Instructions

1. Print these pages.
2. **Simple questions** follow after a few paragraphs of the new code language.
3. Circle the correct answers and transfer the answers to the answer sheets (see last 3 pages).
4. After answering the simple questions you will become familiar with the new code changes.
5. Page down to the last page for the verification form, answer sheets and mailing instructions.

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6 hour course for:

1. Dwelling Contractor Qualifier Certification.
2. UDC Construction Inspector.

Questions call Gary or Amy Klinka at 920-727-9200 or 920-740-6723 or email garyklinka@hotmail.com

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Comm 21.25 (1) (title) STUD CONFIGURATION

SECTION 113. Comm 21.25 Table 21.25-A is repealed and recreated to read:

TABLE 21.25-A
SIZE, HEIGHT AND SPACING OF WOOD STUDS[a]

STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height[a] (feet)	Maximum spacing when supporting roof and ceiling only (inches)	Maximum spacing when supporting one floor, roof and ceiling (inches)	Maximum spacing when supporting two floors, roof and ceiling (inches)	Maximum spacing when supporting one floor only (inches)	Laterally unsupported stud height[a] (feet)	Maximum spacing (inches)
2 x 3[b]	-	-	-	-	-	10	16
2 x 4	10	24	16	-	24	14	24
3 x 4	10	24	24	16	24	14	24
2 x 5	10	24	24	-	24	16	24
2 x 6	10	24	24	16	24	20	24

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by analysis.

b. May not be used in exterior walls.

Note: A 3–story frame house with walls constructed of 2 x 4 standard grade studs would require a 12–inch stud spacing on the lowest level, a 24–inch stud spacing on the intermediate level, and a 24–inch stud spacing on the upper level.

1. 2” x 3” studs are allowed on bearing walls.
   a. true
   b. false
2. 2” x 3” studs are allowed on exterior walls.
   a. true
   b. false

3. 2” x 3” studs maximum unsupported stud height at 24” spacing would be ____ feet.
    a. 10
    b. 14
    c. 16
    d. none of the above
4. 2” x 6” studs maximum unsupported height in a nonbearing wall and at 24” spacing would be _____ feet.
    a. 12
    b. 14
    c. 20
    d. none of the above

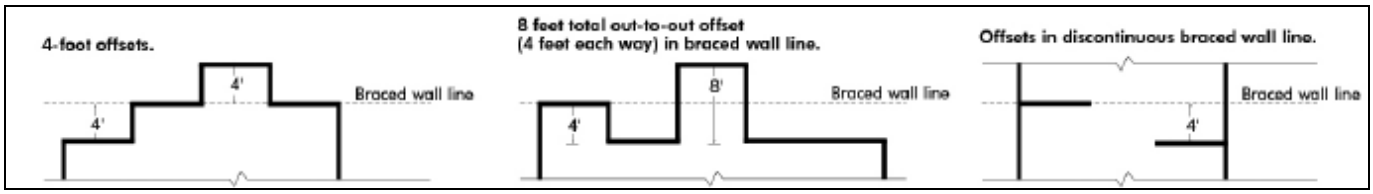
TABLE 21-25-G
EFFECTIVE LENGTHS FOR BRACE WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH
(BRACING METHODS PAR. (b) 3, (b) 4 and (b) 5)

Actual Length of Braced Wall Panel (inches)	Effective Length of Braced Wall Panel (inches)		
	8-foot Wall Height	9-foot Wall Height	10-foot Wall Height
48	48	48	48
42	36	36	N/A
36	27	N/A	N/A

5. The effective length for a braced wall panel 36” in length and an 8’ wall height would be ____ inches?
    a. 48
    b. 36
    c. 27
    d. N/A
6. The effective length for a braced wall panel 42” in length and a 9’ wall height would be ____ inches?
    a. 48
    b. 36
    c. 27
    d. N/A
7. The effective length for a braced wall panel 48” in length and a 10’ wall height would be ____ inches?
    a. 48
    b. 36
    c. 27
    d. N/A

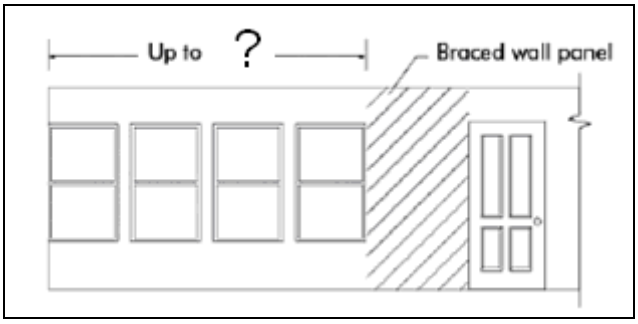
(d) *Braced Wall Panel Location and Amounts*. Braced wall panels shall begin no more than 12.5 feet from each end of a braced wall line per figures 21.25-A and 21.25-B, and shall be located every 25 feet on center. Bracing amounts shall comply with Table 21.25-H for the bracing materials and methods specified under par. (b).
(e) *Braced Wall Lines.* 1. ‘General.’ Maximum spacing between parallel wall lines shall be no more than 35 feet.

2. 'Exception.' Spacing between braced wall lines may be increased to 50 feet however, the percentage of wall bracing on the braced wall lines perpendicular to the spacing, must be increased, by multiplying the values in Table 21.25-G by a factor equal to the braced wall line spacing divided by 35 feet, and the length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.
3. 'Offsets.' Offsets in braced wall lines, out-of-plane of up to 4 feet shall be permitted provided that the total out-to-out offset dimension in any braced wall line is not more than 8 feet per Figure 21.25-C.
4. 'Variation from story to story.' Variation in bracing method from story to story is permitted.
5. 'Variation within a story.' Variation in bracing method from braced wall line to braced wall line within a story is permitted, except that the continuous sheathing method with wood structural panels shall conform to the additional requirements of par. (9) (c).



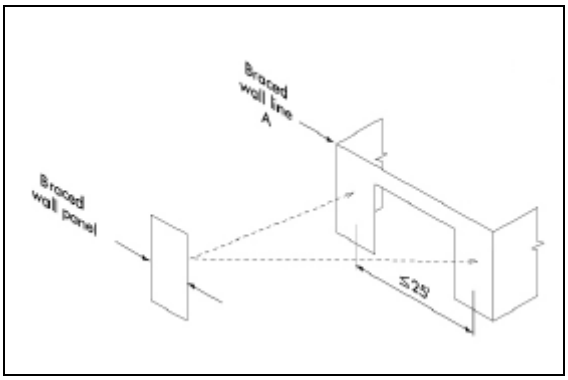
8. Offsets in braced wall lines, out-of-plane of up to ____ feet shall be permitted provided that the total out-to-out offset dimension in any braced wall line is not more than ____ feet.

a. 3 and 6
b. 4 and 8
c. 5 and 10
d. none of the above



9. Braced wall panels shall begin no more than 12.5 feet from each end of a braced wall line per figures 21.25-A and 21.25-B.

a. true
b. false



10. Braced wall panels shall be located every 25 feet on center.
    a. true
    b. false

11. 'General.' Maximum spacing between parallel wall lines shall be no more than 35 feet.
    a. true
    b. false
12. Variation in bracing method from story to story is not permitted.
    a. true
    b. false
13. Variation in bracing method from braced wall line to braced wall line within a story is permitted, except that the continuous sheathing method with wood structural panels shall conform to the additional requirements of par. (9) (c).
    a. true
    b. false

Examples:

'Exception.' Spacing between braced wall lines may be increased to 50' however, the percentage of wall bracing on the braced wall lines perpendicular to the spacing, must be increased, by multiplying the values in Table 21.25-H by a factor equal to the braced wall line spacing divided by 35 feet, and the length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.

TABLE 21.25-H
MINIMUM REQUIRED BRACING AMOUNTS FOR WALLS

Wall Supporting:	AMOUNT OF BRACING PER WALL LINE[4] Braced segments shall be located at least every 25-ft o.c. but not less than the following percentages:	
	Wood Structural Panel Sheathing [Sub. (8) (b) 4., (9) (b) &(9) (c)]	Other Methods Permitted [Sub. (8) (b) 1, 2, 3, 5& 6.]
Roof only[1]	16%	16%[2]
Floor and roof	16%	25%[2]
Two Floors and roof	25%	35%[3]

Can I remove these 2 interior walls?

What on earth does this mean?

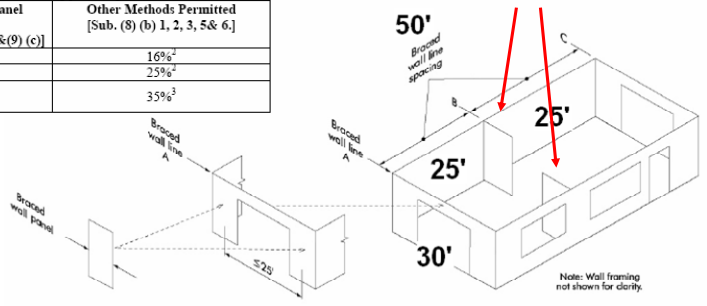


FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES

'Exception.' Spacing between braced wall lines may be increased to 50' however, the percentage of wall bracing on the braced wall lines perpendicular to the spacing, must be increased, by multiplying the values in Table 21.25-H (16%) by a factor equal to the braced wall line (50') spacing divided by 35 feet, and the length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.

TABLE 21.25-H
MINIMUM REQUIRED BRACING AMOUNTS FOR WALLS

Wall Supporting:	AMOUNT OF BRACING PER WALL LINE[4] Braced segments shall be located at least every 25-ft o.c. but not less than the following percentages:	
	Wood Structural Panel Sheathing [Sub. (8) (b) 4., (9) (b) &(9) (c)]	Other Methods Permitted [Sub. (8) (b) 1, 2, 3, 5& 6.]
Roof only[1]	16%	16%[2]
Floor and roof	16%	25%[2]
Two Floors and roof	25%	35%[3]

50' / 35 = 1.4 x 16% = 23%
23% x 30' = 6.9' needed

Floor & roof with wood sheathing

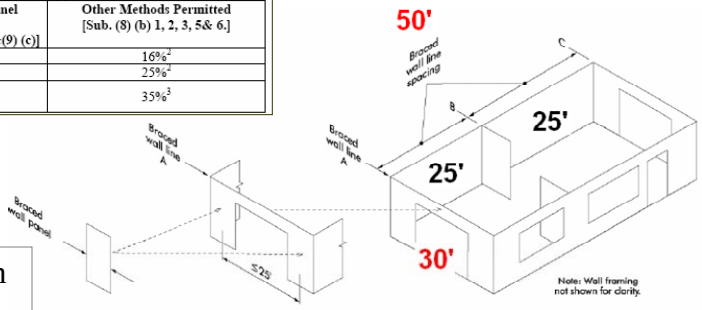
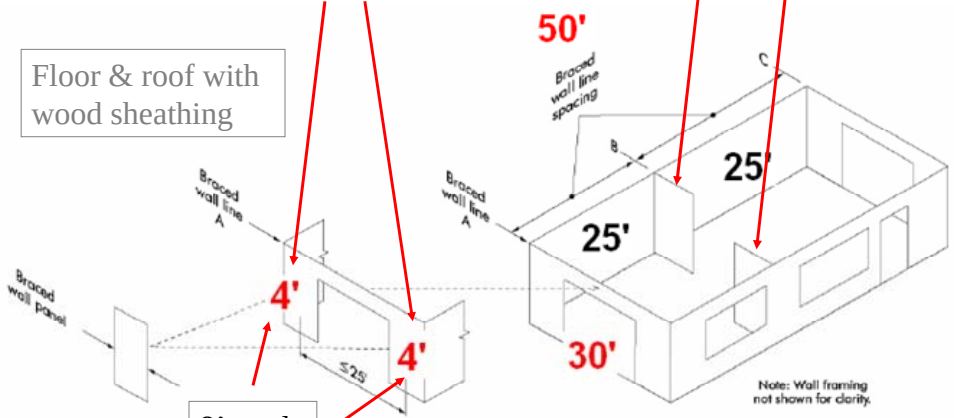


FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES

50' / 35 = 1.4 x 16% = 23%
23% x 30' = 6.9' needed

Good to go! Interior walls can be removed

Floor & roof with wood sheathing



8' total

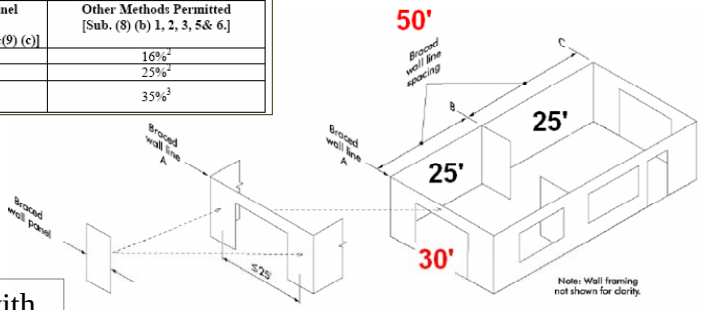
FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES

'Exception.' Spacing between braced wall lines may be increased to 50' however, the percentage of wall bracing on the braced wall lines perpendicular to the spacing, must be increased, by multiplying the values in Table 21.25-H (25%) by a factor equal to the braced wall line (50') spacing divided by 35 feet, and the length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.

TABLE 21.25-H
MINIMUM REQUIRED BRACING AMOUNTS FOR WALLS

Wall Supporting:	AMOUNT OF BRACING PER WALL LINE[4] Braced segments shall be located at least every 25-ft o.c. but not less than the following percentages:	
	Wood Structural Panel Sheathing [Sub. (8) (b) 4., (9) (b) &(9) (c)]	Other Methods Permitted [Sub. (8) (b) 1, 2, 3, 5& 6.]
Roof only[1]	16%	16%[2]
Floor and roof	16%	25%[2]
Two Floors and roof	25%	35%[3]

50' / 35 = 1.4 x 25% = 36 %
36% x 30' = 10.8' needed



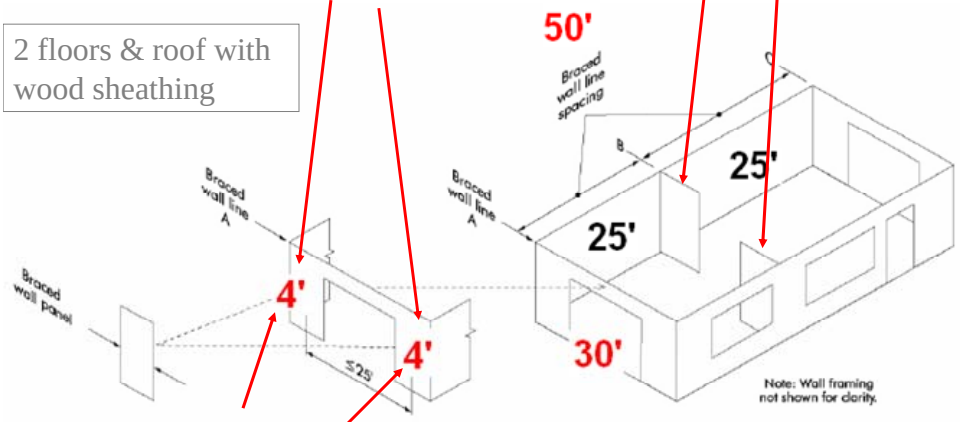
2 floors & roof with wood sheathing

FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES

50' / 35 = 1.4 x 25% = 36 %
36% x 30' = 10.8' total needed.

Interior walls can not be removed

2 floors & roof with wood sheathing

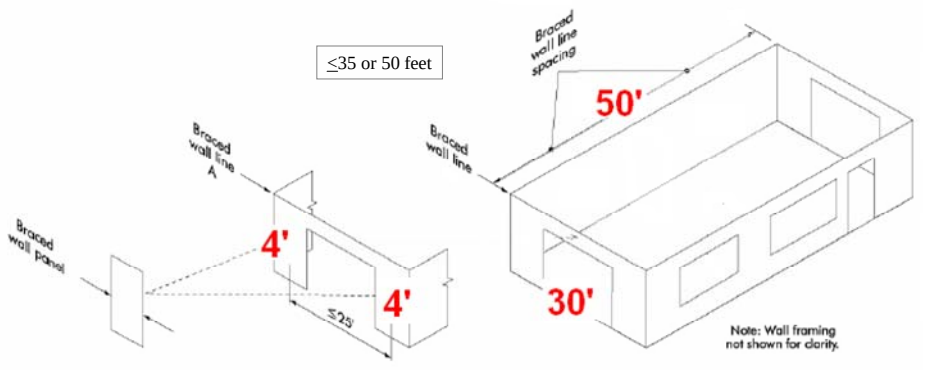


8' total

FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES

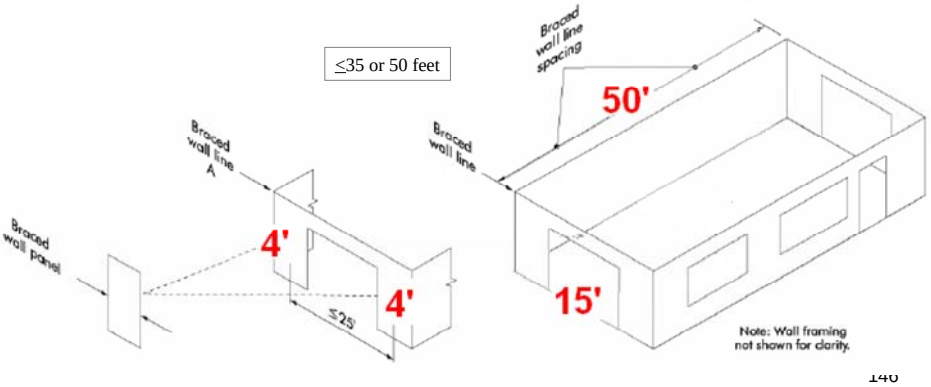
And the length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.

3:1 ratio or 50’ / 30’ = 1.6 (< 3 good to go!)



145

The length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.
3:1 ratio or 50’ / 15’ = 3.33 (> 3 Not good to go!)
Note: Maximum spacing between parallel wall lines shall be no more than 35 feet. ‘Exception.’ Spacing between braced wall lines may be increased to 50 feet.



140

The length to width ratio for the floor/roof diaphragm as measured between braced wall lines does not exceed 3:1.
3:1 ratio or 100’ / 30’ = 3.33 (> 3 Not good to go!)
Note: Maximum spacing between parallel wall lines shall be no more than 35 feet. ‘Exception.’ Spacing between braced wall lines may be increased to 50 feet. Wall is 100’ between parallel wall lines (>50’).

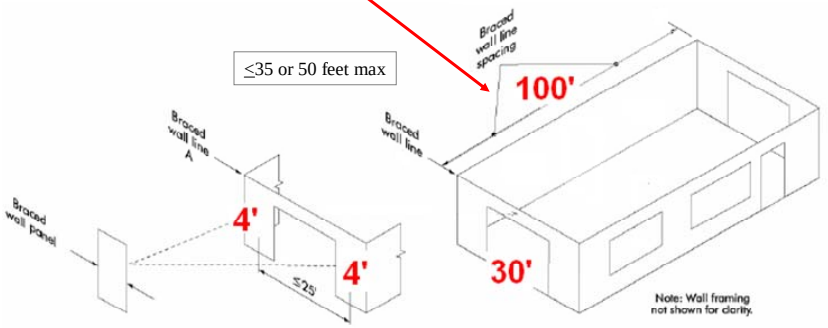
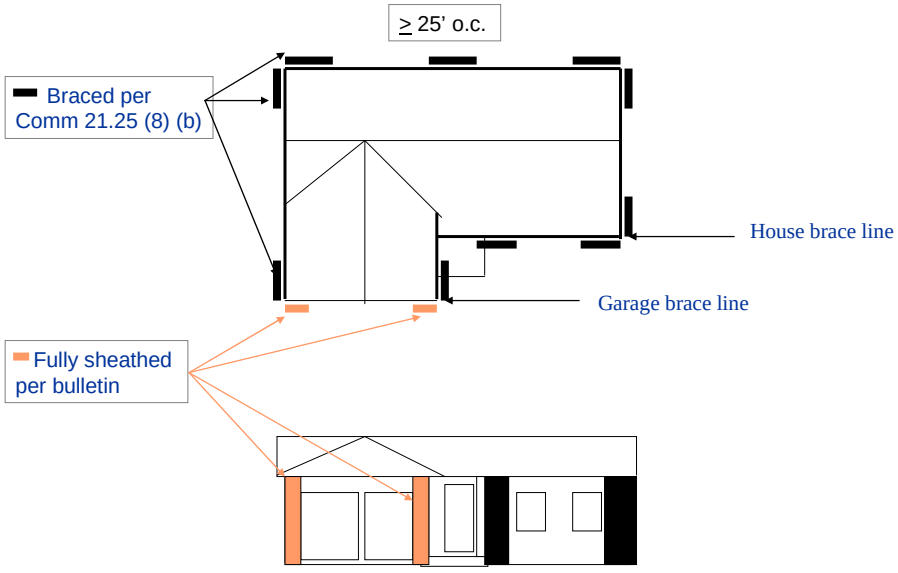


FIGURE 21.25-A
BRACED WALL PANELS AND BRACED WALL LINES



Bracing Example 13

1. Comm 21.25(9)(b)1-3

Bracing panel with hold downs

28" one side – no floor above

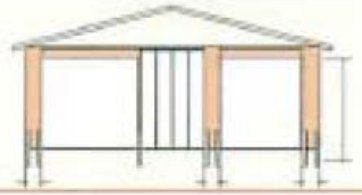
28" two sides – one floor above

12' max panel height

With hold downs. Min. length varies 28" to 42"

2. Comm 21.25(9)(b)4 & 5

Portal frame with hold downs



16" – no floor above

24" – one floor above

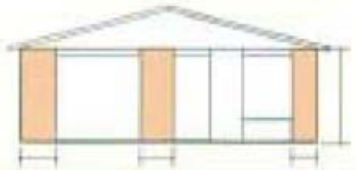
10' max panel height

With hold downs

Continuous sheathing qualifying segments

3. Comm 21.25(9)(c)1-3

Wood structural panel, continuously sheathed



24" and up

10' max panel height & 2' returns

All exterior surfaces sheathed except openings

4. Comm 21.25(9)(c)1-3

Wood structural panel, continuously sheathed

8' wall = 24"

9' wall = 27"

10' wall = 30"

10' max panel height

No hold downs, adjacent to garage door opening, light roof, single story, 4:1 aspect ratio

Comm 21.25(9)(c)5

This method could be the answer

≤ 10'-measured from top of header to bottom of bottom plate & 2' returns

5.

Portal frame without hold downs, continuously sheathed

8' wall = 16"

9' wall = 18"

10' wall = 20"

No hold downs, adjacent to garage door opening, first of two-story, 6:1 aspect ratio

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TABLE 21.25-H
MINIMUM REQUIRED BRACING AMOUNTS FOR WALLS

Wall Supporting:	AMOUNT OF BRACING PER WALL LINE[4] Braced segments shall be located at least every 25-ft o.c. but not less than the following percentages:	
	Wood Structural Panel Sheathing [Sub. (8) (b) 4., (9) (b) &(9) (c)]	Other Methods Permitted [Sub. (8) (b) 1, 2, 3, 5& 6.]
Roof only[1]	16%	16%[2]
Floor and roof	16%	25%[2]
Two Floors and roof	25%	35%[3]

[1] The 'Roof only' condition also applies to one braced wall line of wood frame construction on the ground floor where all other exterior walls on the ground floor are constructed of masonry or concrete in accordance with s. Comm. 21.18.
[2] Wood and metal let in bracing exempt from % bracing requirement, but not spacing requirement.
[3] Wood and metal let in bracing not permitted as a bracing method.
[4] Maximum wall heights equal 12 feet. For wall heights over 10 feet, increase percent bracing requirement an additional 20%.
[5] For continuous sheathing method with wood structural panels, percent requirement may be decreased 10% when openings on the wall line do not exceed 85% of wall height and may be decreased 20% when openings do not exceed 67% of wall height. See Table 21.25-J.

14. Braced segments shall be located at least every 25' o. c. and not less than the percentages in shown in Table 21.25-H.
    a. true
    b. false
15. Using the **Wood Structural Panel Sheathing** section above and a **Two Floors and roof** scenario, what would be the minimum percentages allowed?
    a. 16
    b. 25
    c. 35
    d. none of the above.
16. Using the **Wood Structural Panel Sheathing** section above and the **Floor and roof** scenario, what would be the minimum percentages allowed?
    a. 16
    b. 25
    c. 35
    d. none of the above.
17. Using the **Other Methods Permitted section** above and a **Two Floors and roof** scenario, what would be the minimum percentages allowed?
    a. 16
    b. 25
    c. 35
    d. none of the above.

18. Using the **Other Methods Permitted** section above and the **Floor and roof** scenario, what would be the minimum percentages allowed?

a. 16
b. 25
c. 35
d. none of the above.

19. Using the **Other Methods Permitted section** above and a **Two Floors and roof** scenario, footnote _____ applies.

a. 1
b. 2
c. 3
d. 4

20 Footnote 4 states-Maximum wall heights equal 12'. For wall height over 10', increase bracing requirements an additional 30 percent.

a. true
b. false

FIGURE 21.25-C

PERMITTED OFFSETS

(f) *Angled Corners.* 1. At corners, braced wall lines may angle out of plane up to 45 degrees with a maximum diagonal length of 8 feet.

2. When determining the percentage of bracing, the length of each braced wall line shall be determined as shown in Figure 21.25-D.

3. The placement of bracing for the braced wall lines shall begin at the point where the braced wall line, which contains the angled wall adjoins the adjacent braced wall line.

Note: This is at Point A as shown in Figure 21.25-D.

4. Where an angled corner is constructed at an angle equal to 45 degrees and the diagonal length is no more than 8 feet in length, the angled wall may be considered as part of either of the adjoining braced wall lines, but not both.

5. Where the diagonal length is greater than 8 feet, it shall be considered its own braced wall line and be braced in accordance with par. (b).

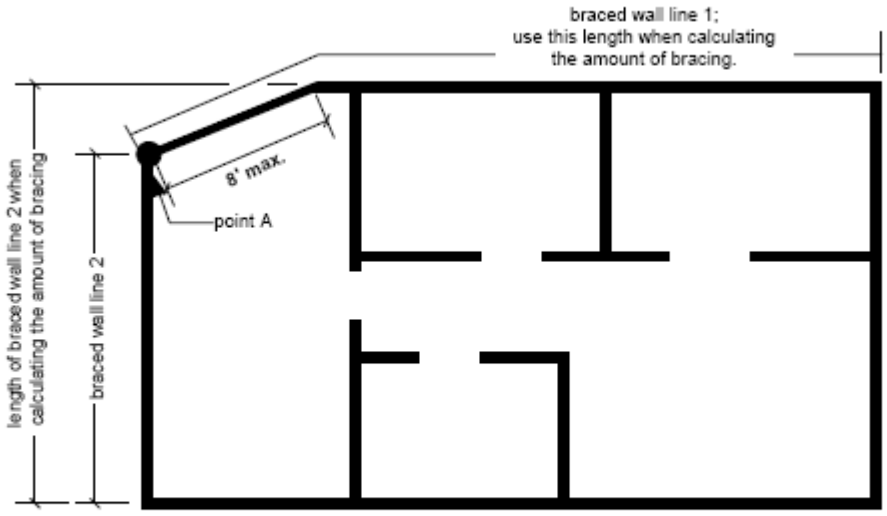


FIGURE 21.25-D
ANGLED CORNERS

21. The placement of bracing for the braced wall lines shall begin at the point where the braced wall line, which contains the angled wall adjoins the adjacent braced wall line.

a. true
b. false

22. Where an angled corner is constructed at an angle > 45 degrees and the diagonal length is > 8 feet in length, the angled wall may be considered as part of either of the adjoining braced wall lines, but not both.

a. true
b. false

23. Where the diagonal length is greater than 8 feet, it shall be considered its own braced wall line and be braced in accordance with par. (b).

a. true
b. false

(g) *Braced wall panel support.* Braced wall panels shall be supported on floor framing or foundations as follows:

1. Where joists are perpendicular to braced wall lines above or below, blocking shall be provided between the joists at braced wall panel locations to permit fastening of wall plates in accordance with the fastener table in the appendix.

2. Where joists are parallel to braced wall lines above or below, a rim joist or other parallel framing member shall be provided at the wall to permit fastening of wall plates in accordance with the fastener table in the appendix.

3. Braced wall panels shall be permitted to be supported on cantilevered floor joists meeting the cantilever limits of s. Comm 21.22 (6) provided joists are blocked at the nearest bearing wall location, except such blocking is not required for cantilevers not exceeding 24 inches where a full height rim joist is provided.

4. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.

(h) *Panel joints.* 1. 'General.' Except as provided under subd. 2., all vertical joints of

panel sheathing shall occur over, and be fastened to common studs. Horizontal joints in braced wall panels shall occur over, and be fastened to common blocking of a minimum 1½ inch thickness.
2. 'Exceptions.' a. Blocking at horizontal joints is not required in wall segments that are not counted as braced wall panels.
b. Where the bracing percentage provided is at least twice the minimum percentage required by Table 21.25-H, blocking at horizontal joints is not required in braced wall panels using methods subs. (b) 4., 5. or 6.

24. Braced wall panels shall be supported on floor framing or foundations as follows:
    a. Where joists are perpendicular to braced wall lines above or below, blocking shall be provided between the joists at braced wall panel locations to permit fastening of wall plates in accordance with the fastener table in the appendix.
    b. Where joists are parallel to braced wall lines above or below, a rim joist or other parallel framing member shall be provided at the wall to permit fastening of wall plates in accordance with the fastener table in the appendix.
    c. neither a or b
    d. both a & b
25. Braced wall panels shall be supported on floor framing or foundations as follows:
    a. Braced wall panels shall be permitted to be supported on cantilevered floor joists meeting the cantilever limits of s. Comm 21.22 (6) provided joists are blocked at the nearest bearing wall location, except such blocking is not required for cantilevers not exceeding 24 inches where a full height rim joist is provided.
    b. Elevated post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.
    c. neither a or b
    d. both a & b
26. 'General.' Except as provided under subd. 2., all vertical joints of panel sheathing shall occur over, and be fastened to common studs.
    a. true
    b. false
27. Horizontal joints in the required "braced wall panels" shall occur over, and be fastened to common blocking of a minimum 1½ inch thickness.
    a. true
    b. false
28. Blocking at horizontal joints is still required in wall segments that are not counted as braced wall panels.
    a. true
    b. false

---

(9) ALTERNATIVE BRACING METHODS AND MODIFICATIONS. (a) *General.* As an alternative to the bracing methods under sub. (8), the wall bracing methods in this subsection may also be used.
(b) *Alternate braced wall panels.* 1. 'General.' Alternate braced wall panels constructed in accordance with subd. 2., 3., 4. or 5. may replace each 4 feet of braced wall panel as required under sub. (8) (b). The maximum height and minimum length of each panel shall be in accordance with Table 21.25-I.
2. 'Supporting roof only.' a. In one-story buildings, each panel shall be sheathed on one face with 3/8-inch-minimum-thickness wood structural panel sheathing nailed with 8d common

or galvanized box nails in accordance with the fastening table in the appendix and blocked at all wood structural panel sheathing edges.
b. Two anchor bolts installed in accordance with s. Comm 21.18 (1) (c) 3. shall be provided in each panel.
c. Anchor bolts shall be placed 6 to 12 inches from each end of the plate.
d. Each panel end stud shall have a tie-down device fastened to the foundation, capable of providing an uplift capacity in accordance with Table 21.25-I.
e. The tie-down device shall be installed in accordance with the manufacturer's recommendations.
f. The panels shall be supported directly on a foundation or on floor framing supported directly on a foundation, which is continuous across the entire length of the braced wall line.
g. This foundation shall be reinforced with not less than one number 4 bar at the top and bottom.
h. When the continuous foundation is required to have a depth greater than 12 inches a minimum 12-inch-by-12-inch continuous footing or turned down slab edge is permitted at door openings in the braced wall line.
i. This continuous footing or turned down slab edge shall be reinforced with not less than one number 4 bar at the top and bottom.
j. This reinforcement shall be lapped 15 inches with the reinforcement required in the continuous foundation located directly under the braced wall line.
3. 'Supporting floor and roof only.' In the first story of two-story buildings, each braced wall panel shall be in accordance with subd. 1., except that the wood structural panel sheathing edge nailing spacing shall not exceed four inches on center.

29. 'General.' Alternate braced wall panels constructed in accordance with subd. 2., 3., 4. or 5. may replace each 4 feet of braced wall panel as required under sub. (8) (b). The maximum height and minimum length of each panel shall be in accordance with Table_____.

a. 21.25-G
b. 21.25-H
c. 21.25-I
d. none of the above

30. 'Supporting roof only.' a. In one-story buildings, each panel shall be sheathed on one face with 5/16-inch-minimum-thickness wood structural panel sheathing nailed with 6d common or galvanized box nails in accordance with the fastening table in the appendix and no blocking at all wood structural panel sheathing edges.

a. true
b. false

31. 'Supporting roof only.' Anchor bolts shall be placed 6 to 12 inches from each end of the plate.

a. true
b. false

32. 'Supporting roof only.' When the continuous foundation is required to have a depth greater than 10 inches a minimum 10-inch-by-10-inch continuous footing or turned down slab edge is permitted at door openings in the braced wall line.

a. true
b. false

33. 'Supporting roof only.' Each panel end stud shall have a tie-down device fastened to the foundation, capable of providing an uplift capacity in accordance with Table 21.25-H.

a. true
b. false

34. 'Supporting roof only.' Two anchor bolts installed in accordance with s. Comm 21.18 (1) (c) 3. shall be provided in each panel.
    a. true
    b. false
35. 'Supporting roof only.' This continuous footing or turned down slab edge shall be reinforced with not less than 2 number 3 bar at the top and bottom.
    a. true
    b. false
36. 'Supporting roof only.' This foundation shall be reinforced with not less than one number 4 bar at the top and bottom.
    a. true
    b. false
37. 'Supporting floor and roof only.' In the first story of two-story buildings, each braced wall panel shall be in accordance with subd. 1., except that the wood structural panel sheathing edge nailing spacing shall not exceed 8 inches on center.
    a. true
    b. false

TABLE 21.25-I
MINIMUM LENGTH REQUIREMENTS AND TIE-DOWN FORCES FOR ALTERNATE BRACED WALL PANELS

	Height of Braced Wall Panel				
	8 ft.	9 ft.	10 ft.	11 ft.	12 ft.
Sheathed Length	2'-4"	2'-8"	2'-8"	3'-2"	3'-6"
Sub. (9) (b) 2. Tie-down Force (lbs) **Supporting roof only**	1800	1800	1800	2000	2200
Sub. (9) (b) 3. Tie-down Force (lbs) **Supporting floor and roof only**	3000	3000	3000	3300	3600

38. The maximum height of a braced wall panel with a sheathed length of 3'-2" supporting floor and roof would be _____ feet.
    a. 9
    b. 10
    c. 11
    d. 12
39. The minimum tie down force of a braced wall panel that is 11' tall, a sheathed length of 3'-2", supporting floor and roof would be _____lbs.
    a. 2000
    b. 1800
    c. 3300
    d. 3600

---

4. 'Alternate bracing method with Extended Header over Opening and Tie Downs,

supporting a roof only.' a. Each panel shall have a length of not less than 16 inches and a height of not more than 10 feet.
b. Each panel shall be sheathed on one face with a single layer of 3/8-inch-minimum thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure 21.25-E.
c. The wood structural panel sheathing shall extend up over the header and shall be nailed in accordance with Figure 21.25-E.
d. Glue laminated beams, LVL's or a built-up header consisting of at least two 2 X 12's fastened in accordance with the fastener table in the appendix may be used.
e. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing.
f. The header shall extend between the inside faces of the first full-length outer studs of each panel.
g. The clear span of the header between the inner studs of each panel shall be not less than 6 feet and not more than 18 feet in length.
h. A strap with an uplift capacity of not less than 1000 pounds shall fasten the header to the side of the inner studs opposite the sheathing.
i. One anchor bolt not less than 5/8-inch-diameter, installed in accordance with s. Comm 21.18 (1) (c) 3. shall be provided in the center of each sill plate.
j. The studs at each end of the panel shall have a tie-down device fastened to the foundation with an uplift capacity of not less than 4,200 pounds.
k. Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening.
L. The bearing studs shall also have a tie-down device fastened to the foundation with an uplift capacity of not less than 1000 pounds.
m. The tie-down devices shall be an embedded-strap type, installed in accordance with the manufacturer's recommendations.
n. The panels shall be supported directly on a foundation, which is continuous across the entire length of the braced wall line.
o. The foundation shall be reinforced with not less than one number 4 bar top and bottom.
p. Where the continuous foundation is required to have a depth greater than 12 inches, a minimum 12-inch-by-12-inch continuous footing or turned down slab edge is permitted at door openings in the braced wall line.
q. This continuous footing or turned down slab edge shall be reinforced with not less than one number 4 bar top and bottom.
r. This reinforcement shall be lapped not less than 15 inches with the reinforcement required in the continuous foundation located directly under the braced wall line.

40. Each panel shall have a length of not less than _____ inches and a height of not more than _____ feet.
    a. 12 & 10
    b. 16 & 10
    c. 18 & 10
    d. 24 & 10
41. The wood structural panel sheathing shall extend under (never over) the header and shall be nailed in accordance with Figure 21.25-E.
    a. true
    b. false

42 Each panel shall be sheathed on both faces with a single layer of 3/8-inch-minimum thickness wood structural panel sheathing nailed with 6d common or galvanized box nails in accordance with Figure 21.25-E.

a. true
b. false

43. A spacer, if used, shall be placed on the side of the built-up beam and directly beneath the wood structural panel sheathing.

a. true
b. false

44. The clear span of the header between the inner studs of each panel shall be not less than ____feet and not more than ____ feet in length.

a. 8 & 18
b. 6 & 18
c. 10 & 18
d. 8 & 20

45. A strap with an uplift capacity of not less than _____ pounds shall fasten the header to the side of the inner studs opposite the sheathing.

a. 800
b. 1000
c. 1018
d. 820

46. One anchor bolt not less than___-inch-diameter, installed in accordance with s. Comm 21.18 (1)(c) 3. shall be provided in the center of each sill plate.

a. 1/2
b. 5/8
c. 3/8
d. 3/4

47. Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening.

a. true
b. false

48. The studs at each end of the panel shall have a tie-down device fastened to the foundation with an uplift capacity of not less than _____ pounds.

a. 800
b. 4200
c. 1000
d. 420

49. The bearing studs shall also have a tie-down device fastened to the foundation with an uplift capacity of not less than _____ pounds.

a. 800
b. 4200
c. 1000
d. 420

50. Where the continuous foundation is required to have a depth greater than 12 inches, a minimum 12-inch-by-12-inch continuous footing or turned down slab edge is permitted at door openings in the braced wall line.

a. true
b. false

51. This reinforcement shall be lapped not less than 6 inches with the reinforcement required in the continuous foundation located directly under the braced wall line.

a. true
b. false

52. This continuous footing or turned down slab edge shall be reinforced with not less than one number 4 bar top and bottom.

a. true
b. false

53. . Glue laminated beams, LVL's or a built-up header consisting of at least three ply of 2 X 12's fastened in accordance with the fastener table in the appendix may be used.

a. true
b. false

54. The panels shall be supported directly on a foundation, which is continuous across the entire length of the braced wall line.

a. true
b. false

55. The tie-down devices shall be an embedded-strap type, installed in accordance with the manufacturer's recommendations.

a. true
b. false

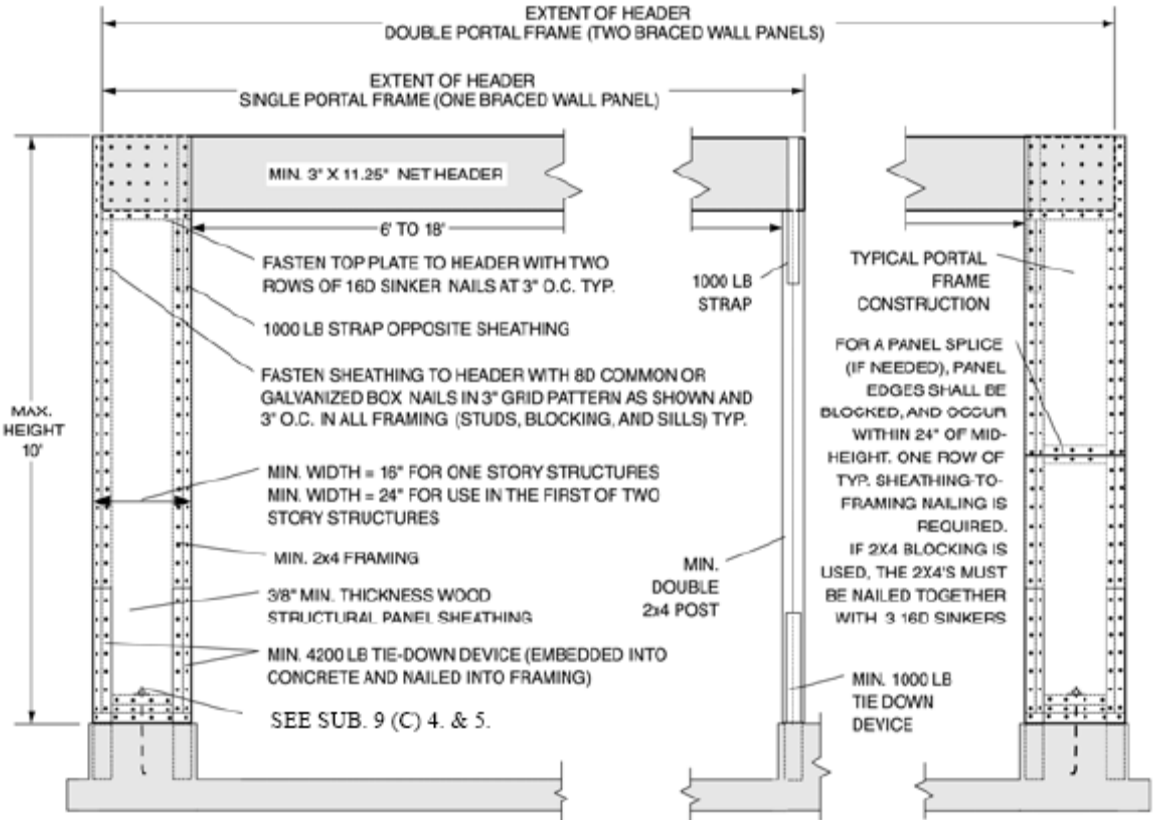


FIGURE 21.25-E
ALTERNATE BRACING METHOD
WITH EXTENDED HEADER AND TIE DOWNS

'Alternate bracing method with Extended Header Over Opening and Tie Downs, in a wall supporting a floor and roof only.' Each wall panel shall be braced in accordance with subd. 4., except that each panel shall have a length of at least 24 inches.

56. Alternate bracing method with Extended Header Over Opening and Tie Downs, in a wall supporting a floor and roof only.' Each wall panel shall be braced in accordance with subd. 4., except that each panel shall have a length of at least ___ inches.

a. 16
b. 24
c. 32
d. 36

(c) *Continuously sheathed braced wall line using wood structural panels.* 1. 'General.'
a. Continuously sheathed braced wall lines using wood structural panels shall comply with this section.
b. Different bracing methods are not permitted within a continuously sheathed braced wall line.
c. Other bracing methods prescribed by this code are permitted on other braced wall lines on the same story level or on different story levels of the building.
2. 'Continuously-sheathed braced wall line requirements.' Continuously-sheathed braced wall lines shall be constructed in accordance with Figure 21.25-F and shall comply with all of the following requirements:
a. Structural sheathing shall be applied to all exterior sheathable surfaces of a braced wall line including areas above and below openings.
b. Only full-height braced wall panels shall be used for calculating the braced wall percentage in accordance with Table 21.25-H.
c. Exterior corner framing shall be constructed and fastened in accordance with details in Figure 21.25-G.
d. Figures 21.25-H, 21.25-I and 21.25-J provide alternative construction options to Figure 21.25-F, when 2 foot wide wood structural panels are not available at the corners of continuous sheathed wall lines and the return wall lines.

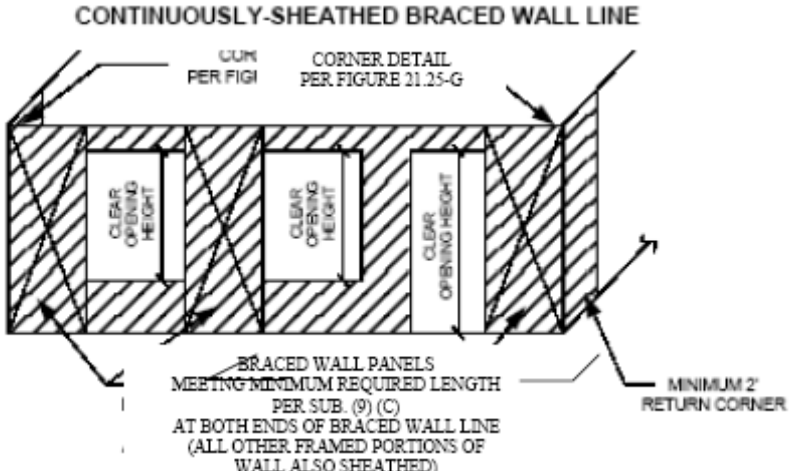


FIGURE 21.25-F
CONTINUOUSLY-SHEATHED BRACED WALL LINE

57. Different bracing methods are permitted within a continuously sheathed braced wall line.

a. true

b. false

58. Other bracing methods prescribed by this code are permitted on other braced wall lines on the same story level or on different story levels of the building.

a. true

b. false

59. Continuously-sheathed braced wall lines shall be constructed in accordance with Figure 21.25-F and shall comply with all of the following requirements:

a. Structural sheathing shall be applied to all exterior sheathable surfaces of a braced wall line including areas above and below openings.

b. Only full-height braced wall panels shall be used for calculating the braced wall percentage in accordance with Table 21.25-H.

c. neither a or b

d. both a & b

60. Continuously-sheathed braced wall lines shall be constructed in accordance with Figure 21.25-F and shall comply with all of the following requirements:

a. Exterior corner framing shall be constructed and fastened in accordance with details in Figure 21.25-G.

b. Figures 21.25-H, 21.25-I and 21.25-J provide alternative construction options to Figure 21.25-F, when 2 foot wide wood structural panels are not available at the corners of continuous sheathed wall lines and the return wall lines.

c. neither a or b

d. both a & b

---

3. 'Braced wall panel length.' In a continuously-sheathed wood structural panel braced wall line, the minimum braced wall panel length shall be permitted to be in accordance with Table 21.25-J.

TABLE 21.25-J
LENGTH REQUIREMENTS FOR BRACED WALL PANELS IN A CONTINUOUSLY SHEATHED WALL [1]

MINIMUM LENGTH OF BRACED WALL PANEL (inches)			MAXIMUM OPENING CLEAR HEIGHT NEXT TO THE BRACED WALL PANEL (% of wall height)	BRACED WALL PANEL HEIGHT TO WIDTH RATIO
8-foot wall	9-foot wall	10-foot wall		
48	54	60	100%	2:1
32	36	40	85%	3:1
24	27	30	67%	4:1[2]

[1] Interpolation is permitted.

[2] A 4:1 aspect ratio is permitted for full-height sheathed wall segments on either side of garage openings.

61. 9' tall wall with a 27 inch braced wall panel requires a width ratio of ____ and the maximum opening height would be _____ percent.

a. 4:1, 67

b. 3:1, 85

c. 2:1, 100

d. none of the above

62. 8' tall wall with a 24 inch braced wall panel requires a width ratio of ____ and the maximum opening height would be _____ percent.

a. 4:1, 67

b. 3:1, 85

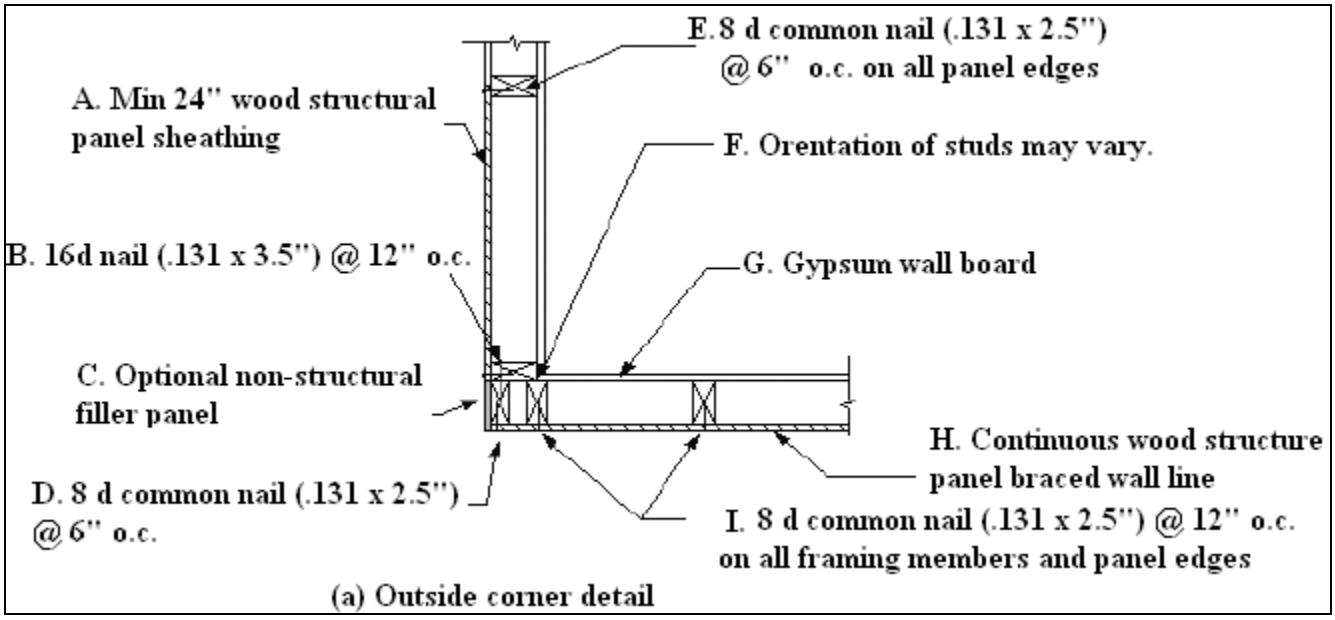
c. 2:1, 100
d. none of the above

63. . 10’ tall wall with a 30 inch braced wall panel requires a width ratio of ____ and the maximum opening height would be _____ percent.
a. 4:1, 67
b. 3:1, 85
c. 2:1, 100
d. none of the above

64. 11’ tall wall with a 30 inch braced wall panel requires a width ratio of ____ and the maximum opening height would be _____ percent.
a. 4:1, 67
b. 3:1, 85
c. 2:1, 100
d. none of the above

65. The above chart allows interpolation.
a. true
b. false

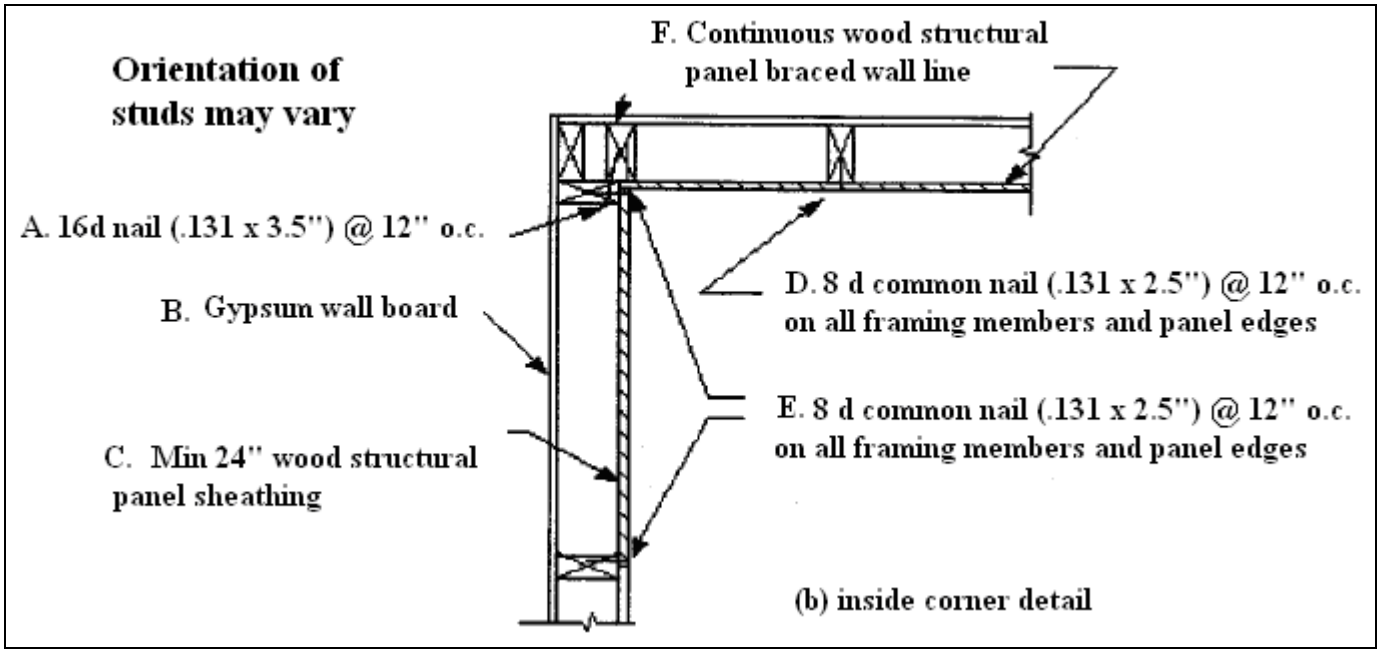
66. 4:1 aspect ratio is permitted for full height sheathed wall segments on either side of garage openings.
a. true
b. false



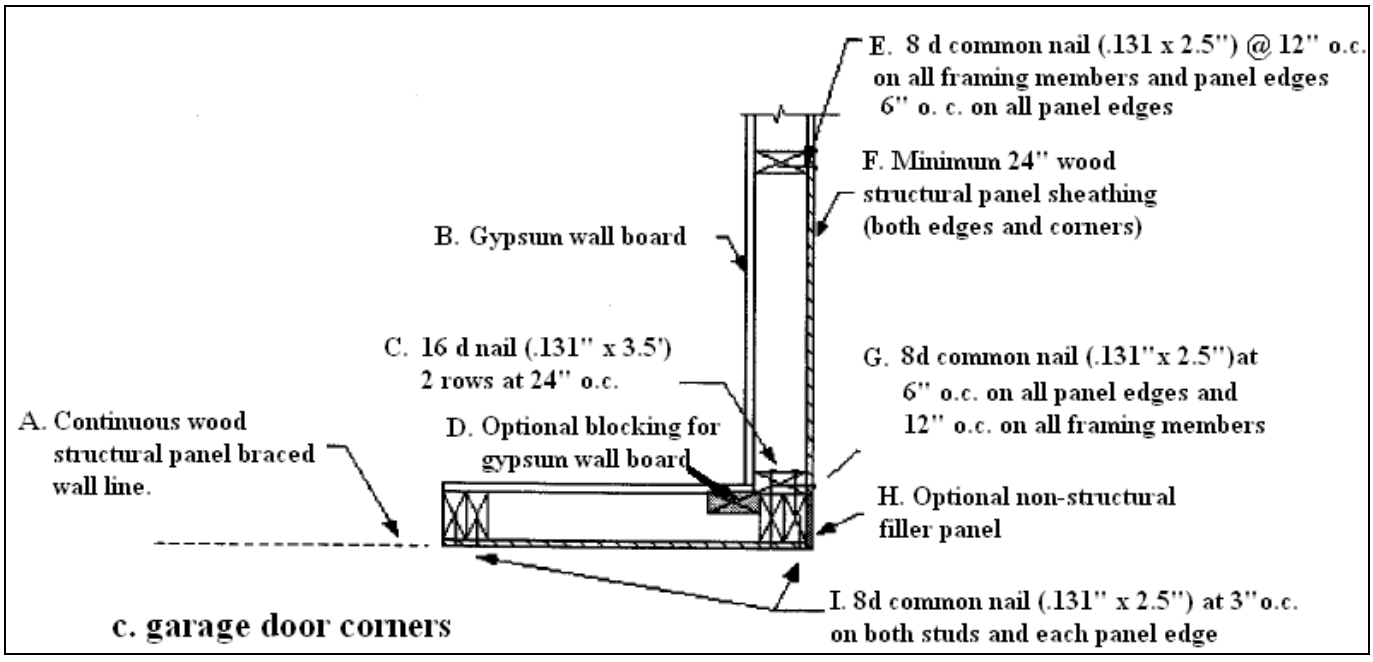
67. Continuous wood structure panel braced wall line
a. F
b. G
c. H
d. I

68. 8d common nail (.131” x 2.5”) @ 12” o.c.on all framing members and panel edges.
a. F.
b. G.
c. H
d. I

69. Gypsum wall board.
    a. F.
    b. G
    c. H
    d. I
70. Orientation of studs may vary
    a. F
    b. G
    c. H
    d. I
71. Minimum 24” wood structural panel sheathing.
    a. A.
    b. B
    c. C
    d. D
72. 16d (.131” x 3.5”) at 12” o.c.
    a. A.
    b. B
    c. C
    d. D
73. Optional non-structural filler panel.
    a. A.
    b. B.
    c. C
    d. D



74. Continuous wood structural panel braced wall line
    a. F
    b. G
    c. H
    d. I
75. 8d common nail (.131” x 2.5”) @ 12” o.c.on all framing members and panel edges.
    a. F
    b. G
    c. H
    d. D & E
76. Gypsum wall board.
    a. F
    b. B
    c. H
    d. I
77. Minimum 24” wood structural panel sheathing.
    a. A
    b. B
    c. C
    d. D
78. 16d (.131” x 3.5”) at 12” o.c.
    a. A
    b. B
    c. C
    d. D



79. Continuous wood structure panel braced wall line
    a. F
    b. G
    c. A
    d. I

80. 8d common nail (.131” x 2.5”) @ 3” o.c.on both studs and each panel edges.
    a. F.
    b. G.
    c. H
    d. I
81. Gypsum wall board.
    a. F.
    b. B
    c. H
    d. I
82. Minimum 24” wood structural panel sheathing (both edges and corners)
    a. F
    b. B
    c. C
    d. D
83. 16d (.131” x 3.5”) 2 rows at 24” o.c.
    a. A.
    b. B
    c. C
    d. D
84. Optional non-structural filler panel.
    a. A.
    b. B.
    c. H
    d. D
85. 8d common nail (.131” x 2.5”) @ 6” o.c. all panel edges & 12” o.c. on framing members.
    a. A.
    b. B
    c. C
    d. E & G

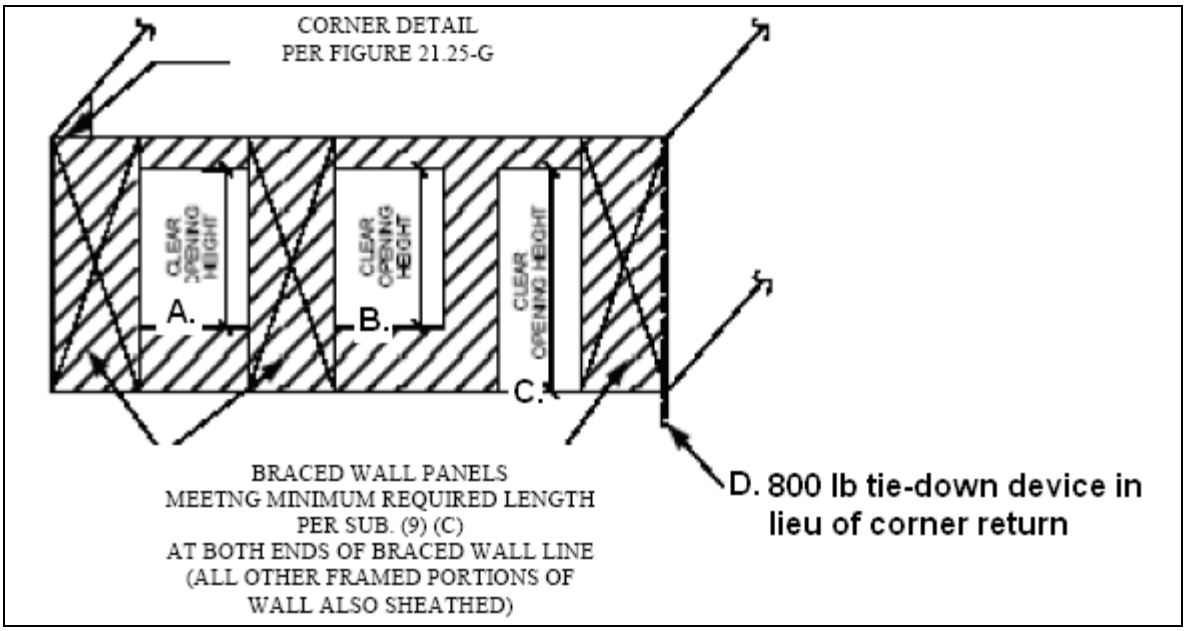


Figure 21.25-H
CONTINUOUSLY-SHEATHED BRACED WALL LINE WITHOUT CORNER RETURN

86. 800 lb tie down device in lieu of corner return would be letter _____ ?
a. A
b. B
c. C
d. D

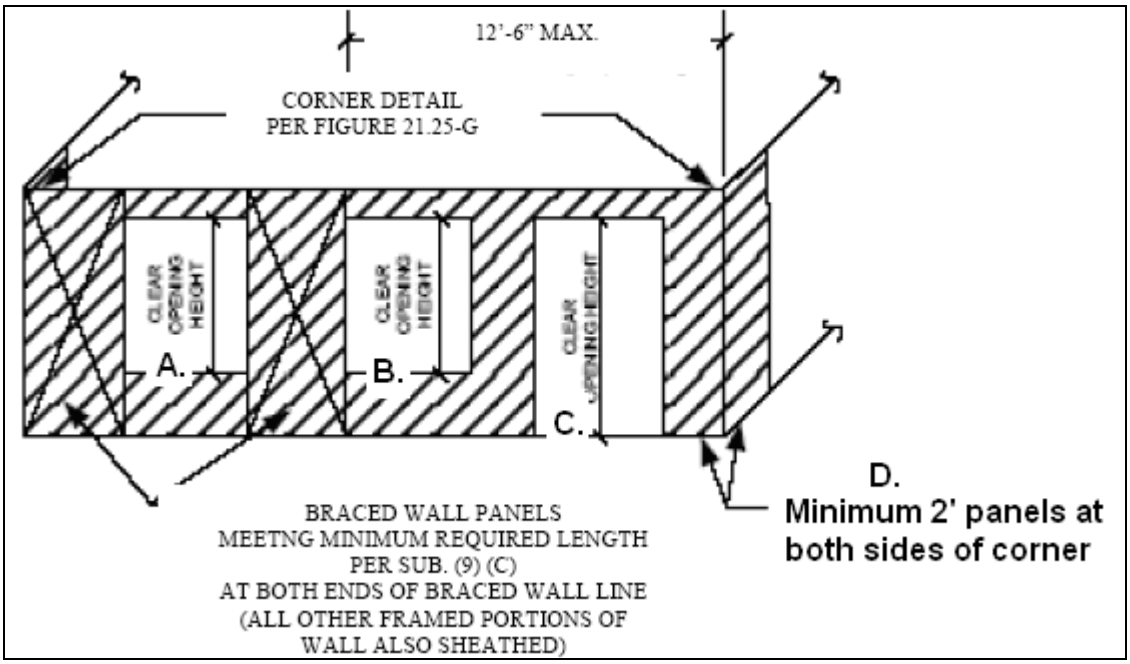
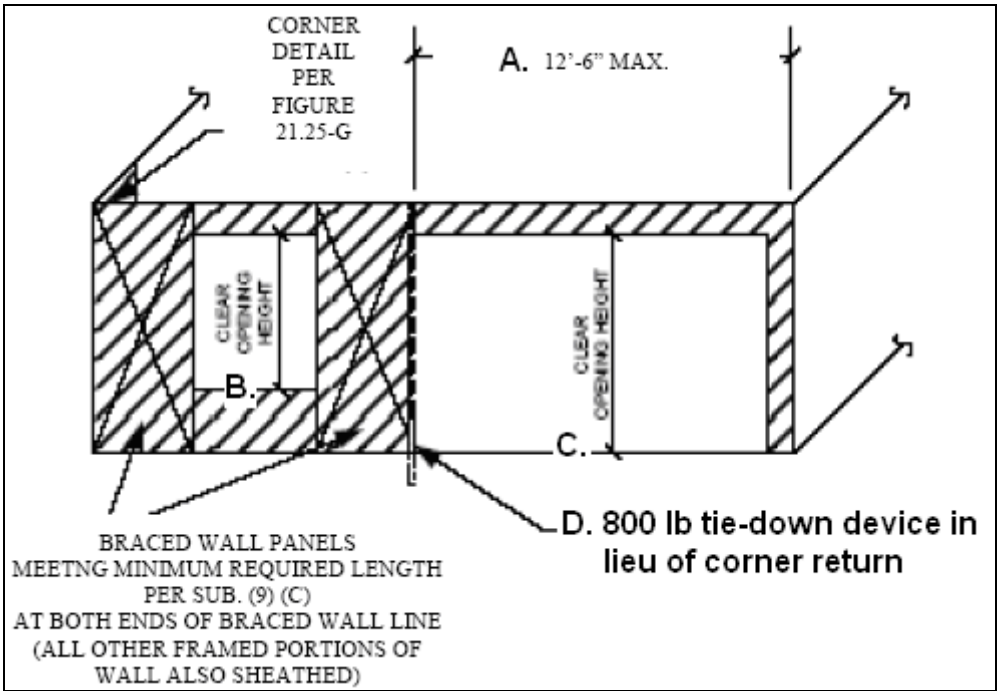


FIGURE 21.25-I
CONTINUOUSLY SHEATHED BRACED WALL LINE-FIRST
BRACED WALL PANEL AWAY FROM END OF WALL LINE WITHOUT TIE DOWN

87. Minimum 2' panels at both sides of corner would be letter _____ ?
a. A
b. B
c. C
d. D



CONTINUOUSLY SHEATHED BRACED WALL LINE – FIRST BRACED WALL PANEL AWAY FROM END OF WALL LINE WITH TIE DOWN

88. 800 lb tie down device in lieu of corner return would be letter _____?

a. A
b. B
c. C
d. D

TABLE 21.25-K
ADJUSTMENT FACTORS TO THE PERCENTAGE OF REQUIRED BRACING PER WALL LINE – CONTINUOUSLY SHEATHED

ADJUSTMENT BASED ON MAXIMUM WALL CLEAR OPENING HEIGHT:		MULTIPLY PERCENTAGE OF BRACING PER WALL LINE BY:
Continuous wood structural panel sheathing when maximum opening height in wall line does not exceed *	85% of wall height	0.9
	67% of wall height	0.8

* Percentage of bracing for continuous wood structural panel sheathing shall be based on sub. (8) (b) 4 requirements.

89. Adjustment factor based on maximum wall clear opening height of up to 67 percent of wall height would be _____?

a. 0.7
b. 0.8
c. 0.9
d. none of the above

90. Adjustment factor based on maximum wall clear opening height of up to 85 percent of wall height would be _____?

a. 0.7
b. 0.8
c. 0.9

d. none of the above

---

4. ‘Braced wall percentage.’ In addition to bracing percentage adjustments specified elsewhere in this code, the braced wall percentages for method under sub. (8) (b) 4 from Table 21.25-G shall be permitted to be multiplied by a factor in accordance with Table 21.25-K.
5. ‘6:1 aspect ratio continuous structural panel sheathing with extended header.’ a. Wall segments having a maximum 6:1 height to width ratio are permitted only when built in accordance with Figure 21.25-K.
b. The maximum 6:1 height-to-width ratio is based on height being measured from the top of the header to the bottom of the wall segment bottom-plate.
c. For purposes of calculating the percentage of panel bracing required by Table 21.25-H, the length of the braced wall panel shall be the measured length of the full height sheathing segment adjacent to the opening.
d. Corners at the ends of walls using this option shall be constructed in accordance with Figure 21.25- G. Where 6:1 ratio segments are used at the ends of braced wall lines, a 2 foot minimum width wood structural panel must be installed on the corner return as shown in Figure 21.25-F. An 800 lb tie down may be installed in lieu of a 2 foot corner return, as shown in Figure 21.25-H.
e. The reduction factors for continuously braced walls from subd. 4. shall be applied when calculating applicable percentages of wall bracing.
f. The number of wall segments having a maximum 6:1 height to width ratio in a wall line may not exceed four.
g. For purposes of resisting wind pressures acting perpendicular to the wall, the minimum requirements of Figure 21.25-K are sufficient for wind speeds less than 110 mph in exposure category B.
h. For exposure categories C and D, the header to jack stud strap requirements and the number of additional jack studs shall be in accordance with Table 21.25-L.**(Not required for exposure B)**
Note: See Table 21.25-L footnotes for definitions of the exposure categories.
I. 6:1 aspect ratio segments with extended header are permitted over raised wood floors or second story applications, when constructed in accordance with rim board/band joist connection in Figure 21.25-K (b) or (c).

91. The maximum ____ height-to-width ratio is based on height being measured from the top of the header to the bottom of the wall segment bottom-plate.

a. 6:1
b. 5:1
c. 7:1
d. none of the above

92. ‘Braced wall percentage.’ In addition to bracing percentage adjustments specified elsewhere in this code, the braced wall percentages for method under sub. (8) (b) 4 from Table 21.25-G shall be permitted to be multiplied by a factor in accordance with Table 21.25-K.

a. true
b. false

93. For purposes of calculating the percentage of panel bracing required by Table 21.25-H, the length of the braced wall panel shall be the measured length of the full height sheathing segment adjacent to the opening.

a. true
b. false

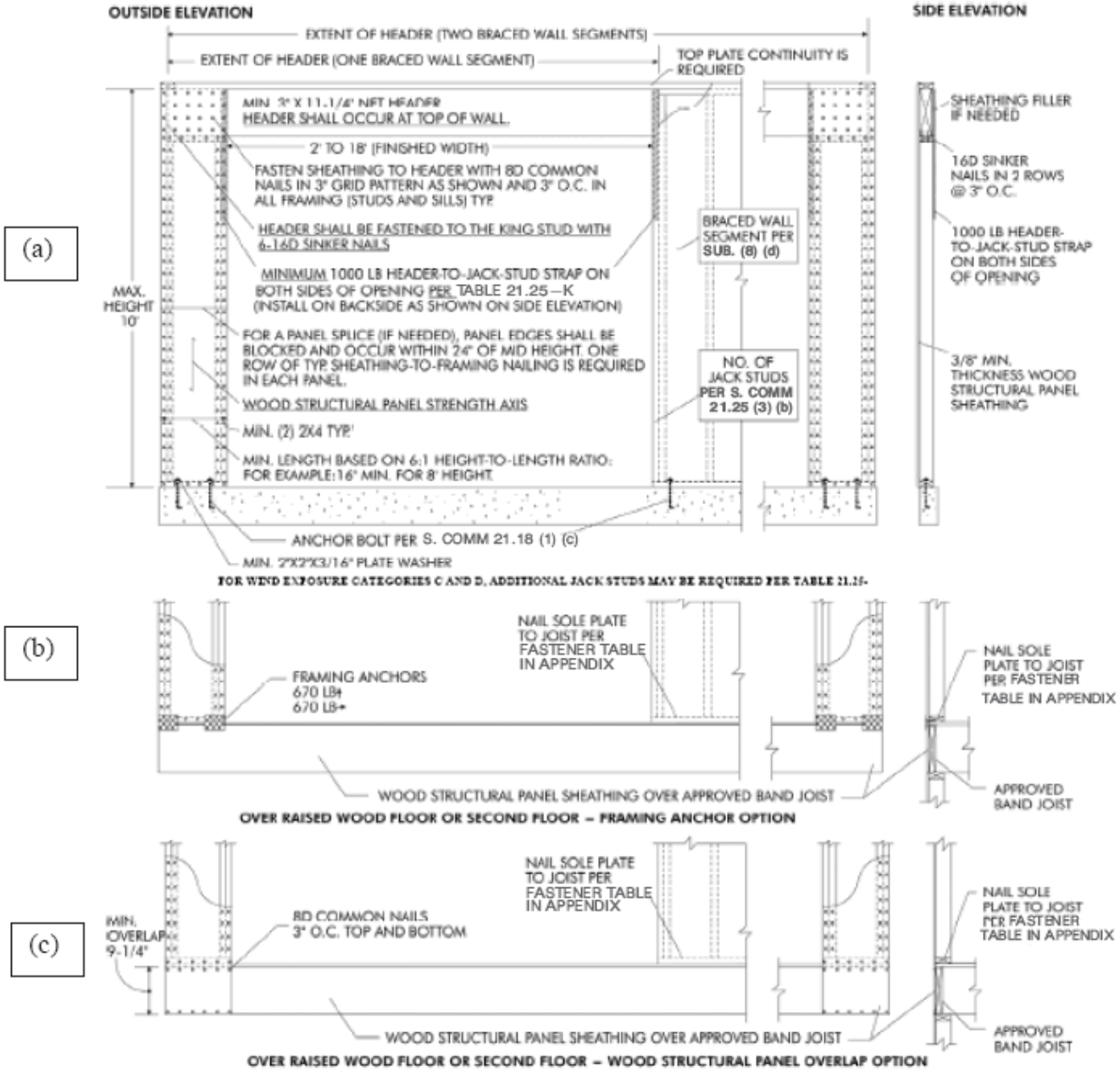
94. For purposes of resisting wind pressures acting perpendicular to the wall, the minimum requirements of Figure 21.25-K are sufficient for wind speeds less than ____ mph in exposure category B.

a. 80
b. 90
c. 100
d. 110

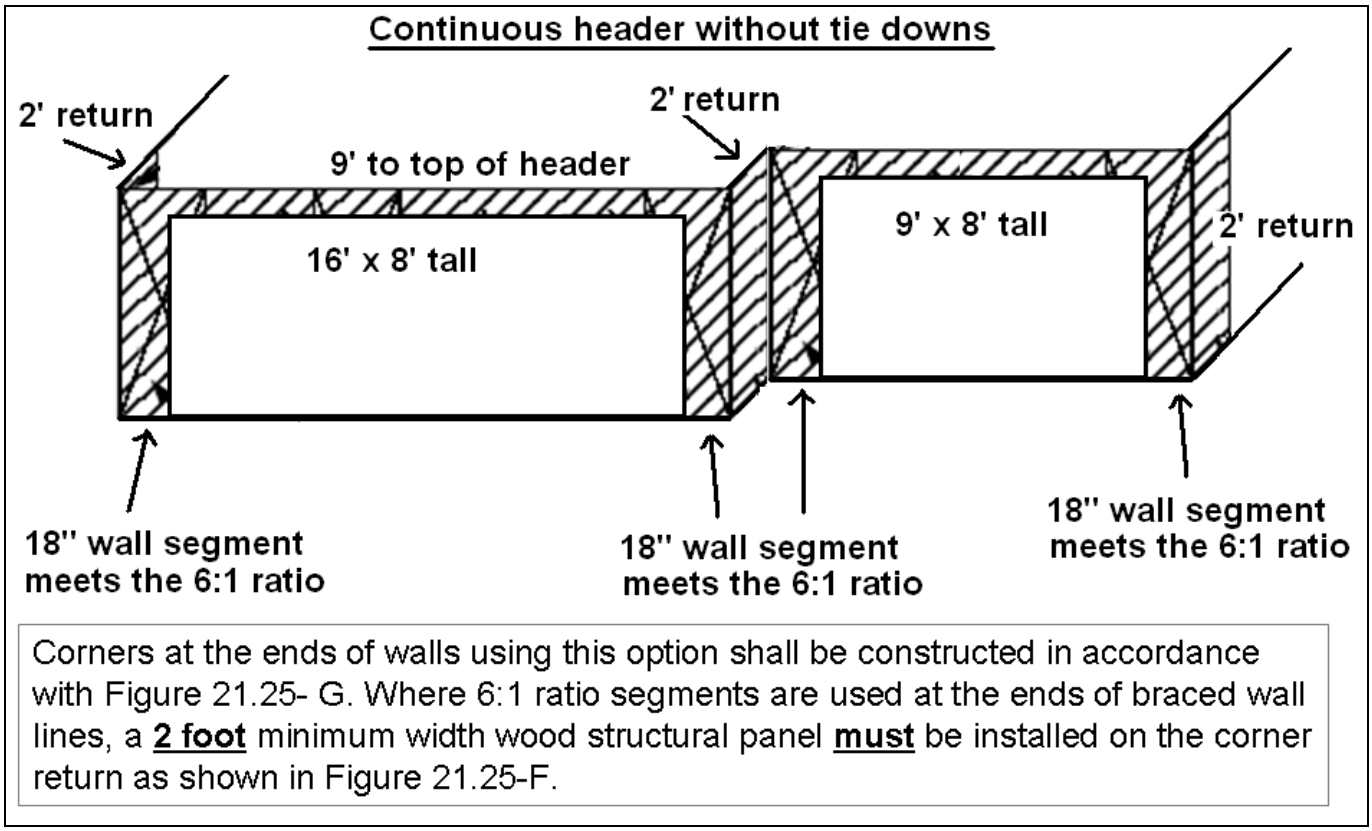
95. 6:1 aspect ratio segments with extended header are permitted over raised wood floors or second story applications, when constructed in accordance with rim board/band joist connection in Figure 21.25-K (b) or (c).

a. true
b. false

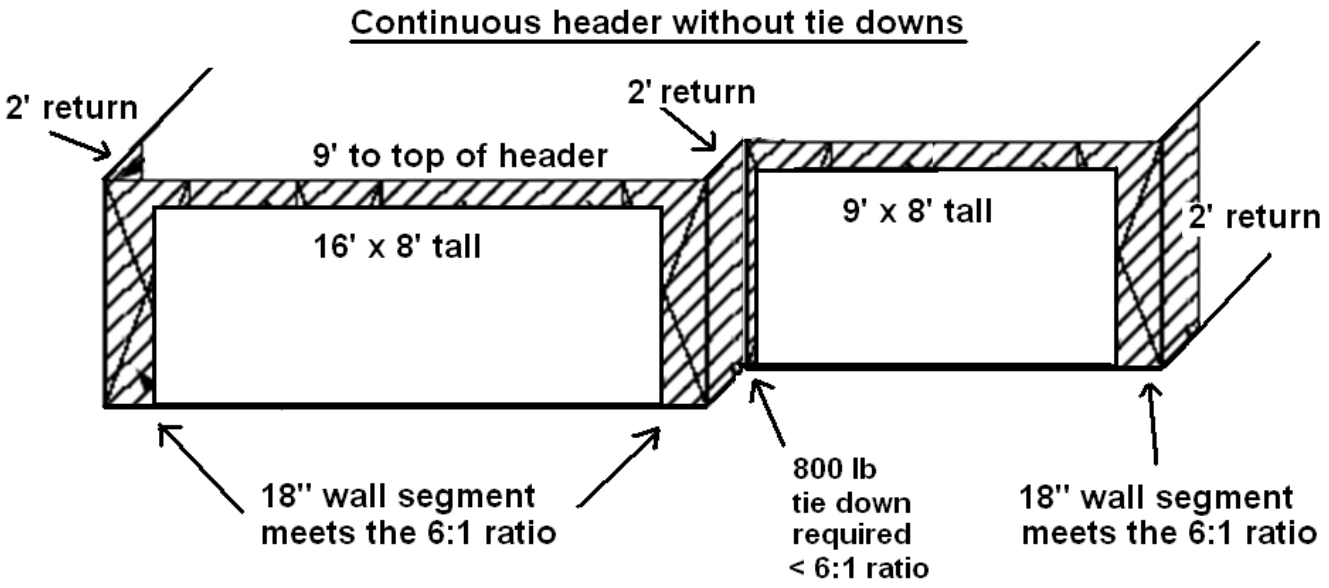
FIGURE 21.25-K
6:1 ASPECT RATIO BRACED WALL PANELS USING CONTINUOUS WOOD STRUCTURAL PANEL SHEATHING AND EXTENDED HEADERS



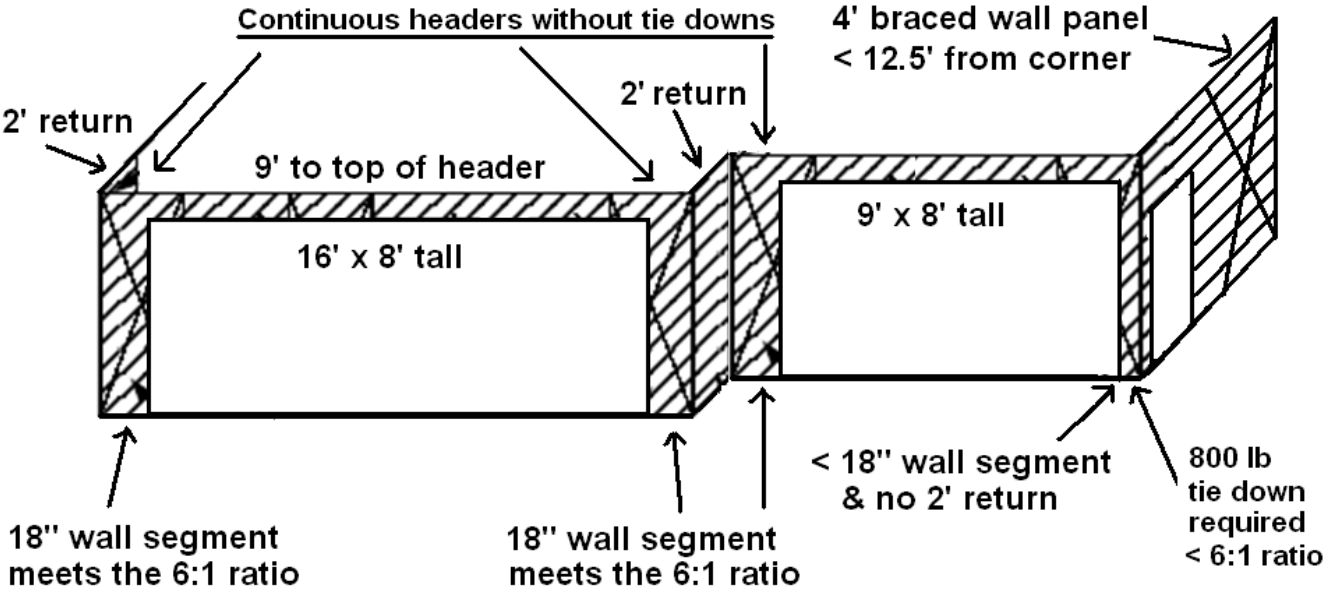
96. The letter ___ above represents 'over raised wood floor or second floor-wood structural panel overlap option'.
    a. a
    b. b
    c. c
    d. none of the above
97. The letter ___ above represents 'over raised wood floor or second floor-framing anchor option'.
    a. a
    b. b
    c. c
    d. none of the above
98. The letter ___ above represents 'for wind exposure categories C & D, additional jack studs may be required per table 21.25'.
    a. a
    b. b
    c. c
    d. none of the above



Corners at the ends of walls using this option shall be constructed in accordance with Figure 21.25- G. Where 6:1 ratio segments are used at the ends of braced wall lines, a **2 foot** minimum width wood structural panel **must** be installed on the corner return as shown in Figure 21.25-F.



An 800 lb tie down may be installed in lieu of a 2 foot corner return, as shown in Figure 21.25-H.



An 800 lb tie down may be installed in lieu of a 2 foot corner return, as shown in Figure 21.25-H.

TABLE 21.25-L
HEADER TO JACK STUD STRAP AND THE NUMBER OF ADDITIONAL JACK STUDS REQUIRED FOR RESISTING WIND PRESSURES PERPENDICULAR TO 6:1 ASPECT RATIO WALLS LOCATED IN WIND EXPOSURE CATEGORIES C AND D [c]

Required	Wall Height (ft)	Wind Exposure Category C			Wind Exposure Category D		
		85 mph	90 mph	less than 110 mph	85 mph	90 mph	less than 110 mph
Strap Capacity(lb)[a]	10 and less	1000	1200	2275	1375	1750	3050
Number of additional 2x4 Jack Studs[b]	8	--	--	--	--	--	1
	9	--	--	1	--	1	2
	10	--	1	2	1	2	3

a. If 2x6 framing is used, then the required strap capacity may be multiplied by 0.65, but in no case shall the required strap capacity be less than 1000 lb.
b. If 2x6 framing is used, then no additional framing shall be required.

c. Exposure category B is comprised of urban and suburban areas, wooded areas, or other terrain with numerous closely-spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.

Exposure category C is comprised of flat open country and grasslands with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet extending more than 1,500 feet from the building site in any quadrant. This exposure also applies to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet.

Exposure category D is comprised of flat, unobstructed areas exposed to wind flowing over open water for a distance of at least 1 mile. This exposure applies only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet or 10 times the height of the building or structure, whichever is greater.

99. Exposure category _____is comprised of flat, unobstructed areas exposed to wind flowing over open water for a distance of at least 1 mile. This exposure applies only to those buildings and other structures exposed to the wind coming from over the water. Exposure _____ extends inland from the shoreline a distance of 1,500 feet or 10 times the height of the building or structure, whichever is greater.

a. C
b. D
c. B
d. none of the above.

100. Exposure category _____ is comprised of flat open country and grasslands with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet extending more than 1,500 feet from the building site in any quadrant. This exposure also applies to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure ____ type terrain in any quadrant for a distance of more than 600 feet.

a. C
b. D
c. B
d. none of the above.

101. Exposure category ___ is comprised of urban and suburban areas, wooded areas, or other terrain with numerous closely-spaced obstructions having the size of single-family dwellings or larger. Exposure ____ shall be assumed unless the site meets the definition of another type exposure.

a. C
b. D
c. B
d. none of the above

SECTION 116. Comm 21.26 (1) is repealed and recreated to read:
Comm 21.26 (1) COLD WEATHER WORK. When ambient air temperature is below 40ₒF, the cold weather construction procedures under ACI 530.1 shall be followed.
Note: The requirements for cold weather work are in sections 1.8 and 1.8C of the 2005 edition of the ACI standard.
SECTION 117. Comm 21.26 (3) (a) is renumbered Comm 21.26 (3) (b) and Comm 21.26 (3) (intro.) is renumbered Comm 21.26 (3) (a).
SECTION 118. Comm 21.26 (3) (a), as renumbered, is amended to read:
Comm 21.26 (3) TYPES OF MORTAR. (a) *Mortar specifications*. The type of **Comm 21.26 (3)** TYPES OF MORTAR. (a) *Mortar specifications*. The type of to the requirements of ASTM C-270
SECTION 119. Comm 21.26 (4) (b) is amended to read:
Comm 21.26 (4) (b) *Admixtures or mortar colors*. Admixtures or mortar colors shall not be added to the mortar unless the resulting mortar conforms to the mortar specifications. Only mineral oxide may be used as mortar color and shall not exceed 10% by weight of the cement.
Comm 21.26 (7) (a) 2. A minimum one-inch air space shall be provided between the veneer and the sheathing unless a manufactured offset material is used.
SECTION 124. Comm 21.26 (7) (a) 5. to 7. are created to read:
Comm 21.26 (7) (a) 5. Ventilation openings shall be provided at the top of the wall.
Note: The ventilation opening could be other than a weep hole.
Comm 21.26 (7) (a) 6. Studs and sheathing behind masonry veneer shall be covered with material used to construct the water-resistive barrier as required under s. Comm 21.24 (4).
Note: Acceptable water-resistive barrier materials include polymeric-based house wraps and # 15 or greater asphalt-saturated felts that comply with ASTM D 226 for type I felt.
Comm 21.26 (7) (a) 7. Masonry or brick veneer shall be above final exterior grade unless there is through-wall flashing at grade or within two courses above grade.
SECTION 125. Comm 21.26 (7) (c) is created to read:
Comm 21.26 (7) (c) *Veneer attachment.* Veneers shall be anchored or adhered in accordance with ACI 530 and ACI 530.1.
SECTION 126. Comm 21.26 (8) and Comm 21.26 (12) are repealed and recreated to read:
Comm 21.26 (8) FLASHING. (a) *General*. 1. Flashing shall be installed in accordance with this section to drain any water outward away from structural members, sheathing and insulation.
2. Open joints or weep holes shall be provided in the facing immediately above the flashing at a horizontal spacing not exceeding 2 feet.
3. Flashing shall consist of materials that are durable and permanently UV-resistant such as sheet metal or heavy gauge PVC.
Note: Materials including house wrap, asphalt-impregnated building paper, plastic sheeting, peel-and-stick rubberized sheet material, and light gauge PVC are not acceptable as meeting this requirement.
(b) *Location*. 1. 'Lintels and chimneys.' In exterior hollow masonry walls, flashing shall be installed at the backsides of chimneys and at the bottom of the cavity formed by openings such as lintels over doors and windows.
2. 'Veneer.' Flashing shall be installed at the bottom of veneer and shall extend over the top of the foundation and up at least 8 inches and be embedded in the backing course.
(c) *Weep holes*. 1. Weep holes may not be placed below final grade.
2. Rope or similar material used to form a weep hole shall be removed as soon as the mortar sets.
3. Weep holes shall be 3/8-inch minimum diameter.
Comm 21.26 (12) JOINTS. Joints in masonry construction shall be constructed in accordance with ACI 530.1.

102. Only mineral oxide may be used as mortar color and shall not exceed 30% by weight of the cement.

a. true
b. false

103. When ambient air temperature is below 40ºF, the cold weather construction procedures under ACI 530.1 shall be followed.
a. true
b. false

104. Studs and sheathing behind masonry veneer shall be covered with material used to construct the water-resistive barrier as required under s. Comm 21.24 (4).
a. true
b. false

105. Acceptable water-resistive barrier materials include polymeric-based house wraps and # 15 or greater asphalt-saturated felts that comply with ASTM D 226 for type I felt.
a. true
b. false

106. Open joints or weep holes shall be provided in the facing immediately above the flashing at a horizontal spacing not exceeding 4 feet.
a. true
b. false

107. Flashing shall consist of materials that are durable and permanently UV-resistant such as sheet metal or heavy gauge PVC.
a. true
b. false

108. Materials including house wrap, asphalt-impregnated building paper, plastic sheeting, peel-and-stick rubberized sheet material, and light gauge PVC are acceptable as meeting the flashing requirement.
a. true
b. false

109. In exterior hollow masonry walls, flashing shall be installed at the backsides of chimneys and at the bottom of the cavity formed by openings such as lintels over doors and windows.
a. true
b. false

110. Weep holes may be placed below final grade.
a. true
b. false

111. Rope or similar material used to form a weep hole shall can remain permanently.
a. true
b. false

112. Weep holes shall be the minimum diameter of the best drill bit on site.
a. true
b. false

113. Joints in masonry construction shall be constructed in accordance with the spacing necessary to complete the job.
a. true
b. false

Comm 21.27 Roof design and framing. (1) STRUCTURAL DESIGN. (a) *General.*
Roof and roof-ceiling assemblies shall support all dead loads plus the minimum live loads under par. (c) and s. Comm 21.02.
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(b) *Applicability of tables*. The joist and rafter tables in the appendix are valid for roofs

with a minimum slope of 3 in 12. Lesser slopes require engineering analysis or shall be provided with a ridge beam.

(c) *Sloped roof snow loads.* Snow loads specified in s. Comm 21.02 (1) (b) 2. may be reduced for roof slopes greater than 30° by multiplying the snow load by Cs. The value of Cs shall be determined by the following: $Cs = 1 - \frac{(a-30)}{40}$ where a is the slope of the roof expressed in degrees.

Note: A roof pitch of 7 in 12 is equal to 30°.

(2) LATERAL RESTRAINT OF WALLS. Provisions shall be taken to absorb the horizontal thrust produced by a sloping roof through the use of wall ties, ceiling joists, beams at the ridge or at the wall or a system designed through structural analysis.

(3) UPLIFT AND SUCTION FORCES. (a) *General*. 1. Roofs shall withstand a pressure of at least 20 pounds per square foot acting upward normal to the roof surface.

2. Roof overhangs, eaves, canopies and cornices shall withstand an upward wind pressure of at least 20 pounds per square foot applied to the entire exposed area.

(b) *Anchorage.* 1. Roof framing members spanning more than 6 feet measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using engineered clips, straps or hangers.

2. Roof framing members spanning 6 feet or less measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using toe-nailing or engineered clips, straps or hangers.

Note: For information on toe nailing, see the fastener schedule table in the appendix.

114. Provisions shall be taken to absorb the horizontal thrust produced by a sloping roof through the use of _____.

a. wall ties
b. ceiling joists
c. neither a or b
d. both a & b

115. Provisions shall be taken to absorb the horizontal thrust produced by a sloping roof through the use of _____.

a. beams at the ridge
b. a system designed through structural analysis.
c. neither a or b
d. both a & b

116. The joist and rafter tables in the appendix are valid for roofs with a minimum slope of 3 in 12. Lesser slopes require:

a. engineering analysis
b. shall be provided with a ridge beam.
c. neither a or b
d. either a or b

117. Roof framing members spanning 6 feet or less measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using:

a. toe-nailing
b. engineered clips
c. neither a or b
d. either a or b

118. Roof framing members spanning 6 feet or less measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using:

a., straps
b. hangers
c. neither a or b
d. either a or b

119. Roof framing members spanning more than 6 feet measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using:

a. engineered clips
b. straps
c. hangers.
d. all of the above

120. _____ shall withstand a pressure of at least 20 pounds per square foot acting upward normal to the roof surface.

a. roofs
b. walls
c. garage doors
d. all of the above

121. _____ and cornices shall withstand an upward wind pressure of at least 20 pounds per square foot applied to the entire exposed area.

a. Roof overhangs
b. eaves
c. canopies
d. all of the above

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(4) ROOF RAFTERS. (a) *General.* 1. Rafters shall be notched to fit the exterior wall plate and fastened to the wall.

2. Collar ties shall be installed on the upper third of every third pair of abutting roof rafters or every 48 inches, whichever is less.

Note: Collar ties are intended to provide stability to the roof at the ridge. Lateral restraint for the walls must be provided in accordance with sub. (2).

(b) *Ridge boards.* 1. Where rafters meet to form a ridge, the rafters shall be attached to a ridge board.

2. The ridge board shall have a depth at least equal to the length of the cut end of the rafter abutting it.

3. Where all rafters are placed directly opposite each other or are offset at the ridge board by less than the thickness of the rafter, the ridge board shall have a nominal thickness of at least 1 inch.

4. Where one or more rafters are offset at the ridge board by more than the thickness of the rafter, the ridge board shall have a nominal thickness of at least 2 inches.

(c) *Ridge beams.* Rafters shall be attached to ridge beams using engineered clips, straps or hangers or the connection shall be designed through structural analysis.

(d) *Bearing.* The required bearing for wood rafters shall be in accordance with the NDS adopted in Table 20.24-2, except in no case shall the bearing be less than 1½ inches on wood or metal or less than 3 inches on masonry or concrete.

(e) *Ladders.* 1. Overhangs at gable end walls of more than 12 inches shall be provided with ladders which extend into the structure a distance no less than the length of the overhang.

2. The ladders shall be fastened at the wall.

3. The interior end of each ladder shall be attached to a rafter or truss with a hanger.

Note: For the purposes of this section, a ladder is defined as a perpendicular projection extending beyond the face of the wall below.

(5) CEILING JOISTS. (a) Ceiling joists shall be nailed to exterior walls and to the ends of rafters.

(b) Ends of ceiling joists shall be lapped at least 3 inches and be fastened either with 3-16d nails or in accordance with the floor joist requirements under s. Comm 21.22 (4) (a) 1. d.

Note: See the fastener table in appendix for a nailing schedule for ceiling joists.

(c) Where ceiling joists are placed at right angles to the rafters, the lookout joist or ties shall be fastened to the parallel ceiling joists or rafters using engineered clips, straps or hangers or the connection shall be designed through structural analysis.

122. Ends of ceiling joists shall be lapped at least 3 inches and be fastened either with 3- 16d nails or in accordance with the floor joist requirements under s. Comm 21.22 (4) (a) 1. d.

a. true
b. false

123. Where ceiling joists are placed at right angles to the rafters, the lookout joist or ties shall be fastened to the parallel ceiling joists or rafters using:

a. engineered clips
b. straps
c. neither a or b
d. both a & b

124. Where ceiling joists are placed at right angles to the rafters, the lookout joist or ties shall be fastened to the parallel ceiling joists or rafters using:

a. the connection shall be designed through structural analysis.
b. hangers
c. neither a or b
d. both a or b

125. The interior end of each ladder >12” shall be attached to a rafter or truss with a hanger.

a. true
b. false

126. Overhangs at gable end walls of more than 12 inches shall be provided with ladders which extend into the structure a distance no less than the length of the overhang.

a. true
b. false

127. The required bearing for wood rafters shall be in accordance with the NDS adopted in Table 20.24-2, except in no case shall the bearing be less than 1½ inches on wood or metal or less than 3 inches on masonry or concrete.

a. true
b. false

128. Rafters shall be attached to ridge beams using engineered:

a. clips
b. straps or hangers
c. the connection shall be designed through structural analysis
d. all of the above

129. Where one or more rafters are offset at the ridge board by more than the thickness of the rafter, the ridge board shall have a nominal thickness of at least 1 inches.

a. true
b. false

130. Where rafters meet to form a ridge, the rafters shall be attached to a ridge board.

a. true
b. false

131. Collar ties shall be installed on the upper forth of every third pair of abutting roof rafters or every 64 inches, whichever is less.
a. true
b. false

132. Rafters shall be notched to fit the exterior wall plate and fastened to the wall.
a. true
b. false

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(6) VALLEY AND HIP RAFTERS. (a) *Valley rafters.* 1. Where no bearing is provided under valley rafters at the intersection of 2 roof areas, the valley rafters shall be doubled in thickness and shall be at least 2 inches deeper than the required common rafter to permit full bearing at the beveled end.
2. Where ridges are provided at different elevations, vertical support shall be provided for the interior end of the lower ridge board or ridge beam.
(b) *Hip rafters.* Where no bearing is provided under hip rafters, the hip rafters shall be of the same thickness as common rafters and shall be at least 2 inches deeper than required to permit full contact with the jack rafter.
(7) ROOF TRUSSES. (a) Metal plate connected wood roof trusses shall be designed in accordance with TPI 1 and the NDS adopted under s. Comm 20.24.
(b) Truss members shall not be cut, bored or notched, except as allowed under sub. (8)(d).
(c) If connection is provided to stabilize a non-load bearing wall, a slotted expansion joint or clip shall be used.

133. Where no bearing is provided under valley rafters at the intersection of 2 roof areas, the valley rafters shall be doubled in thickness.
a. true
b. false

134. Where no bearing is provided under valley rafters the valley rafters shall be doubled in thickness and shall be at least 3 inches deeper than the required common rafter to permit full bearing at the beveled end.
a. true
b. false

135. Where ridges are provided at different elevations, horizontal support shall be provided for the exterior end of the lower ridge board or ridge beam.
a. true
b. false

136. Where no bearing is provided under hip rafters, the hip rafters shall be double in thickness as common rafters.
a. true
b. false

137. Where no bearing is provided under hip rafters, the hip rafters shall be shall be at least 2 inches deeper than required to permit full contact with the jack rafter.
a. true
b. false

138. Truss members shall not be cut, bored or notched, except as allowed under sub. (8)(d).
a. true
b. false

139. If connection is provided to stabilize a non-load bearing wall, a slotted expansion joint or clip shall be used.

a. true
b. false

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(8) NOTCHING AND BORING. (a) *General.* 1. Notching and boring of beams or girders is prohibited unless determined through structural analysis.
2. Notching and boring of ceiling joists and rafters shall comply with pars. (b) and (c).
(b) *Notching.* 1. Notches located in the top or bottom of ceiling joists and rafters are prohibited from all of the following:
a. Having a depth exceeding 1/6 the depth of the member.
b. Having a length exceeding 1/3 the depth of the member.
c. Being located in the middle 1/3 of the span of the member.
2. Where ceiling joists or rafters are notched at the ends, the notch may not exceed ¼ the depth of the member.
3. Bird mouth cuts may not exceed 1/3 the depth of the rafter unless the seat cut bears fully on the wall plate.
(c) *Boring.* 1. Holes bored within 2 inches of the top or bottom of ceiling joists or rafters may not be located in the middle 1/3 of the span of the member.
2. The diameter of a hole may not exceed 1/3 the depth of the member.
3. A hole may not be bored within 2 inches of a notch or another hole.
4. The distance between adjacent holes may not be less than the diameter of the larger hole.
(d) *Engineered wood products.* Notching or boring of engineered wood products shall be done in accordance with the manufacturer's instructions provided those instructions were developed through structural analysis or product testing.

140. Where ceiling joists or rafters are notched at the ends, the notch may not exceed 1/2 the depth of the member.

a. true
b. false

141. Bird mouth cuts may not exceed 1/3 the depth of the rafter unless the seat cut bears fully on the wall plate.

a. true
b. false

142. Holes bored within 2 inches of the top or bottom of ceiling joists or rafters may not be located in the middle 1/3 of the span of the member.

a. true
b. false

143. The diameter of a hole may not exceed 1/2 the depth of the member.

a. true
b. false

144. A hole may be bored within 2 inches of a notch or another hole.

a. true
b. false

145. The distance between adjacent holes may be less than the diameter of the larger hole.

a. true
b. false

146. Notching or boring of engineered wood products shall be done in accordance with the manufacturer's instructions provided those instructions were developed through structural analysis or product testing.

a. true
b. false

147. Notches located in the top or bottom of ceiling joists and rafters are prohibited from which of the following:
a. Having a depth exceeding 1/6 the depth of the member.
b. Having a length exceeding 1/3 the depth of the member.
c. Being located in the middle 1/3 of the span of the member.
d. all of the above

148. Notching and boring of beams or girders is prohibited unless determined through structural analysis.
a. true
b. false

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(9) ROOF SHEATHING, BOARDS AND PLANKING. (a) *Structural sheathing.* The allowable loads and spans for structural sheathing shall be in accordance with the grade stamp on the panel.
(b) *Roof boards.* 1. Where the rafter spacing is 24 inches on center or less, roof boards may be used that have a minimum thickness of 5/8-inch for solid sheathing and ¾-inch for spaced sheathing.
2. Where the rafter spacing is greater than 24 inches on center, roof boards shall be tongue and groove, at least 1.5 inches thick.
(c) *Roof planks.* 1. Roof planks shall be tongue and groove or splined and at least 2 inches, nominal, in thickness.
2. Planks shall terminate over beams unless the joints are end matched.
3. The planks shall be laid so that no continuous line of joints will occur except at points of support.
4. Planks shall be nailed or fastened to each beam.

149. Where the rafter spacing is greater than 24 inches on center, roof boards shall be tongue and groove
a. true
b. false

150. Where the rafter spacing is greater than 24 inches on center, roof boards shall be at least 1.5 inches thick.
a. true
b. false

151. Roof planks shall be tongue and groove or splined and at least 1 1/2 inches, nominal, in thickness
a. true
b. false

152. Planks shall terminate over beams unless the joints are end matched.
a. true
b. false

153. The planks shall be laid so that a continuous line of joints will occur..
a. true
b. false

154. Planks shall be nailed or fastened to each beam.
a. true
b. false

155. Where the rafter spacing is 24 inches on center or less, roof boards may be used that have a minimum thickness of 5/8-inch for solid sheathing
a. true
b. false

156. Where the rafter spacing is 24 inches on center or less, roof boards may be used that have a minimum thickness of ¾-inch for spaced sheathing.

a. true
b. false

157. The allowable loads and spans for structural sheathing shall be in accordance with the grade stamp on the panel.

a. true
b. false

Comm 21.28 Weather protection for roofs. (1) GENERAL. (a) All roofs shall be designed and constructed to assure drainage of water.

(b) All fasteners shall be corrosion resistant.

(2) UNDERLAYMENT FOR SHINGLES. Underlayment consisting of number 15 asphalt-impregnated felt paper or equivalent or other type I material that shows no water transmission when tested in accordance with ASTM D 226 or ASTM D 4869 shall be provided under shingles.

Note: Underlayment materials meeting the requirements of ASTM D 1970 meet the performance requirements of this section.

(3) ASPHALT SHINGLES. (a) *General*. 1. Shingles that have a self-sealing adhesive strip shall include a sealant which has an average bond strength of at least 1.5 pounds per 3.75 inches of shingle width, at 32º F.

Note: The department will accept results of testing conducted in accordance with an approved test method for verifying compliance with the sealant uplift resistance required in this paragraph. Information on the applicable test method may be obtained from the department.

2. Each shingle package shall be labeled by the manufacturer to indicate conformance to the applicable ASTM standard for each type of shingle or the exception in par (c).

3. Shingles shall be installed in accordance with the manufacturer's recommendations.

4. Shingles shall have at least 4 fasteners per strip shingle or 2 fasteners per interlocking shingle, unless the manufacturer has other specifications.

5. Shingle head lap shall be at least 2 inches, unless the manufacturer has other specifications.

Note 1: See s. Comm 20.07 (62) for definitions of shingle terms.

Note 2: The Residential Asphalt Roofing Manual can be purchased from the Asphalt Roofing Manufacturers Association at 6000 Executive Boulevard, Suite 201, Rockville, Maryland 20852-3803. This manual contains extensive information on shingles from manufacture through installation, inspection and maintenance. It includes a recommendation that properly driven and applied nails are the preferred fastening system for asphalt shingles.

Note 3: Section Comm 20.04 (2) requires compliance with all parts of this code, including these roofing provisions, for an alteration to any dwelling that is regulated under this code.

(b) *Organic shingles*. Organic asphalt shingles shall conform to ASTM D 225 and the Class C requirements of ASTM E 108, and shall pass the wind resistance test of ASTM D 3161.

(c) *Fiberglass shingles*. Fiberglass asphalt shingles shall conform to ASTM D 3462 except that laminated shingles shall have a tear strength of at least 1450 grams in each ply.

158. Underlayment consisting of number 25 asphalt-impregnated felt paper or equivalent or other type I material that shows no water transmission when tested in accordance with ASTM D 226 or ASTM D 4869 shall be provided under shingles.

a. true
b. false

159. Underlayment materials meeting the requirements of ASTM D 1970 meet the performance requirements of this section.

a. true
b. false

160. Shingles that have a self-sealing adhesive strip shall include a sealant which has an average bond strength of at least 7.5 pounds per 3.75 inches of shingle width, at 90º F.

a. true
b. false

161. The department will accept results of testing conducted in accordance with an approved test method for verifying compliance with the sealant uplift resistance required in this paragraph. Information on the applicable test method may be obtained from the department.

a. true
b. false

162. Each shingle package shall be labeled by the manufacturer to indicate conformance to the applicable Fly-Away standard for each type of shingle or the exception in par (c).

a. true
b. false

163. Section Comm 20.04 (2) requires compliance with all parts of this code, including these roofing provisions, for an alteration to any dwelling that is regulated under this code.

a. true
b. false

164. Organic asphalt shingles shall conform to ASTM Z 225 and the Class Z requirements of ASTM Z 108, and shall pass the wind resistance test of ASTM D 3161.

a. true
b. false

165. Fiberglass asphalt shingles shall conform to ASTM D 3462 except that laminated shingles shall have a tear strength of at least 1450 grams in each ply.

a. true
b. false

166. All roofs shall be designed and constructed to assure drainage of water.

a. true
b. false

167. All fasteners shall be corrosion resistant.

a. true
b. false

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(4) ICE DAM PROTECTION. (a) Shingled or shake roofs that extend over a heated area of a dwelling or attached garage and that have a slope of 4:12 or less shall be provided with ice dam protection in the form of sheet metal or a product labeled as meeting the requirements of ASTM D 1970.

(b) The ice dam protection shall extend at least 30 inches up the roof slope from the roof edge and at least 12 inches up the roof slope beyond the inner face of the exterior wall.

(5) OTHER ROOF COVERINGS. All roof coverings not otherwise addressed in this section shall be installed in accordance with the manufacturer's instructions or a national standard recognized by the department.

(6) REROOFING. New roof coverings may not be installed over existing roof coverings where any of the following conditions exist:

(a) The existing roof or roof covering is water-soaked or has deteriorated such that it is inadequate as a base for additional roofing.

(b) The existing roof is wood shake, slate, clay, cement or asbestos-cement tile.

(c) The existing roof has 2 or more applications of any type of permanent roof covering.

168. New roof coverings may not be installed over existing roof coverings where any of the following conditions exist: The existing roof has 1 or more applications of any type of permanent roof covering.
a. true
b. false
169. New roof coverings may not be installed over existing roof coverings where any of the following conditions exist: The existing roof is wood shake, slate, clay, cement or asbestos-cement tile.
a. true
b. false
170. New roof coverings may be installed over existing roof coverings where any of the following conditions exist: The existing roof or roof covering is water-soaked.
a. true
b. false
171. New roof coverings may be installed over existing roof coverings where any of the following conditions exist: has deteriorated such that it is inadequate as a base for additional roofing.
a. true
b. false
172. All roof coverings not otherwise addressed in this section shall be installed in accordance with the manufacturer's instructions or a national standard recognized by the department.
a. true
b. false
173. Shingled or shake roofs that extend over a heated area of a dwelling or attached garage and that have a slope of 2:12 or less shall be provided with ice dam protection in the form of sheet metal or a product labeled as meeting the requirements of ASTM D 1970.
a. true
b. false
174. The ice dam protection shall extend at least 60 inches up the roof slope from the roof edge and at least 24 inches up the roof slope beyond the inner face of the exterior wall.
a. true
b. false

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(7) FLASHING. (a) *General*. Flashing shall be installed at the junction of chimneys and roofs, in all valleys, and around all roof openings.
(b) *Flashing of open valleys.* 1. Open valleys shall be flashed with at least No. 28 gauge corrosion-resistant sheet metal, 16 inches wide, or a layer of at least 50-pound roll roofing, 16 inches wide, placed over a layer of number 15 roofing underlayment.
2. Flashing sections shall be overlapped by at least 4 inches.
(c) *Flashing of closed valleys*. Where shingles are laced or woven over the valley, the valley shall be flashed with at least one layer of 50-pound roofing, at least 20 inches wide, over a layer of number 15 roofing underlayment.
(d) *Chimney flashing.* 1. Chimneys shall be flashed and counter-flashed to a height of at least 6 inches.
2. Chimney crickets or saddles shall be installed where the upper side of a chimney is more than 30 inches wide on a sloping roof.
3. The intersection of the cricket and the chimney shall be flashed and counter-flashed to a height of at least 6 inches.

175. Flashing shall be installed at the junction of chimneys.
a. true
b. false
176. Flashing shall be installed at the junction of roofs.

a. true
b. false

177. Flashing shall be installed in all valleys.
a. true
b. false

178. Flashing shall be installed around all roof openings.
a. true
b. false

179. Where shingles are laced or woven over the valley, the valley shall be flashed with at least one layer of 50-pound roofing.
a. true
b. false

180. Where shingles are laced or woven over the valley, the valley shall be flashed with at least 24 inches wide, over a layer of number 25 roofing underlayment.
a. true
b. false

181. Open valleys shall be flashed with at least No. 28 gauge corrosion-resistant sheet metal, 16 inches wide, or a layer of at least 50-pound roll roofing, 16 inches wide, placed over a layer of number 15 roofing underlayment.
a. true
b. false

182. Chimney crickets or saddles shall be installed where the upper side of a chimney is more than 20 inches wide on a sloping roof.
a. true
b. false

183. The intersection of the cricket and the chimney shall be flashed and counter-flashed to a height of at least 16 inches.
a. true
b. false

Comm 21.40 (2) (b) 13. a. Each pier shall be capped with a solid concrete block at least 4 inches thick or a solid wood block having a nominal thickness of at least 2 inches.
b. The cap shall be the same width and length as the top of the pier.
c. The cap shall consist of no more than 2 pieces.
d. Two-piece caps shall be positioned with the joint perpendicular to the main frame.

184. Each pier shall be capped with a solid concrete block at least 6 inches thick or a solid wood block having a nominal thickness of at least 4 inches.
a. true
b. false

185. The cap shall consist of no more than 3 pieces.
a. true
b. false

186. Two-piece caps shall be positioned with the joint perpendicular to the main frame.
a. true
b. false

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09 UDC CODE UPDATES PART 2-Quiz Answer Sheet

1	a	b	c	d	41	a	b	c	d	81	a	b	c	d
2	a	b	c	d	42	a	b	c	d	82	a	b	c	d
3	a	b	c	d	43	a	b	c	d	83	a	b	c	d
4	a	b	c	d	44	a	b	c	d	84	a	b	c	d
5	a	b	c	d	45	a	b	c	d	85	a	b	c	d
6	a	b	c	d	46	a	b	c	d	86	a	b	c	d
7	a	b	c	d	47	a	b	c	d	87	a	b	c	d
8	a	b	c	d	48	a	b	c	d	88	a	b	c	d
9	a	b	c	d	49	a	b	c	d	89	a	b	c	d
10	a	b	c	d	50	a	b	c	d	90	a	b	c	d
11	a	b	c	d	51	a	b	c	d	91	a	b	c	d
12	a	b	c	d	52	a	b	c	d	92	a	b	c	d
13	a	b	c	d	53	a	b	c	d	93	a	b	c	d
14	a	b	c	d	54	a	b	c	d	94	a	b	c	d
15	a	b	c	d	55	a	b	c	d	95	a	b	c	d
16	a	b	c	d	56	a	b	c	d	96	a	b	c	d
17	a	b	c	d	57	a	b	c	d	97	a	b	c	d
18	a	b	c	d	58	a	b	c	d	98	a	b	c	d
19	a	b	c	d	59	a	b	c	d	99	a	b	c	d
20	a	b	c	d	60	a	b	c	d	100	a	b	c	d
21	a	b	c	d	61	a	b	c	d	101	a	b	c	d
22	a	b	c	d	62	a	b	c	d	102	a	b	c	d
23	a	b	c	d	63	a	b	c	d	103	a	b	c	d
24	a	b	c	d	64	a	b	c	d	104	a	b	c	d
25	a	b	c	d	65	a	b	c	d	105	a	b	c	d
26	a	b	c	d	66	a	b	c	d	106	a	b	c	d
27	a	b	c	d	67	a	b	c	d	107	a	b	c	d
28	a	b	c	d	68	a	b	c	d	108	a	b	c	d
29	a	b	c	d	69	a	b	c	d	109	a	b	c	d
30	a	b	c	d	70	a	b	c	d	110	a	b	c	d
31	a	b	c	d	71	a	b	c	d	111	a	b	c	d
32	a	b	c	d	72	a	b	c	d	112	a	b	c	d
33	a	b	c	d	73	a	b	c	d	113	a	b	c	d
34	a	b	c	d	74	a	b	c	d	114	a	b	c	d
35	a	b	c	d	75	a	b	c	d	115	a	b	c	d
36	a	b	c	d	76	a	b	c	d	116	a	b	c	d
37	a	b	c	d	77	a	b	c	d	117	a	b	c	d
38	a	b	c	d	78	a	b	c	d	118	a	b	c	d
39	a	b	c	d	79	a	b	c	d	119	a	b	c	d
40	a	b	c	d	80	a	b	c	d	120	a	b	c	d

09 UDC CODE UPDATES PART 2-Quiz Answer Sheet

121	a	b	c	d	143	a	b	c	d	165	a	b	c	d
122	a	b	c	d	144	a	b	c	d	166	a	b	c	d
123	a	b	c	d	145	a	b	c	d	167	a	b	c	d
124	a	b	c	d	146	a	b	c	d	168	a	b	c	d
125	a	b	c	d	147	a	b	c	d	169	a	b	c	d
126	a	b	c	d	148	a	b	c	d	170	a	b	c	d
127	a	b	c	d	149	a	b	c	d	171	a	b	c	d
128	a	b	c	d	150	a	b	c	d	172	a	b	c	d
129	a	b	c	d	151	a	b	c	d	173	a	b	c	d
130	a	b	c	d	152	a	b	c	d	174	a	b	c	d
131	a	b	c	d	153	a	b	c	d	175	a	b	c	d
132	a	b	c	d	154	a	b	c	d	176	a	b	c	d
133	a	b	c	d	155	a	b	c	d	177	a	b	c	d
134	a	b	c	d	156	a	b	c	d	178	a	b	c	d
135	a	b	c	d	157	a	b	c	d	179	a	b	c	d
136	a	b	c	d	158	a	b	c	d	180	a	b	c	d
137	a	b	c	d	159	a	b	c	d	181	a	b	c	d
138	a	b	c	d	160	a	b	c	d	182	a	b	c	d
139	a	b	c	d	161	a	b	c	d	183	a	b	c	d
140	a	b	c	d	162	a	b	c	d	184	a	b	c	d
141	a	b	c	d	163	a	b	c	d	185	a	b	c	d
142	a	b	c	d	164	a	b	c	d	186	a	b	c	d

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