Update 10/10/08

Participation

VBCOA Fall Conference	10/23/2007	75
VBCOA Region 5	12/20/2007	50
Newport News DHCD	5/12	59
Newport News contractors	5/13	31
Blacksburg contractors	6/23	52
Roanoke DHCD	6/24	33
Chesterfield contractors	7/9	65
Henrico DHCD	7/10	62
Fredericksburg contractors	7/28	40
Fredericksburg DHCD	7/29	47
AIA/City of Alexandria	7/30	53
Chesterfield contractors	8/13	90
Chesterfield DHCD	8/14	41
Fairfax contractors	10/6	98
Falls Church DHCD	10/7	60
Virginia Beach	10/30	

Understanding Braced Walls

Section R602.10
2006 Virginia Statewide Building Code

Jack A. Proctor Virginia Building Code Academy

Department of Housing and Community Development

Was that English?

Presenters

- ***Chuck Bajnai***
  Chesterfield County
  Chief Residential Plan Reviewer
  Registered Architect
  bajnaic@chesterfield.gov

- ***Brian Foley***
  Fairfax County
  Chief Structural Engineer
  Professional Engineer
  brian.foley@fairfaxcounty.gov

Handouts and Slideshow

Virginia Building and Code Officials Association

VBCOA

www.vbcoa.org

On Line

Wanting a copy of the Power Point Wall Bracing Presentation?
We Have It

This file is a Power Point program and is quite large, about 26 mb in size. Follow the download instructions listed above and be patient. The download may take several minutes.

Wall Bracing.ppt

Please note this is only the Power Point Program. The program may ask for associated files but our server has it's limits for storage size and the full file exceeds this size.

"For handouts and other related publications, click here."

Logistics

Exits

Restrooms

Cell phones

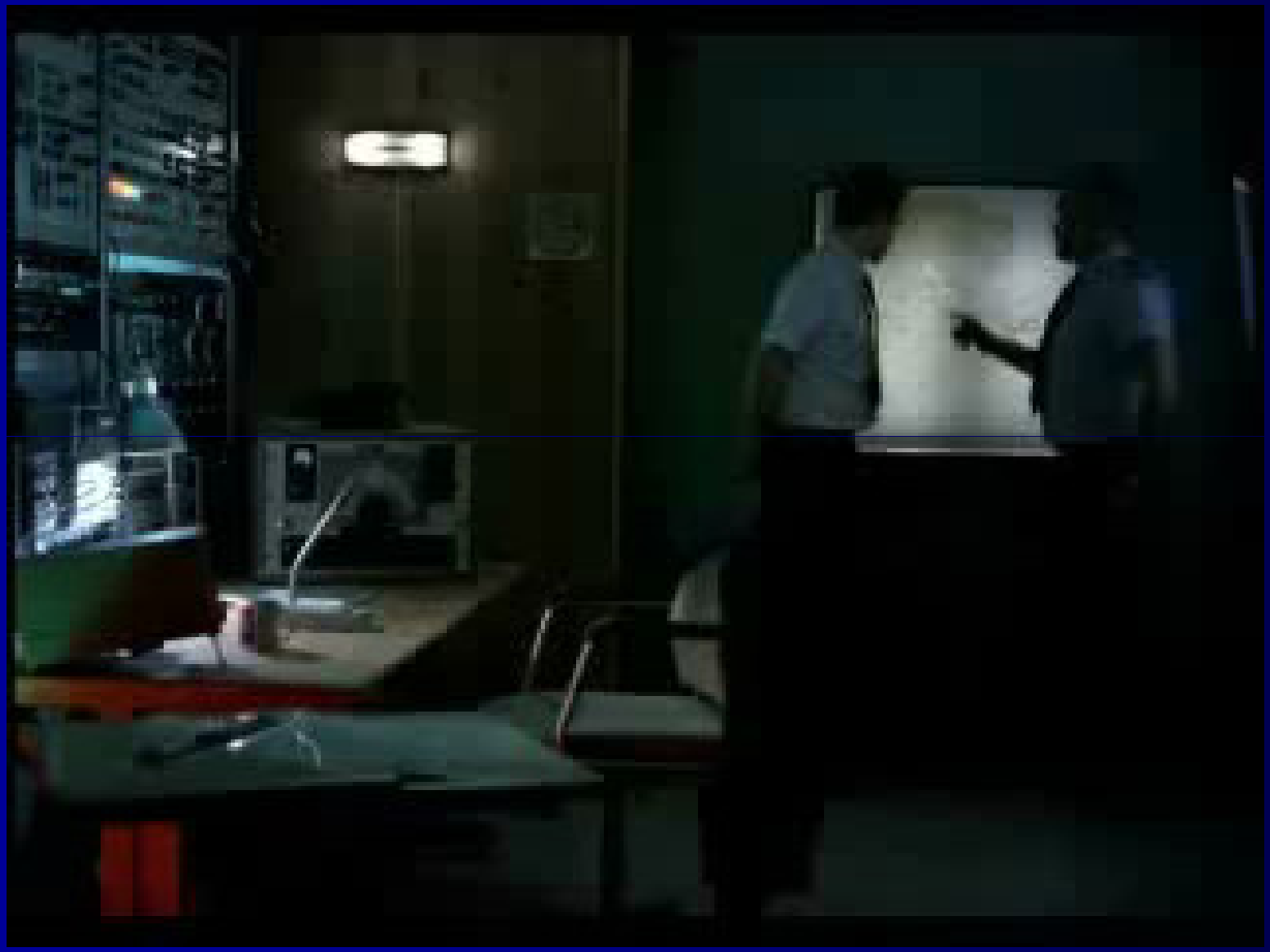
No smoking

Questions?

SURE– Go ahead and ask your question!

This class is interactive!

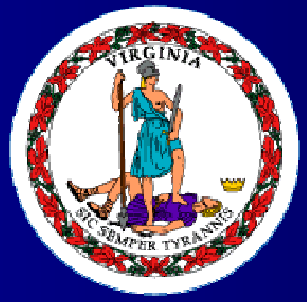
Thinking is Good!



Class Outline

Unit 1: Background
Unit 2: Horizontal Loads
Unit 3: Resisting Horizontal Loads
Unit 4: Braced Wall Lines
Unit 5: Amounts & Types of Bracing
Unit 6: Intermittent Bracing
Unit 7: Continuous Sheathing
Unit 8: Mixing Methods
Unit 9: Miscellaneous Provisions
Unit 10: Whole House Exercise

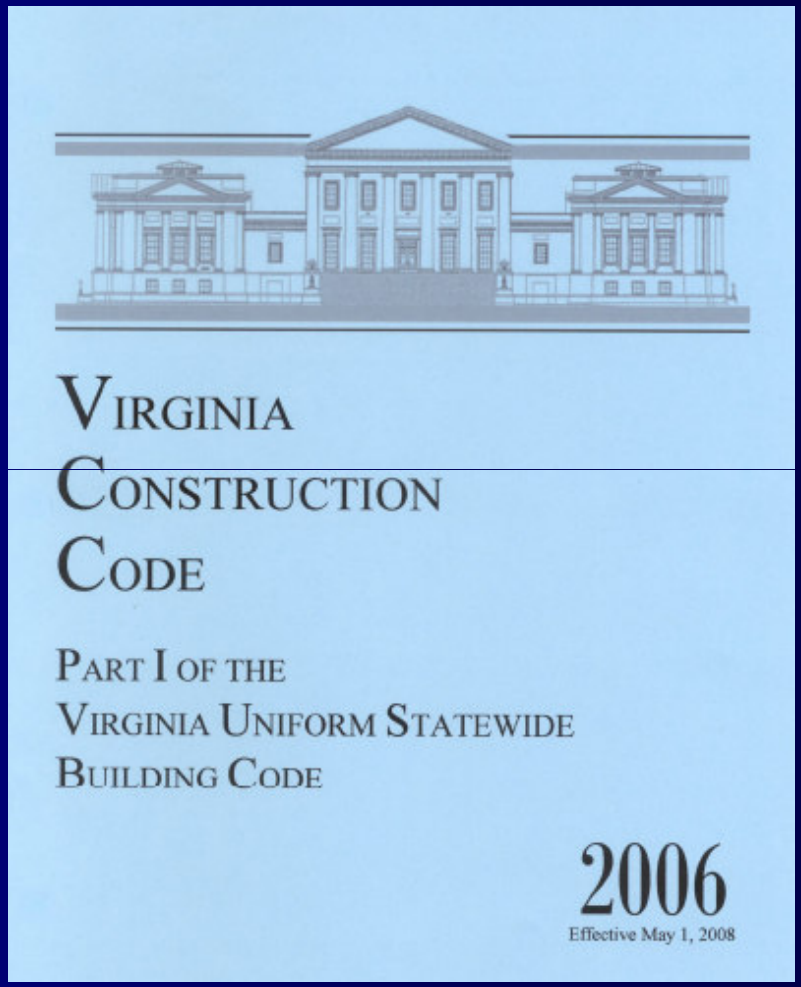
Unit 1



Background

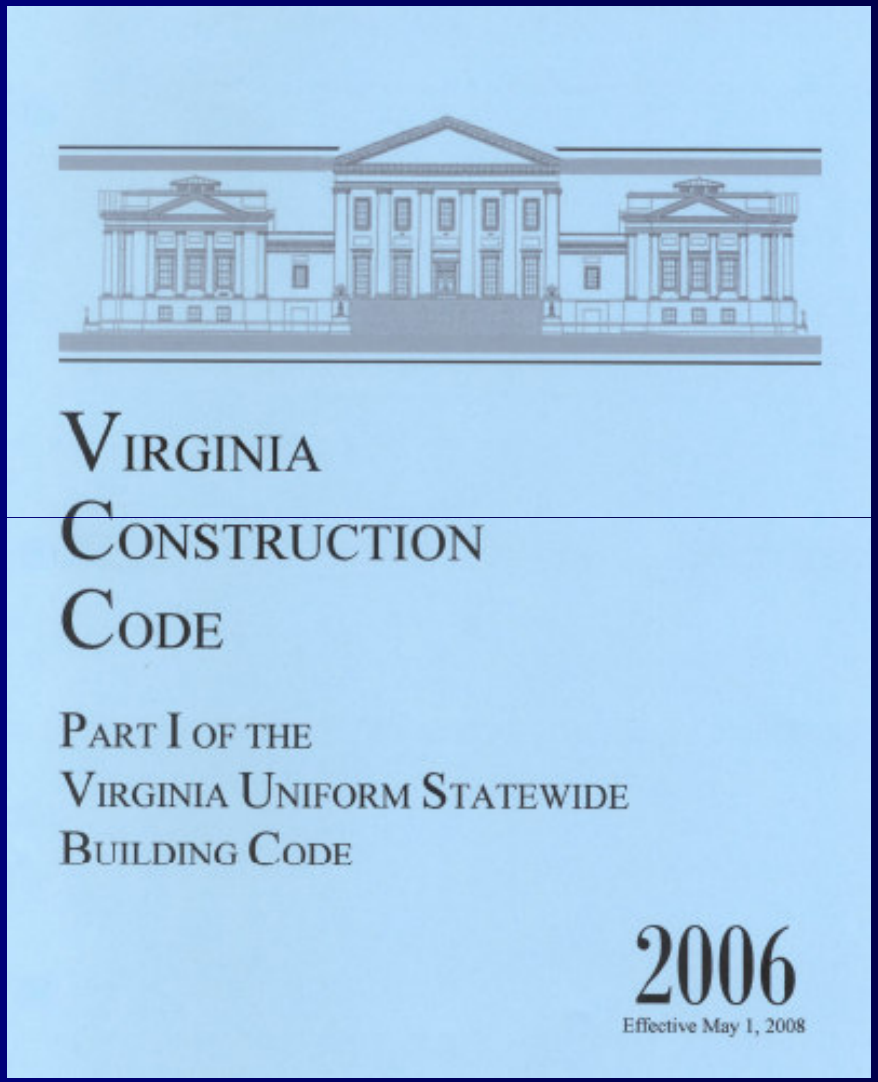
USBC Reformat

- Chartered by DHCD.
- Written by Chuck and Brian.
- Incorporates many of the changes from 2009 IRC.
- Will go back to the 2009 IRC without any Virginia amendments.



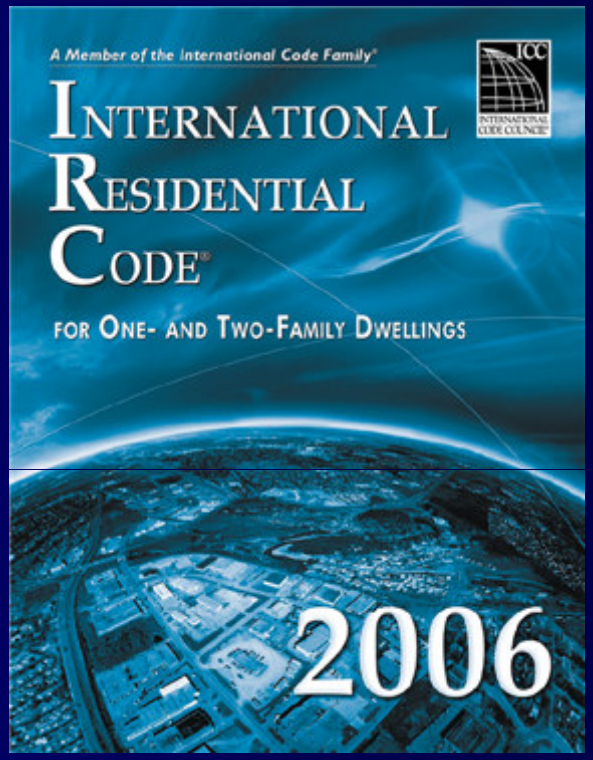
USBC – Virginia Construction Code

- VCC invokes the I-Codes.
- USBC amends I-Codes for Virginia-specific needs.



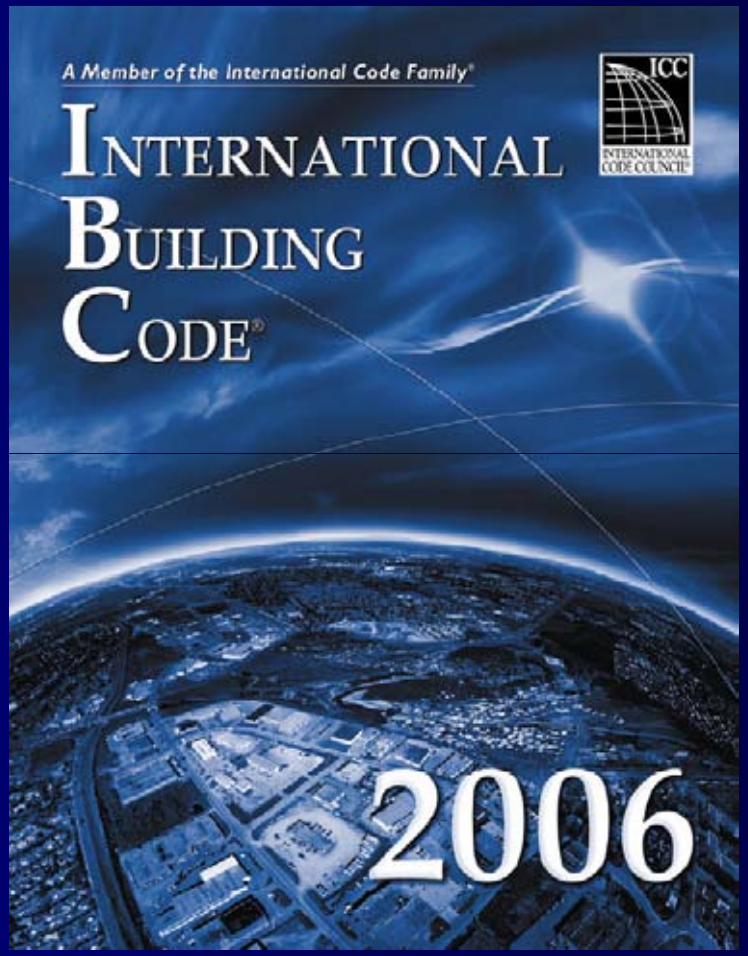
IRC - Prescriptive Code

- Answers “how?”
- Specifies materials and methods of construction.
- “Cookbook” with limits.
- Recipes based on…
  - Historical practices.
  - Typical construction methods, materials.
  - Standard house types.
- Universal
- Conservative
- It is the worst house you can legally build!



IBC - Performance Code

- Answers “why?”
- Describes minimum acceptable performance for construction.
- Allows for more creative solutions.



IRC vs IBC

IBC "medicine"

- Visit the doctor (engineer).
- Specific prescription (calculations/design).
- More $$$.

IRC "medicine"

- DIY diagnosis.
- Generic, over-the-counter remedy.
- cheaper.

Wall bracing applies to...

- **New buildings**

  includes detached structures.

- **Additions**

  includes 3 and 4 season rooms.

- **Conversions**

  includes decks and screen porches converted to Florida rooms and sunrooms.

  (Screen porches are exempt.)

Wall bracing does not applies to…

- **Screen porches.**
- **Steel or aluminum structures.**

Unit 1 - Quiz Question 1

Section R602.10 of 2006 USBC was rewritten to:

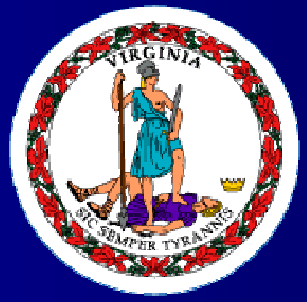
a. **Mimic the 1997 UBC.**
b. **Incorporate the wall bracing provisions in the 2007 IRC Supplement.**
c. **Mimic what will be seen in the 2009 IRC.**
d. **Mimic what might be seen in the 2012 IRC.**

Unit 1 – Quiz Question 2

Wall bracing provisions do not apply to:

a. Detached garages
b. New homes.
c. Additions.
d. Sunrooms.
e. Screen porches.

Unit 2

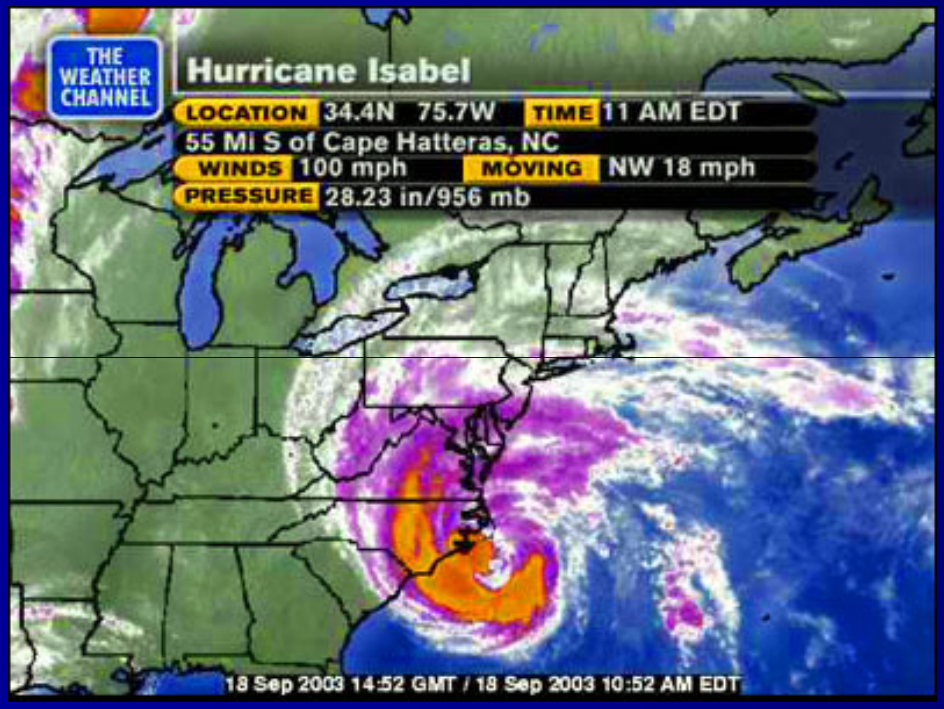


Horizontal Loads

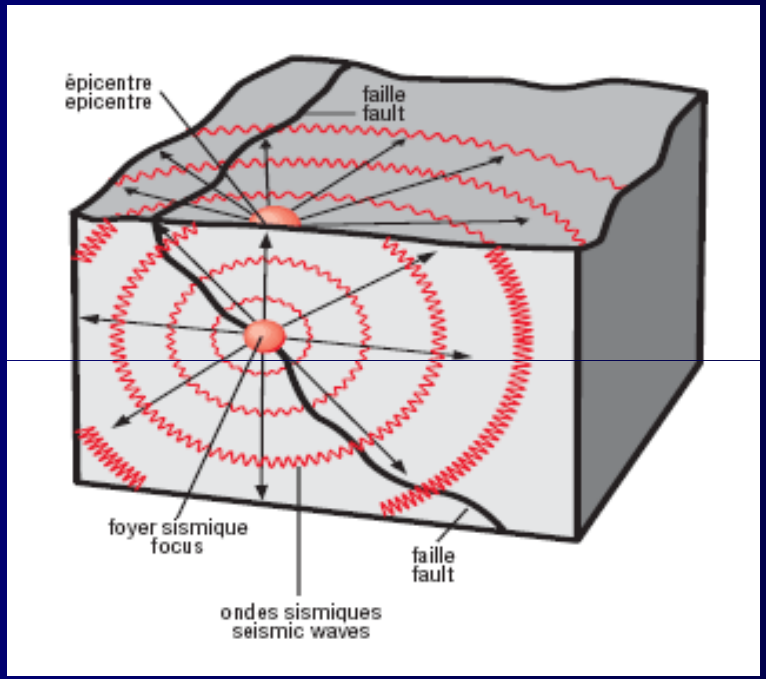
Unit 2 Topics

- Horizontal loads and load path.
- Wind speed.
- Seismic design category.
- Design trends.

Horizontal Loads



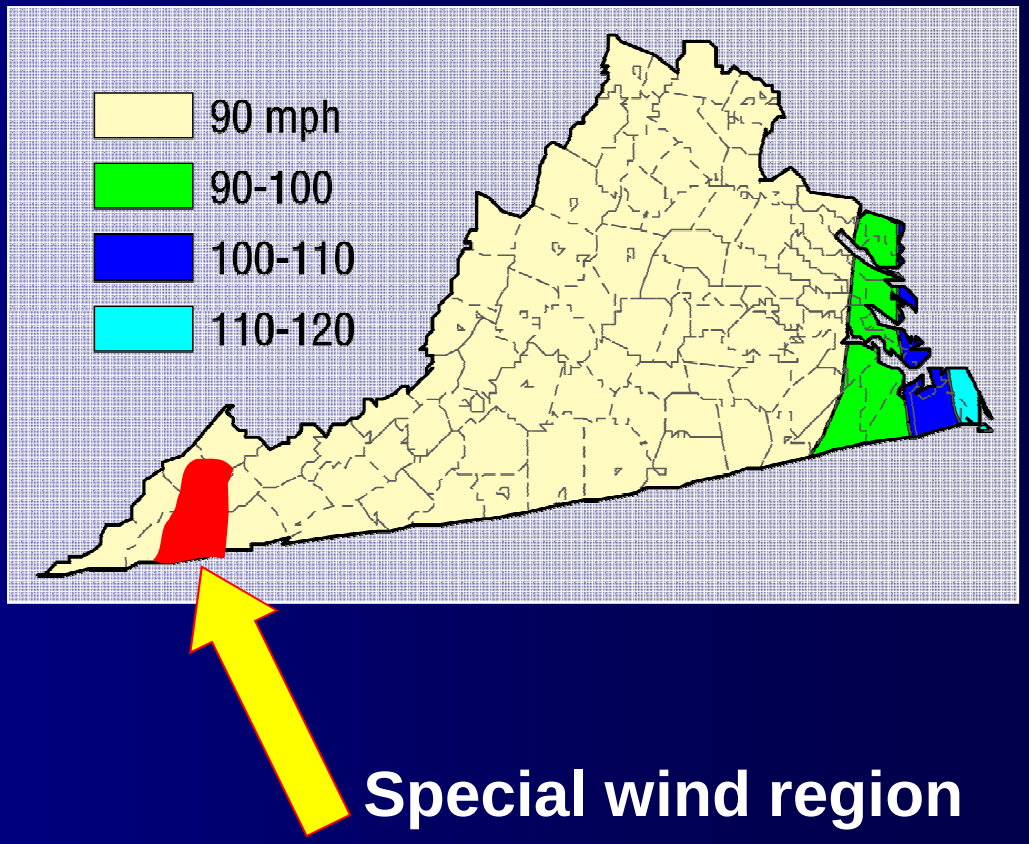
Wind Load



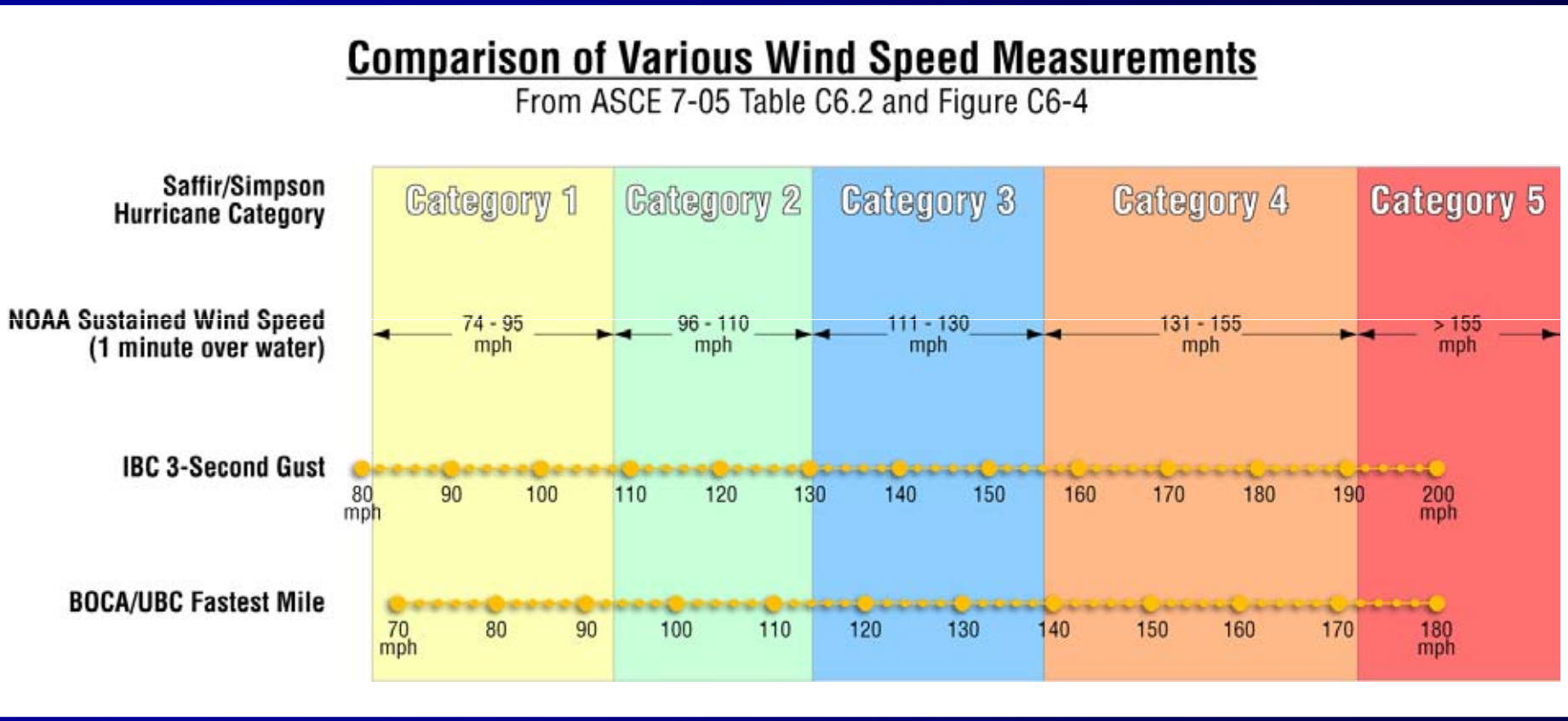
Seismic Load

Virginia Wind Speed

- **Wind speeds 90 mph – 120 mph.**
  - **3 second gust.**
  - **50 year storm.**
  - **30’ above grade.**
- **Wind speeds > 110 mph require engineered design.**



Wind Speed Comparison

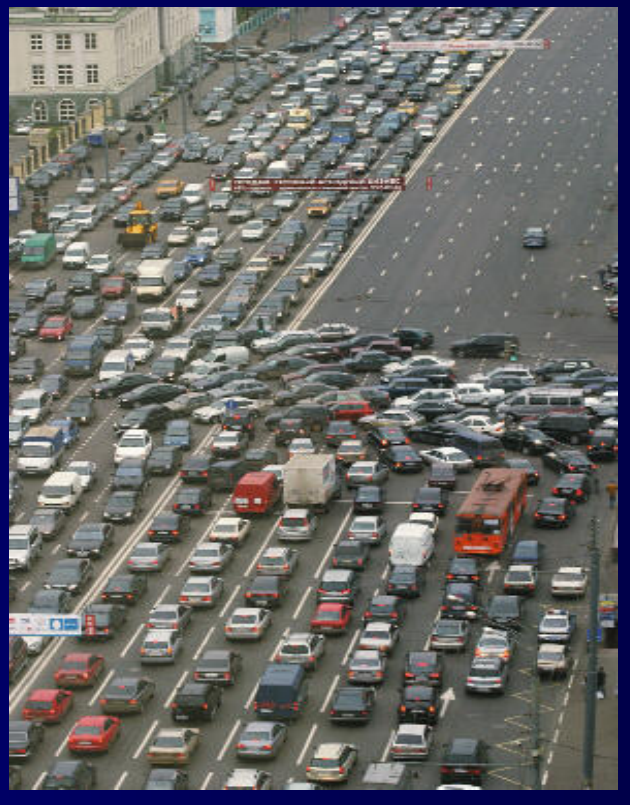


Why do we need braced walls?

Once upon a time, life was good on Route 66.

Why do we need braced walls?

Then came more cars - faster cars - and more serious accidents



Why do we need braced walls?

Seat belts were going to save us from ourselves and have been required since 1966

Why do we need braced walls?

But that wasn't enough so integral seat and shoulder belts were required.

Why do we need braced walls?

But not everybody would wear them, so a passive restraint system was required!

Even if you are a great driver, doesn't mean you wont be in an accident!

Why do we need braced walls?

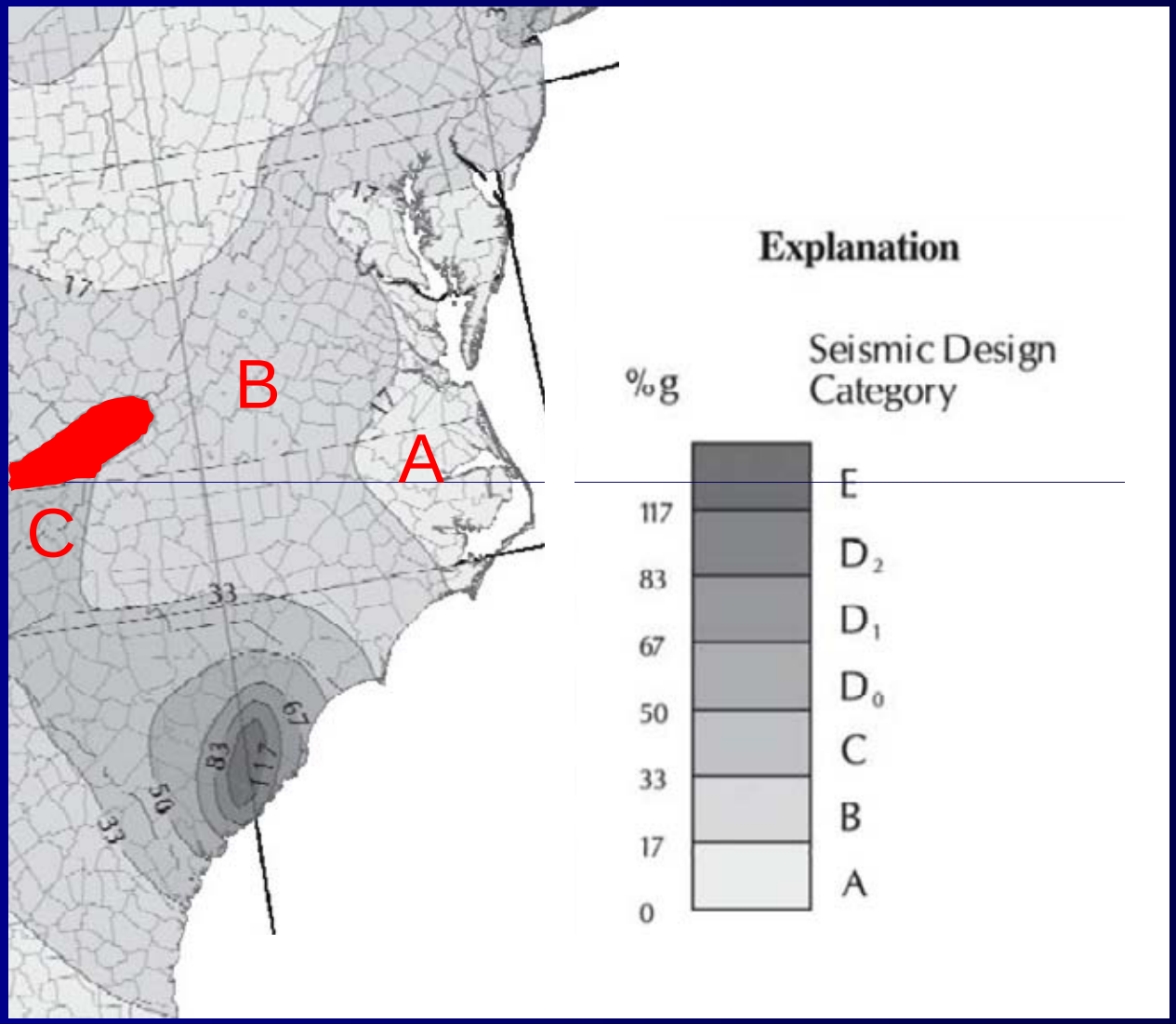
Bottom line: If you are never in an accident, safety belts and air bags are just an expensive inconvenience!

Why do we need braced walls?

Paraphrase: If your house never encounters an act of God, wall bracing is an expensive inconvenience!

Virginia Seismic Design Categories

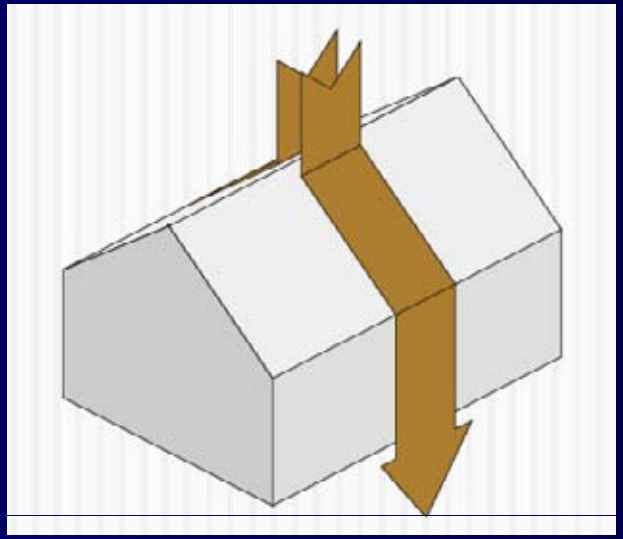
- Most of VIRGINIA is SDC A or B.
- Except a small corner of the state is SDC C.



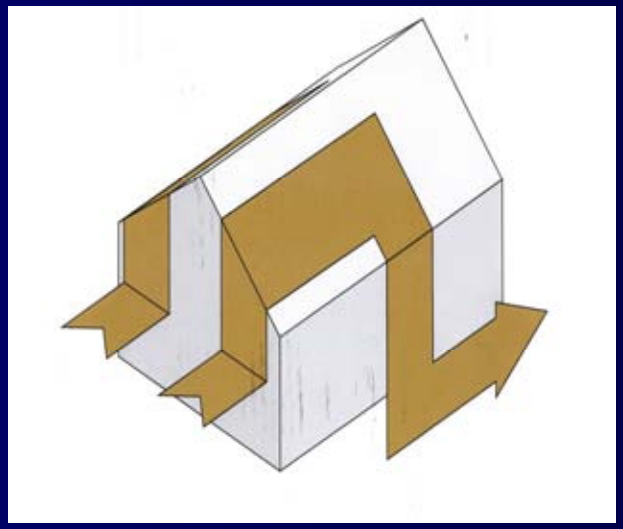
Load Path

- **Load Path:** the direction a force travels from the area where it is applied on the structure to the ground.

Vertical forces

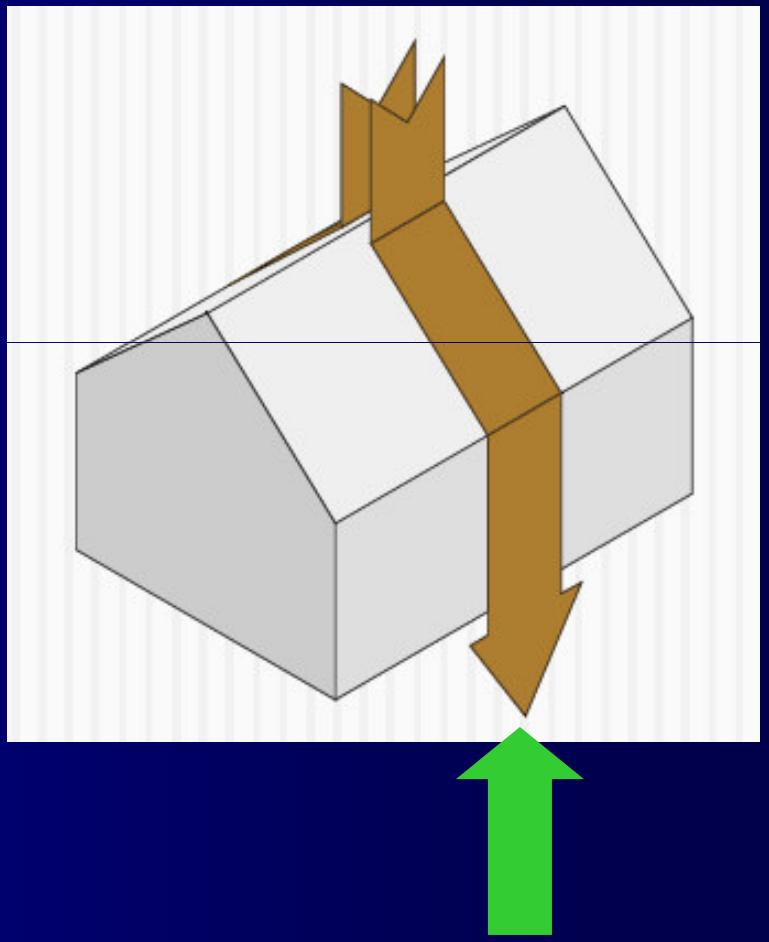


Horizontal forces



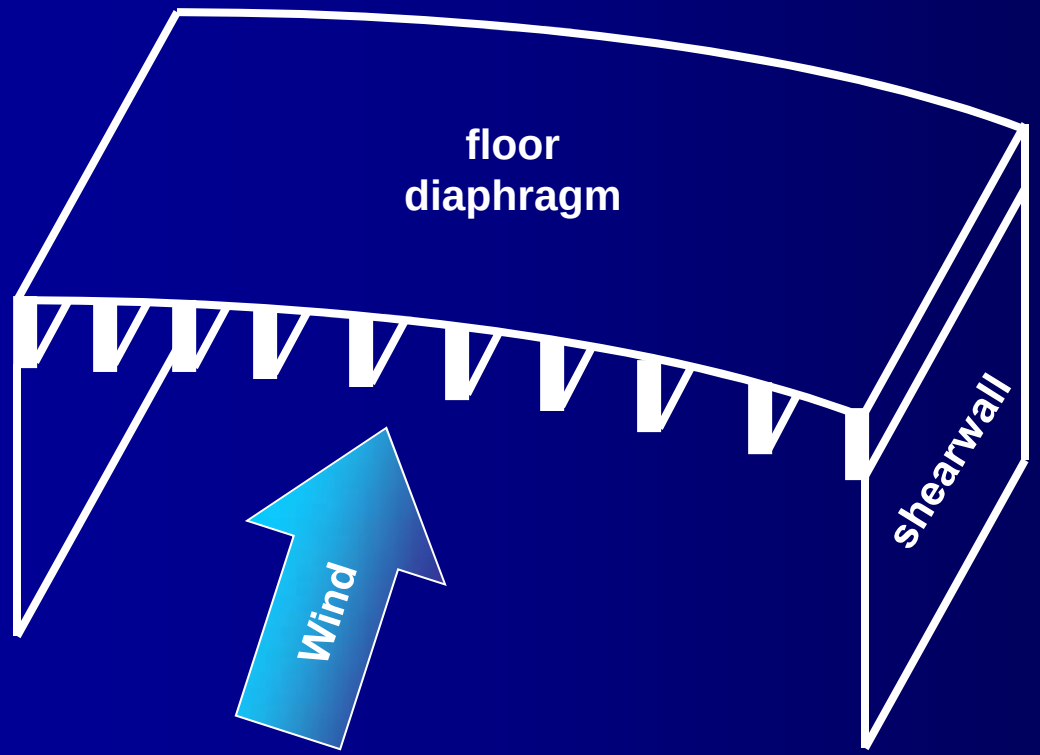
Vertical Load Path

- Vertical load path transfers snow load:
  - to roof sheathing,
  - to rafters,
  - to top plate,
  - to studs,
  - to bottom plate,
  - to foundation & footings,
  - to ground.



Diaphragm Definition

- **The floor or roof system of a building which is covered in sheathing and acts as a deep thin beam to resist horizontal load.**



Diaphragm Definition

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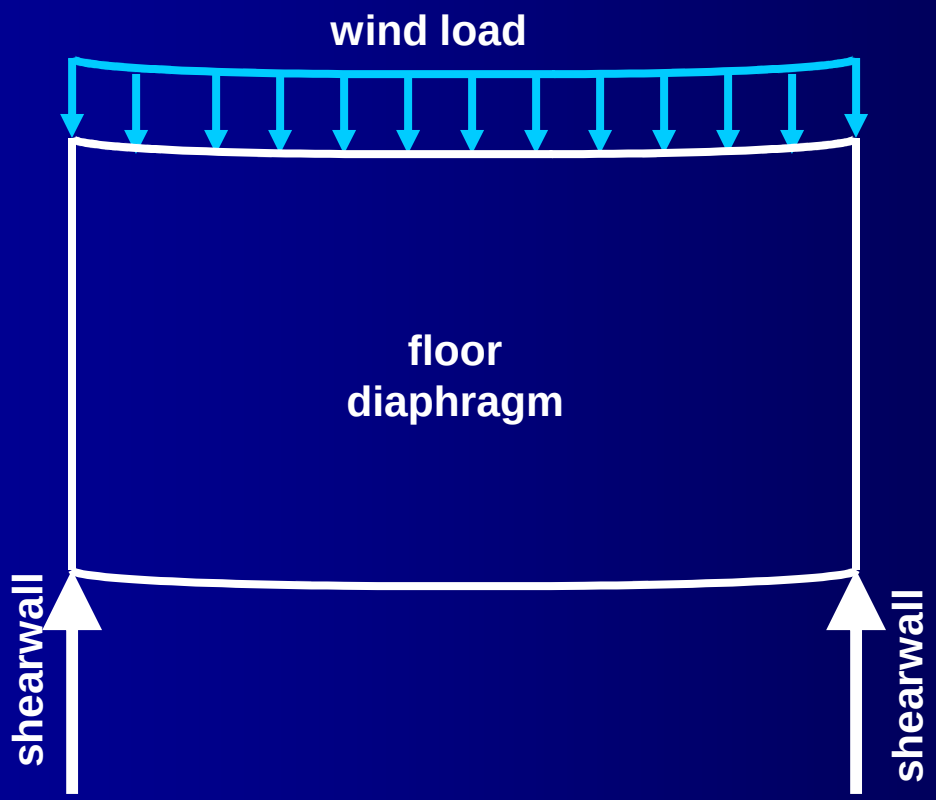
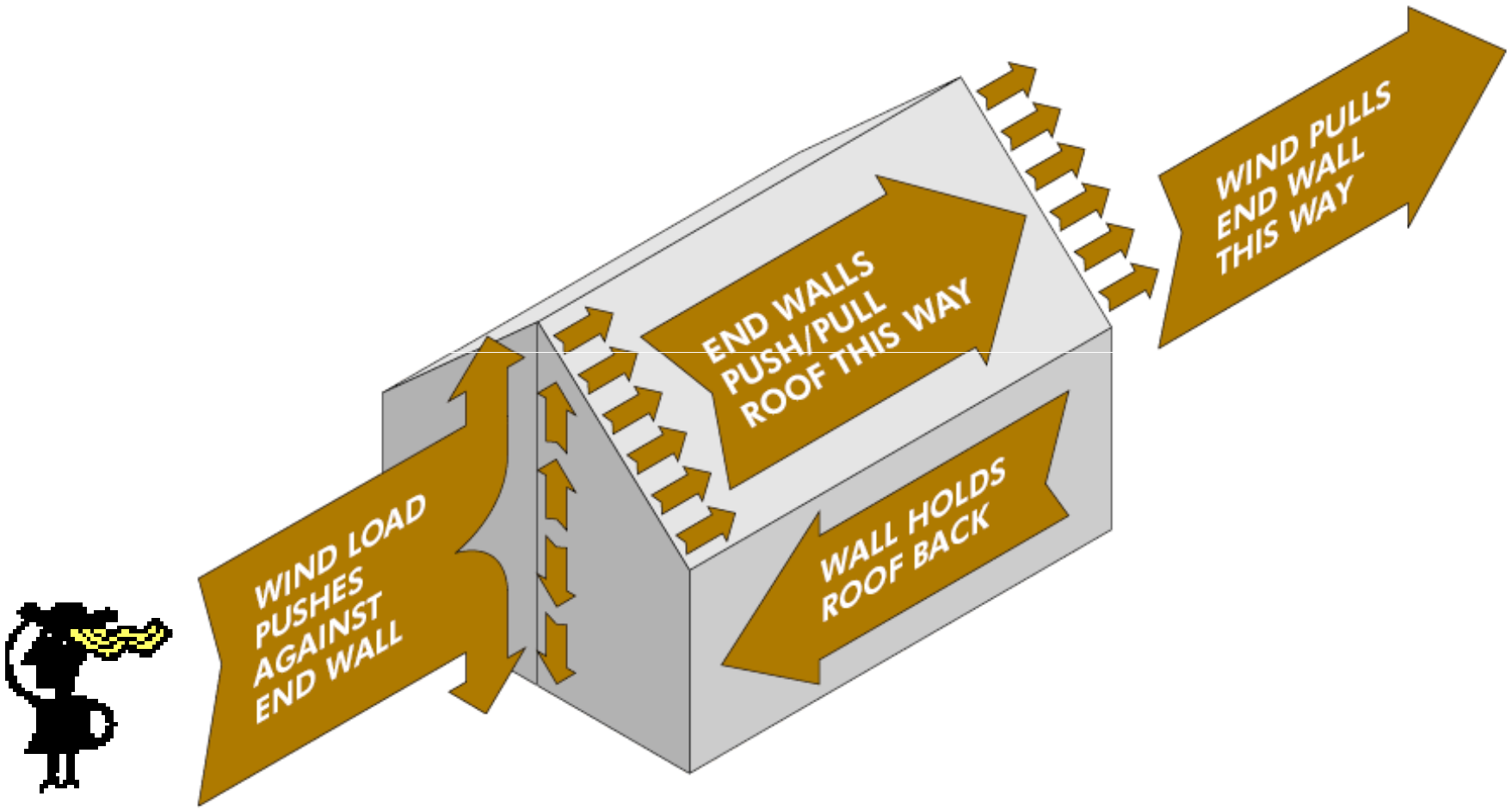


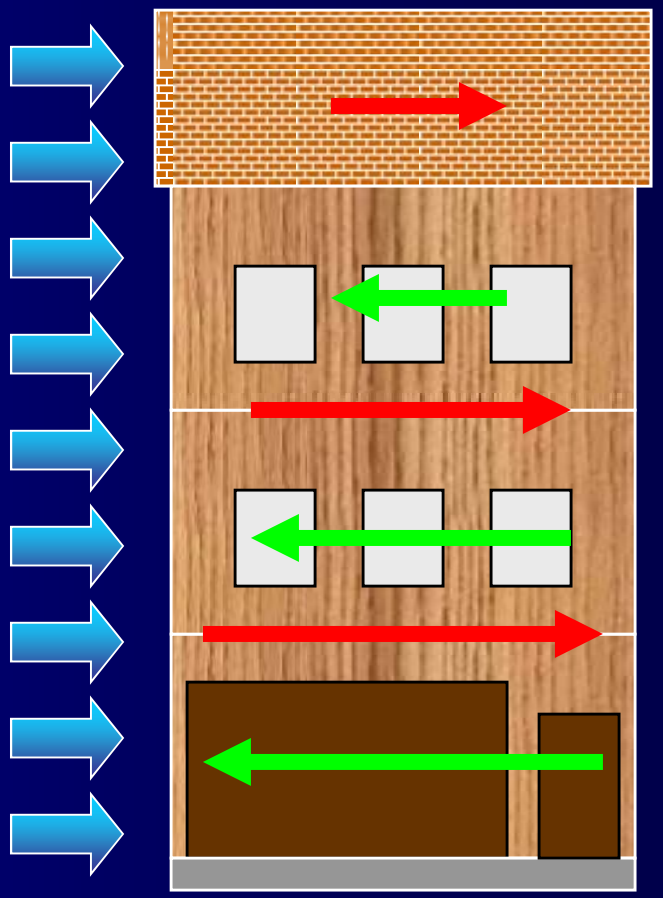
Horizontal Load Path



Multi-story House

- Accumulative process:
  - Upper stories transfer loads to diaphragms below.
  - More bracing required on lower floors.
- Where are majority of large openings?

  Bottom Floor



Design Trends

- Open floor plans.
- Open rooms.
- Two-story walls.
- More windows.

Unit 2 – Quiz Question 1

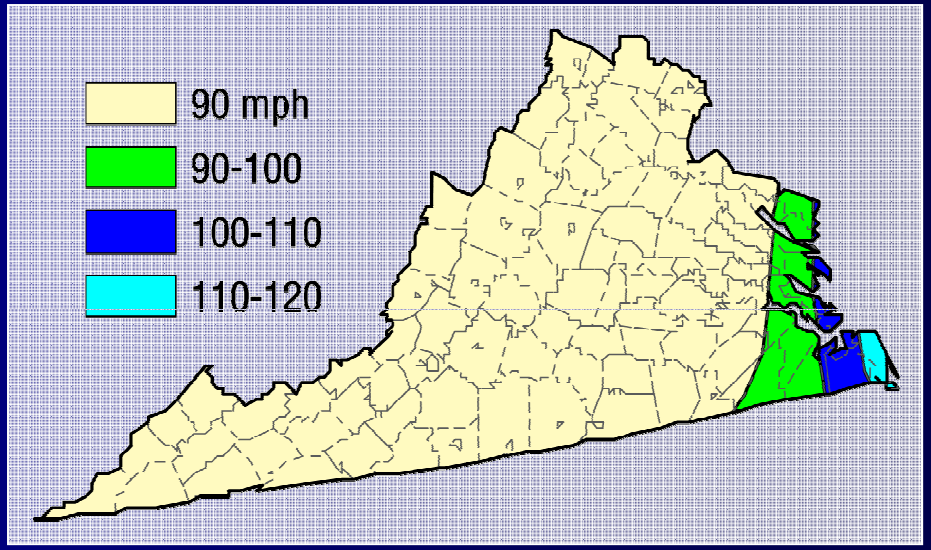
For most of Virginia, the governing horizontal load is from:

a. Dead load.

b. Seismic load.

c. Snow load.

d. Wind load.



Most of Virginia is in the 90 mph wind zone. A small portion of the west side of the state is SDC C.

Unit 2 – Quiz Question 2

The floor with the greatest accumulation of horizontal forces is:

a. Top floor.

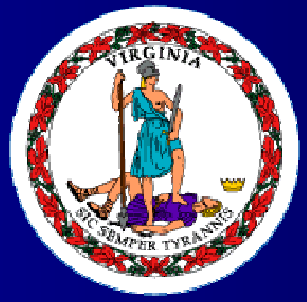
b. Middle floor.

c. Bottom floor.

d. All floors are the same.

Loads accumulate and are transferred down to the lowest floor before being resisted by the ground.

Unit 3



Resisting Horizontal Load

Unit 3 Topics

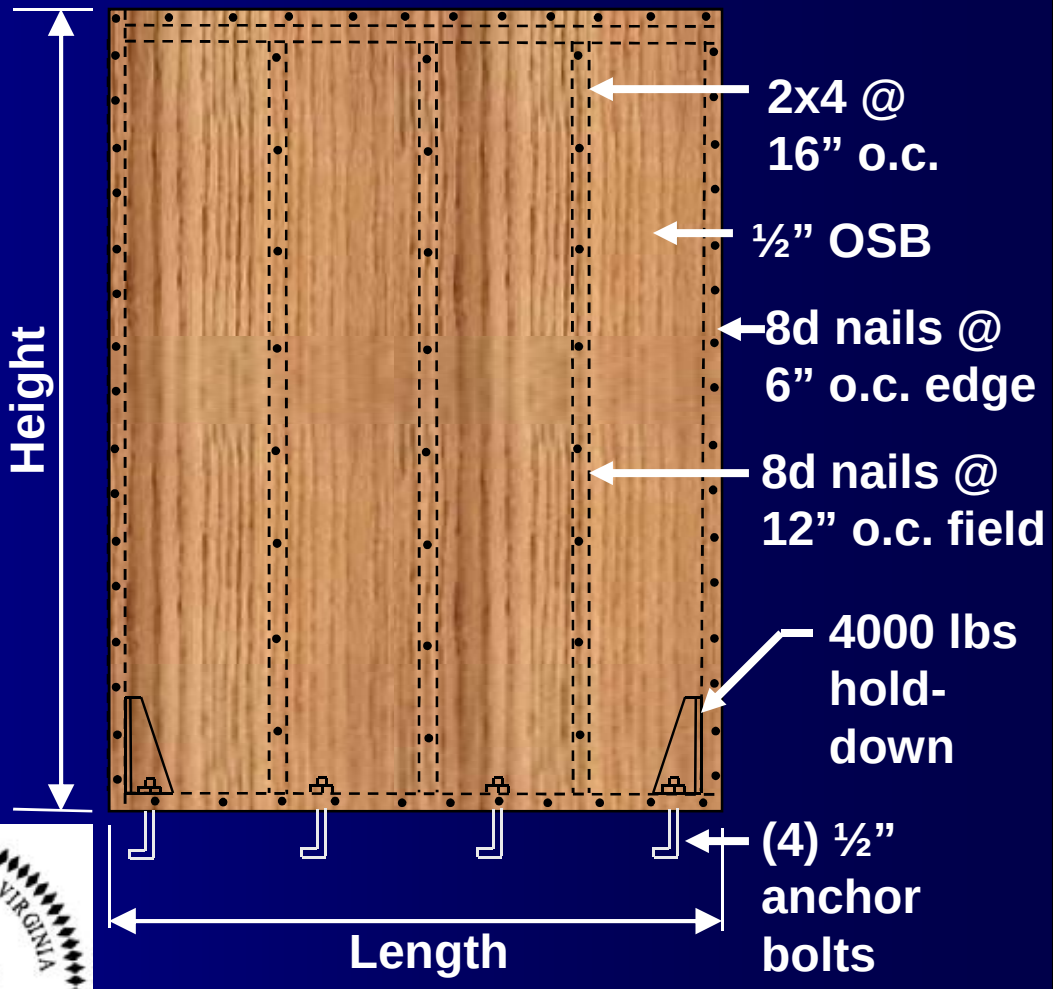
- Resisting horizontal loads.
- Failure modes due to horizontal loads.
- Engineered shearwalls.
- Braced walls.

Resist Horizontal Load

- **Three approaches to resist horizontal loads:**
  1. **Shearwalls.**
     - ***Engineered*** **solution.**
     - **Per IBC.**
  2. **Proprietary Products.**
     - ***Tested*** **solution by manufacturer.**
     - **Per ICC-ES acceptance criteria.**
  3. **Braced Walls.**
     - ***Prescriptive*** **solutions.**
     - **Per IRC.**

Engineered Shearwalls

- Engineer's design should contain:
  - Stud size & spacing.
  - Sheathing specs and nailing requirements.
  - Hold-down and/or anchor bolt info.
  - Any additional hardware, straps, blocking, etc.
  - Engineer's seal



Engineered Shearwalls

- **Remember: per IBC Table 2305.3.4 max. aspect ratio for wood structural panel shearwalls is:**

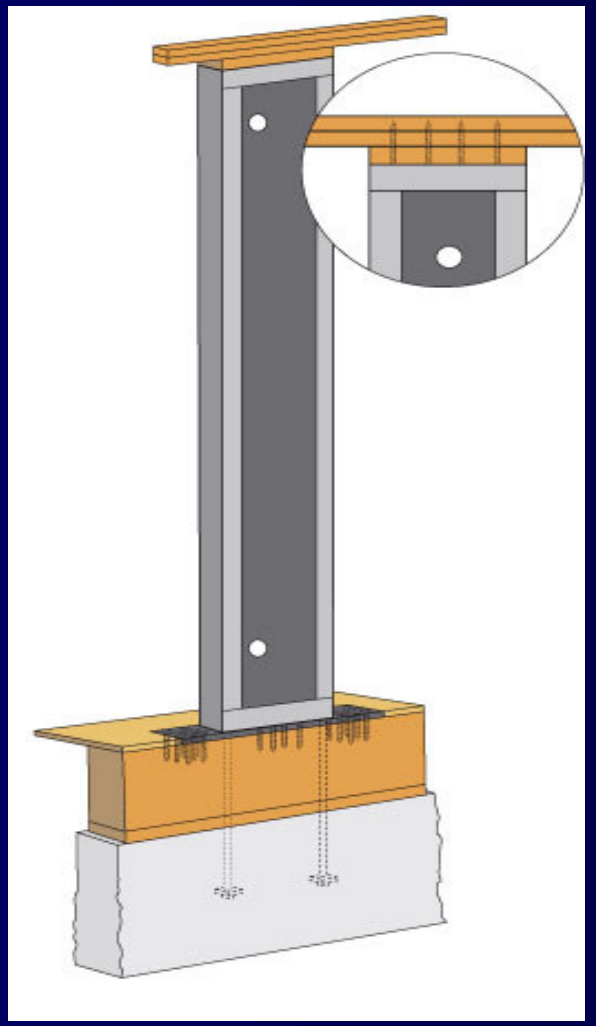
$$\frac{\text{Height}}{\text{Length}} = 3\frac{1}{2}:1$$

8’	9’	10’	11’	12’
27”	31”	34”	38”	41”

The RDP must provide calculations as deemed necessary by the code official.

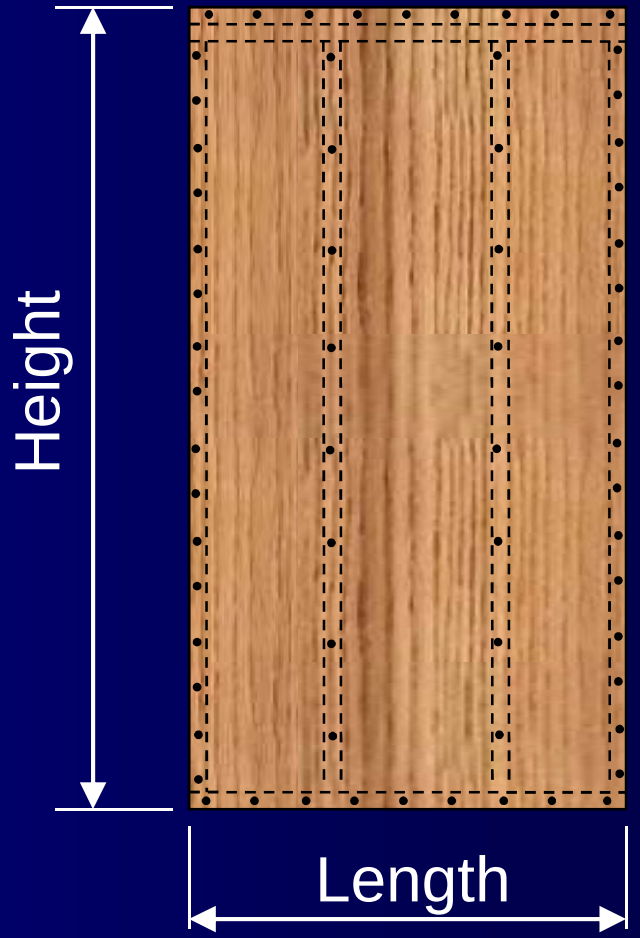
Proprietary Products

- Installation in accordance with manufacturer's requirements.

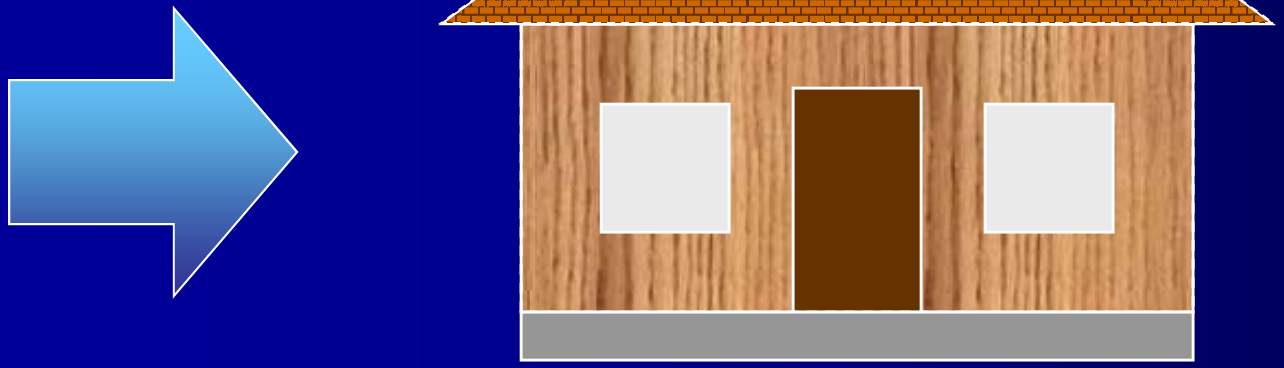


Braced Wall Panels - IRC

- **Braced wall panels (BWP) must be:**
  - **Full height of the wall.**
  - **A minimum specified length.**
  - **Placed at specific locations.**



Failure Mode: Sliding

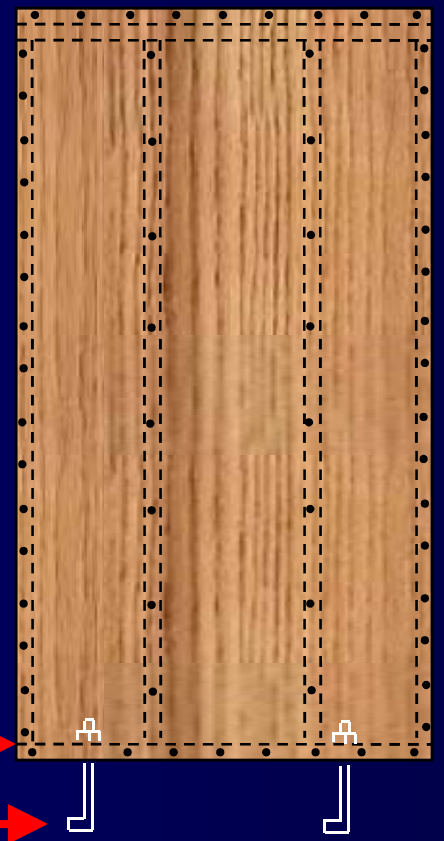


Failure Mode: Sliding

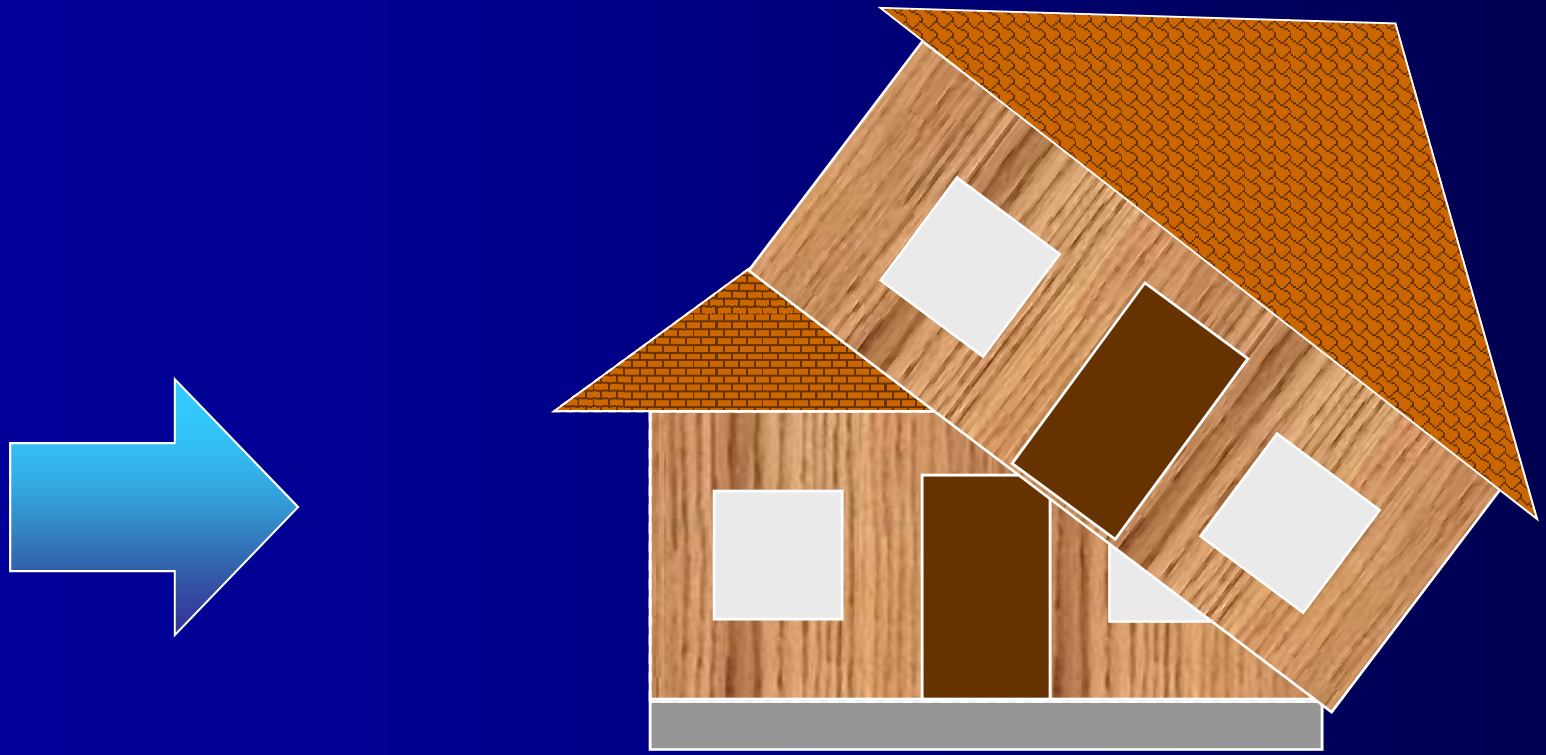
Failure Mode: Sliding

Resisting Sliding

- Sliding is resisted by:
  - The connection of the bracing material to the bottom plate.
  - The anchor bolts into the foundation.



Failure Mode: Overturning

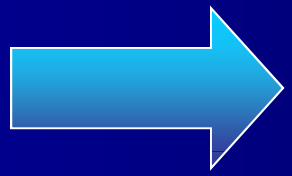


Failure Mode: Overturning

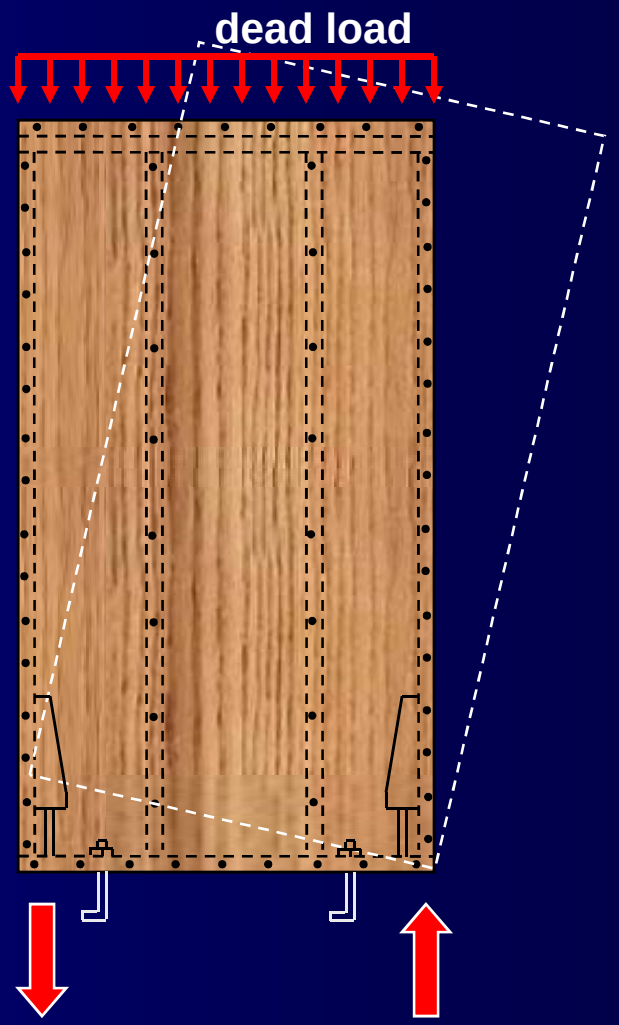
Failure Mode: Overturning

Resisting Overturning

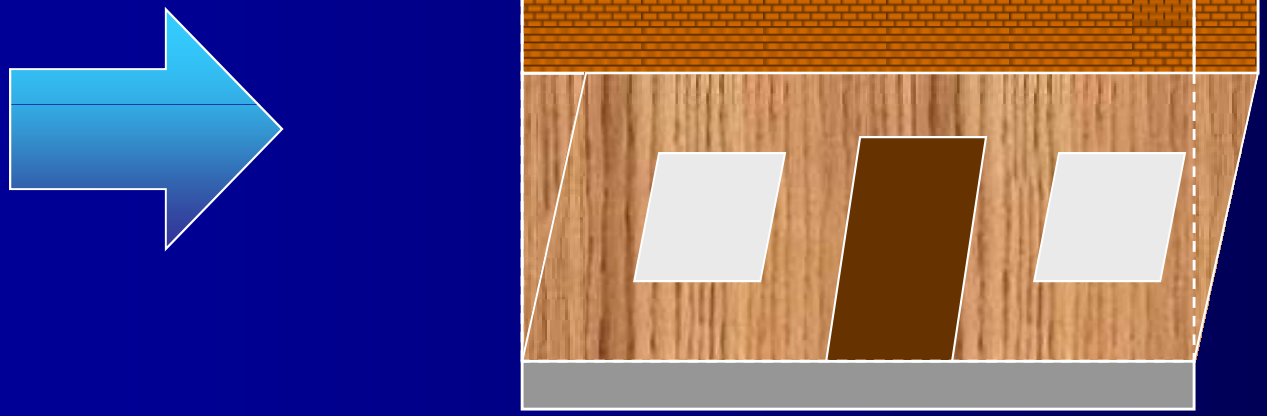
- Overturning creates the need for a restraint force at bottom of panel.



- Overturning is resisted by:
  - Anchor bolts,
  - Hold downs devices, and/or
  - Dead load above.



Failure Mode: Racking

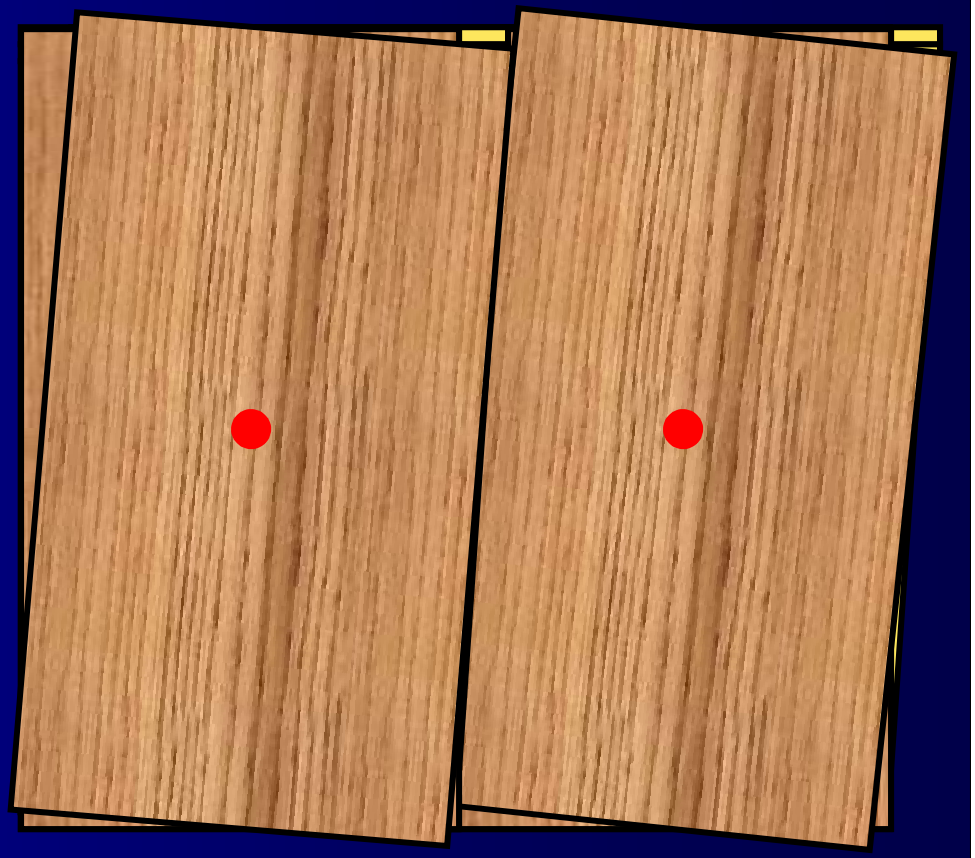


Failure Mode: Racking

Failure Mode: Racking

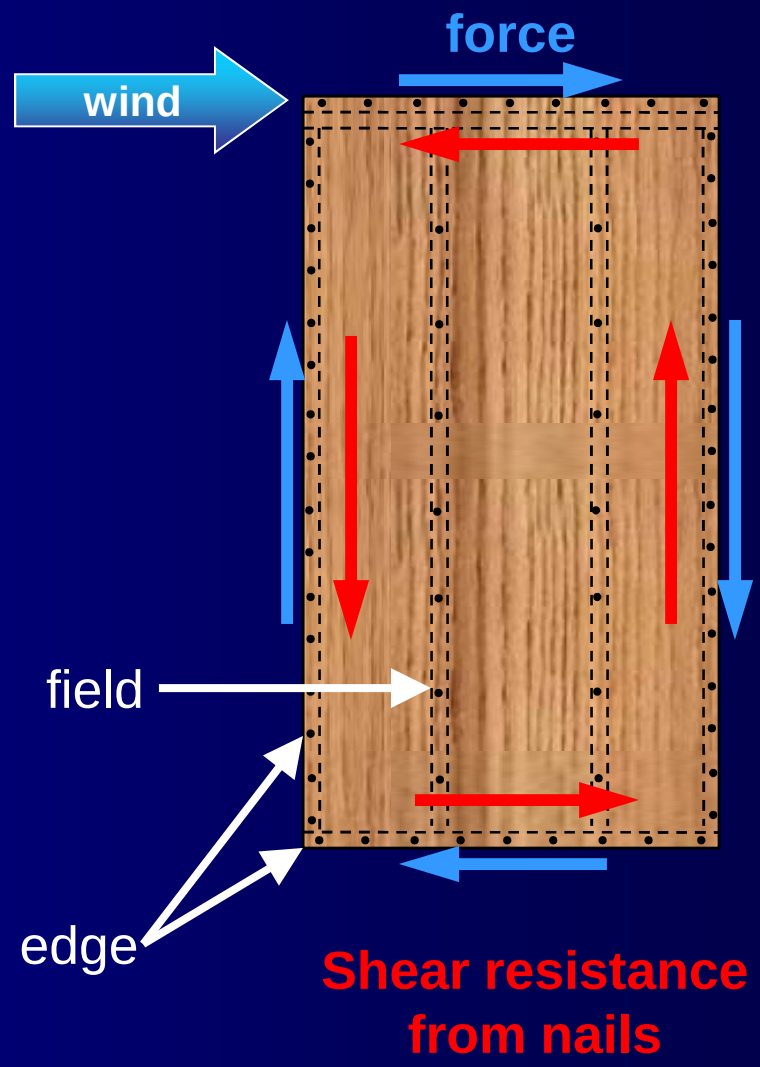
Resisting Racking

- Studs shift at top with movement of diaphragm.
- Panels rotate about their centroid.



Resisting Racking

- Racking is resisted by:
  - Connection of bracing material to studs with edge nails.
  - Field nails resist buckling.



Unit 3 – Quiz Question 1

This is an example of which failure mode?

a. Overturning.

b. Racking.

c. Sliding.

Sliding is caused by insufficient anchor bolts.

Unit 3 – Quiz Question 2

This is an example of which failure mode?

a. Overturning.

b. Racking.

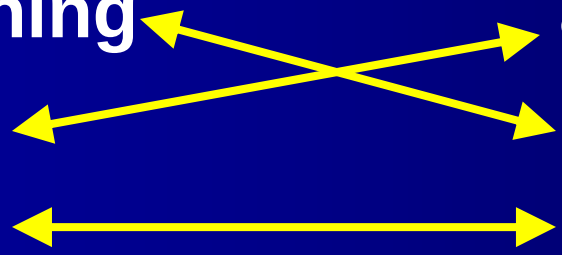
c. Sliding.

Racking is caused by insufficient wall bracing and/or insufficient fasteners.

Unit 3 - Quiz Question 3

Match the failure mode to the resisting element of a braced wall panel.

1. Overturning	a. Fasteners-to-studs
2. Racking	b. Dead load above
3. Sliding	c. Fasteners-to-bottom plate



Unit 3 - Quiz Question 4

Match the bracing element to applicable standard

1. Braced wall panels
2. Proprietary products
3. Shearwalls

a. International Building Code

b. International Residential Code

c. ICC-ES Evaluation Reports

Unit 4

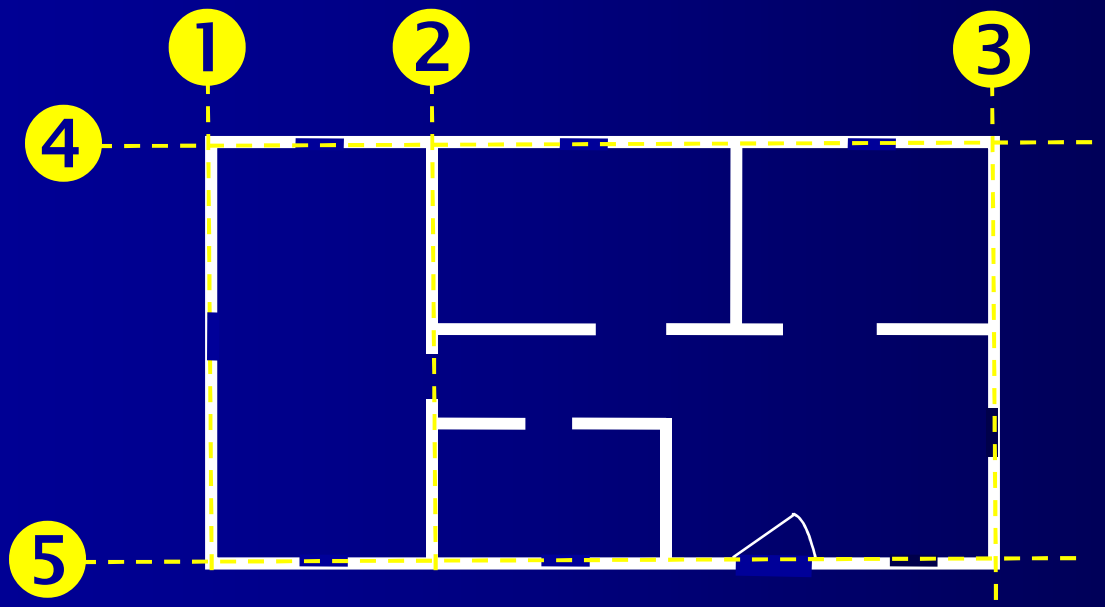
Braced Wall Lines

Unit 4 Topics

- Braced wall line ends.
- Intermediate braced wall lines.
- Braced wall line spacing
- “Designated” braced wall lines.
- Offsets from the braced wall line.
- Angled walls.
- Braced wall line length.

Braced Wall Lines (BWL)

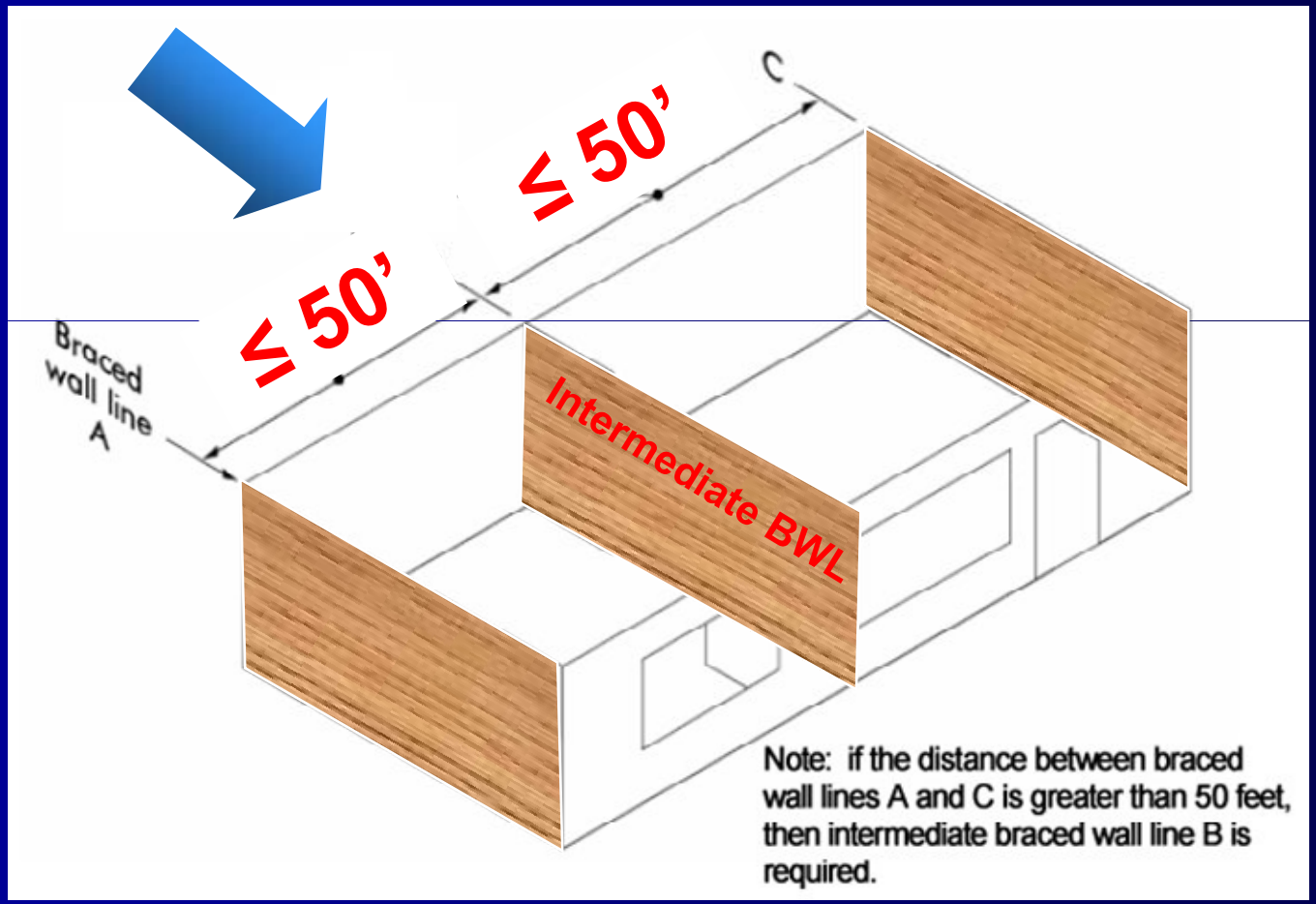
- **Braced wall line requirements:**
  - **Extend through the building plan at each floor.**
  - **Must end perpendicularly at another BWL (angled wall exception)...or the projection of a BWL.**



R602.10.1.1

BWL-Spacing

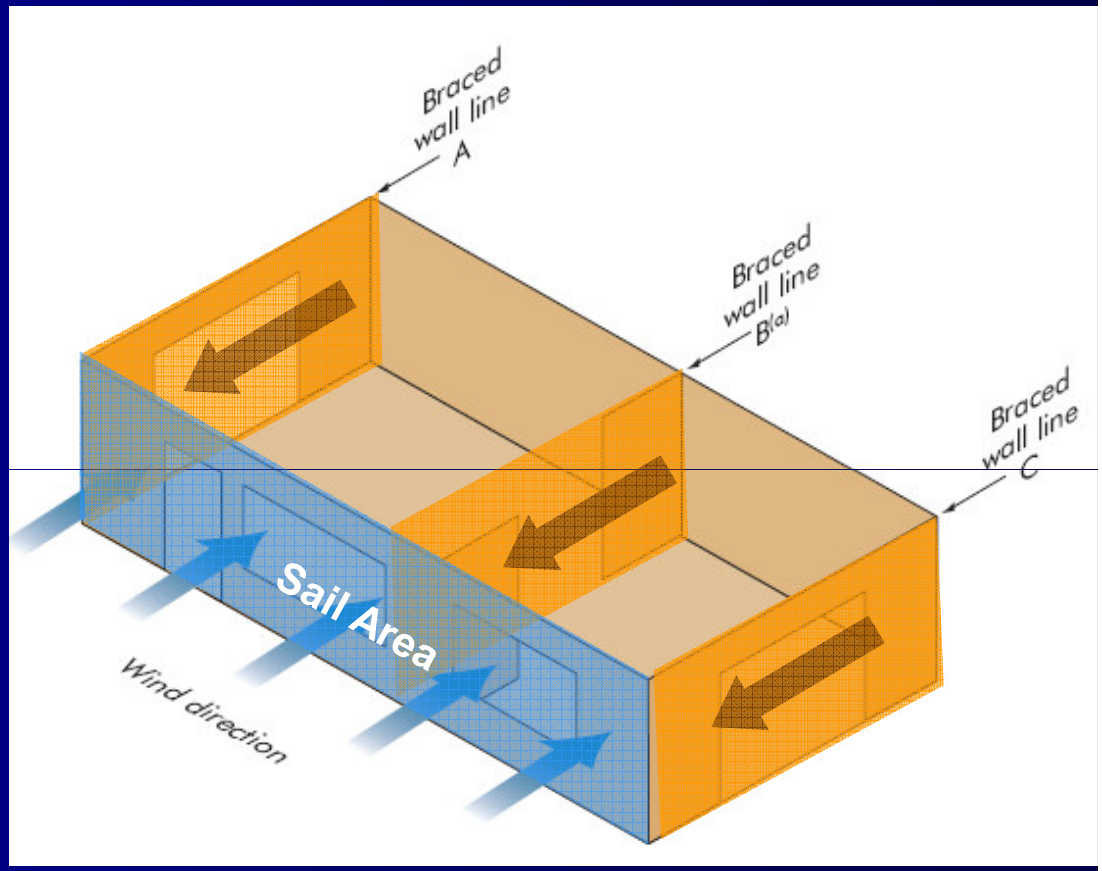
- **BWLs cannot be spaced more than 50’ apart.**



R602.10.1.1

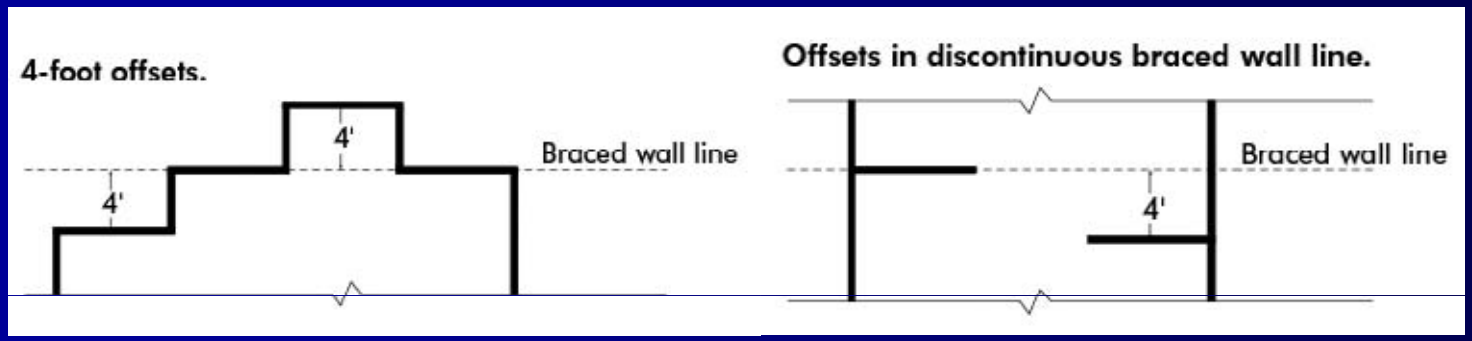
BWL-spacing = sail area

- BWL-spacing is helps determine “sail area.”
- Each BWL resists an amount of wind load based on sail area.
- Wind load applied to the sail area is resisted by BWLs parallel to the direction of the wind.

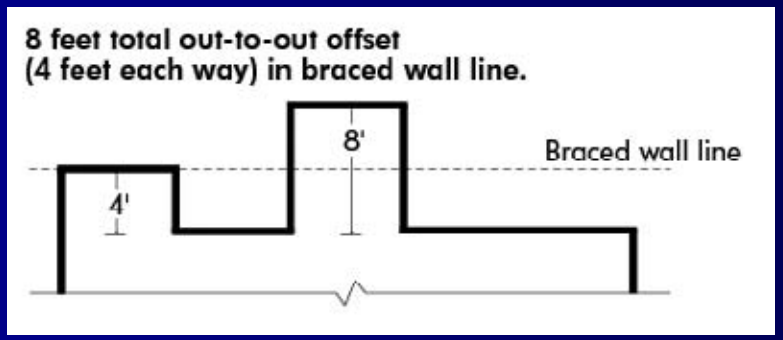


Braced Wall Line Offsets

- **Segments of the wall may offset from the designated braced wall line up to 4’.**



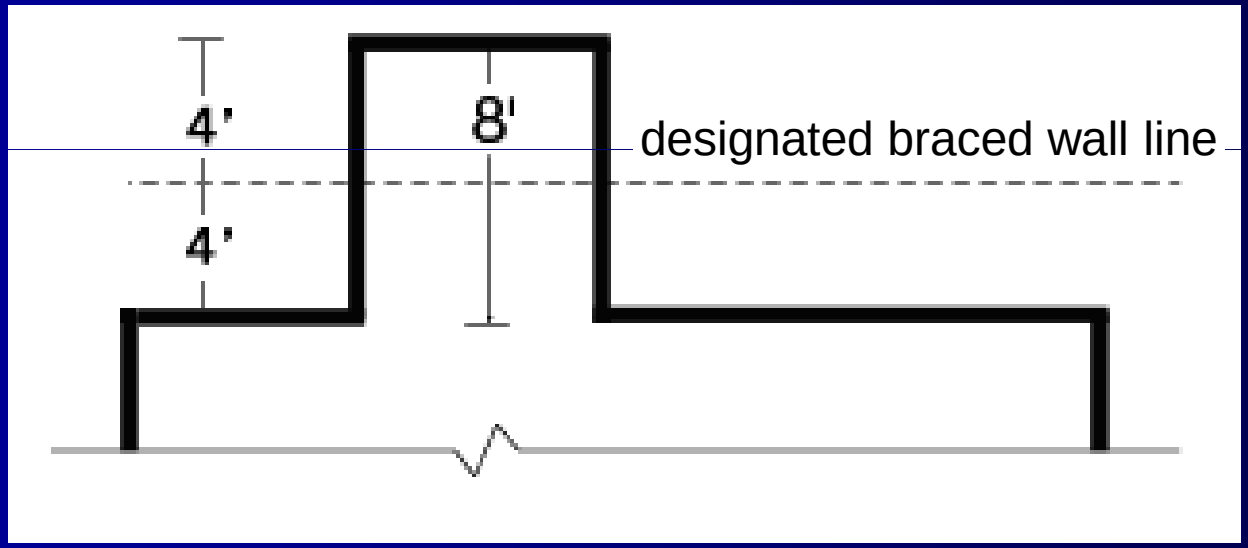
- **The total out-to-out offset can be no more than 8’.**



R602.10.1.3

Braced Wall Line Offsets

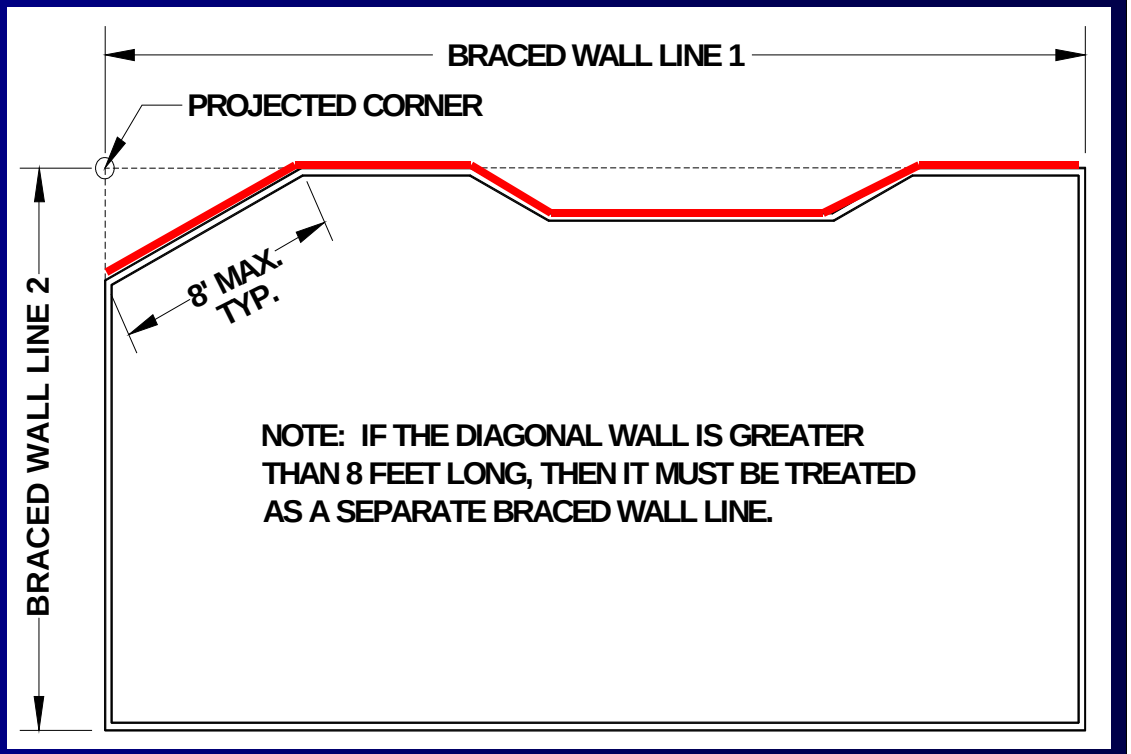
- **All wall segments may offset from the *designated* BWL.**



R602.10.1.3

Angled Walls

- Segments of a braced wall line may angle out of plane and still be considered the same BWL.



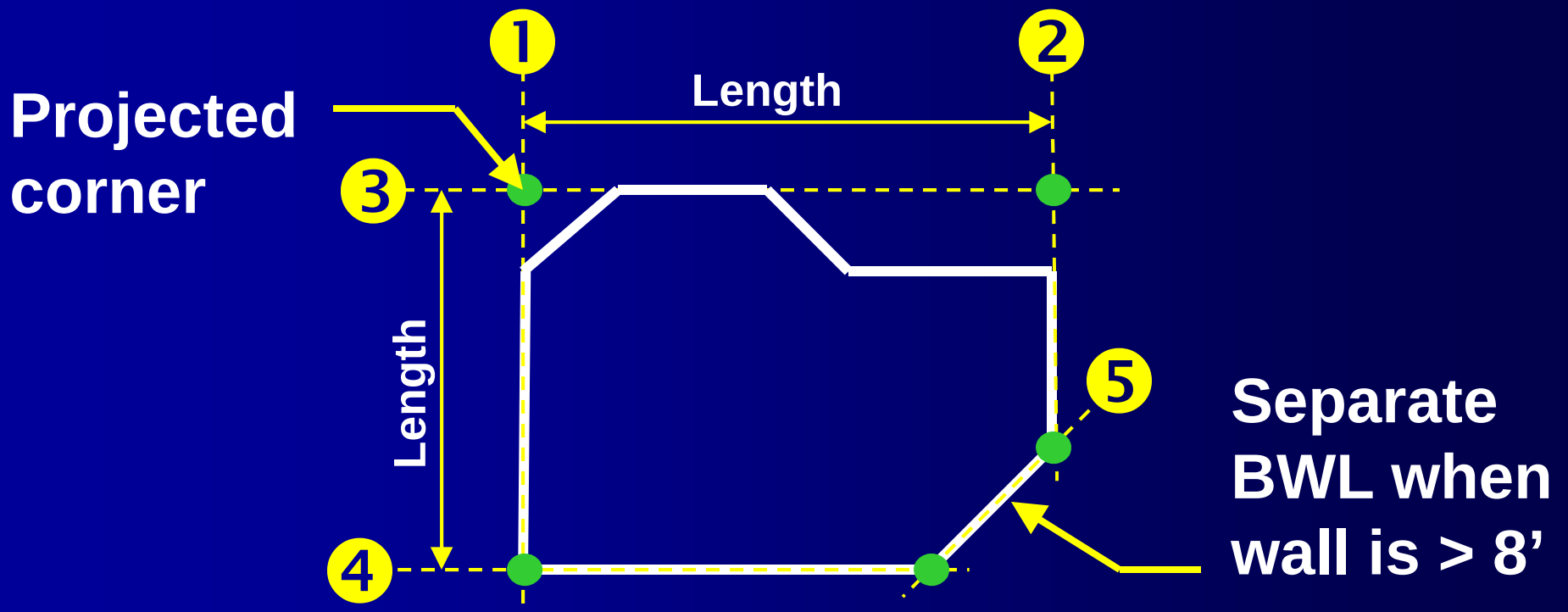
R602.10.1.4

Angled Walls

- Angled walls less than 8’ long are considered part of the designated BWL.
- Angled walls greater than 8’ long are separate BWL.

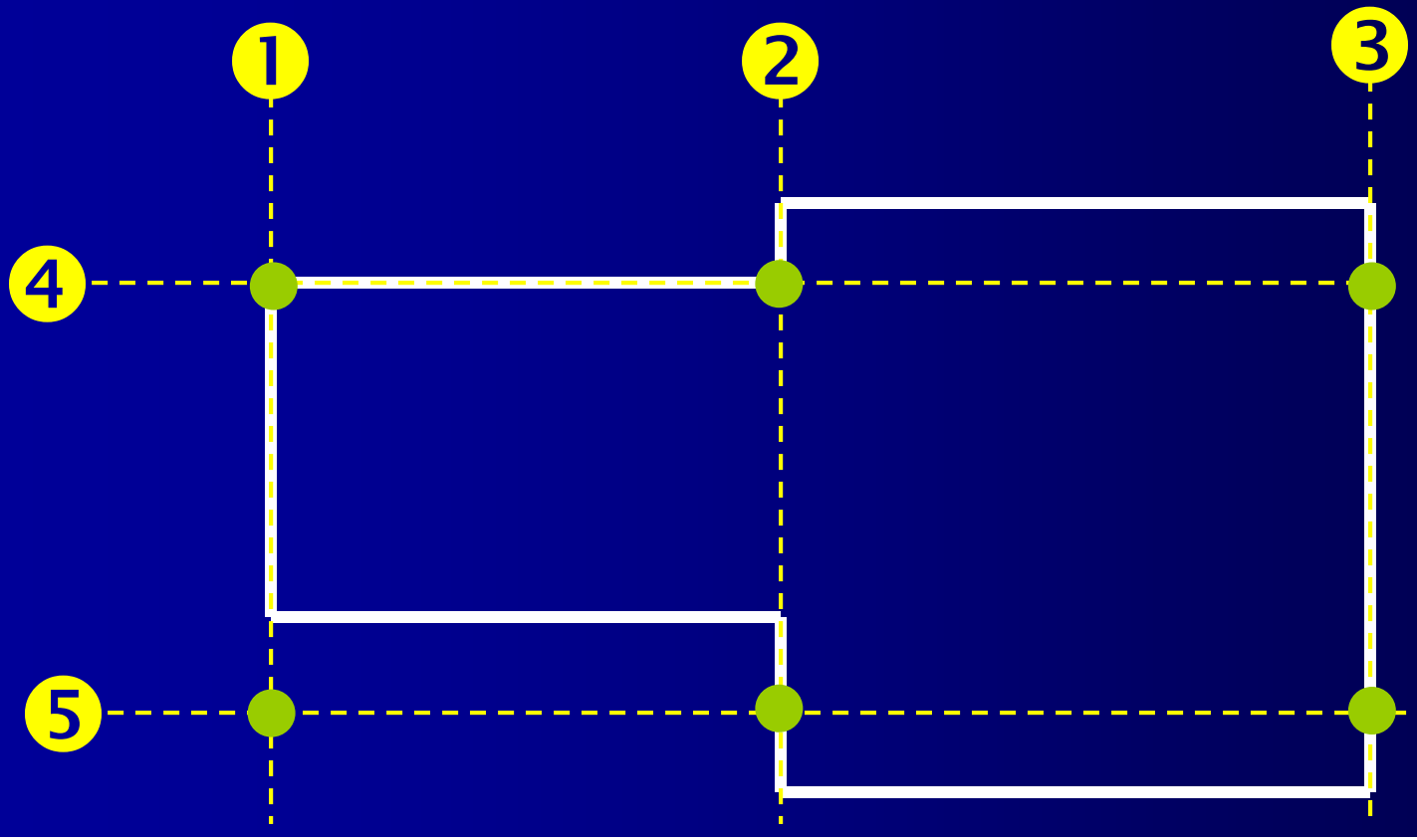
Angled Walls

- Length of BWL taken from projected corner when angled wall is < 8’.



BWL Length

- The length of a BWL is defined by the points where it intersects the perpendicular BWLs at each end.



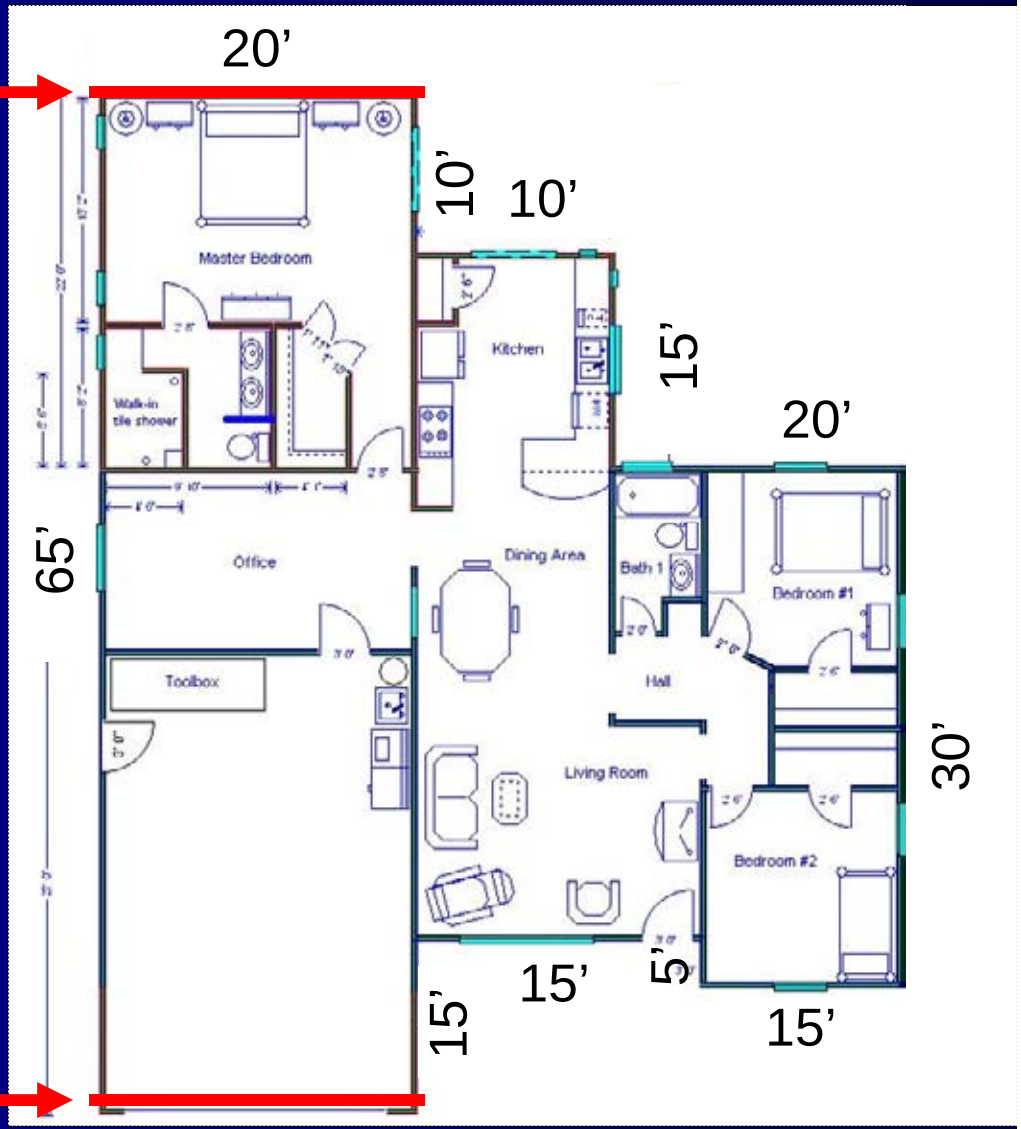
Unit 4 - Quiz Question 1

True or False:

An intermediate BWL is not required on this house?

False.

The exterior BWLs are spaced more than 50’ apart.



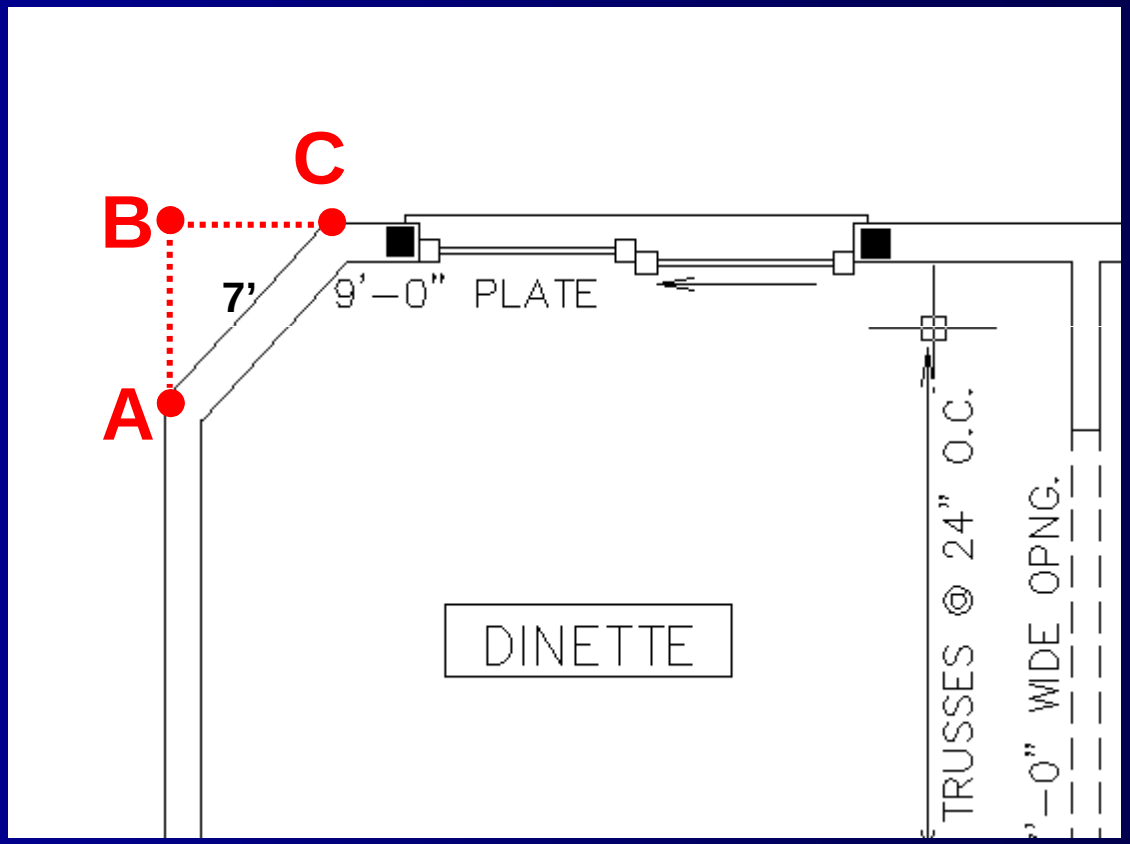
Unit 4 – Quiz Question 2

The rear BWL begins at which point?

a. A

b. B

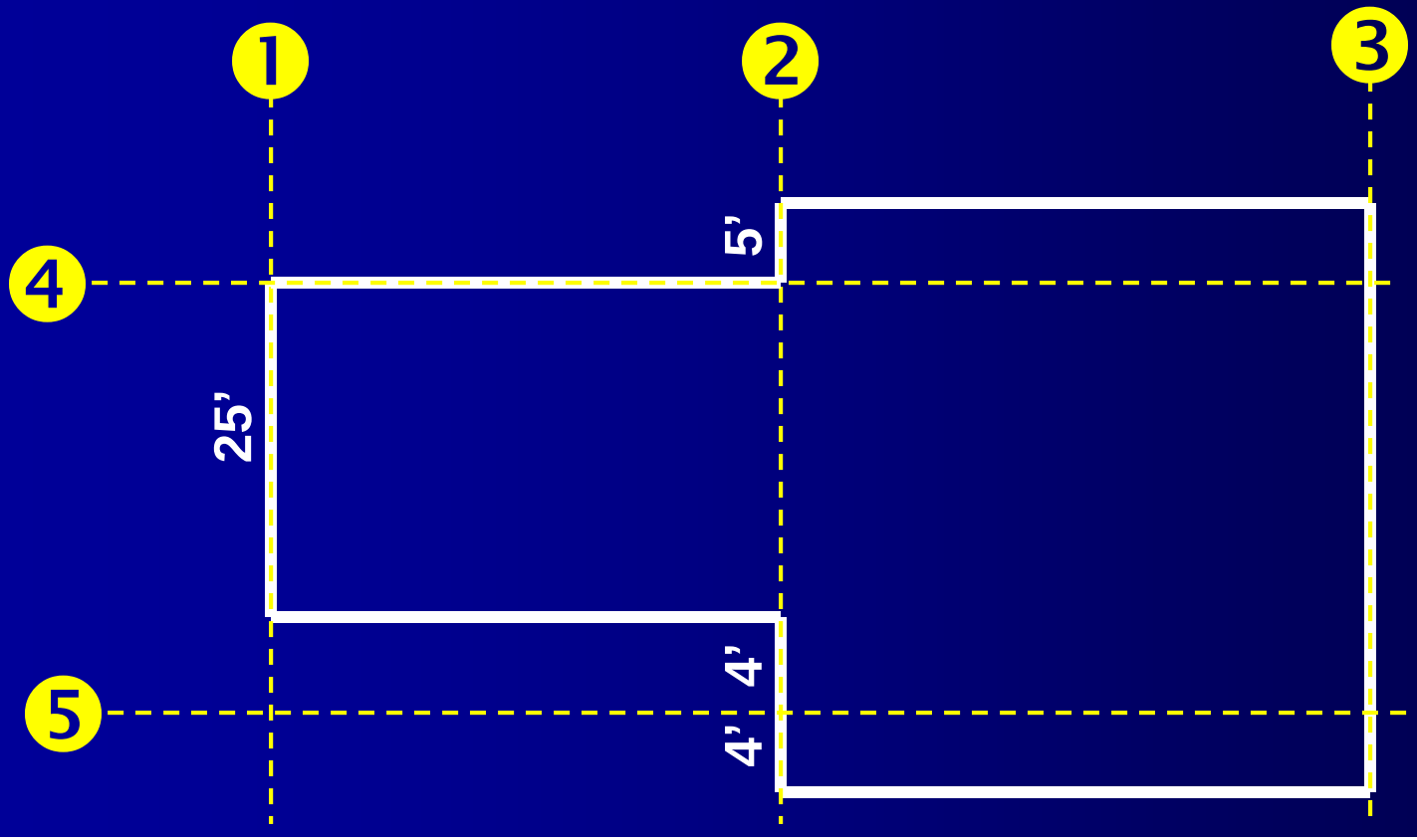
c. C



Unit 4 – Quiz Question 3

What is the length of BWL 1?

a. 25’ **b. 29’** **c. 33’** **d. 38’**



Unit 4 – Quiz Question 4

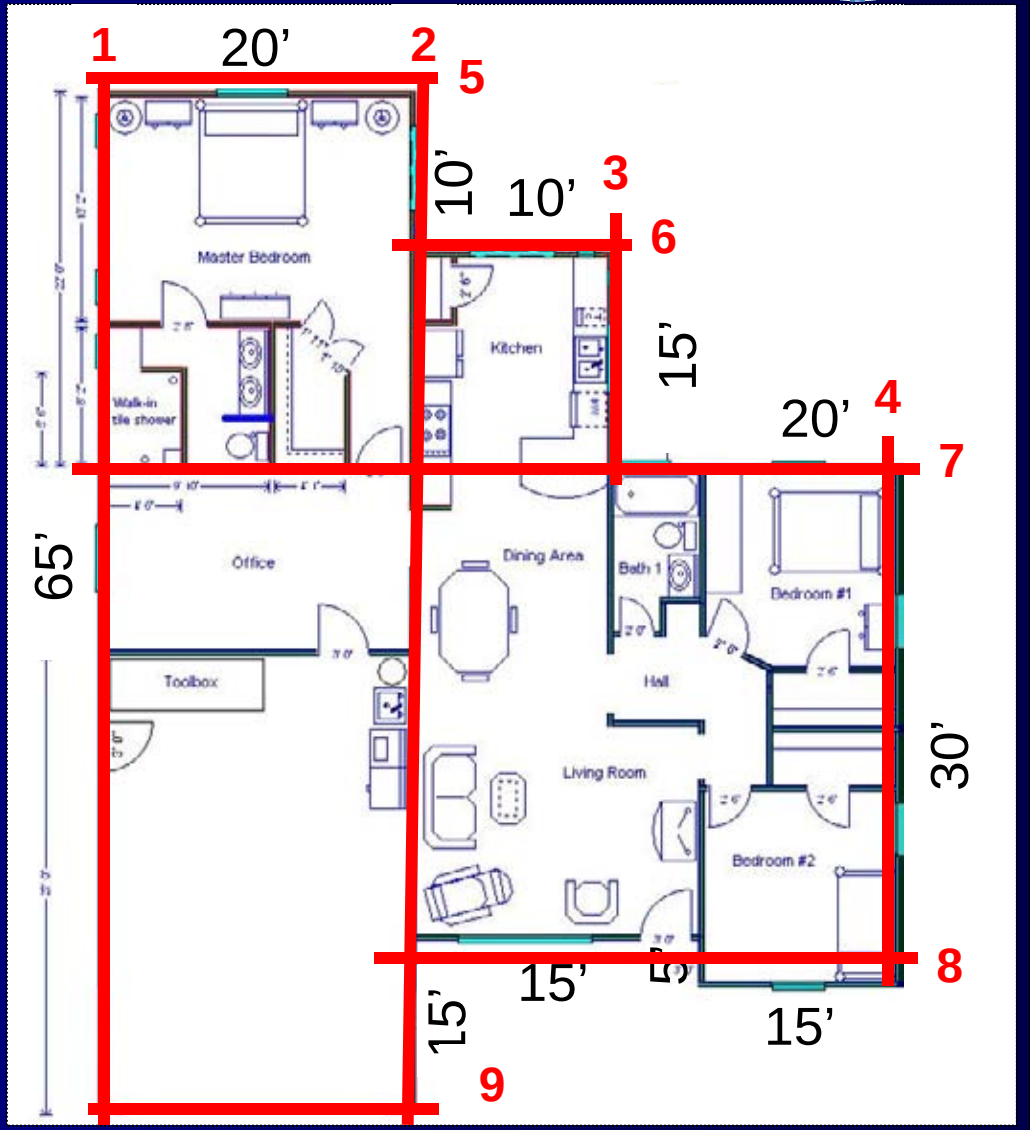
What is the minimum number of BWLs possible for this house?

a. 8

b. 9

c. 10

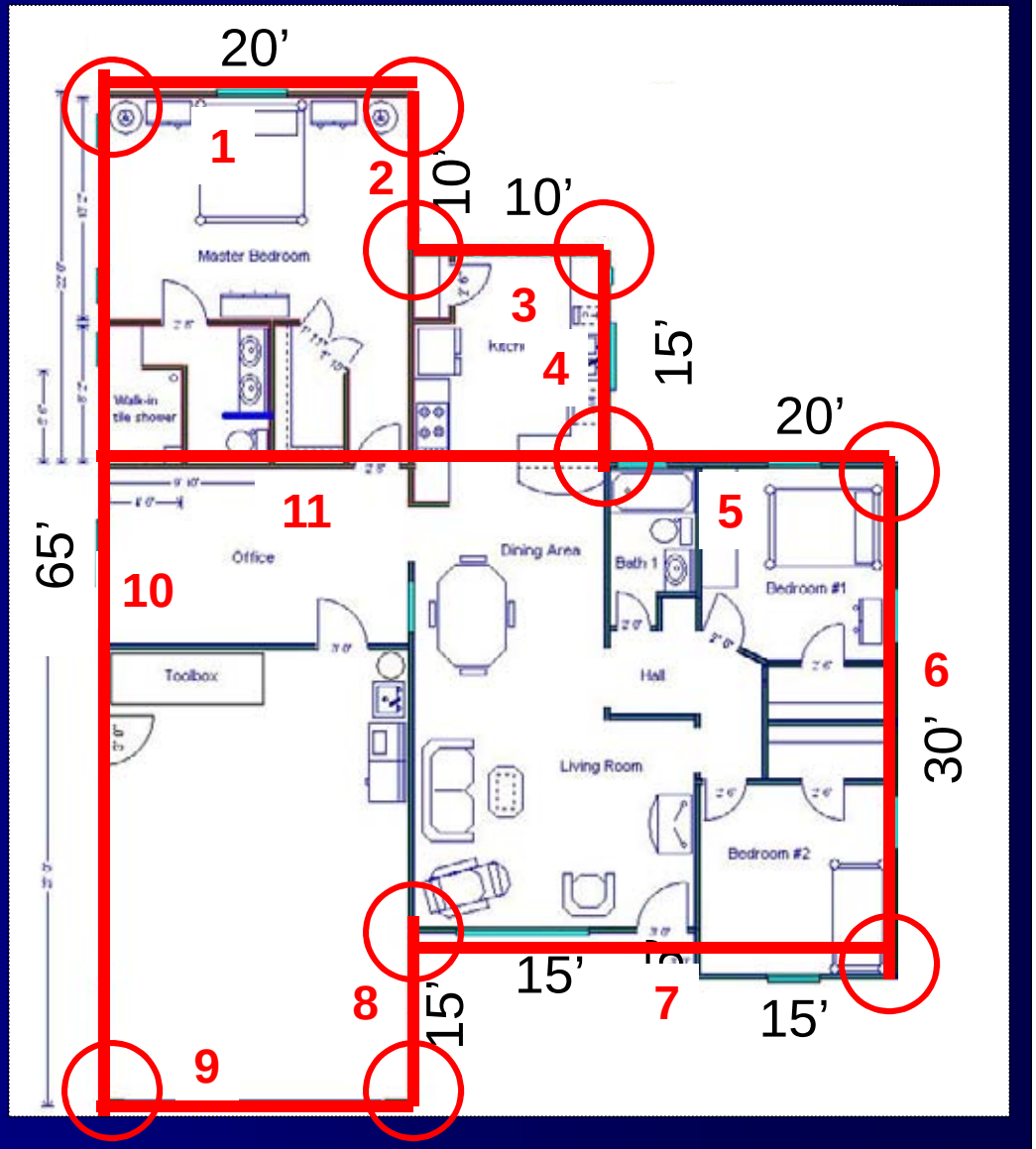
d. 11



Unit 4 – Quiz Question 4

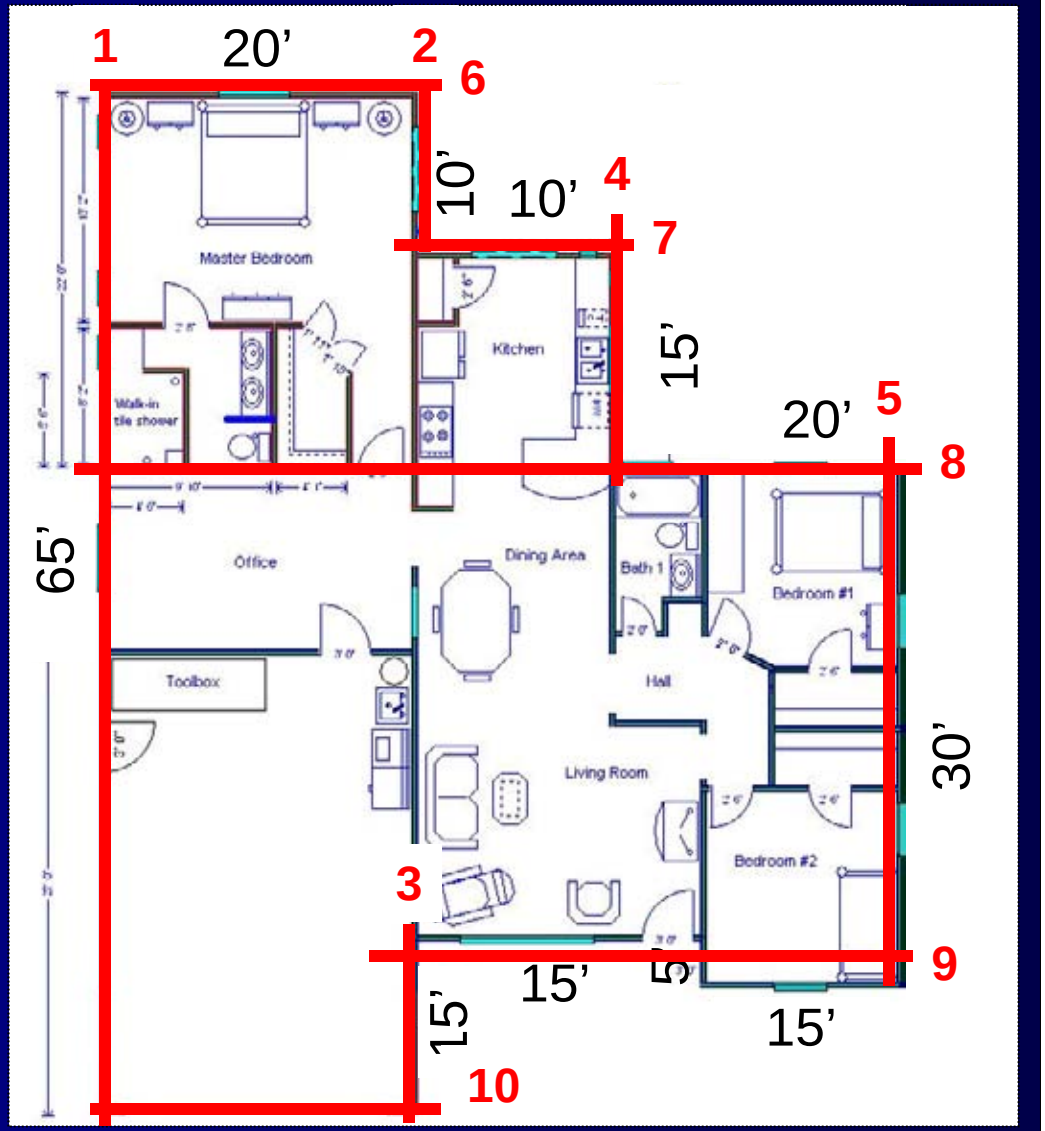
Chuck's method - 11

- Offsets greater than 8' create a new BWL
- Otherwise continue
- If any BWL exceeds 50', add intermediate BWLs



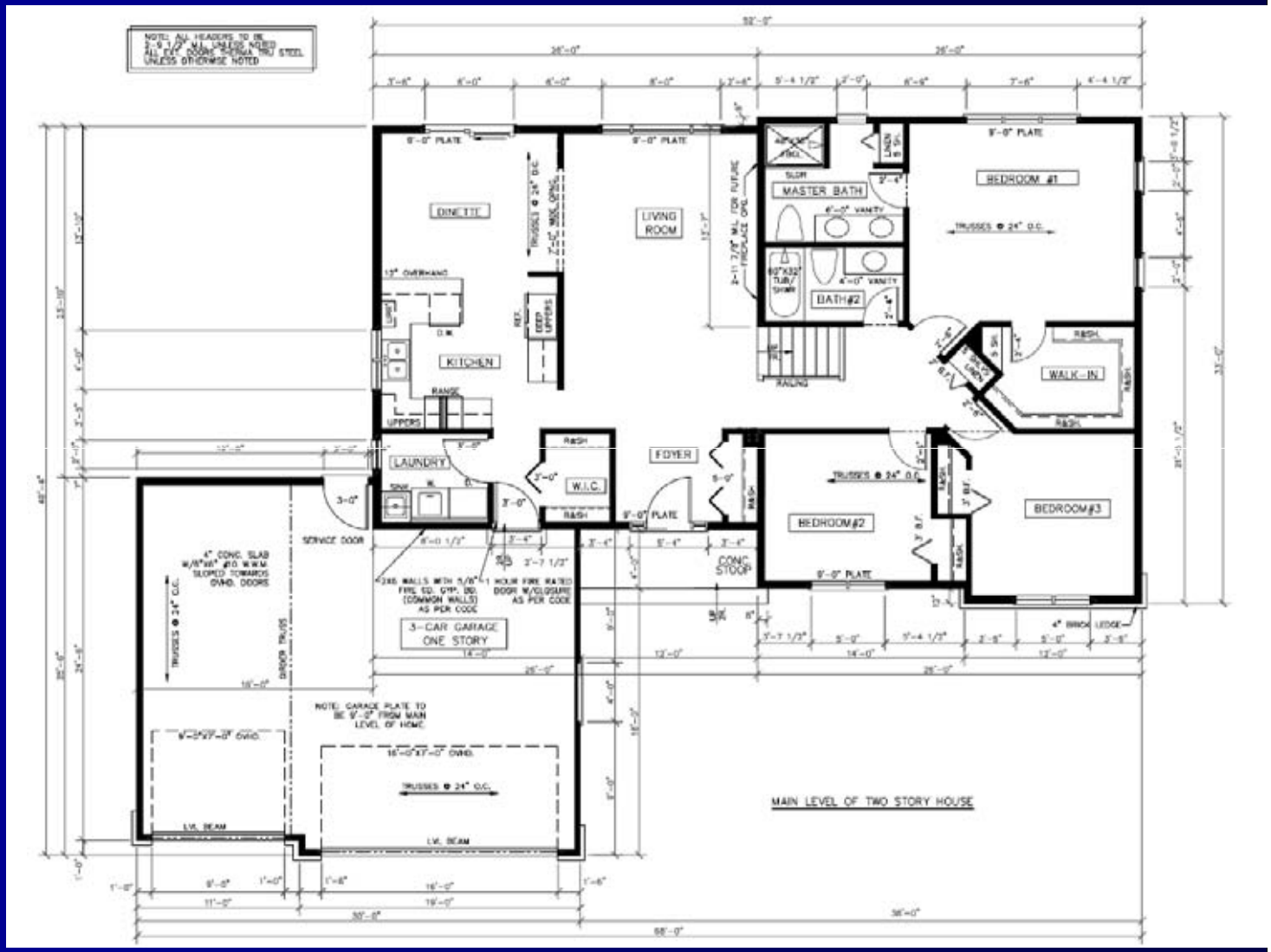
Unit 4 – Quiz Question 4

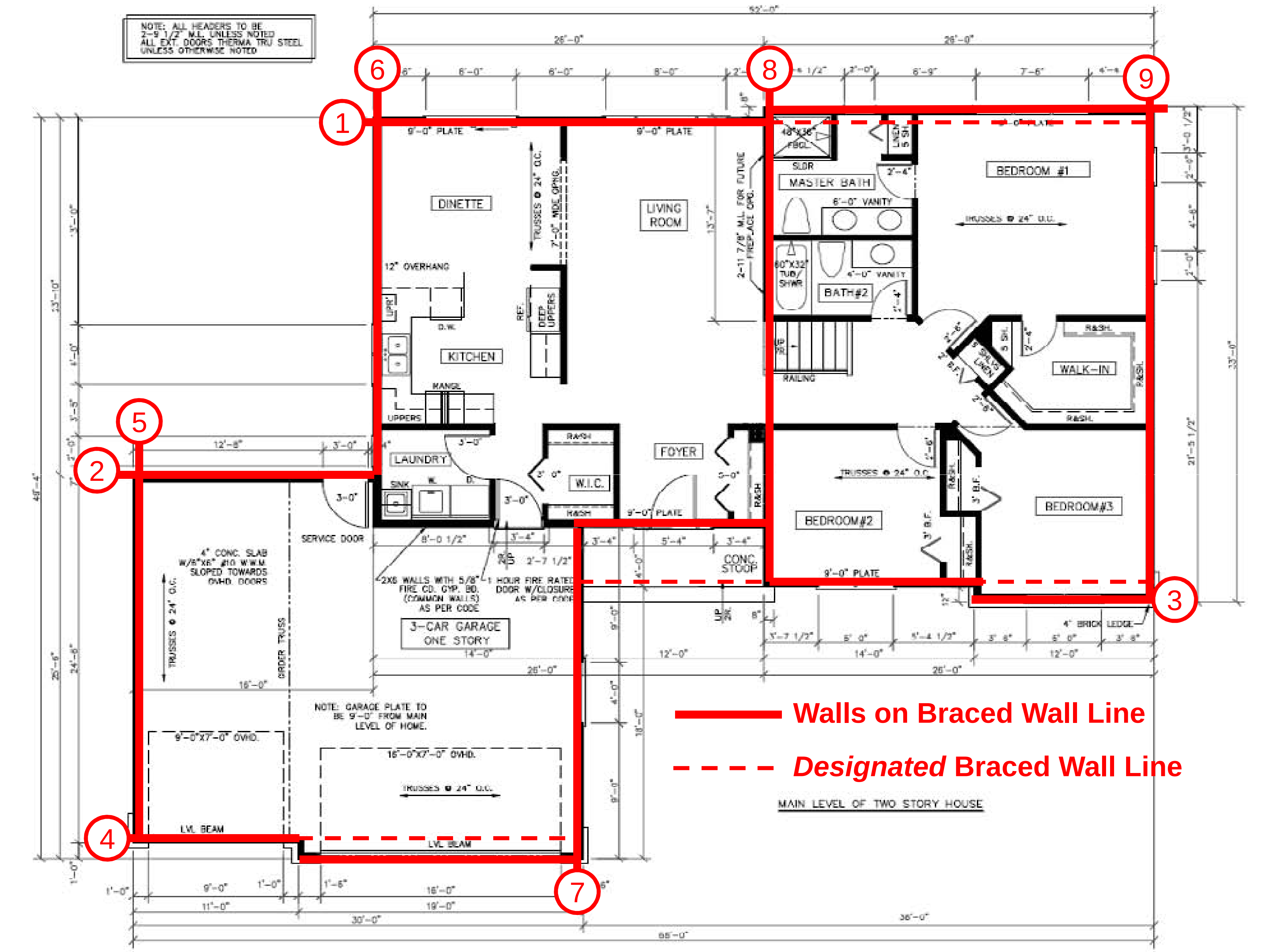
Thus the reason why it is required that the plan preparer show the intended BWLs.



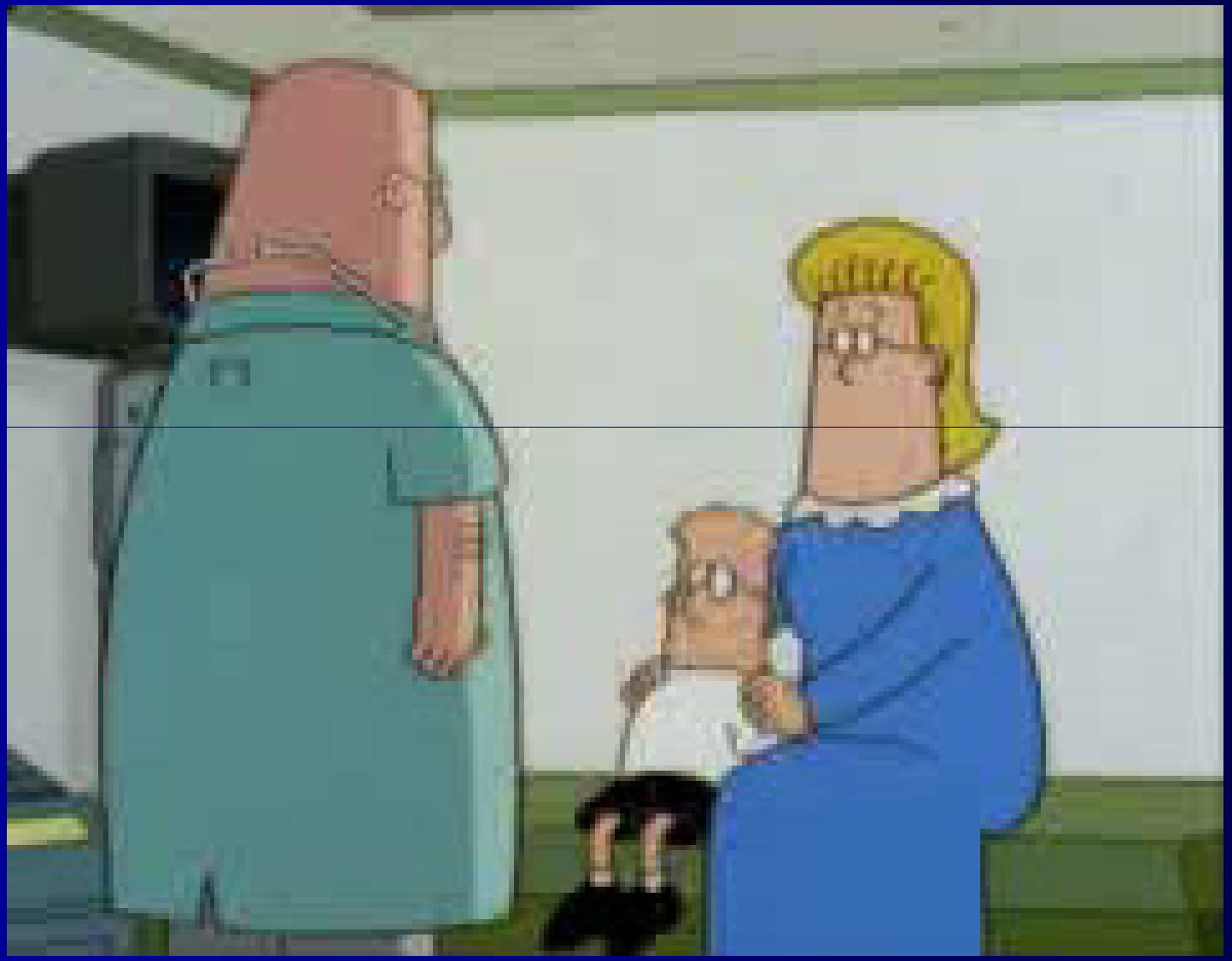
Unit 4 – Quiz Question 5

On the handout, designate the location of the BWLs for this house plan.




NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
1
2
3
4
5
6
7
8
9
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
W.I.C.
FOYER
MASTER BATH
BATH#2
BEDROOM #1
BEDROOM#2
BEDROOM#3
WALK-IN
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
9'-0" PLATE
12" OVERHANG
LVL BEAM
9'-0"X7'-0" OVHD.
16'-0"X7'-0" OVHD.
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
4" CONC. SLAB W/6"X6" #10 W.W.M. SLOPED TOWARDS OVHD. DOORS
2X6 WALLS WITH 5/8" FIRE CD. GYP. BD. (COMMON WALLS) AS PER CODE
4" BRICK LEDGE
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE

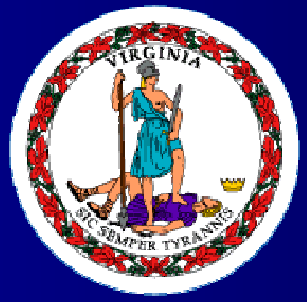
The Knack!



Break

Braced walls are so EEE-ZZZ

Unit 5



Amounts & Types of Bracing

Unit 5 Topics

- Three minimum bracing requirements.
- Location of braced wall panels.
- Spacing of braced wall panels.
- Minimum percent of bracing required.
- Calculating the actual percent of bracing.

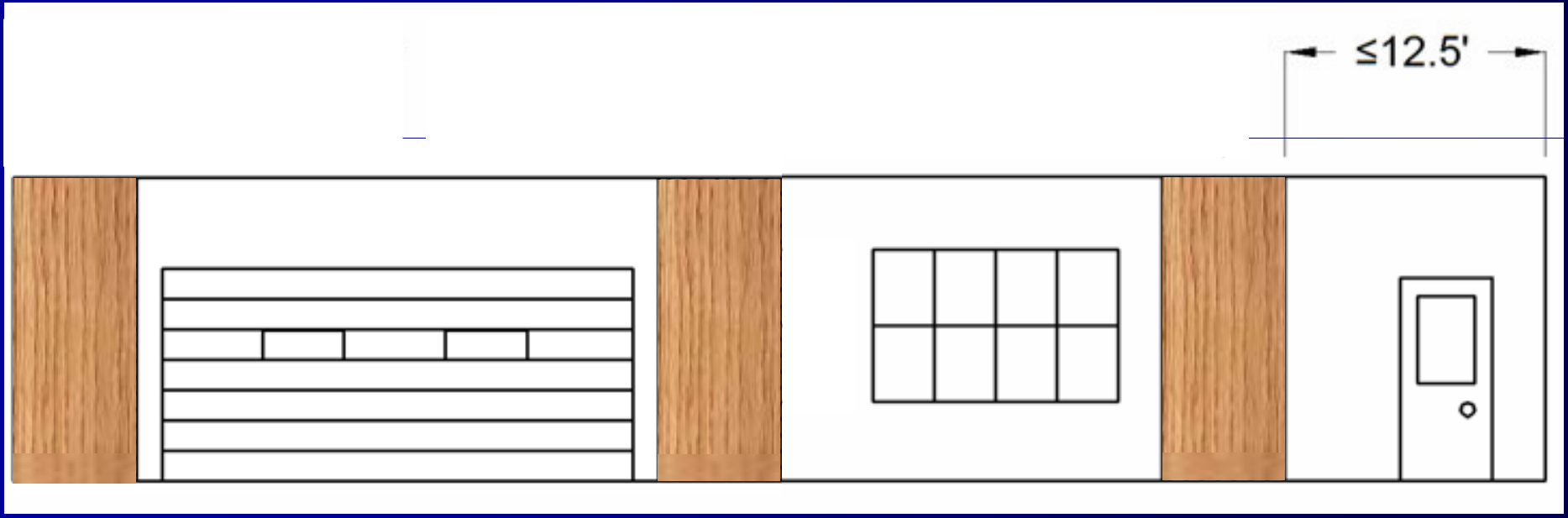
Braced Wall Panel Requirements

1. Location:
   - BWPs must be located at each end of a BWL.
2. Spacing:
   - BWPs center-to-center spacing must not exceed maximum.
3. Amount:
   - The BWL must contain a minimum percentage of qualified BWPs.

LOCATION SPACING AMOUNT

1. Location

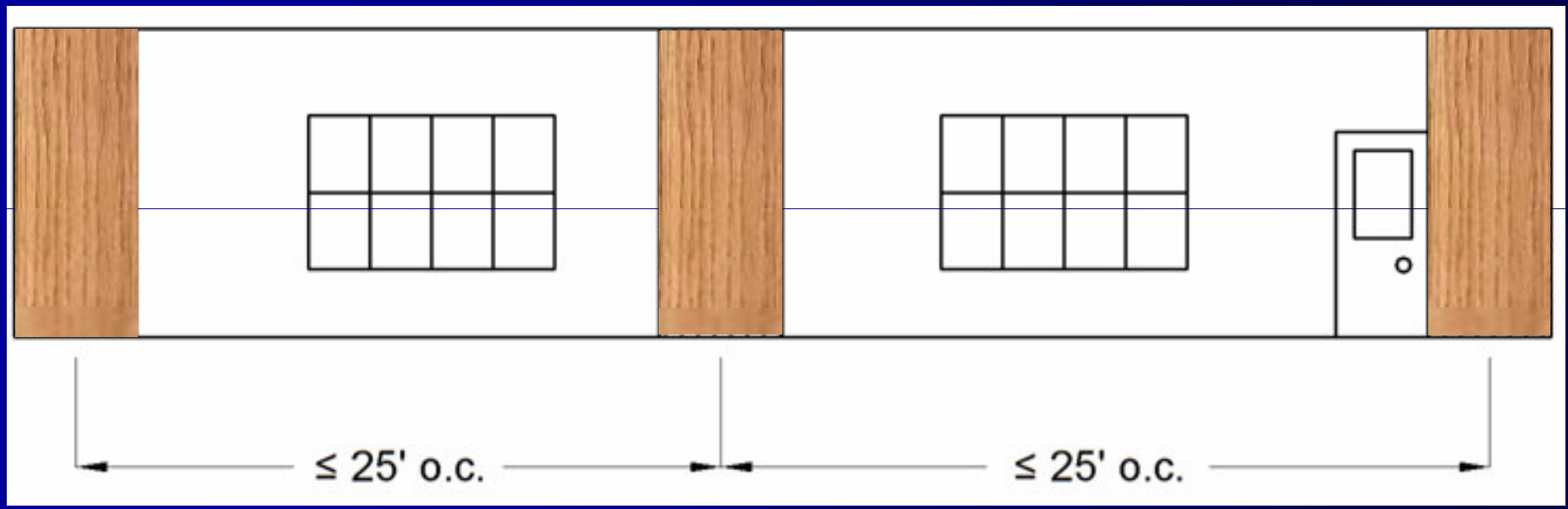
- **BWPs must begin at the end of a BWL or within 12’-6”.**



R602.10.1.3

2. BWP-Spacing

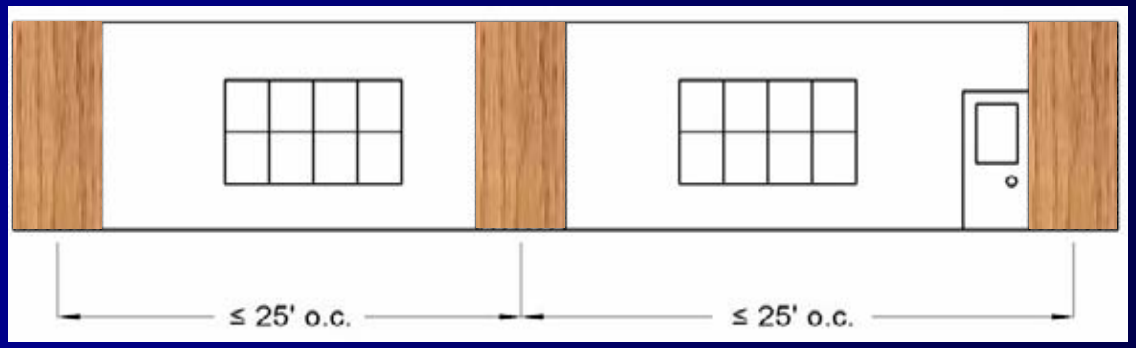
- **BWPs cannot be spaced more than 25’ o.c.**



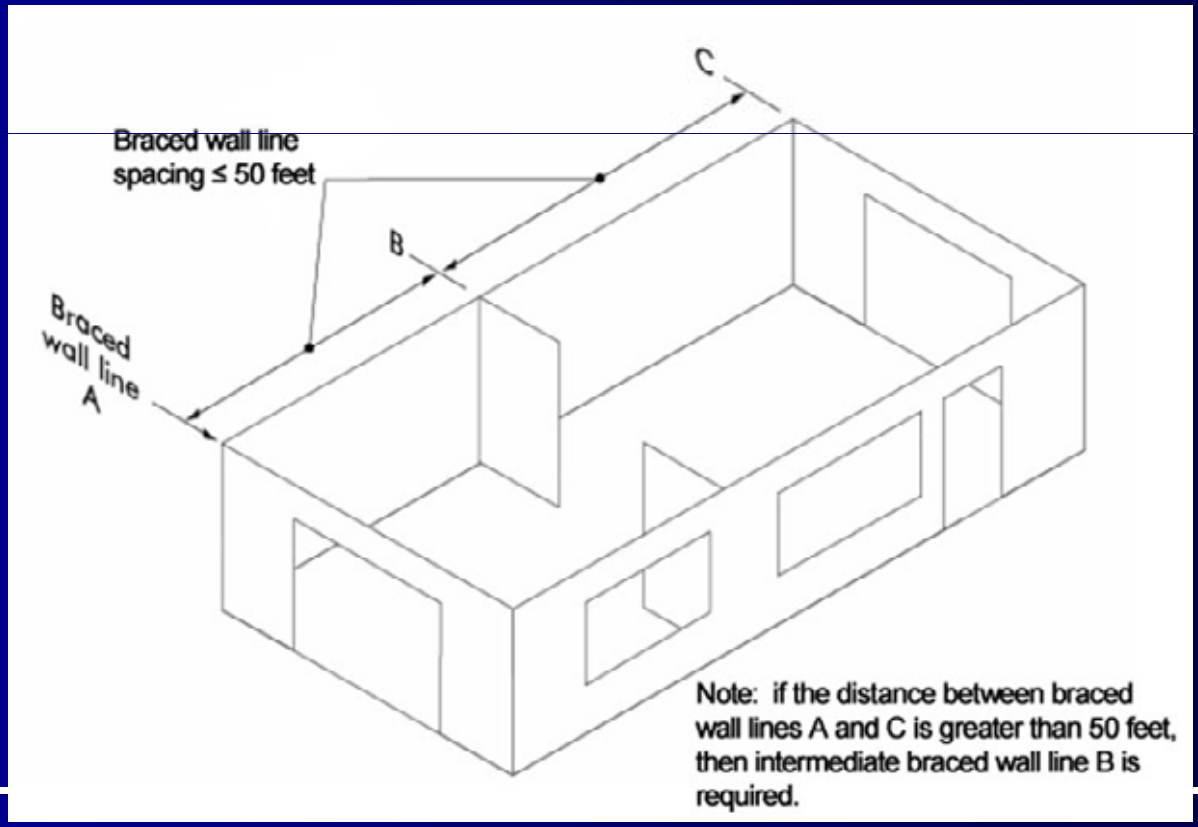
R602.10.1.3

Do Not Confuse…

- BWP-Spacing



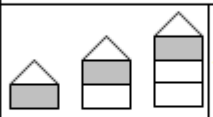
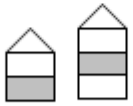
- with BWL-Spacing



3. Amount – Required Percentage

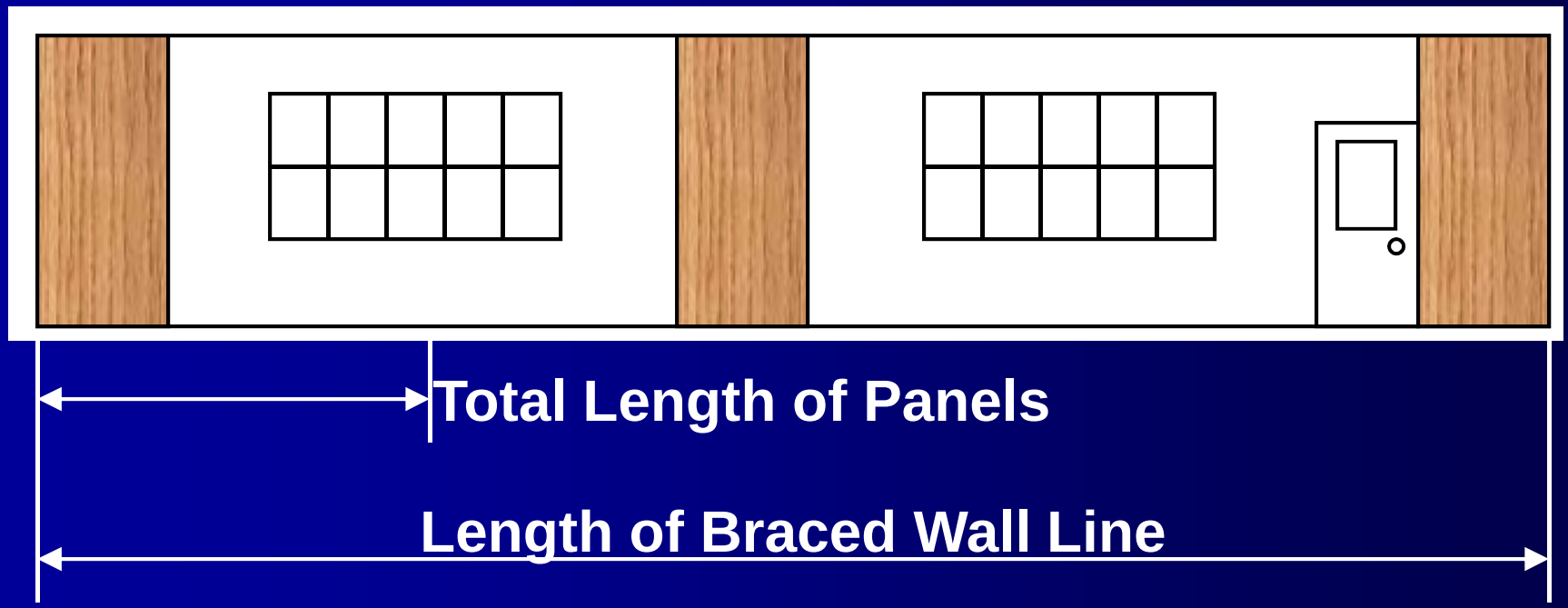
- Wind speed.
- Floor.
- BWL-spacing.
- Bracing material.

TABLE R602.10.1.5 [a,b,c]
MINIMUM REQUIRED PERCENTAGE OF WALL BRACING

SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENTAGE OF FULL-HEIGHT BRACING PER WALL LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	23%	36%
		First floor of a three-story house	25%	35%	36%	50%

R602.10.1.5

Calculate Actual Percentage



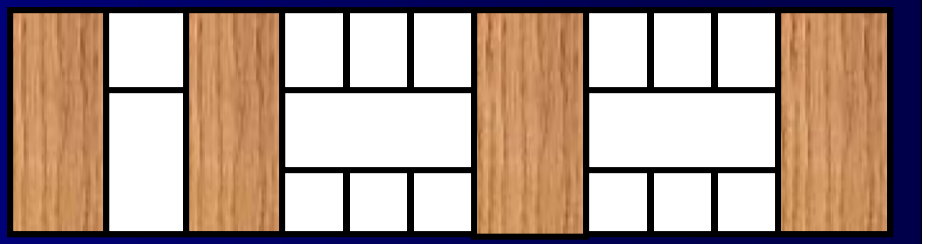
$$\text{Actual \% Bracing} = \frac{\text{Total Length of Panels}}{\text{Length of Braced Wall Line}} \times 100$$

Compare the actual % to the required %.

R602.10.1.5

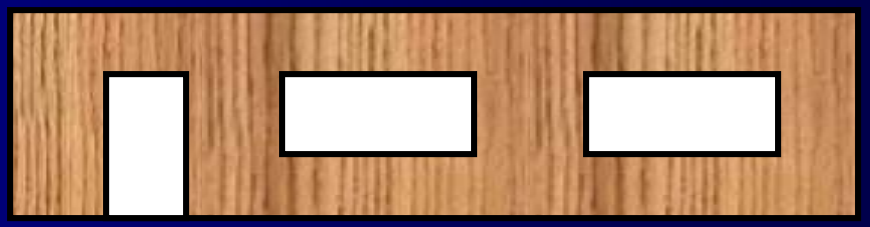
Types of Bracing

- **Intermittent:**
  Bracing material placed at BWP locations only.



Prescriptive equivalent to "segmented" shearwall

- **Continuous:**
  Bracing material placed on entire wall, including above and below doors and windows.



Prescriptive equivalent to "perforated" shearwall

Unit 5 - Quiz Question 1

Which of the following is NOT a BWP requirement?

a. 25’ o.c. maximum spacing.
b. Location at each end of the BWL.
c. Minimum required percentage.
d. Location above windows.

Location above windows is not a BWP requirement.

Unit 5 – Quiz Question 2

What is the maximum spacing of a BWP along a braced wall line?

a. 12’-6” on center.

b. 21’-0” edge to edge.

c. 25’-0” on center.

d. 25’-0” edge to edge.

25’ o.c. is the maximum spacing.

Unit 5 – Quiz Question 3

True or False:

A BWP does not have to be located at the end of a BWL provided the entire panel length is within 12’-6” of the end.

False:

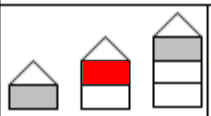
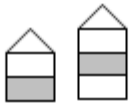
A BWP may <u>begin</u> within 12’-6” from the end of the BWL.

Unit 5 – Quiz Question 4

What is the minimum required percentage of bracing for...

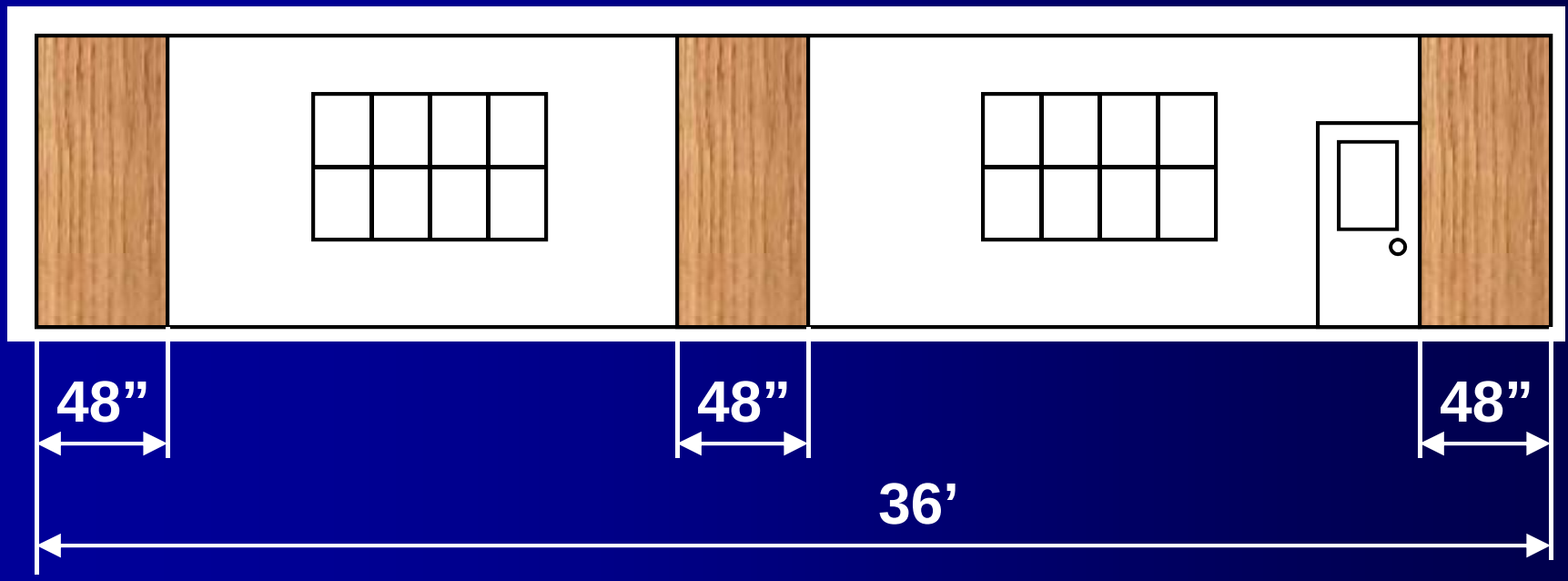
Wind speed: 90 mph,
Location: 2nd story of two-story house,
BWL-spacing: 42' o.c.

a. 16%
b. 23%
c. 35%
d. 36%

SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENTAGE OF FULL-HEIGHT BRACING PER WALL LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	23%	36%
		First floor of a three-story house	25%	35%	36%	50%

Unit 5 – Quiz Question 5

Using the figure below, what is the actual percentage of bracing?

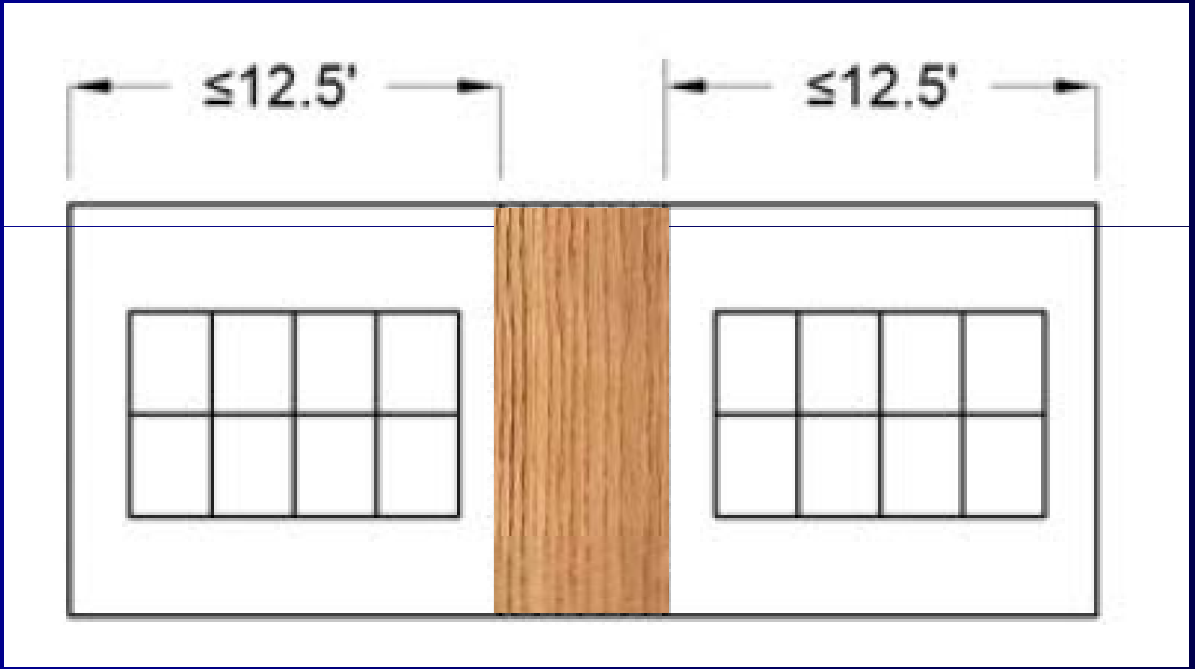


$$\text{Actual \% Bracing} = \frac{48”+48”+48”}{36’\text{x}12} \text{ x } 100 = 33\%$$

Unit 5 – Quiz Question 6

What is the maximum BWL length that would require only one 48” BWP?

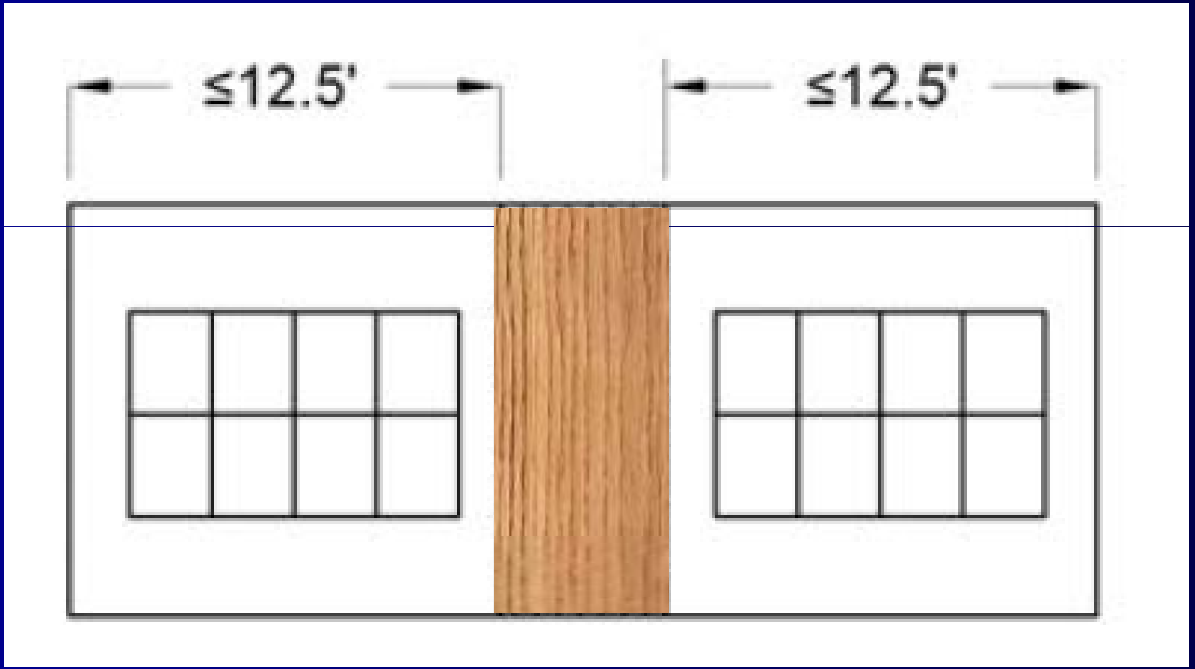
a. 29’-0”
b. 25’-0”
c. 21’-0”
d. 16’-0”



Unit 5 – Quiz Question 6

Check criteria #1: Location…is BWP within 12.5’ of each end?

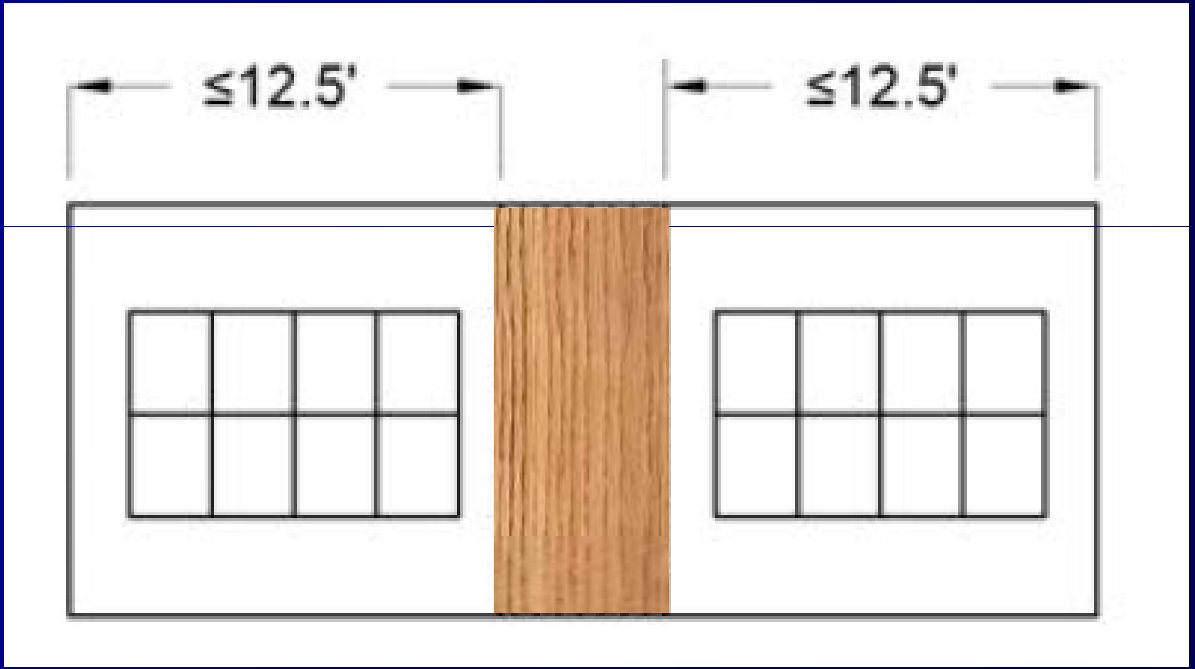
Yes



Unit 5 – Quiz Question 6

Check criteria #2: BWP-Spacing…is BWP 25’ on center?

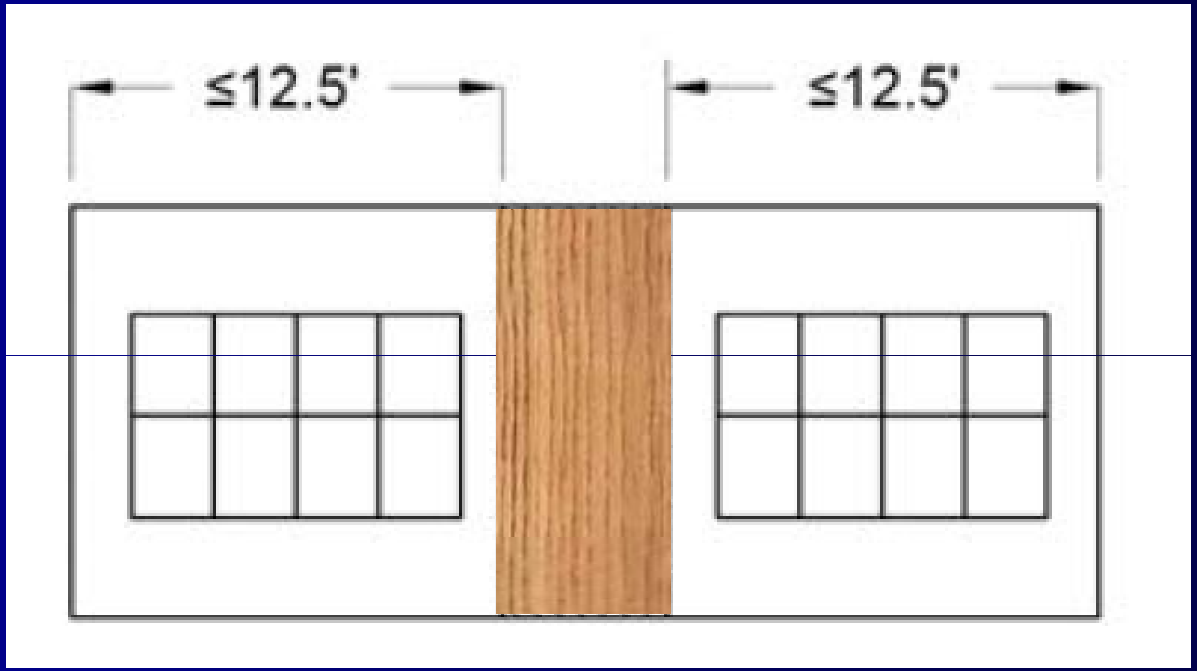
Moot point



Unit 5 – Quiz Question 6

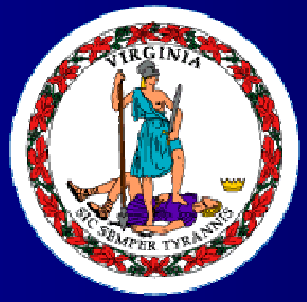
Check criteria #3: Percentage…what is 16% of the BWL?

a. 29’-0”
b. 25’-0”
c. 21’-0”
d. 16’-0”



a. 16% x 29’ = 4.6’ = 55.7”
b. 16% x 25’ = 4’ = 48”
c. 16% x 21’ = 3.4’ = 40.3”
d. 16% x 16’ = 2.6’ = 30.7”

Unit 6



Intermittent Bracing

Unit 6 Topics

- Intermittent bracing methods.
- Minimum length and requirements.
- Thermo-ply for prescriptive applications.
- Partial credit.
- Braced wall line compliance.

Intermittent Bracing Methods

- In 2003 code there were 8 bracing methods:
  - 1: let-in bracing.
  - 2: diagonal wood boards.
  - 3: wood structural panels.
  - 4: structural fiber board.
  - 5: gypsum board.
  - 6: particleboard sheathing .
  - 7: Portland cement plaster.
  - 8: hardboard panel siding.

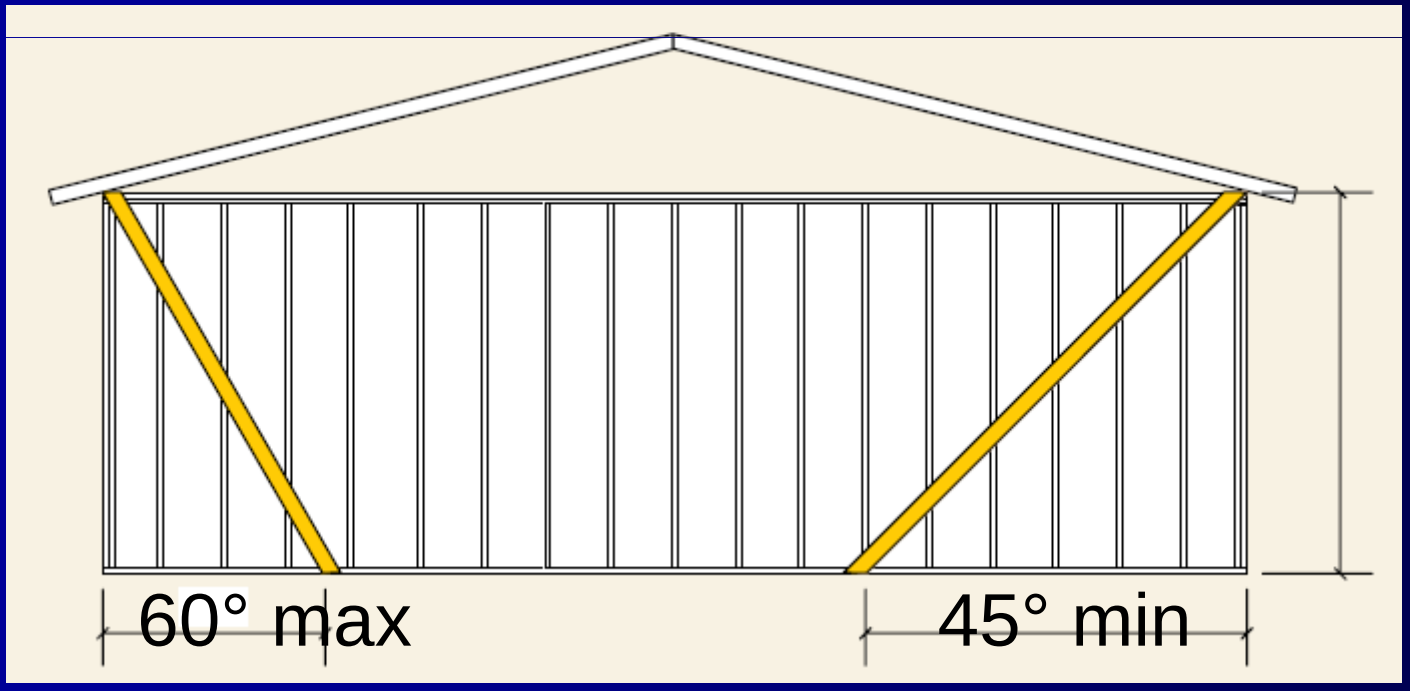
Intermittent Bracing Methods

- In 2006 code there are 10 intermittent bracing methods:
  - LIB: let-in bracing.
  - DWB: diagonal wood boards.
  - WSP: wood structural panels.
  - SFB: structural fiber board.
  - GB: gypsum board.
  - PBS: particleboard sheathing.
  - PCP: Portland cement plaster.
  - HPS: hardboard panel siding.
  - ABW: alternate braced wall panel.
  - IPF: intermittent portal frame (with hold-downs).

R602.10.2.1

LIB: Let-in Bracing

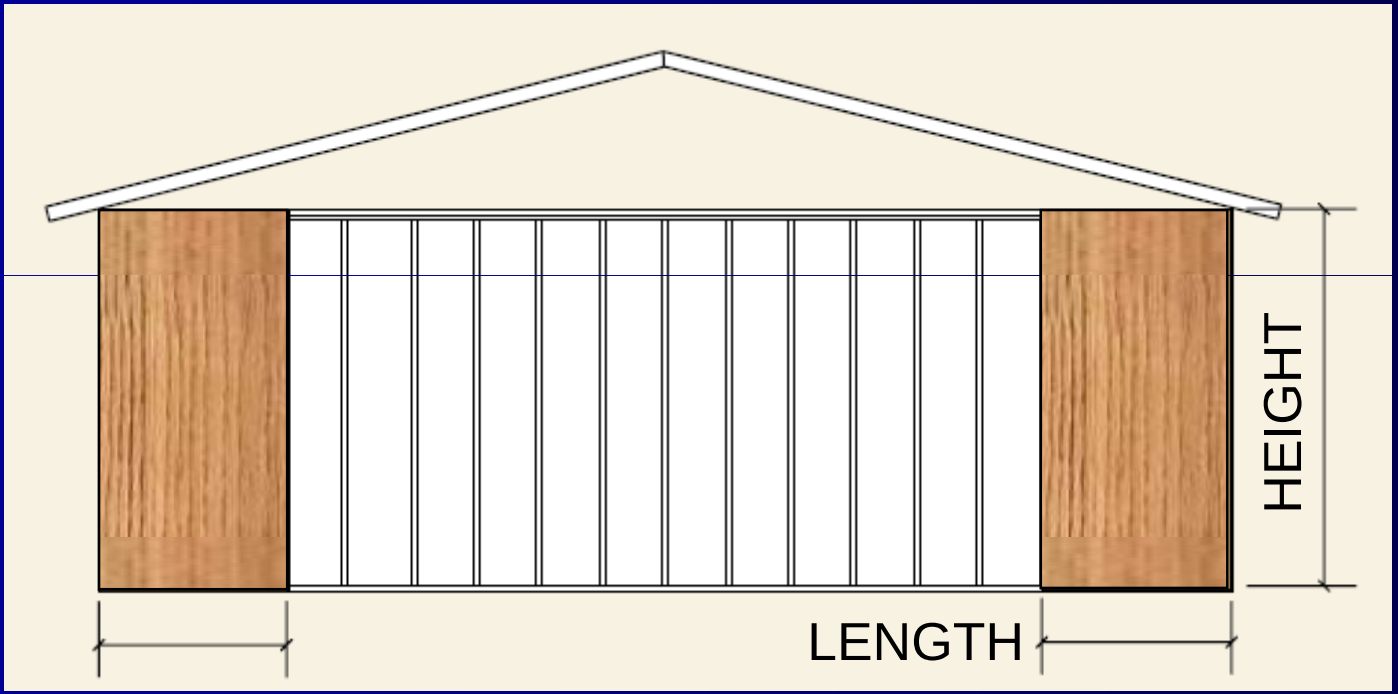
- 1x4 wood or metal strap.
- 45° to 60° angle.
- 2-8d nails per stud.
- When calculating percent bracing, Method LIB is equivalent to 48”.



R602.10.2.1

WSP: Wood Structural Panel

- Minimum 3/8” thick OSB or plywood.
- 6d nails @ 6” o.c. edges, 12” field.

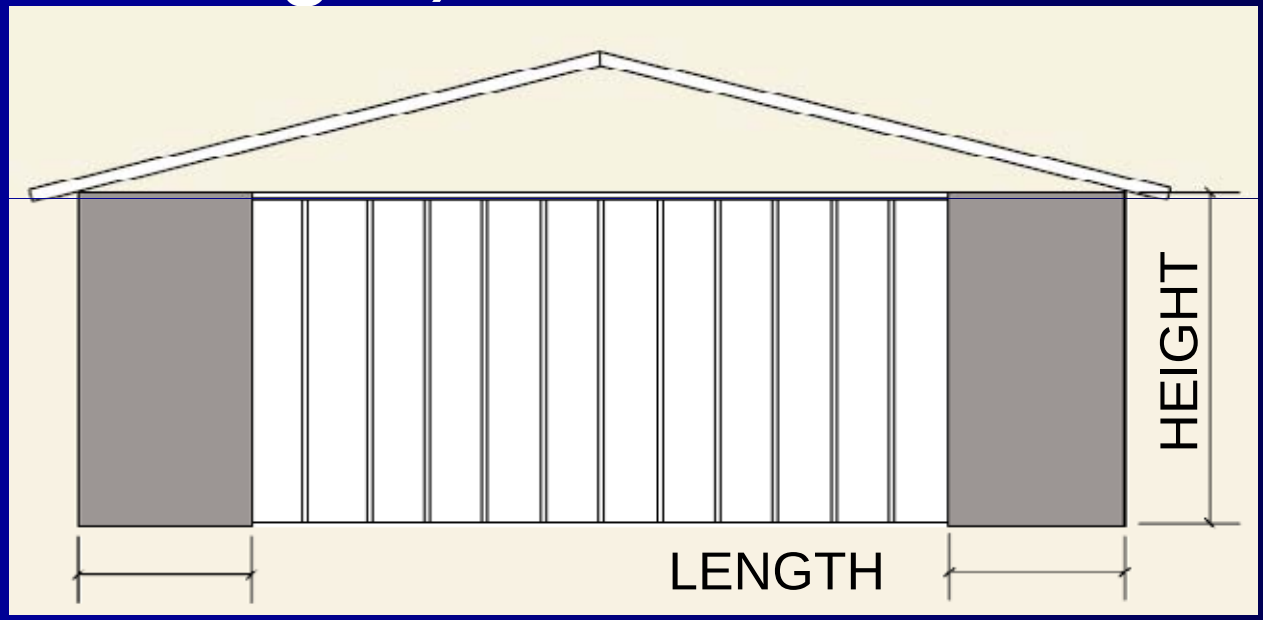


8’	9’	10’	11’	12’
48”	48”	48”	53”	58”

R602.10.2.1

SFB: Structural Fiberboard

- ½” or $^{25}/_{32}$” for stud spacing @ 16” o.c. only.
- 1-½” galv. roofing nails or 8d common nails at 3” o.c. edges, 6” field.

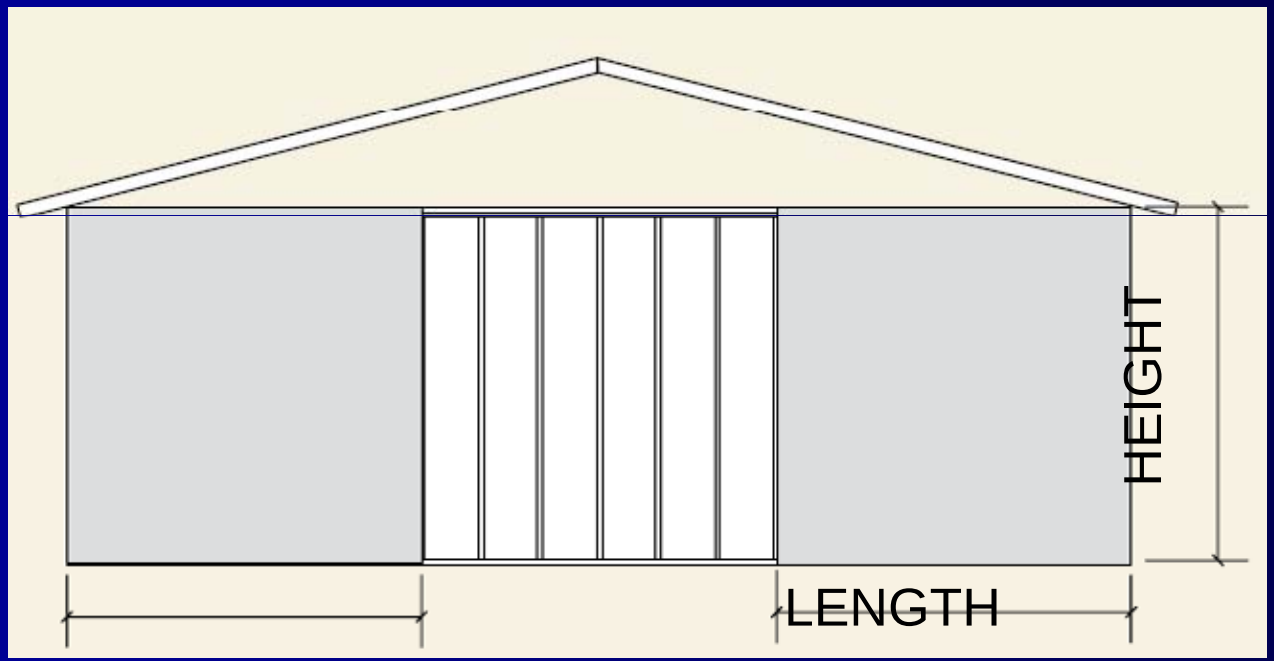


8’	9’	10’	11’	12’
48”	48”	48”	53”	58”

R602.10.2.1

GB: Gypsum Board

- ½” minimum thickness.
- Nails at 7” o.c. Interior: per Table R702.3.5.
  Exterior: 6d



	8’	9’	10’	11’	12’
Both Side	48”	48”	48”	53”	58”
One Side	96”	96”	96”	106”	116”

R602.10.2.1

RCK: Big Rocks

- Strong.
- No nails or strapping necessary.
- Based on historical performance.

Minimum Panel Length

- **IMPORTANT:**
  - **Most intermittent BWPs, with 8', 9' and 10' stud walls require a minimum of 48" wide panels.**
  - **Panels with less than the minimum required length do not contribute towards the actual percentage.**

With an exception….

Partial Credit

- **Exception parameters:**
  - **Panels ≤ 9’ in height.**
  - **Panels > 36” in length.**
  - **Applies to INTERMITTENT methods WSP, SFB.**
  - **Does NOT apply to method GB.**

TABLE R602.10.2.3
EFFECTIVE LENGTHS FOR BRACE WALL PANELS WHEN DETERMINING PERCENTAGE OF BRACING[a]

ACTUAL LENGTH OF BRACED WALL PANEL	WALL HEIGHT		
	8'	9'	10'
48"	48"	48"	48"
42"	36"	36"	N/A
36"	27"	N/A	N/A

R602.10.2.2
Exception

Partial Credit

- **How Partial Credit Works:**
  - **Enter actual length in table.**
  - **Find effective length based on wall height.**
  - **Apply effective length when computing compliance with minimum percentage of bracing required.**

TABLE R602.10.2.3
EFFECTIVE LENGTHS FOR BRACED WALL PANELS WHEN DETERMINING PERCENTAGE OF BRACING[a]

ACTUAL LENGTH OF BRACED WALL PANEL	WALL HEIGHT		
	8'	9'	10'
48"	48"	48"	48"
42"	36"	36"	N/A
36"	27"	N/A	N/A

R602.10.2.2
Exception

Partial Credit Example

- **Find the effective length of a panel that is 9’ high and 45” long.**
  - **Panel length is between 42” and 48”.**
  - **For a 9’ high wall, the effective length is between 48” and 36”.**
  - **Interpolation yields an effective length of 42”.**

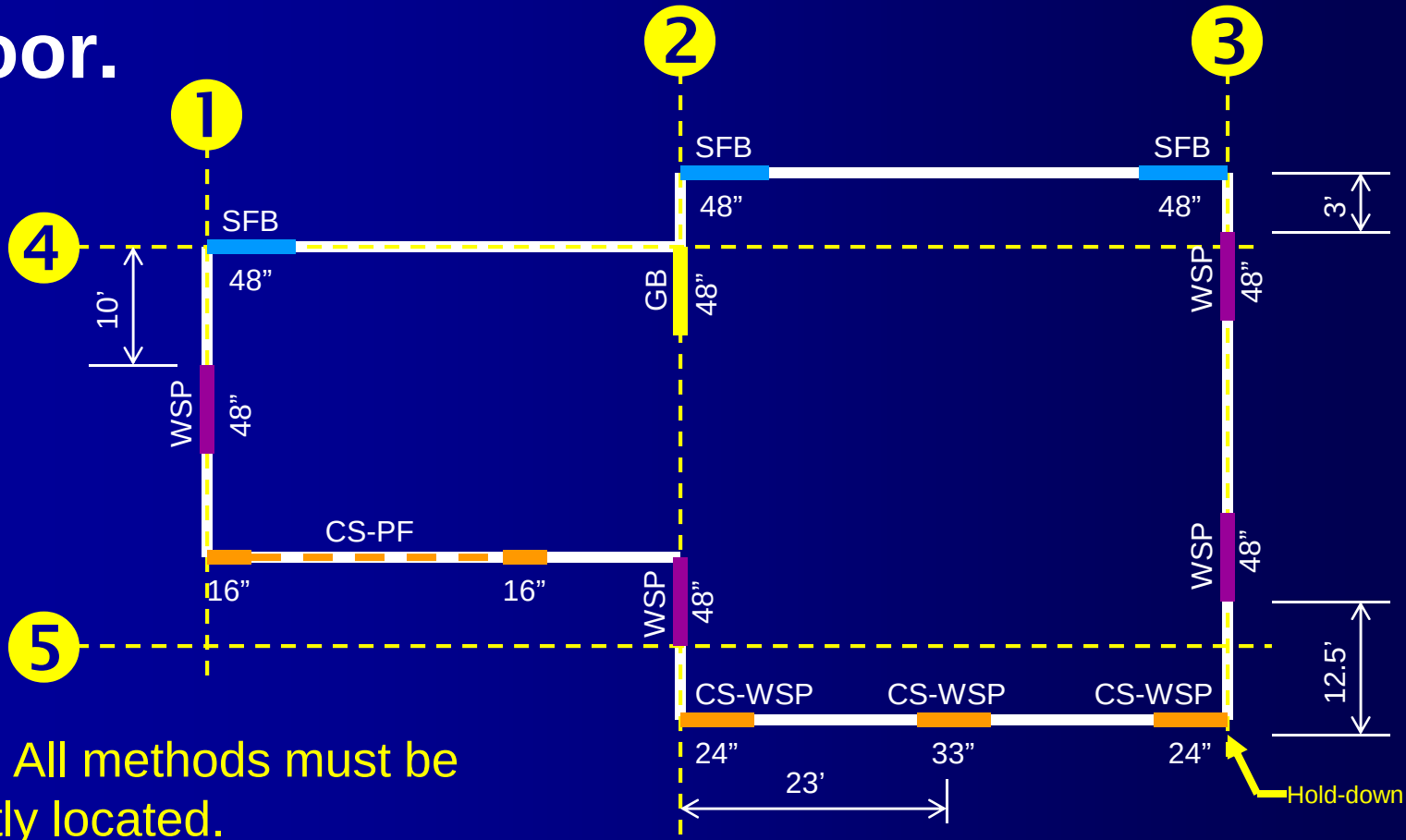
TABLE R602.10.2.3
EFFECTIVE LENGTHS FOR BRACE WALL PANELS WHEN DETERMINING PERCENTAGE OF BRACING[a]

ACTUAL LENGTH OF BRACED WALL PANEL	WALL HEIGHT		
	8'	9'	10'
48"	48"	48"	48"
42"	36"	36"	N/A
36"	27"	N/A	N/A

R602.10.2.2 Exception

Bracing Information on Plans

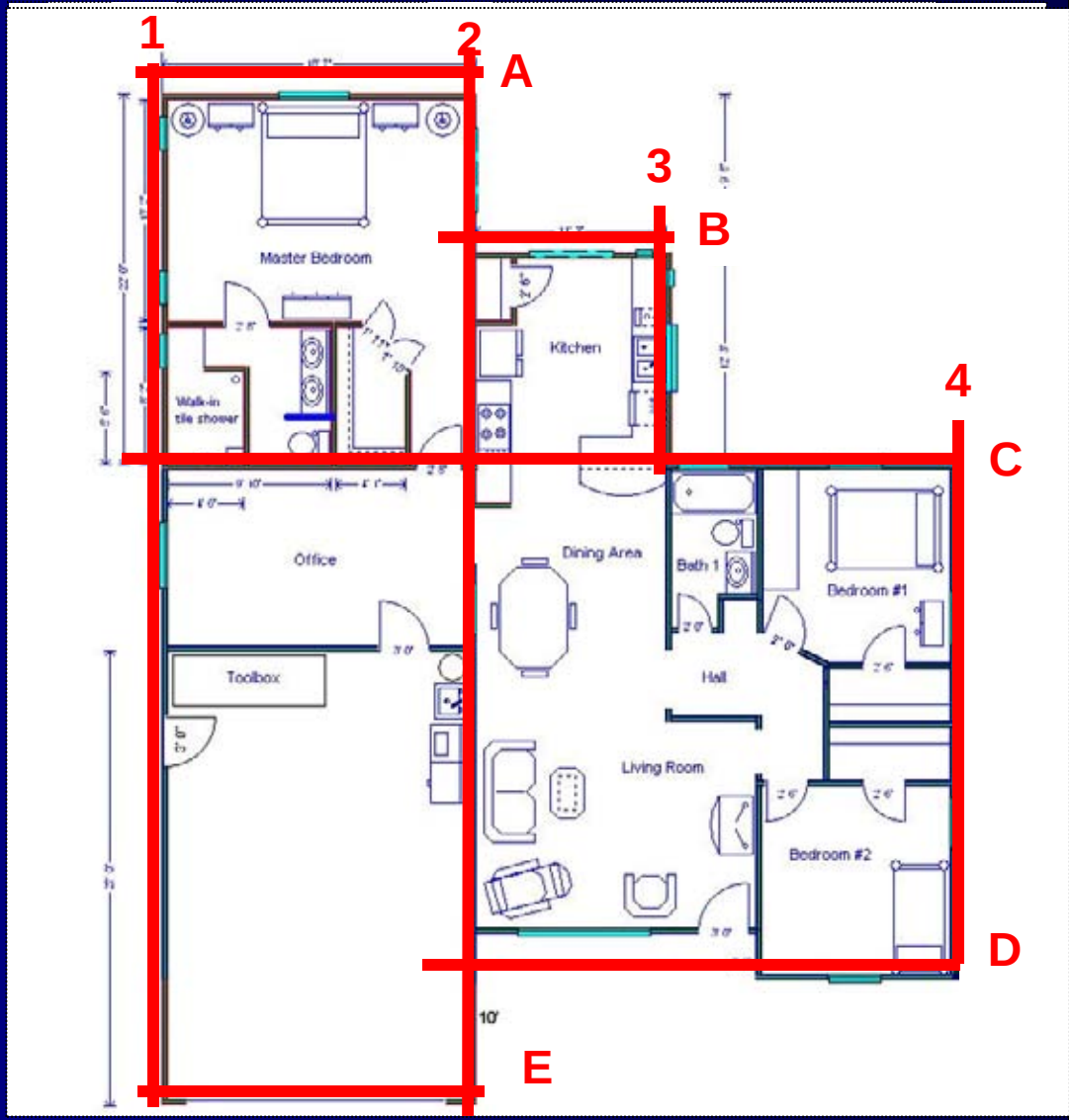
- **All BWLs and bracing methods must be identified and located on the plans for each floor.**



Note: All methods must be exactly located.

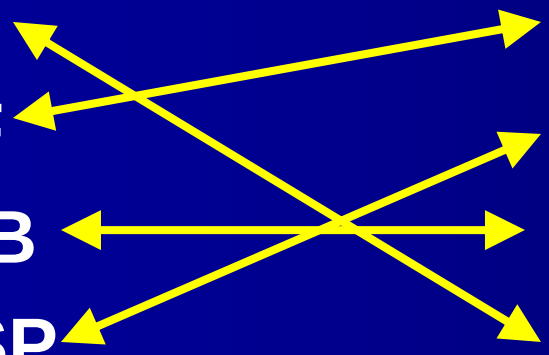
Proper identification of BWL

- Location of BWLs must be precise.
- BWLs should be drawn to their intended length.
- BWLs are NOT column lines, i.e., commercial plans.
- BWLs, as shown, must comply with 3 criteria: location, spacing, percentage.



Unit 6 – Quiz Question 1

Match the intermittent bracing methods.



1. GB	a. Intermittent portal frame
2. IPF	b. Wood structural panel
3. SFB	c. Structural fiber board
4. WSP	d. Gypsum board

Unit 6 – Quiz Question 2

What is the minimum length for a BWP with…

Method: WSP,

Height: 10’.

a. 27”

b. 36”

c. 48”

d. 53”

BRACING METHOD	FLOOR		HEIGHT OF INTERMITTENT BRACED WALL PANEL				
			8'	9'	10'	11'	12'
DWB, WSP, SFB, GB[c], PBS, PCP, HPS	All		48"	48"	48"	53"	58"
ABW	All		28"	32"	34"	38"	42"
IPF		One-story house	16"	16"	16"	18"	20"
		First floor of a two-story house	24"	24"	24"	27"	29"

Unit 6 – Quiz Question 3

What is the minimum required percentage for…

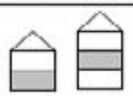
- **Wind speed: 90 mph,**
- **Location: Second story of a three-story house,**
- **Method: One-sided GB,**
- **Spacing of BWLs: 14'.**

a. 16%

b. 25%

c. 32%

d. 50%

SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENTAGE OF FULL-HEIGHT BRACING PER WALL LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	X 2 = 50%	36%
		First floor of a three-story house	25%	35%	36%	50%

For SI: 1 foot = 305 mm

a. Foundation cripple wall panels shall be braced in accordance with Section R602.10.8.

b. Methods of bracing shall be as described in Sections R602.10.2 and R602.10.3.

c. The total amount of bracing required for a given braced wall line shall be the product of the minimum required percentage and all the applicable adjustment factors described in Sections R602.10.4, R602.10.7 and R602.10.8.

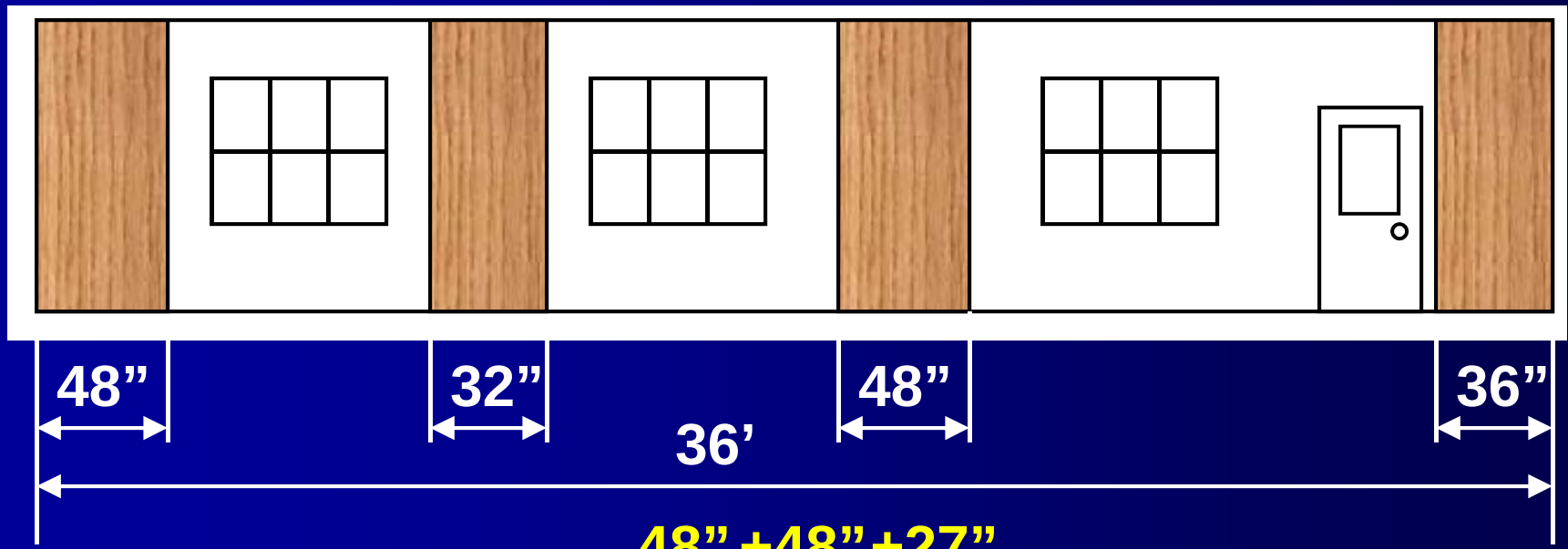
d. For Method GB, the percentage required shall be doubled for one-sided applications.

Unit 6 – Quiz Question 4

What is the actual percentage of bracing for…

Method: WSP,

Height: 8’,



$$\text{Actual \% Bracing} = \frac{48” + 48” + 27”}{36’ \times 12} \times 100 = 28\%$$

Unit 6 – Quiz Question 5

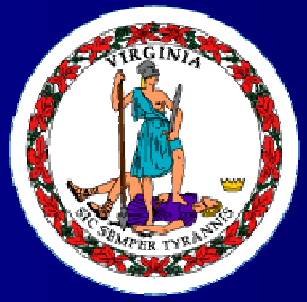
True or False:

The partial credit exception applies to Intermittent Bracing only.

True:

Partial credit only applies Intermittent Bracing Methods WSP and SFB and does NOT apply to Continuous Sheathing.

Unit 7

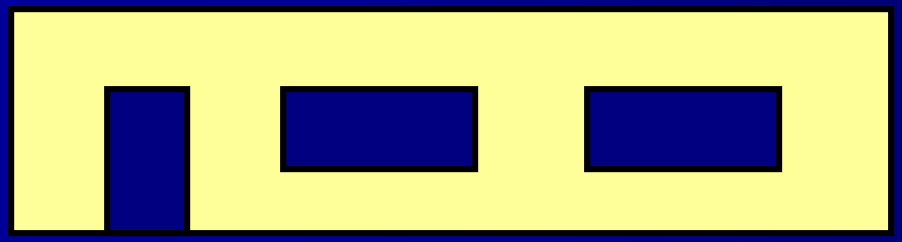


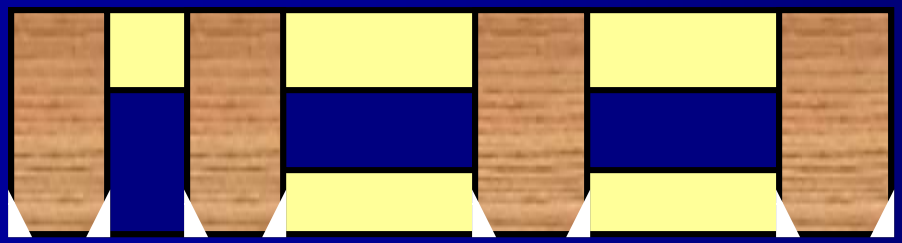
Continuous Sheathing

Unit 7 Topics

- Origins of continuous sheathing.
- Continuous sheathing methods.
- Minimum length.
- The continuous sheathing portal frame.
- Panel requirements at the end of a BWL.

Continuous Sheathing Evolution



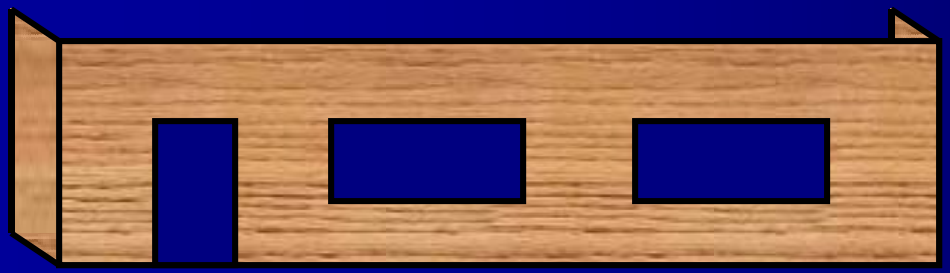


Engineered shearwall approach

- Shearwalls between openings.
- Hold-downs at each end of each shearwall.

Perforated shearwall approach

- One big shearwall with openings in it.
- Hold-downs at each end.



Continuous sheathing

- Similar approach to perforated shearwall.
- All portions of a braced wall line are sheathed.
- Hold-downs are replaced by return panels.

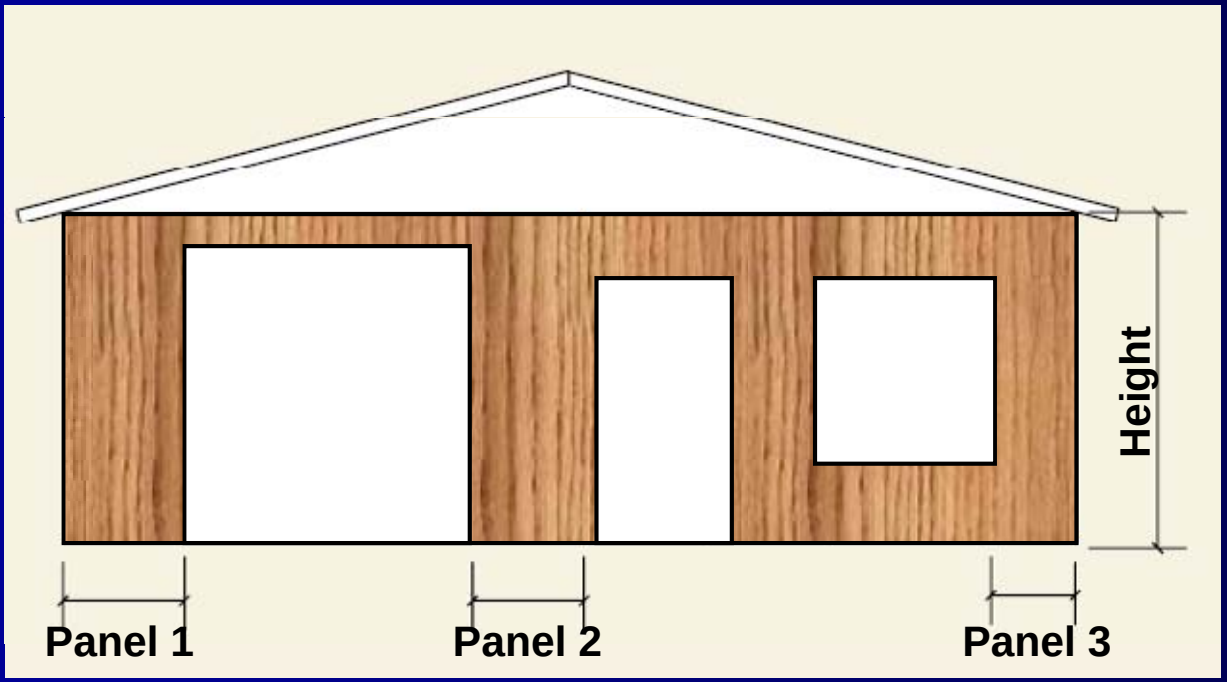
Continuous Sheathing Methods

- 3 continuous sheathing methods:
  - CS-WSP: wood structural panels.
  - CS-G: wood structural panels at garage openings.
  - CS-PF: continuously sheathed portal frames without hold-downs.

R602.10.3.1

CS-WSP: Wood Structural Panels

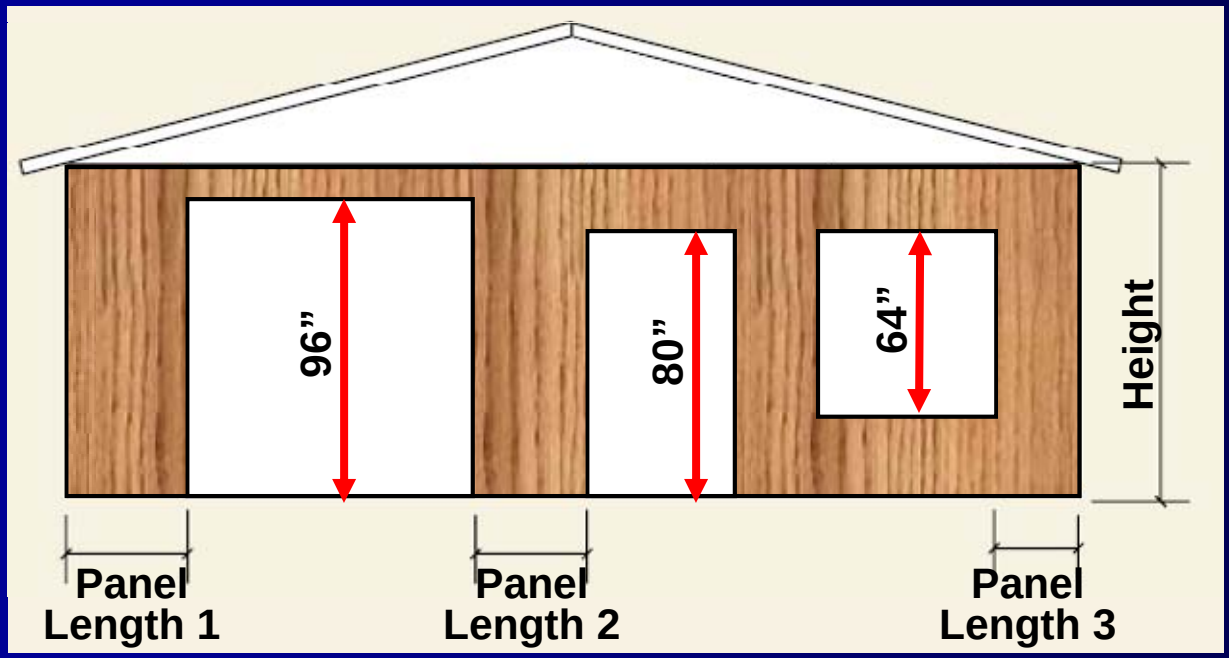
- 3/8” full-height wood structural panels; attach with 6d nails @ 6” o.c. edges, 12” field.
- Required length is based on height of tallest <u>adjacent</u> clear opening(s).



R602.10.3.1

CS-WSP Panel Height & Length

- For panels between openings of differing heights, the taller opening governs.
- Wall segments less than the required length are NOT considered panels and do NOT contribute towards the percentage required, but must still be sheathed.



CS-WSP Panel Height & Length

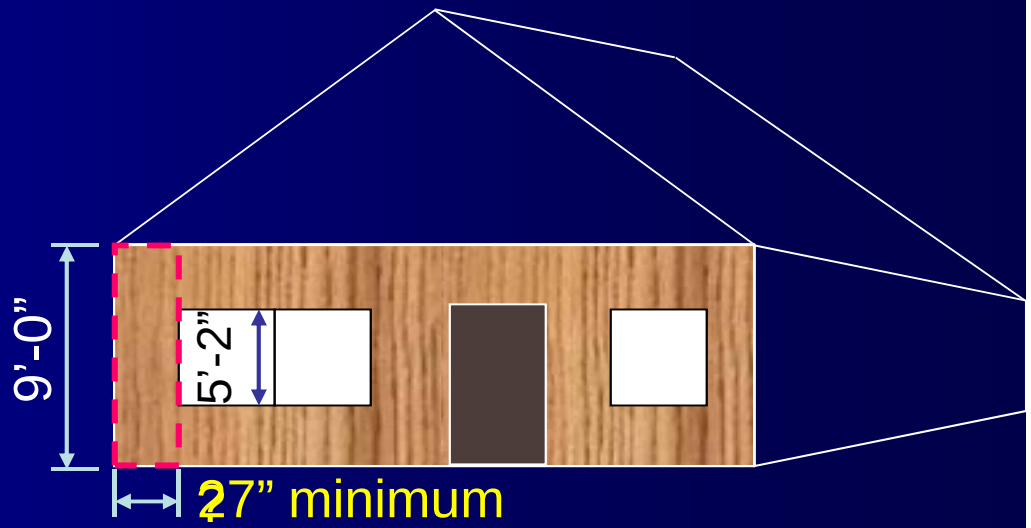
- New Table R602.10.3.2.

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
	64"	24"	27"	30"	33"	36"
	68"	26"	27"	30"	33"	36"
	72"	28"	27"	30"	33"	36"
	76"	29"	30"	30"	33"	36"
	80"	31"	33"	30"	33"	36"
	84"	35"	36"	33"	36"	36"
	88"	39"	39"	36"	38"	36"
CS-WSP	92"	44"	42"	39"	41"	36"
	96"	48"	45"	42"	43"	39"
	100"		48"	45"	47"	42"
	104"		51"	48"	48'	44"
	108"		54"	51"	51"	47"
	112"			54"	53"	50"
	116"			57"	56"	53"
	120"			60"	58"	55"
	124"				61"	58"
	128"				63"	61"
	132"				66"	64"
	136"					66"
	140"					69"
	144"					72"

CS-WSP: wood structural panels

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
CS-WSP	64"	24"	27"	30"	33"	36"
	68"	26"	27"	30"	33"	36"
	72"	28"	27"	30"	33"	36"
	76"	29"	30"	30"	33"	36"
	80"	31"	33"	30"	33"	36"
	84"	35"	36"	33"	36"	36"
	88"	39"	39"	36"	38"	36"
	92"	44"	42"	39"	41"	36"
	96"	48"	45"	42"	43"	39"
	100"		48"	45"	47"	42"
	104"		51"	48"	48'	44"
	108"		54"	51"	51"	47"
	112"			54"	53"	50"
	116"			57"	56"	53"
	120"			60"	58"	55"
	124"				61"	58"
	128"				63"	61"
	132"				66"	64"
	136"					66"
	140"					69"
	144"					72"

5'-2" Window = 62"

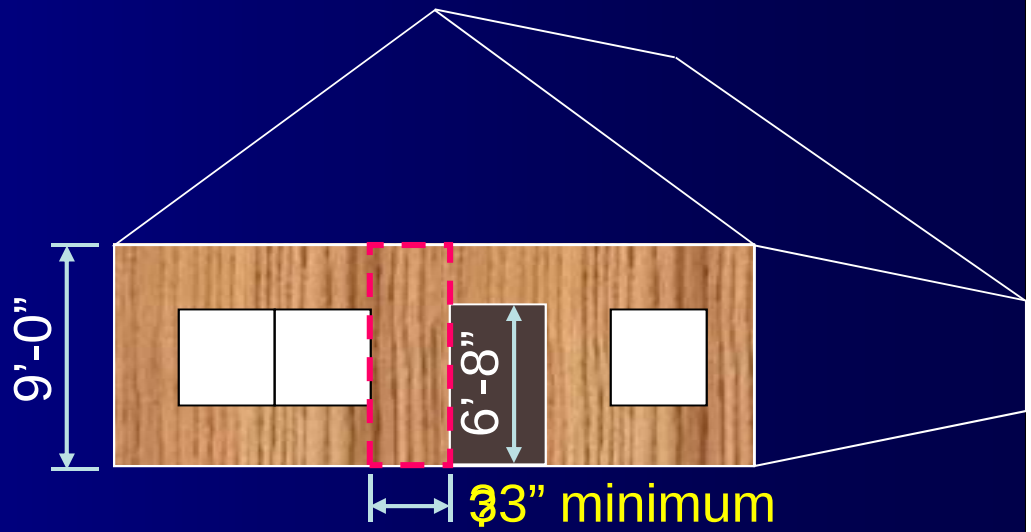


R602.10.3.2

CS-WSP: wood structural panels

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
	64"	24"	27"	30"	33"	36"
	68"	26"	27"	30"	33"	36"
	72"	28"	27"	30"	33"	36"
	76"	29"	30"	30"	33"	36"
	80"	31"	33"	30"	33"	36"
	84"	35"	36"	33"	36"	36"
	88"	39"	39"	36"	38"	36"
	92"	44"	42"	39"	41"	36"
CS-WSP	96"	48"	45"	42"	43"	39"
	100"		48"	45"	47"	42"
	104"		51"	48"	48'	44"
	108"		54"	51"	51"	47"
	112"			54"	53"	50"
	116"			57"	56"	53"
	120"			60"	58"	55"
	124"				61"	58"
	128"				63"	61"
	132"				66"	64"
	136"					66"
	140"					69"
	144"					72"

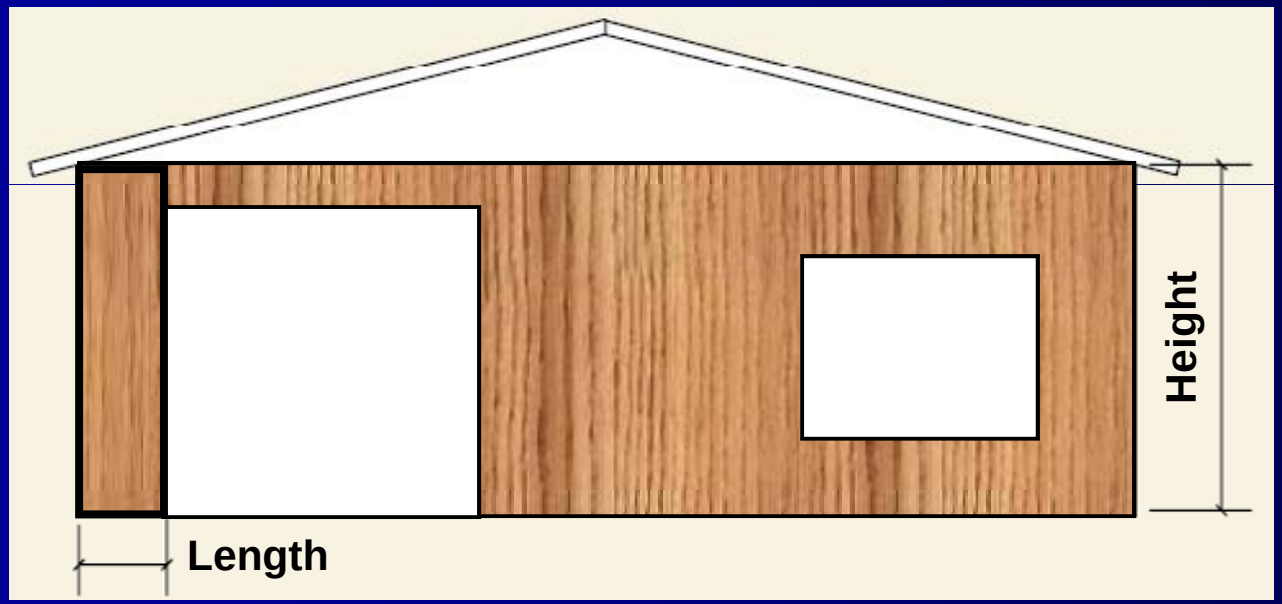
6’-8” Door = 80”



R602.10.3.2

Method CS-G

- Material and attachment per method CS-WSP.
- Wall only supporting roof load (or gable end wall).
- One wall only.



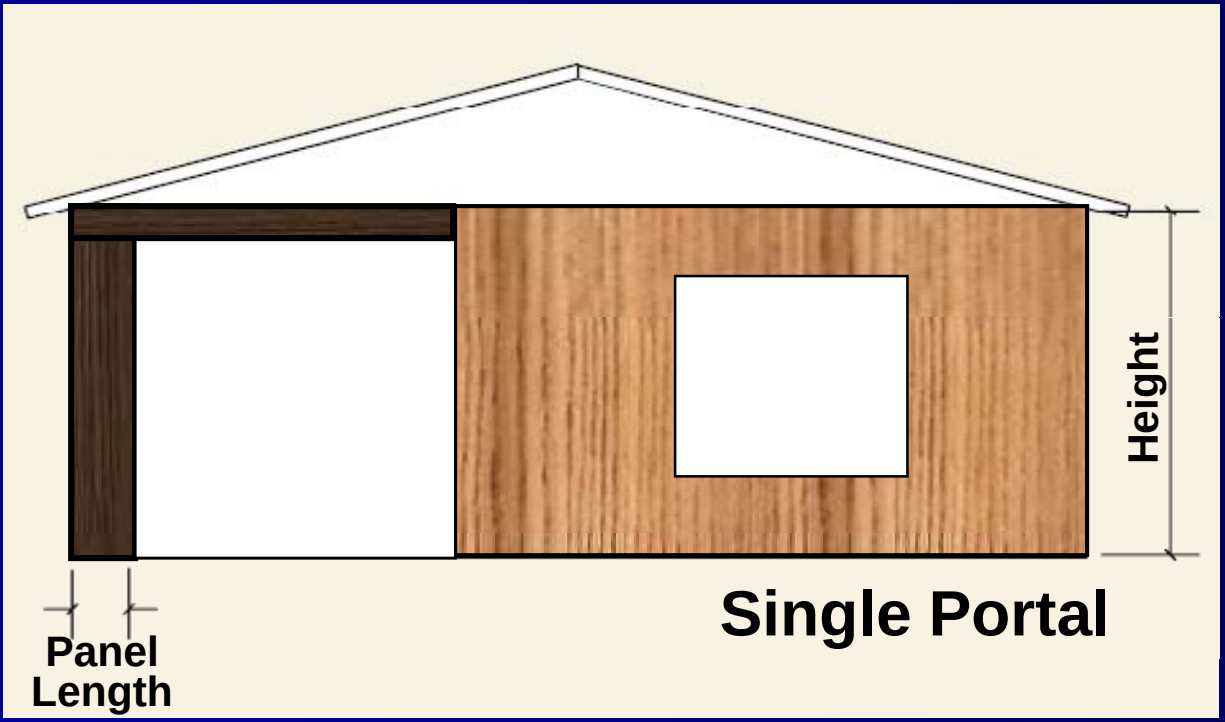
Wall height measured to top of top plates.

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
CS-G	≤ 120"	24"	27"	30"	33"	36"

R602.10.3.1

CS-PF: Continuous Portal Frame

- Maximum of four portals per braced wall line.
- Cannot be stacked.



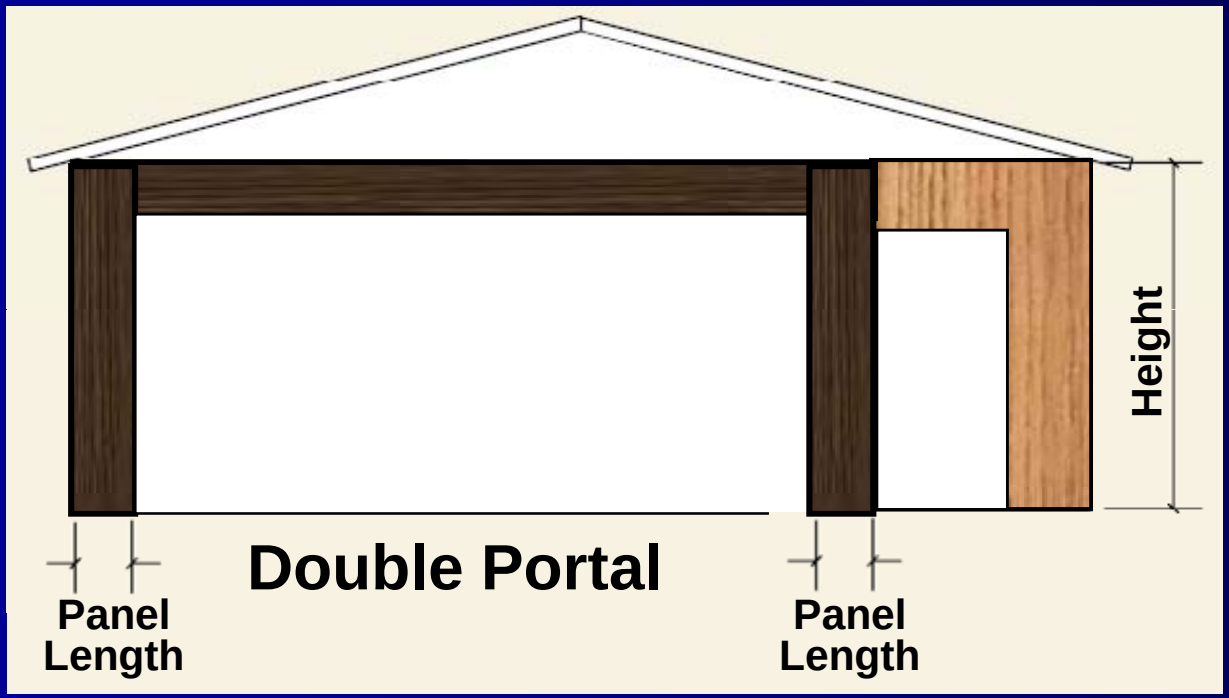
Wall height measured to top of top plates.

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
CS-PF	≤ 120"	16"	18"	20"	22"	24"

R602.10.3.1

CS-PF: Continuous Portal Frame

- Maximum of four portals per braced wall line.
- Cannot be stacked.

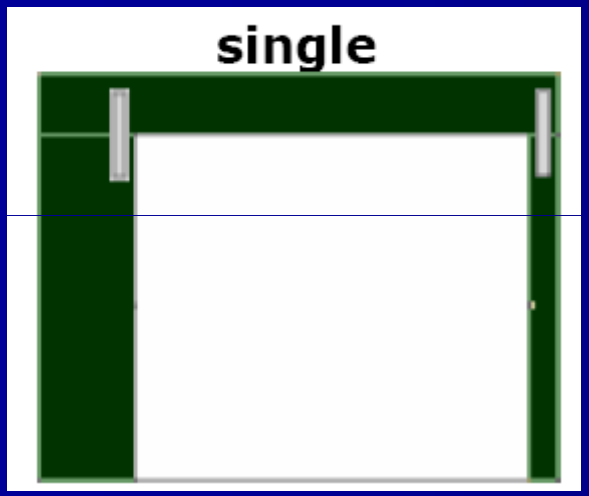


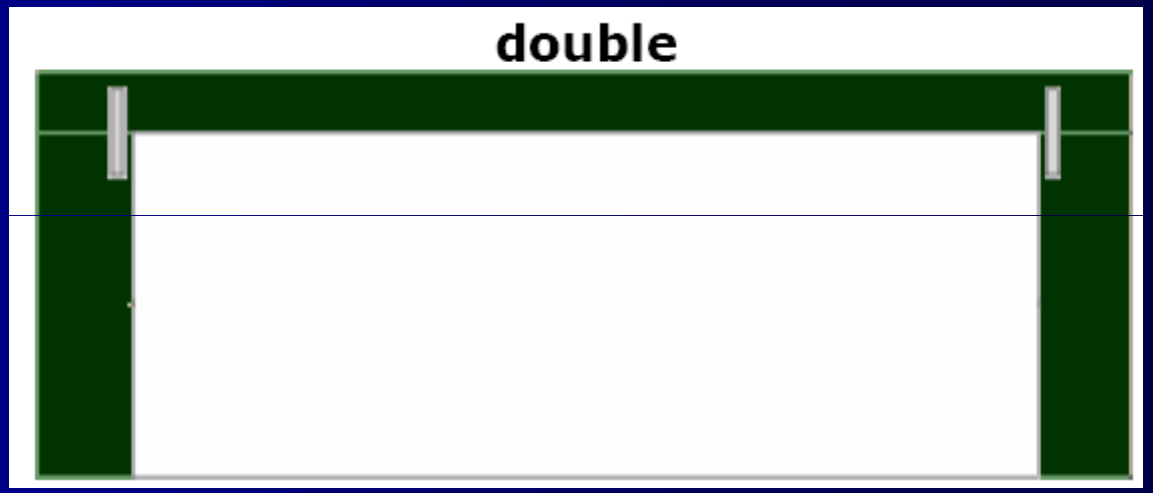
Wall height measured to top of top plates.

Method	ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
		8'	9'	10'	11'	12'
CS-PF	≤ 120"	16"	18"	20"	22"	24"

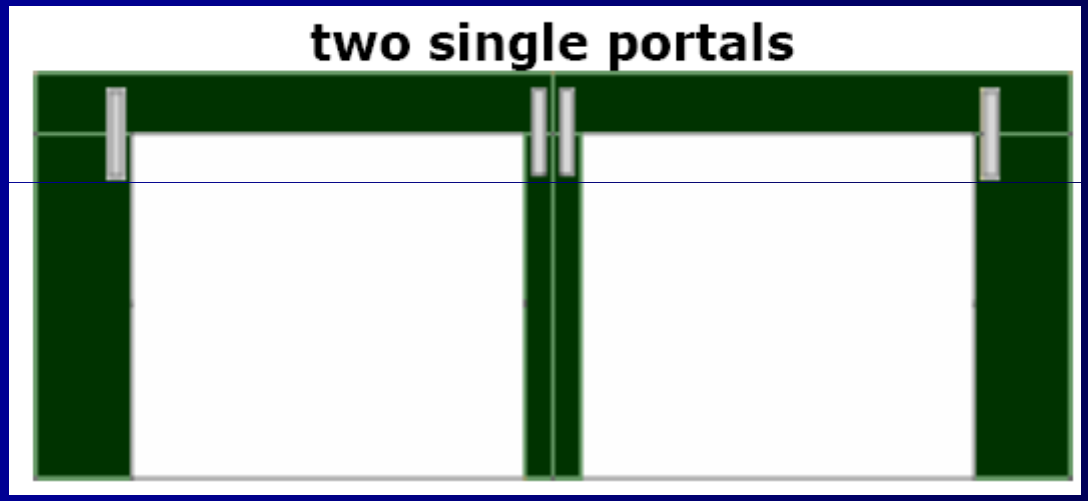
R602.10.3.1

Single vs. Double Portal

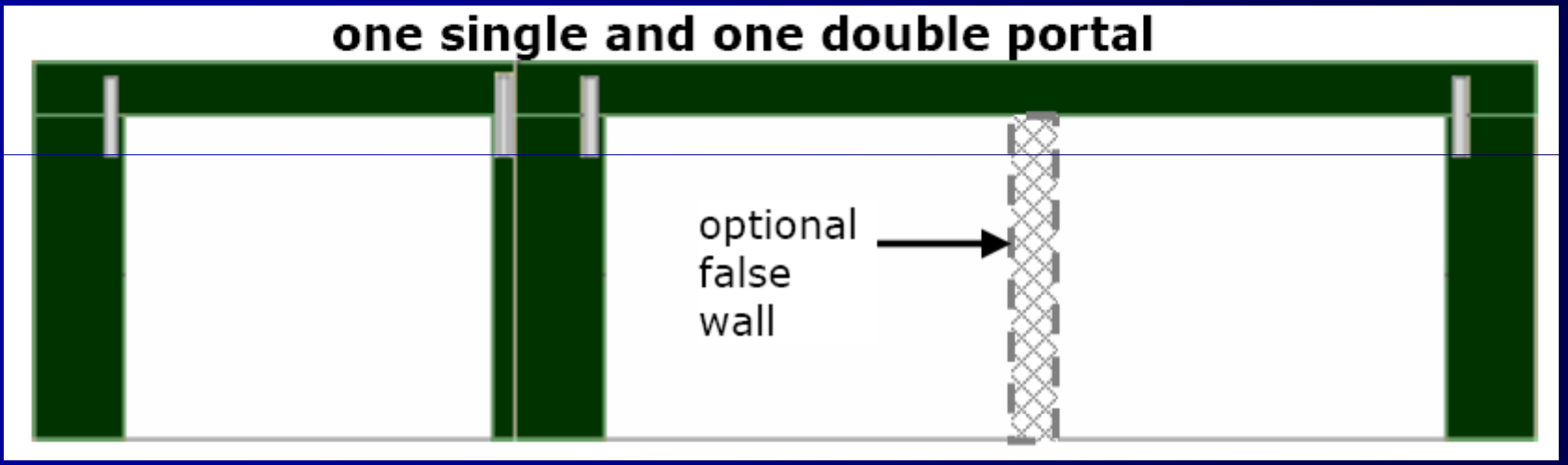




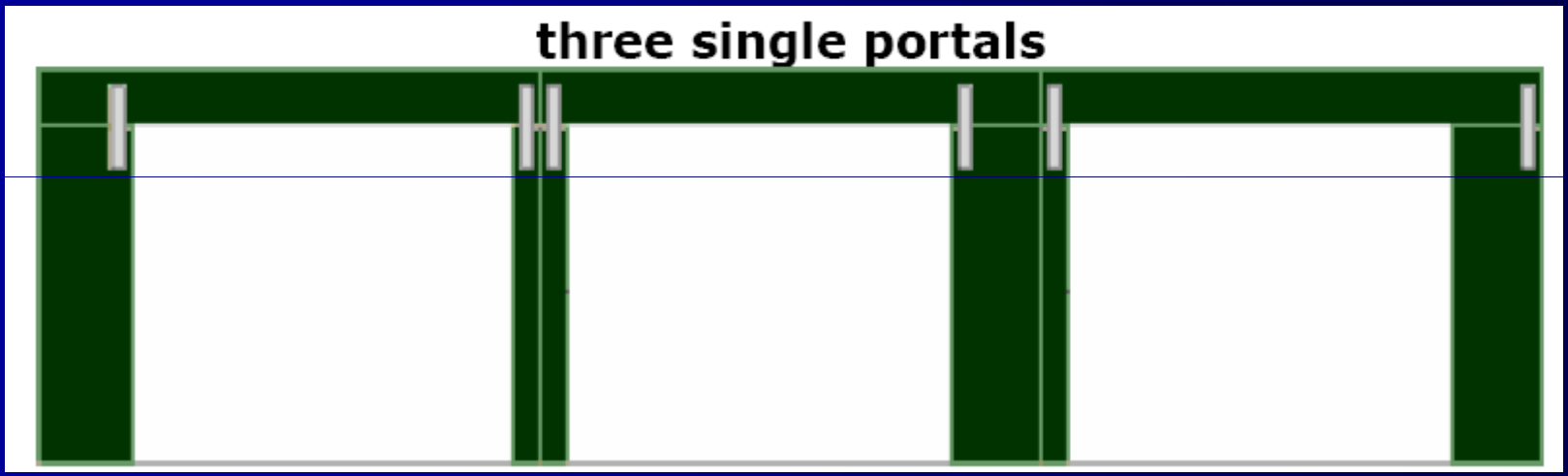
Garage Door Braced Wall Line



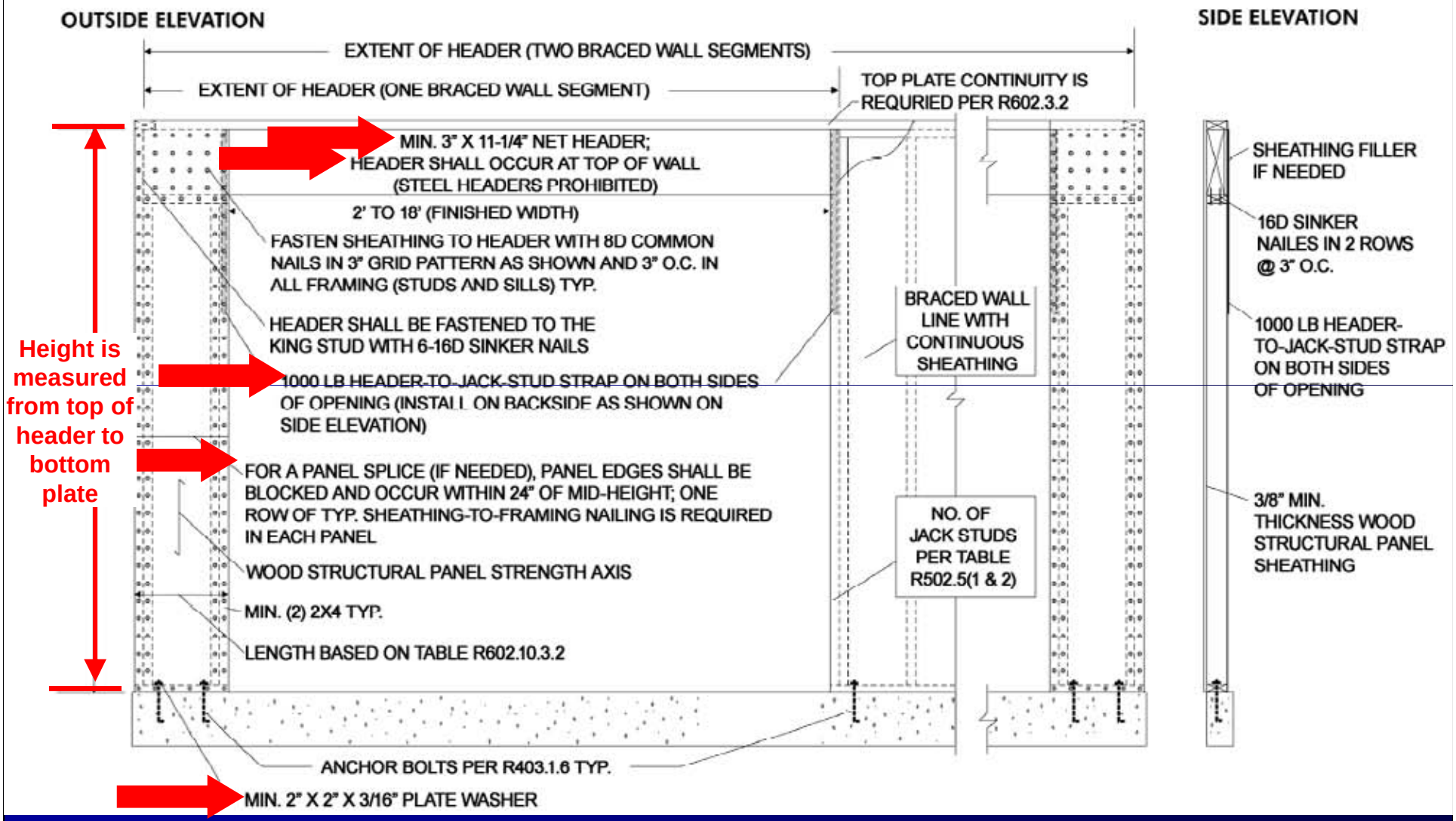
Garage Door Braced Wall Line



Garage Door Braced Wall Line

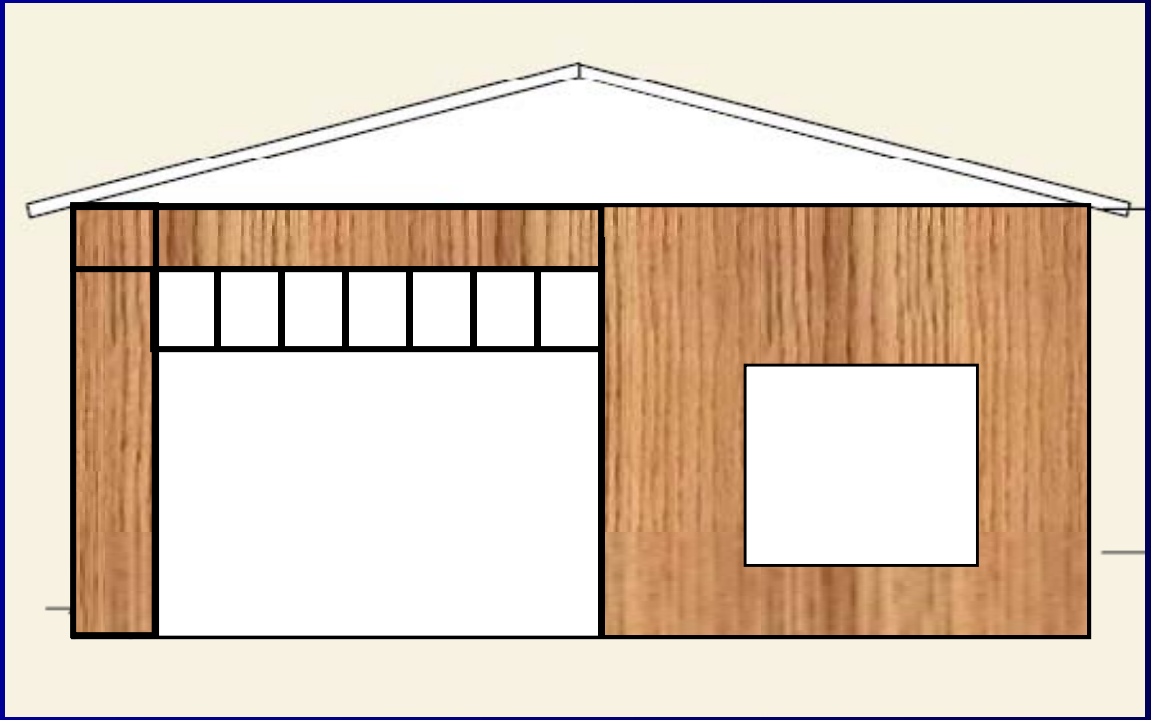


CS-PF: Continuous Portal Frame

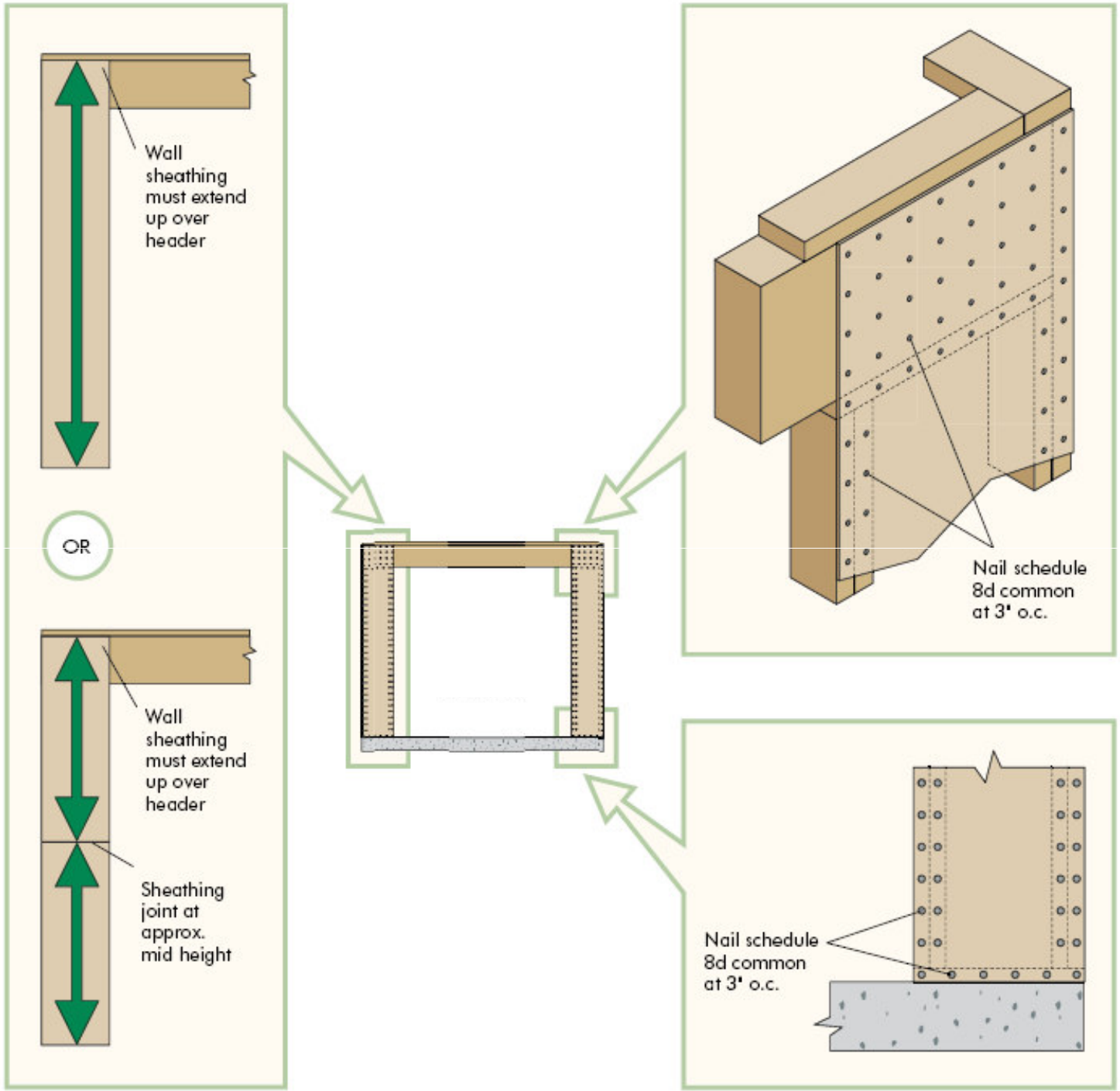


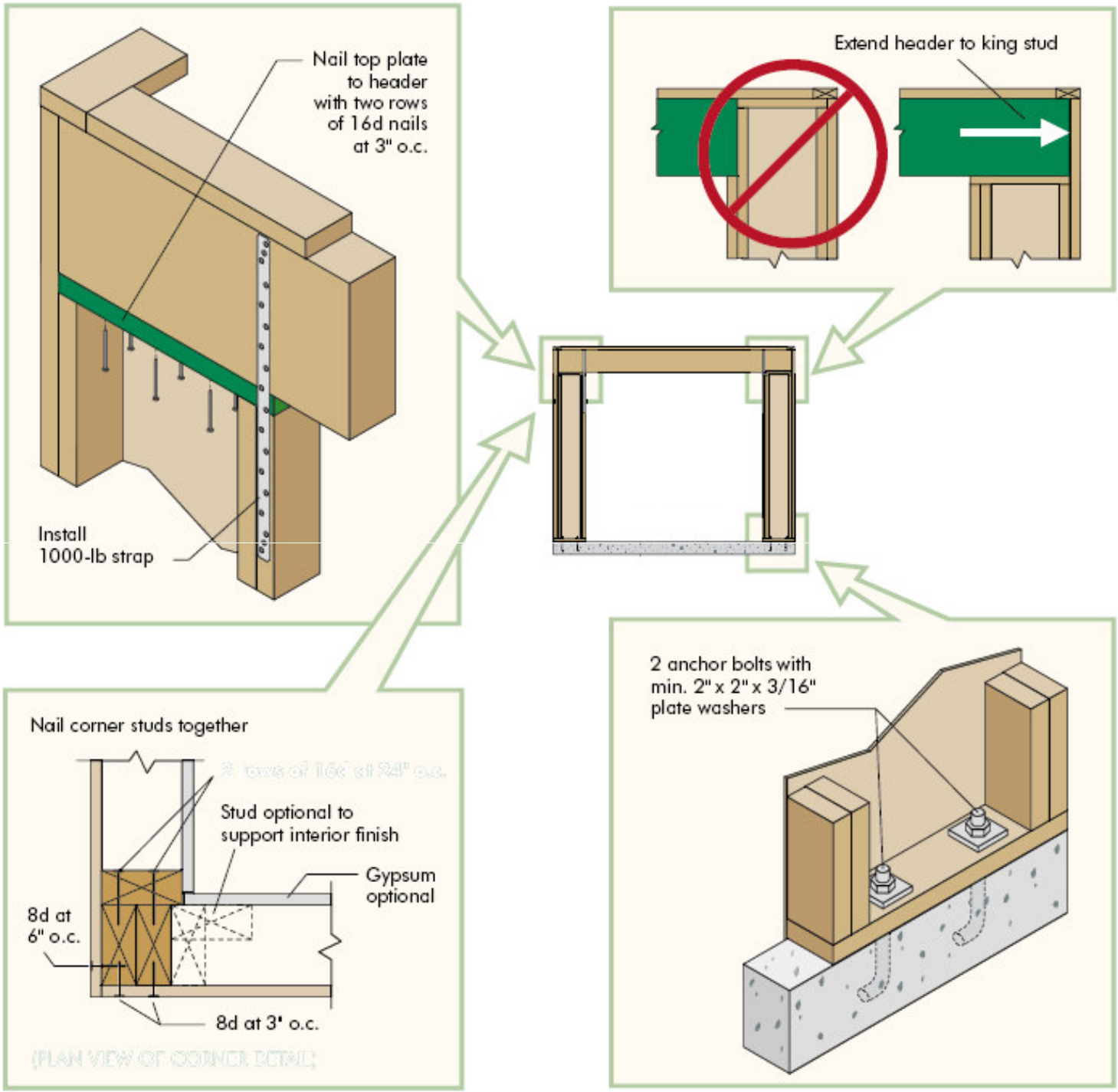
CS-PF: Continuous Portal Frame

- A pony/stud wall should “hang” beneath the header, not on top of the header.

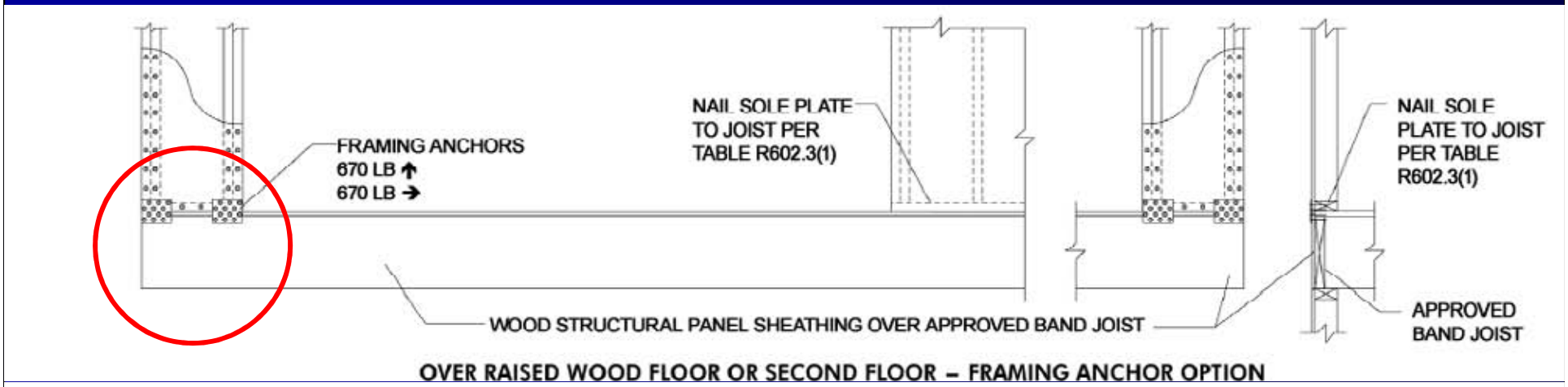


CS-PF: Continuous Portal Frame

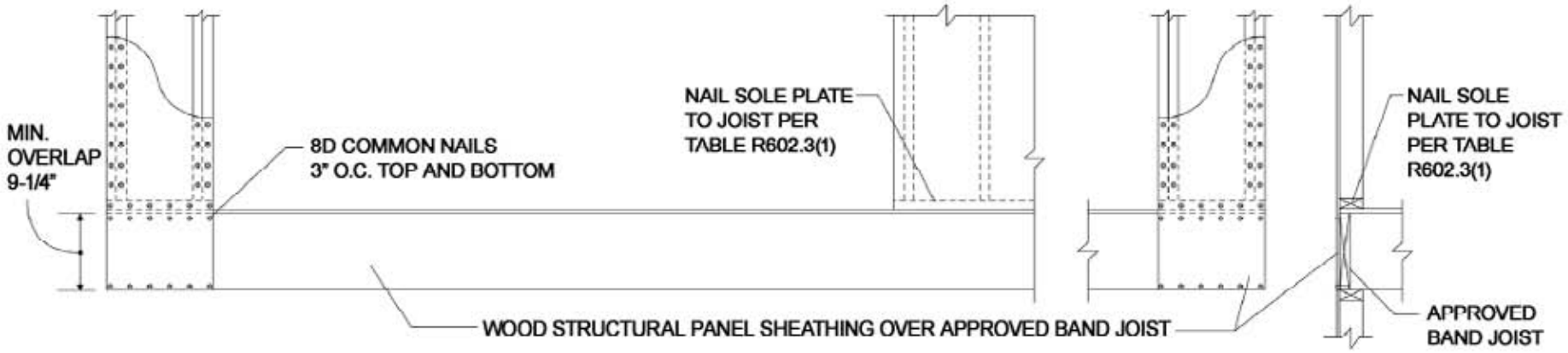

Wall sheathing must extend up over header
OR
Wall sheathing must extend up over header
Sheathing joint at approx. mid height
Nail schedule 8d common at 3" o.c.
Nail schedule 8d common at 3" o.c.


Nail top plate to header with two rows of 16d nails at 3" o.c.
Install 1000-lb strap
Extend header to king stud
Nail corner studs together
Stud optional to support interior finish
Gypsum optional
8d at 6" o.c.
8d at 3" o.c.
2 anchor bolts with min. 2" x 2" x 3/16" plate washers

CS-PF: Continuous Portal Frame



OVER RAISED WOOD FLOOR OR SECOND FLOOR – FRAMING ANCHOR OPTION



OVER RAISED WOOD FLOOR OR SECOND FLOOR – WOOD STRUCTURAL PANEL OVERLAP OPTION

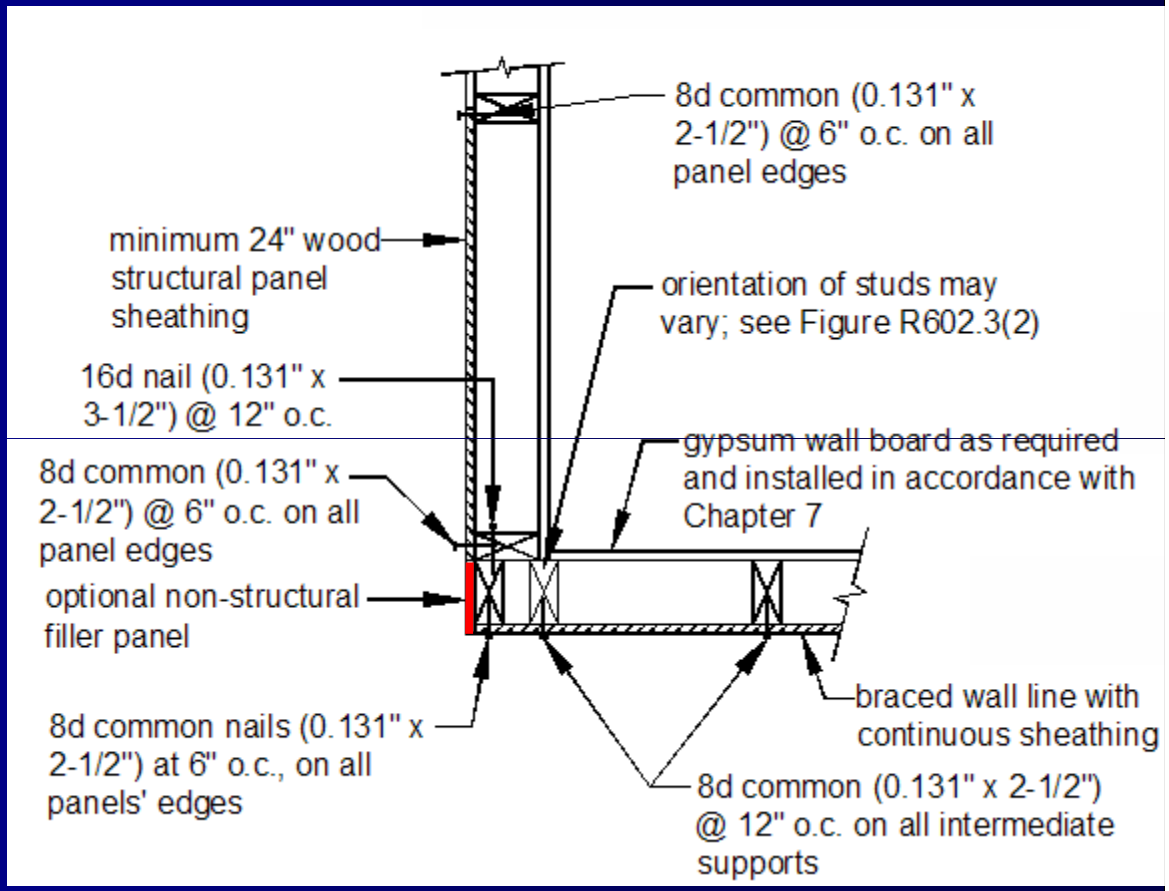
We want your head to explode!

Lunch Break

Das Hammer

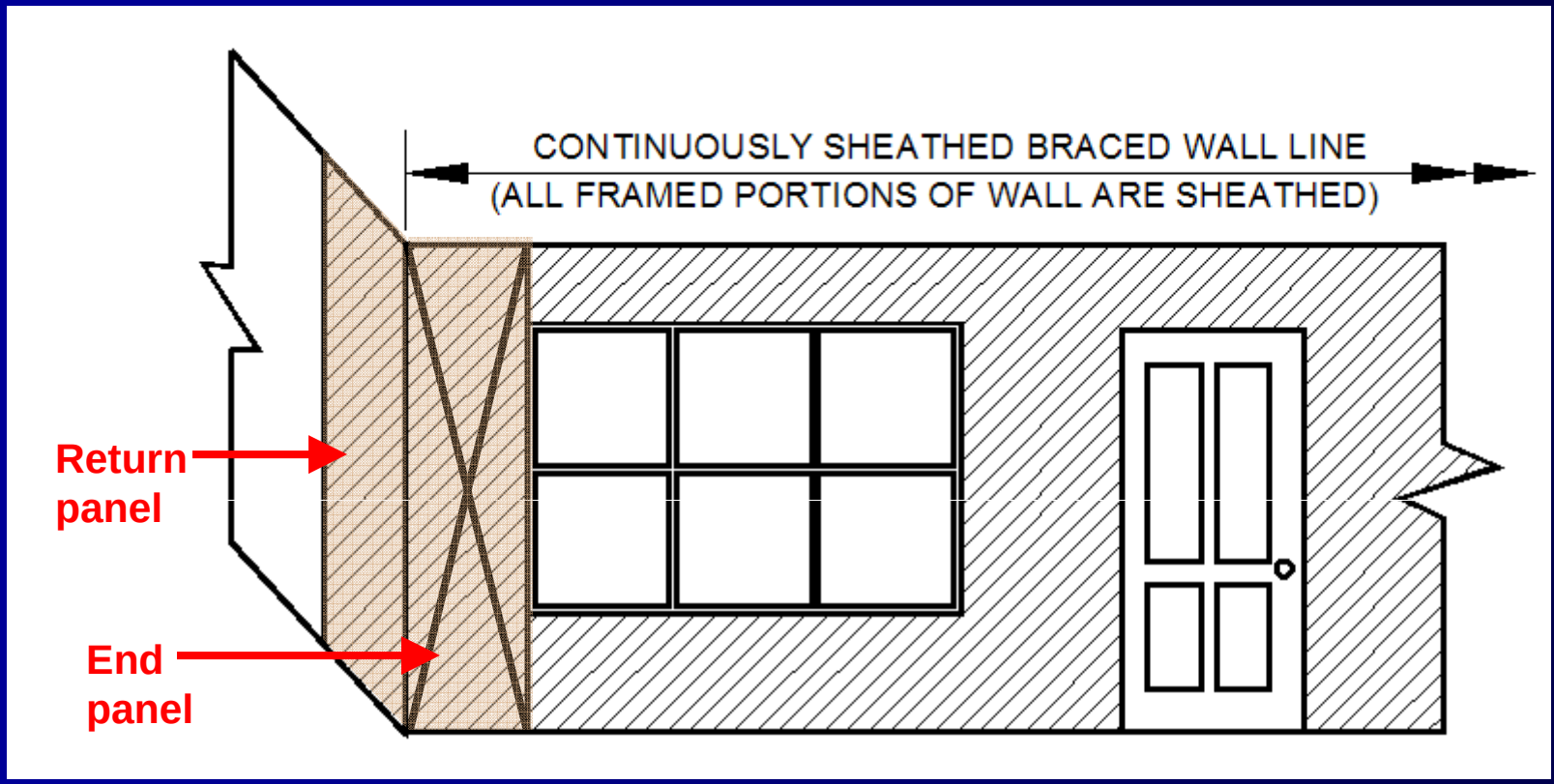
Corner Framing

- Return panels acts as a hold-downs
- Corner framing must be able to transfer load to the foundation.
- Added nailing and studs are required.



R602.10.3.3

Corner Panels

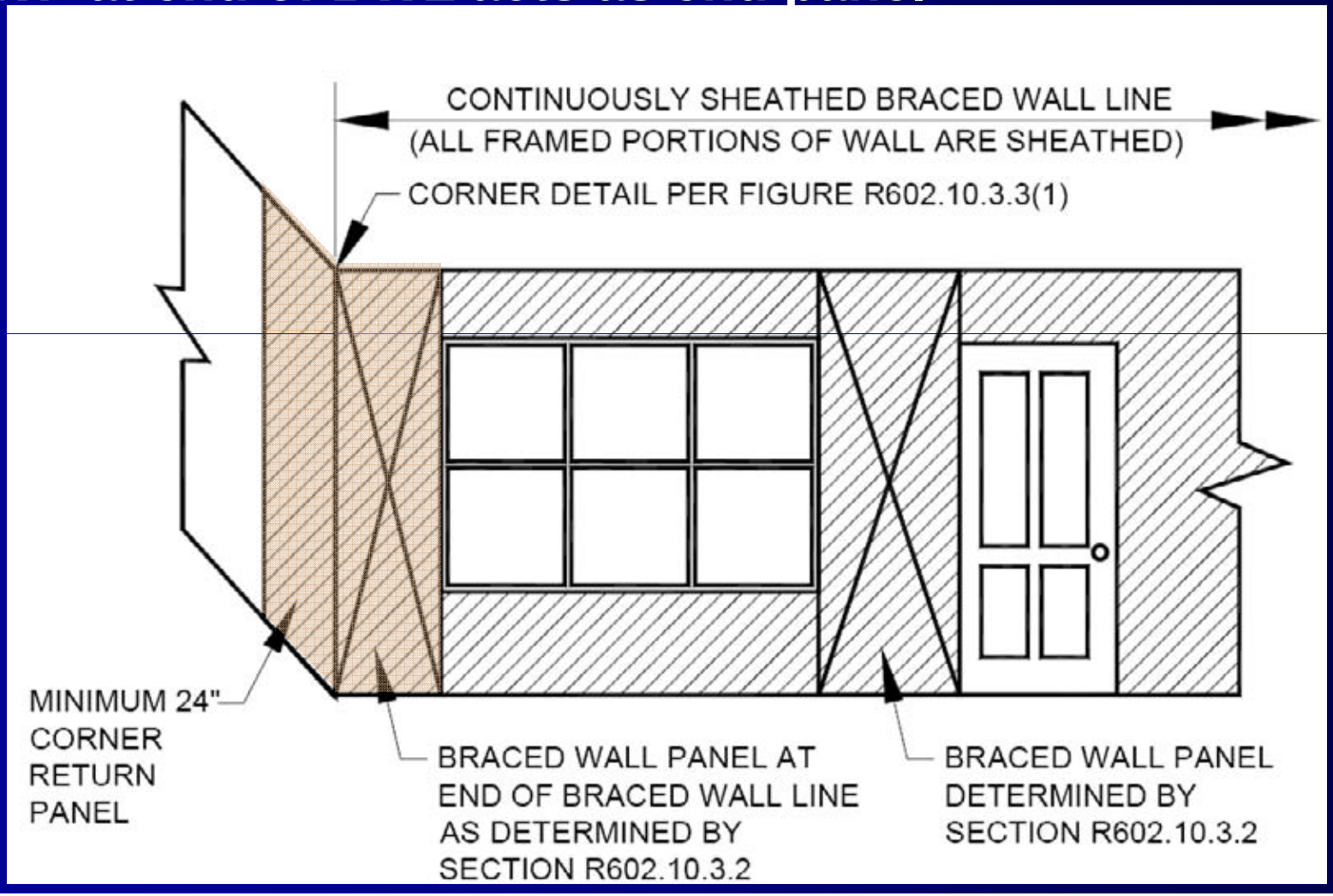


- 24” panels are required on both sides of corner.
- The return panel.
- The end panel.
- Sometimes the end panel will also be a BWP.

R602.10.3.3

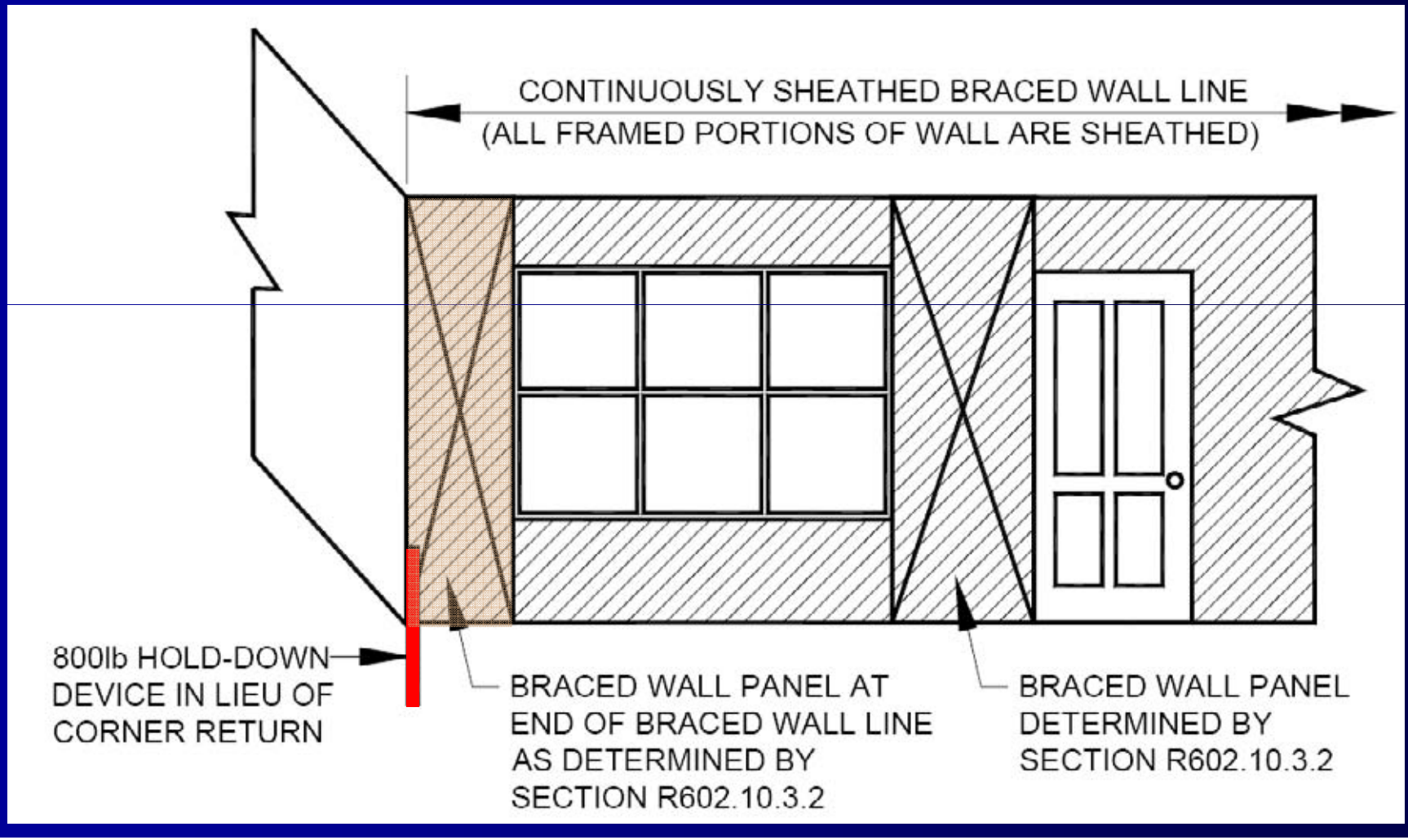
Continuous Return Panels, Option 1

- Return panel provided.
- BWP at end of BWL acts as end panel.



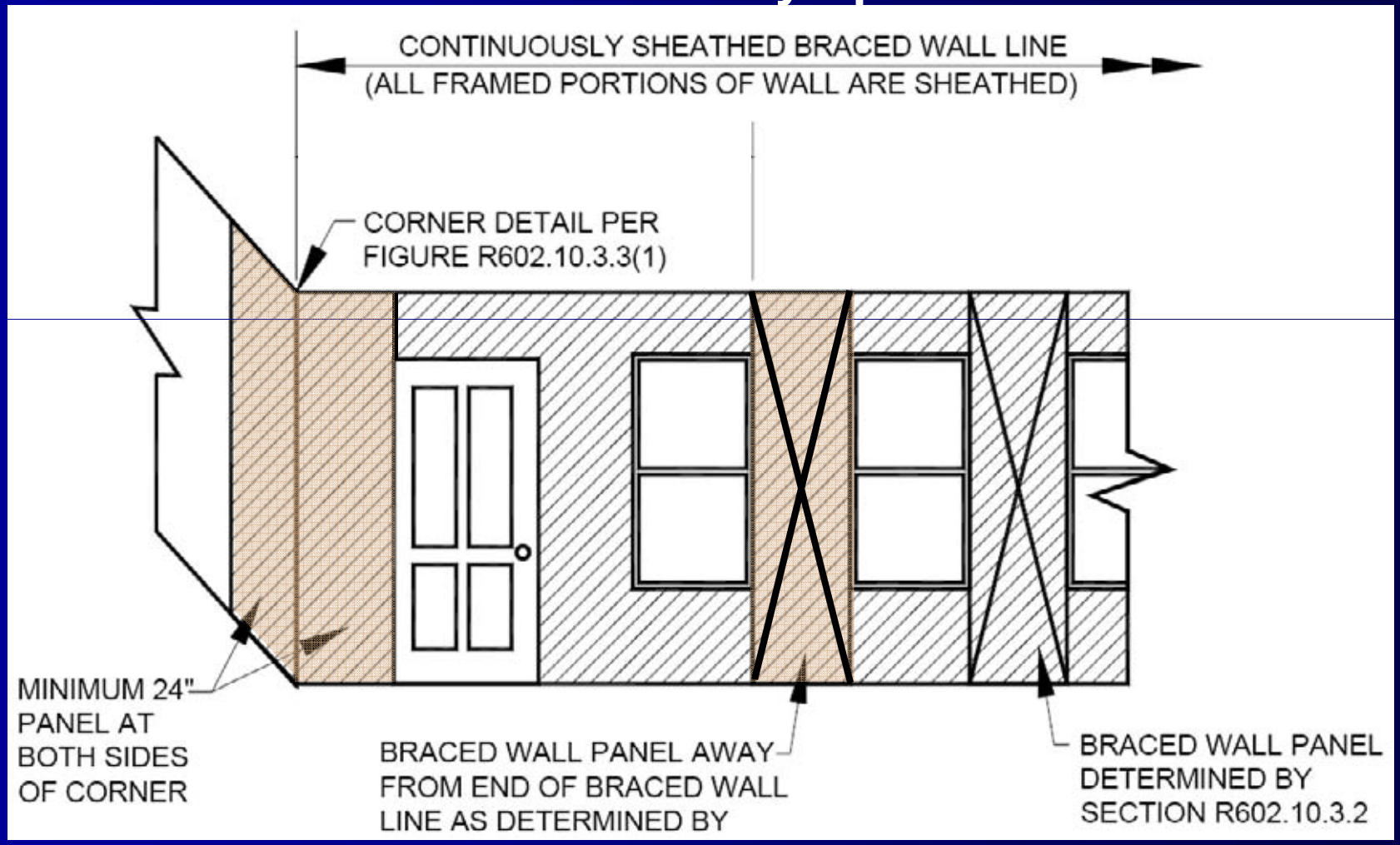
Continuous Return Panels, Option 2

- Hold-down replaces return panel.
- BWP at end of BWL acts as 24” end panel.



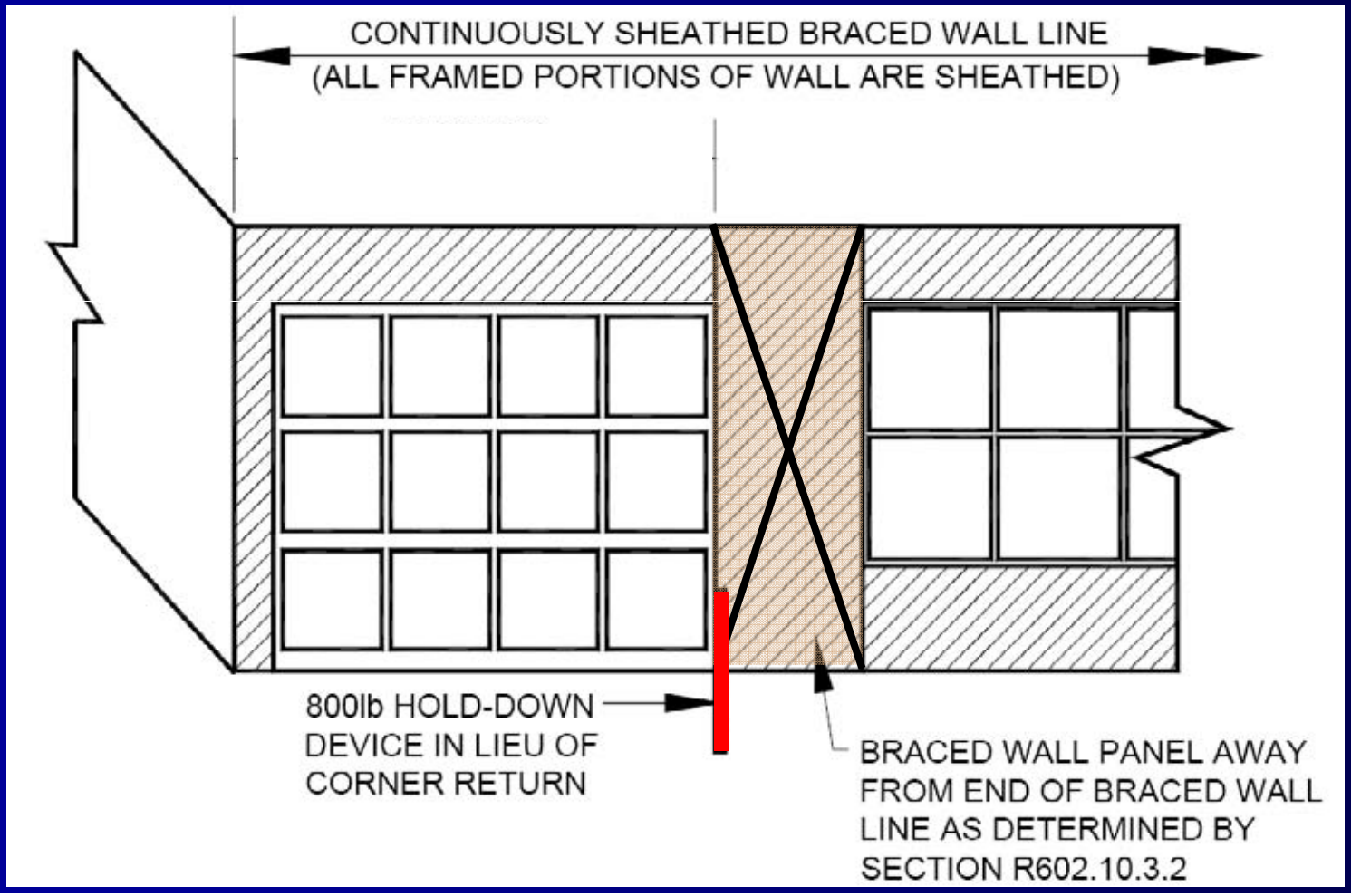
Continuous Return Panels, Option 3

- Both return panel and end panel provided.
- BWP offset from end of BWL by up to 12.5’.



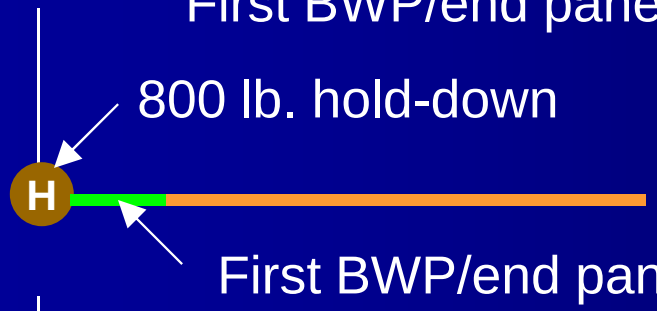
Continuous Return Panels, Option 4

- Neither return panel nor end panel provided.
- BWP offset from end of BWL by up to 12.5’ with hold-down.

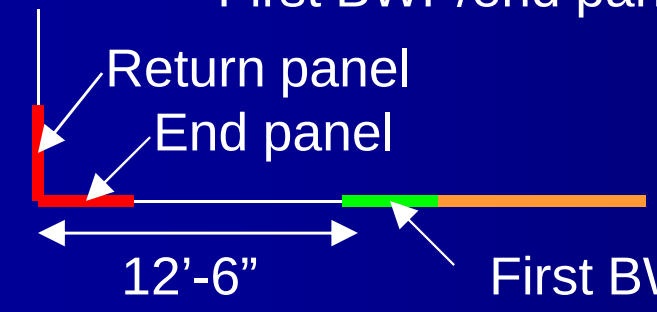


Corner Return Options, Review

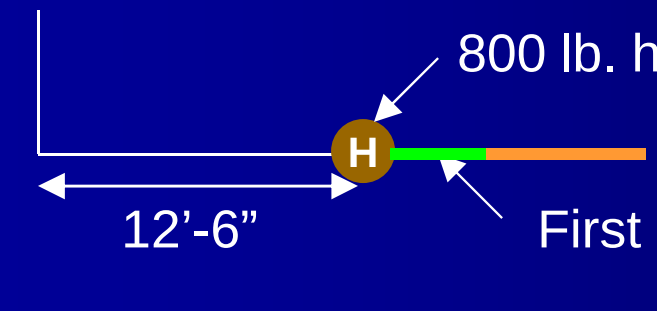
Option 1



Option 2



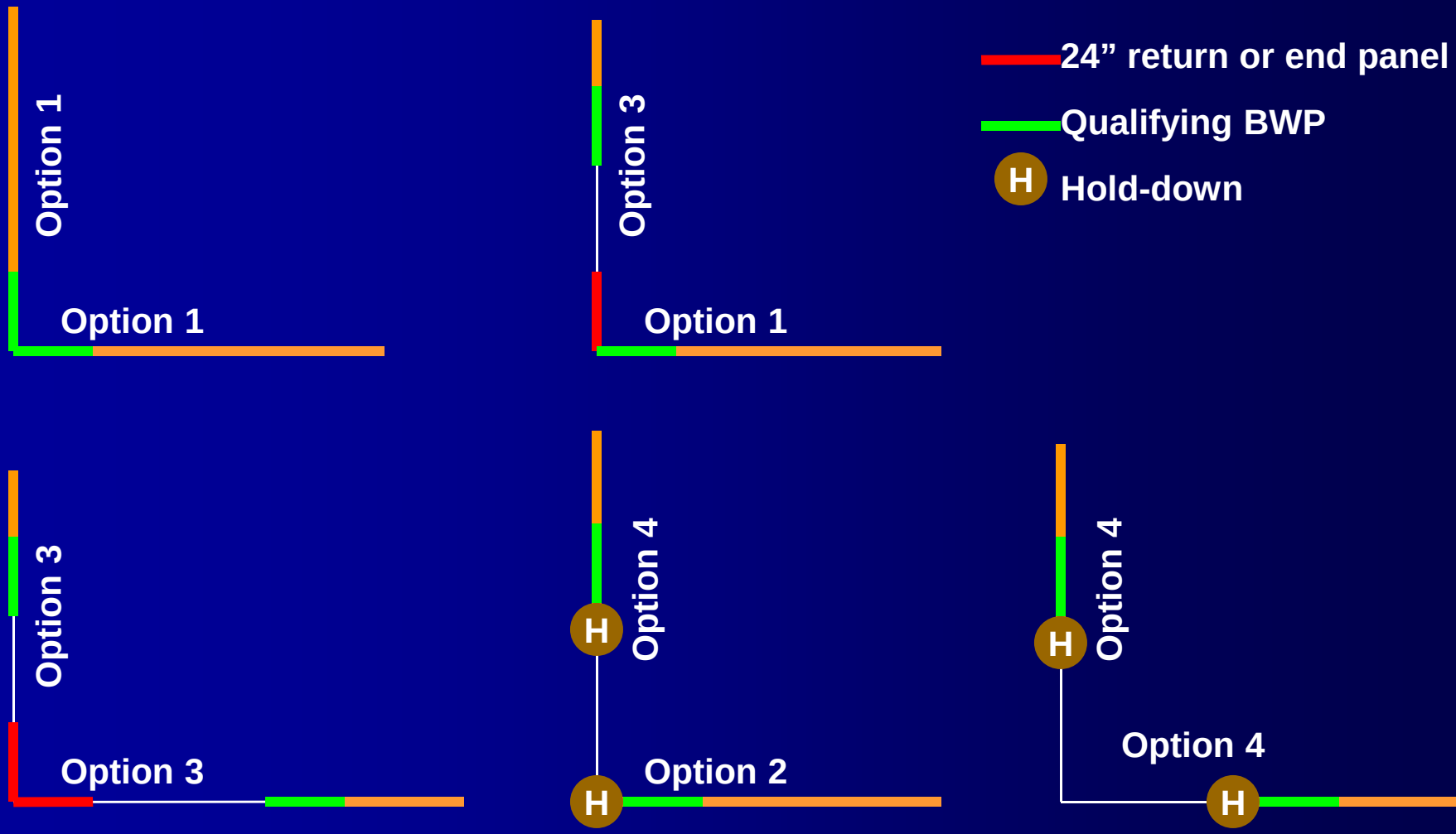
Option 3



Option 4

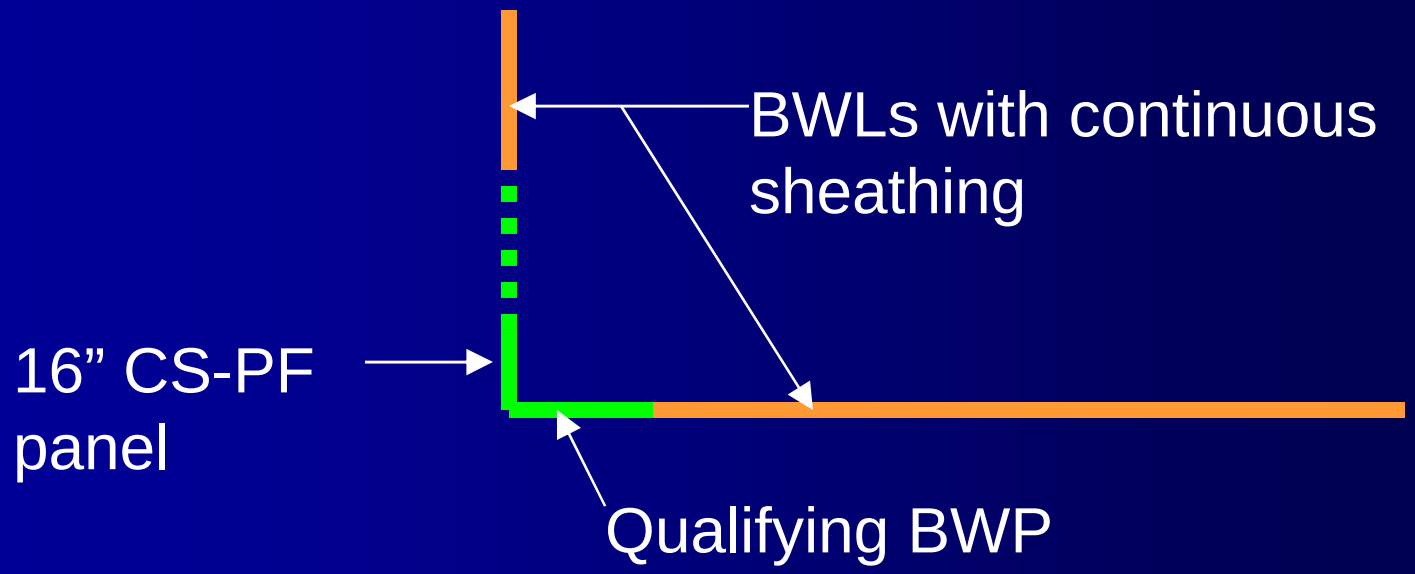
Corner Return Options, Review

Combination of options if using CS-WSP



Corner Return Options, Review

Can a CS-PF panel of a perpendicular BWL act as the return panel for a BWL? Yes



Unit 7 – Quiz Question 1

True or False:

A pony/stud wall up to 2’ in height can be constructed on top of the header of a portal frame, Method CS-PF?

False:

The header must be placed at the top of the wall, and the wall should be constructed under the header.

Unit 7 – Quiz Question 2

In a BWL with corner return panels, what is the minimum hold-down capacity for a portal frame, Method CS-PF?

a. 800 lbs.

b. 1,600 lbs.

c. 4,200 lbs.

d. No hold-down required.

However, if a 24” return is not provided, then an 800 lb. hold-down would be required.

Unit 7 – Quiz Question 3

True or False:

A return panel is required for a BWL which contains BWPs of Method WSP.

False:

A return panel is only required for continuous sheathing methods. WSP is an intermittent method. If the method begins with a "CS" then a return panel is required, i.e., CS-WSP.

Unit 7 – Quiz Question 4

True or False:

Partial credit can be applied to Method CS-WSP.

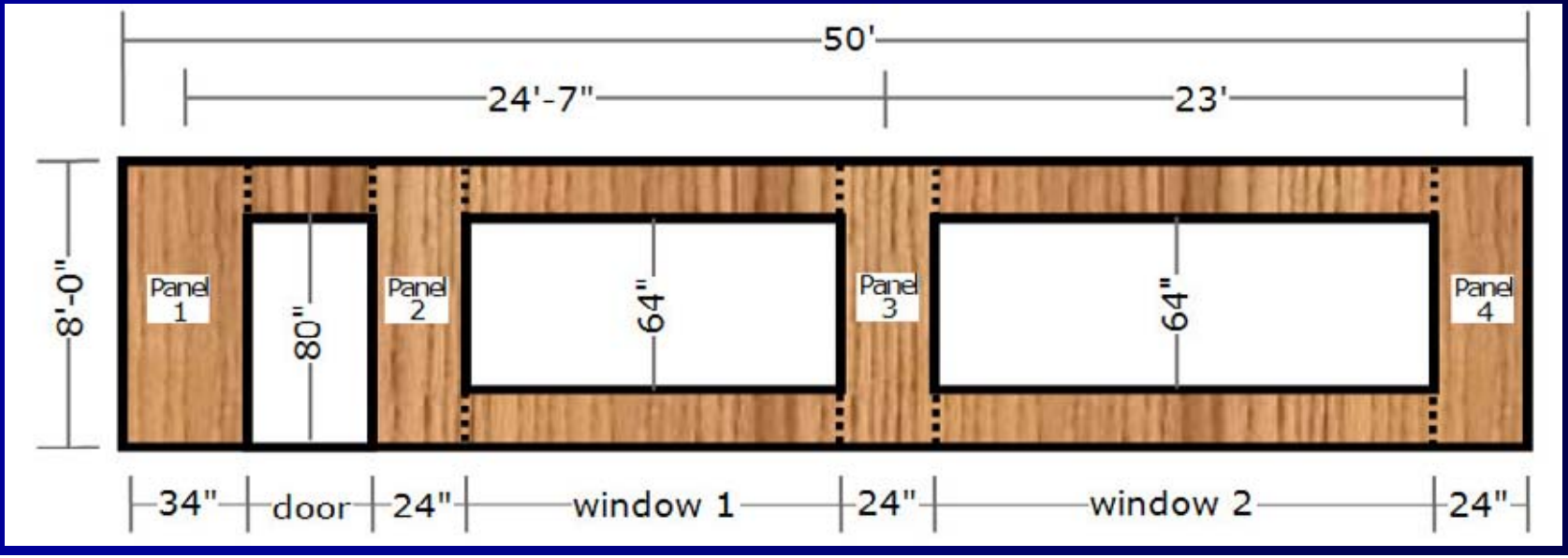
False:

Partial credit is only applicable for intermittent methods.

Unit 7 – Quiz Question 5

Determine compliance of the BWL below.

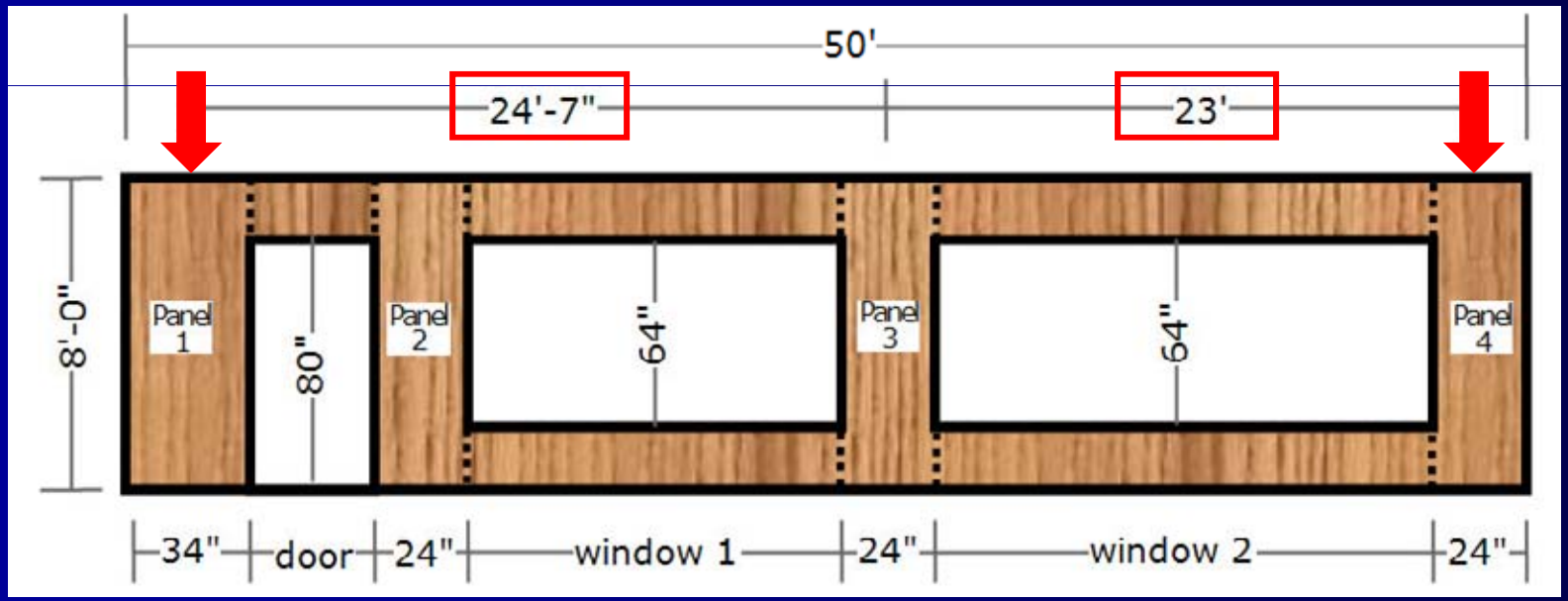
- **Method: CS-WSP,**
- **Location: One story house,**
- **BWL-spacing: 44’,**
- **Return Panels: BWL has 24” return panels @ ends.**



Unit 7 – Quiz Question 5 solution

Placement of BWPs comply:

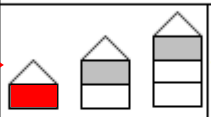
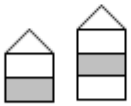
- **Compliant panels at each end of the BWL.**
- **Spacing of compliant panels is ≤ 25’.**



Unit 7 – Quiz Question 5 solution

For BWLs spaced at 44', and a one-story house, the required percent bracing required is 23%.

TABLE R602.10.1.5 [a,b,c]
MINIMUM REQUIRED PERCENTAGE OF WALL BRACI

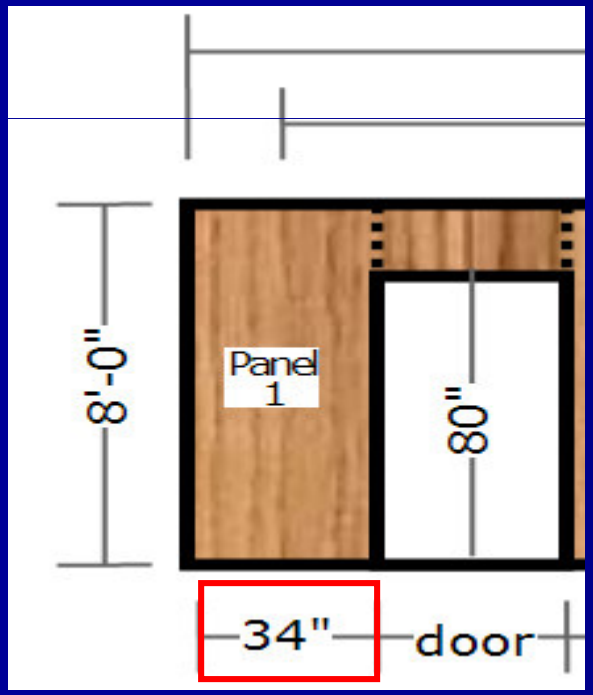
SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENT E OF FULL-HEIGHT BRACING PER WA LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	23%	36%
		First floor of a three-story house	25%	35%	36%	50%

Unit 7 – Quiz Question 5 solution

34” panel - adjacent to door:

- 80" opening - min. 31” to qualify.

This panel contributes.



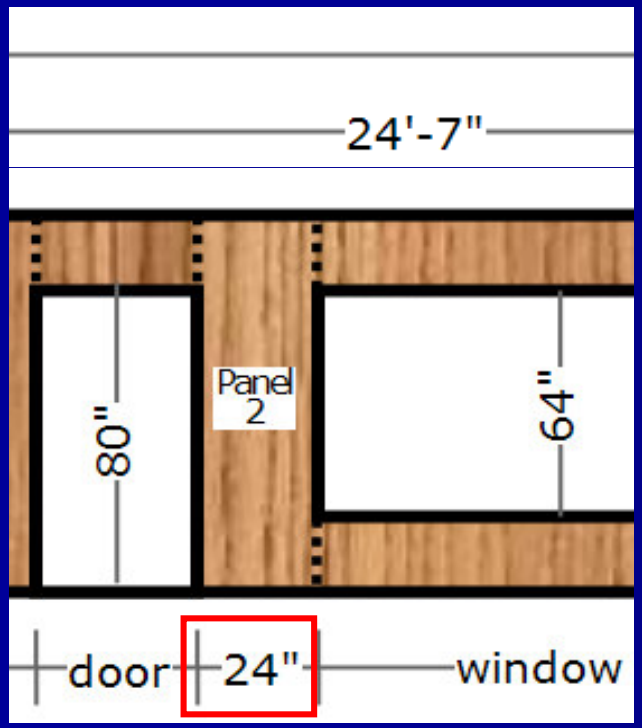
ADJACENT CLEAR OPENING HEIGHT	WALL HEIGHT				
	8'	9'	10'	11'	12'
64"	24"	27"	30"	33"	36"
68"	26"	27"	30"	33"	36"
72"	28"	27"	30"	33"	36"
76"	29"	30"	30"	33"	36"
80"	31"	33"	30"	33"	36"
84"	33"	36"	33"	36"	36"
88"	39"	39"	36"	38"	36"
92"	44"	42"	39"	41"	36"
96"	48"	45"	42"	43"	39"
100"		48"	45"	47"	42"
104"		51"	48"	48'	44"
108"		54"	51"	51"	47"
112"			54"	53"	50"
116"			57"	56"	53"
120"			60"	58"	55"
124"				61"	58"
128"				63"	61"
132"				66"	64"
136"					66"
140"					69"
144"					72"

Unit 7 – Quiz Question 5 solution

24” panel adjacent to door and window:

- 80” opening governs - min. 31” to qualify.

This panel DOES NOT contribute!



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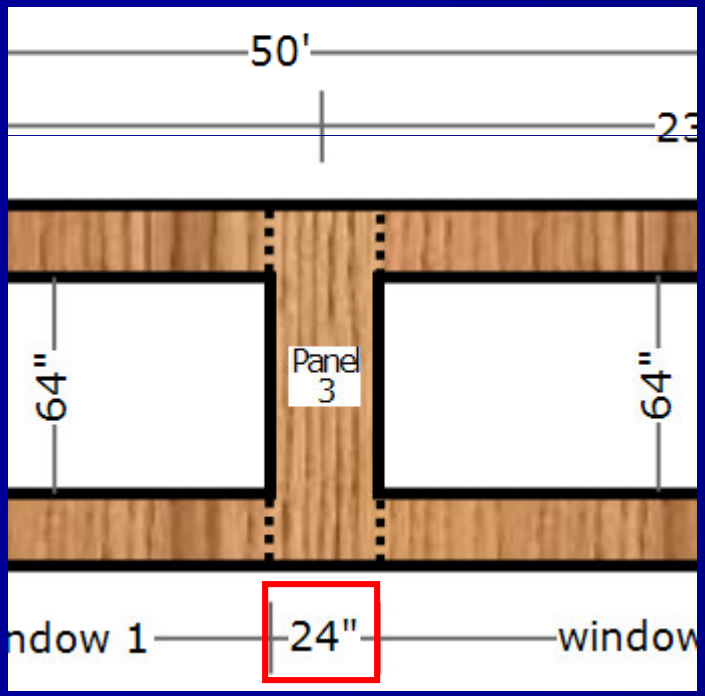
84"	35"	36"	33"	36"	36"
88"	39"	39"	36"	38"	36"
92"	44"	42"	39"	41"	36"
96"	48"	45"	42"	43"	39"
100"		48"	45"	47"	42"
104"		51"	48"	48'	44"
108"		54"	51"	51"	47"
112"			54"	53"	50"
116"			57"	56"	53"
120"			60"	58"	55"
124"				61"	58"
128"				63"	61"
132"				66"	64"
136"					66"
140"					69"
144"					72"

Unit 7 – Quiz Question 5 solution

24” panel adjacent to two windows:

- 64” openings – min. 24” to qualify.

This panel contributes.



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76"	29"	30"	30"	33"	36"
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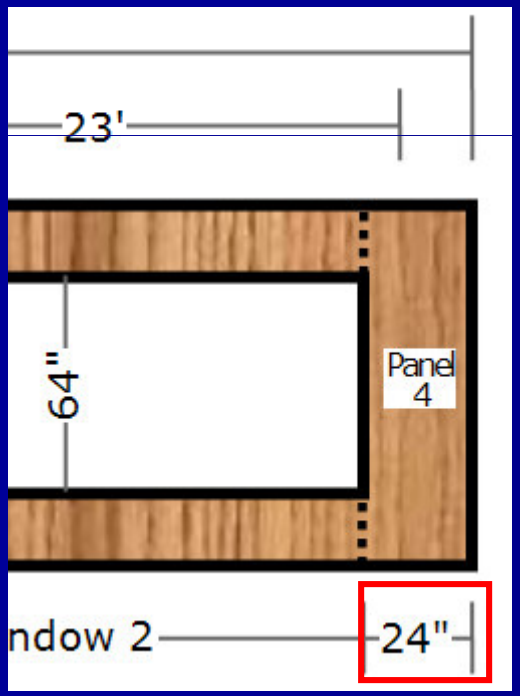
84"	35"	36"	33"	36"	36"
88"	39"	39"	36"	38"	36"
92"	44"	42"	39"	41"	36"
96"	48"	45"	42"	43"	39"
100"		48"	45"	47"	42"
104"		51"	48"	48'	44"
108"		54"	51"	51"	47"
112"			54"	53"	50"
116"			57"	56"	53"
120"			60"	58"	55"
124"				61"	58"
128"				63"	61"
132"				66"	64"
136"					66"
140"					69"
144"					72"

Unit 7 – Quiz Question 5 solution

24” panel adjacent to a window:

- 64" opening: - min 24“ to qualify.

This panel <u>can</u> contribute.



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76"	29"	30"	30"	33"	36"
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120"			60"	58"	55"
124"				61"	58"
128"				63"	61"
132"				66"	64"
136"					66"
140"					69"
144"					72"

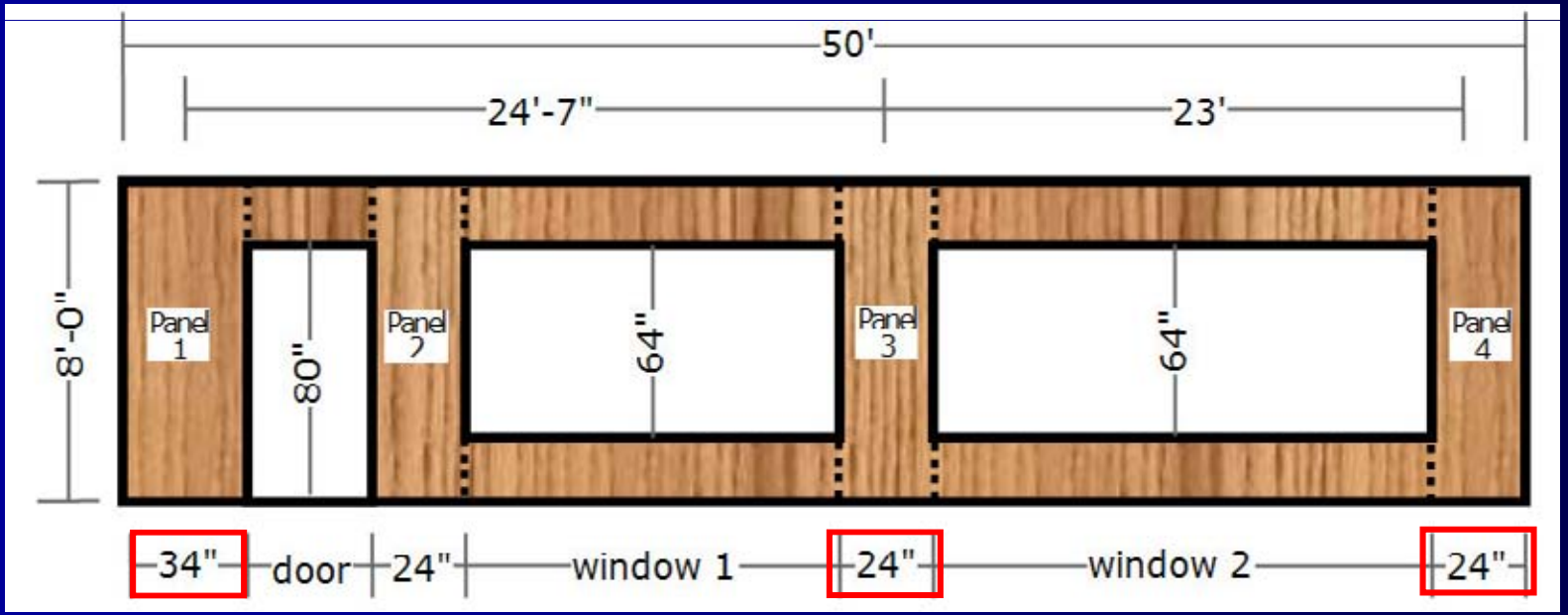
Unit 7 – Quiz Question 5 solution

Compute actual percent of bracing:

$$\% \text{ actual bracing} = \frac{34” + 24” + 24”}{50’ \times 12} \times 100 = 13.7\%$$

Actual % = 13.7% < required % = 23%

This braced wall line FAILS!



Intermittent vs. Continuous

WSP

Min. 48”

CS-WSP

Min. 24”

CS-PF

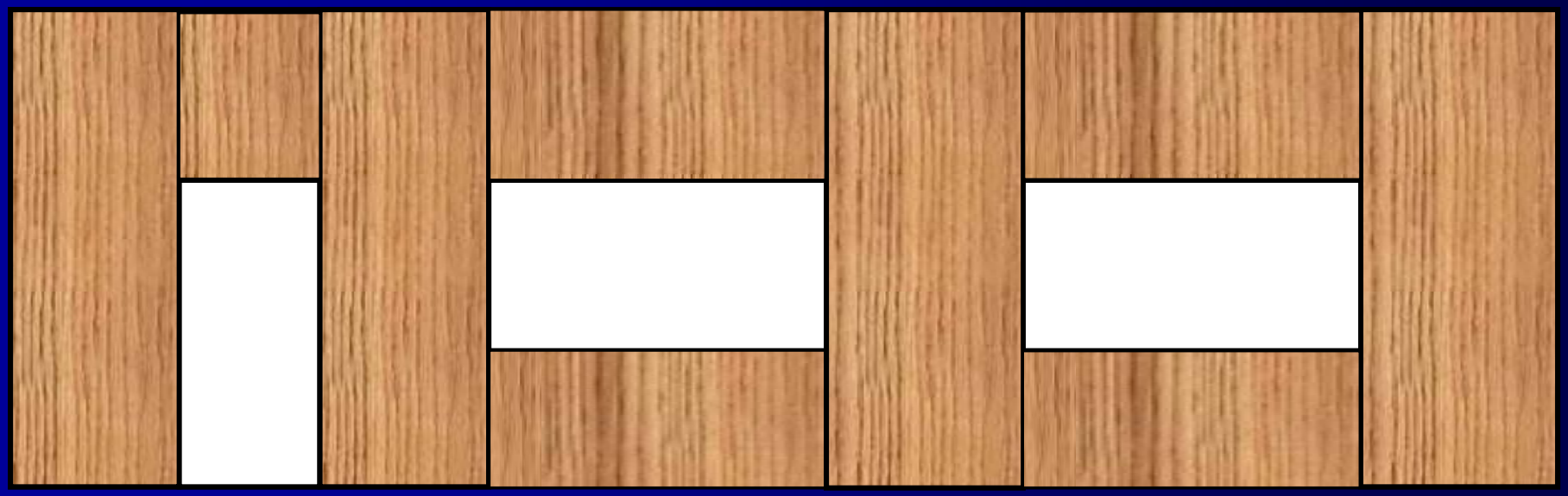
Min. 16”

Proprietary

Min. 12”

Intermittent vs Continuous

Intermittent or continuous?



Unit 8

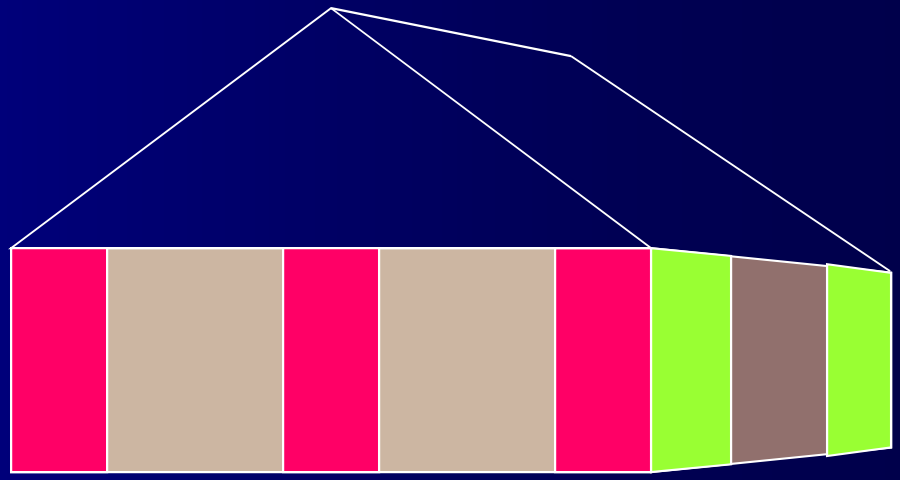
Mixing Methods

Unit 8 Topics

- Mixing methods.
- Adjacent BWLs with mixed methods.
- Minimum required percent bracing for a BWL with mixed methods.

Mixing Methods by Braced Wall Line

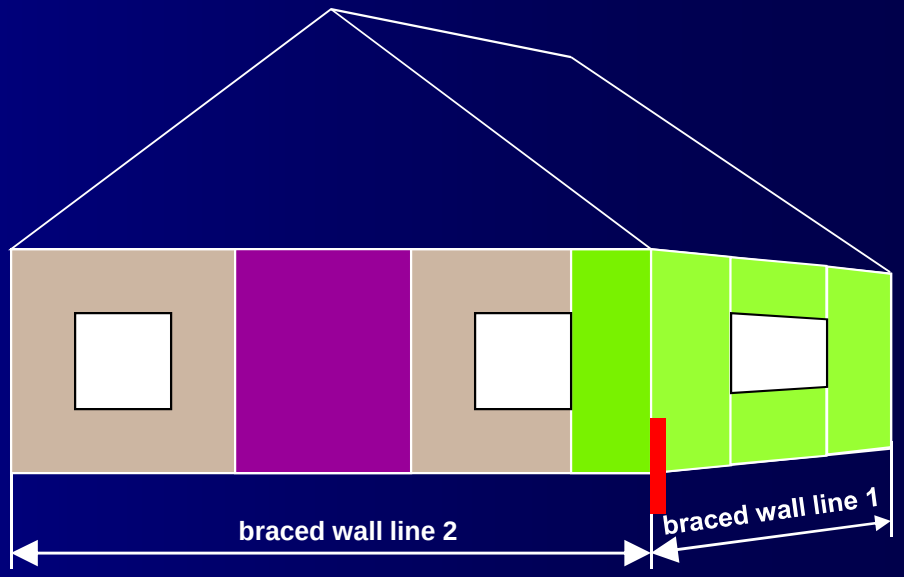
- **Mixing methods on different BWLs is permitted.**
  - **Analyze each braced wall line separately.**
  - **Ensure each method's requirements are met.**
  - **Look for return panels, hold-downs, etc.**



R602.10.1.2

Mixing Methods by Braced Wall Line

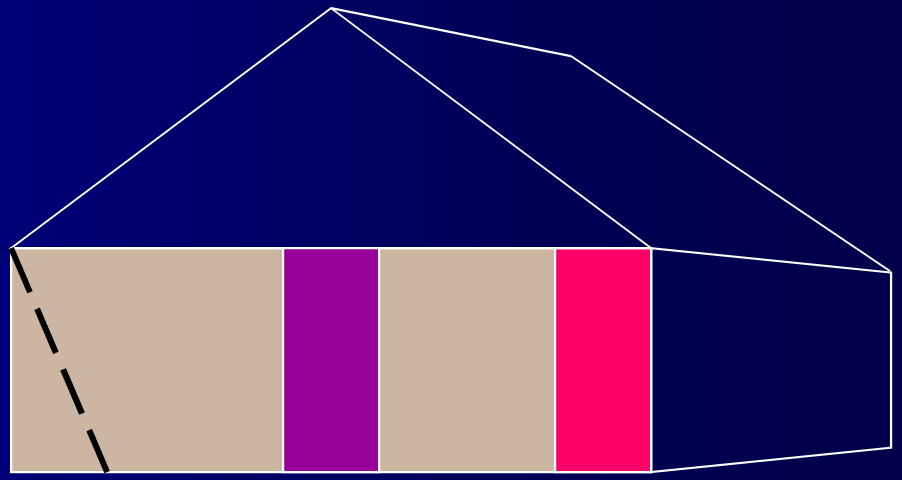
- For instance:
  - Braced wall line 1 is Method CS-WSP.
  - Braced wall line 2 is Method SFB.
  - Braced wall line 2 MUST include 24” corner return for Braced wall line 1, or…
  - Braced wall line 1 must have hold-down.



R602.10.1.2

Mixing Methods by Braced Wall Panel

- **Mixing methods along a braced wall line is permitted.**
  - **When calculating minimum required percentage, the method with the greater value applies.**
  - **Cannot mix continuous methods with intermittent methods.**



Note: This does not apply to townhouses in SDC-C.

R602.10.1.2

Unit 8 – Quiz Question 1

True or False:

A braced wall line may contain panels with Method WSP, Method GB, Method SFB and Method CS-PF.

False:

Method CS-PF is a continuous sheathing method and cannot be mixed on the same braced wall line with an intermittent method.

Unit 8 – Quiz question 2

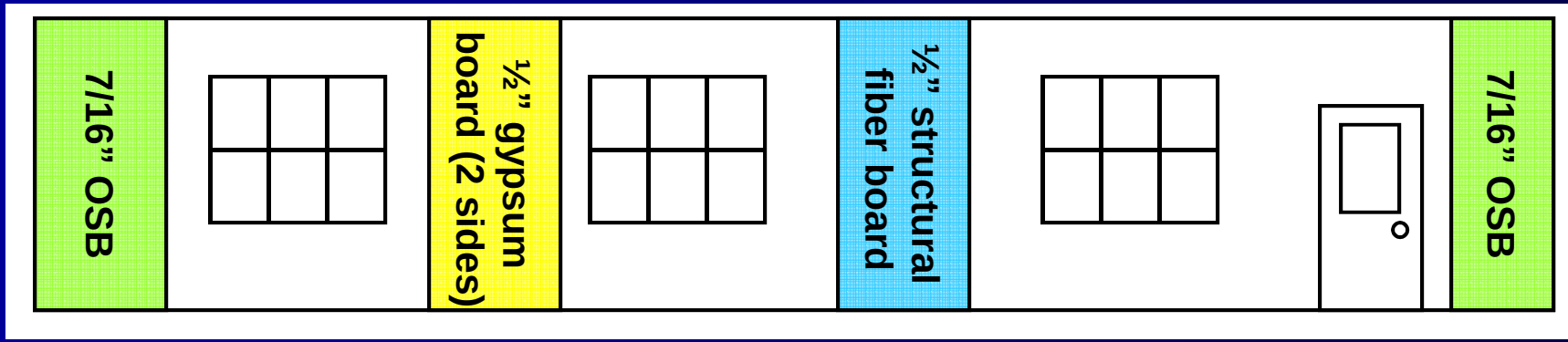
Determine minimum percentage of wall bracing required for…

Location: first story of a 3-story house,

Wind speed: 90 mph,

Braced wall line spacing: 25’.

a. 16% b. 25% c. 35% d. 36%



Solution

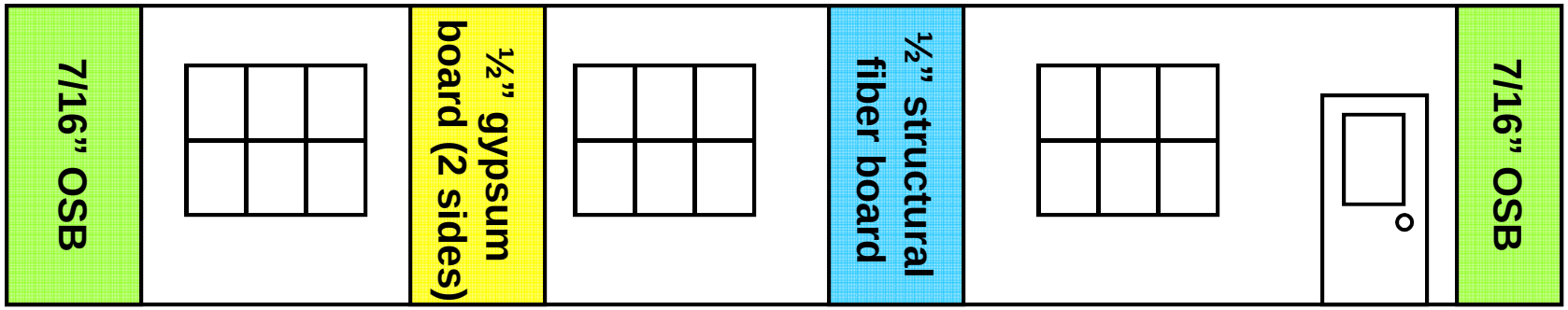
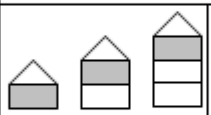
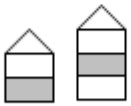
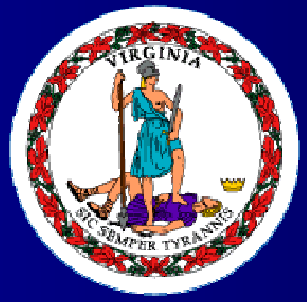


TABLE R602.10.1.5 [a,b,c]
MINIMUM REQUIRED PERCENTAGE OF WALL BRACING

SEISMIC DESIGN CATEGORY (SDC) OR WIND SPEED	FLOOR		MINIMUM REQUIRED PERCENTAGE OF FULL-HEIGHT BRACING PER WALL LINE			
			Braced wall line spacing less than or equal to 35'		Braced wall line spacing greater than 35' and less than or equal to 50'	
			Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]	Methods WSP, CS-WSP, CS-G, CS-PF	All other methods[d]
SDC A, B or wind speed ≤ 100 mph		One-story house or top floor of a two- or three-story house.	16%	16%	23%	23%
		First floor of a two-story or second floor of a three-story house.	16%	25%	23%	36%
		First floor of a three-story house	25%	35%	36%	50%

Unit 9



Miscellaneous Provisions

Unit 9 Topics

- Interior finishes.
- Blocking.
- BWPs atop masonry stem walls.
- Cripple wall.

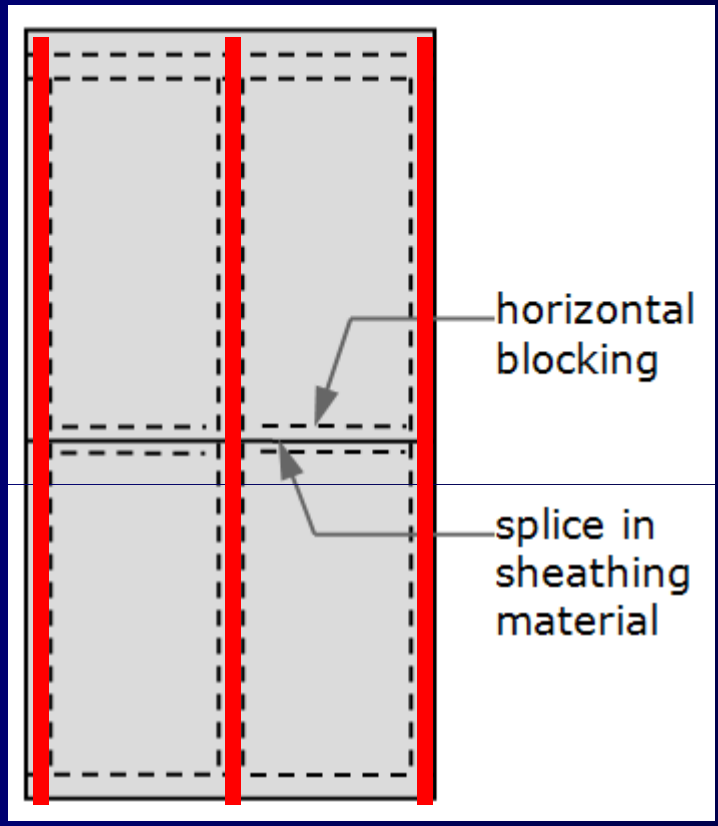
Inside Finishes

- **Both sides of each BWP is to be finished with ½" minimum gypsum board.**
  - **Paneling with equivalent properties of ½" gypsum board can be substituted.**
  - **Can be eliminated if the percentage of bracing is increased by 50% (1.5 factor).**
  - **Method CS-PF are exempt from inside finish requirement (CS-G is not).**

R602.10.4

Blocking

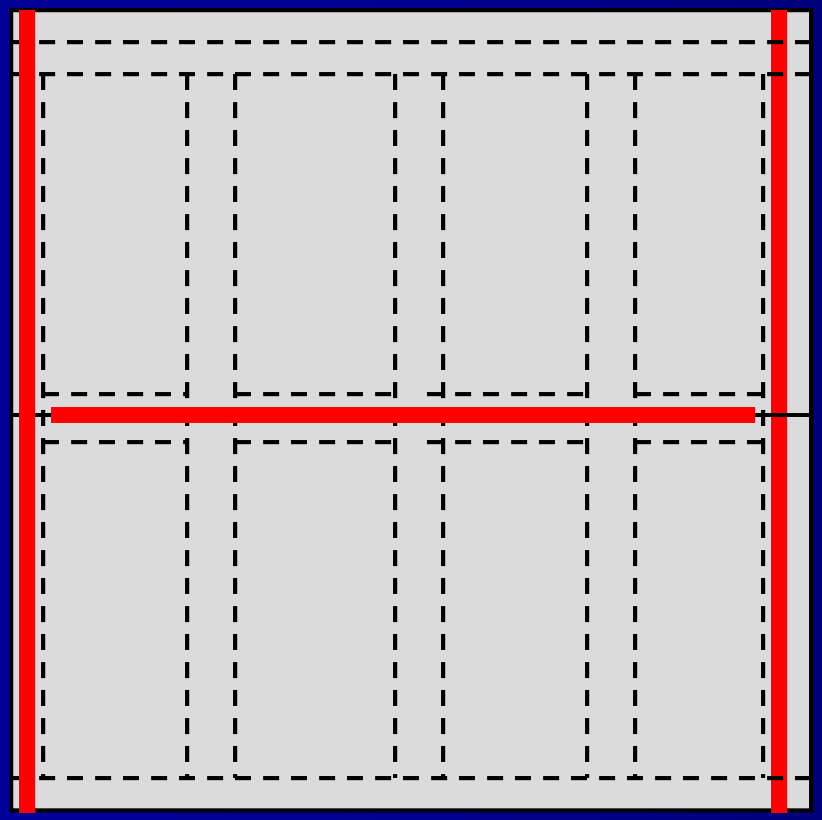
- Vertical joints must occur at studs.



R602.10.7

Blocking

- Vertical joints must occur at studs.



- Yes, the panels can be installed horizontally.

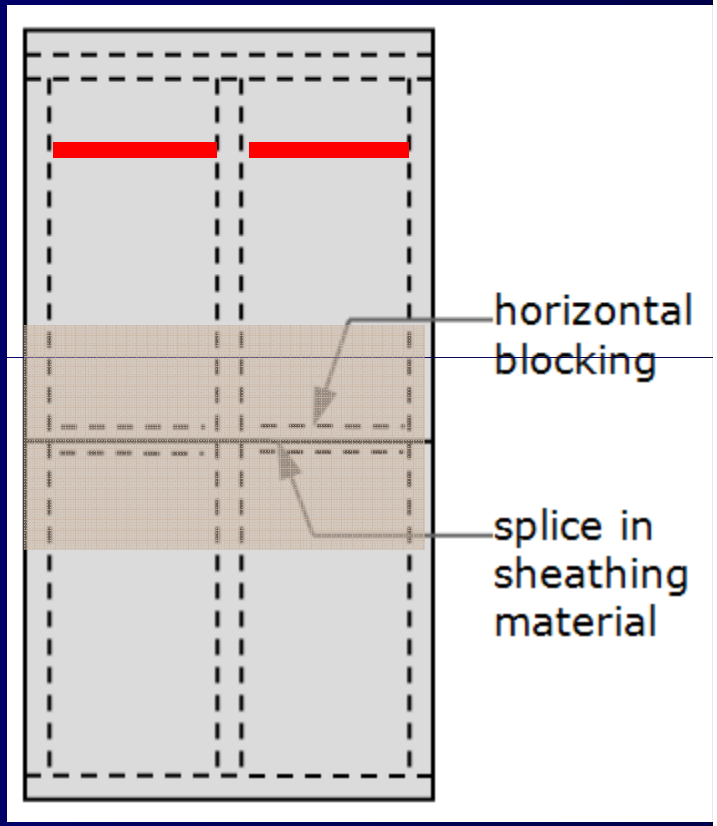
R602.10.7

Blocking

- Horizontal joints must be blocked with 2x material.
- Horizontal joints may occur at any height, except...

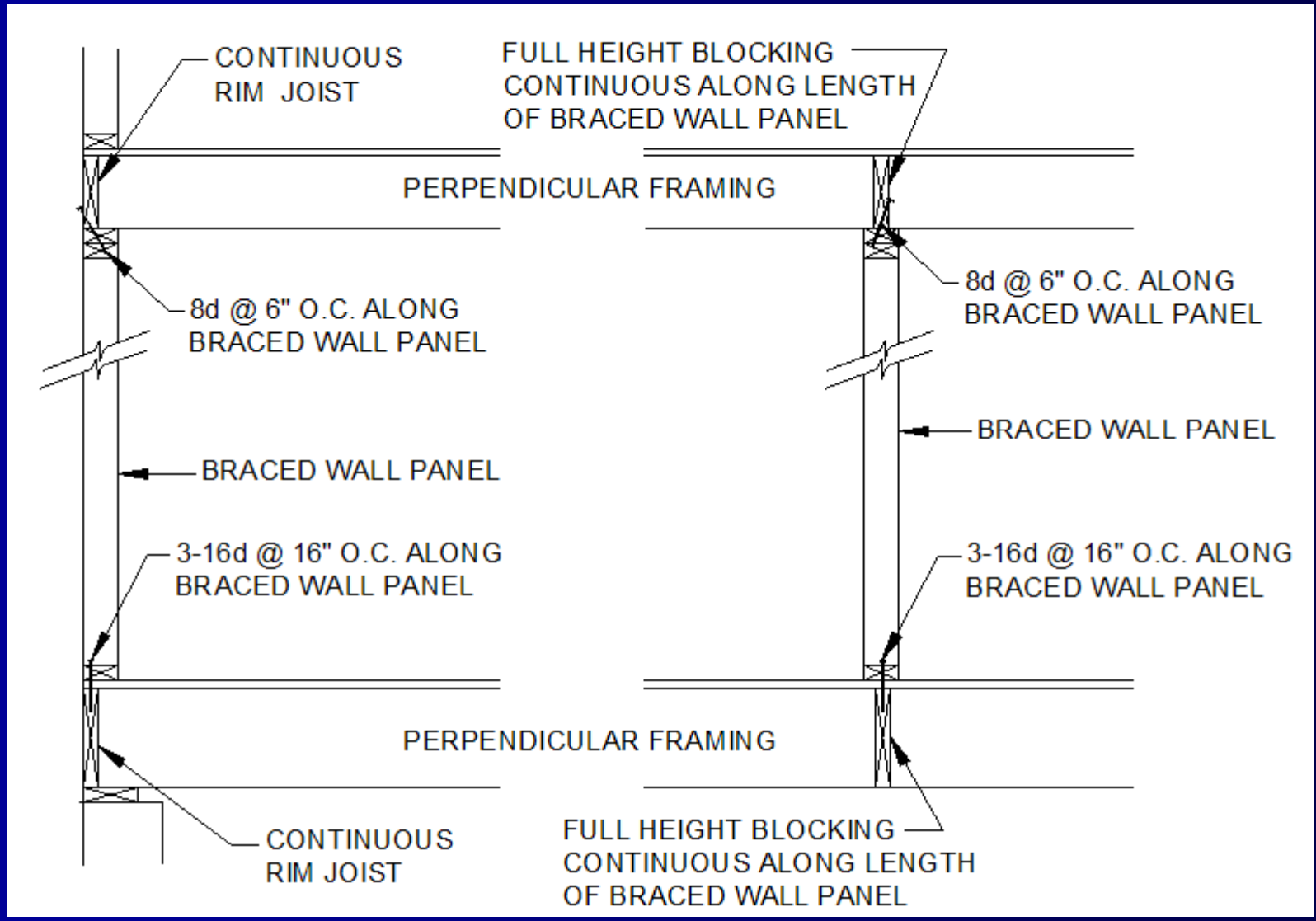
  Horizontal joints for Method CS-PF must occur within 24" of mid-height of panel.

- Horizontal blocking may be eliminated if the percentage of bracing required is increased by 100% (2.0 factor).



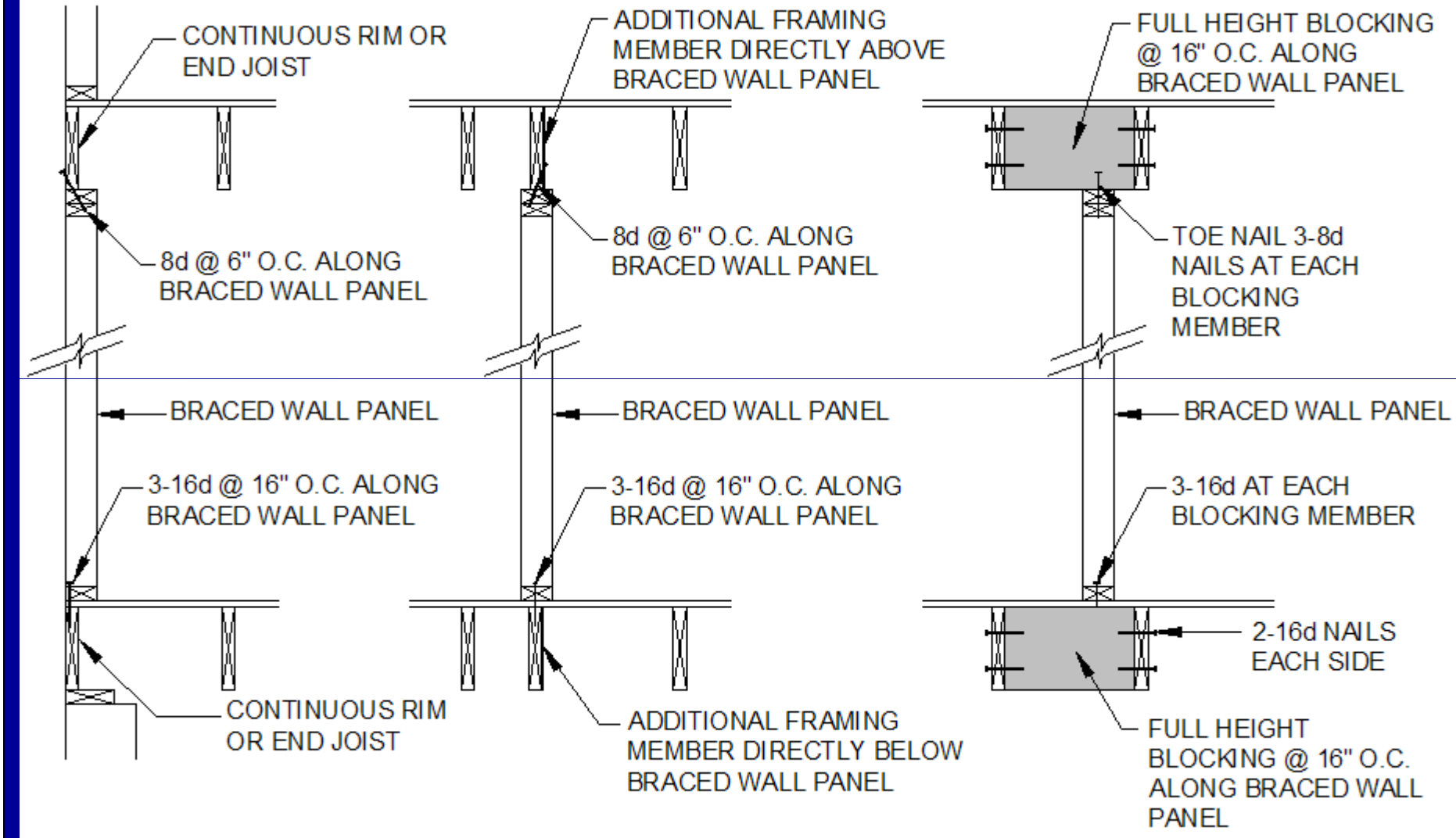
R602.10.7

Perpendicular Connections



R602.10.7

Parallel Connections



R602.10.7

Support of Braced Wall Panels

- BWPs may be supported on a cantilever if:
  - Blocking at bearing wall below is provided.
  - Length of cantilever is within IRC limits (Section 502.3.3).

R602.10.6

Support of Braced Wall Panels

- **Structures supported on piers or posts must be engineered.**

R602.10.6

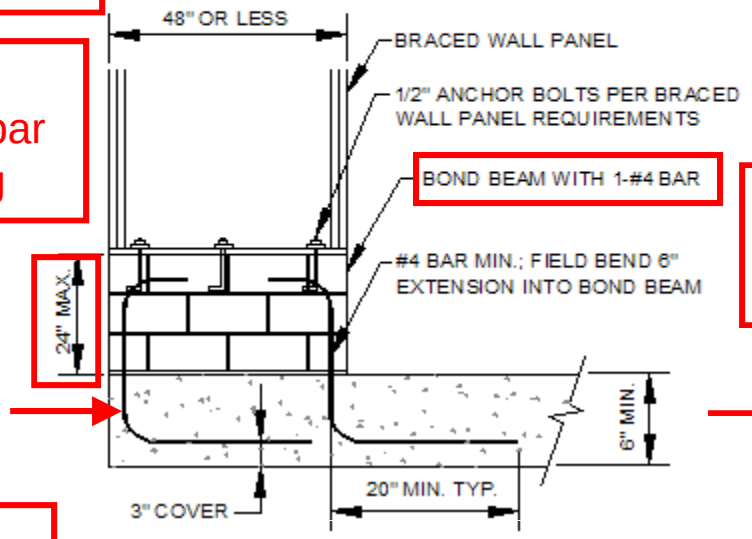
Support of Braced Wall Panels

- Masonry stemwalls must be reinforced.

R602.10.6

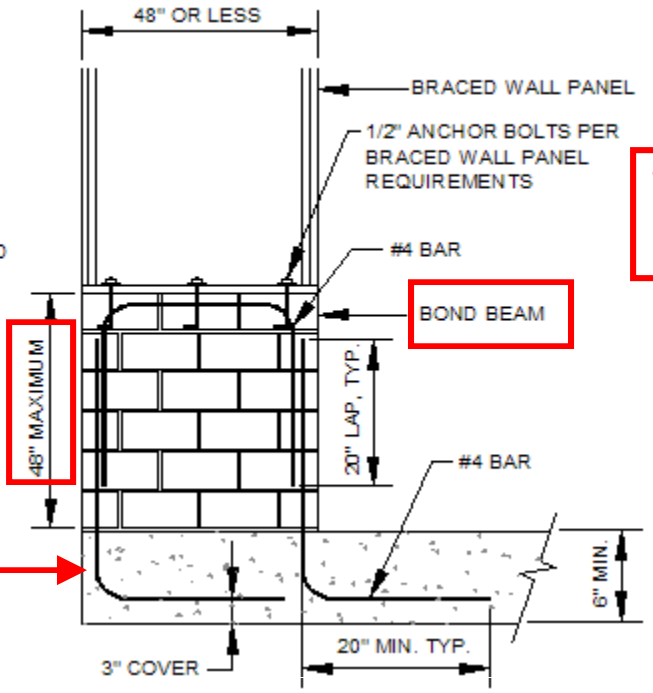
Short stemwall 24” and less

Cast in place rebar in footing



SHORT STEM WALL REINFORCEMENT

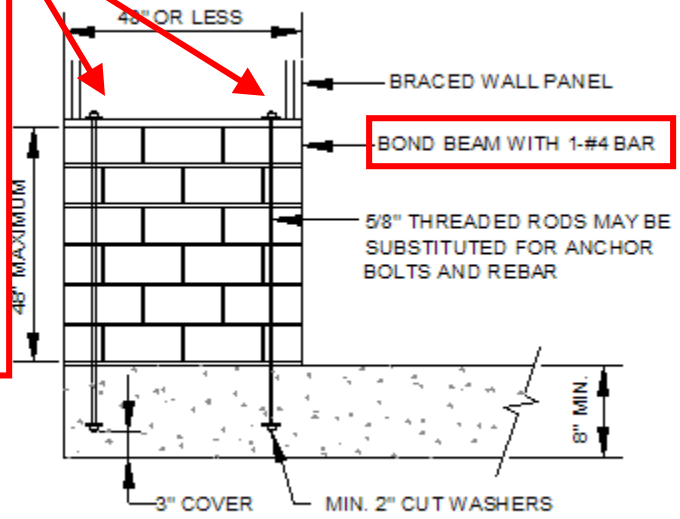
Tall stemwall up to 48”



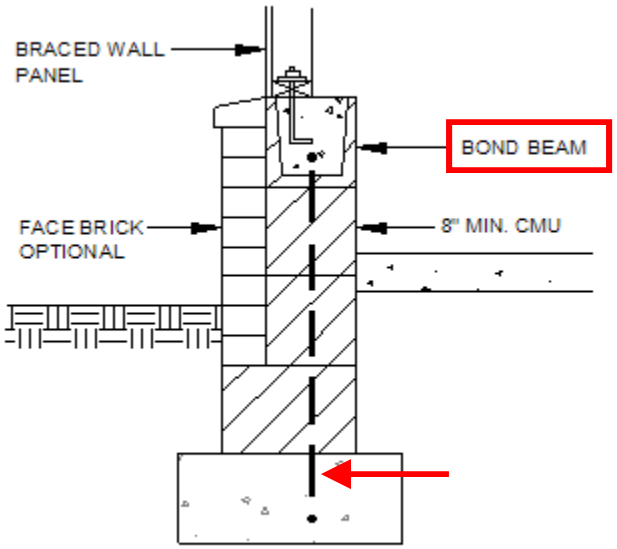
TALL STEM WALL REINFORCEMENT

Reinforced bond beams

Optional stemwall with 5/8” threaded rods and 2” washers to replace rebar and anchor bolts



OPTIONAL STEM WALL REINFORCEMENT



TYPICAL STEM WALL SECTION

NOTE: GROUT BOND BEAMS AND ALL CELLS WHICH CONTAIN REBAR, THREADED RODS AND ANCHOR BOLTS.

Support of Braced Wall Panels

- What about poured walls?

  Engineered design is required.

Masonry Failure

Masonry Don’ts

Masonry Don’ts

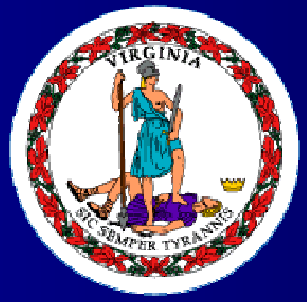
Masonry Dos

Cripple Wall Provisions

- To make cripple walls comply:
  - Increase percentage of bracing by 15%, and decrease spacing of panels to 18’ o.c.
  - Treat cripple wall as if it were first floor, adjust floors above accordingly.

R602.10.8

Unit 10



Whole House Exercise

Condensed Chart

Shows

- Methods
- Percentages
- Calculated lengths
- Similar chart in handout for all the continuous methods

Note 100 mph

Separate chart for 110 mph

INTERMITTENT BRACING METHODS FOR WALLS UP TO 12' TALL (PER 2006 USBC)

≤ 100 MPH

METHOD	FIGURE MINIMUM PANEL LENGTHS	MINIMUM MATERIAL PROPERTIES	CONNECTION CRITERIA	BWL Length (ft)	MINIMUM BRACING REQUIRED (FEET)											
					BWL spacing (ft)				BWL spacing (ft)				BWL spacing (ft)			
					0' - 35'		35' - 50'		0' - 35'		35' - 50'		0' - 35'		35' - 50'	
LIB [1] Let-in bracing	60° 45°	1x4 wood or approved metal straps between 45° to 60° angle	wood braces: 2-8d nails per stud metal straps per manufacturer	10	16%	6.9	23%	6.9	25%	6.9	36%	6.9	NOT PERMITTED			
	8'x4.6' 11'x6.38' 8'x8' 11'x11' 9'x5.2' 12'x6.92' 9'x9' 12'x12' 10'x5.8' 10'x10'			20		6.9		6.9		6.9		7.1				
				30		6.9		6.9		7.5		10.7				
				40		13.8		13.8		13.8		14.3				
				50		13.8		13.8		13.8		17.9				
				60		20.7		20.7		20.7		21.4				
DWB Diagonal wood boards	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	5/8" thick spaced max. 24" o.c.	2-d (2-1/2"x 0.113") nails or 2 staples, 1-3/4" long per stud spaced max. 24" o.c.	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
WSP Wood structural panel	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	3/8" thick	6d common nails at 6" edge spacing and at 12" field spacing or 16 gage x 1-3/4" staples at 3" edge spacing and 6" field spacing	10	16%	4.0	23%	4.0	16%	4.0	23%	4.0	25%	4.0	36%	4.0
				20		4.0		4.6		4.0		4.6		5.0		7.2
				30		5.0		6.9		5.0		6.9		7.5		10.8
				40		8.0		9.2		8.0		9.2		10.0		14.4
				50		11.5		11.5		11.5		11.5		12.5		18.0
				60		12.0		13.8		12.0		13.8		15.0		21.6
SFB Structural fiberboard	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	1/2" or 25/32" at 16" stud spacing only	1-1/2" galvanized roofing nails or 8d common nails at 3" edge spacing and at 6" field spacing	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
GB [2] Gypsum board	Wall height 8' 9' 10' 11' 12' Length, 1 side 48" 48" 48" 53" 58" Length, 2 sides 96" 96" 96" 106" 116"	1/2" thick	Nails at 7" spacing at panel edges, for exterior sheathing nail size- see Table R602.3(1), for interior gypsum board nail size - see Table R702.3.5	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
PBB Particle board sheathing	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	3/8" or 1/2" at 16" stud spacing only	0.092" dia., 0.225" head nails with length to accommodate 1-1/2" penetration into studs at 4" edge spacing and at 8" filed spacing	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
PCP Portland cement plaster	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	See Section R703.6	1-1/2", 11 gage, 7/16" head nails at 16" spacing or 7/16" 16 ga staples at 6" spacing	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
HPS Hardboard siding	Wall height 8' 9' 10' 11' 12' Panel length 48" 48" 48" 53" 58"	7/16"	0.092" dia., 0.225" head nails with length to accommodate 1½" penetration into studs at 4" edge spacing and at 8" field spacing	10	16%	4.0	23%	4.0	25%	4.0	36%	4.0	35%	4.0	50%	5.0
				20		4.0		4.6		5.0		7.1		7.0		10.0
				30		5.0		6.9		7.5		10.7		10.5		15.0
				40		8.0		9.1		10.0		14.3		14.0		20.0
				50		8.0		11.4		12.5		17.9		17.5		25.0
				60		12.0		13.7		15.0		21.4		21.0		30.0
ABW Alternate braced wall	Wall height 8' 9' 10' 11' 12' Panel length 28" 32" 34" 38" 42"	3/8" wood structural panel	See Figure R602.10.2.1(1); Requires (2) 3500 lb hold-downs per panel. Cannot use with CMU foundation/stemwall.	BWL spacing is limited to 50'; if spacing exceeds 50', another BWL is required. Required length of bracing along each BWL (ft). within 12.5' of corner. 25' o.c. max. panel length (ft).												
IPF Intermittent portal frame	Wall height 8' 9' 10' 11' 12' Length, 1 story 16" 16" 16" 18" 20" Length, 2 stories 24" 24" 24" 27" 29"	3/8" wood structural panel	See Figure R602.10.2.1(2); Requires (2) 2400 lb hold-downs per panel. Cannot use with steel header beam or CMU foundation/stemwall.													

(1) The minimum length required assumes 60 degrees installation for an 8' tall wall.

(2) The required bracing assumes double sided application. If single sided application, the amount listed must be doubled.

(3) The lengths of a BWL are not limited to 60 feet.

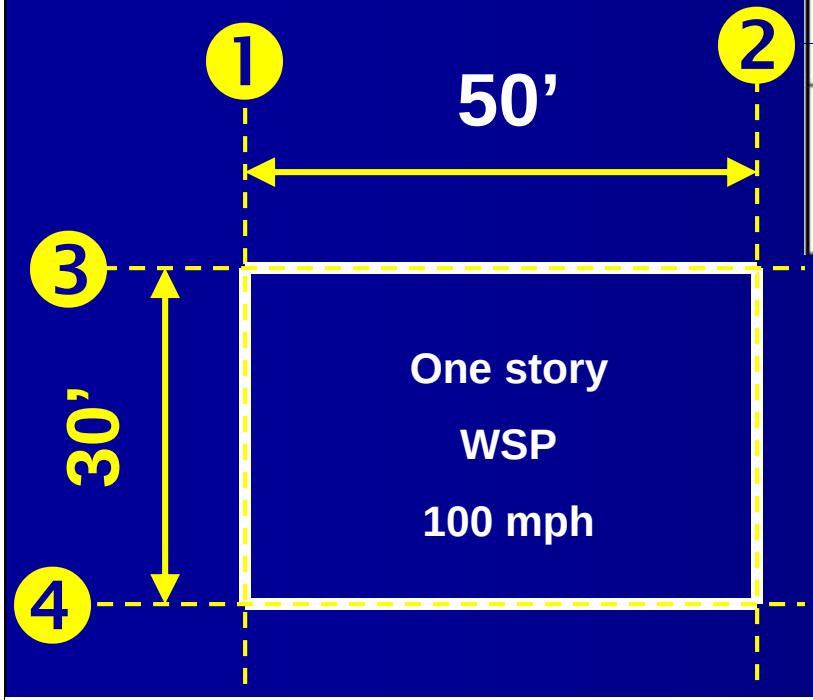
(4) The amount of bracing in the table provides the total length of braced wall panels required. Panels less than the minimum length cannot constitute. Requirements for location and spacing of panels must also be met.

BWL length and BWL-spacing

BWL 1 and 2:

Length: 30’

BWL-spacing: 50’



METHOD	FIGURE MINIMUM PANEL LENGHTS	MINIMUM MATERIAL PROPERTIES	CONNECTION CRITERIA	MINIMUM BRACING REQU				
				BWL Length (ft)	BWL spacing (ft) 0’ - 35’		35’ - 50’	
LIB [1] Let-in bracing	60° 45° 8'x4.6' 11'x6.35' 8'x8' 11'x11' 9'x5.2' 12'x6.92' 9'x9' 12'x12' 10'x5.8' 10'x10'	1x4 wood or approved metal straps between 45° to 60° angle	wood braces: 2-8d nails per stud metal straps per manufacturer	10	16%	6.9	23%	6.9
				20		6.9		6.9
				30		6.9		6.9
				40		13.8		13.8
				50		13.8		13.8
				60		20.7		20.7
DWB Diagonal wood boards	Wall height 8’ 9’ 10’ 11’ 12’ Panel length 48” 48” 48” 53” 58”	5/8” thick spaced max. 24” o.c.	2-d (2-1/2”x 0.113”) nails or 2 staples, 1-3/4” long per stud spaced max. 24” o.c.	10	16%	4.0	23%	4.0
				20		4.0		4.6
				30		5.0		6.9
				40		8.0		9.1
				50		10.0		11.4
				60		12.0		13.7
WSP Wood structural panel	Wall height 8’ 9’ 10’ 11’ 12’ Panel length 48” 48” 48” 53” 58”	3/8” thick	6d common nails at 6” edge spacing and at 12” field spacing or 16 gage x 1-3/4” staples at 3” edge spacing and 6” field spacing	10	16%	4.0	23%	4.0
				20		4.0		4.6
				30		5.0		6.9
				40		8.0		9.2
				50		11.5		11.5
				60		12.0		13.8

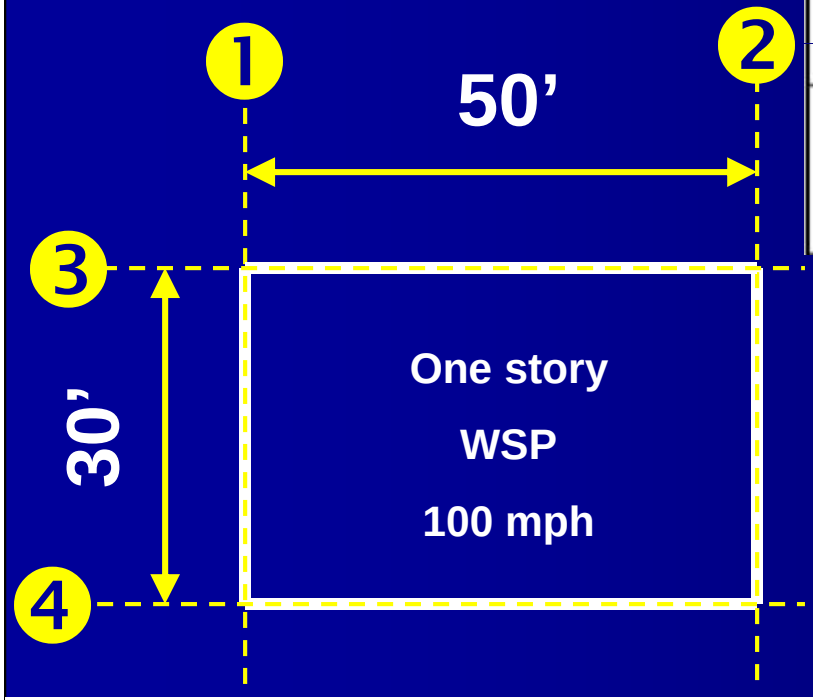
From Table: BWL needs at least 6.9’ of BWPs.

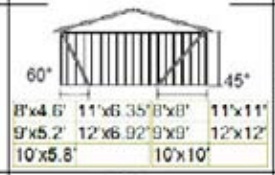
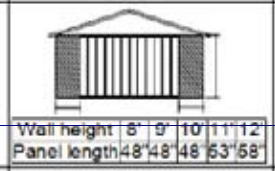
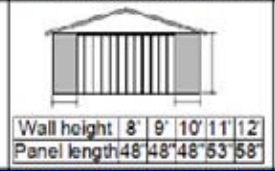
BWL length and BWL-spacing

BWL 3 and 4:

Length: 50’

BWL-spacing: 30’



METHOD	FIGURE MINIMUM PANEL LENGHTS	MINIMUM MATERIAL PROPERTIES	CONNECTION CRITERIA	MINIMUM BRACING REQU				
				BWL Length (ft)	BWL spacing (ft) 0’ - 35’		35’ - 50’	
LIB [1] Let-in bracing	 60° 45° 8'x4.6' 11'x6.35' 8'x8' 11'x11' 9'x5.2' 12'x6.92' 9'x9' 12'x12' 10'x5.8' 10'x10'	1x4 wood or approved metal straps between 45° to 60° angle	wood braces: 2-8d nails per stud metal straps per manufacturer	10	16%	6.9	23%	6.9
				20		6.9		6.9
				30		6.9		6.9
				40		13.8		13.8
				50		13.8		13.8
				60		20.7		20.7
DWB Diagonal wood boards	 Wall height 8’ 9’ 10’ 11’ 12’ Panel length 48” 48” 48” 53” 58”	5/8” thick spaced max. 24” o.c.	2-d (2-1/2”x 0.113”) nails or 2 staples, 1-3/4” long per stud spaced max. 24” o.c.	10	16%	4.0	23%	4.0
				20		4.0		4.6
				30		5.0		6.9
				40		8.0		9.1
				50		9.0		11.4
				60		12.0		13.7
WSP Wood structural panel	 Wall height 8’ 9’ 10’ 11’ 12’ Panel length 48” 48” 48” 53” 58”	3/8” thick	6d common nails at 6” edge spacing and at 12” field spacing or 16 gage x 1-3/4” staples at 3” edge spacing and 6” field spacing	10	16%	4.0	23%	4.0
				20		4.0		4.6
				30		5.0		6.9
				40		8.0		9.2
				50		11.5		11.5
				60		12.0		13.8

From Table: BWL needs at least 11.5’ of BWPs.

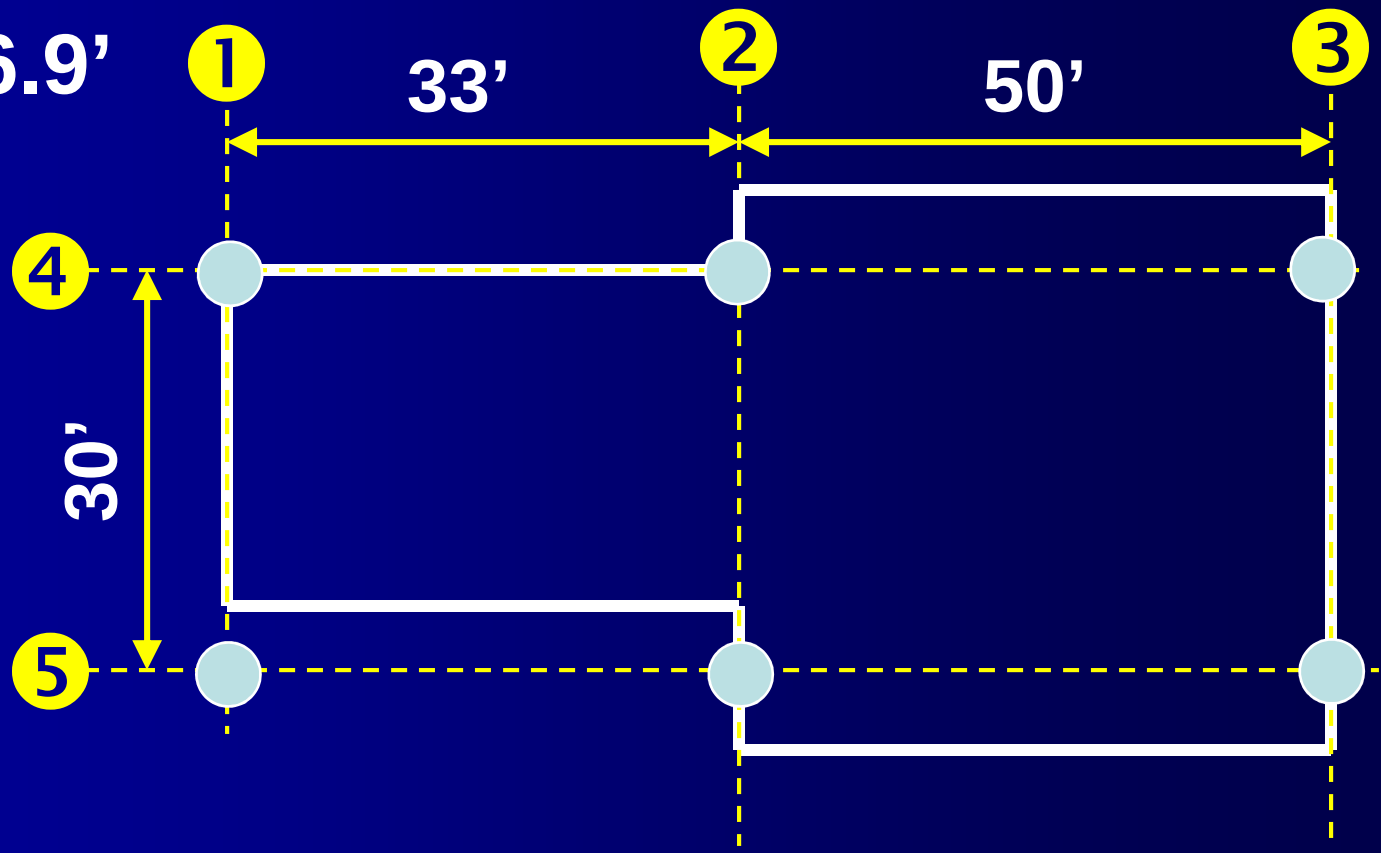
BWL length and BWL-spacing

BWL 2:

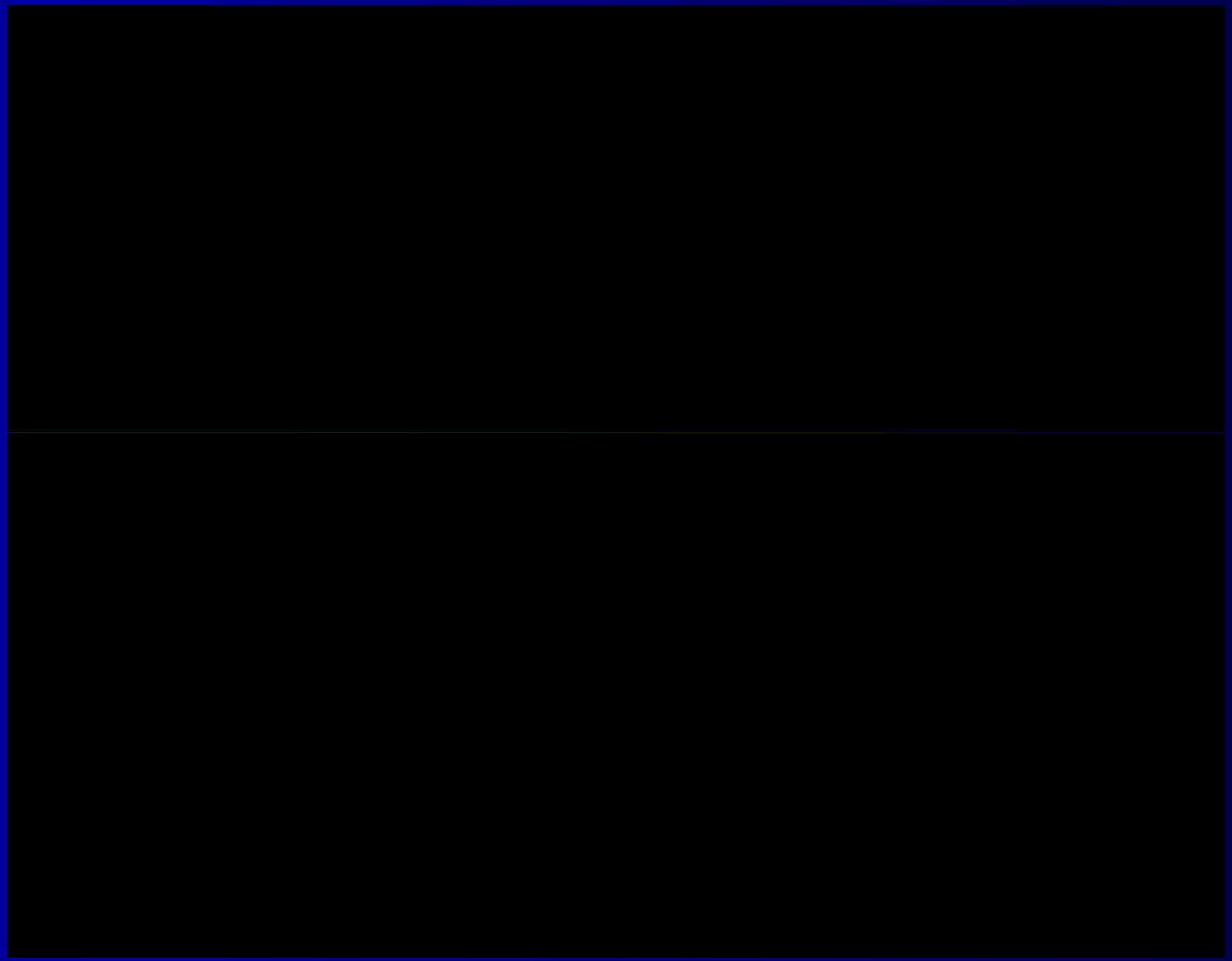
Length: 30’,

Spacing: 33’ & 50’

Required: 6.9’

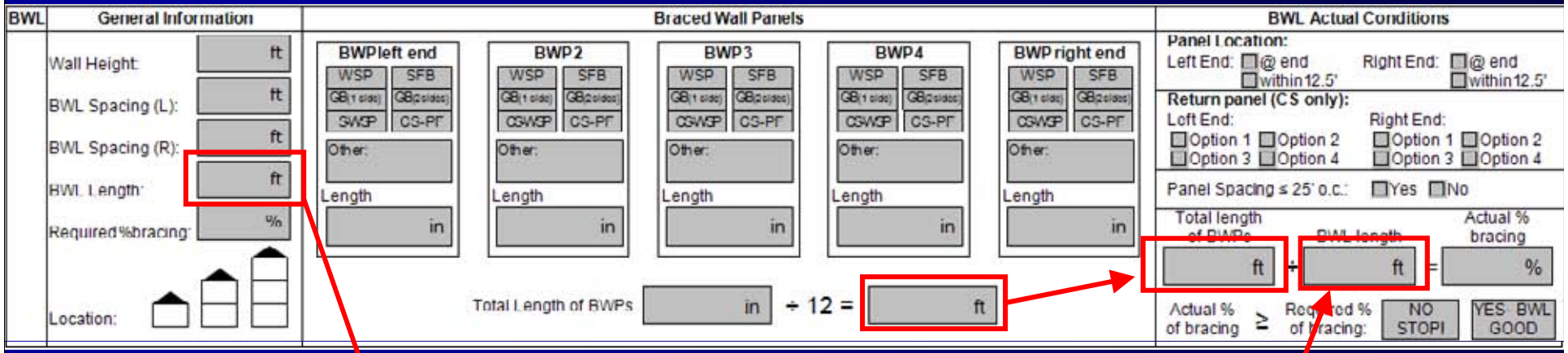


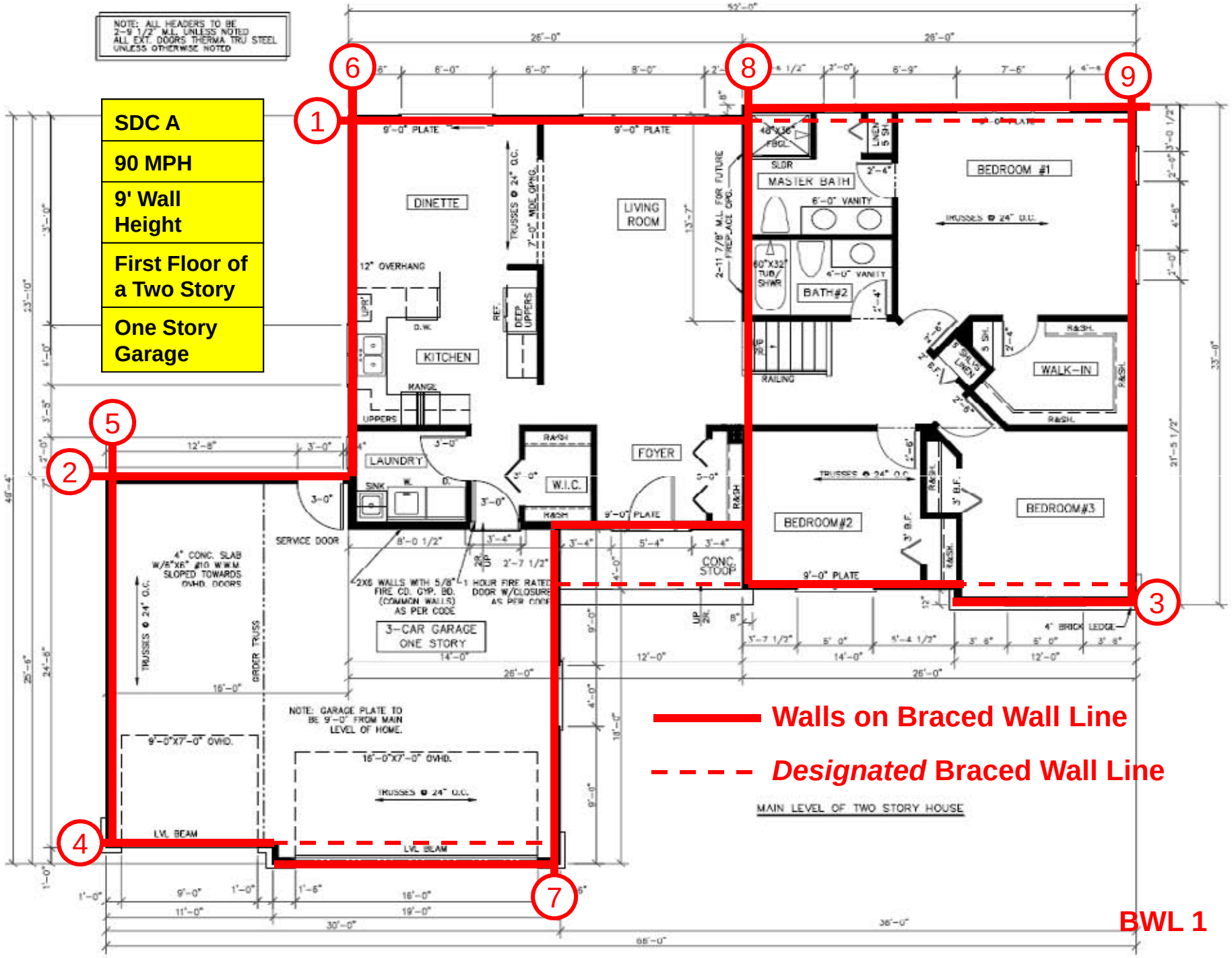
More head room



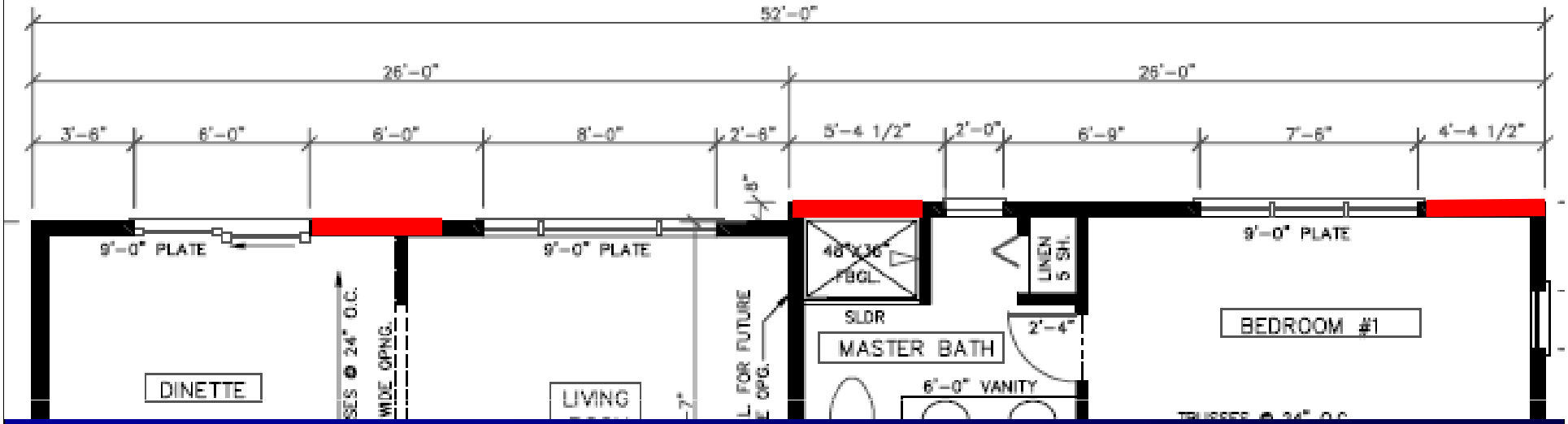
Break

Braced Wall Line Analysis Form



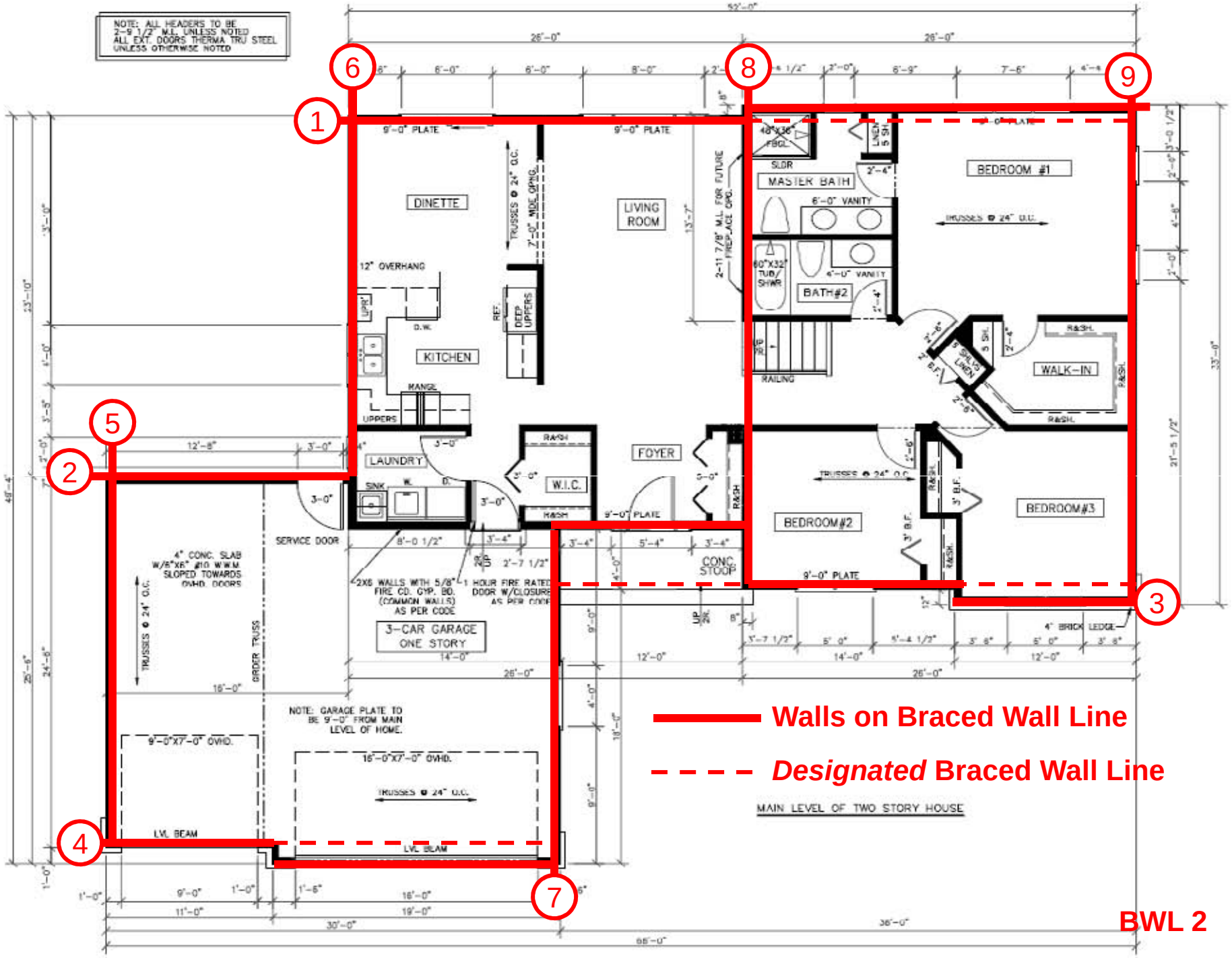

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
SDC A
90 MPH
9' Wall Height
First Floor of a Two Story
One Story Garage
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
LVL BEAM
9'-0" PLATE
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 1

Braced Wall Line 1

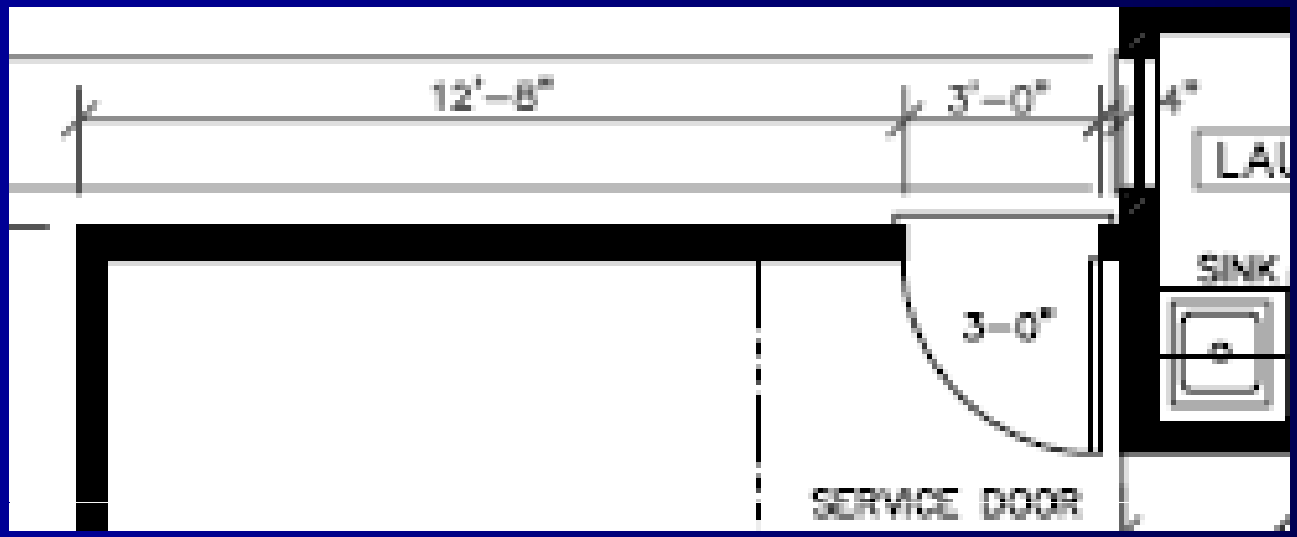


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
1	Wall Height:	9 ft	BWP left end: SFB; GB(1 side); GB(2 sides); SWSP; CS-PF; Other:	BWP 2: SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP 3: SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP 4: WSP; SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP right end: WSP; SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	Panel Location: Left End: ☐ @ end ☒ within 12.5' Right End: ☒ @ end ☐ within 12.5'
	BWL Spacing (L):	23.83 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	31.33 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	BWL Length:	52 ft	Length: 48 in	Length: 48 in	Length: 48 in	Length: in	Length: in	Total length of BWPs: 12 ft ÷ BWL length: 52 ft = Actual % bracing: 23 %
	Required %bracing:	16 %						
	Location:							Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

Total Length of BWPs: 144 in ÷ 12 = 12 ft

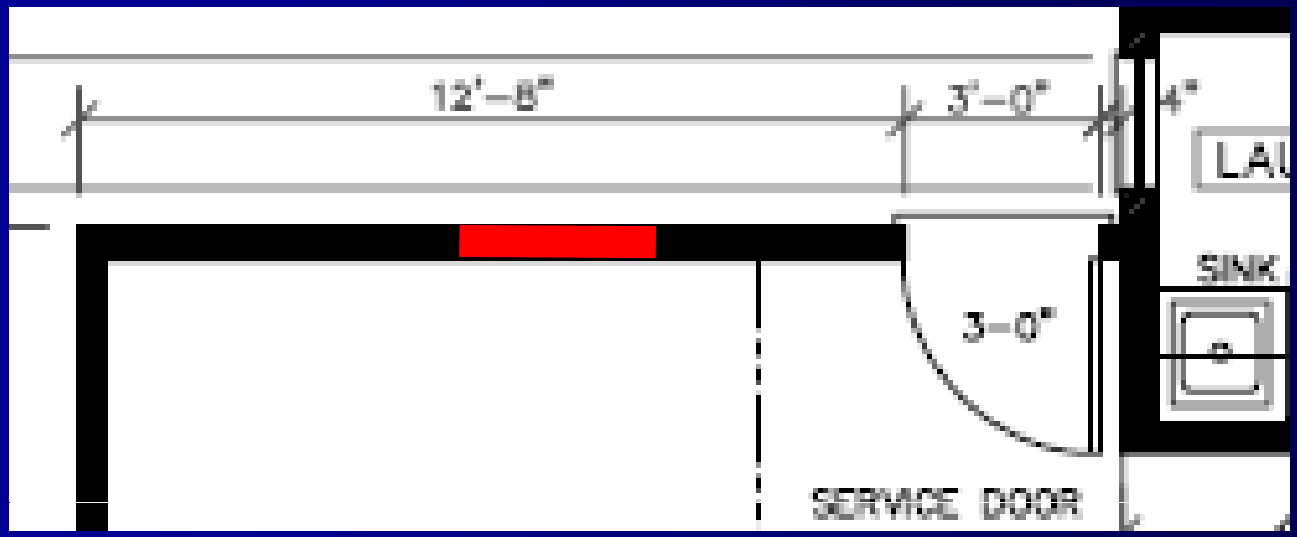

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
4" CONC. SLAB W/6"X6" #10 W.W.M. SLOPED TOWARDS OVHD. DOORS
2X6 WALLS WITH 5/8" FIRE CD. GYP. BD. (COMMON WALLS) AS PER CODE
1 HOUR FIRE RATED DOOR W/CLOSURE AS PER CODE
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
9'-0"X7'-0" OVHD.
16'-0"X7'-0" OVHD.
LVL BEAM
4" BRICK LEDGE
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 2

Braced Wall Line 2



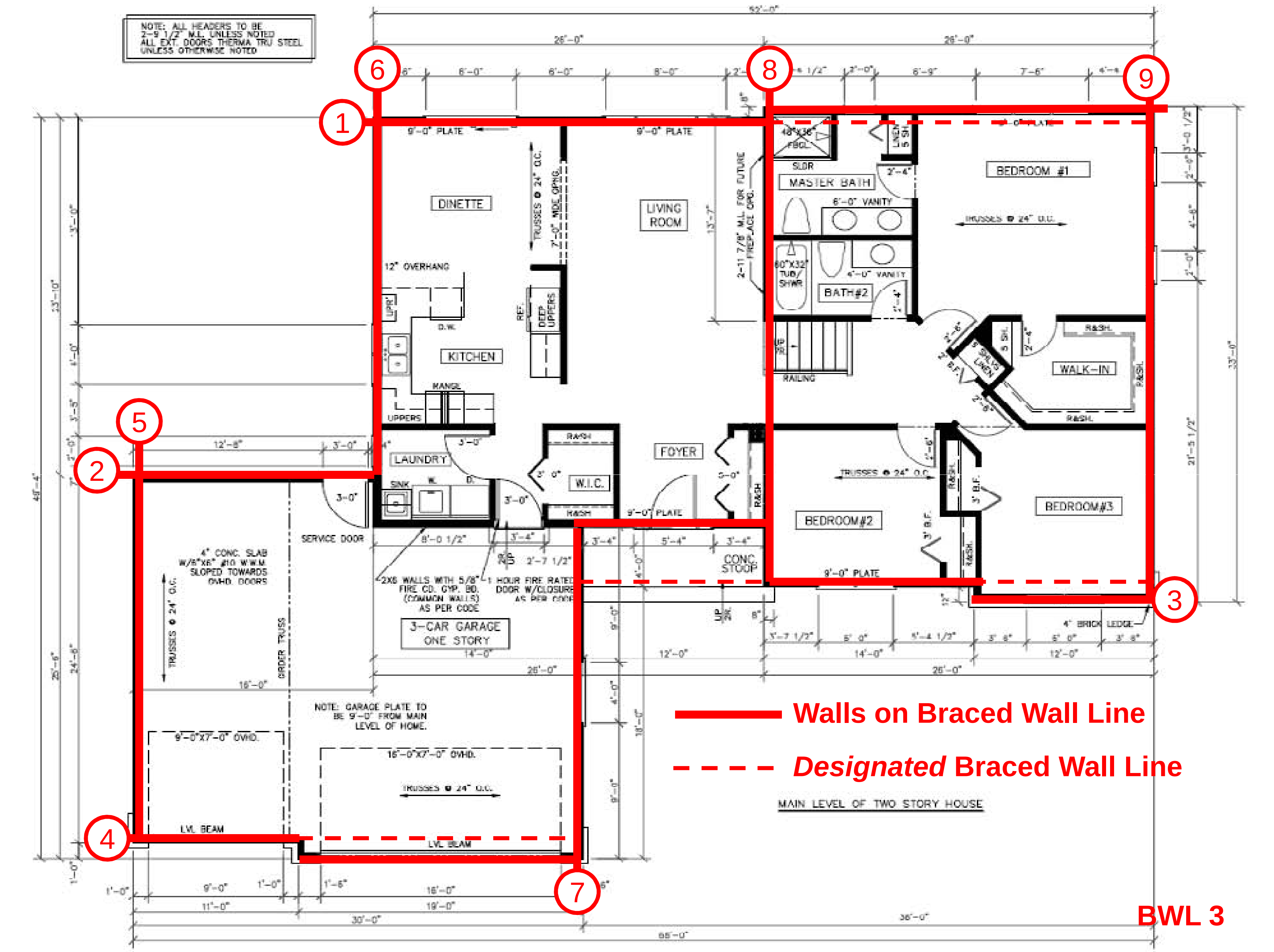
BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs ____ in ÷ 12 = ____ ft					Total length of BWPs ____ ft ÷ BWL length ____ ft = Actual % bracing ____ %
								Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

Braced Wall Line 2

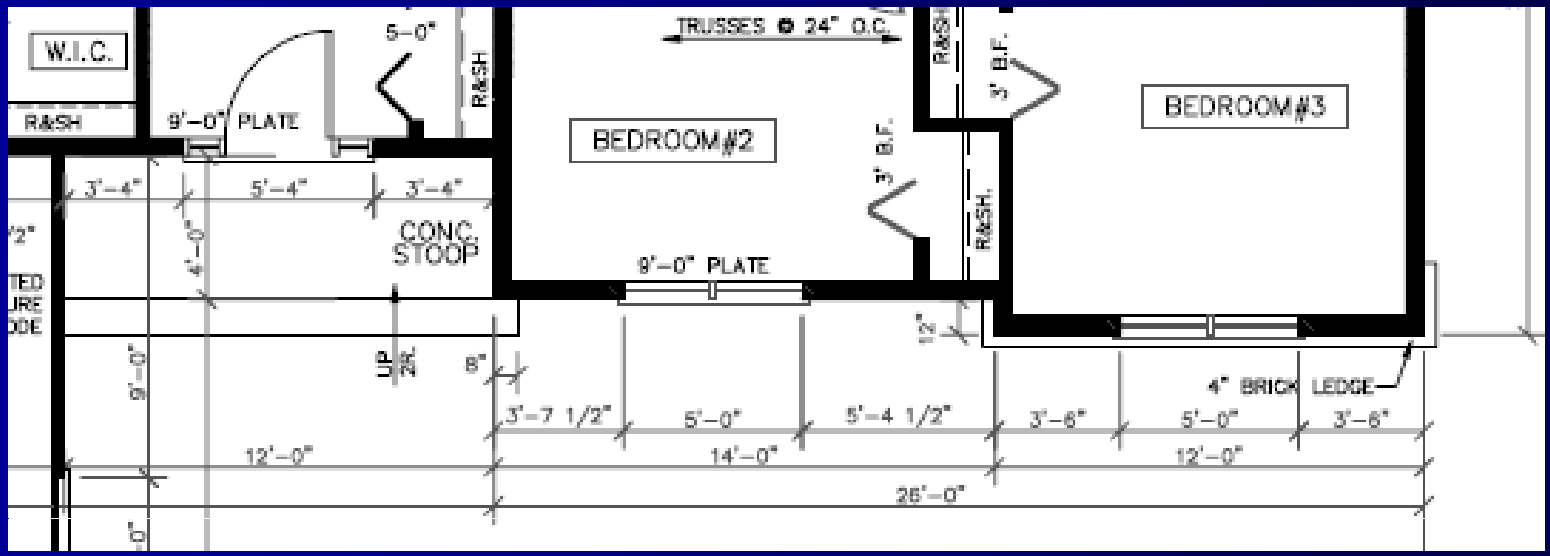


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
2	Wall Height:	9 ft	BWP left end: ~~WSP~~ SFB; GB(1 side) GB(2 sides); SWSP CS-PF; Other:	BWP 2: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 3: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 4: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP right end: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	Panel Location: Left End: ☐ @ end ☒ within 12.5" Right End: ☐ @ end ☒ within 12.5"
	BWL Spacing (L):	23.83 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	24.5 ft						
	BWL Length:	16 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	Required %bracing:	16 %	Length: 48 in	Length: in	Length: in	Length: in	Length: in	Total length of BWPs: 4 ft ÷ BWL length: 16 ft = Actual % bracing: 25 %
	Location:							Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~

Total Length of BWPs: 48 in ÷ 12 = 4 ft

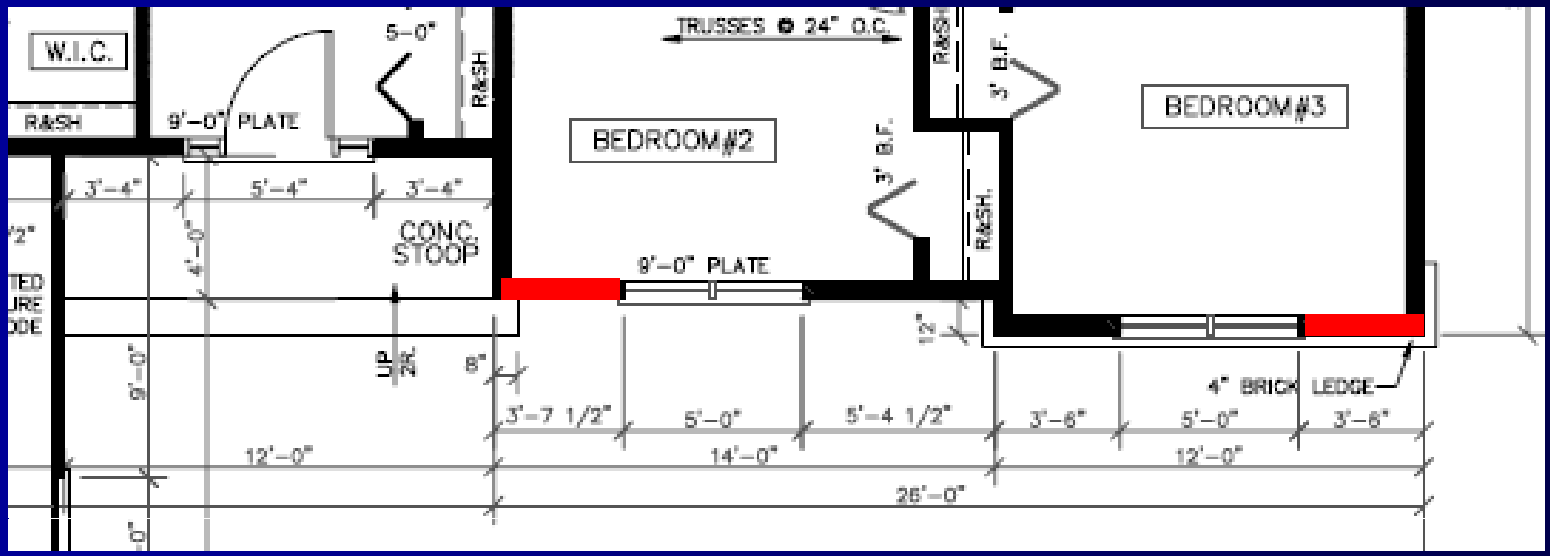

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
W.I.C.
FOYER
MASTER BATH
BATH#2
BEDROOM #1
BEDROOM#2
BEDROOM#3
WALK-IN
CONC. STOOP
3-CAR GARAGE ONE STORY
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 3

Braced Wall Line 3



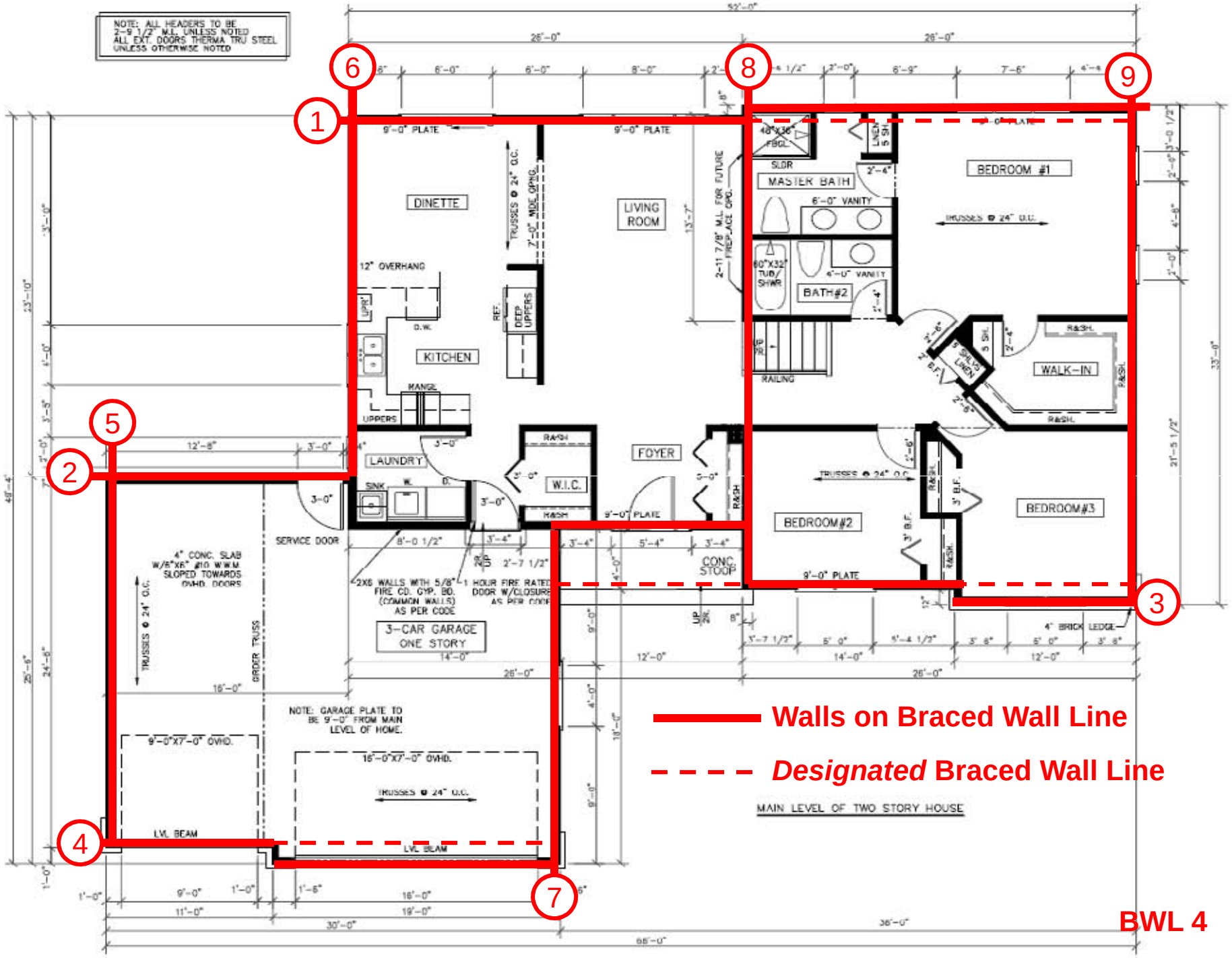
BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs: in ÷ 12 = ft					Total length of BWPs: ft ÷ BWL length: ft = Actual % bracing: %
								Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

Braced Wall Line 3

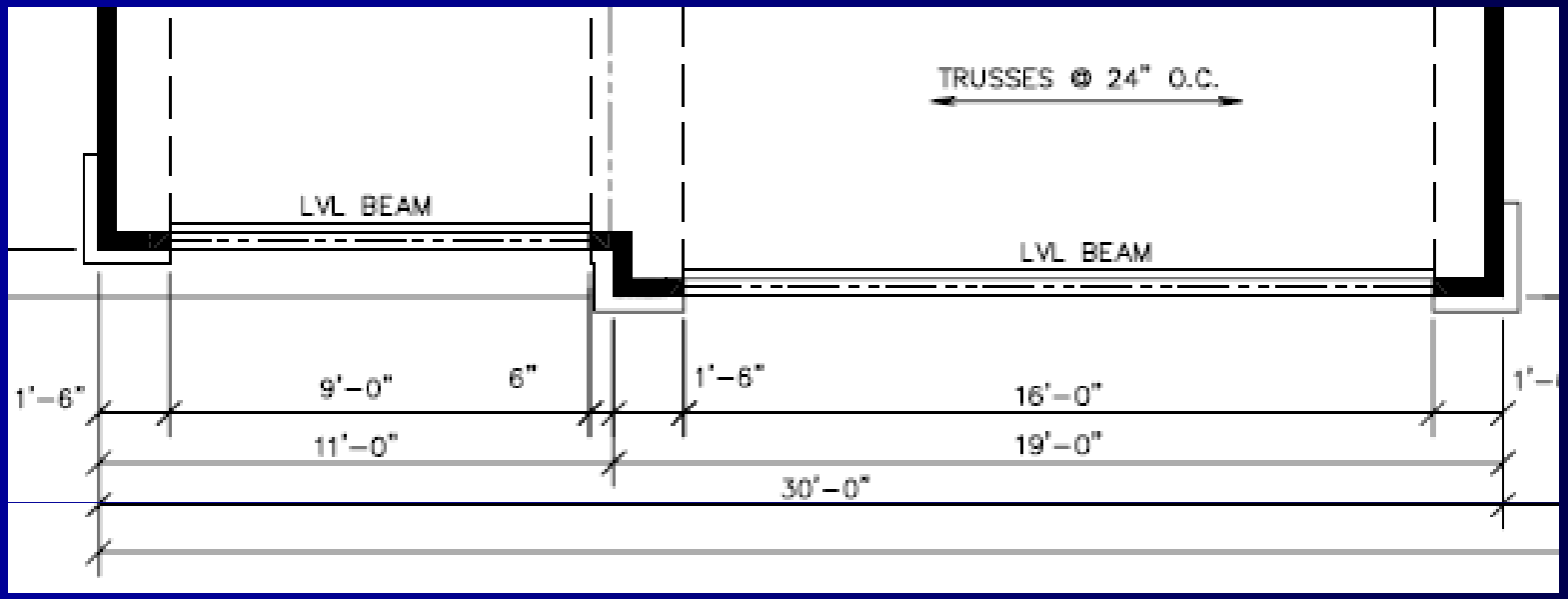


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
3	Wall Height:	9 ft	BWP left end: ~~WSP~~ SFB; GB(1 side) GB(2 sides); SWSP CS-PF; Other:	BWP 2: ~~WSP~~ SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 3: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 4: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP right end: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	Panel Location: Left End: ☐ @ end ☒ within 12.5' Right End: ☒ @ end ☐ within 12.5'
	BWL Spacing (L):	18.00 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	31.33 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	BWL Length:	38 ft						
	Required %bracing:	16 %	Length: 39 eff in	Length: 36 eff in	Length: in	Length: in	Length: in	Total length of BWPs: 6.25 ft ÷ BWL length: 38 ft = Actual % bracing: 16 %
	Location:		43.5"	42"				Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~

Total Length of BWPs: 75 in ÷ 12 = 6.25 ft

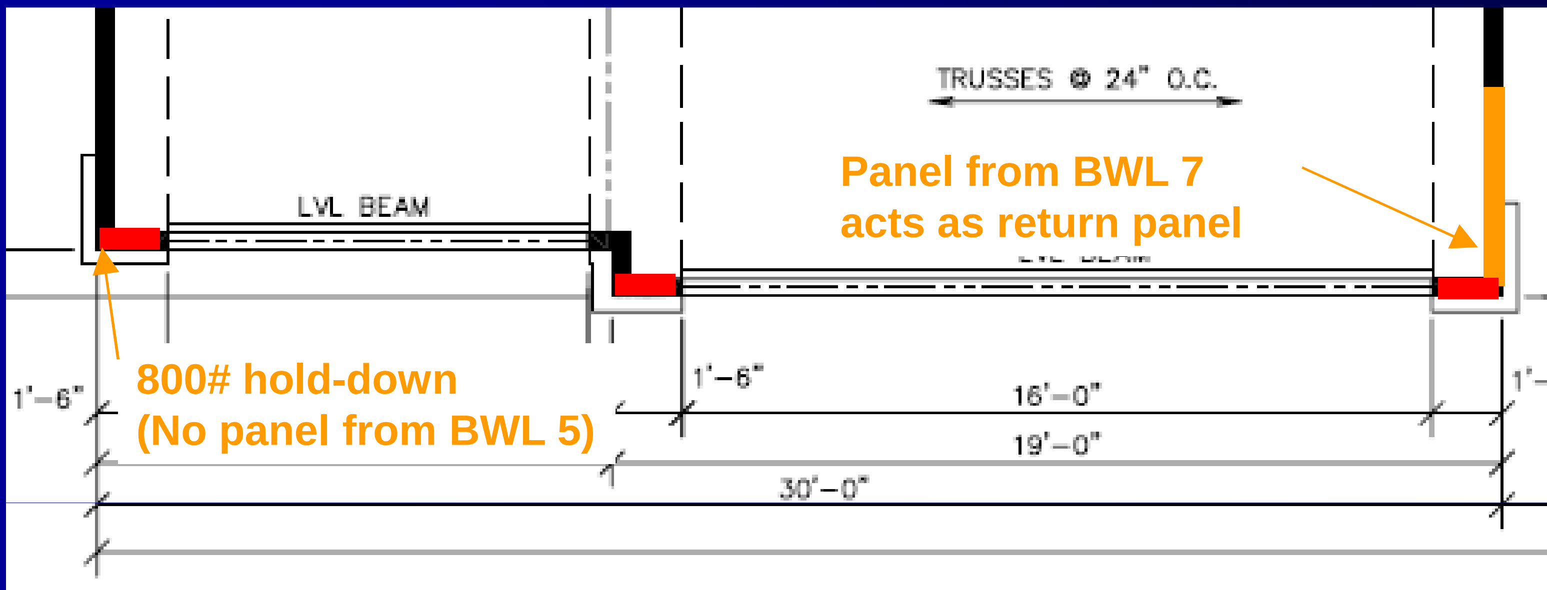

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
LVL BEAM
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 4

Braced Wall Line 4



BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs: in ÷ 12 = ft					Total length of BWPs: ft ÷ BWL length: ft = Actual % bracing: %
								Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

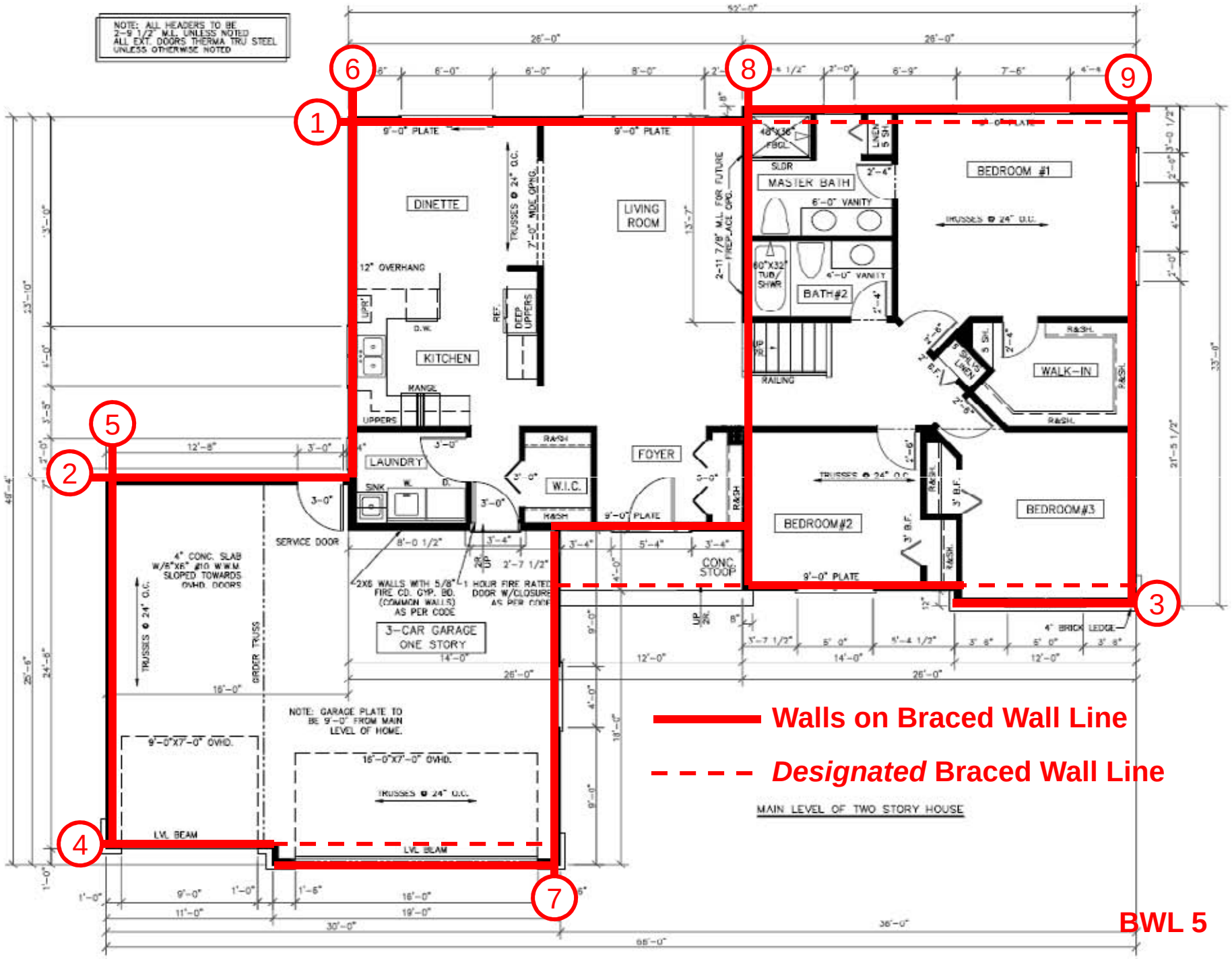
Braced Wall Line 4



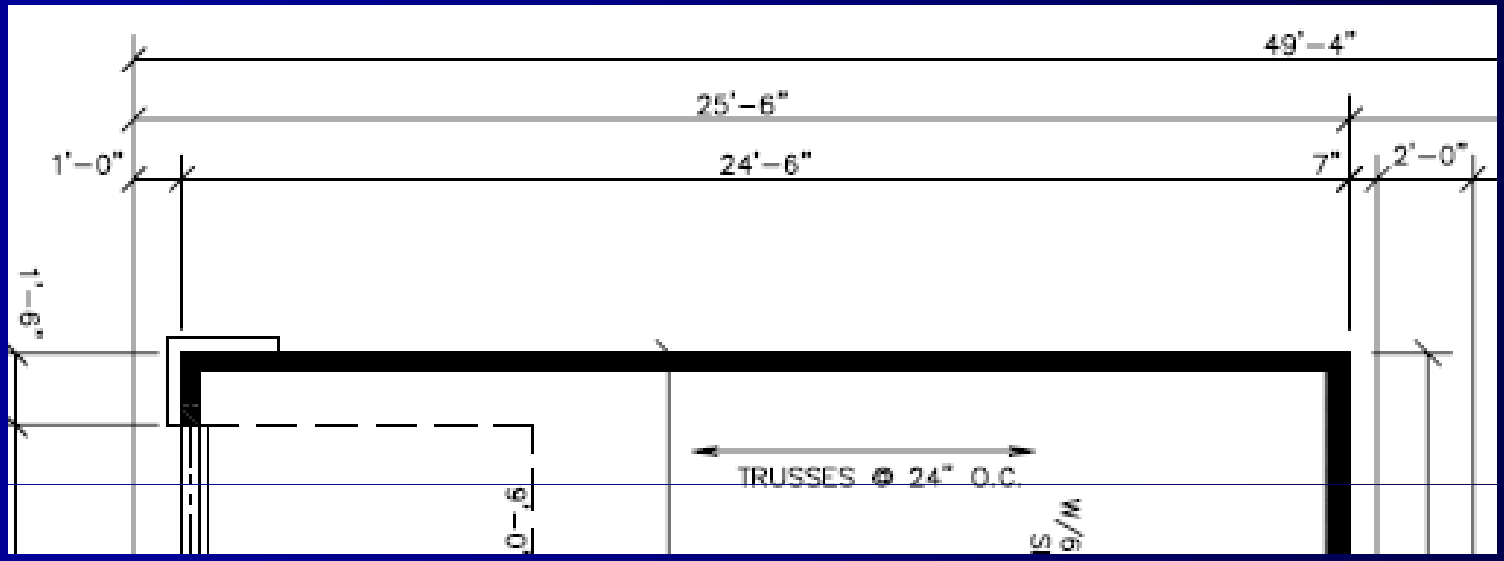
BWL	General Information		Braced Wall Panels					BWL Actual Conditions
			BWP left end	BWP2	BWP3	BWP4	BWP right end	
4	Wall Height:	9 ft	WSP / SFB / CB(1 side) / CB(2 sides) / SWSP / ~~CS-PF~~ (crossed out)	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / ~~CS-PF~~ (crossed out)	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / ~~CS-PF~~ (crossed out)	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	Panel Location: Left End: ☒ @ end ☐ within 12.5' — Right End: ☒ @ end ☐ within 12.5'
	BWL Spacing (L):	24.5 ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☒ Option 3 ☐ Option 4 — Right End: ☒ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	16.0 ft	Length 18 in	Length 18 in	Length 18 in	Length in	Length in	Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	BWL Length:	30 ft						Total length of BWPs 4.5 ft ÷ BWL length 30 ft = Actual % bracing 15 %
	Required %bracing:	16 %						Actual % of bracing ≥ Required % of bracing: ~~NO STOP!~~ (crossed out) / YES- BWL GOOD
	Location:	☒ (one story) ☐ ☐						

Total Length of BWPs 54 in ÷ 12 = 4.5 ft

Engineered solution, redesign required or use proprietary product.

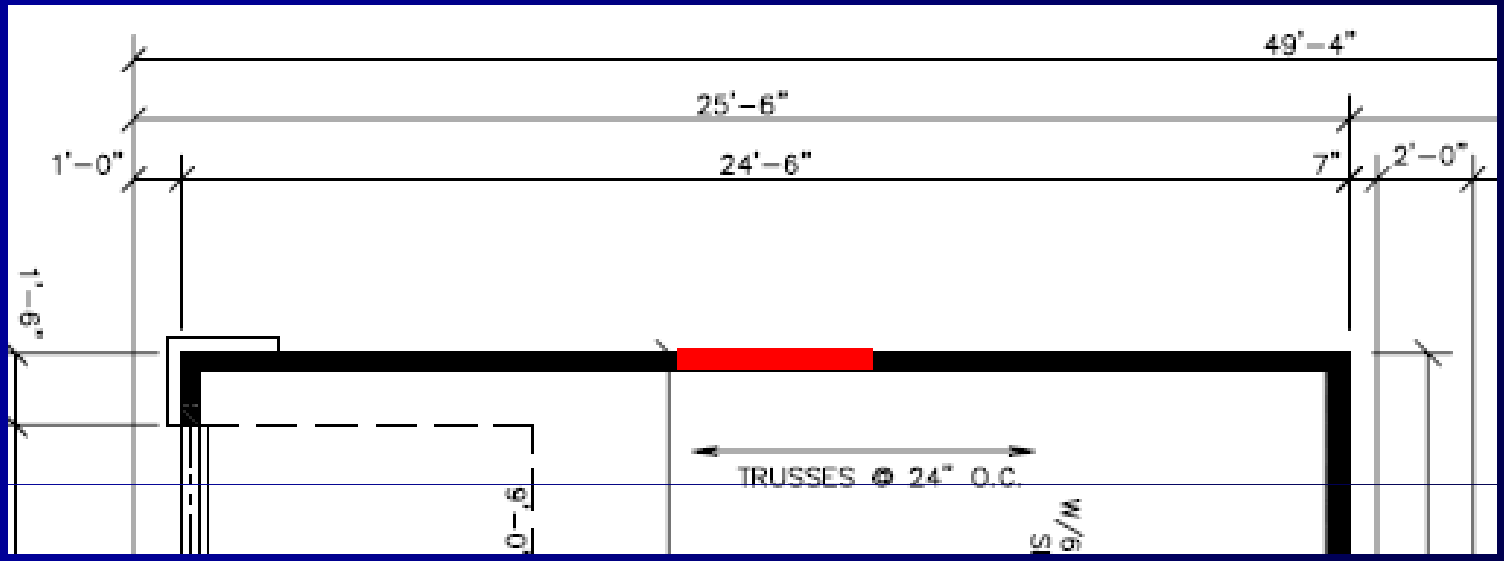

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
LVL BEAM
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 5

Braced Wall Line 5



BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length	Length	Length	Length	Length	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%	in	in	in	in	in	Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs: in ÷ 12 = ft					Total length of BWPs: ft ÷ BWL length: ft = Actual % bracing: %
								Actual % of bracing ≥ Required % of bracing: NO STOP! / YES- BWL GOOD

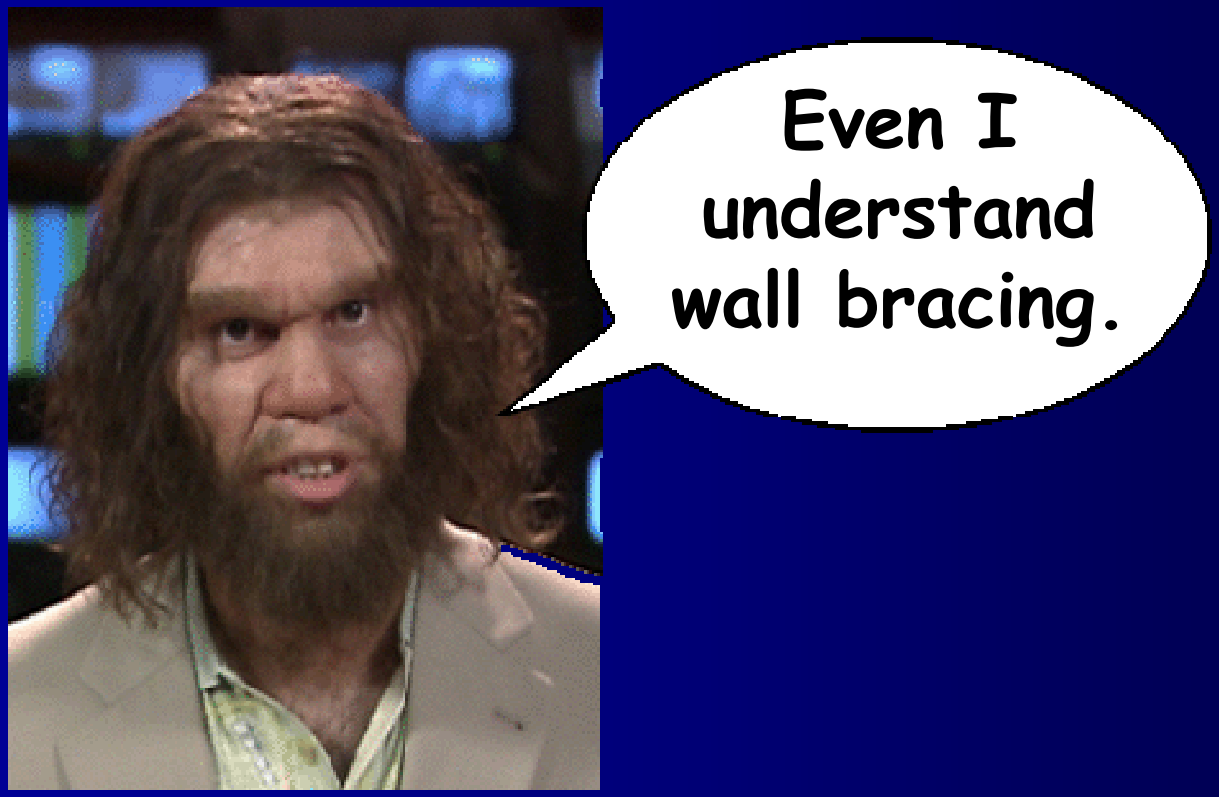
Braced Wall Line 5

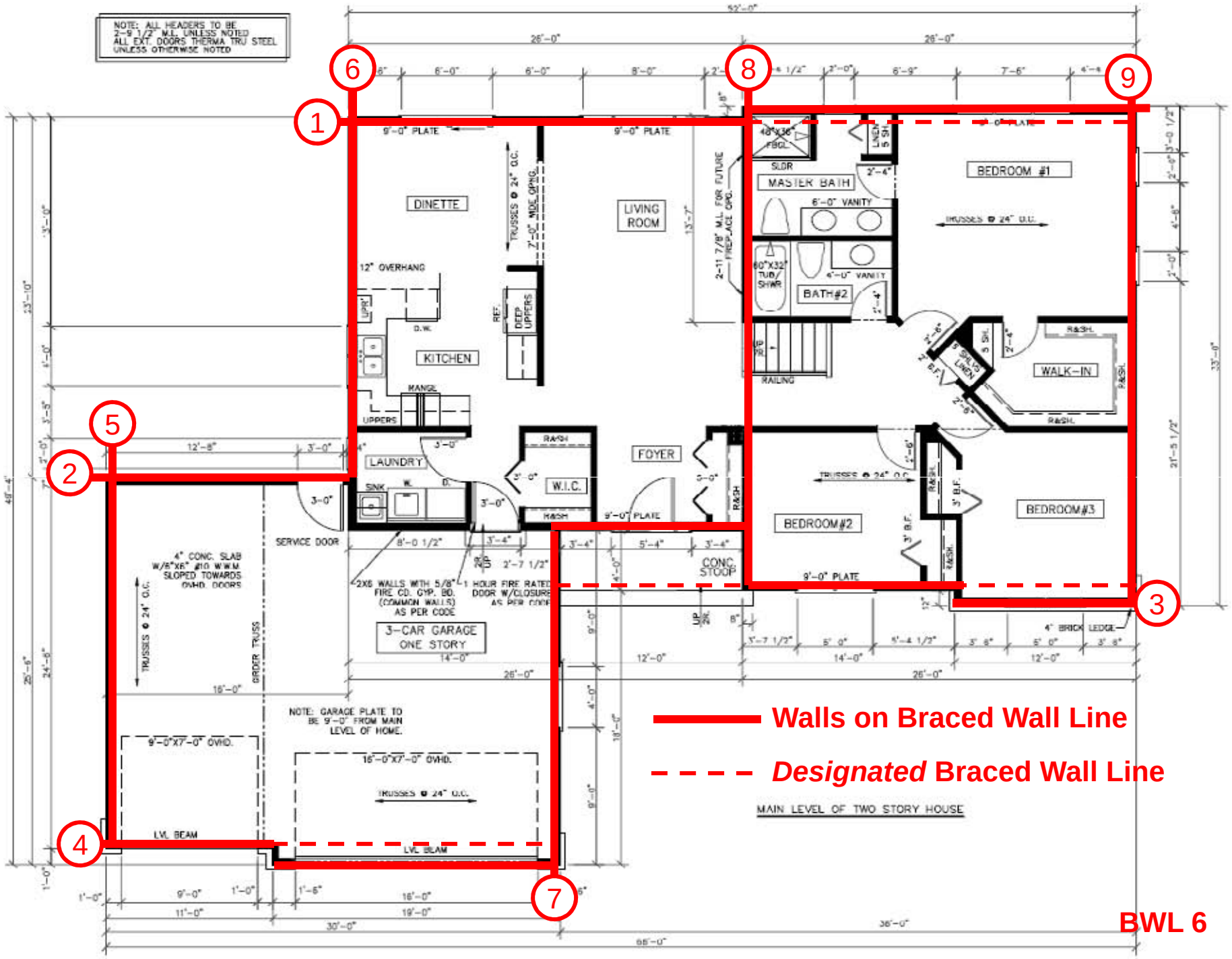


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
5	Wall Height:	9 ft	BWP left end: ~~WSP~~ SFB; GB(1 side) GB(2 sides); SWSP CS-PF; Other:	BWP 2: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 3: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP 4: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	BWP right end: WSP SFB; GB(1 side) GB(2 sides); CSWSP CS-PF; Other:	Panel Location: Left End: ☐ @ end ☒ within 12.5" Right End: ☐ @ end ☒ within 12.5"
	BWL Spacing (L):	15.67 ft	Length: 48 in	Length: in	Length: in	Length: in	Length: in	Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	30 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	BWL Length:	24.5 ft						Total length of BWPs: 4 ft ÷ BWL length: 24.5 ft = Actual % bracing: 16 %
	Required %bracing:	16 %						Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~
	Location:	☒ ☐ ☐	Total Length of BWPs: 48 in ÷ 12 = 4 ft					

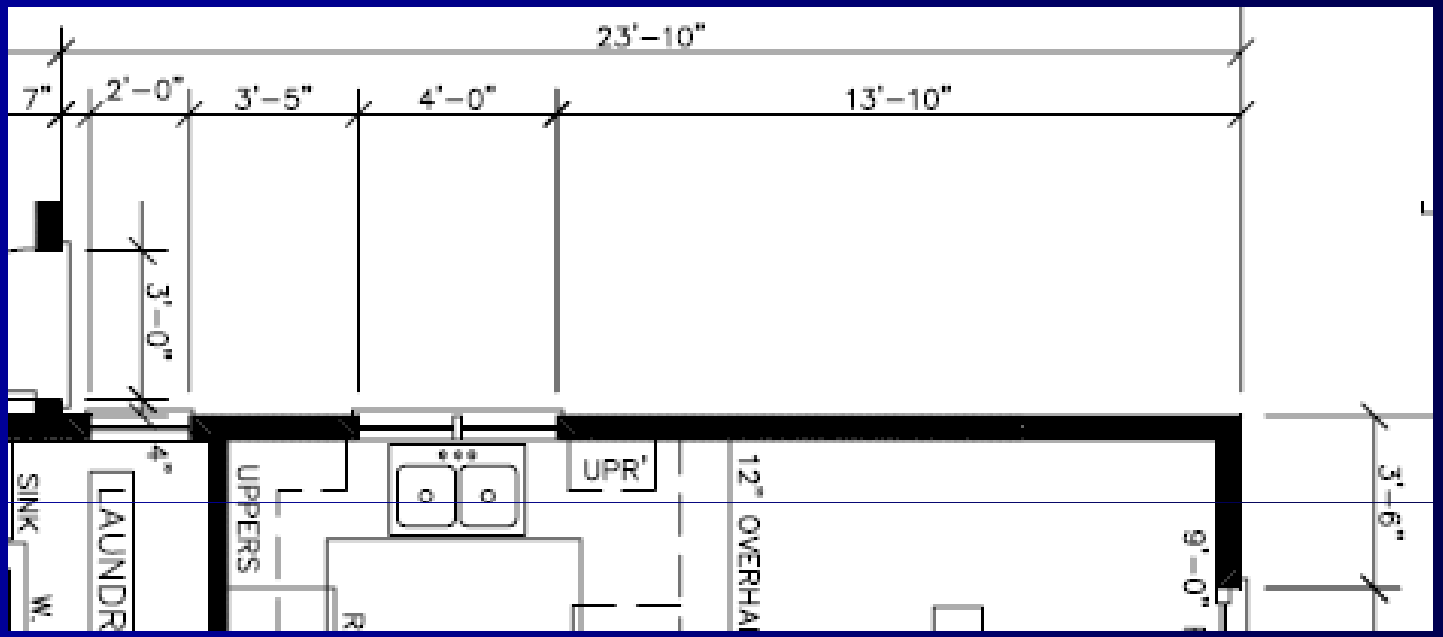
Wall Bracing is so easy….

…even a caveman can do it!



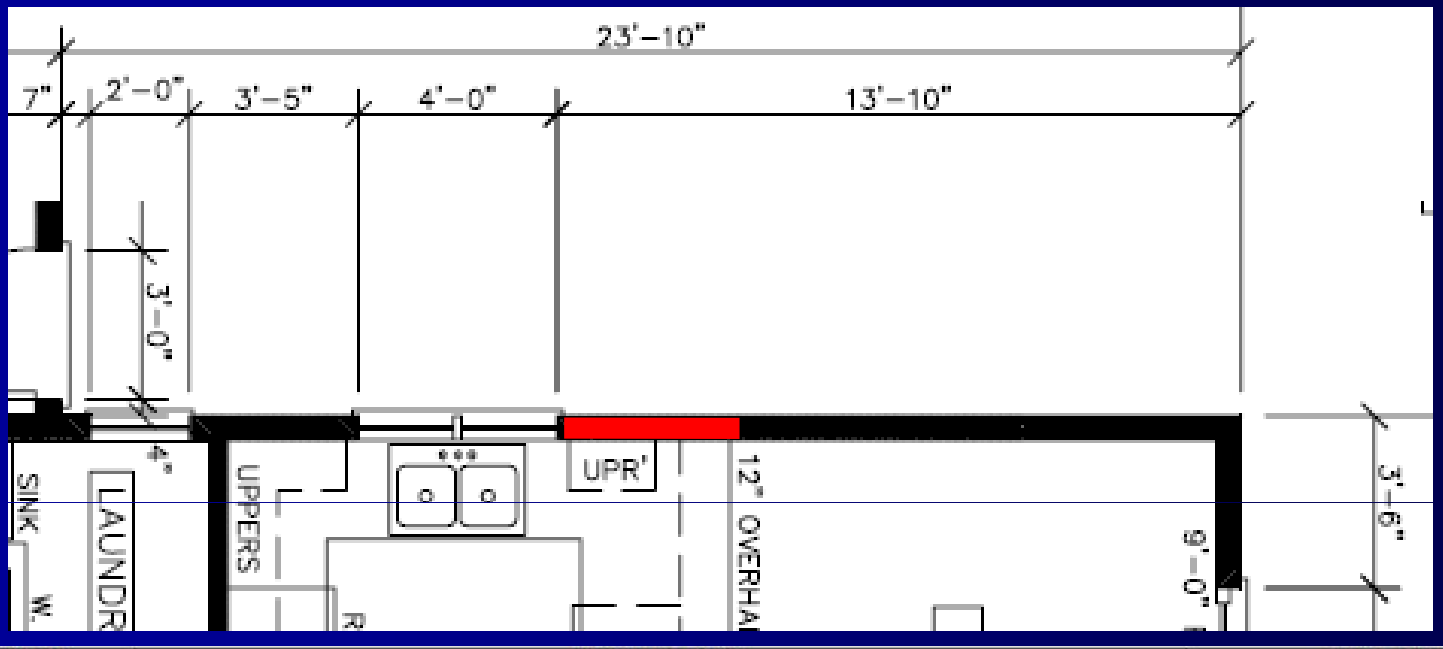

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
3-CAR GARAGE ONE STORY
CONC. STOOP
SERVICE DOOR
LVL BEAM
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 6

Braced Wall Line 6



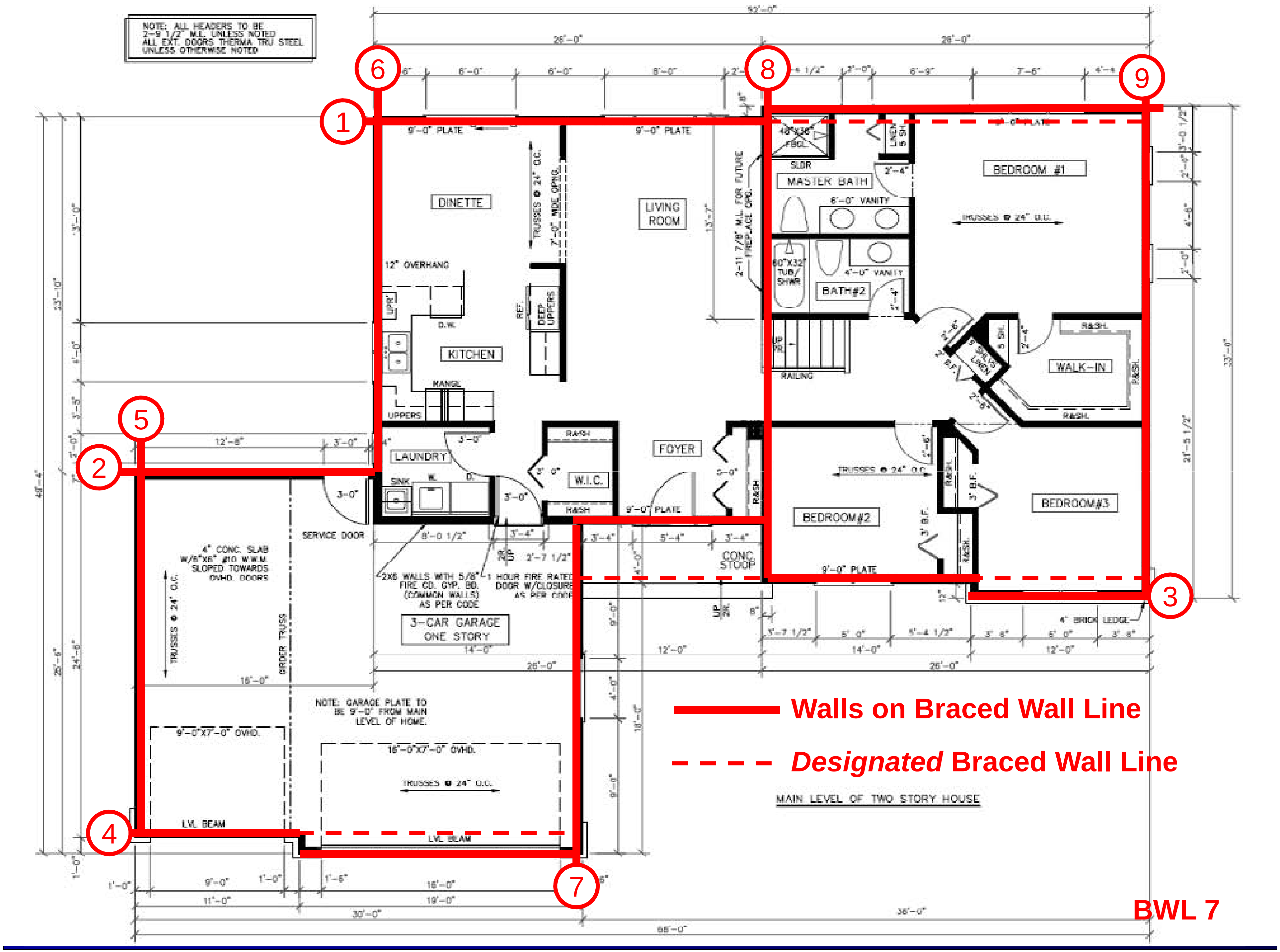
BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs ____ in ÷ 12 = ____ ft					Total length of BWPs ____ ft ÷ BWL length ____ ft = Actual % bracing ____ %
								Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

Braced Wall Line 6

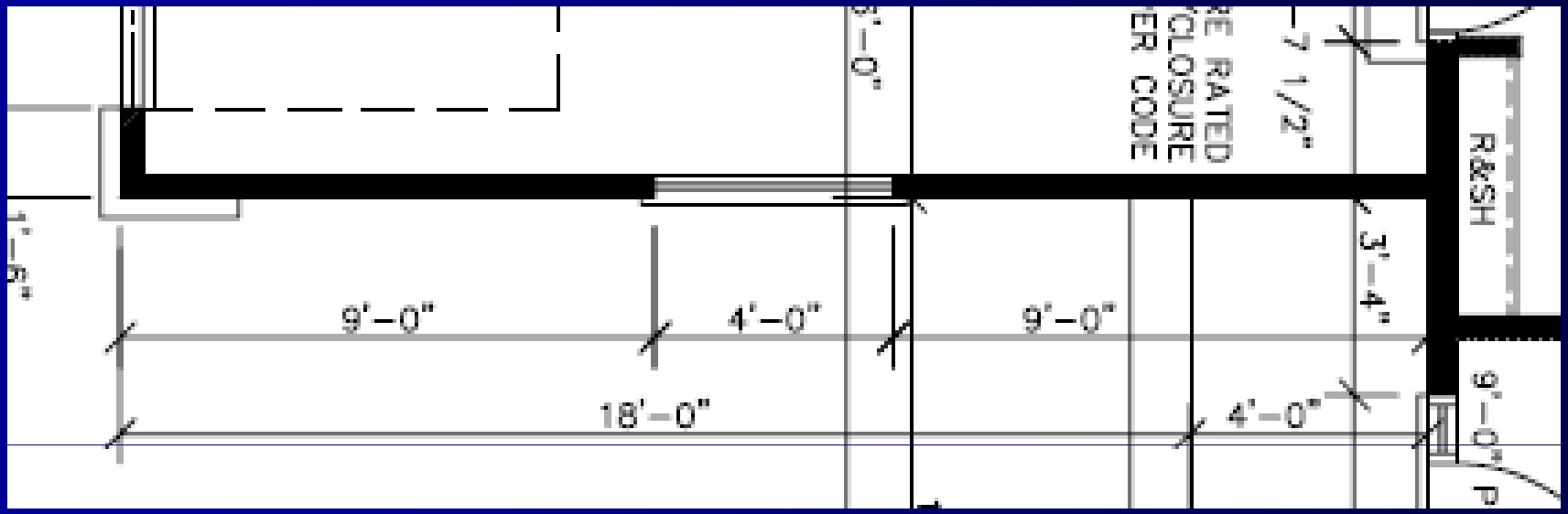


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
6	Wall Height:	9 ft	BWP left end: SFB; OB (1 side); OB (2 sides); SWSP; CS-PF; Other:	BWP 2: WSP; SFB; OB (1 side); OB (2 sides); CSWSP; CS-PF; Other:	BWP 3: WSP; SFB; OB (1 side); OB (2 sides); CSWSP; CS-PF; Other:	BWP 4: WSP; SFB; OB (1 side); OB (2 sides); CSWSP; CS-PF; Other:	BWP right end: WSP; SFB; OB (1 side); OB (2 sides); CSWSP; CS-PF; Other:	Panel Location: Left End: ☐ @ end ☒ within 12.5' Right End: ☐ @ end ☒ within 12.5'
	BWL Spacing (L):	26 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	16 ft						
	BWL Length:	23.83 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	Required %bracing:	16 %	Length: 48 in	Length: in	Length: in	Length: in	Length: in	Total length of BWPs: 4 ft ÷ BWL length: 23.83 ft = Actual % bracing: 17 %
	Location:							Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~

Total Length of BWPs: 48 in ÷ 12 = 4 ft

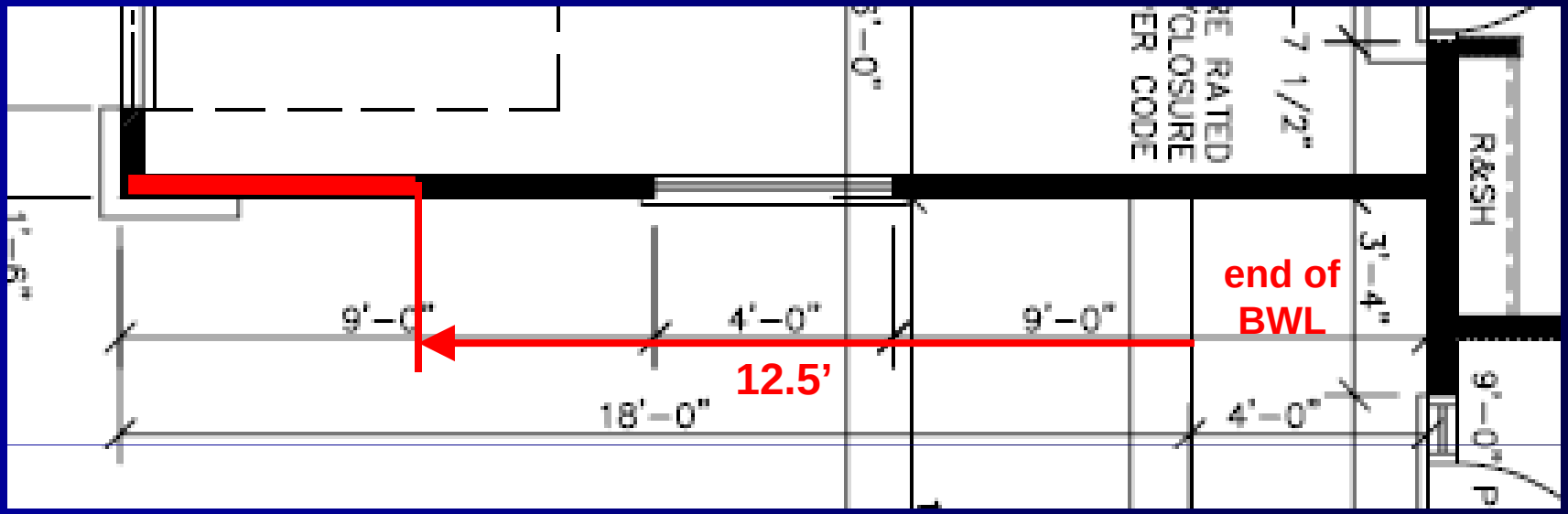

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
1
2
3
4
5
6
7
8
9
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
W.I.C.
FOYER
MASTER BATH
BATH#2
BEDROOM #1
BEDROOM#2
BEDROOM#3
WALK-IN
CONC. STOOP
3-CAR GARAGE ONE STORY
SERVICE DOOR
4" CONC. SLAB W/6"X6" #10 W.W.M. SLOPED TOWARDS OVHD. DOORS
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
9'-0"X7'-0" OVHD.
16'-0"X7'-0" OVHD.
LVL BEAM
9'-0" PLATE
12" OVERHANG
2X6 WALLS WITH 5/8" FIRE CD. GYP. BD. (COMMON WALLS) AS PER CODE
4" BRICK LEDGE
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 7

Braced Wall Line 7

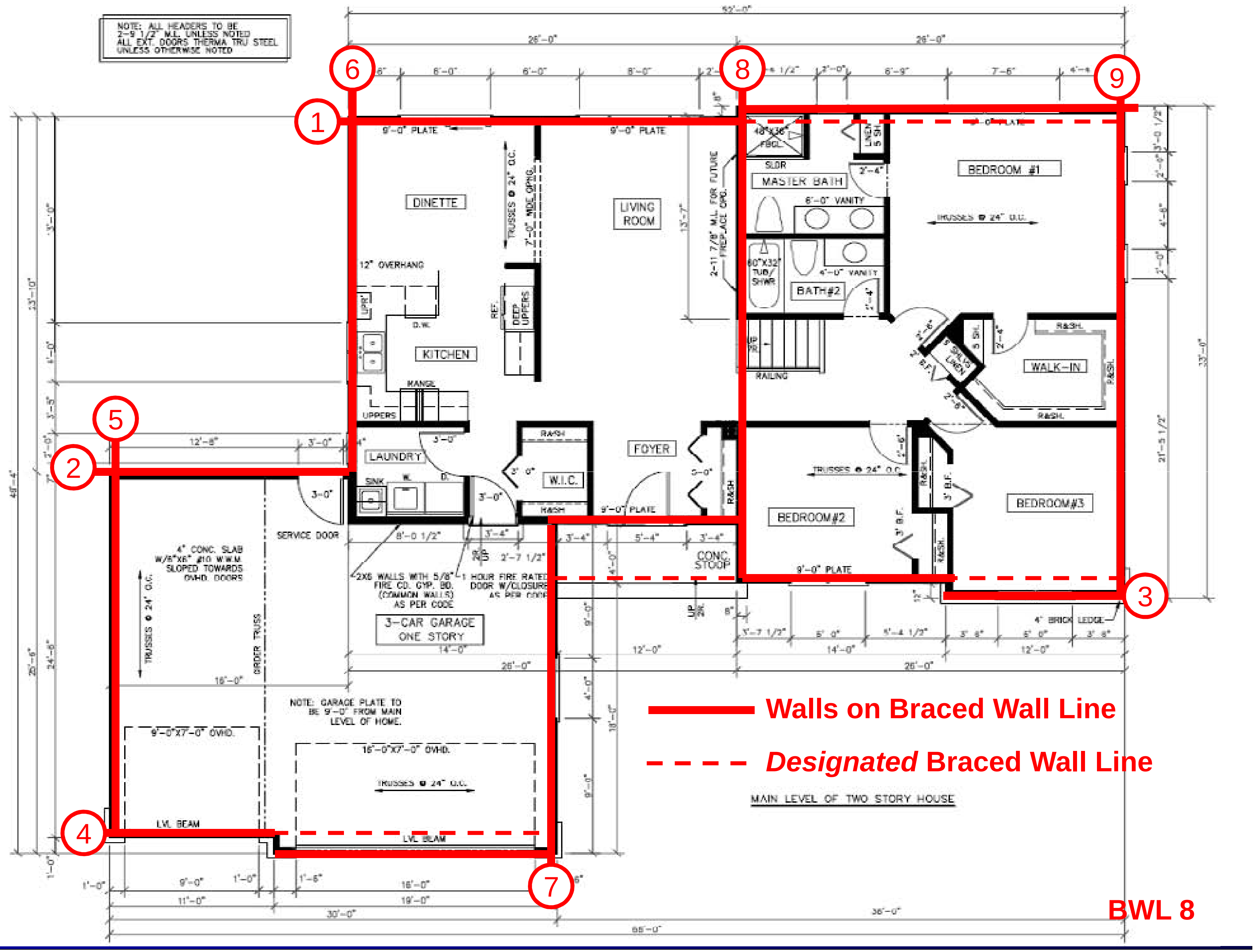


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / CB(1 side) / CB(2 sides) / SWSP / CS-PF	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	WSP / SFB / CB(1 side) / CB(2 sides) / CSWSP / CS-PF	Left End: ☐ @ end ☐ within 12.5' Right End: ☐ @ end ☐ within 12.5'
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Return panel (CS only):
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:		Total Length of BWPs ____ in ÷ 12 = ____ ft					Total length of BWPs ____ ft ÷ BWL length ____ ft = Actual % bracing ____ %
								Actual % of bracing ≥ Required % of bracing: NO STOP! / YES- BWL GOOD

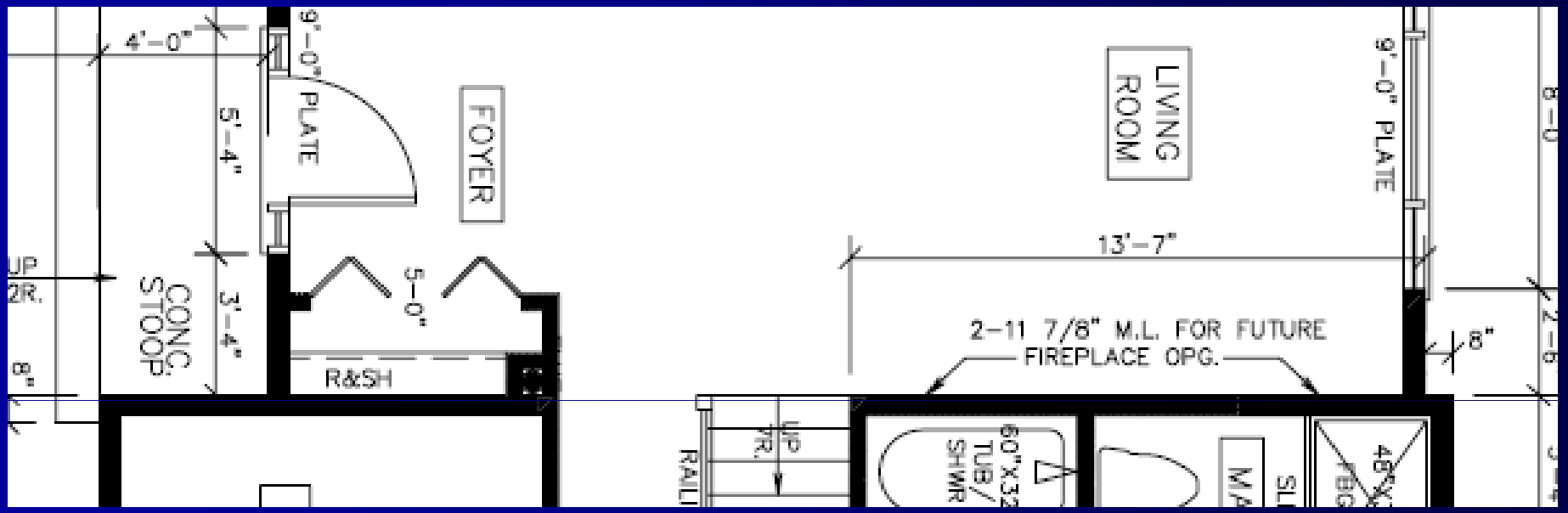
Braced Wall Line 7



BWL	General Information		Braced Wall Panels					BWL Actual Conditions
7	Wall Height:	9 ft	BWP left end: ~~SFB~~, ~~GB(1 side)~~, ~~GB(2 sides)~~, SWSP, CS-PF; Other: ; Length: 66 in	BWP 2: WSP, SFB, GB(1 side), GB(2 sides), CSWSP, CS-PF; Other: ; Length: in	BWP 3: WSP, SFB, GB(1 side), GB(2 sides), CSWSP, CS-PF; Other: ; Length: in	BWP 4: WSP, SFB, GB(1 side), GB(2 sides), CSWSP, CS-PF; Other: ; Length: in	BWP right end: WSP, SFB, GB(1 side), GB(2 sides), CSWSP, CS-PF; Other: ; Length: in	Panel Location: Left End: ☒ @ end ☐ within 12.5' Right End: ☐ @ end ☒ within 12.5'
	BWL Spacing (L):	30 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	12 ft						
	BWL Length:	17 ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	Required %bracing:	16 %						Total length of BWPs: 5.5 ft ÷ BWL length: 17 ft = Actual % bracing: 32 %
	Location:	☒ ☐ ☐	Total Length of BWPs: 66 in ÷ 12 = 5.5 ft					Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~

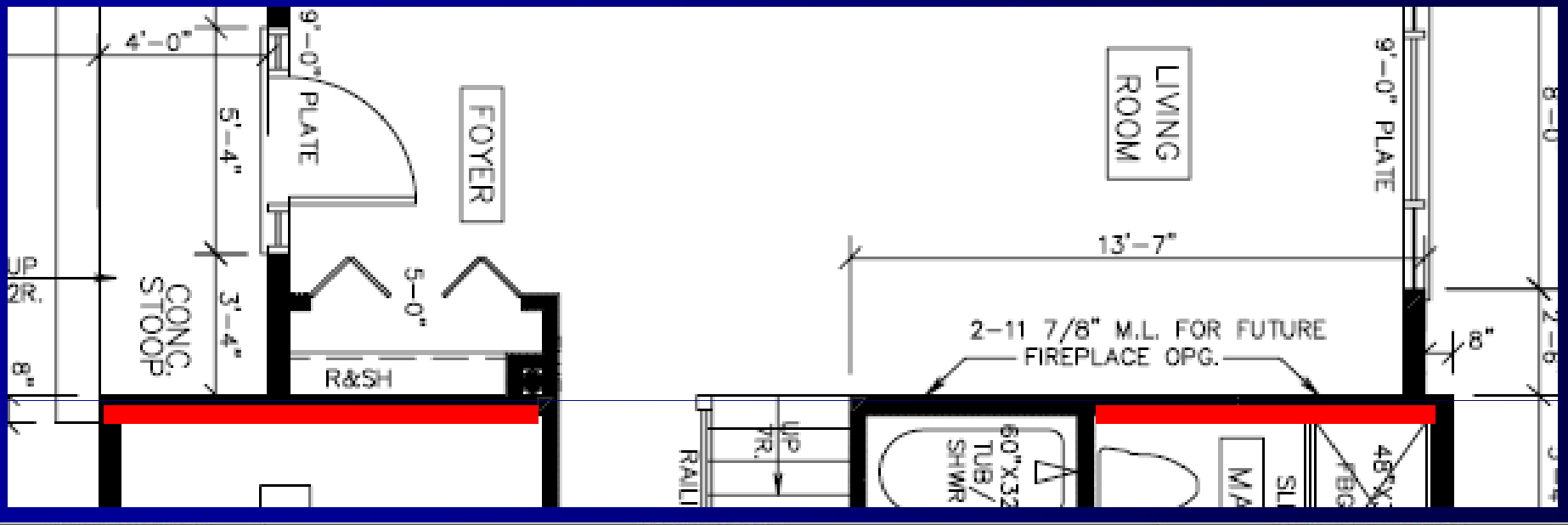

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
1
2
3
4
5
6
7
8
9
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
W.I.C.
FOYER
MASTER BATH
BATH#2
BEDROOM #1
BEDROOM#2
BEDROOM#3
WALK-IN
CONC. STOOP
3-CAR GARAGE ONE STORY
SERVICE DOOR
9'-0" PLATE
12" OVERHANG
TRUSSES @ 24" O.C.
GIRDER TRUSS
LVL BEAM
9'-0"X7'-0" OVHD.
16'-0"X7'-0" OVHD.
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
4" BRICK LEDGE
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 8

Braced Wall Line 8

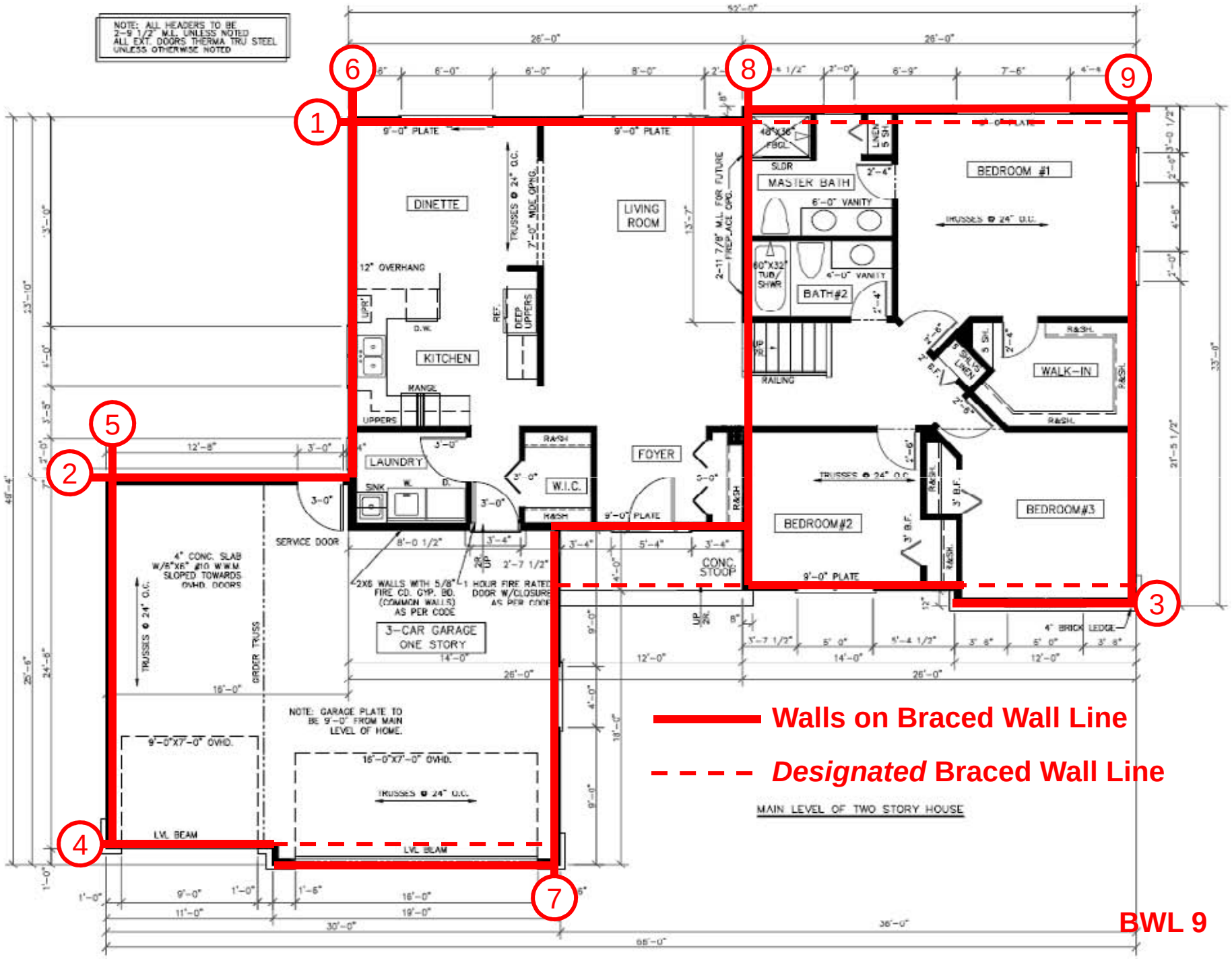


BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location:
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF / Other: / Length (in)	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF / Other: / Length (in)	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF / Other: / Length (in)	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF / Other: / Length (in)	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF / Other: / Length (in)	Left End: ☐ @ end ☐ within 12.5" Right End: ☐ @ end ☐ within 12.5"
	BWL Spacing (R):	ft						Return panel (CS only):
	BWL Length:	ft						Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	Required %bracing:	%						Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	Location:							Total length of BWPs ft ÷ BWL length ft = Actual % bracing %
			Total Length of BWPs in ÷ 12 = ft					Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD

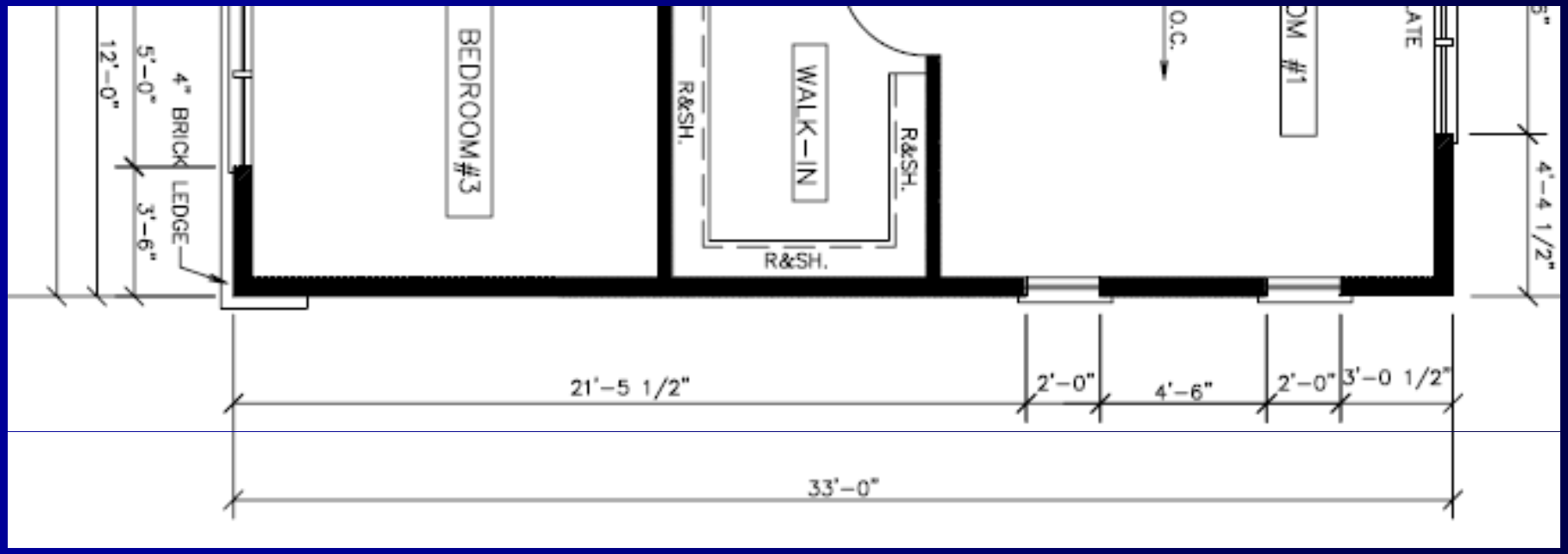
Braced Wall Line 8



BWL	General Information		Braced Wall Panels					BWL Actual Conditions
8	Wall Height:	9 ft	BWP left end: WSP / SFB / GB(1 side) / SWSP / CS-PF; Other:	BWP 2: WSP / SFB / GB(1 side) / CSWSP / CS-PF; Other:	BWP 3: WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF; Other:	BWP 4: WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF; Other:	BWP right end: WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF; Other:	Panel Location: Left End: [X] @ end [ ] within 12.5' Right End: [X] @ end [ ] within 12.5'
	BWL Spacing (L):	26 ft	Length: 120 in	Length: 96 in	Length: in	Length: in	Length: in	Return panel (CS only): Left End: [ ] Option 1 [ ] Option 2 [ ] Option 3 [ ] Option 4 Right End: [ ] Option 1 [ ] Option 2 [ ] Option 3 [ ] Option 4
	BWL Spacing (R):	26 ft						Panel Spacing < 25' o.c.: [X] Yes [ ] No
	BWL Length:	31.33 ft						Total length of BWPs: 18 ft ÷ BWL length: 31.33 ft = Actual % bracing: 57 %
	Required %bracing:	50 %						Actual % of bracing ≥ Required % of bracing: NO STOP! [X] YES- BWL GOOD
	Location:		Total Length of BWPs: 216 in ÷ 12 = 18 ft					

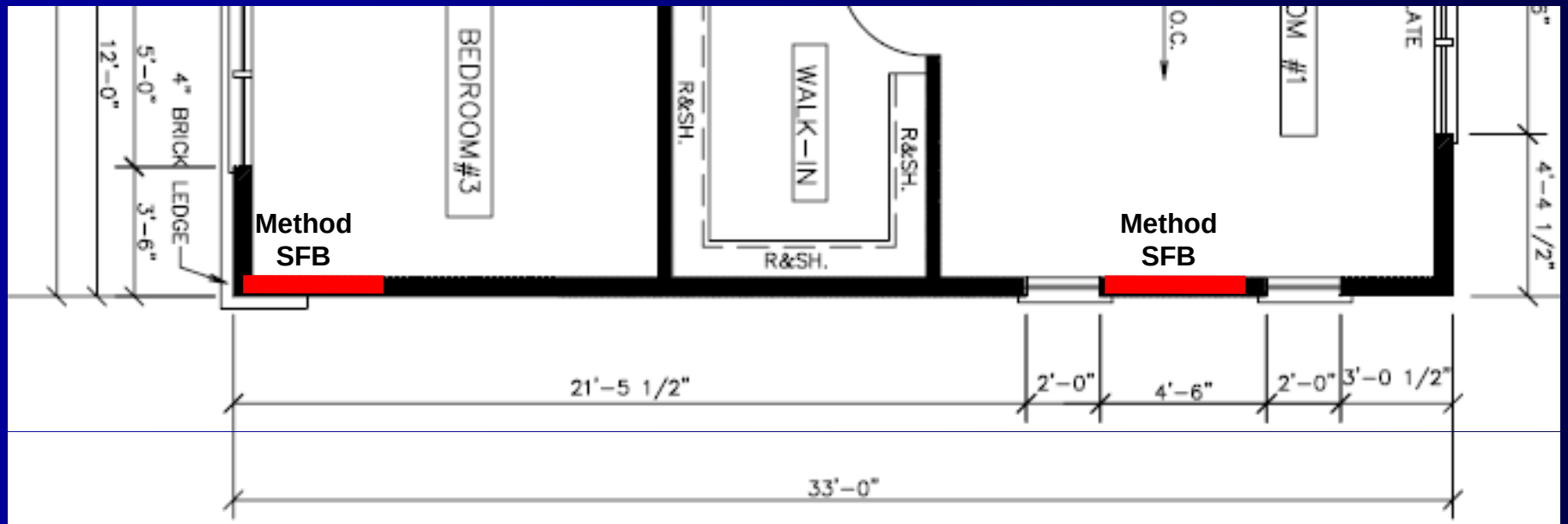

NOTE: ALL HEADERS TO BE 2-9 1/2" M.L. UNLESS NOTED ALL EXT. DOORS THERMA TRU STEEL UNLESS OTHERWISE NOTED
52'-0"
26'-0"
26'-0"
6
8
9
1
2
5
4
3
7
DINETTE
LIVING ROOM
KITCHEN
LAUNDRY
FOYER
W.I.C.
MASTER BATH
BEDROOM #1
BATH#2
WALK-IN
BEDROOM#2
BEDROOM#3
SLDR
6'-0" VANITY
4'-0" VANITY
60"X32" TUB/ SHWR
48"X36" FBGL
12" OVERHANG
TRUSSES @ 24" O.C.
2'-0" WIDE OPNG.
2-11 7/8" M.L. FOR FUTURE FIREPLACE OPNG.
9'-0" PLATE
RAILING
SERVICE DOOR
4" CONC. SLAB W/6"X6" #10 W.W.M. SLOPED TOWARDS OVHD. DOORS
2X6 WALLS WITH 5/8" FIRE CD. GYP. BD. (COMMON WALLS) AS PER CODE
1 HOUR FIRE RATED DOOR W/CLOSURE AS PER CODE
CONC. STOOP
4" BRICK LEDGE
3-CAR GARAGE ONE STORY
NOTE: GARAGE PLATE TO BE 9'-0" FROM MAIN LEVEL OF HOME.
9'-0"X7'-0" OVHD.
16'-0"X7'-0" OVHD.
LVL BEAM
ORDER TRUSS
Walls on Braced Wall Line
Designated Braced Wall Line
MAIN LEVEL OF TWO STORY HOUSE
BWL 9

Braced Wall Line 9



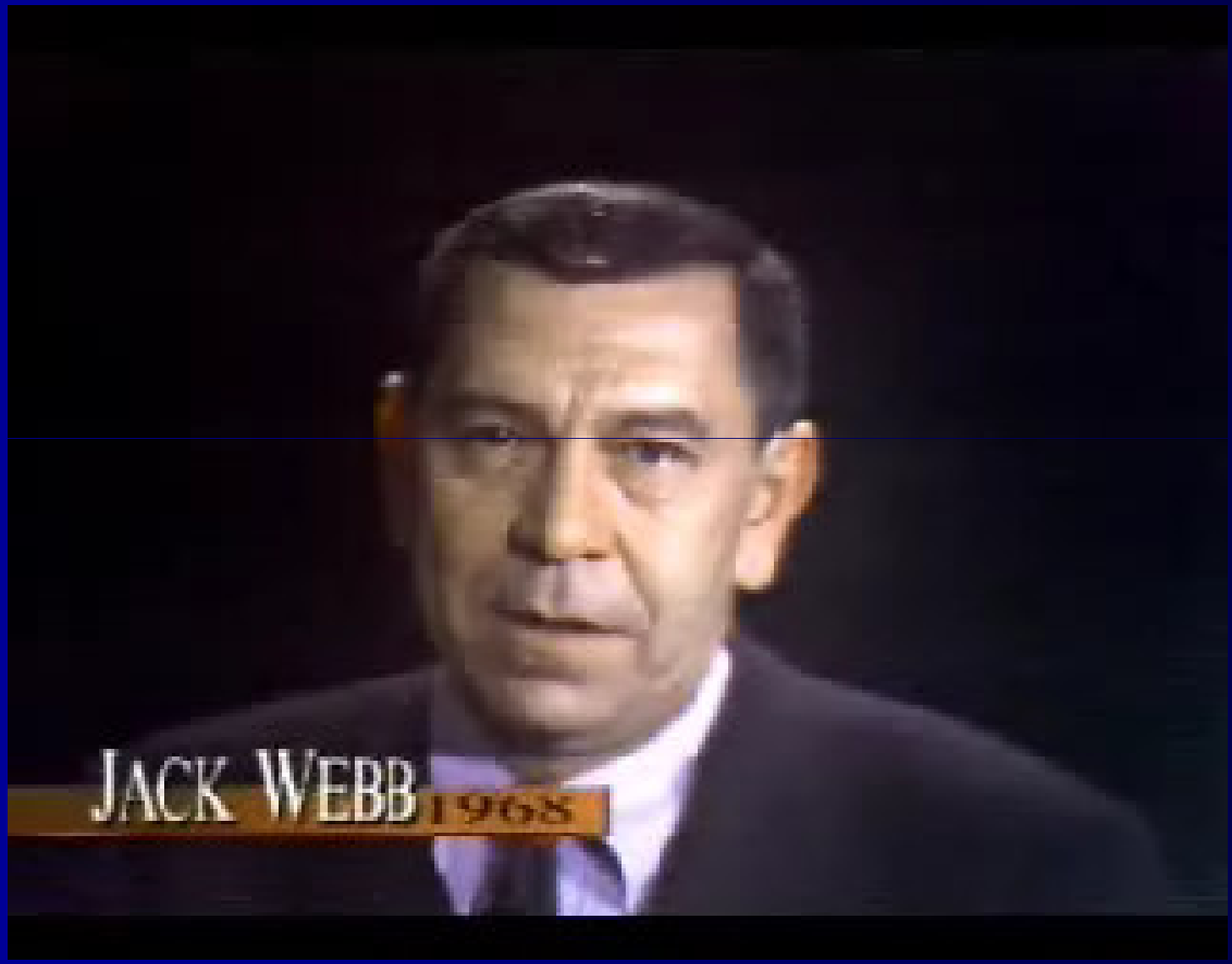
BWL	General Information		Braced Wall Panels					BWL Actual Conditions
	Wall Height:	ft	BWP left end	BWP 2	BWP 3	BWP 4	BWP right end	Panel Location: Left End: ☐ @ end ☐ within 12.5" Right End: ☐ @ end ☐ within 12.5"
	BWL Spacing (L):	ft	WSP / SFB / GB(1 side) / GB(2 sides) / SWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	WSP / SFB / GB(1 side) / GB(2 sides) / CSWSP / CS-PF	Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	ft	Other:	Other:	Other:	Other:	Other:	Panel Spacing < 25' o.c.: ☐ Yes ☐ No
	BWL Length:	ft	Length in	Length in	Length in	Length in	Length in	Total length of BWPs ft ÷ BWL length ft = Actual % bracing %
	Required %bracing:	%						Actual % of bracing ≥ Required % of bracing: NO STOP! YES- BWL GOOD
	Location:		Total Length of BWPs in ÷ 12 = ft					

Braced Wall Line 9



BWL	General Information		Braced Wall Panels					BWL Actual Conditions
9	Wall Height:	9 ft	BWP left end: WSP ~~SFB~~; GB(1 side); GB(2 sides); SWSP; CS-PF; Other:	BWP 2: WSP ~~SFB~~; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP 3: WSP; SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP 4: WSP; SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	BWP right end: WSP; SFB; GB(1 side); GB(2 sides); CSWSP; CS-PF; Other:	Panel Location: Left End: ☒ @ end ☐ within 12.5' Right End: ☐ @ end ☒ within 12.5'
	BWL Spacing (L):	26 ft						Return panel (CS only): Left End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 Right End: ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4
	BWL Spacing (R):	ft						Panel Spacing < 25' o.c.: ☒ Yes ☐ No
	BWL Length:	31.33 ft						Total length of BWPs: 8 ft ÷ BWL length: 31.33 ft = Actual % bracing: 26 %
	Required %bracing:	25 %						
	Location:		Length: 48 in	Length: 48 in	Length: in	Length: in	Length: in	
			Total Length of BWPs: 96 in ÷ 12 = 8 ft					Actual % of bracing ≥ Required % of bracing: NO STOP! ~~YES- BWL GOOD~~

One last thing...



Hopefully you learned something

Drive carefully going home

That's All Folks