

Wall Bracing Examples:



Building #1
One-Story

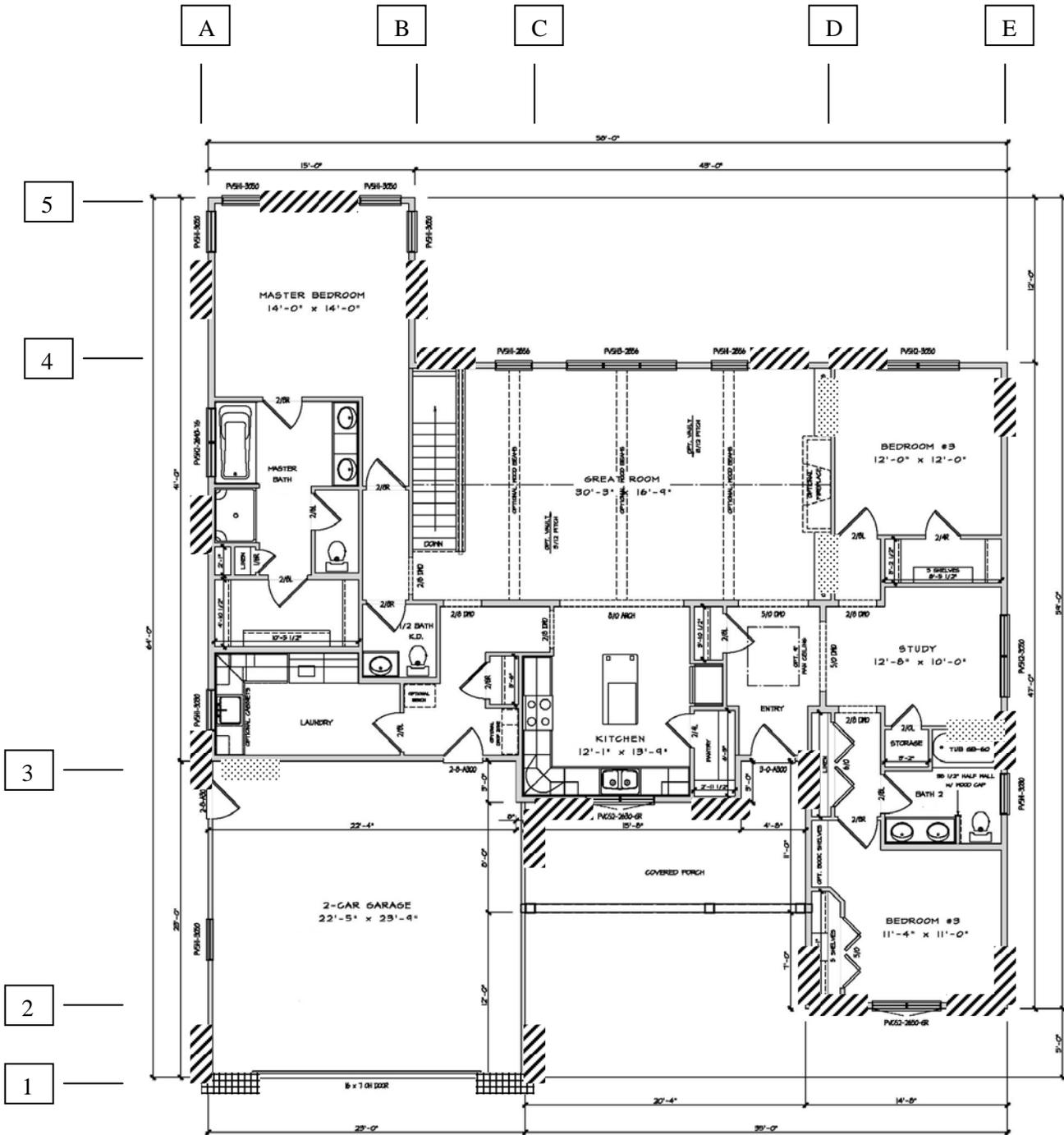
Front Elevation

21.25(8) & (9)

 Continuously- sheathed per s. Comm 21.25(9)(c)5., Fig. 21.25-K, W/2 foot return.

 Four Feet of Wood Structural Panel Sheathing or Diagonal Bracing.

 Four Feet of Gypsum Wallboard Applied to Both Sides of Wall or Diagonal Bracing.



Building #1

One-Story

First Floor

Steps used to determine wall bracing for Bldg. # 1

[Note: This plan and selected bracing solutions were presented at the winter 2009 building inspector association sponsored UDC training sessions. Alternative wall bracing solutions have been provided in this example analysis.]

1. Find braced wall lines in exterior walls using analysis such as the plan north-south and east-west grid line pattern. Braced wall lines may include walls that are offset no more than 4 feet. [Comm 21.25(8)(e)]

2. Check the width of the building to determine whether or not an interior braced wall line is needed. (Spaced no more than 35 ft. apart, or up to 50 ft., with conditions.) [Comm 21.25(8)(e)1. & 2.]

3. Grid Line # 1

- First check to see if you can comply with the wall bracing provisions of Comm 21.25(8) for 4 ft. wide panels or let-in bracing. This wall does not have the 4 ft. wide space available on either side of the garage door.
- An option, as identified on the plan, would be to use the continuously sheathed method of Comm 21.25(9)(c), Fig. 21.25-K with 2 ft. returns.
 - If the garage wall height is 9 ft., this design with the 3" nailing pattern and sheathing overlapping the header permits you to have sheathing on the sides of the garage door opening of 18" minimum. OK
 - The percent of braced wall panels provided shall be checked for conformance with Comm 21.25(9)(c)5.c., Table 21.25-H. The length required for this wall line would be $23 \text{ ft.} \times 0.16 = 3.68 \text{ ft.}$ OK.
 - Be reminded that the corners at the end of this braced wall line will have to be constructed in accordance with Fig 21.25-G.
- Another option to consider is Comm 21.25(8)(c)2.c., Table 21.25-G. If the wall height of the garage is 9 ft., braced wall panels could be reduced from 48" to 42" in width. If 42" width is provided, then the continuously sheathed method with 3" nailing pattern and 2 ft. returns would not be needed. This would still meet the percentage requirements of Tables 21.25-G and 21.25-H. [$23 \text{ ft.} \times 0.16 = 3.68 \text{ ft.}$ The effective length of 36 inches from Table 21.25-G $\times 2 \text{ sides} = 72" \text{ or } 6 \text{ ft.} > 3.68 \text{ ft.}$ OK]

4. Grid Line # 2 - Provide 4 ft. wide panels or let-in bracing within 12.5 feet of each end.

5. Grid Line # 3 - This grid line contains interior and exterior wall segments that are offset no more than 4 ft. from the braced wall line. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center. As this is no more than 35 ft. from grid line #1 and grid line #4 this satisfies the maximum 35 ft. braced wall line spacing requirements. Note: Grid line # 4 was used for this spacing determination instead of grid line #5 as it is that exterior wall that has the majority of the braced wall panels to resist the wind loads.

6. Grid Line # 4 - Provide 4 ft. wide panels or let-in bracing within 12.5 ft. of each end and a maximum of 25 ft. on-center.

7. Grid Line # 5 - Provide 4 ft. wide panels or let-in bracing within 12.5 feet of each end. The plan shows two of 4 ft. wide panels. The code may be met by using just one panel in the center of the braced wall line as this would be within 12.5 ft. of each end. The single panel would also meet the percentage requirements of Table 21.25-H. [$15 \text{ ft.} \times 0.16 = 2.4 \text{ ft.} < 4 \text{ ft.}$ provided.]

8. Grid Line A

- Provide 4 ft. wide panels within 12.5 ft. of each end and a maximum of 25 ft. on-center.
- Note: The plans show that let-in/diagonal bracing can be used in this braced wall line. After further review and consideration it has been determined that let-in bracing can not be used because this is a braced wall line that exceeds the 35 ft. braced wall line spacing requirement (grid lines A and D) resulting in a need for a check of an added amount of wall bracing required by Comm 21.25(8)(c)2. The use of grid lines B and C could not be considered in that spacing check above, as they do not extend to within 12.5 ft. of each endwall.
- Determine percent wall bracing required. Since the distance between braced walls lines A and D is 46 feet the required percentage would be $(46 \text{ ft.}/35 \text{ ft.} \times 0.16) \times 64 \text{ ft.}$ wall length = 13.5 ft. < 16 ft. provided. OK.

9. Grid Line B - Provide a 4 ft. wide panel within 12.5 ft. of each end.

10. Grid Line C - Provide 4 ft. wide panels within 12.5 ft. of each end. A single panel centered in the braced wall line would meet this requirement. Note, though, that a 2 ft. return may be required at the overhead garage door and the 4 ft. panel at the end would serve a dual purpose.

11. Grid Line D

- This grid line contains interior and exterior wall segments that are offset no more than 4 ft. from the braced wall line. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center.
- Note: The plans show that let-in/diagonal bracing can be used in this braced wall line. After further review and consideration it has been determined that let-in bracing can not be used because this is a braced wall line exceeding 35 ft. braced wall line spacing requirement (grid lines A and D) resulting in a check of an added amount of wall bracing required by Comm 21.25(8)(c)2.
- Determine percent wall bracing required. Since the distance between braced walls lines A and D is 46 feet the required percentage would be $(46 \text{ ft.}/35 \text{ ft.} \times 0.16) \times 47 \text{ ft.}$ wall length = 9.9 ft. < 16 ft. provided. OK.

12. Grid Line E - Provide 4 ft. wide panels or let-in bracing within 12.5 feet of each end and a maximum of 25 ft. on-center.

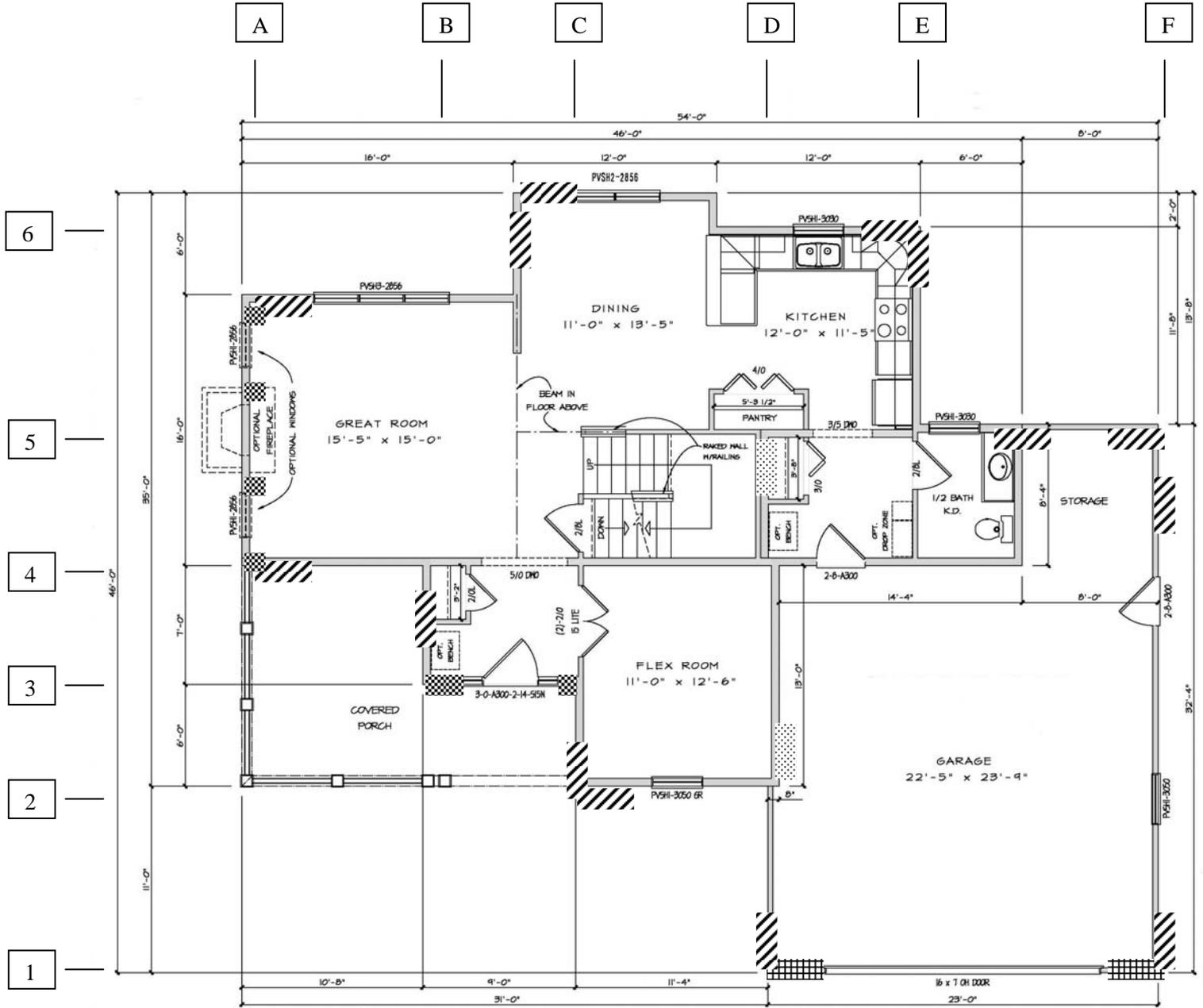


Building #2
Two-Story

Front Elevation

Analysis on the following pages is shown with first floor and then second floor, which may not be normal for the order of analysis used in plan examination that follows load path from point of origin through load-resisting elements down to the foundation as required by Comm 21.02(1) language. The order of the analysis is not typically as important as the completeness of that analysis to assure minimum code compliance.

-  Continuously- sheathed per s. Comm 21.25(9)(c)5., Fig. 21.25-K, W/2 foot return.
-  Four Feet of Wood Structural Panel Sheathing or Diagonal Bracing.
-  Continuously- sheathed per s. Comm 21.25(9)(c) 2.&3., W/2 foot return.
-  Four Feet of Gypsum Wallboard Applied to Both Sides of Wall or Diagonal Bracing.



Building #2
Two-Story

First Floor

Steps used to determine wall bracing for Bldg. # 2

[Note: These plans and selected bracing solutions were presented at the winter 2009 building inspector association sponsored UDC training sessions. Alternative wall bracing solutions have been provided in this example analysis.]

1. Find braced wall lines in exterior walls using analysis such as the plan north-south and east-west grid line pattern. Braced wall lines may include walls that are offset no more than 4 ft. [Comm 21.25(8)(e)]
2. Check the width of the building to determine whether or not an interior braced wall line is needed. (Spaced no more than 35 ft. apart, or up to 50 ft., with conditions.) [Comm 21.25(8)(e)1. & 2.]

Steps used to determine wall bracing for Bldg. # 2, First Floor

3. Grid Line # 1

- First check to see if you can comply with the wall bracing provisions of Comm 21.25(8) for 4 ft. wide panels or let-in bracing. This wall does not have the 4 ft. wide space available on either side of the garage door.
- An option, as identified on the plan, would be to use the continuously sheathed method of Comm 21.29(9)(c), Fig. 21.25-K with 2 ft. returns.
 - If the garage wall height is 9 ft., this design with the 3" nailing pattern and sheathing overlapping the header permits you to have sheathing on the sides of the garage door opening of 18" minimum. OK
 - The percent of braced wall panels provided shall be checked for conformance with Comm 21.25(9)(c)5.c., Table 21.25-H. The length required for this wall line would be $23 \text{ ft.} \times 0.16 = 3.68 \text{ ft.}$ OK.
 - Be reminded that the corners at the end of this braced wall line will have to be constructed in accordance with Fig 21.25-G.
- Another option to consider is Comm 21.25(8)(c)2.c., Table 21.25-G. If the wall height of the garage is 9 ft., braced wall panels could be reduced from 48" to 42" in width. If 42" width is provided, then the continuously sheathed method with 3" nailing pattern and 2 ft. returns would not be needed. This would still meet the percentage requirements of Tables 21.25-G and 21.25-H. [$23 \text{ ft.} \times 0.16 = 3.68 \text{ ft.}$ The effective length from Table 21.25-G of 36 in. $\times 2 \text{ sides} = 72" \text{ or } 6 \text{ ft.} > 3.68 \text{ ft.}$ OK]

4. Grid Line # 2 - Provide a 4 ft. wide panel or let-in bracing within 12.5 feet of each end.

5. Grid Line # 3.

- This wall does not have the 4 ft. wide space available on either side of the entrance door. The continuously sheathed method, as identified on the plan, will need to be used. In accordance with Table 21.25-J, the braced wall segments at the ends of this braced wall line will have to be at least 32 inches

wide and have return at the ends of at least 2 ft. [note not shown]. In addition the corners will have to be constructed in accordance with Fig. 21.25-G.

- An option, if the builder can not meet the 32” minimum braced wall panel length requirement, would be to use the continuously sheathed method of Comm 21.29(9)(c), Fig. 21.25-K with 2 ft. returns [not on shown on diagram]. The additional nailing and overlapping of sheathing over a header would permit a braced wall panel width of 16” in an 8 ft. high wall.

6. Grid Line # 4 - Provide a 4 ft. wide panel or let-in bracing within 12.5 ft. of each end.

7. Grid Line # 5 – Provide 4 ft. wide panels or let-in bracing within 12.5 ft. of each end and a maximum of 25 ft. on-center. The plan shows two of 4 ft. wide panels. The code may be met by using just one panel in the center of the braced wall line as this would be within 12.5 ft. of each end. The single panel would also meet the percentage requirements of Table 21.25-H. [$14 \text{ ft.} \times 0.16 = 2.24 \text{ ft.} < 4 \text{ ft.}$ provided.]

8. Grid Line # 6

- This grid line contains exterior wall segments that are offset no more that 4 ft. from the braced wall line. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center.
- Determine percent wall bracing required per Table 21.25-H.: $40 \text{ ft. wall length} \times 0.16 = 6.4 \text{ ft.} < 12 \text{ ft.}$ provided. OK.

9. Grid Line A [– Plan notes options, inspector should verify which is chosen as below:]

- This wall does not have the 4 ft. wide space available between the fireplace and the windows, if all were provided in this braced wall line. The continuously sheathed method was identified as an option on the plan. In accordance with Table 21.25-J, this would mean that the braced wall segments at the ends of this braced wall line will have to be at least 24 in. wide if the wall is 8 ft. in height and the windows do not take up more than 67% of the wall height.
- If this width can not be met, the fireplace will have to go if the windows are provided and, if the fireplace is provided, the windows must go. Also, if the fireplace or windows are not provided there may be enough space in the braced wall line to get a 4 ft. braced wall panel in and thus eliminating the 2 ft. returns, and specially constructed corners per Fig. 21.25-G.
- Another option may be use Comm 21.25(9)(c)5., Fig. 21.25-K with 2 ft. returns.

10. Grid Line B - Provide a 4 ft. wide panel or let-in bracing within 12.5 ft. of each end.

11. Grid Line C - Provide 4 ft. wide panels within 12.5 ft. of each end. Note that as there is a 3’-8” difference in wall line of dining room and wall line of the flex room walls as designed, this can qualify as one wall line. With large openings in the center of this braced wall line, it would not likely to meet the 25 ft. spacing requirement, causing some additional analysis as shown in following for grid D.

12. Grid Line D

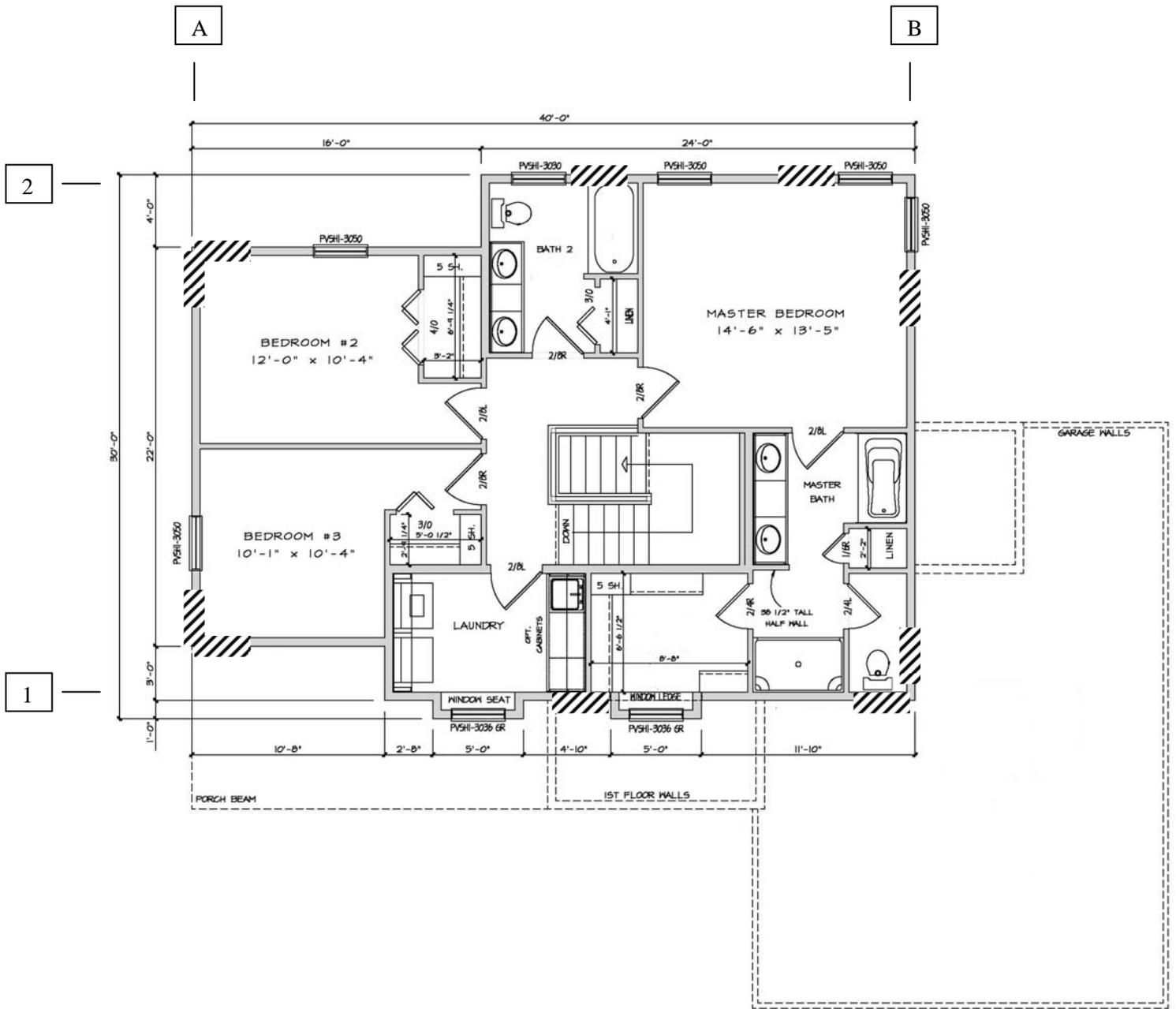
- This grid line contains interior and exterior wall segments that are offset no more than 4 ft. from the braced wall line. As kitchen is only 11'-5" wide, this braced wall line meets the 12.5 ft. from kitchen exterior wall to interior braced wall gypsum sheathing between closet & stairs. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center.
- Note: The plans show that let-in/diagonal bracing can be used in this braced wall line. After further review and consideration it has been determined that let-in bracing could be used because this is a braced wall line that does not exceed the 35 ft. braced wall line spacing requirement, since the distance between braced walls lines A and D is 31 feet. OK.

13. Grid Line E - Provide a 4 ft. wide panel or let-in bracing within 12.5 ft. of each end.

14. Grid Line F - Provide 4 ft. wide panels or let-in bracing within 12.5 feet of each end and a maximum of 25 ft. on-center.

21.25(8) & (9)

Four Feet of Wood Structural Panel Sheathing or Diagonal Bracing



Building #2
Two-Story

Second Floor

Steps used to determine wall bracing for Bldg. # 2, Second Floor

1. Grid Line # 1

- This grid line contains exterior wall segments that are offset no more than 4 ft. from the braced wall line. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center.
- Determine percent wall bracing required per Table 21.25-H.: wall length 40 ft. $X 0.16 = 6.4 \text{ ft.} < 12 \text{ ft.}$ provided. OK.

2. Grid Line # 2

- This grid line contains exterior wall segments that are offset no more than 4 ft. from the braced wall line. Since this is considered one braced wall line, braced wall panels or let-in bracing must only be provided within 12.5 ft. of the ends and spaced no more than 25 ft. on center.
- Determine percent wall bracing required per Table 21.25-H.: 40 ft. wall length $X 0.16 = 6.4 \text{ ft.} < 12 \text{ ft.}$ provided. OK.

3. Grid Line A

- Provide 4 ft. wide panels within 12.5 feet of each end and a maximum of 25 ft. on-center.
- Note: The plans show that let-in/diagonal bracing can be used in this braced wall line. After further review and consideration it has been determined that let-in bracing can not be used because this is a braced wall line that exceeds the 35 ft. braced wall line spacing requirement (grid lines A and B) resulting in a need for a check of an added amount of wall bracing required by Comm 21.25(8)(c)2.
- Determine percent wall bracing required. Since the distance between braced walls lines A and B is 40 feet the required percentage would be $(40 \text{ ft.}/35 \text{ ft.} X 0.16) X 22 \text{ ft. wall length} = 4.0 \text{ ft.} < 8 \text{ ft.}$ provided. OK.

4. Grid Line B

- Provide 4 ft. wide panels within 12.5 feet of each end and a maximum of 25 ft. on-center.
- Note: The plans show that let-in/diagonal bracing can be used in this braced wall line. After further review and consideration it has been determined that let-in bracing can not be used because this is a braced wall line that exceeds the 35 ft. braced wall line spacing requirement (grid lines A and B) resulting in a need for a check of an added amount of wall bracing required by Comm 21.25(8)(c)2.
- Determine percent wall bracing required. Since the distance between braced walls lines A and B is 40 feet the required percentage would be $(40 \text{ ft.}/35 \text{ ft.} X 0.16) X 30 \text{ ft. wall length} = 5.5 \text{ ft.} < 8 \text{ ft.}$ provided. OK.