registered professional engineer.

#### 461.2 Piling Foundation

Unless previous guidelines outlined in Section 411.2 can be followed exactly, renovation or repair of a piling foundation shall be certified by a Texas registered professional engineer.

#### 461.3 Pier and Beam Foundation

- When repairing piers or beams, previous guidelines should be followed. If it is impossible to provide continuous anchorage from beam through pier to footing, alternate methods may be approved. Two of these are as follows:
  1. Construct an anchor between each pier. (Maximum of 8 feet apart). This is accomplished by digging a 3' x 3' x 3' hole and filling it a minimum of 1' deep with concrete. Embed a corrosion resistant length of angle iron or 4" x 4" (minimum) treated lumber into the concrete and fasten it to the beam with a minimum of two 1/2 inch bolts. The angle iron or lumber shall be securely anchored to resist uplift. Fill in hole over concrete.
  2. Approved mobile home tie-down system may also be used. At least one tie-down should be installed at each pier around the perimeter of the structure, with a minimum of one for each six feet of length of each wall.
- When replacing or repairing less than one-third of piers or beams on structures constructed prior to June 1, 1972, guidelines will not have to be followed as long as the member is being replaced with an equivalent member.
- Contact local field office or State Board of Insurance engineering staff for approval if other methods are to be used.

## ***462 Framing***

All framing repairs and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

## ***463 Exterior Covering***

All exterior covering repair and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

## ***464 Mechanical Equipment***

All mechanical equipment related repair and renovation shall comply with any applicable previous guidelines, or shall be certified by a Texas registered professional engineer.

## 470 Roofing-Seaward

### 471 New Roofing

#### 471.1 Composition Shingle Roof

A new composition shingle roof shall be applied in the following manner:

##### 471.1(a) Roof Deck

- Roof decking shall be *APA (American Plywood Association)* or *TECO (TECO Products and Testing Company)* rated plywood or properly graded wood boards laid to form a solid wood deck.
- Board decking shall have a minimum nominal thickness of 1 inch.
- End joints between boards shall be located over the centers of rafters, and each end shall be nailed with the proper number of nails.
- Board decking shall be 1 X 4 or 1 X 6 lumber.
- Board decking shall be nailed with two 8d galvanized nails at each support.
- Sheathing panels shall be 5/8 inch plywood, minimum. Non-veneer panels are not acceptable seaward of the Intracoastal Waterway. For this type of deck, 24 inches O.C. shall be the maximum spacing of rafters or roof trusses.
- End joints shall occur over the center of rafters.
- End joints of adjacent courses shall be staggered.
- Roof sheathing panels shall be oriented with their long dimension across the rafters.
- There shall be a 1/8 inch space maintained between the panels.
- Panel roof decking shall be nailed with galvanized 8d nails 6 inches O.C. along the edges of the panel, and 12 inches O.C. along all interior supports.
- Fasteners shall not be overdriven.

##### 471.1(b) Underlayment

- For roof slopes of 4 in 12 or greater, decking shall be covered with a minimum of one layer of minimum 15 pound felt.
- For roof slopes less than 4 in 12, the decking shall be covered with a minimum of two layers of minimum 15 pound felt.

### First Printing

- Felt shall only be applied when the deck is dry.
- Felt shall be lapped 2 inches along the top and bottom, and 4 inches along the ends when applied in a single layer.
- Felt shall be lapped 18-19 inches along the top and bottom and 4 inches along the ends when two layers are applied.
- Felt shall be fastened down with enough nails or staples to hold it down until the shingles can be applied. Aluminum caps may be used only if aluminum nails are used.

#### 471.1(c) Composition Shingles

- Composition shingles shall be applied as per the manufacturer's published specifications for high wind areas. The 1973 Standard Building Code defines the area within 125 miles of the coast as a high wind area. For the purpose of this program, this will only apply to the 14 coastal counties listed in the introduction of this construction guide.
- If the manufacturer does not specify an application for high wind areas, each shingle shall be fastened using six nails. All nails shall be installed on the original nailing line. The fastener nearest the right and left edge shall be installed in the location specified by the manufacturer. For three-tab shingles, the remaining nails shall be placed on the nailing line, one on each side of the cut out which separates the tabs. For no-cutout or random-tab (dimensional) type shingles, the remaining four nails shall be evenly spaced along the nailing line. This requirement shall not apply to interlocking-type shingles.
- Other products or fastening methods will be accepted if supporting test data from an approved testing laboratory is submitted to the State Board of Insurance. Testing criteria shall comply with the wind loads specified in Section 120.
- Fasteners shall be roofing nails as specified by the manufacturer.
- Fasteners shall be galvanized steel or other corrosion resistant material.
- Fasteners shall have adequate penetration into the roof deck, but **MUST NOT BE OVERDRIVEN**. Overdriven fasteners will **NOT** be approved.
- Fasteners shall be driven in straight, not at an angle.
- Roofing nails shall be 11 or 12 gauge nails with large heads (3/8 inch to 7/16 inch in diameter). Nails shall be long enough to penetrate through the shingle and felt and at least 3/4 inch into the roof deck or the roof deck lumber or completely through the plywood roof deck. *The Asphalt Roofing Manufacturer's Association* recommends 1 1/4 inch long nails for asphalt shingles over new wood decks.
- If a metal drip edge is placed around the perimeter of the roof, it shall be securely fastened to the deck with galvanized nails spaced 10 inches O.C.

#### 471.2 Wood Shingle or Shake Roof

A new wood shingle or shake roof shall be applied in the following manner.

##### 471.2(a) Spaced Boards

- Wood shingles or shakes should be applied to spaced board sheathing although solid sheathing may also be accepted.
- Spaced boards shall have a minimum nominal thickness of one inch.

### *First Printing*

- Spaced boards shall be nailed to the rafters with two 8d galvanized nails at each intersection.
- Spacing of boards will depend upon the shingle exposure.
- Rafters shall be spaced a maximum of 24 inches on center.
- Nailing of solid sheathing shall comply with Section 471.1(a).

#### **471.2(b) Wood Shingles or Shakes**

Wood shingles or shakes shall be installed as per the manufacturer's recommendation. The following are some general guidelines to follow unless otherwise recommended.

- The exposure used must provide a minimum of three layers of shingles over all areas of the roof.
- Leave approximately 1/4 inch to 3/8 inch gap between adjacent shingles and 3/8 inch to 5/8 inch gap between adjacent shakes to allow for expansion.
- Each overlapping course shall cover the gaps in the course below, with the gaps in the overlapping course being at least 1-1/2 inches from the gaps in the lower course.
- Fasten each shingle or shake with two corrosion resistant nails. These nails should be located 1 to 1-1/2 inches above the butt line of the overlapping course, and no more than 3/4 inch in from each side of the shingle or shake.
- When applying wood shakes, an 18 inch strip of 30 pound felt is placed over the top third of each course of shakes.

#### **471.3 Tile Roofs**

Due to the fact that different brands of roofing tiles are made from different materials, there can be no single approved method for applying tile roofs. Each manufacturer must submit test reports or other approved justification for their particular recommended method of application.

The following are two acceptable methods of installing *Lifetile* tile roofs. The first is based on a test report submitted by *Lifetile*. The second method is based on a procedure accepted by the *Southern Building Code Congress* through the *National Evaluation Service*. One of these two methods shall be used to apply *Lifetile* tile roofs. These methods do not apply to any other brands of tile roofing.

##### **471.3(a) Method 1**

The following requirements are taken from a test report submitted by *Lifetile* and apply to *Lifetile* tile roofs only. Installation of other brands of tile will require submittal of test reports to justify installation method.

- A solid roof deck shall be applied as per Section 371.1(a), except that the additional weight of a tile roof may require stronger roof sheathing and larger roof framing members.
- A minimum of one layer of 30 pound felt shall be applied to the roof deck.
- 1 x 2 pressure treated pine battens shall be installed with galvanized 6d nails spaced 8 inches O.C. Cedar battens are not acceptable.

### First Printing

- The eave closures and valley flashing shall be attached to the deck with galvanized 6d nails spaced 12 inches O.C.
- The eave closures shall be bedded to the felt with roofing cement.
- Any vent-stack boots shall be bedded to the felt with roofing cement and sealed to the surrounding tiles with mortar.
- Rake tiles (tiles at edges of gable roofs) shall be nailed with two 10d annular ring shank copper nails and sealed to the adjoining tiles with mortar. Clips may also be used as a substitute for mortar.
- Tiles at hips and ridges shall be sealed with mortar.
- Tiles at valleys shall be sealed to adjoining tiles with roofing cement.
- Where nails are in contact with mortar, nails shall be 10d copper annular ring shank nails with a 9/16 inch diameter by 1/8 inch thick rubber washer.
- Where nails are not in contact with mortar, nails shall be 10d annular ring shank galvanized steel roofing nails with a 9/16 inch diameter by 1/8 inch thick rubber washer.
- The number of nails used depends on the type of tile being installed.

*España Mission Tile* (or similar S-type concrete roof tile, having approximate dimensions of 17" x 12-3/8" x 1/2" thick) shall be nailed to the battens with one nail per tile.

*Colonial Slate Tile* (or similar flat concrete roof tile having approximate dimensions of 17" x 12-3/8" x 1/2" thick) shall be nailed to the battens with two nails per tile.

#### 471.3(b) Method 2 (Alternate)

- Foreign particles shall be cleaned from all interlocking areas of tiles.
- Cracked or broken tiles shall not be installed.
- Solid roof decking and roof framing shall be installed as per previous guidelines.
- Battens shall be installed whenever the roof sheathing is less than 3/4 inch thick. Battens shall also be installed when the roof pitch is below 3:12 or exceeds 7:12.
- Battens shall be 1 X 2 pressure treated pine. Cedar battens are not acceptable.
- Battens shall be installed with 8d corrosion resistant steel nails into each rafter (maximum of 24 inches O.C.).
- On pitches below 2:12, tiles are considered decorative and shall be installed over an approved roof covering, such as built-up or roll roofing.
- On pitches of 2:12 to 3:12, an approved built-up roof consisting of two plies of 15 pound felt hot mopped between layers shall be installed over the solid roof sheathing. Then nominal 3/8 inch redwood lath strips are installed vertically from eave to ridge at 24 inches O.C. and nailed to the deck. Then the entire deck is top mopped. Then 1 X 2 horizontal battens are installed and fastened at each intersection to the vertical strips with one 8d corrosion resistant steel nail. When nailing tiles, the nails shall penetrate the batten but not the roof membrane.
- On pitches of 3:12 to 4:12, underlayment shall be one layer of Type 40 asphalt-coated base sheet. Either counterbattens shall be installed as above, or 2 inch square shims cut from asphalt shingles shall be placed between the batten and the deck where nailing at 24 inches O.C.
- On pitches of 4:12 or greater, underlayment shall be a minimum of one layer of 30 pound felt, installed with a minimum of 2 inches head lap and 4 inches end lap. Batten ends shall be separated 1/2 inch every 4 feet for drainage, or asphalt shims must be installed as above.

### First Printing

- Valley flashing shall be a minimum 28 gauge corrosion resistant metal, extending at least 11 inches from the valley center line each way. Flashing end laps shall not be less than 4 inches.
- Flashing shall be installed with galvanized 6d nails spaced a maximum of 12 inches O.C.
- Openings through tile for vents, pipes, skylights, chimneys, etc. shall be adequately weatherproofed with flashing. Flashing for *España, Capri, or Sentry Classic* tiles shall be of lead, aluminum, or other approved flexible material and shall be formed to the contours of the tile.
- When installing *España Mission, Capri, Chateau, and Sentry Classic* styles of tile, "Lifetile Weatherblock Strip", mortar, or roofers cement shall be used at ridge, hip, and wall intersections to provide a weather block. For these tiles, an eave closure strip shall also be installed by nailing to the deck with galvanized 6d nails spaced 12 inches O.C., and bedding the strip to the felt with approved roofers cement.
- Slate or shake styles require no weather block.
- Nails shall be a minimum of 10d annular ring shank galvanized steel roofing nail.
- Copper nails shall be used where the nails are in contact with mortar.
- The heads of all tiles shall be nailed to the battens.
- All rake tiles shall be nailed with two nails.
- The noses of all eave course tiles shall be fastened with a special *Lifetile "XRP Grip Clip."*
- The noses of all ridge, hip, and rake tiles shall be set in a bead of approved roofer mastic.

#### 471.4 Corrugated Metal Roofs

Corrugated metal roofs may be applied over purlins or over a solid wood deck.

##### 471.4(a) Corrugated metal roofing applied over a solid wood roof deck.

- The solid wood deck shall be applied as per Section 471.1(a).
- Metal roofing shall be a minimum of 24 gauge thickness.
- Metal sheets shall be installed with a minimum of 8 inches end lap and 1-1/2 corrugations side lap.
- Fasten using lead washers and galvanized drive screws, deformed shank nails or woodscrews spaced 16 inches O.C. each way.
- Fasteners shall be spaced 10 inches O.C. along edges of sheets.

##### 471.4(b) Corrugated metal roofing applied to wood purlins

- Purlins shall be spaced a maximum of 18 inches O.C.
- Metal roofing shall be a minimum of 24 gauge thickness.
- Metal sheets shall be installed with a minimum of 8 inches end lap and 1-1/2 corrugations side lap.
- Fasten using lead washers and galvanized drive screws or deformed shank nails or wood screws spaced 8 inches O.C. along each purlin.

#### 471.5 Manufactured Metal Roofing

- Manufactured metal roofing, similar to that used on metal buildings, shall be installed as per the manufacturer's recommendation.
- Documentation and/or certification from the manufacturer may be required. Documentation shall clearly show the installation method to be used and the wind loads that method will withstand.

#### 471.6 Steel Deck Roofing for Concrete or Insulation Decks.

- The steel deck shall be fastened by placing washers in the valleys of the deck along the steel framing members, and then plug welding through the middle of the washers onto the steel framing member below.
- Welds shall be located in every other valley along each joist and at the side laps. Adjacent deck units shall be fastened together at the center of span with self-drilling screw fasteners.
- The washers used shall be at least three times the thickness of the steel deck, and shall have an outside diameter of at least 3/4 inch.
- Other types of fastening may be used if substantiated by tests from an approved testing laboratory.

#### 471.7 Built-up Roofing

This section applies when built-up roofing is applied to a wood roof deck.

- The wood deck shall be applied as per Section 471.1(a). Other types of decks shall be as per the manufacturer's recommendation.
- The first layer of roofing felt shall be either one layer of minimum 30 pound felt lapped 2 inches, or 2 layers of 15 pound felt lapped 18 inches.
- The first layer shall be fastened to the deck with galvanized nails and tin caps or the equivalent.
- When the appearance of the underside of the deck is unimportant, the anchor sheet shall be fastened down using 1 inch nails spaced 6 inches O.C. along the laps and 12 inches O.C. both ways in the area between the laps, or as specified by the roofing manufacturer.
- When the underside of the roof deck is exposed, the alternative is to fasten the anchor sheet down with 1-1/4 inch nails spaced 6 inches O.C. along all rafters and 3/4 inch nails spaced 12 inches O.C. both ways in the area between the rafters, or as specified by the roofing manufacturer.
- Each additional sheet or ply above the anchor sheet shall be mopped into place with hot asphalt or hot coal tar pitch.
- Coal tar pitch shall be used only on flat roofs.
- For residential structures, a minimum of 3 plies shall be mopped over the base sheet.
- Where vertical surfaces intersect the roof, the built-up roof covering shall extend up the vertical surface to completely seal the joint created in the roof.
- A cant strip shall be placed at the intersection between the roof and parapet wall or any other long vertical surface. This provides a transition for the built-up roof plies from a horizontal direction to a vertical direction.
- A minimum of 50% of the gravel or stone placed over the top ply shall be anchored down.
- Proper sized gravel (3/8" to 5/8") shall be used.

- Specific requirements of the roofing manufacturer shall be followed if they differ from those outlined here.

#### **471.8 Roll Roofing**

- Roll roofing shall only be applied to roofs with slopes of 1 in 12 or greater when using the concealed nail method.
- Roll roofing shall be applied using the lap cement or asphalt plastic cement recommended by the manufacturer.
- Roll roofing shall be applied using the concealed nail method when roofing is fastened with nails.
- 9 inch wide strips of roll roofing shall be placed along all eaves and rakes, positioning them to overhang the deck 1/4 to 3/8 inches.
- Roofing nails with large heads and lengths long enough to fully penetrate the roof deck shall be used.
- Fasten the strips with rows of nails located 1 inch and 8 inches from the roof edge and spaced 4 inches O.C. in each row.
- For the first course, position a full width strip of roll roofing so that it covers the edge strips (end and lower edge of roll roofing and edge of strips flush along eaves and rakes).
- Starting at one end, fasten the upper edge with nails spaced 4 inches O.C. and slightly staggered.
- Nails shall be located so that the next course will overlap them a minimum of 1 inch (generally not more than 2 inches, and never less than 3/4 inch from the top edge of the sheet).
- Lift the lower edge of the first course and cover the edge strips with cement according to the manufacturer's specifications.
- On all cementing, apply the cement in a continuous but not excessive layer over the full width of the lap.
- Press the lower edge and rake ends of the first course firmly into the cement-covered edge strips. Work from one side of the sheet to the other to avoid wrinkling or bubbling.
- Using a roller, apply pressure uniformly over the entire cemented area.
- End laps shall be 6 inches wide and cemented over the full lap area with the recommended cement.
- Nail the underlying sheet in rows 1 inch and 5 inches from the end of the sheet, with nails spaced 4 inches O.C. and slightly staggered.
- End laps in succeeding courses in the field shall not line up with one another.
- The second course shall be positioned so that it overlaps the first course at least 3 inches or as specified by the roofing manufacturer.
- Fasten the upper edge to the deck, cement the laps, and finish installing the sheet in the same manner as the first course.
- The same procedure shall be followed for each successive course.
- Nails shall not be applied within 18 inches of the rake until cement has been applied to the edge strip and the overlying strip has been pressed down.
- All hips and ridges shall be covered with 12 inch by 36 inch strips of roll roofing, with 6 inch laps and two nails at each lap.

- The entire length of these strips at hips and ridges shall be cemented to the roll roofing below.
- Specific requirements of the roofing manufacturer shall be followed if they differ from those outlined here. The contractor shall be prepared to show written instructions if different methods are to be used.

#### 471.9 Other Roofing Systems

Other roofing systems, not previously mentioned, will be acceptable provided they have been certified by *Underwriter's Laboratories Class* as 60, or 90, or certified by *Factory Mutual* as I-60 or I-90, or tested by another testing laboratory approved by the State Board of Insurance, and certified able to withstand 43.75 pounds per square foot uplift. Complete test reports, including method of installation, shall be submitted.

### 472 Re-roofing and Repairs

#### *Important Notes:*

1. Fasteners for re-roofing shall be galvanized or other corrosion-resistant nails only.
2. When re-roofing, care shall be taken to ensure that the existing deck and other members are not damaged. Re-roofing over a damaged roof deck or roofing member will not be accepted. Replacement of damaged members shall comply with previous guidelines.

#### 472.1 Re-roofing a Composition Shingle Roof

- A maximum of one layer of composition shingles may be applied over a single layer of existing composition shingles.
- All existing shingles shall be removed if there are two or more layers of shingles already present.
- The manufacturer's recommendation for re-roofing shall be followed.
- One layer of 15 pound felt shall be applied over the existing shingle roof. Felt shall be adequately fastened to hold it down until the shingles can be applied.
- Felt may be omitted if and only if all of the following three conditions are met:
  1. Existing shingles and deck must provide an adequate nailing surface.
  2. Existing shingles must be in a satisfactory condition so that new shingles can lay flat.
  3. Butts of new shingles must be butted directly against tabs of existing shingles.

The inspector's judgement shall be final as to whether felt is required. Consultation with the inspector prior to re-roofing is suggested if any questions exist regarding felt application.

- Shingles rated by *Underwriter's Laboratories* as being "wind resistant" shall be used when re-roofing over an existing roof.
- Each shingle shall be applied as per Section 471.1(c).
- Fasteners shall be galvanized or corrosion resistant roofing nails which have sufficient length to penetrate a minimum of 3/4 inch into the roof deck lumber or completely through the plywood roof deck. Most manufacturers recommend a 1-1/2 to 2 inch long nail for this use.

#### 472.2 Re-roofing a Wood Shingle Roof

When re-roofing a wood shingle roof, the owner has three main choices. A new wood shingle roof may be desired, in which case Section 472.2(a) shall be followed. On the other hand, a new composition shingle roof may be preferred. Ideally, the wood shingles should be removed and replaced with composition shingles, following the guidelines in Section 472.2(b). However, if only one layer of wood shingles are present, a single layer of composition shingles may be placed over the wood shingles if the guidelines of Section 472.2(c) are followed. Please note that composition shingles may not be placed over a wood shake roof.

**472.2(a) Replacing wood shingles or shakes with same.**

- All shingles shall be removed.
- All loose or protruding nails shall be removed or driven completely into the boards.
- Any loose shingles which are not to be replaced shall be renailed in a new location.
- New shingles may be applied to existing spaced boards, if the boards are in satisfactory condition.
- Boards shall be fastened to each rafter with two 8d galvanized nails
- Application shall follow the guidelines set forth in Section 471.2.

**472.2(b) Replacing Wood Shingles or Shakes with Composition Shingles.**

- All wood shingles or shakes shall be removed.
- All old nails shall be removed or driven completely into the boards.
- Composition shingles shall be applied to a solid wood deck using the guidelines in Sections 471.1(b) and 471.1(c).
- A solid wood decking may be accomplished by one of the following methods:
  1. Replace all damaged boards. Fill in the spaces between the boards with boards of the same thickness. Fasten boards with two 8d nails in each rafter.
  2. Nail plywood decking directly to spaced boards. Boards shall have two 8d nails in each rafter, and decking shall be nailed to boards with one 8d nail in each board along each rafter, or the equivalent.
  3. Remove all spaced boards and nails. Nail plywood decking to rafters with galvanized 8d nails spaced 6 inches O.C. along plywood edges and 12 inches O.C. along interior rafters.

**472.2(c) Placing composition shingles over wood shingles.**

- A single layer of composition shingles may be applied over a single layer of wood shingles.
- Composition shingles may not be placed over wood shakes.
- Composition shingles rated by Underwriter's Laboratories as being "wind resistant" shall be used.
- All loose wood shingles shall be renailed in a new location.
- Badly curled or warped shingles shall be split and the segments shall be renailed.
- Any missing shingles shall be replaced, or the holes otherwise filled in.
- All hip and ridge shingles shall be removed.

- A 30 pound layer of felt shall be applied over the wood shingles.
- Composition shingles shall be applied using a minimum of 2 inch galvanized roofing nails, ensuring that all fasteners penetrate into boards.
- Shingles shall be fastened as per Section 471.1(c).

### **472.3 Re-roofing a Built-up Roof.**

When re-roofing a built-up roof, the owner has two choices. The preferable choice would be to tear off the existing roof and install a completely new roof. The alternative is to recover the existing roof. The decision on which to choose must be based on a complete survey of the existing roof assembly, the underlying deck, and the support structure.

#### **472.3(a) Complete Tear-Off**

- This method is preferable because it allows the inspection of the existing deck and the correction of any damaged or decayed areas, and drainage can be improved as needed.
- After repairing of any damaged areas of the roof deck, proceed with the roof as if it were a new application.
- New flashing shall be installed.

#### **472.3(b) Recover of existing roof.**

- A roof shall not be recovered if there is more than one built-up roof membrane system.
- A single roof may be recovered if the original roofing system is securely anchored to the deck and is not badly deteriorated, and where the deck and insulation are in good condition and do not contain moisture.
- If the existing roof system is gravel surfaced, all loose gravel shall be swept off. All surfaces shall be free of dirt, dust, and debris. Priming may be required. When installing a new roof over embedded aggregate, a separator material shall be used. This material could be rigid insulation, a venting base felt, or other base felt, as recommended by the manufacturer.
- If ply felts are to be installed directly to the old roof, all existing gravel shall be removed.
- All wet or deteriorated insulation shall be removed and replaced with new material.
- Prior to the application of any material, the insulation shall be vented by making random cuts in the existing membrane.
- All buckles, ridges, folds, blisters, etc. shall be cut out and a smooth, even surface provided.
- All old flashing shall be torn out.
- The roof shall then be recovered as if it were a new roof, including installing new flashing.

### **472.4 Re-roofing Roll Roofing**

- A single layer of roll roofing may be re-roofed in much the same manner as built-up roofing. Manufacturer's specifications for the re-roofing product shall be followed.

#### **472.5 Other Re-roofing Systems**

Other types of re-roofing will be acceptable provided they have been certified by *Underwriter's Laboratories* as Class 60, or 90, or certified by *Factory Mutual* as I-60 or I-90, or tested by another testing laboratory approved by the State Board of Insurance, and certified able to withstand 43.75 pounds per square foot uplift. Complete test reports, including method of installation, shall have to be submitted.

# ***APPENDIX***

## Appendix A. Windstorm Field Offices

### 01-BEAUMONT

5550 Eastex Frwy., Suite EE

(409) 892-4677

*Mailing Address:* P.O. Box 20091, 77720-0091

(409) 898-7463 FAX

### 02-GALVESTON

2201 Market Street, Suite 600, 77550

(409) 765-9341

(713) 474-5025 (Houston)

(409) 765-4729 FAX

### 03-BAY CITY

3009 Avenue F, 77414

(409) 244-9451

(409) 244-9433 FAX

### 04-CORPUS CHRISTI

615 Leopard, Suite 418

(512) 881-9463

*Mailing Address:* P.O. Box 1168, 78403-1168

(512) 881-9479 FAX

### 05-HARLINGEN

630 Ed Carey Drive, Suite 200

(512) 421-4675

*Mailing Address:* P.O. Box 2667, 78551

(512) 233-4549 (Brownsville/Los Fresnos) (512) 421-4549 FAX

### 06-ANGLETON

200 East Mulberry, Suite A, 77515

(409) 848-0953

(409) 848-1235 FAX

### 07-PORT LAVACA

1204 N. Virginia Street, 77979

(512) 552-2501

(512) 552-2179 FAX

## Glossary

**A Zone:** That portion of the 100 year flood plain not subject to wave action. May, however be subject to residual forward momentum of breaking waves.

**Addition:** An extension or increase in floor area or height of a building or structure.

**Agricultural:** Relating to or used in producing or storing crops and livestock or their properties.

**Anchorage:** The principle of securing one member to another in a manner that does not allow for easy separation except under extreme conditions.

**Annular ring shank nail:** A nail having a rough shank consisting of ridges which form rings around the shank.

**Approved:** Judged to meet or exceed specified standards.

**Batten:** A strip of wood placed across a surface to cover joints or provide a nailing strip.

**Beam:** A principal structural member used between posts, columns, or walls to support loads.

**Belled Hole:** A hole which is belled out or flared at the bottom which aids in distributing the mass or weight throughout the foundation.

**Board:** Lumber measuring two inches (2") or less in thickness.

**Bond Beam:** A horizontal beam found in masonry walls which strengthens the wall.

**Breakaway Walls:** Walls which are designed to break away from their structural supports when subjected to wind and/or water loads.

**Brick Ledge:** That portion along the exterior of a slab on grade foundation which is reserved for and supports the brick veneer.

**Brick Ties:** Non-corrosive metal strips or heavy wire which are used to secure masonry veneer to the structure it is applied to.

**Brick Veneer:** An exterior finish for walls which consists of a single layer of brick

**Built-up Roof:** A type of roof composed of asphalt felt laminated with coal tar, pitch or asphalt. The top is finished with crushed slag or gravel.

**Butt Joint:** Formed when two members are placed end to end without overlapping.

**Cant Strip:** A strip having triangular cross-section which provides support for felt layers of a roof as they curve from a horizontal to a vertical position.

**Cantilever:** A projecting beam or member which is supported only at one end.

**Ceiling Joist:** One of a series of parallel framing members used to support ceiling loads.

**Clear Span:** The horizontal distances between structural supports.

**Code Approved:** Accepted by either the Southern Building Code Congress International or the National Evaluation Service.

**Commercial Buildings:** Structures designed and used for business purposes.

**Compliance:** The act or process of conforming to official requirements, or to a desire or proposal.

**Corrosion Resistant:** Treated in such a way as to deter or retard weakening, wear and decay.

**Cripple Stud:** A short stud used above a wall opening. It extends from the header above the opening to the top plate. Also used beneath an opening between the sole plate and the rough sill.

**Dead Load:** The weight of permanent, stationary construction included in a building.

**Diagonal Brace:** A support placed at a 45 degree angle which has the purpose of bracing a part of a structure against lateral loads.

**Diameter:** The width or thickness of a circular, or somewhat circular, object

**Dimension Lumber:** Lumber which is two to five inches (2" - 5") thick and up to twelve inches (12") wide.

**Discontinuous Member:** A member which has one or more break points and is not considered a whole unit unless tied or fastened together.

**Drip Edge:** A strip, usually metal, placed on the edges of a roof to alter water flow freely away from the underlying cornice and protect that area from water damage.

**Eaves:** The part of a roof structure which projects over an exterior wall. Also called overhang. This area of a structure is subject to very high wind loads.

**Eave Closure:** That component of a tile roofing system which is used to seal the openings along the eaves of a structure under the first layer of tile. Also called closure tile.

**Elevation:** The height of an object or specific part of an object above grade level.

**Embedment; Embedded:** Set firmly into a surrounding mass.

**Equivalent:** Having an equal value, amount, or force.

**Fascia:** A wood member used for the outer face of a box cornice where it is nailed to the ends of the rafters and lookouts.

**Felt:** A heavy paper of organic or asbestos fibers impregnated with asphalt

**Flashing:** Sheet metal or other material used in roof and wall construction (especially around chimneys and vents, and at roof valleys), to prevent moisture from entering the structure.

**Flood Plain:** The land adjoining an ocean, river, stream, bay, or lake which is likely to be flooded.

**Floor Joist:** One of a series of parallel framing members used to support floor loads and supported, in turn, by larger beams, girders or bearing walls.

**Footing:** The spreading course or courses at the base or bottom of a foundation wall, pier, or column.

**Foundation:** The supporting portion of a structure below the first floor construction, or grade, including the footings and floor joists.

**Framing Anchor:** A corrosion-resistant (galvanized) pre-engineered metal piece designed to fasten wooden members together or to masonry. They prevent lateral motion and/or uplift. Also called hurricane clips.

**Gable Roof:** A roof shape characterized by two sections of roof of constant slope which meet at

the ridge and which form a vertical triangle at the end of the structure.

**Gable Stud:** A stud which is a component of the framing of the gable end of a structure. These members normally extend from the top plate to the end of the rafter.

**Grider:** The largest or principal horizontal beam used to support concentrated loads at particular points along its path.

**Grade (Finish Grade):** A reference plane representing the average finished ground level adjoining or around a structure.

**Grade (Lumber Grade):** The designation of the quality of a manufactured piece of wood.

**Green Lumber:** Lumber which has not been dried or seasoned.

**Grout:** A thin mortar used in masonry work.

**Header:** (1) A horizontal structural member which supports the load over an opening, such as a window or door; also called a lintel. (2) A beam placed perpendicular to joists and to which joists are nailed in framing for a chimney, stairway, other similar opening.

**High Wind Area:** All 14 counties along the Texas coast have been determined to be in high wind area for the purposes of this inspection program.

**Horizontal:** Parallel to the horizon

**Hurricane Clip:** See framing anchor

**Inland:** The area in the 14 coastal counties located on the western side (inland) of the Intra-coastal Waterway.

**Inward:** Directed toward the interior

**Knee Bracc:** A diagonal member (usually at a 45 degree angle) that is attached from a piling to a main structural beam or girder, and serves to stiffen the foundation.

**Lateral:** See horizontal

**Lateral Bracc:** A wall brace which stiffens a structure against loads acting on the side walls.

**Lath:** A building material fastened to the sides of a structure to act as a base for plaster. Can also refer to spaced boards used for roof decking

**Ledger:** A strip attached to framing or structural members which supports joists or other horizontal framing.

**Let-in:** Refers to the process of cutting a notch in a series of studs, joists, or other structural members and placing another member into the notches. The other member is used to stiffen or strengthen the original members.

**Lintel:** See definition (1) under header.

**Live Load:** The total of all moving and variable loads which may be placed upon a structure.

**Load-bearing Wall:** A wall which is subject to forces other than its own weight. Refer to Sections 312.3 and 412.3.

**Masonry:** Stone, brick, hollow tile, concrete block, tile, poured concrete, gypsum block, or similar materials, or a combination of the above, bonded together with mortar to form a wall, pier, buttress, column, etc.

**Mechanical Equipment:** Any mechanical device located on the exterior of a structure.

**Mobile Home:** A structure, transportable in one or more sections, which is eight body feet or more in width, and is 32 body feet or more in length, which is built on a permanent chassis and is designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning and electrical systems contained therein.

**Moisture Content:** The weight of the water in wood expressed as a percentage of the weight of oven dry wood.

**Monolithic:** Term used for concrete construction poured and cast in one unit without joints.

**Non-load bearing Wall:** A wall which supports no load other than its own weight

**On Center (abbreviated by O.C.):** The measurement of spacing for framing members, fasteners, etc., which designate the distance from the center of one member or component to the center of the next. Also called center to center spacing.

**Outward:** Directed toward the outside, usually at a 90 degree angle (perpendicular to) the exterior surface.

**Overhang:** That area of a roof or upper story which projects beyond the wall of the lower part.

**Partition:** Any wall which subdivides spaces within any story of a structure.

**Permanent Incorporation:** When referring to wood framing members, this occurs when the wood is cut to size and nailed in place.

**Perpendicular:** Being at right angles (90 degrees) to a given line, plane or surface

**Pitch:** The slope of a roof, usually expressed as the number of inches of rise for each 12 horizontal inches (for example: 3 in 12).

**Powder Actuated Fasteners:** A fastener which is set (usually into masonry or concrete) by a powder charge.

**Purlins:** Horizontal members which, when laid over roof framing members are used to support rafters or other roofing, and, when placed over vertical wall framing members, are used to fasten siding to.

**Rafter:** One of a series of structural members of a roof designed to support roof loads, and which generally run from the ridge to the wall top plate. The rafters of a flat roof are sometimes called roof joists.

**Rake Edge:** The edge of a gable roof system which runs parallel to the roof slope, from the eave to the ridge.

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

**Ridge Beam:** The board or beam placed on edge at the ridge (peak) of the roof into which the upper ends of the rafters are framed.

**S.B.C.C.I.:** Southern Building Code Congress International. This is the group who writes the Standard Building Code.

**Scab:** A piece of wood or metal which is fastened or attached to another member and serves to add additional length or width.

**Scouring:** The erosion of sand and soil caused by wave action.

**Seaward:** That area of the Texas Gulf Coast located on the eastern side (or seaward) of the Intracoastal Waterway.

**Shall:** Used to denote a mandatory condition

**Sheathing:** The structural covering. Consists of boards or prefabricated panels (plywood) that are attached to the exterior studding or rafters of a structure.

**Siding:** The finished covering on the outside wall of a building.

**Sill:** The lowest member of the frame of a structure, usually horizontal, resting on the foundation and supporting the uprights of the frames. Also the lowest member of a window or outside door frame.

**Soffit:** The underside of the members of a building, such as overhangs, staircases, cornices, arches, etc.

**Sole Plate:** The lowest horizontal member on wall and partition framing. (See sill.)

**Span:** The horizontal distance between structural supports such as walls, columns, piers, beams, girders and trusses.

**Start of Construction:** The first placement of a permanent construction of a structure on a site, such as pouring slabs or footings, or any other work beyond the stage of excavation.

**Story:** That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

**Stringer:** A long horizontal timber which is used to connect uprights in a frame and/or to support a floor.

**Strongback:** An L-shaped wooden support attached to tops of ceiling joists to strengthen them, maintain spacing, and bring them to the same level

**Structure:** That which is built, constructed, or composed of parts joined together in some definite manner.

**Stud:** The vertical framing member of a wall.

**Suspense:** A term used to describe the status of an inspection in which an inspection is not yet approved, but the basic method being used is correct.

**T.C.P.I.A.:** Abbreviation for the Texas Catastrophe Property Insurance Association.

**Top Plate:** The horizontal member resting on top of the wall studs which the joists and rafters rest on and are anchored or fastened to.

**Trimmer:** The beam or floor joist into which a header is framed. Adds strength to the side of the opening.

**Trimmer Stud:** A stud which supports a header over a wall opening. The trimmer stud extends from the sole plate to the bottom of the header.

**Truss:** A structural member consisting of such members as beams, bars, webs, and ties, usually arranged to form triangles. It provides rigid support over wide spans with a minimum amount of material.

**Unapproved:** A term used to describe the status of an inspection in which the procedure or material being used is not correct and changes need to be addressed.

**Underlayment:** A thin cover of asphalt saturated felt or other material which acts as a water barrier.

**Underwriters Laboratories (U.L.):** A non-profit, independent organization which maintains and operates laboratories for the examination and testing of devices, systems, and materials to determine their relation to life, fire, casualty hazards and crime prevention.

**Unit:** A group of rooms arranged as a private residence and permanently equipped for house-keeping.

**Uplift:** An upware exerted force or pressure.

**V-Zone:** An area within the 100-year flood plain which is subject to high velocity waters, including hurricane storm surge and wave action.

**Vapor Barrier:** A watertight material used to prevent the passage of moisture or water vapor into or through structural elements.

**Veneer:** A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

**Vertical:** Perpendicular to the plane of the horizon; straight up and down

**Water Repellent:** Treated so as to retard changes in moisture content.

**Weep Hole:** A small hole, usually used in masonry to drain water to the outside.

**Windward Wall:** The wall of a structure which is facing the direction from which the wind is blowing. As a hurricane passes, the wind changes directions so that every wall may act as the windward wall at one time or another.

**Withdrawal:** Removal of a fastener or pulling it out by applying a force in the the opposite direction from the force used to install it.

**Wind Load:** The force exerted on a structure by the wind.

**Wood Preservative:** A treatment of wood used to protect against decay and insects.

First Printing

Plywood Panel Siding 55, 120  
Roof Covering 56, 121  
Roof Decking 56, 121  
Steel Siding 56, 121  
Stone Veneer 56  
ties 56  
Stucco 56, 121  
Lath 56, 121  
Vinyl Siding 56, 121  
Exterior Equipment 57, 121

**F**

Fasteners 36, 101  
hot dipped 36  
fees 13  
Field Form 13  
Final Framing inspections 12  
first tier counties 2  
floor joists 20, 85  
foundation 7, 31, 33, 96, 97  
Bearing Wall Footings 36, 101  
Pier and Beam Foundation 33, 97  
footing 33, 97  
mobile home tie downs 33, 97  
portable buildings 33, 97  
temporary buildings 33, 97  
Piling 31, 96  
Beams 31, 96  
Floor Joists 31, 96  
joist hanger 31, 96  
ledge strip 31, 96  
Splices 31, 96  
Stringers 31, 96  
Foundation inspections 11  
Slab on grade 11  
Framing 36, 37, 42, 43, 47, 49, 101, 102, 107,  
108, 114, 116  
Awnings 49, 114  
Corner Bracing 42, 107  
Framing Anchors 36, 101  
framing anchor 36, 101  
gable ends 36, 101  
hurricane clip 36, 101  
Framing Around Openings 43, 108  
Headers 43, 108  
Lumber 36, 101  
American Lumber Standards  
Committee 36, 101  
grade mark 36, 101  
Overhangs 49, 114  
Roof Framing Members 37, 102  
ceiling joist 37, 102  
collar beams 37, 102  
purlin 40, 104  
Rafters Span Table 40, 104  
rafter ties 37, 102  
Rafters 37, 102  
Ridge Beams 37, 102  
strongback 40, 104

Trusses 42, 107  
Two Story Wood Framing 49, 116  
Floor tie Anchor 49, 116  
Wall Bracing 42, 107  
Shear walls 42, 107  
Wall Framing 36, 101  
Windows 47, 114

**H**

HB 2012 1  
Headers 43, 108

**I**

inland 3  
Inland Construction Guidelines 36, 101  
Framing 36, 101  
Inspection Requirements,  
See BUILDING CODE  
Inspections 11  
Final Framing 11  
Foundation 11  
Mechanical 11  
Rough Framing 11  
Intracoastal Waterway 1, 2

**J**

Joists 31, 51, 120  
holes 51, 120  
cables 120  
pipes 120  
notches 51, 120

**L**

load bearing walls 37, 101  
Lumber 36, 101  
American Lumber Standards  
Committee 36, 101  
grade mark 36, 101

**M**

Masonry 33, 97  
temporary buildings 33, 97  
portable buildings 33, 97  
Masonry Construction 57, 122  
Foundation 57, 122  
lap 57, 122  
tie-downs 57, 122  
Masonry Veneer 23, 87

brick ledge 23, 87  
 Masonry Walls 58, 123  
     General Requirements 58, 123  
         bond beam 58, 123  
         mortar 58, 123  
 Hollow Masonry 61, 126  
     filled masonry units 61, 126  
 Solid Masonry 58, 123  
     Bond Beams 58, 123  
 Masonry-Exterior 63, 128  
     Floor Framing Members 63, 128  
     Masonry Veneer 64, 129  
     Openings 64, 129  
         lintel 64, 129  
     Roof Framing 63, 128  
         fasteners 63, 128  
         Members Connected Directly to Bond  
         Beam 63, 128  
         Other Connections 63, 128  
         Top Plate Bolted 63, 128  
 Mechanical Equipment 57, 121  
     See also Exterior Equipment  
     Air Conditioner 57, 121  
         cantilevered platform 57, 122  
     Other Exterior Equipment 57, 122  
 Mechanical inspections 13  
 Metal Construction 64, 129  
     Manufactured Metal Structures 64, 129  
         girts 64, 129  
         installation 64, 129  
 Miscellaneous Construction 65, 130  
     Boat Houses 69, 134  
     Docks 69, 134  
     Manufactured Housing 69, 134  
     Mobile Homes 69, 134  
     Other Miscellaneous Structures 70, 135  
     other structures built over water 69, 134  
         walkways 69, 134  
     Patio Covers 69, 134  
         awnings 69, 134  
         covered walkways 69, 134  
     Piers (Over Water) 69, 134  
     Pole Barns 66, 131  
     Portable and Temporary Buildings 69, 134

**N**

Non-engineered construction,  
     See Building Code  
 non-engineered structures 4  
     private dwellings 4  
     public work 4  
 non-load bearing walls 36, 101

**O**

Overhangs 49, 114

**P**

Piling Foundation 23, 29, 88, 94  
     A-zones 29, 94  
     storm surge 29, 94  
     V-zones 29, 94  
     wave action 29, 94

**R**

rafter ties 37, 102  
 Rafters 37, 102  
 Re-Roofing 83, 147  
     Built-up Roof 84, 148  
         Other Systems 85, 149  
         Recover of existing roof 84, 148  
         Roll Roofing 84, 148  
         Tear-Off 84, 148  
 Re-roofing and Repairs 82, 146  
     Composition Shingle Roof 82, 146  
     Wood Shingle Roof 83, 146  
         Composition Shingles 83, 147  
         Replacing wood shingles or shakes 83,  
         147  
 Renovation and Repair 71, 136  
     See also Construction  
     Exterior Covering 71, 136  
     Foundation 71, 136  
     Framing 71, 136  
     Mechanical Equipment 71, 136  
     Pier and Beam Foundation 71, 136  
         mobile home tie-down systems 71, 136  
     Piling Foundation 71, 136  
     Slab on Grade Foundation 71, 136  
         leveling 71, 136  
 Ridge Beams 37, 102  
 Roof 121  
     gabled 121  
     hipped 121  
 Roof Covering 56, 121  
 Roof Decking 56, 121  
 Roof Framing Members 37, 102  
 Roofing 19, 73, 74, 76, 77, 80, 81, 138, 139,  
     140, 141, 143, 145  
     Built-up Roofing 80, 144  
         cant strip 80, 144  
         gravel 80, 144  
     Composition Shingles 75, 140  
         metal drip edge 75, 140  
         staples 75, 140  
     Concrete or Insulation Decks 80, 144  
     Corrugated Metal Roofs 77, 79, 141, 143  
         purlins 79, 143  
     General Requirements 77, 141  
     Manufactured Metal Roofing 80, 143  
     Metal Roofing 80, 143  
         Manufactured Metal Roofing 80, 143  
     Other Roofing Systems 82, 146  
     Roll Roofing 81, 145  
     Roofing Nails 76, 140

First Printing

*Steel Deck Roofing* 80, 143  
*Tile Roofs* 77, 141  
    *battens* 77, 141  
    *flat concrete roof tile* 77, 141  
    *Lifetile* 77, 141  
    *Rake Tiles* 77, 141  
    *S-type concrete roof tile* 77, 141  
*Underlayment* 75, 139  
    *felt* 75, 139  
*Wood Shingle or Shake Roof* 76, 140  
    *See also Shingle*  
    *Spaced Boards* 76, 140  
*Roofing-Inland* 73  
    *Composition Shingle Roof* 74  
    *New Roofing* 74  
    *Roof Deck* 74  
        *APA* 74  
        *Board Decking* 74  
        *oriented strand board* 74  
        *plywood* 74  
        *staples* 74  
        *TECO* 74  
        *waferboard* 74  
*Roofing-Seaward* 138  
    *Composition Shingle Roof* 139  
    *New Roofing* 139  
    *Roof Deck* 139  
        *APA* 139  
        *Board Decking* 139  
        *oriented strand board* 139  
        *plywood* 139  
        *staples* 139  
        *TECO* 139  
        *waferboard* 139  
*Roofs* 56  
    *gabled roofs* 56  
    *hipped* 56  
*Rough Framing inspections* 12

S

*seaward-T.C.P.I.A.* 3  
*Shear walls* 42, 107  
*Shingles* 75, 83, 140, 147  
    *Replacing* 83, 147  
        *composition shingles* 83, 147  
        *wood shingles* 83, 147

*Roofing nails* 76, 140  
*Southern Standard Building Code* 3  
    *Section 1205* 3  
*staples* 74, 75, 139, 140  
*Steel Siding* 56, 121  
*Structures,*  
    *See Construction*

T

*Texas Catastrophe Property Insurance Association* 2, 6  
    *eligibility* 6  
*Texas Engineering Practice Act* 5  
*T.C.P.I.A.* 3  
    *building codes* 3  
    *methods* 3

U

*unit* 6

V

*Vinyl Siding* 56, 121

W

*Wall Bracing* 42, 107  
*Wind loads* 3  
    *inland* 3  
    *requirements* 3  
    *seaward* 3  
*wind resistant* 83, 147  
*Windows* 47, 114  
*Wood frame*  
    *See Construction*

**WINDSTORM RESISTANT CONSTRUCTION GUIDE  
CODE INTERPRETATIONS**



**Code Interpretations**  
for the Texas Department of Insurance's  
*Windstorm Resistant Construction Guide*

**120 Building Specifications (GR-1)**

Height limitations of the *Windstorm Resistant Construction Guide*.

**140 What The State Board of Insurance Will Inspect (I-1)**

Clarifications the positions of the T.C.P.I.A. and F.E.M.A. regarding insurance of portions of structures located below the flood level.

**311.1(a)/411.1(a) Anchorage (FA-1, FA-5, FR-2)**

The use of mud sill anchors and methods for anchoring interior walls

**311.2(d)/411.2(d) Beams, Stringers, and Floor Joists (FR-23)**

Notching and borings of floor joist.

**311.3/411.3 Pier and Beam Foundation (FO-1, FO-2)**

Pier and beam foundations for manufactured housing and a pictorial representation of methods to anchor pier and beam foundations

**312/412 Framing (FA-12)**

Fastening schedule.

**312.1/412.1 Lumber (FR-5, FR-6, FR-8, FR-12)**

Lumber grades, finger-jointed studs, moisture content, structural use panels, and flooring.

**312.2/412.2 Fasteners (FA-9, FA-13)**

Fastener requirements.

**312.3/412.3 Wall Framing and Framing Anchors (FR-11, FR-17, FR-23)**

Sole plate and wall stud requirements. Notching and boring of wall studs.

**312.4/412.4 Roof Framing Members (Rafters) (FR-3, FR-16, FR-22, FR-23)**

Cathedral ceilings and ceiling joist requirements. Notching and boring of ceiling joist and rafters.

**312.6/412.6 Corner and Wall Bracing (FR-10)**

Clarifications of corner and wall bracing requirements.

**312.7/412.7 Framing Around Openings (FR-13)**

Construction of header systems.

**313.1/413.1 Plywood Panel Siding (FR-20)**

Enclosing the underside of buildings on piles or piers and for enclosing overhangs and ceilings of porches.

**313.2/413.2 Lap Siding (EC-14)**

Additional types of wood lap siding.

**313.3/413.3 Brick Veneer or Stone Veneer (EC-36, FA-2, FA-7)**

Mortar type, nail size for brick ties, and staple-use chart for wall sheathing beneath veneer.

**313.4/413.4 Stucco (FA-2, FR-6)**

Wall sheathing beneath stucco.



**313.5/413.5 Vinyl, Aluminum, and Steel Siding (EC-6, EC-20)**

Vinyl soffits and enclosing the underside of buildings on piles or piers and for enclosing overhangs and ceilings of porches.

**314/414 Mechanical and Exterior Equipment (ME-1)**

Addition method to tie down mechanical and exterior equipment.

**340/440 Miscellaneous Construction (MC-1)**

Construction of wood decks.

**350/450 Additions (A-1, FR-7)**

Requirements for additions.

**371.1(a)/471.1(a) Roof Deck (RC-2)**

Requirements for roof decks.

**371.1(b)/471.1(b) Underlayment (RC-1)**

Application of underlayment for composition shingles.

**371.1(c)/471.1(c) Composition Shingles (RC-1)**

UL 997, minimum roof slope, fasteners, and application of starter coarse and drip edge.

**371.2 Wood Shingle or Shake Roof (RC-4)**

Staples used for wood shingles.

**371.7/471.7 Built-up Roofing (RC-26)**

Application of insulation boards.

**372/472 Re-Roofing and Repairs (RC-9)**

Replacing damaged wood decks.

**372.2/472.2 Re-roofing a Wood Shingle Roof (RC-5)**

Tearing off wood shingles and applying a plywood deck over the existing lath

**372.2(c)/472.2(c) Replacing Wood shingles or Shakes with Composition Shingles (RC-1)**

Re-roofing wood shingles with composition shingles



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION 120 Building Specifications (GR-1)

Effective September 1, 1997

The following code interpretation applies to **Section 120** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

Many of the prescriptive requirements for building construction contained in the Texas Department of Insurance's (TDI) *Windstorm Resistant Construction Guide* (Guide) were developed using the wind pressures specified in **Section 120**, Building Specifications, of the TDI Guide. The prescriptive requirements for both inland and seaward construction were determined using wind pressures associated with a building height less than or equal to 30 feet. As evidence, please refer to **Sections 312.4, 312.5, 312.9, and 371.9** of the TDI Guide for inland construction and **Sections 412.4, 412.5, 412.9, and 471.9** of the TDI Guide for seaward construction.

The following guidelines shall be used to determine if a building is capable of being inspected using the TDI Guide:

### Foundation, Wall Framing, and Exterior Wall Coverings

The horizontal wind pressures that are applied to the exterior walls are based on the wall height of the building. Therefore, if the eave height of the building exceeds 30 feet, then the prescriptive requirements contained in the TDI Guide can not be used to inspect the construction. It would then become necessary for a Texas registered professional engineer to certify the structure.

**EXCEPTION:** For construction inland of the Intracoastal Waterway where the eave height of the building exceeds 30 feet, but is less than or equal to 50 feet, **Section 120** of the Guide specifies a horizontal wind pressure of 35 psf. Therefore, the prescriptive requirements contained in **Section 400** of the Guide for seaward construction may be used for inland construction at these building heights.

### Roof Framing, Roof Decks, and Roof Coverings

The wind pressures that act on the roof are based on the height of the building. For the purpose of this code interpretation, the building height is measured as the vertical distance from grade (taken as the average level of the ground adjacent to the building) to the average height of the roof for sloped roofs or to the highest finished roof surface for flat roofs. Therefore, if the building height exceeds 30 feet, then the prescriptive requirements contained in the TDI Guide can not be used to inspect the construction. It would then become necessary for a Texas registered professional engineer to certify the structure.

**EXCEPTION:** For construction inland of the Intracoastal Waterway where the building height exceeds 30 feet, but is less than or equal to 50 feet, **Section 120** of the TDI Guide specifies a horizontal wind pressure of 35 psf. Therefore, the prescriptive requirements contained in **Section 400** of the Guide for seaward construction may be used for inland construction at these building heights.

### Product Evaluations

Each product evaluation developed by the Texas Department of Insurance's engineering staff contains a limitation section that specifies the maximum building height that the product may be used. The height limitations associated with the products are based on the wind pressures specified in **Section 120** of the Guide. The height limitations associated with the building product should be reviewed before the product is accepted for installation.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

140 What The State Board of Insurance Will Inspect  
(I-1)

The following code interpretation applies to **Sections 140** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

This code interpretation is being issued to clarify the positions of the T.C.P.I.A. and F.E.M.A. regarding insurance of portions of structures located below the flood level.

The T.C.P.I.A. will write windstorm insurance on parts of a structure below the base flood elevation, if that part is built to meet the applicable wind load. However, this can conflict with federal guidelines for flood insurance (see below). So the T.C.P.I.A. has a mandatory endorsement which excludes parts of structures with breakaway walls (and the enclosed contents) from windstorm coverage. For this reason, it is very important for inspectors to make careful notes when portions of a structure below the flood elevation are non-breakaway, since that part actually will be covered for windstorm insurance. Remember, though, that if that non-breakaway section, or even the whole house, gets washed away by a flood, T.C.P.I.A. will not pay for it because it is a flood loss, not a windstorm loss.

F.E.M.A.'s guidelines for flood insurance are quite a bit different. They must write flood insurance for anyone who applies. The rate a homeowner pays is determined by whether the structure is elevated above the base flood elevation or not. As long as less than 300 square feet of area below the flood level is enclosed by non-breakaway walls, the house will rate as though the entire structure is elevated. If more than 300 square feet of area below the base flood elevation is enclosed by non-breakaway walls, the structure will rate as being built at ground level. This rate is so high (up to 40 times higher than if rated as elevated) that most people cannot afford to enclose more than 300 square feet.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

311.1(a)/411.1(a) Anchorage  
(FA-1, FA-5, FR-2)

The following code interpretation applies to **Sections 311.1(a) and 411.1(a)** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### MUD SILL ANCHORS:

Galvanized metal mud sill anchors that are S.B.C.C.I. or N.E.S. approved will be acceptable inland of the Intracoastal Canal. They should be applied every 36 inches or every other stud, whichever is less. Simpson MAS mud sill anchors will be acceptable spaced up to 5 feet on center for one story buildings only.

Metal mud sill anchors are not acceptable seaward of the Intracoastal Waterway.

### INTERIOR WALLS:

Where interior walls intersect exterior walls, the interior wall must be anchored to the foundation in an approved manner for at least the first 10 feet in from the exterior wall. For slab on grade foundations, one acceptable method is to nail the sole plate to the slab with fluted concrete nails spaced at a maximum of 10 inches on center.

Interior walls which are not required by the guide to be anchored by special methods (within 10 feet of an exterior wall or used to brace rafters) may be glued down or fastened with concrete nails.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

311.2(d)/411.2(d) Beams, Stringers, and Floor Joists  
(FR-23)

The following code interpretation applies to **Sections 311.2(d) and 411.2(d)** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### NOTCHING AND BORINGS OF FLOOR JOIST:

Notches on the ends of floor joists shall not exceed  $\frac{1}{4}$  the joist depth. Bored holes shall not be within 2 inches of the top and bottom of the floor joist and the diameter of the hole shall not exceed  $\frac{1}{3}$  the depth. Notches in the top or bottom of the floor joist shall not exceed  $\frac{1}{6}$  the depth and shall not be located in the middle  $\frac{1}{3}$  of the joist span.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

### 311.3/411.3 Pier and Beam Foundation (FO-1, FO-2)

The following code interpretation applies to **Sections 311.3 and 411.3** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

#### MANUFACTURED HOUSING:

An exception to the normal pier on beam requirements is allowed for manufactured housing (not mobile homes). They are built on one site, moved to another site, and usually placed on precast footings. When this type of structure is roughly square, and exceeds 1200 square feet, the piers need not be anchored to the footing. The piers must still be reinforced and securely fastened to the beams of the house.

#### PICTORIAL REPRESENTATION OF METHODS TO ANCHOR PIER AND BEAM FOUNDATIONS:

##### 311.3/411.3 Pier and Beam Foundation

- If it is impossible to anchor piers to footings, one alternate method would be to construct an additional anchor between each pier. This is accomplished by digging a 3' x 3' x 3' hole and filling it a minimum of 1 foot deep with reinforced concrete. Embed a corrosion-resistant length of angle iron, or 4" x 4" (minimum) treated lumber into the concrete. The angle iron shall have a 90 degree bend in the bottom, and the lumber shall have some type of dowel in the end, or some other method shall be provided to anchor the iron or lumber against uplift. The angle iron or wood post shall be fastened to the beam with a minimum of two 1/2 inch bolts, or shall be otherwise securely fastened. The remainder of the hole shall be filled back in. One of these anchors shall be installed between each pier, with a maximum spacing of 10 feet between each anchor. See Figure 1.

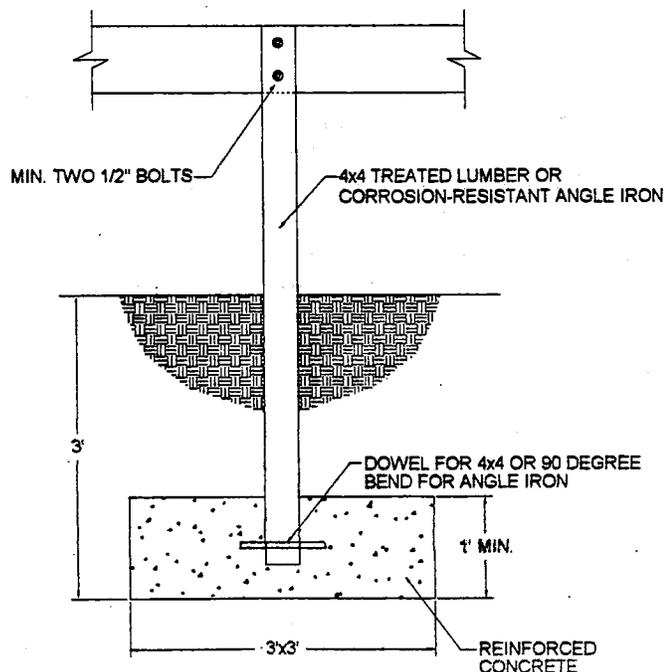


Figure 1

- Another alternate method which will be accepted when the structure is elevated less than three feet above grade is as follows. Dig a belled hole a minimum of 36 inches deep, a minimum of 24 inches wide at the bottom, and a maximum of 12 inches wide at the top. Place a treated wood or corrosion-resistant steel pier in the hole and fill the hole with concrete and reinforcement. The column shall have some type of dowel or horizontal protrusions near its bottom to anchor against uplift. The pier shall have a minimum width of 6 inches. The beam shall be securely anchored to the top of this pier. The maximum spacing between piers shall be 10 feet. See Figure 2.

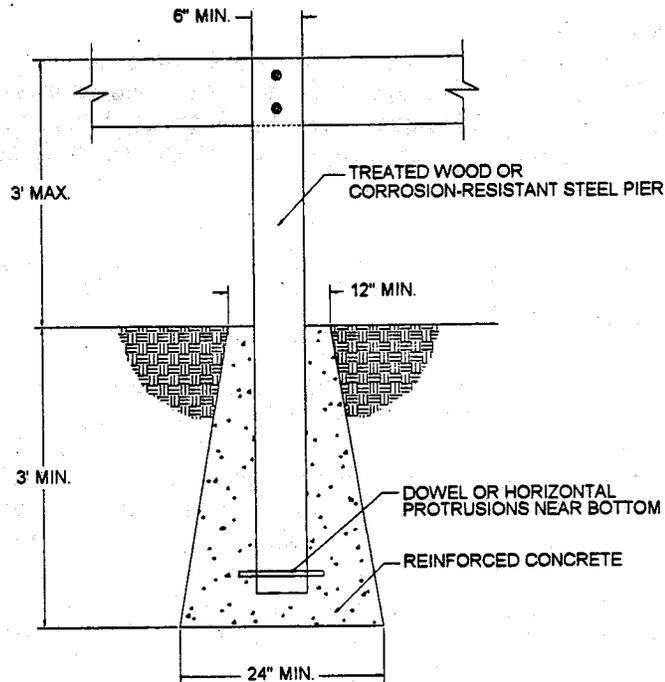


Figure 2

- Small temporary buildings or portable buildings which have an area of less than 200 square feet and which are elevated less than 12 inches above grade may be anchored by the following method. Dig a 2' x 2' x 2' hole at each corner, fill the hole at least 1 foot deep with concrete, and embed a 1 1/2" x 1 1/2" x 1/4" angle iron or a 2 inch x 1/4" steel strap. Straps or anchors shall be corrosion-resistant. Straps or anchors shall have a 90 degree bend at the bottom to anchor them against uplift. Straps or anchors shall be securely fastened to each corner of the building. Temporary or portable buildings having an area greater than 200 square feet shall be anchored by one of the previously outlined methods. See Figure 3.

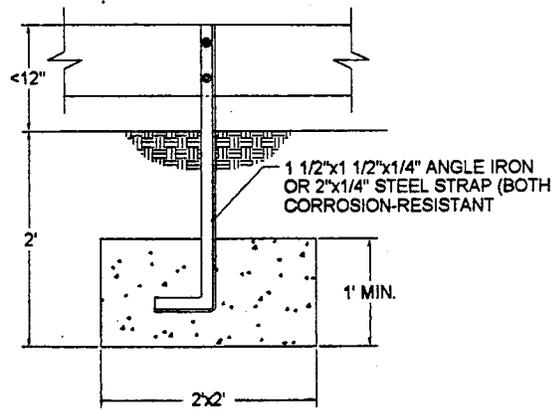


Figure 3

- If none of these methods can be used, the installation of approved mobile home tie-downs may be accepted. Generally, 48 inch long tie-downs installed at each exterior pier as per their manufacturer's instructions with a minimum of one tie-down for each 6 feet of wall length, will be acceptable. See Figure 4.

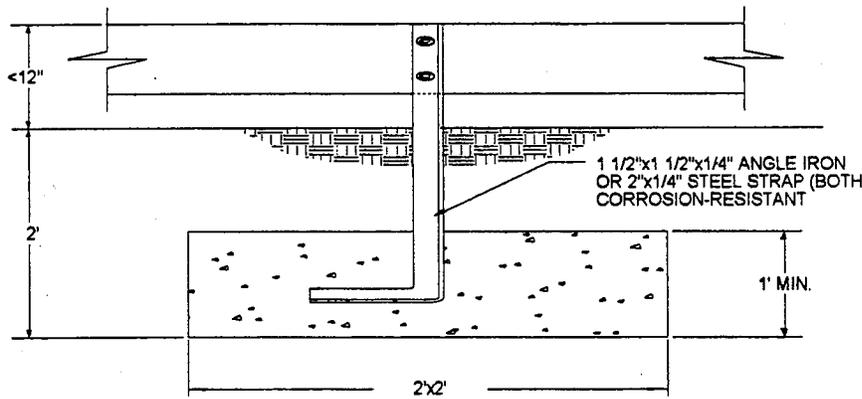


Figure 4



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

312/412 Framing  
(FA-12)

Effective September 1, 1997  
Revised November 28, 1997

The following code interpretation applies to Sections 312 and 412 of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

The 1973 Edition of the Standard Building Code provides a fastening schedule for various framing connections. The fasteners specified in this framing schedule are common wire nails. Often box nails and proprietary pneumatic gun nails are used for framing applications. In order to provide guidance on the appropriate type and number of fasteners required for a framing connection, the Texas Department of Insurance has developed a fastening schedule that includes requirements for common wire, box, and pneumatic gun nails. The fastening schedule provided in this code interpretation includes the typical framing connections specified in the fastening schedule of the 1973 Edition of the Standard Building Code as well as specific connections specified in the Texas Department of Insurance's *Windstorm Resistant Construction Guide*.

Fasteners shall be provided in accordance with the minimum requirements listed in this schedule unless otherwise specified in the Texas Department of Insurance's *Windstorm Resistant Construction Guide*, or a Texas Department of Insurance code interpretation or product evaluation. All fasteners shall comply with either **Federal Specification FF-N-105B** or **ASTM F 1667**. All fasteners shall be corrosion resistant as specified in the *Windstorm Resistant Construction Guide*.

**NOTES:** The fastener requirements are presented in terms of the minimum required length and shank diameter of the nails. As an example, a fastener designation written as: 2 ½" x 0.131" means that the length of the nail is 2 ½ inches and the shank diameter is 0.131 inches.

## FASTENING SCHEDULE FOR THE WINDSTORM RESISTANT CONSTRUCTION GUIDE

### ROOF FRAMING

- Rafter to Top Plate (Toe-nailed)

3 nails: 2 ½" x 0.131" (8d common)	4 nails: 2 ¾" x 0.113"
3" x 0.128" (10d box)	3" x 0.120"
3" x 0.131"	3 ¼" x 0.120"
3 ¼" x 0.131"	
  
- Rafter to Ridge Board (Toe-nailed)

2 nails: 3 ½" x 0.162" (16d common)	4 nails: 3" x 0.120"
3 nails: 3" x 0.131"	3 ¼" x 0.120"
3 ¼" x 0.131"	
3 ½" x 0.135" (16d box)	
  
- Rafter to Ridge Board (Face-nailed)

2 nails: 3 ½" x 0.162" (16d common)	4 nails: 3" x 0.120"
3 nails: 3 ¼" x 0.131"	3 ¼" x 0.120"
3 ½" x 0.135" (16d box)	3" x 0.131"

**FASTENING SCHEDULE FOR THE WINDSTORM RESISTANT CONSTRUCTION GUIDE**

**ROOF FRAMING (Continued)**

- Collar Tie to Rafter (Face-nailed)  
3 nails: 3 1/2" x 0.162" (16d common)      4 nails: 3" x 0.120"  
3 1/4" x 0.120"  
3 1/4" x 0.128 (12d box)  
3" x 0.131"  
3 1/4" x 0.131"
- Ceiling Joist to Top Plate (Toe-nailed)  
3 nails: 2 1/2" x 0.131" (8d common)  
3" x 0.128" (10d box)  
3" x 0.131"  
3 1/4" x 0.131"      4 nails: 2 3/8" x 0.113"  
3" x 0.120"  
3 1/4" x 0.120"
- Ceiling Joist to Parallel Rafter (Face-nailed)  
3 nails: 3 1/2" x 0.162" (16d common)      4 nails: 3" x 0.120"  
3 1/4" x 0.120"  
3 1/4" x 0.128 (12d box)  
3" x 0.131"  
3 1/4" x 0.131"
- Ceiling Joist Laps over Partitions (Face-nailed)  
3 nails: 3 1/2" x 0.162" (16d common)      4 nails: 3" x 0.120"  
3 1/4" x 0.120"  
3 1/4" x 0.128 (12d box)  
3" x 0.131"  
3 1/4" x 0.131"

**WALL FRAMING**

- Double Top Plate (Face-nailed)  
1 nail at 16" o.c.: 3 1/2" x 0.162" (16d common)  
1 nail at 12" o.c.: 3" x 0.120"  
3 1/4" x 0.120"  
3" x 0.131"  
3 1/4" x 0.131"  
3 1/2" x 0.135" (16d box)
- Top Plate Laps and Intersections (Face-nailed - number of nails each side of lap)  
2 nails: 3 1/2" x 0.162" (16d common)      3 nails: 3" x 0.120"  
3 1/4" x 0.120"  
3 1/4" x 0.128 (12d box)  
3" x 0.131"  
3 1/4" x 0.131"



## FASTENING SCHEDULE FOR THE WINDSTORM RESISTANT CONSTRUCTION GUIDE

### FLOOR FRAMING

- Joist to Sill, Top Plate, or Girder (Toe-nailed)
  - 3 nails: 2 1/2" x 0.131" (8d common)
  - 3" x 0.128" (10d box)
  - 3" x 0.131"
  - 3 1/4" x 0.131"
  - 4 nails: 3" x 0.120"
  - 3 1/4" x 0.120"
- Bridging to Joist (Toe-nailed), number of nails at each end
  - 2 nails: 2 1/2" x 0.131" (8d common)
  - 3" x 0.128" (10d box)
  - 3 nails: 3" x 0.120"
  - 3 1/4" x 0.120"
  - 4 nails: 2" x 0.113"
  - 2 3/8" x 0.113"
- Band Joist to Joist (End-nailed)
  - 3 nails: 3 1/2" x 0.162" (16d common)
  - 5 nails: 3" x 0.131"
  - 3 1/4" x 0.131"
  - 3 1/2" x 0.135" (16d box)
  - 6 nails: 3" x 0.120"
  - 3 1/4" x 0.120"

### WALL SHEATHING

(sheathing not used for lateral resistance)

- Wood Structural Sheathing (Plywood or OSB) or Structural Panel Siding; 1/2 inch thick or less  
Nailing Pattern: 6" o.c. along panel edges and 12" o.c. along interior framing
  - 1 nail: 2" x 0.113" (6d common)
  - 2 1/2" x 0.131"
  - 2" x 0.113" deformed shank
  - 2 1/2" x 0.131" deformed shank
  - 2 1/2" x 0.113 (8d box)
  - 3" x 0.131"
  - 2 3/8" x 0.113"
  - 3 1/4" x 0.131"
  - 2 3/8" x 0.113" deformed shank
  - 2 1/2" x 0.120" deformed shank
  - 3" x 0.120"
  - 3" x 0.120" deformed shank
  - 3 1/4" x 0.120"
- Wood Structural Sheathing (Plywood or OSB) or Structural Panel Siding; 19/32 inch thick or greater  
Nailing Pattern: 6" o.c. along panel edges and 12" o.c. along interior framing
  - 1 nail: 2 1/2" x 0.131" (8d common)
  - 2 1/2" x 0.131" deformed shank
  - 2 1/2" x 0.120" deformed shank
  - 3" x 0.120" deformed shank
  - 3" x 0.128" (10d box)
  - 3" x 0.131"
  - 3 1/4" x 0.131"

---

## FASTENING SCHEDULE FOR THE WINDSTORM RESISTANT CONSTRUCTION GUIDE

### WALL SHEATHING (sheathing used for lateral resistance)

- Wood Structural Sheathing (Plywood or OSB) or Structural Panel Siding; Minimum  $\frac{3}{8}$  inch thick

NOTE: If 6d common nails are specified, then the following alternatives are permitted:  
Nailing Pattern: 6" o.c. along panel edges and 12" o.c. along interior framing

1 nail:	2" x 0.113" (6d common)	2 1/2" x 0.131"
	2" x 0.113" deformed shank	2 1/2" x 0.131" deformed shank
	2 1/2" x 0.113 (8d box)	3" x 0.131"
	2 3/8" x 0.113"	3 1/4" x 0.131"
	2 3/8" x 0.113" deformed shank	
	2 1/2" x 0.120" deformed shank	
	3" x 0.120"	
	3" x 0.120" deformed shank	
	3 1/4" x 0.120"	

- Wood Structural Sheathing (Plywood or OSB) or Structural Panel Siding; Minimum  $\frac{3}{8}$  inch thick

NOTE: If 8d common nails are specified, then the following alternatives are permitted:  
Nailing Pattern: 6" o.c. along panel edges and 12" o.c. along interior framing

1 nail:	2 1/2" x 0.131" (8d common)
	2 1/2" x 0.131" deformed shank
	2 1/2" x 0.120" deformed shank
	3" x 0.120" deformed shank
	3" x 0.128" (10d box)
	3" x 0.131"
	3 1/4" x 0.131"

- Wood Structural Sheathing (Plywood or OSB) or Structural Panel Siding; Minimum  $\frac{3}{8}$  inch thick

NOTE: If 8d common nails are specified, then the following alternatives are permitted:  
Nailing Pattern: 4" o.c. along panel edges and 8" o.c. along interior framing

1 nail:	2 3/8" x 0.113" deformed shank
	2 1/2" x 0.113" deformed shank
	3" x 0.120"

### ROOF SHEATHING

- Wood Structural Sheathing (Plywood or OSB);  $\frac{5}{8}$  inch thick or less)

Nailing Pattern: 6" o.c. along panel edges and 12" o.c. along interior framing

1 nail:	2 1/2" x 0.131" (8d common)
	2 1/2" x 0.131" deformed shank
	2 1/2" x 0.120" deformed shank
	3" x 0.120" deformed shank
	3" x 0.128" (10d box)
	3" x 0.131"
	3 1/4" x 0.131"

## FASTENING SCHEDULE FOR THE WINDSTORM RESISTANT CONSTRUCTION GUIDE

### ROOF SHEATHING (Continued)

- Wood Structural Sheathing (Plywood or OSB);  $\frac{5}{8}$  inch thick or less  
Nailing Pattern: 4" o.c. along panel edges and 8" o.c. along interior framing  
1 nail: 2  $\frac{3}{8}$ " x 0.113" deformed shank  
2  $\frac{1}{2}$ " x 0.113" deformed shank  
3" x 0.120"

# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

312.1/412.1 Lumber  
(FR-5, FR-6, FR-8, FR-12)

The following code interpretation applies to **Sections 312.1 and 412.1** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### LUMBER:

All lumber shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the American Lumber Standards Committee. That means each piece of lumber must be stamped with a grade mark (#1, #2, #3, etc.) and the stamp of the grading agency.

### FINGER-JOINTED LUMBER:

Properly graded finger-jointed lumber will be an acceptable alternative to solid lumber of the same grade and species. The lumber must be graded by a grading agency which is approved by the American Lumber Standards Committee. Furthermore, it is extremely important that finger-jointed lumber which has wording in its grademark reading "Stud Use Only," or Vertical Use Only," (or similar wording) be used only as studs in an upright position.

The following agencies are authorized by the American Lumber Standards Committee to supervise finger-jointing:

California Lumber Inspection Service  
Northeastern Lumber Manufacturers Association  
Northern Softwood Lumber Bureau  
Southern Pine Inspection Bureau  
Timber Products Inspections  
West Coast Lumber Inspection Bureau  
Western Woods Products Association  
Alberta Forest Products Association  
Canadian Mill Services Association  
Canadian Softwood Inspection Agency, Inc.

Cariboo Lumber Manufacturers Association  
Coniferous Lumber Inspection Bureau  
Interior Lumber Manufacturers Association  
MacDonald Inspection  
Maritime Lumber Bureau  
Northern Forest Products Association  
Ontario Lumber Manufacturers Association  
Pacific Lumber Inspection Bureau  
Quebec Lumber Manufacturers Association

### MOISTURE CONTENT:

The 1973 *Standard Building Code* states that "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." Permanent incorporation is defined as when the lumber is cut to size and nailed in place.

Therefore, all lumber marked S-GRN should have its moisture content checked at the time of the first framing inspection. At that time, if the lumber has moisture content above 19%, the inspection will not be approved and the house will not be eligible for further inspection by the TDI. It could, however, still be certified by a Texas registered professional engineer.

If you find a few boards slightly above 19%, make a good number of tests (over 20) and get with your supervisor and the engineering staff. We will soon have guidelines on exactly how much over we will accept. If quite a few are over 20%, go ahead and turn it down.

### STRUCTURAL PANELS:

APA and TECO rated non-veneer panels (waferboard and oriented strand board) are acceptable for use in all coastal areas (including the area seaward of the Intracoastal Waterway).

**FLOORING:**

When used as subflooring or combination flooring/subflooring (STURD-I-FLOOR) on elevated structures, the bottom of the non-veneer panels shall be either primed, sealed, or painted in the areas seaward of the Intracoastal Waterway.

# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

312.2/412.2 Fasteners  
(FA-9, FA-13)

The following code interpretation applies to **Sections 312.2 and 412.2** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

The following requirements are for fasteners that are specified in the Texas Department of Insurance's *Windstorm Resistant Construction Guide* for use in framing and roofing applications. These fasteners may be driven by hand or by a pneumatic nail gun.

All fasteners (including those that are not manufactured in the U.S.) shall comply with **Federal Specification FF-N-105B** or **ASTM F 1667**. Information shall be available on the job site at all times specifying the fasteners compliance with one of the above standards. Fasteners shall be either hot dipped, electrically, or mechanically galvanized steel or stainless steel as specified in the Texas department of Insurance's *Windstorm Resistant Construction Guide*.

### IMPORTANT NOTES:

- (1) The fastener specifications for roofing nails listed below are for nails that are driven by hand or by a pneumatic nail gun.
- (2) Framing nails specified in the *Windstorm Resistant Construction Guide* are common wire nails. The list below contains fastener specifications for the framing nails specified in the Guide. The Texas Department of Insurance does not prohibit the use of box or pneumatic gun nails in place of common wire nails. However, the correct number of box or pneumatic gun nails shall be used to satisfy the required withdrawal and/or shear capacity of a specific framing connection.

To determine the size and number of common wire or box nails required for typical framing connections, refer to either the fastening schedule in Code Interpretation 312/412 Framing (FA-12), the *Windstorm Resistant Construction Guide*, or consult with the engineering staff in Austin. To determine the size and number of pneumatic gun nails required for typical framing connections, refer to the fastening schedule in Code Interpretation 312/412 Framing (FA-12) or consult with the engineering staff in Austin.

### ROOFING NAILS:

Roofing nails shall be minimum 11 gauge (0.120 inch diameter) or 12 gauge (0.106 inch diameter) wire. The head diameter shall be at least  $\frac{3}{8}$  inch. Nails shall be long enough to penetrate completely through the shingle, felt, and at least  $\frac{3}{4}$  inch into the roof deck lumber or completely through the plywood roof deck. The *Asphalt Roofing Manufacturer's Association* recommends  $1\frac{1}{4}$  inch long nails for asphalt shingles over new wood decks.

### FRAMING NAILS:

If 4d nails are specified:

Nail length =  $1\frac{1}{2}$  inches

Shank diameter = 0.099 inches

If 6d nails are specified:

Nail length = 2 inches  
Shank diameter = 0.099 inches

If 8d nails are specified:

Nail length = 2 ½ inches  
Shank diameter = 0.131 inches

If 10d nails are specified:

Nail length = 3 inches  
Shank Diameter = 0.148 inches

If 12d nails are specified:

Nail length = 3 ¼ inches  
Shank diameter = 0.148 inches

If 16d nails are specified:

Nail length = 3 ½ inches  
Shank diameter = 0.162 inches

If 20d nails are specified:

Nail length = 4 inches  
Shank diameter = 0.192 inches

# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

312.3/412.3 Wall Framing and Framing Anchors  
(FR-11, FR-17, FR-23)

The following code interpretation applies to **Sections 312.3 and 412.3** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### SOLE PLATES:

The *Windstorm Resistant Construction Guide* requires that exterior sole plates be treated seaward and either treated or set on a moisture barrier inland. The 1973 Standard Building Code states the following: "Sleepers and joists on concrete or masonry slabs which are in direct contact with the earth shall be of approved wood of natural decay resistance or pressure treated wood." This means that if the slab is poured directly onto earth, without a polyethylene film or other moisture barrier, all sole plates (interior and exterior) must be treated (or set on moisture barrier, inland). We will not count any soil that is simply piled up against the side of the slab.

### WALLS:

A loadbearing wall, as defined in model building codes, is a wall that supports vertical loads in addition to its own weight. This shall include gravity loads, such as dead and live loads, and uplift and compressive forces due to the wind. Walls that support **only** horizontally applied wind pressures are not considered loadbearing walls. Also, as stated in the *Windstorm Resistant Construction Guide*, interior walls that are used to brace exterior walls shall be considered loadbearing walls.

The following four species of lumber may be used for exterior and interior wall studs: Southern Pine, Douglas Fir-Larch, Spruce-Pine-Fir, and Hem-Fir. Stud grade shall be the minimum grade used for exterior loadbearing and non-loadbearing walls and interior loadbearing walls. Standard or utility grade may be used for interior non-loadbearing walls. Approval from the engineering staff shall be required before other species of lumber are used.

As stated in the *Windstorm Resistant Construction Guide*, loadbearing wall studs, both exterior and interior, shall be spaced a maximum of 16 inches on center if 2x4's are used and a maximum of 24 inches on center if 2x6's are used. In the bottom story of three story buildings, all wall studs shall be minimum 2x6. Interior non-loadbearing wall studs may be spaced up to 28 inches on center.

Loadbearing walls studs shall not exceed 10 feet in height between horizontal supports. This requirement is in line with model building code requirements for loadbearing walls. Non-loadbearing wall studs shall not exceed 20 feet in height between horizontal supports. This is a practical requirement since typical lumber lengths do not exceed this limit. Tables 1 and 2 specify the maximum allowable lengths of exterior wall studs. Approval from the engineering staff shall be required before stud lengths that exceed those specified in Tables 1 and 2 are used.

**Table 1**  
**Maximum Exterior Wall Stud Lengths Resisting Wind**  
**(Inland Areas)**

Stud Grade	Stud Spacing	Southern Pine		Douglas Fir-Larch Spruce-Pine-Fir Hem-Fir	
		2x4	2x6	2x4	2x6
Stud	12"	11'-6"	17'-0"	10'-6"	15'-10"
	16"	9'-11"	14'-8"	9'-2"	13'-8"
	24"	-	12'-0"	-	11'-2"
No. 2	12"	15'-0"	20'-0"	14'-0"	20'-0"
	16"	13'-0"	18'-8"	12'-2"	17'-9"
	24"	-	15'-3"	-	14'-6"

**Table 2**  
**Maximum Exterior Wall Stud Lengths Resisting Wind**  
**(Seaward Areas)**

Stud Grade	Stud Spacing	Southern Pine		Douglas Fir-Larch Spruce-Pine-Fir Hem-Fir	
		2x4	2x6	2x4	2x6
Stud	12"	9'-8"	14'-4"	8'-11"	13'-4"
	16"	8'-5"	12'-5"	8'-0"	11'-7"
	24"	-	10'-2"	-	9'-5"
No. 2	12"	12'-8"	18'-2"	11'-10"	17'-4"
	16"	11'-0"	15'-9"	10'-3"	15'-0"
	24"	-	12'-10"	-	12'-3"

**NOTCHING AND BORING OF WALL STUDS:**

Notches in exterior wall studs shall be limited to 25% of the stud depth. Bored holes in exterior wall studs shall be limited to 40% of the stud depth. The edge of a bored hole shall be a minimum of 3/8 inch from the edge of the stud. Notches and bored holes shall not occur in the same cross section. Bored holes in double studs of exterior walls shall be limited to 60% of the stud depth.

# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

312.4/412.4 Roof Framing Members (Rafters)  
(FR-3, FR-16, FR-22, FR-23)

The following code interpretation applies to **Sections 312.4 and 412.4** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### METAL STRAPS USED FOR CATHEDRAL CEILINGS:

Metal straps from rafter to rafter across the ridge are not substitutes for collar beams (may be the only way for cathedral ceilings).

### CEILING JOISTS:

As a general rule, we do not inspect ceiling joists, because they usually are not considered wind load resisting elements.

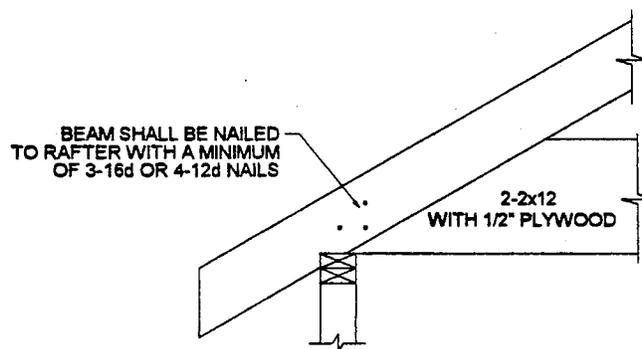
However, when over spanned rafters are braced down to ceiling joists and not to loadbearing walls, they do become wind load resisting elements. Therefore, when over spanned rafters are braced directly to ceiling joists in the unsupported portion of their spans, we have the authority to enforce maximum recommended spans.

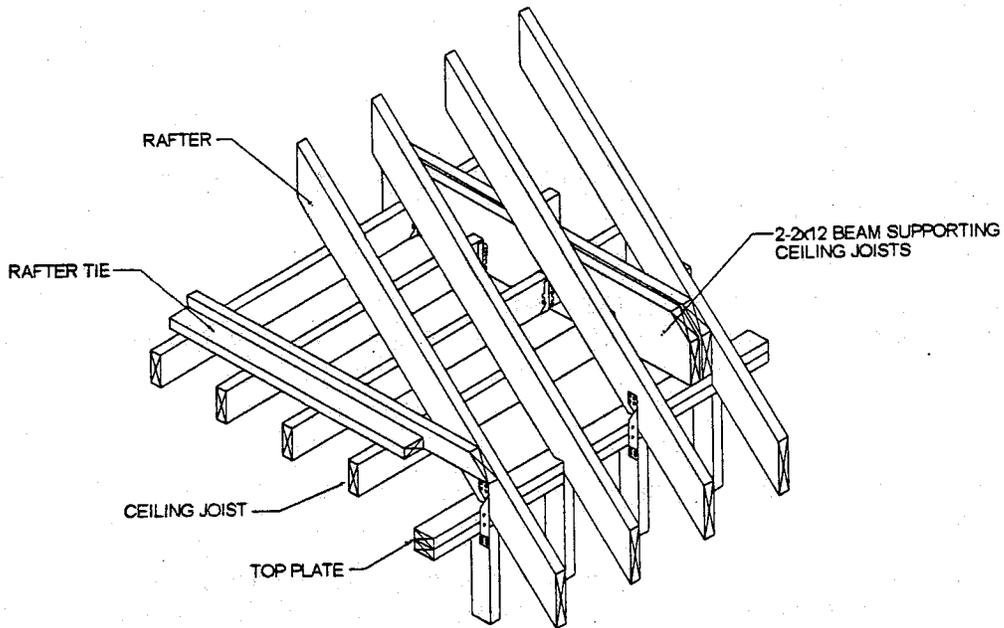
Note: The *Standard Building Code* states that "Valley and hip rafters shall be two (2) inches deeper than jack rafters." This means that they will usually have to be the same dimension as the ridge.

The *Standard Building Code* states that "Where rafters meet to form a ridge, they shall be placed directly opposite and nailed to a ridge board..." Rafters shall be directly opposite each other on the ridge.

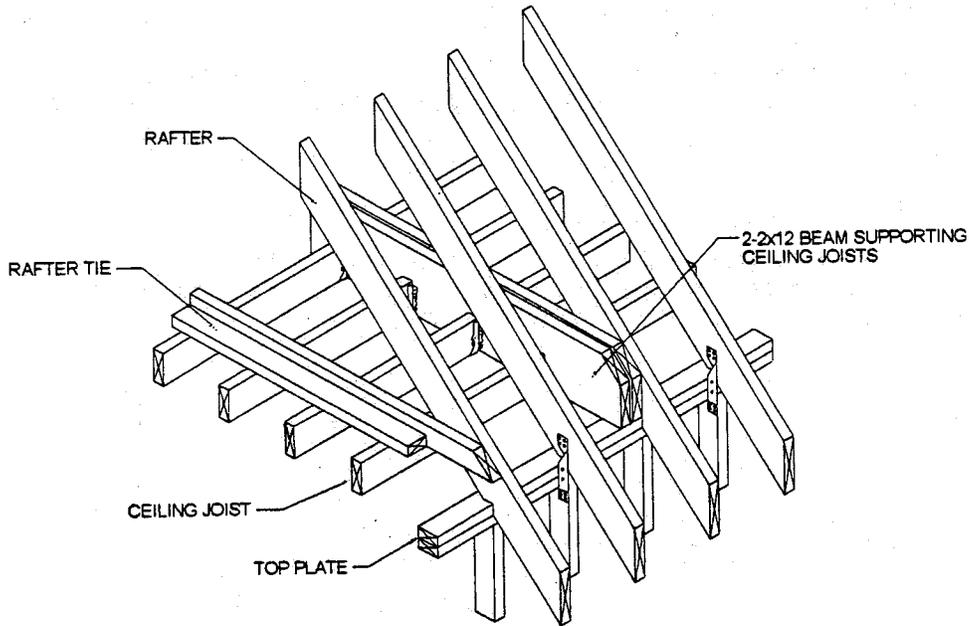
### BEAMS USED TO SUPPORT CEILING JOIST:

When a beam is used to support ceiling joists that run perpendicular to the rafters, the beam can also be used as a rafter tie if the rafter is nailed to the beam with 3-16d or 4-12d common nails. Rafter tie spacing shall comply with **Section 312.4** and **Section 412.4**.





**Inland**



**Seaward**

**NOTCHING AND BORING:**

**Ceiling Joist:**

Notches on the ends of ceiling joists shall not exceed  $\frac{1}{4}$  the joist depth. Bored holes shall not be within 2 inches of the top and bottom of the ceiling joist and the diameter of the hole shall not exceed  $\frac{1}{3}$  the

September 1, 1997

312.4/412.4 Roof Framing Members (Rafters) (cont.)

---

depth. Notches in the top or bottom of the ceiling joist shall not exceed  $\frac{1}{6}$  the depth and shall not be located in the middle  $\frac{1}{3}$  of the joist span.

**Rafters:**

Notches at supports shall not exceed  $\frac{1}{4}$  the rafter depth. Bored holes shall not be within 2 inches of the top and bottom of the rafter and the diameter of the hole shall not exceed  $\frac{1}{3}$  the depth. Notches in the top or bottom of the rafter shall not exceed  $\frac{1}{6}$  the depth and shall not be located in the middle  $\frac{1}{3}$  of the rafter span.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective May 1, 1997

312.6/412.6 Corner and Wall Bracing  
(FR-10)

The following code interpretation applies to **Sections 312.6 and 412.6** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

The following comments are offered as clarifications to the guidelines for corner bracing and wall bracing specified in **Section 312.6** and **Section 412.6** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*. The engineering staff has made every attempt to provide as clear and concise an interpretation of the wall bracing requirements as possible. The Texas Department of Insurance windstorm inspector has the responsibility of determining if the wall bracing provided on the building complies with the guidelines outlined in this code interpretation. The builder may choose to submit to the engineering staff an alternate wall bracing design. The engineering staff will review the alternate wall bracing design as long as the design has been submitted by a Texas registered professional engineer accompanied by substantiating information (i.e., calculations). The engineering staff will not design the wall bracing system.

The code interpretation is divided into two major sections: Section One includes the clarifications to the wall bracing requirements for both inland and seaward locations. Section Two includes two example floor plans showing the placement of exterior wall bracing that conforms to the requirements outlined in Section One. The clarifications to the wall bracing requirements are separated into five parts: (A) General Wall Bracing Requirements; (B) Wall Bracing Methods; (C) Sheathing Between Floors of Two-Story Buildings; (D) Bracing of Interior Walls; and (E) Other Structural Sheathing Products.

## SECTION I: WALL BRACING CLARIFICATIONS FOR INLAND AND SEAWARD LOCATIONS

### (A) General Wall Bracing Requirements

The following general wall bracing requirements shall apply to each of the wall bracing methods presented in Part B.

A wall brace shall be provided at each exterior building corner. In addition, a wall brace shall also be provided for each 18 feet of exterior wall length. In other words, the maximum unbraced wall length shall not exceed 18 feet. For this code interpretation, an exterior wall shall be defined as the distance between two exterior building corners. An exterior building corner shall be defined as the point where converging exterior walls meet.

### EXCEPTIONS:

- 1) Exterior walls less than or equal to 3 feet in length are not required to be braced.
- 2) Wood structural sheathing (plywood, OSB, waferboard) or structural panel siding shall be provided around all openings in the recessed front entry way. If the minimum wall bracing requirements can be achieved, then the sheathing around the openings can be omitted.
- 3) If an exterior wall contains a bay window (defined as a window or group of windows, usually supported by a foundation, extending beyond the exterior wall of the building) or if an exterior wall of a room is constructed in the shape of a bay window (such as an exterior wall of a bedroom, morning area, breakfast area, study, etc.) then they shall be considered as window assemblies located along

the exterior wall. For the application of wall bracing, the entire bay window or exterior wall shaped in the form of a bay window shall be represented as a single 'window' opening in the plane of the wall.

Figure FR-10.1 illustrates an example of a bay window. The figure on the left represents the actual bay window located along an exterior wall. The figure on the right illustrates how the bay window shall be represented for wall bracing - as a single 'window' opening in the plane of the wall. Wall bracing shall be provided along the wall as specified in this code interpretation.

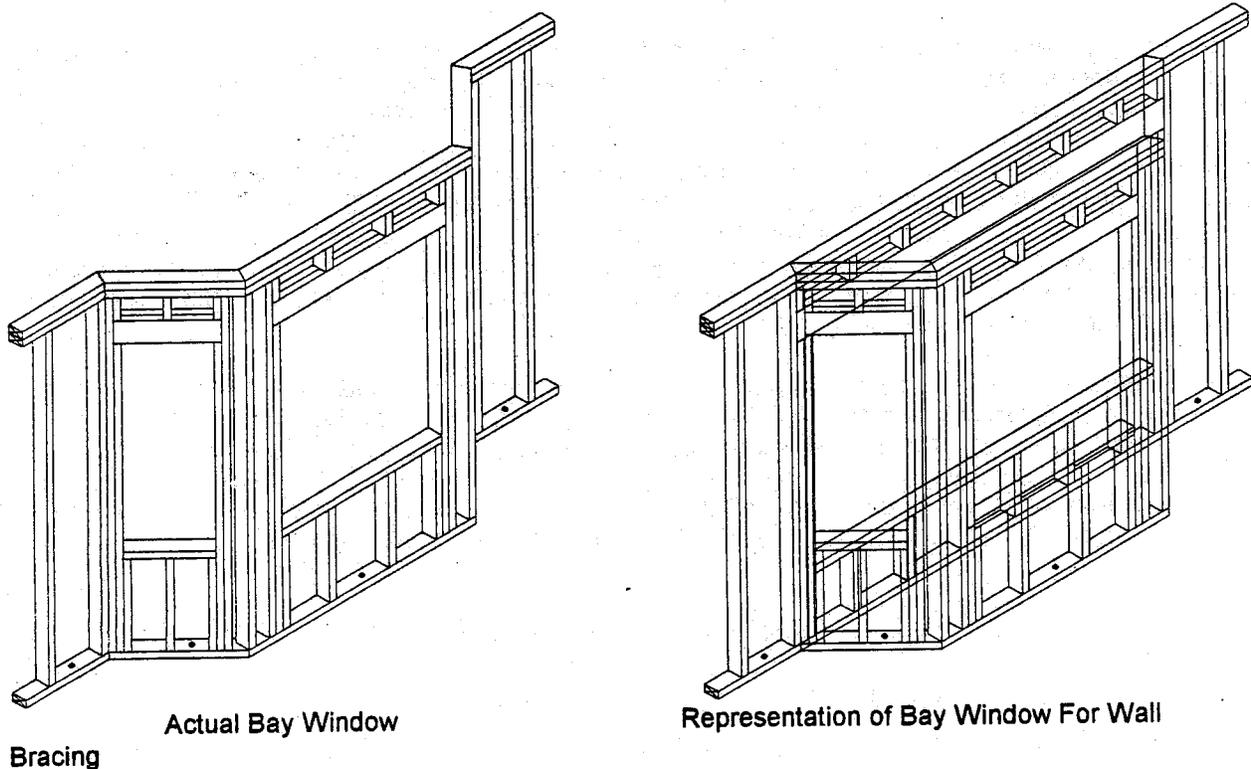


Figure FR-10.1: Treatment of Bay Windows

- 4) The walls of a dormer (defined here as a projecting structure built out from a sloping roof) are not required to have wall bracing. If the walls of a dormer are braced, then this bracing shall not count as part of the lateral wall bracing system.
- 5) If a chimney is located on an exterior wall, then the chimney shall be treated as an opening located in the plane of the wall. The chimney may be sheathed; however, the sheathing shall not count as wall bracing. **EXCEPTION:** If the chimney is located at a building corner, then the chimney shall be fully sheathed in accordance with the requirements of this code interpretation.
- 6) The perimeter of each garage door opening shall be fully sheathed on the exterior wall surface. The following guidelines shall be used:

The sheathing material shall be minimum  $\frac{3}{8}$  inch thick wood structural sheathing (plywood, OSB, waferboard) or structural panel siding. If Wall Bracing Method 1 is used, then minimum  $\frac{1}{6}$  inch thick sheathing shall be used. **NOTE:** Minimum  $\frac{15}{32}$  inch plywood (or  $\frac{1}{6}$  inch OSB) shall be used if required by either Section 312.7 or Section 412.7 (Framing Around Openings) of the *Windstorm Resistant Construction Guide*.

If a garage door return is located at a building corner, and the required wall bracing at the building corner can not be achieved, then the following sheathing detail shall be used: The upper corner of the garage door opening shall be sheathed with a single "L" shaped piece of sheathing material. The "L" shaped piece of sheathing shall extend a minimum of 4 feet down from the top plate of the wall and 4 feet horizontally away from the building corner.

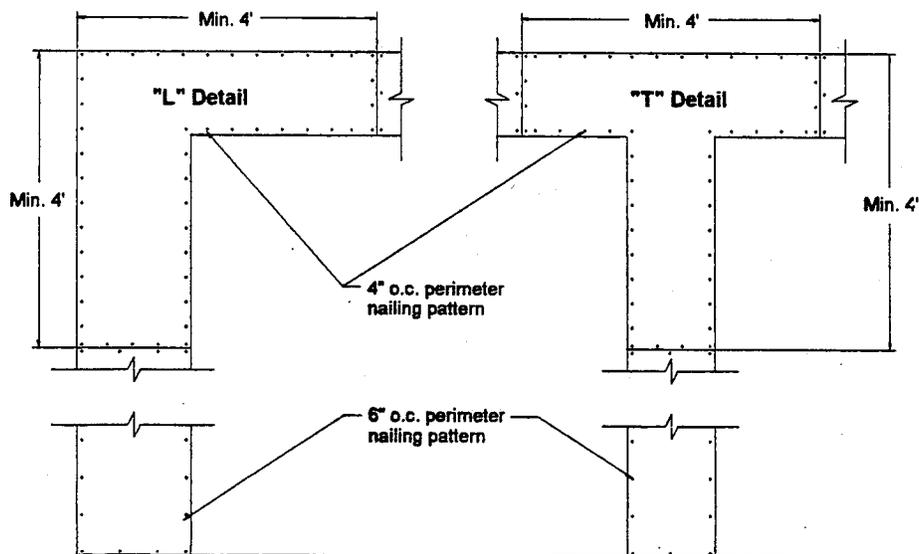
If a wall segment separates two garage door openings, then the following sheathing detail shall be used at the top of the wall segment: A single piece of sheathing material shall form a "T". The horizontal portion of the "T" shall be 4 feet in length. The vertical portion of the "T" shall extend 4 feet down from the top plate of the wall.

Each "L" or "T" shaped piece of sheathing material shall be fastened with either minimum 8d common nails or nails with a minimum shank diameter of 0.131 inches and a minimum length of 2 ½ inches. The fasteners shall be spaced a maximum of 4 inches on center along the panel edges. The remainder of the perimeter sheathing around the garage door shall be fastened to the wall framing with fasteners spaced a maximum of 6 inches on center along the panel edges. **Figure FR-10.2** illustrates an "L" detail and a "T" detail for garage door returns.

- 7) The bottom story of two story buildings shall be braced using either Wall Bracing Method 1 or Wall Bracing Method 5. **NOTE:** If Wall Bracing Method 5 is used, then the entire building shall be sheathed.

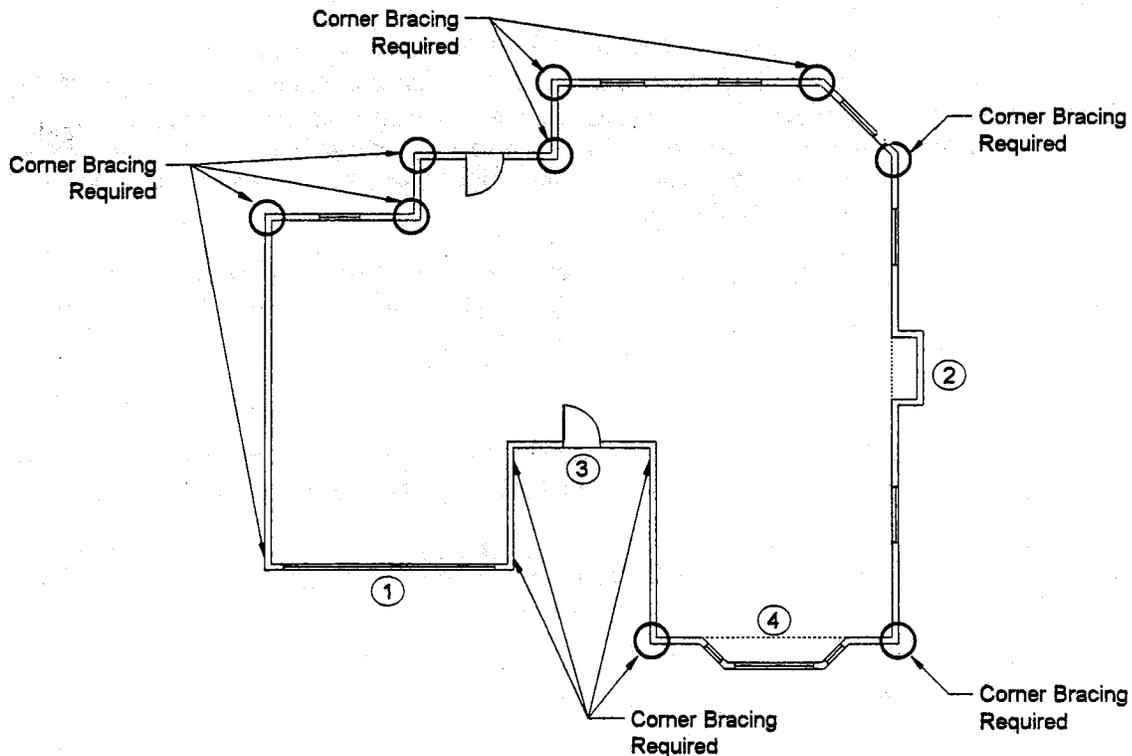
**NOTES:**

- 1) The use of sheathing on ceiling, floor, and/or roof systems and the use of sheathing on the interior surfaces of exterior walls shall not reduce the minimum requirements for exterior wall bracing.
- 2) If an alternate wall bracing material is being considered for use, consult with the local windstorm field office or the engineering staff before applying the alternate wall bracing material.



**Figure FR-10.2: Example Garage Door Return Details**

Figure FR-10.3 shows a building floor plan that indicates where wall bracing is required at the building corners. Where an arrow points to a building corner that is circled, wall bracing is required on each side of that corner. Where an arrow points to a corner that is not circled, wall bracing is required only on the side of the corner indicated by the arrow. Items 1 thru 4 (denoted by the circled numbers in the figure) highlight exceptions to the general wall bracing requirements.



- ① The perimeter of the garage door opening shall be sheathed.
- ② The chimney shall be treated as an opening in the plane of the wall. The chimney may be sheathed; however, the sheathing shall not count as wall bracing.
- ③ Sheathing shall be provided around all openings located in the recessed front entry way.
- ④ The bay window shall be treated as a single window opening in the plane of the wall.

Figure FR-10.3: Building Corners that Require Wall Bracing and Specific Exceptions to the General Wall Bracing Requirements

### (B) Wall Bracing Methods

The following five methods may be used for wall bracing. **EXCEPTION:** Wall Bracing Method 3 is not permitted for seaward locations. **NOTES:** Wall Bracing Methods 1 thru 4 may be used in combination. If Wall Bracing Method 5 is used, then the whole building shall be braced using this method.

1. Minimum  $\frac{15}{32}$  inch (or  $\frac{7}{16}$  inch) thick wood structural sheathing (plywood, waferboard, or OSB). The sheathing material shall comply with the provisions of either the U.S. Department of Commerce Voluntary Products Standard 1 (PS1), *Construction and Industry Standard Plywood*; the APA PRP-108, *Performance Standards and Policies for Structural-Use Panels*; or the U.S. Department of Commerce Voluntary Products Standard 2 (PS2), *Performance Standard for Wood-Based Structural-Use Panels* (waferboard, or OSB).

Each wall brace shall be a minimum of 48 inches in width. The structural sheathing may be applied either horizontally or vertically as shown in **Figure FR-10.4**. Openings are permitted in each brace as long as the sum of the openings do not exceed one square foot in area and no opening is greater than 12 inches in length. Each sheathing panel shall be attached to the wall framing along all four edges. Joints for adjacent panels shall occur over wall framing members (wall studs and plates) or over blocking that is nailed between the wall studs. If blocking is required, then the blocking may be oriented such that the sheathing is fastened to either the narrow or wide dimension of the blocking. Blocking shall be minimum 2x4 lumber and shall be fastened to the wall studs as specified in Code Interpretation FA-12. Refer to **Figure FR-10.5** for an illustration showing the application of the sheathing to the plates and to the blocking.

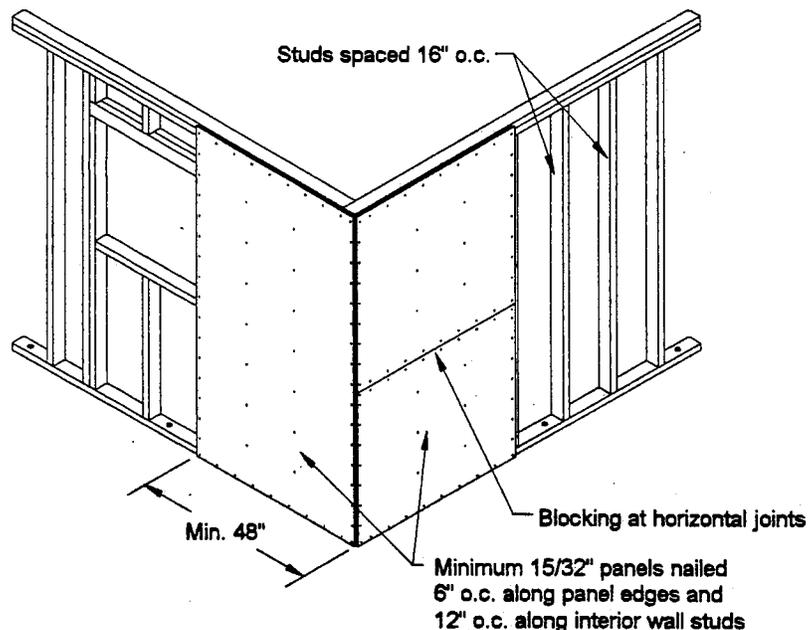


Figure FR-10.4: Application of Full Wall Height Sheathing

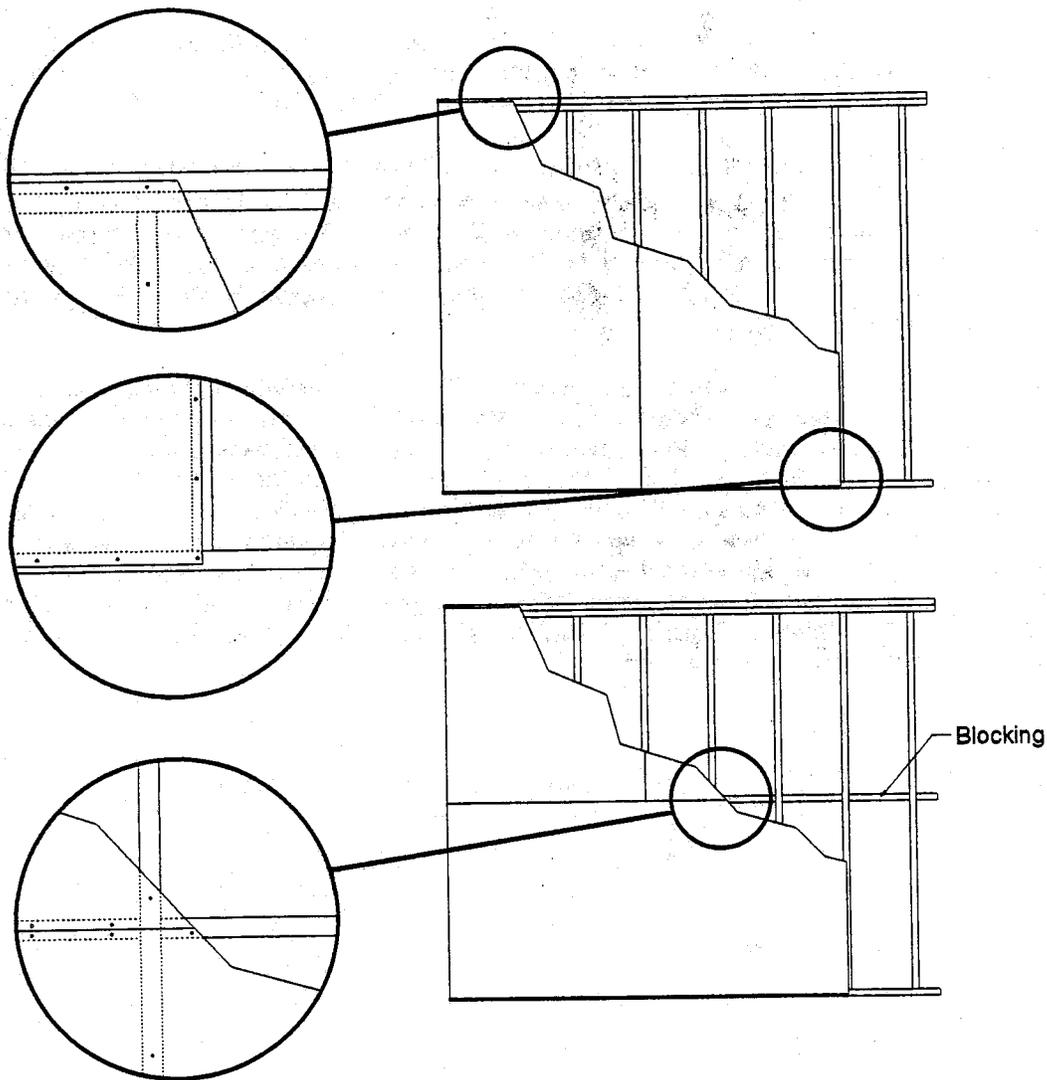


Figure FR-10.5 Application of Sheathing to Plates and Blocking

The sheathing shall be fastened to the sole plate and to the upper member of the double top plate; however, it is not required that the sheathing fully cover these plates. The sheathing shall be fastened to the wall framing with either minimum 6d common nails or fasteners with a minimum shank diameter of 0.113 inches and a minimum length of 2 inches. For seaward locations, either minimum 8d common nails or nails with a minimum shank diameter of 0.131 inches and a minimum length of 2½ inches shall be used. The fasteners shall be spaced a maximum of 6 inches on center along the panel edges and 12 inches on center along interior wall studs.

Sheathing material *should* be applied before rafters are installed. If however, the rafters are installed before the sheathing material is applied, and they prevent the sheathing from being fastened to the upper member of the double top plate (such as a birdsmouth connection of the rafters to the double top plate), then one of the following methods shall be used to attach the sheathing to the wall framing:

- (1) Cut a notch out of the end of the birdsmouth so that sheathing may be slipped underneath and fastened to the upper member of the double top plate.

- (2) Cut the sheathing so that the top of the sheathing covers only the bottom member of the double top plate. Nail the sheathing to the bottom member of the double top plate using the nailing pattern required by the Wall Bracing Methods. Face nail the top plates together with 16d common nails spaced 6 inches on center. The top plates shall be face nailed at those locations where sheathing is used as wall bracing.
  - (3) Notch the sheathing so that the sheathing slips around the rafter. Nail the sheathing to the upper member of the double top plate with fasteners spaced a maximum of 6 inches on center.
2. A 1x4 wood diagonal brace let in to the wall studs, the bottom plate, and the lower plate of the double top plate. The wood 1x4 shall be minimum Standard grade lumber. The wood 1x4 brace shall be fastened to the wall framing with a minimum of two 8d common nails at each intersection with a wall stud or plate or as specified in Code Interpretation FA-12. The wood 1x4 brace shall begin within 6 inches of the corner at the lower plate of the double top plate. The brace shall be installed at a 45 degree angle and must fit tightly into the slots cut into the studs.

If an opening prevents a single 1x4 let-in brace from being installed, then two shorter 1x4 braces may be let into the wall studs in a K pattern. Both members of the brace shall converge at the corner studs within 6 inches of each other. **Figure 15** on page 44 (or **Figure 44** on page 109) of the *Windstorm Resistant Construction Guide* illustrate the application of the K brace. Each leg of the K brace shall be installed at a 45 degree angle. The K brace shall only be used at building corners. **Figure FR-10.6** illustrates the application of the wood 1x4 let-in brace.

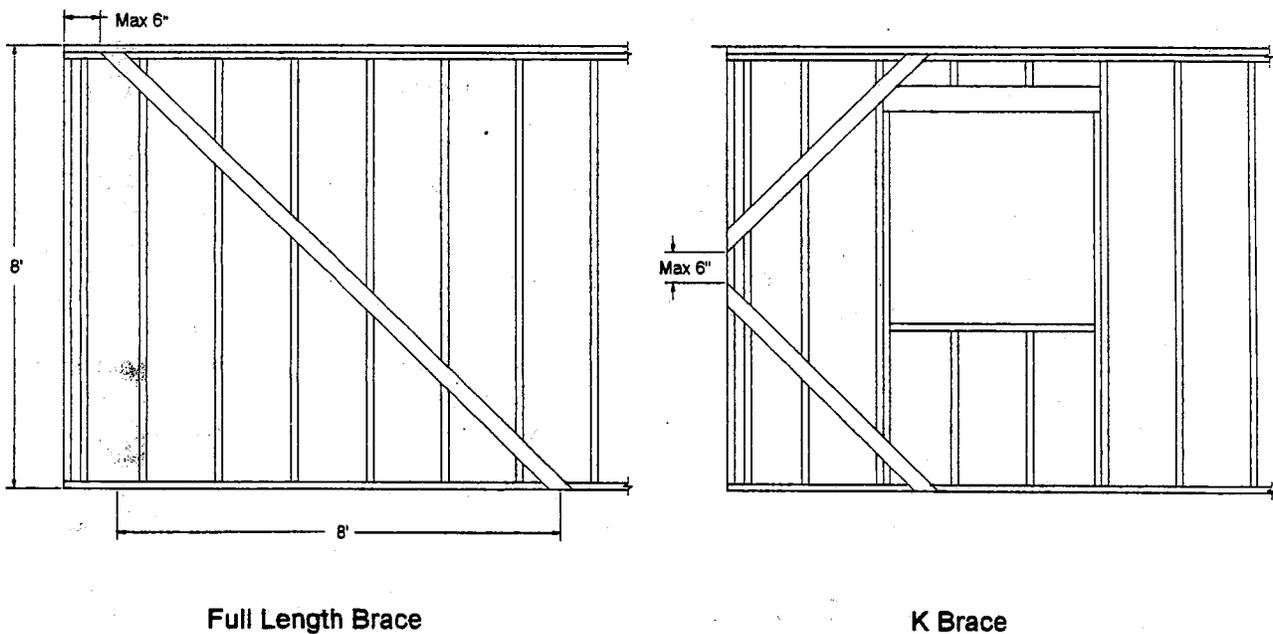


Figure FR-10.6 Application of Wood 1x4 Let-In Braces

3. A metal let-in brace installed at a 45 degree angle and nailed as per the manufacturer's instructions. When used as corner bracing, the brace shall begin within 6 inches of the corner and shall start at the top of the wall. Metal braces shall not be cut unless permitted by the manufacturer. The manufacturer of the metal let-in brace shall specify that the brace is an acceptable alternative to a wood 1x4 let-in brace. NOTES: (1) The metal let-in brace is not permitted in seaward locations. (2) Most metal connector manufacturers discourage the use of metal let-in braces to resist wall racking loads caused by high wind events.
  
4. Wood boards applied diagonally (at a 45 degree angle) over the entire wall surface. This includes areas above and below wall openings. The boards shall be a minimum of  $\frac{5}{8}$  inch thick and shall be minimum Standard grade lumber. The boards shall be fastened to the wall framing with either minimum 8d common nails or nails with a minimum shank diameter of 0.131 inches and a minimum length of  $2\frac{1}{2}$  inches. Each board shall be fastened to the wall framing with a minimum of two nails at each wall stud they cross and with a minimum of three nails at each end. A braced wall segment shall consist of wood boards applied to the wall framing in a solid manner from the sole or bottom plate to the upper member of the double top plate. The minimum width of the braced wall segment shall be 48 inches. Openings are permitted in the braced wall segments as long as the sum of the openings do not exceed one square foot in area and no opening is greater than 12 inches in length. A braced wall segment shall be located along each wall as specified in the general wall bracing requirements. The unbraced length shall be the distance between braced wall segments.
  
5. NOTE: This method shall only be used if the whole house is sheathed.

All exterior walls of the building shall be fully sheathed with either wood structural sheathing (plywood, waferboard, or OSB) or structural panel siding. This includes areas above and below openings. The wood structural sheathing or structural panel siding shall be a minimum of  $\frac{3}{8}$  inches thick.

The wood structural sheathing or structural panel siding may be applied either horizontally or vertically in a manner similar to that described in Wall Bracing Method 1. The wood structural sheathing or structural panel siding shall be attached to the wall framing along all four edges. Joints for adjacent panels shall occur over wall framing members (wall studs and plates) or over blocking that is nailed between the wall studs. If blocking is required, then the blocking may be oriented such that the sheathing is fastened to either the narrow or wide dimension of the blocking. Blocking shall be minimum 2x4 lumber and shall be fastened to the wall framing as specified in Code Interpretation FA-12. The wood structural sheathing or structural panel siding shall be fastened to the sole plate and to the upper member of the double top plate; however, it is not required that the sheathing fully cover these plates. The wood structural sheathing or structural panel siding shall be fastened to the wall studs with either minimum 8d common nails or nails with a minimum shank diameter of 0.131 inches and a minimum length of  $2\frac{1}{2}$  inches. The fasteners shall be spaced a maximum of 6 inches on center along panel edges and 12 inches on center along interior wall studs.

Each fully sheathed exterior wall shall have a full wall height wood structural sheathing or structural panel siding segment located as specified in the general wall bracing requirements. The unbraced length shall be the distance between full wall height segments. The width of the full wall height segments located at the building corners shall be in accordance with Table FR-10.1. The width of full wall heights segments located at the corners of gable endwalls shall also be in accordance with Table FR-10.1 with the story height of the building being used as the wall height. Full wall height segments not located at building corners shall be a minimum of 48 inches in width. Openings are permitted in the full wall height segments as long as the sum of the openings in each segment do not exceed one square foot in area and no opening is greater than 12 inches in length.

**Table FR-10.1**  
**Minimum Full Wall Height Segment Widths**

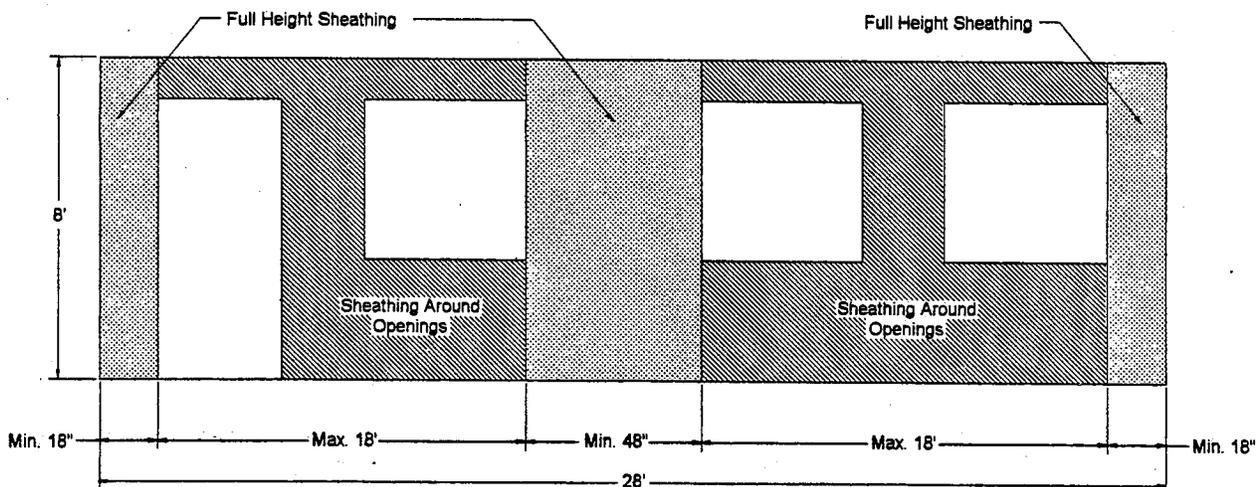
Wall Height (ft)	Minimum Segment Width
8	1'-6"
9	2'-0"
10	2'-4"

If wood structural sheathing is used, then the sheathing material shall comply with the provisions of either the U.S. Department of Commerce Voluntary Products Standard 1 (PS1), *Construction and Industry Standard Plywood*; the APA PRP-108, *Performance Standards and Policies for Structural-Use Panels*; or the U.S. Department of Commerce Voluntary Products Standard 2 (PS2), *Performance Standard for Wood-Based Structural-Use Panels* (waferboard, or OSB).

If structural panel siding is used, then APA rated siding products (such as 303 or Texture 1-11) are acceptable. Other siding products, which may or may not be APA rated, shall be evaluated by the Texas Department of Insurance engineering staff for shear resistance before being accepted for use. Consult with the Texas Department of Insurance's product evaluations for siding products to determine the specific nailing requirements.

If a siding product is not applied to all exterior walls of the building (such as three walls with siding and one wall with brick veneer), then the remaining wall(s) shall be fully sheathed in accordance with this bracing method.

As an example of the application of Wall Bracing Method 5, **Figure FR-10.7** shows a wall 28 feet in length and 8 feet in height. The wall contains three windows and a door. The wall is fully sheathed. At each corner, a minimum 18 inch wide, full wall height sheathing segment is required. Since the maximum distance between full wall height sheathing segments is greater than 18 feet, a 48 inch wide full height sheathing segment is required along the wall length.



**Figure FR-10.7: Example of a Fully Sheathed Wall that Contains the Minimum Required Number of Full Wall Height Sheathing Segments (Sheathing May be Applied Horizontally or Vertically)**

Sheathing material *should* be applied before rafters are installed. If however, the rafters are installed before the sheathing, and they prevent the sheathing from being fastened to the upper member of the double top plate (such as a birdsmouth connection of the rafters to the double top plate), then one of the methods specified in Wall Bracing Method 1 shall be used to attach the sheathing to the wall framing.

### **(C) Sheathing Between Floors of Two-Story Buildings**

Wood structural sheathing (plywood, OSB, waferboard) may be used as a method of tying the second story to the first story (an alternative to using metal framing connectors to transfer uplift loads between floors). The wood structural sheathing shall be minimum  $\frac{7}{16}$  inch thick. A solid piece of sheathing shall extend a minimum of 18 inches above and below the band joist. The sheathing shall be fastened to the wall framing with either minimum 8d common nails or nails with a minimum shank diameter of 0.131 inches and a minimum length of  $2\frac{1}{2}$  inches. The fasteners shall be spaced as shown in either **Figure 22** on page 54 or **Figure 51** on page 119 of the *Windstorm Resistant Construction Guide*. If Wall Bracing Method 5 is used, then blocking shall occur at all panel joints. If Wall Bracing Method 1 is used, then blocking shall only be required at those panels joints used as wall bracing. Structural panel siding is not permitted for this type of application.

### **(D) Bracing of Interior Walls**

Exterior walls greater than 24 feet in length shall be braced by interior walls greater than 6 feet in length where they intersect the exterior wall. The brace shall be installed as close to the exterior wall as possible. If let-in braces are used, then they shall be installed as specified in the Wall Bracing Methods of this section. A wood K brace shall only be used if it is located at the intersection of the interior wall and the exterior wall. If metal braces are used, then flat metal straps installed in an X pattern are also acceptable. The metal braces or straps shall be accepted for use by the Texas Department of Insurance engineering staff.

For each 10 feet of exterior wall length over 24 feet, an interior wall shall brace the exterior wall (unless there are no intersecting walls).

Interior walls bracing exterior walls are considered loadbearing walls. Therefore, these walls shall be anchored to the foundation as specified in either **Section 311.1(a)** or **Section 411.1(a)** of the *Windstorm Resistant Construction Guide*.

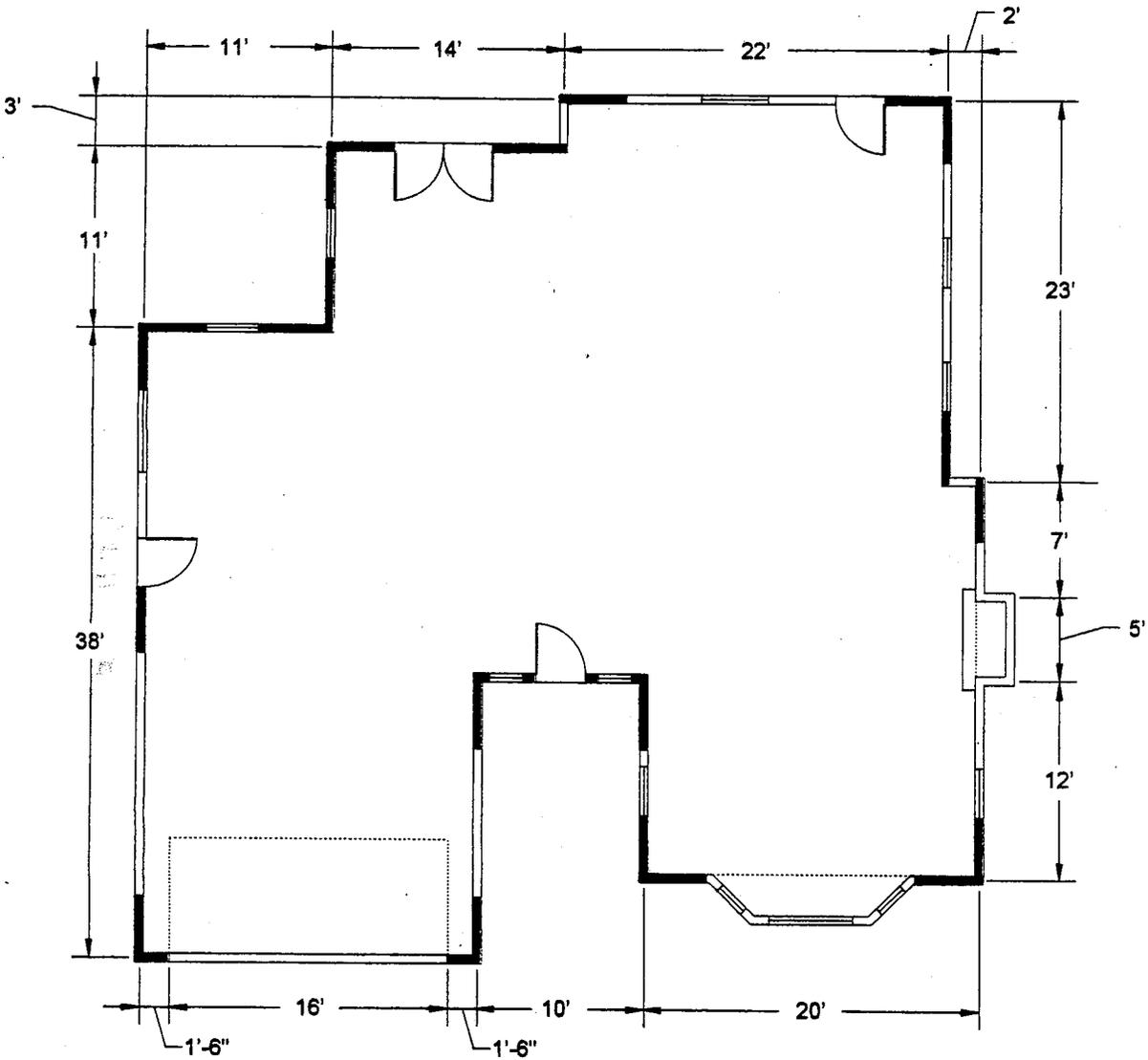
Note: The absence or inclusion of bracing for interior walls does not change the bracing requirements for exterior walls.

### **(E) Other Structural Sheathing Products**

The Texas Department of Insurance permits the use of structural sheathing products not mentioned in this code interpretation for use as wall bracing. These structural sheathing products will need to be evaluated by the Texas Department of Insurance for lateral load resistance. It may be necessary for the Texas Department of Insurance to issue a product evaluation report for the structural sheathing product.

**SECTION II : EXTERIOR WALL BRACING EXAMPLES**

Figures FR-10.8 and FR-10.9 show floor plans with wall bracing that satisfies the minimum requirements of this code interpretation. The wall bracing shown on these two figures is based on Wall Bracing Method 1. Some areas of the buildings, such as the garage door returns, contain wall bracing that exceeds the minimum requirements specified in this code interpretation.



**Figure FR-10.8: Example Floor Plan Showing the Minimum Exterior Wall Bracing Requirements**

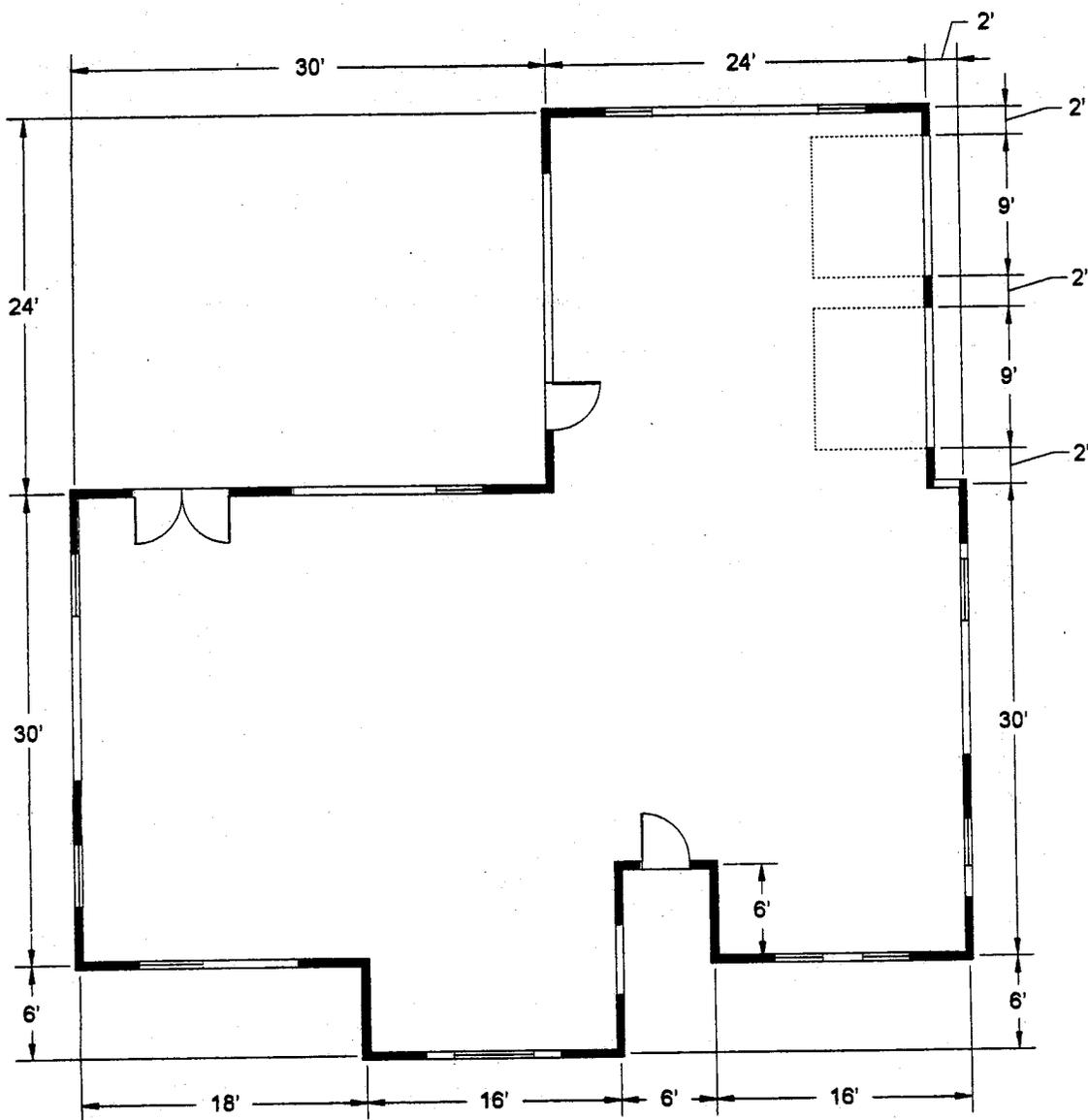


Figure FR-10.9: Example Floor Plan Showing the Minimum Exterior Wall Bracing Requirements

# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

312.7/412.7 Framing Around Openings  
(FR-13)

The following code interpretation applies to **Sections 312.7 and 412.7** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

Construction of header systems should be based on the width of the opening, not the actual length of the header. Therefore, the header only needs to be supported by two trimmer studs at each end when the width of the opening exceeds 6 feet, and supported by one trimmer stud at each end when the width of the opening exceeds 3 feet. Anchorage of header studs and spans of headers should also be based on the width of the actual opening.

Headers for opening 3 feet or less in width do not have to be strapped to either the top plate or header stud, as long as the full length (king) stud on each side of the header is clipped at the top and bottom. However, these headers must be supported by a framing anchor at each end if they are not supported by trimmer studs at each end.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

313.1/413.1 Plywood Panel Siding  
(FR-20)

The following code interpretation applies to **Sections 313.1 and 413.1** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### **ENCLOSING THE UNDERSIDE OF BUILDINGS ON PILES OR PIERS AND FOR ENCLOSING OVERHANGS AND CEILINGS OF PORCHES:**

Often products such as structural panels are applied to the underside of buildings on piles or piers or are used to enclose overhangs and ceilings of porches. While the use of these products in this manner may be for aesthetic purposes only, the possibility exists that these products may become windborne debris during a high windstorm event if they are not applied correctly. Therefore, the following guidelines shall be followed:

If the structural panel has been accepted for use by the Texas Department of Insurance, the structural panel shall be installed to the framing members in the same manner as if it were being installed as an exterior wall covering. This means that the fastener type, size, and nailing pattern shall be the same.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## CODE INTERPRETATION

Effective September 1, 1997

313.2/413.2 Lap Siding  
(EC-14)

The following code interpretation applies to Sections 313.2 and 413.2 of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

The following siding products shall be nailed as specified in Figure 23 (inland) or Figure 52 (seaward) of the *Windstorm Resistant Construction Guide*.

### VERTICAL V-GROOVE OR TONGUE AND GROOVE BOARD SIDING:

(Boards  $\frac{5}{8}$  inch thick by 6 inches wide by 8 feet long)

Horizontal blocking (minimum 2 x 4's) is installed 2 feet on center between the studs, (3 sets of blocking between sole plate and top plate for an 8 foot high wall). Blocking is end nailed from stud into blocking (not toe-nailed) with a minimum of two 10d nails at each end. Siding boards are then nailed to all blocking, sole plate, and top plate with two 8d nails at each location. Nails may be finish nails. This method only applies if boards are Southern Pine.

### WESTERN RED CEDAR SIDING:

Siding shall be installed over building paper. Siding shall not be installed over a vapor barrier, such as plastic sheets. However, a vapor barrier should be installed on the interior side of the stud wall. Staples shall not be used. Nails shall be stainless steel, high tensile strength aluminum, or hot-dipped galvanized steel. Ring shank or spiral shank nails are recommended, but not required. Nails must be long enough to penetrate  $1\frac{1}{2}$  inches into studs or blocking for smooth shank nails,  $1\frac{1}{4}$  inches for ring or spiral shank nails.

### HORIZONTAL REDWOOD SIDING:

Apply waterproof building paper over studs or wall sheathing. Nail siding to studs using stainless steel, aluminum, or high quality hot-dipped galvanized nails. Plated nails and staples are not acceptable. Nails shall be long enough to penetrate into studs a minimum of  $1\frac{1}{2}$  inches. Holes in siding may be pre-drilled if necessary to prevent splitting. Note also that on the rabbeted bevel and channel shiplap profiles,  $\frac{1}{8}$  inch clearance between boards is maintained to allow for expansion. For this same reason, nails on the bevel siding should not go through more than one board.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
 Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

313.3/413.3 Brick Veneer or Stone Veneer  
 (EC-36, FA-2, FA-7)

The following code interpretation applies to **Sections 313.3 and 413.3** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### MORTAR FOR BRICK OR STONE VENEER:

Type N or S mortar shall be used for non-loadbearing brick or stone veneer. This code interpretation applies only to **Sections 313.3 and 413.3** of the *Windstorm Resistant Construction Guide*.

### BRICK TIES NAILS:

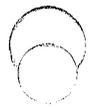
The minimum size nail shall be 6d common (8d common if nailing through 1/2 inch or thicker non-nailable sheathing, such as foam board).

### STAPLE USE CHART FOR SHEATHING BENEATH BRICK OR STONE VENEER:

(Applies Inland of Intracoastal Waterway)

Use	Minimum Staple Size			Nailing	
	Gauge	Leg length	Crown width	Edges	Interior
Wall Sheathing 5/16", 3/8", 1/2" 5/8", 3/4"	16	1 1/2"	3/8"	6" o.c.	12" o.c.
	16	width+1"	3/8"	6" o.c.	12" o.c.
Fiberboard Sheathing 1/2" 25/32"	16	1 1/8"	7/16"	3" o.c.	6" o.c.
	16	1 1/2"	7/16"	3" o.c.	6" o.c.

- Notes: 1. All staples must be galvanized.  
 2. Staples are not allowed for fastening of wall bracing and plywood exterior wall coverings.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

313.4/413.4 Stucco  
(FA-2, FR-6)

The following code interpretation applies to Sections 313.4 and 313.4 of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### WALL SHEATHING BENEATH STUCCO:

Whether veneer or non-veneer, sheathing panels beneath stucco shall have the following minimum thickness and span ratings. When the panels are placed vertically, they shall be  $\frac{15}{32}$  inch thick and 32/16 rated (minimum). When the panels are placed horizontally, they shall be  $\frac{7}{16}$  inch thick and 24/16 rated, minimum, and all horizontal joints shall be blocked.

### STAPLE USE CHART:

(Applies Inland of Intracoastal Waterway)

Use	Minimum Staple Size			Nailing	
	Gauge	Leg length	Crown width	Edges	Interior
Wall Sheathing					
$\frac{5}{16}$ " , $\frac{3}{8}$ " , $\frac{1}{2}$ "	16	1 $\frac{1}{2}$ "	$\frac{3}{8}$ "	6" o.c.	12" o.c.
$\frac{5}{8}$ " , $\frac{3}{4}$ "	16	width+1"	$\frac{3}{8}$ "	6" o.c.	12" o.c.

- Notes: 1. All staples must be galvanized.  
2. Staples are not allowed for fastening of wall bracing and plywood exterior wall coverings.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

**313.5/413.5 Vinyl, Aluminum, and Steel Siding  
(EC-6, EC-20)**

The following code interpretation applies to **Sections 313.5 and 413.5** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### **VINYL SOFFITS:**

Vinyl soffit panels will be acceptable when installed in accordance with the manufacturer's installation instructions for overhangs less than 24 inches wide. If the overhang is over 24 inches wide, the method of installation shall be established through testing by an approved, independent laboratory or stamped calculations performed by a Texas registered professional engineer. The test information or engineering calculations shall prove that the vinyl soffit material will withstand the wind loads specified in **Section 120** of the Texas Department of Insurance *Windstorm Resistant Construction Guide*.

Note: The manufacturer of the vinyl soffit panels shall have a vinyl siding product evaluation developed by the Texas Department of Insurance.

### **ENCLOSING THE UNDERSIDE OF BUILDINGS ON PILES OR PIERS AND FOR ENCLOSING OVERHANGS AND CEILINGS OF PORCHES:**

Often products such vinyl sidings are applied to the underside of buildings on piles or piers or are used to enclose overhangs and ceilings of porches. While the use of these products in this manner may be for aesthetic purposes only, the possibility exists that the products may become windborne debris during a high windstorm event if they are not applied correctly. Therefore, the following guidelines shall be followed:

The vinyl siding must be a product that has been accepted for use by the Texas Department of Insurance. Typically either vinyl vertical siding or vinyl soffit are used as the enclosure. The vinyl siding or soffit can be installed in one of two ways: (1) over a structural panel substrate or (2) directly to the framing members. In either case, the vinyl siding or soffit shall be installed as required by either the manufacturer or by the Texas Department of Insurance if the installation procedure differs from the manufacturer.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

**314/414 Mechanical and Exterior Equipment  
(ME-1)**

The following code interpretation applies to **Sections 314 and 414** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

Mobile home tie-downs may be used to anchor exterior mechanical equipment, such as air conditioner equipment. The unit should be square or rectangular shaped, and should have one anchor on each side, with a standard tie-down strap either over the top or through the base of the unit. The straps must be tightened so that the unit will not slip out from the straps.

If the unit is raised up on blocks, the blocks must have a minimum dimension on their base at the height the unit is elevated. Thus, if the unit is elevated 12 inches, 12 x 12 blocks must be used, as a minimum.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

340/440 Miscellaneous Construction  
(MC-1)

The following code interpretation applies to Sections 340 and 440 of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### WOOD DECKS:

Wood decks shall be accepted for construction in areas inland and seaward of the Intracoastal Waterway when constructed in accordance with this code interpretation.

The wood deck shall consist of wood joists that are supported by wood beams. The wood beams in turn are supported by wood post that are placed into the ground. The height of the deck shall be limited to 8 feet above finished grade.

Wood post shall be minimum 4 x 4 lumber with a minimum grade of No. 2. The wood post shall be pressure treated with a wood preservative. Wood post shall be spaced a maximum of 10 feet on center along the length of each beam. The wood post shall be buried into the ground a minimum of 3 feet. Each wood post shall have a  $\frac{5}{8}$  inch diameter dowel placed horizontally through its buried end to prevent uplift. The entire hole, a minimum of 12 inches in diameter, shall be filled with concrete.

Beams shall consist of two pieces of dimension lumber and shall be a minimum grade of No. 2. The two pieces of dimension lumber shall be fastened together with minimum 10d box nails spaced 16 inches on center along each edge. If the beams are required to be spliced, the splice shall occur over a wood post. The following schedule shall be used to size beams:

*Beam supporting one span:* If the beam supports one span as shown in Figure 1, the beam shall be sized using the following table:

Post Spacing (ft.)	Joist Span (ft.)			
	8	10	12	16
8	2-2x8	2-2x8	2-2x10	2-2x10
10	2-2x10	2-2x10	2-2x10	2-2x12

*Beams supporting two spans:* If the beam supports two spans as shown in Figure 2, the interior beam shall be sized using the following table:

Post Spacing (ft.)	Joist Span (ft.)			
	8	10	12	16
6	2-2x8	2-2x8	2-2x10	2-2x10
8	2-2x10	2-2x10	2-2x12	-
10	2-2x12	-	-	-

Two  $\frac{1}{2}$  inch x 12 inch x  $\frac{1}{8}$  inch galvanized metal straps shall be used to connect each beam to each wood post. The galvanized metal straps shall be fastened to the beams and to the post with two  $\frac{1}{2}$  inch diameter bolts.

The maximum spans for joists shall be accordance with the requirements of Section 311.2(d) or Section 411.2(d) of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*.

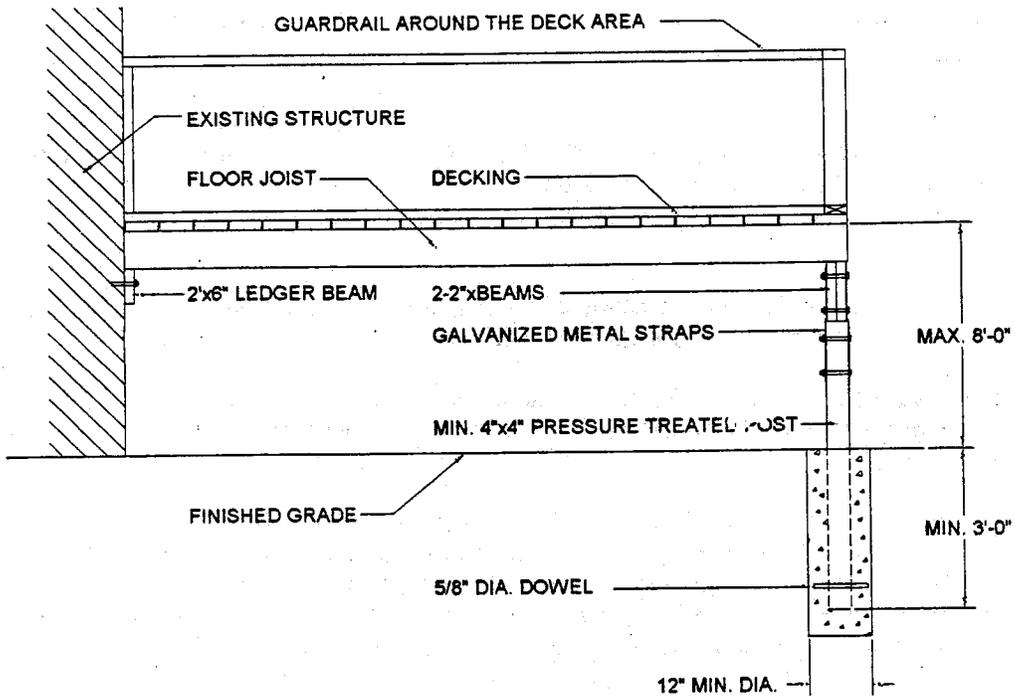


Figure 1: Beam Supporting One Span.

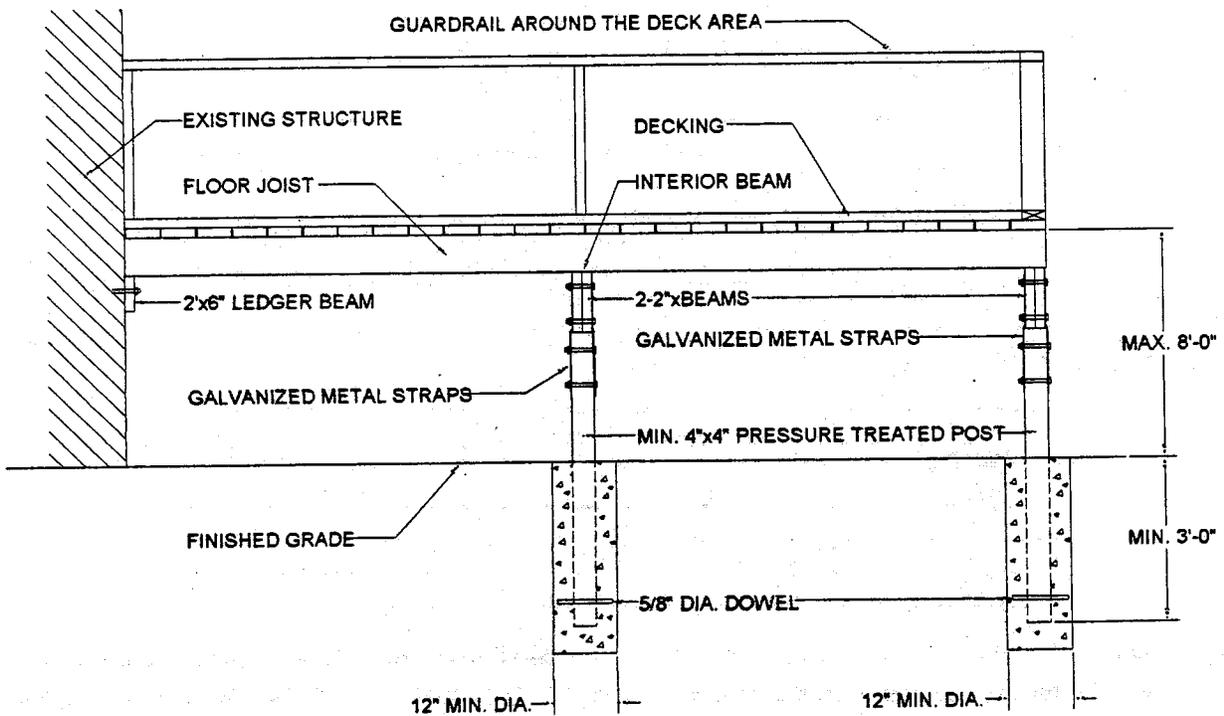


Figure 2: Beam Supporting Two Spans.

Each joist shall be toe nailed to the beams with three 8d common nails. If the joists rest on top of the beams, every joist shall be anchored to the beams with a minimum 300 lb. hurricane clip. If the joists are not continuous over the beams, the joint shall occur over a beam. The joint shall consist of a lap that is a minimum 12 inches in length and is nailed together with a minimum of four 12d common nails. Joists framing over interior beams shall be anchored with a 600 lb. hurricane clip. If the joists frame directly into the beams, a joist hanger shall be provided. The joist hanger shall be rated for 300 lb. uplift.

If the joists frame into an existing structure, a 2 x 6 ledger beam, No. 2 grade wood or better, shall be fastened to the existing structure. If the existing structure is wood framed, the ledger beam shall be fastened to the existing structure with one row of  $\frac{1}{2}$  inch diameter x 4 inch long lag screws spaced a maximum of 24 inches on center. In addition, the ledger beam shall be nailed to the existing structure with one row of 16d common nails. The nails shall be spaced a maximum 24 inches on center for joist spans ten feet or less in length or maximum 8 inches on center for joist spans greater than ten feet in length. If the ledger beam frames into a masonry structure, the ledger beam shall be fastened to the masonry with  $\frac{3}{8}$  inch diameter anchor bolts spaced a maximum of 24 inches on center. Joist shall be fastened to the ledger beam with either hurricane clips or joist hangers rated for 300 lb. uplift.

The wood decking shall consist of minimum 2 inch thick lumber with a minimum grade of No. 2. The wood decking shall be fastened to each joist with a minimum of two 8d box nails.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

350/450 Additions  
(A-1, FR-7)

The following code interpretation applies to **Sections 350 and 450** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

Where new additions are made to existing grandfathered structures, the entire addition must be anchored from the roof through the walls to the foundation. Where new additions are only attached to the existing structure, they must be properly anchored at that point.

Where additions or repairs are made to an existing structure, and it is obvious that the existing framing cannot support the new portion or repair, the inspector should require that any rotted or otherwise unacceptable lumber be replaced or properly repaired.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

**CODE INTERPRETATION**  
371.1(a)/471.1(a) Roof Deck  
(RC-2)

Effective September 1, 1997  
Revised December 3, 1997

The following code interpretation applies to **Sections 371.1(a) and 471.1(a)** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

## **ROOF DECKS:**

Proper anchorage of the roof deck is critical to holding a structure together in a windstorm. The proper nail or staple size must be enforced. The size and spacing of hand driven and pneumatic nails for roof sheathing shall be in accordance with Code Interpretation 312/412 Framing. Staples are permitted for inland applications only. The size and spacing of staples for roof sheathing shall be in accordance with Figure 28 on page 75 of the Guide. The fasteners must not be overdriven. Anything over about  $\frac{1}{8}$  inch should be considered overdriven. Ensure that there are a sufficient number of fasteners to hold the deck down, and that the fasteners are not missing the rafters underneath.

The fastener spacing used at the gable end to attach the panel edge of the roof sheathing to the barge rafter shall also be used to fasten the roof sheathing to the gable end rafter or truss.

Roof deck panel clips are not required as long as the edges of the plywood fall on rafters and a  $\frac{1}{8}$  inch space is maintained between plywood sheets.



# TEXAS DEPARTMENT OF INSURANCE

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

## CODE INTERPRETATION

Effective September 1, 1997

371.1(b)/471.1(b) Underlayment  
(RC-1)

The following code interpretation applies to Sections 371.1(b) and 471.1(b) of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### UNDERLAYMENT APPLIED TO ROOF SLOPES LESS THAN 4:12:

Asphalt shingles may not be applied to roof slopes less than 2:12. For slopes greater than or equal to 2:12 and less than 4:12, two layers of underlayment shall be applied in the following manner:

Start by fastening a 19 inch wide strip of felt along the eaves. Then place a full 36 inch wide strip along the eaves completely overlapping the 19 inch wide starter strip. Succeeding courses shall be full width strips applied overlapping the lower course by 19 inches. See Figure 1.

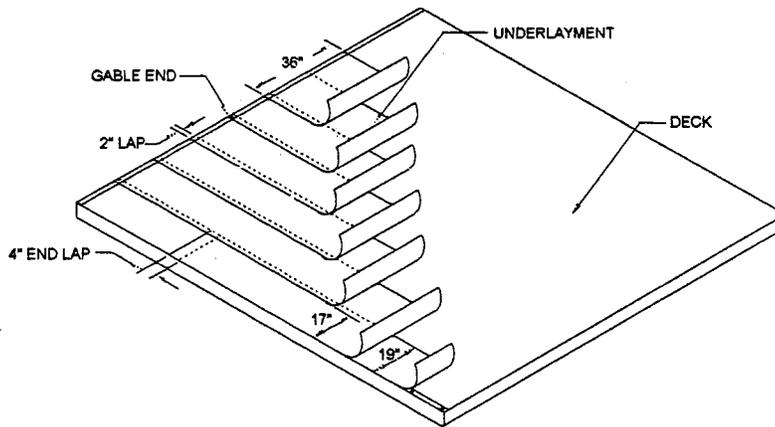


Figure 1: Double Layer Underlayment Application

### UNDERLAYMENT APPLIED ROOF SLOPES GREATER THAN 4:12:

For slopes greater than or equal to 4:12, one layer of underlayment shall be applied as stated in the *Windstorm Resistant Construction Guide*. See Figure 2.

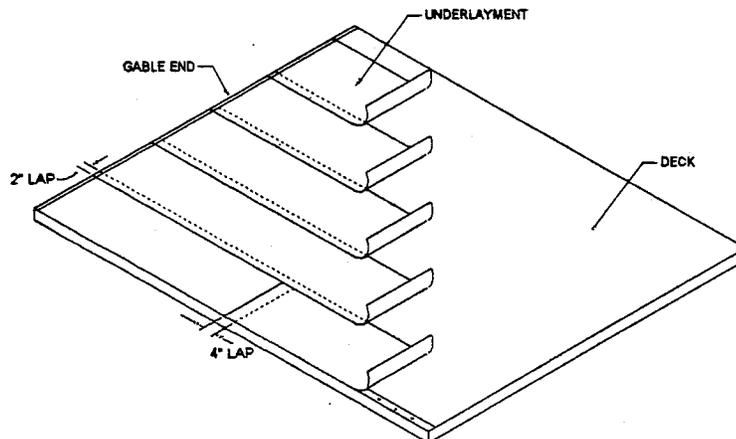


Figure 2: Single Layer Underlayment Application

**UNDERLAYMENT APPLIED ROOF SLOPES GREATER THAN 7:12:**

For roof slopes greater than 7:12 and composition shingles are applied, the underlayment may be applied perpendicular to the ridge and eaves if a 15 to 18 inch side lap is used.

**ALUMINUM CAPS USED TO FASTEN UNDERLAYMENT:**

Aluminum caps may be used to hold underlayment down, provided aluminum nails are used.

# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

371.1(c)/471.1(c) Composition Shingles  
(RC-1)

The following code interpretation applies to **Sections 371.1(c) and 471.1(c)** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### **UL 997:**

Composition shingles which have passed UL 997 (look for stamp on package) will be accepted when applied using the normal manufacturer's installation instructions. In inland areas, staples will be accepted if allowed by the manufacturer.

### **ROOF SLOPE:**

Asphalt shingles may not be applied to roof slopes less than 2:12.

### **FASTENERS:**

The nails or staples must be driven in straight, and not overdriven. The fasteners must be in the nail line area. Staples must be driven with the crown parallel to the top of the shingle.

See Code Interpretation 312.2/412.2 Fasteners (FA-9, FA-13) to determine the size and length of roofing nails.

### **STARTER COURSE:**

The starter course may be either a row of shingles trimmed to the shingle manufacturer's recommendations or a strip of mineral surfaced roll roofing at least 7 inches wide.

If self-sealing shingles are used for the starter strip, remove the tab portions of each shingle and position the remaining strip with the factory-applied adhesive face up along the eaves. Trim at least 3 inches from the end of the first shingle in the starter strip. Fasten starter strips parallel to the eaves along a line 3 to 4 inches above the eaves. Position the fasteners so that they will not be exposed under the cutouts in the first course.

If shingles without a self-sealing adhesive are used for the starter strip, remove the tab portion of each shingle and position the remaining strip along the eaves. Complete the procedure by following the instructions above.

If roll roofing is used for the starter strip, nail along a line 3 to 4 inches above the eaves. Space the nails 12 inches apart. If more than one piece of roll roofing must be used, lap the end joint 2 inches and apply cement.

When three-tab shingles are applied or roll roofing is used for the starter course, bond the tabs of each shingle in the first course to the starter strip by placing a spot of asphalt plastic cement about the size of a quarter on the starter strip beneath each tab and then press the tabs firmly into the cement. The asphalt plastic cement shall conform to ASTM D-4586, Type II.

### **DRIP EDGE:**

If a drip edge is not used on composition shingle roofs, the shingles must overhang the rakes and eaves by  $\frac{3}{8}$  inch. The acceptable tolerance will be from  $\frac{1}{4}$  inch to  $\frac{1}{2}$  inch.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

**371.2 Wood Shingle or Shake Roof  
(RC-4)**

The following code interpretation applies to **Sections 371.2 and 471.2** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

Aluminum or stainless steel (type 304 or 316) staples may be used to apply wood shingles or shakes in the area inland of the Intracoastal Waterway. The staples shall be minimum 16 gauge having  $\frac{7}{16}$  inch minimum crown width. Staples shall be long enough to penetrate the spaced boards at least  $\frac{1}{2}$  inch. Staples shall be driven parallel to the shingle or shake butt and in the same locations as nails. Staples shall be driven flush with the shingle surface.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

**371.7/471.7 Built-up Roofing**  
**(RC-26)**

The following code interpretation applies to **Sections 371.7 and 471.7** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

When applying rigid insulation board to a nailable deck, it can be hot-mopped over the base sheet, if desired. It can also be screwed on with the applicable screws. In most cases, the rigid insulation is hot-mopped on. If the roofer wants to use screw fasteners, they shall be spaced 7 inches around the perimeter and 14 inches in the field.

When fastening rigid insulation to a non-nailable deck such a concrete, it is always mopped.

When fastening rigid insulation board to metal decking, it must be screwed on with the manufacturer's recommendation.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

**372/472 Re-Roofing and Repairs  
(RC-9)**

The following code interpretation applies to **Sections 372 and 472** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

In the *Windstorm Resistant Construction Guide*, **Sections 372 and 472**, re-roofing and repairs, state that "Replacement of damaged members shall comply with previous guidelines." This was meant to apply to the deck as well as the roof covering. However, when the repairs are minor, a non-conforming item may be replaced with the same material. The follow guidelines shall be used:

When a sheet or less of plywood ( $\frac{3}{8}$  inch plywood for inland or  $\frac{1}{2}$  inch plywood for seaward) roof decking is being replaced, it may be replaced with panels having the same thickness with the following minimum ratings:

- 24/0 when rafters are spaced 24 inches on center or less
- 20/0 when rafters are spaced 20 inches on center or less



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

**372.2/472.2 Re-roofing a Wood Shingle Roof  
(RC-5)**

Effective September 1, 1997  
Revised December 3, 1997

The following code interpretation applies to **Sections 372.2 and 472.2** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

When tearing off wood shingles and applying a solid wood deck over the existing spaced boards, the following shall apply:

1. The plywood or OSB roof sheathing shall be placed horizontally.
2. The plywood or OSB shall have a minimum span rating of 24/16 for inland construction and 40/20 for seaward construction.
3. If the horizontal ends do not fall over 1x4's, either 1x4's can be added under the edge, or a strip of plywood can be cut off so the edge is over a 1x4, or pyclips installed at 24 inches on center.
4. The ends of the plywood or OSB do not have to fall over the rafters. If the ends do not fall over the rafters, then the ends must be nailed to the spaced boards between the rafters in addition to nailing into the rafter closest to the end.
5. As long as the existing spaced boards are nailed to every rafter with at least a 6d nail, then the new decking can be nailed to the 1x4's with an 8d nail at each rafter intersection. This should give a maximum of 8 inches on center nailing along each rafter. Nails must penetrate into the rafter.



# **TEXAS DEPARTMENT OF INSURANCE**

Engineering Services / MC 103-3A 333 Guadalupe Street P.O. Box 149104 Austin, Texas 78714-9104  
Phone No. (512) 322-2212 Fax No. (512) 463-6693

---

## **CODE INTERPRETATION**

Effective September 1, 1997

372.2(c)/472.2(c) Placing Composition Shingles Over Wood Shingles  
(RC-1)

Revised December 3, 1997

The following code interpretation applies to **Sections 372.2( c) and 472.2( c)** of the Texas Department of Insurance's *Windstorm Resistant Construction Guide*:

### **RE-ROOFING WOOD SHINGLES WITH COMPOSITION SHINGLES:**

When applying composition shingles over wood shingles, the shingles must be able to lay flat against each other so that they can seal together. This is why the existing wood shingle surface must be properly prepared, with curled or warped shingles split and re-nailed, and the holes filled in. If the wood shingle surface is still too rough, then feathering strips may have to be placed along the butts of the wood shingles.

