

The background of the slide features a light blue gradient with a faint, vertical image of classical columns on the left side. The entire slide is framed by a dark brown border.

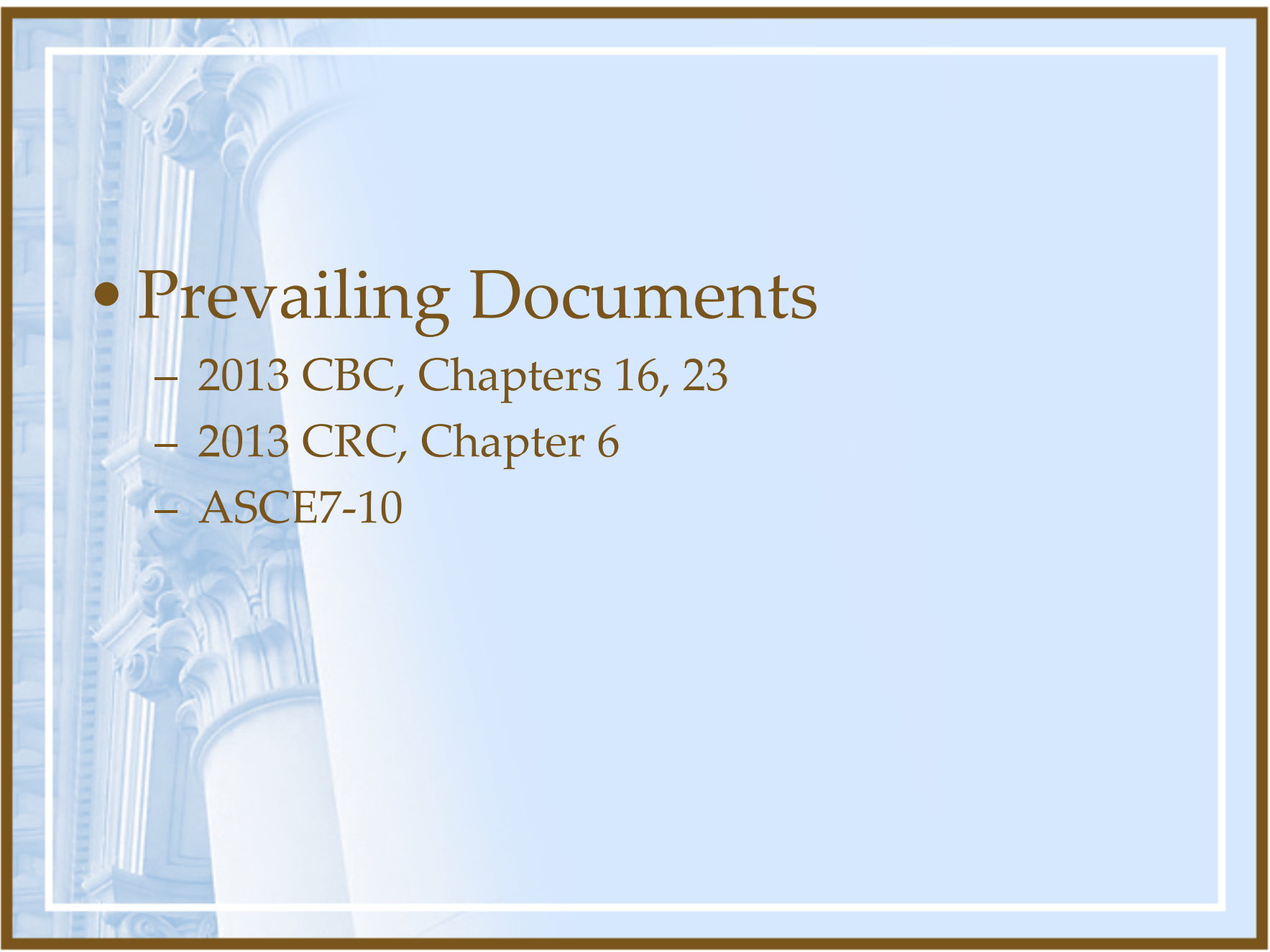
Inspection Standard for Tuolumne County - Shear and Roof

What you should know before calling
for an inspection.

Presented by,
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Chief Building Official
County of Tuolumne

What We'll Cover:

- Shear or Bracing?
- General Principles
- Inspection Policy
- Defensible Space
- Green Building

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• Prevailing Documents

- 2013 CBC, Chapters 16, 23
- 2013 CRC, Chapter 6
- ASCE7-10

Did we find your project?

- Address must be posted per County Standard for all inspections
 - 4 inch stroke
 - ½" lettering
 - Contracting, reflectorized background

Shear or Bracing?

- Trick question, they are the fundamentally the same:
 - Shear - force resisting system designed by a licensed professional to meet CBC Chapter 16, 23, and/or ASCE 7-10.
 - Bracing – prescriptive conventional light-frame design allowed under CBC Chapter 23 or CRC Chapter 6

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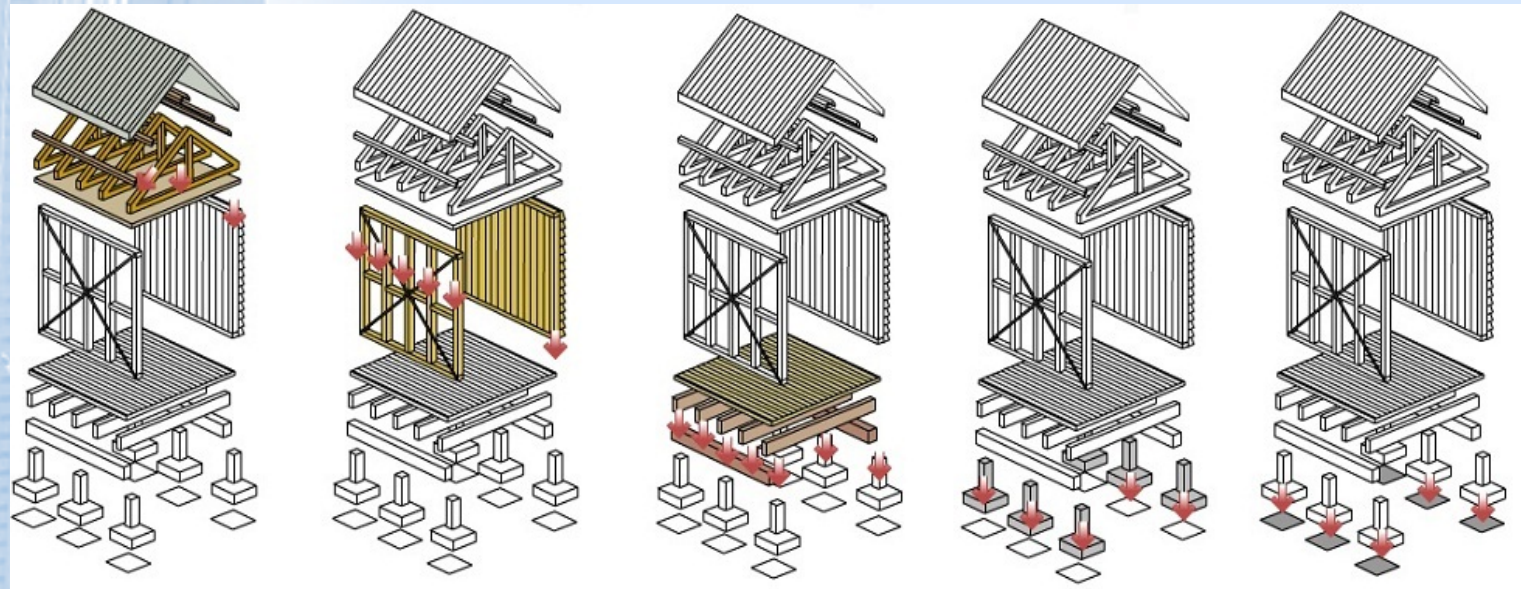
How Does Your Driveway Look?

- All-weather surface and correct slope must be in in order to receive inspection.

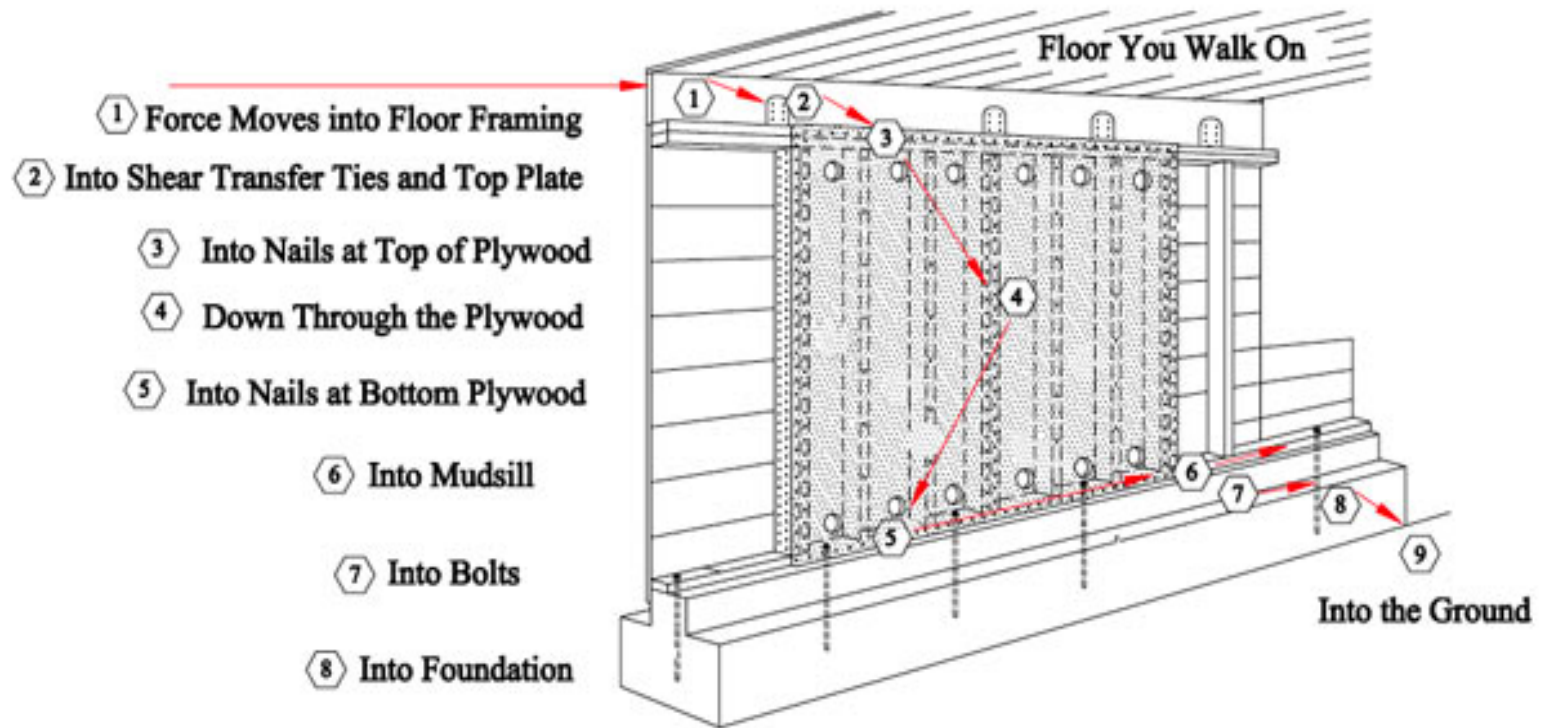
General Principles

- Strength – 1604.2: *...shall be designed to support safely the factored loads in load combinations without exceeding the appropriate strength limits for the materials.*
- Load Path – 2304.9.6 *.....members shall be secured to ensure a continuous load path....*
- The Shear and Roof inspection is the primary inspection for ensuring the structural integrity of any structure.
- Loads applied to the structure due to wind, earthquake, snow, and the basic weight of the materials used to build the structure, must transfer from the uppermost structural elements to the foundation and distribute to the soil.
- The roof, walls, floor system, and foundation are not the only elements. The connections between them are equally important.

Gravity Load Path Example



Lateral Load example



Load Path of Earthquake Forces

The Inspection “Flow”

- Foundation connecting elements
- Wall design
- Floor to wall design elements
- Floor Diaphragm
- Roof to wall design elements
- Roof Diaphragm
- *Or reversed! Either way, following the load path ensures continuity of all structural elements*

TRUE STATEMENT

- ALL structural components carry gravity/lateral forces, not just the components designed to resist them.
 - SO, we look at it all to make sure there are no breaks in the design that prevent the loads from getting to the resisting elements.

Everything must line up.....

- In general, in multistory buildings uplift connections for shear walls must line up in a way that transmits the uplift force from the resisting wall directly to the foundation connection below.
- Otherwise, structural elements in plane must be designed to resist uplift.



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Foundation elements

- Anchor bolts: did they survive the framing process?
 - If not, how is that fixed?
 - Epoxy bolt installations
 - Wedge anchors
 - Titan bolts

GOOD!



Foundation elements: Hold Downs

- Is placement good?
 - Straps cannot be bent more than once for wall installation
 - Bolts cannot be bent to fit the hold-down
 - All devices must attach directly to outside framing member of shear wall.
- Is it the right Hold-down?
- Is it the right bolt?
 - anchor bolts are not uplift bolts!



Missing a hold-down bolt?

- Epoxy placed uplift bolts are a good solution.
- Special inspection may be required by engineer.
 - Witness
 - Pull test

Wall Design

- All components are important!
 - Edge and Field Nailing
 - Nail size
 - Plywood thickness
 - Stud, sill, top plate size.
 - Stud spacing
- Any portion that is incorrect, omitted, or damaged will cause the wall to fail
- ****Edge nailing at end of braced/shear wall must line up with framing member carrying the holddown, not necessarily the end of the plywood panel!!*

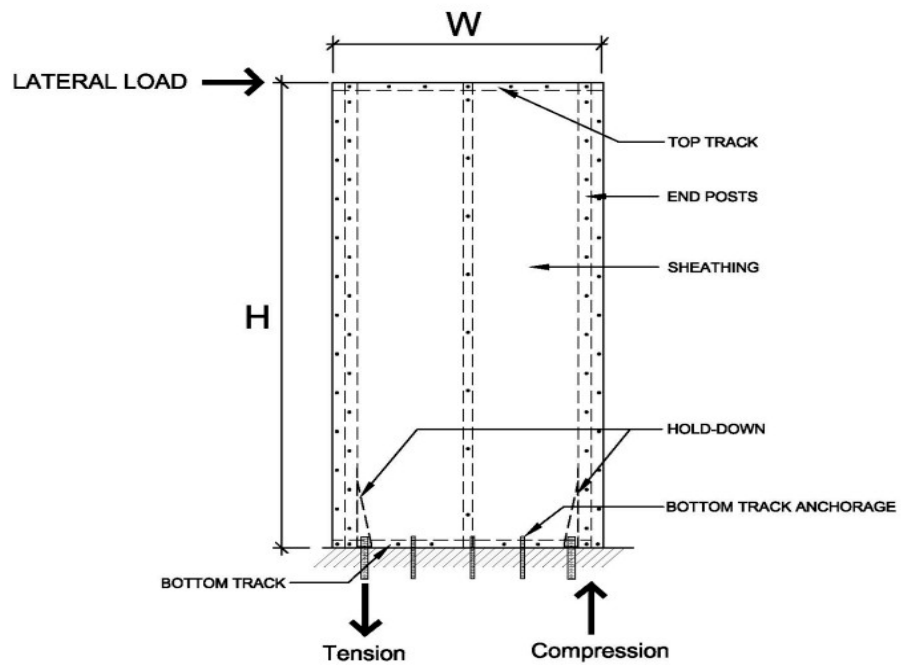
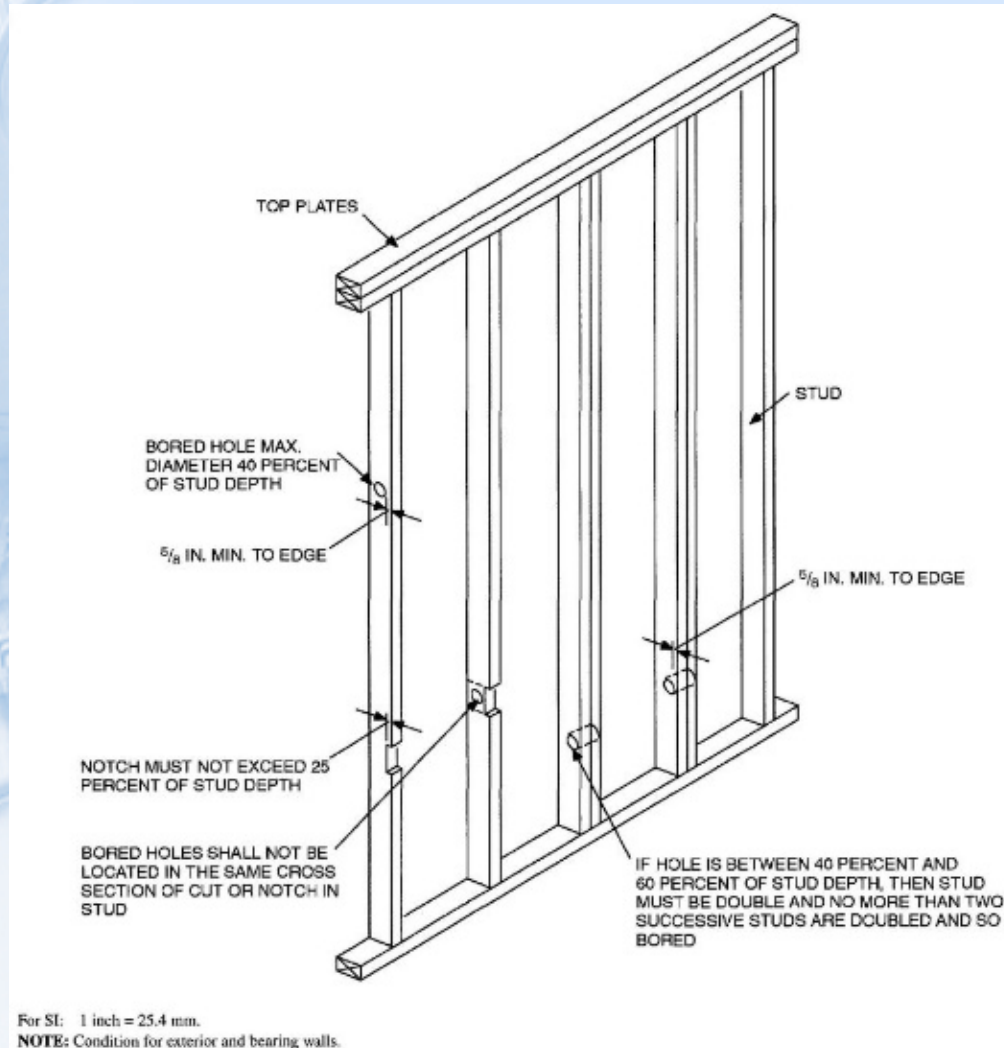


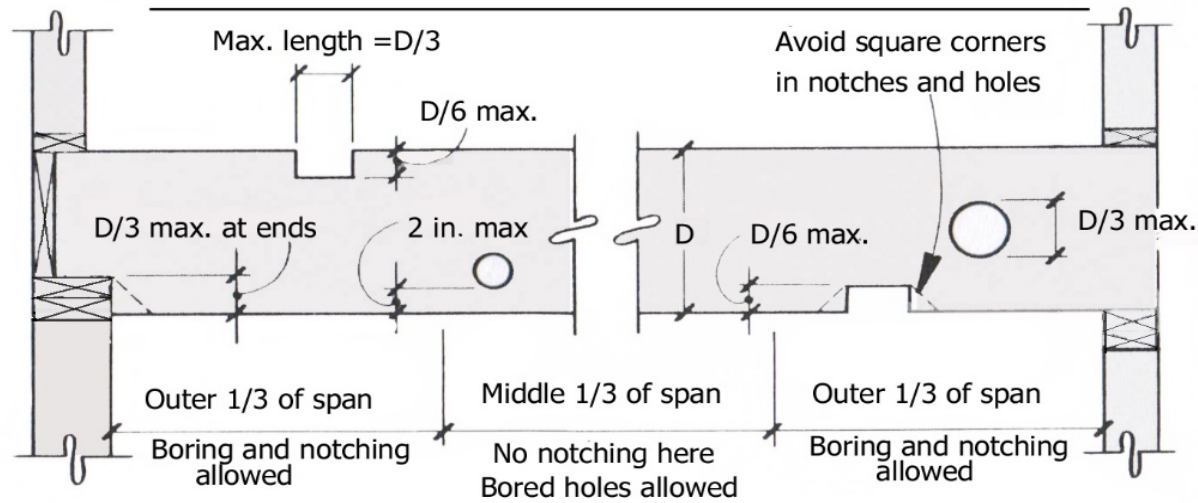
Figure 1

Notching/boring in conventional construction



Guide to Notching and Boring Joists

Joist Size	Max. Hole	Max. Notch Depth	Max. End Notch
2x4	None	None	None
2x6	1-1/2	7/8	1-3/8
2x8	2-3/8	1-1/4	1-7/8
2x10	3	1-1/2	2-3/8
2x12	3-3/4	1-7/8	2-7/8



Notch/Boring for engineered plans

- All over notching and over boring is corrected by engineer recommendations.
 - Not all engineers fix it the same
 - Often referred to minimum code standard
 - Structural Stud shoes
 - Strapping

Engineered Structural Products

- Be careful on location of boring or notching of TJI, LVL, PSL, Wood Trusses, or any other separately engineered product. If damaged, your engineer of record may not design a fix. In addition, the product manufacturer may not recommend a fix, or charge you more for a specific fix!

Top Plate lap and nailing

- 4 foot lap standard
- Conventional Light Frame Fix:
 - 16 gauge metal strap with 8 10d nails each side of short lap
- Engineered Structure
 - May not be a fix! May be specialty nailing regardless of plate lap
 - Use engineers fix
 - If it isn't specified, call engineer.

Wall Penetrations?

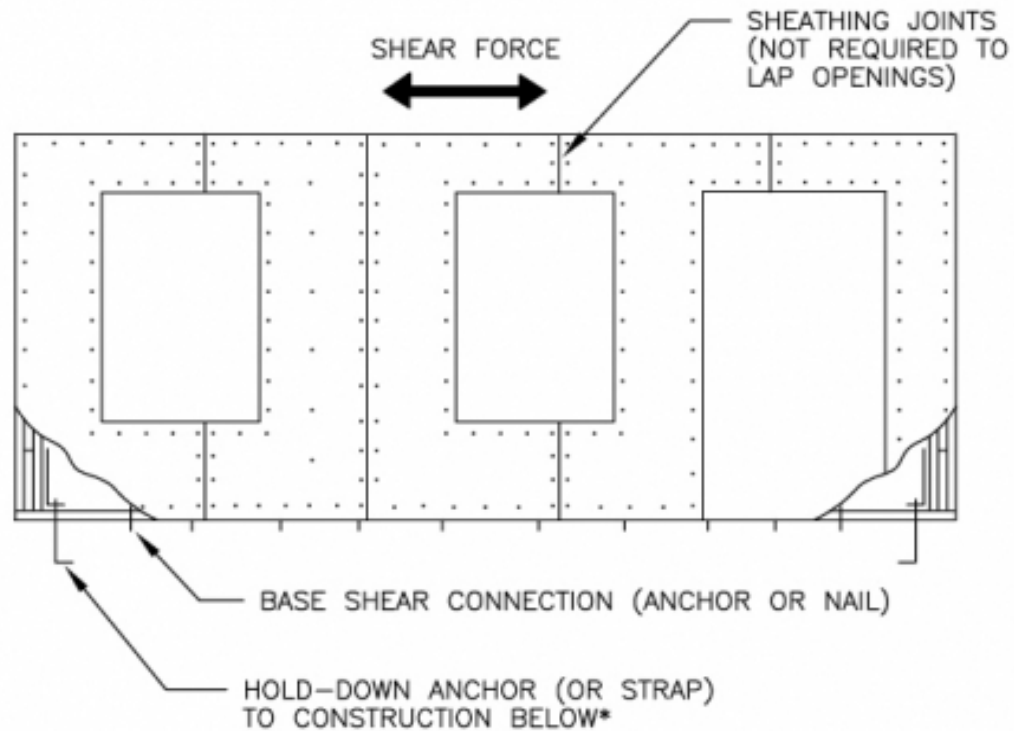
- Don't Do It! (unless)
 - Blocking around small openings
 - Perforated Shear Wall
 - Continuous Bracing
 - Blocking and strapping at large openings

Small openings (conventional)

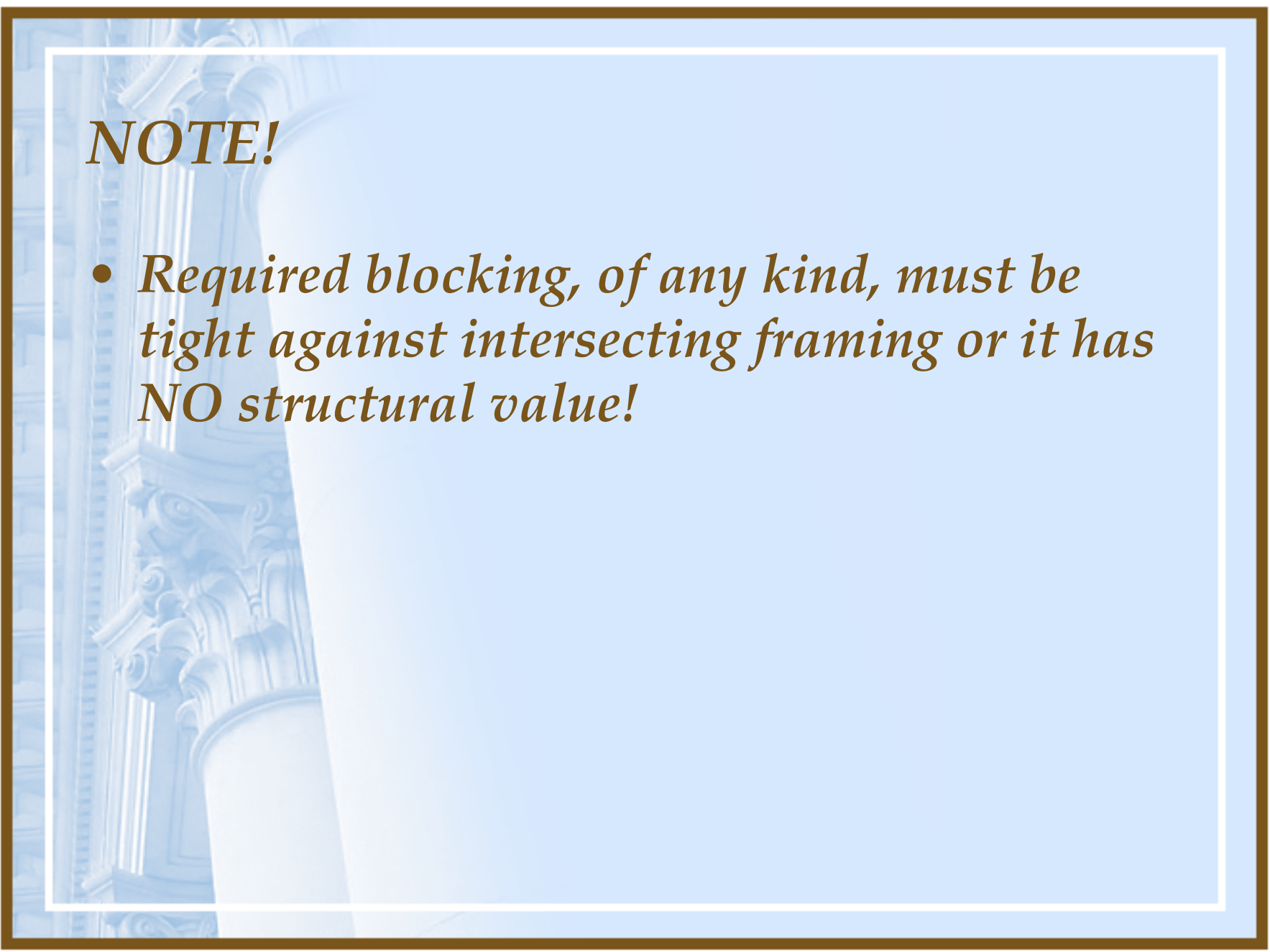
- No larger than 2 square feet
- Cannot be at any corner of the wall diaphragm
- Must have blocking on all sides of the opening with edge nailing.

Perforated Shear Wall Design

- Engineered shear design that takes the value of an entire wall line and deducts strength of opening in the wall area.
- May include strapping and blocking around openings.
- Specified nail spacing and full depth blocking is required above and below openings, such as windows.



*NOTE: CONSIDERING CORNER FRAMING (i.e. THE PERPENDICULAR WALL) AND DEAD LOAD CAN ELIMINATE THE NEED FOR HOLD-DOWNS IN CERTAIN CONDITIONS.

The background of the slide features a faded, light blue image of classical architectural columns, likely Corinthian or Ionic, with detailed capitals. The columns are positioned on the left side, creating a sense of depth and structure. The entire slide is framed by a thin brown border.

NOTE!

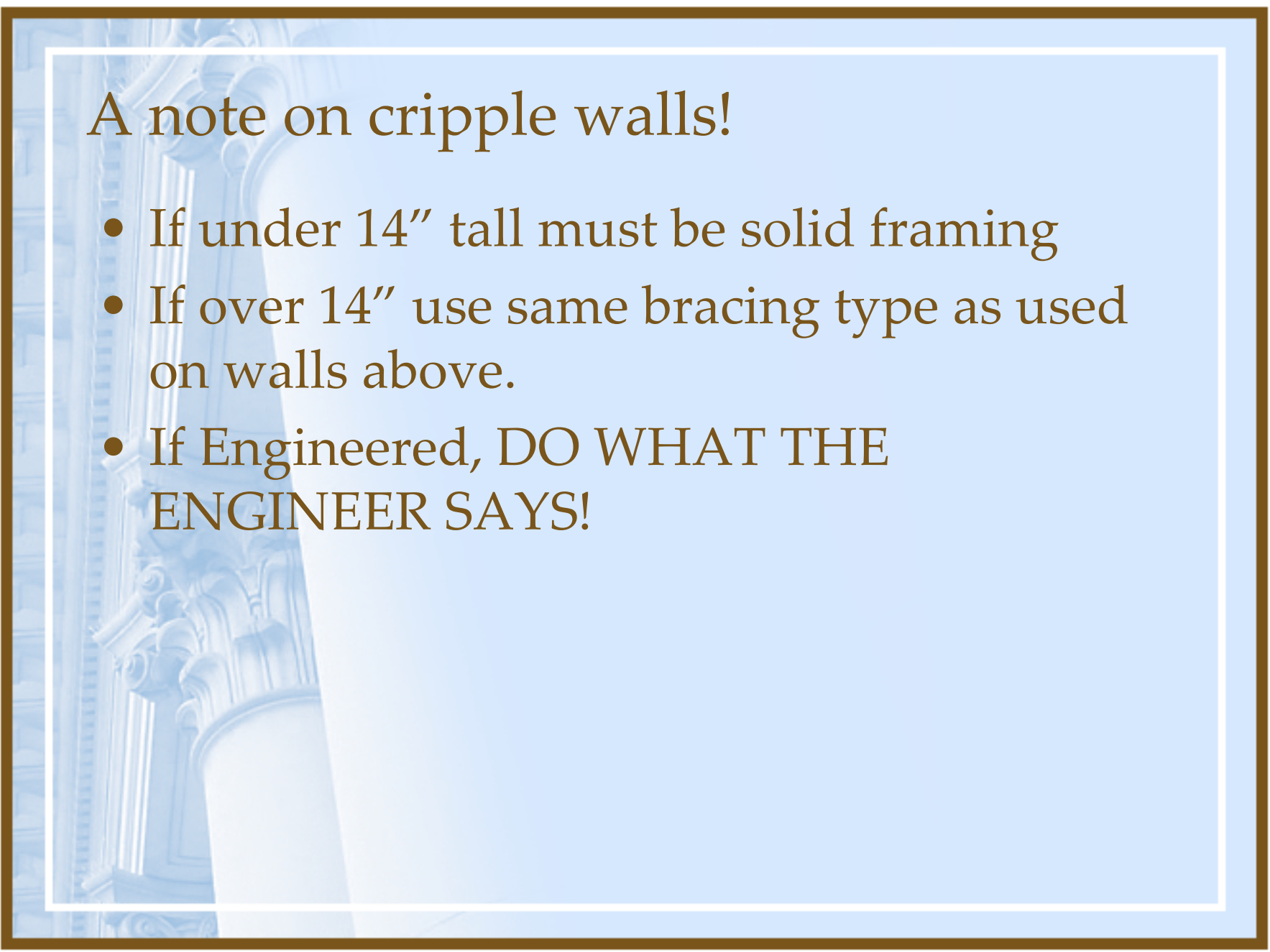
- *Required blocking, of any kind, must be tight against intersecting framing or it has NO structural value!*

Continuous Bracing

- The conventional framing equivalent to Perforated Shear.
- Similar inspection practice, nailing and framing above and below openings are necessary

Strapping and Blocking and large openings

- Generally used by engineers to fix hole made in shear after the fact for ducting or electrical panel placement.
- Used to prevent the loss of wall strength
- Strapping above and below opening usually extends two or more bays on each side of openings.
- Be careful you don't nail the straps to your service entrance conductors!

A decorative background image of classical columns, rendered in a light blue, semi-transparent style, is visible on the left side of the slide. The columns are fluted and have ornate capitals. The entire slide is framed by a thick brown border.

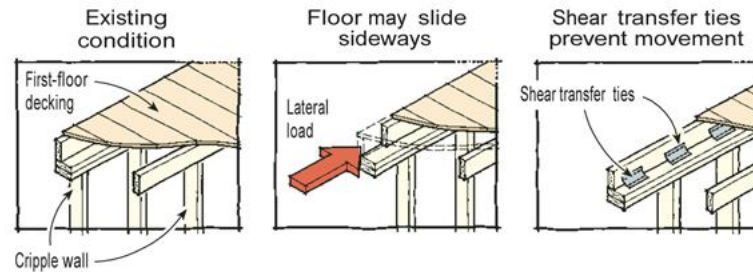
A note on cripple walls!

- If under 14" tall must be solid framing
- If over 14" use same bracing type as used on walls above.
- If Engineered, DO WHAT THE ENGINEER SAYS!

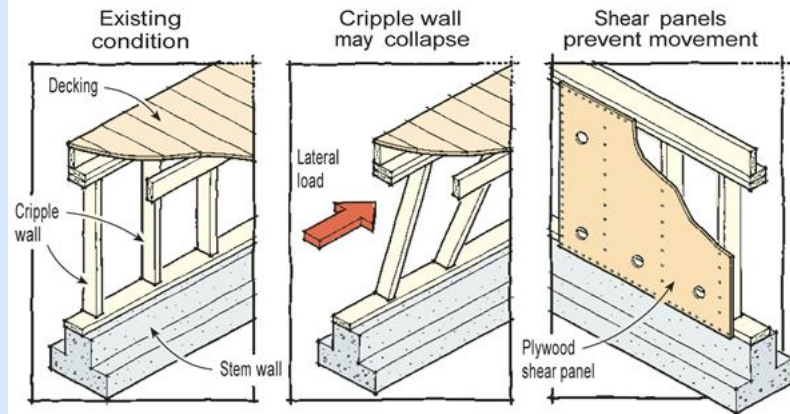
Cripple wall right and wrongs

Reinforcing Cripple Walls

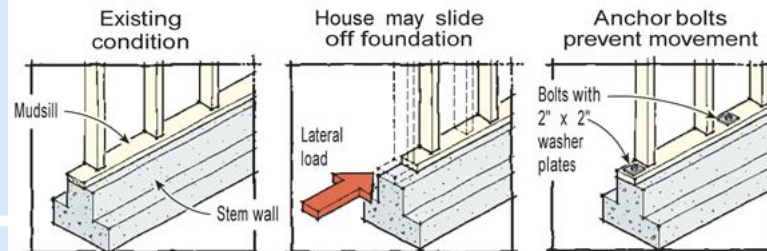
Floor-to-Wall Connection



Wall-to-Mudsill Connection



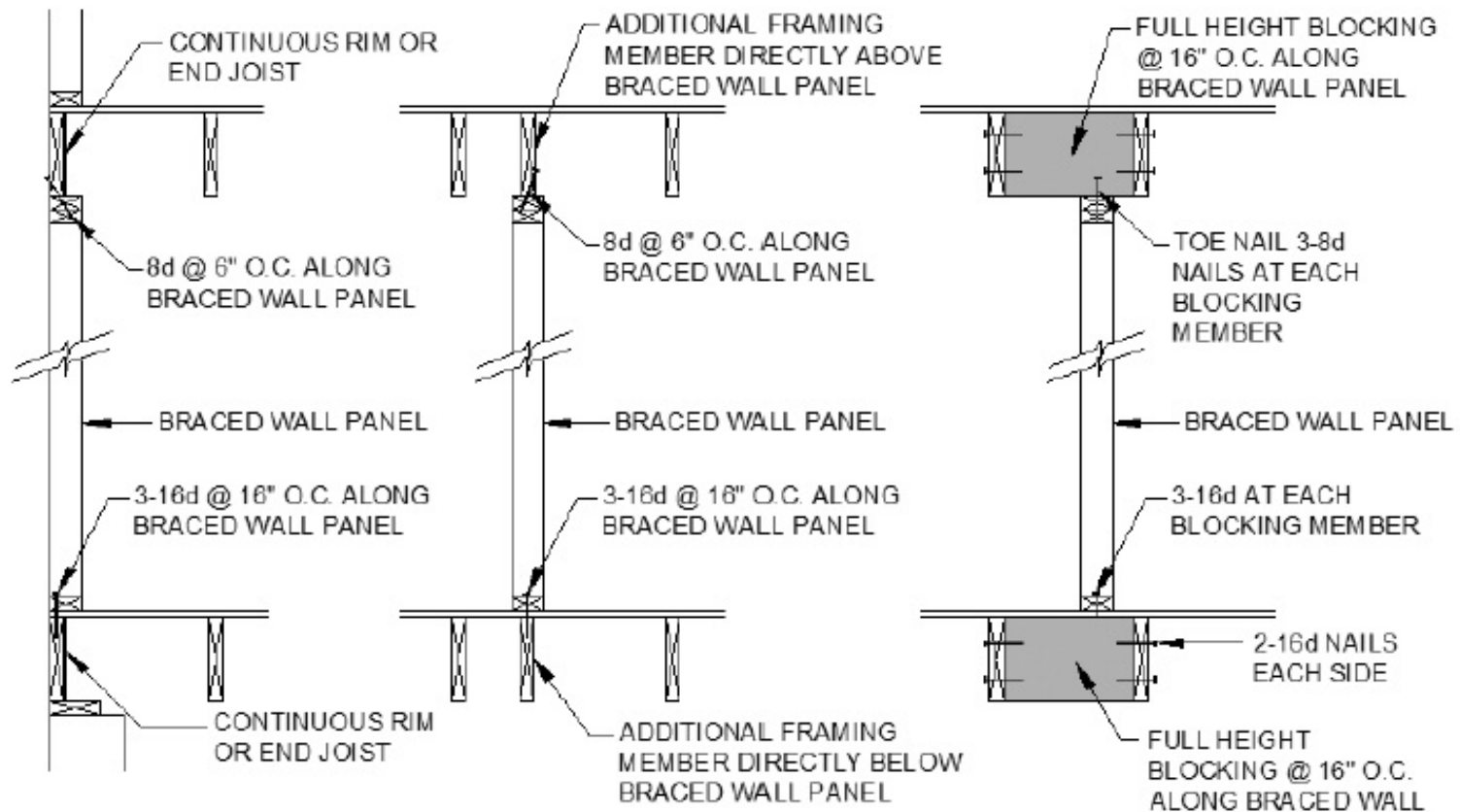
Mudsill-to-Foundation Connection



Floor to Wall Connections

- Commonly called “shear transfer”
- Designed to transfer lateral and uplift loads from the floor diaphragm to the top of the wall system.
- Several ways to do it based on location of wall
 - Engineers design
 - Conventional nailing schedule
 - Residential Code standard details
 - Engineered hardware

Conventional solutions



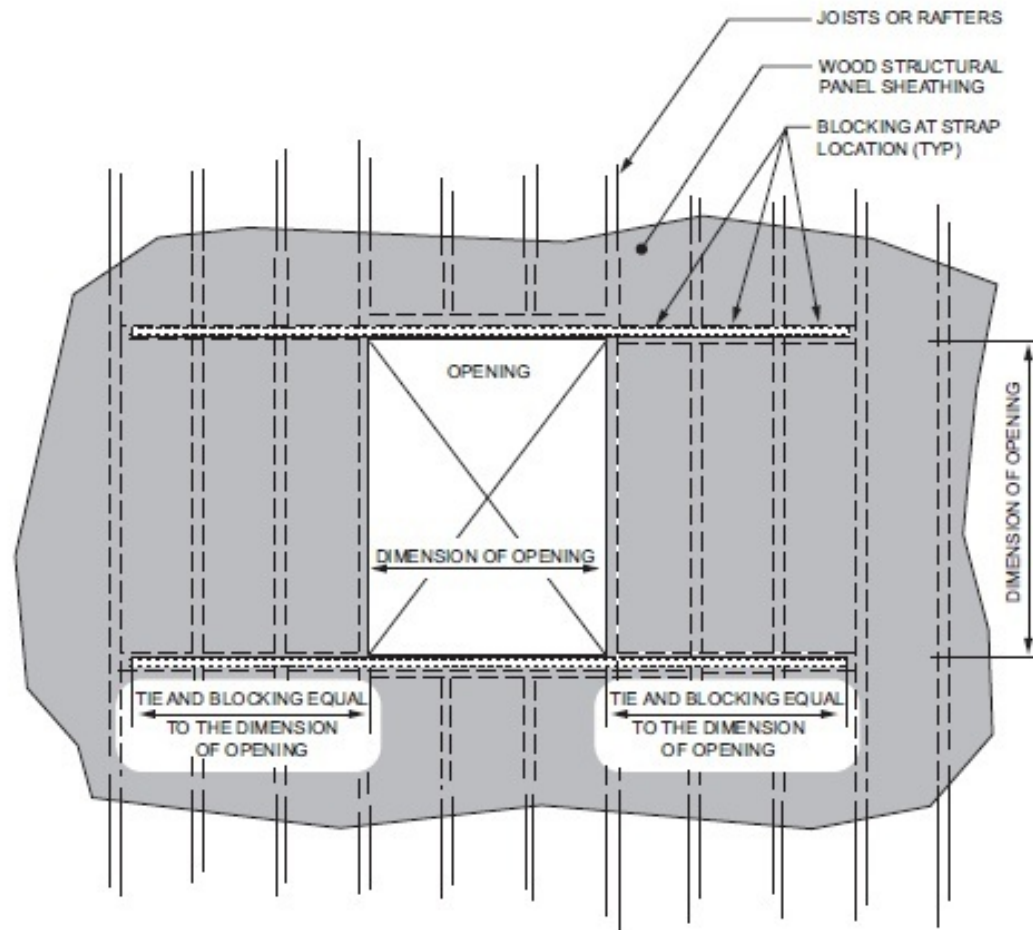
Exterior wall Shear Transfer



Floor Diaphragm

- As important as the roof diaphragm.
- Similar principles employed
- Conventional Light Frame
 - Nailing Schedule
 - Specifics on nailing around openings
- Engineered designs will include
 - Drag struts and Collectors
 - Sub-diaphragms
 - Additional hardware
 - Specialty nailing

Nailing/Framing around openings over 4 feet



Collectors/Drag Struts

- Often a structural member or floor truss becomes a “conduit” for lateral force.
- Diaphragm must be nailed to top of member correctly
- Correct hardware necessary to distribute force to walls in plane.

Example?



Roof To Wall Connections

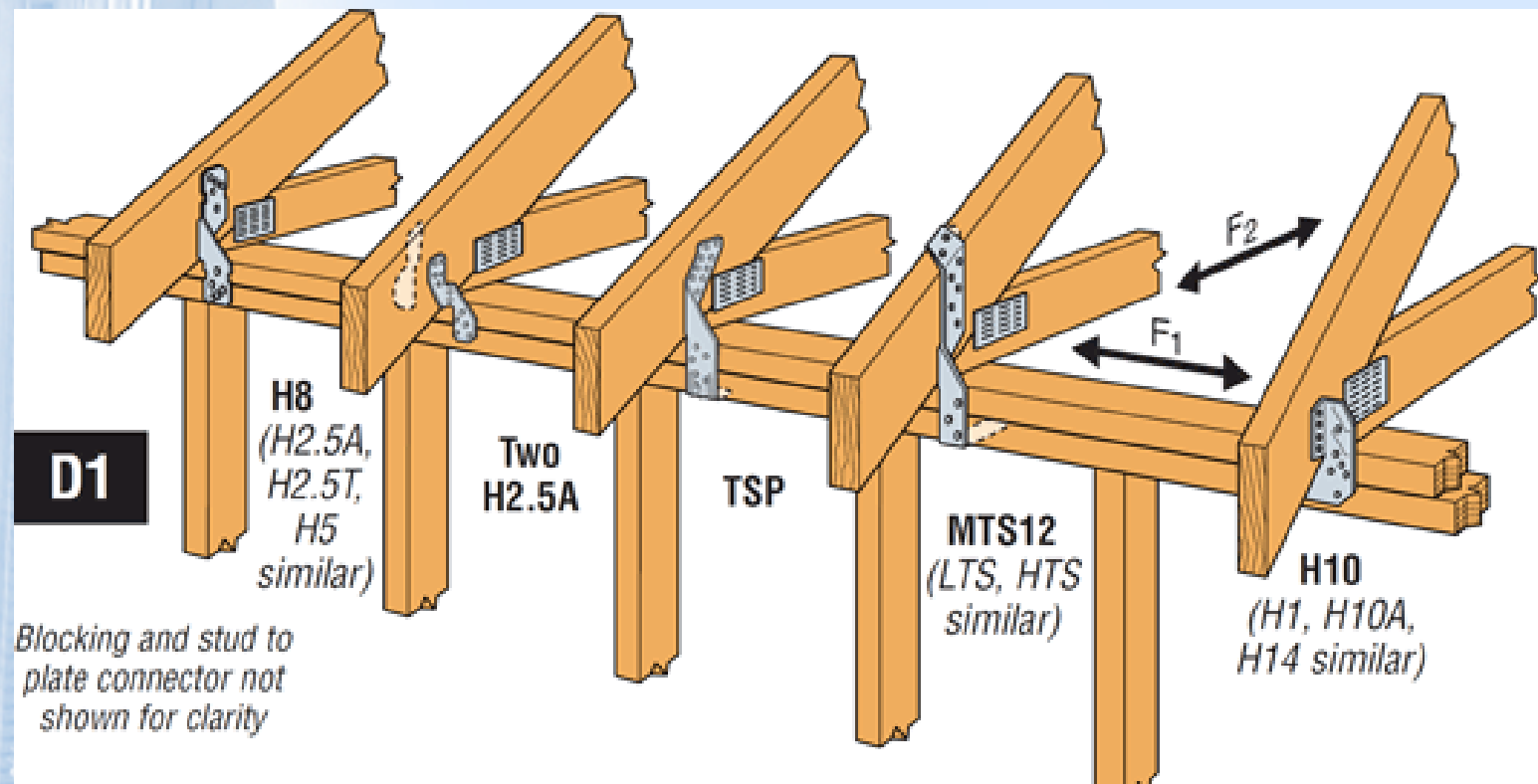
- Same principle as wall to floor (Horizontal Diaphragm to Vertical Diaphragm) just different components.
 - Conventional
 - Engineered

Conventional Light-Frame

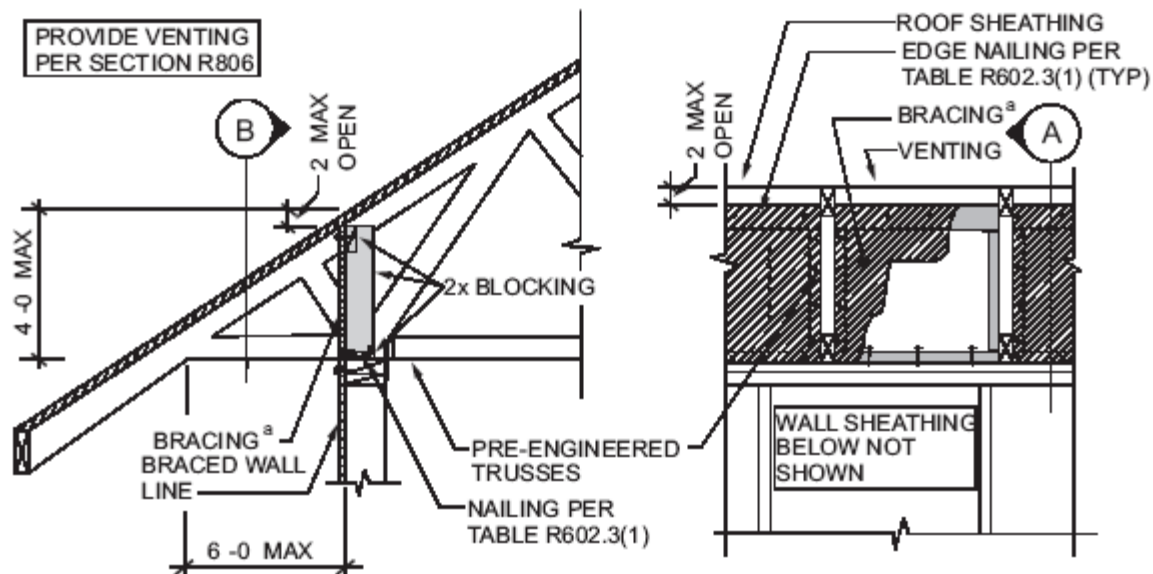
- Nailing Schedule
- Uplift connector requirements
- Interior Braced Walls “must connect to the framing above”
- Details provided!

Uplift Resistance – Section/Table

R802.11, 2013 CRC



Details! Straight out of the CODE!



^a METHODS OF BRACING SHALL BE AS DESCRIBED IN SECTION R602.10.2 METHODS DWB, WSP, SFB, GB, PBS, PCP OR HPS

A SECTION

B ELEVATION

Standard Engineering Practice

- If an engineer designs the structure, each connection detail is designed as well.
- Don't "make it work". If it doesn't work, call the engineer.
- If something is missing, say something. We will!

The background of the slide features a low-angle photograph of several tall, white classical columns with Corinthian capitals. The columns are set against a clear, bright blue sky. The image is slightly faded and serves as a decorative backdrop for the text.

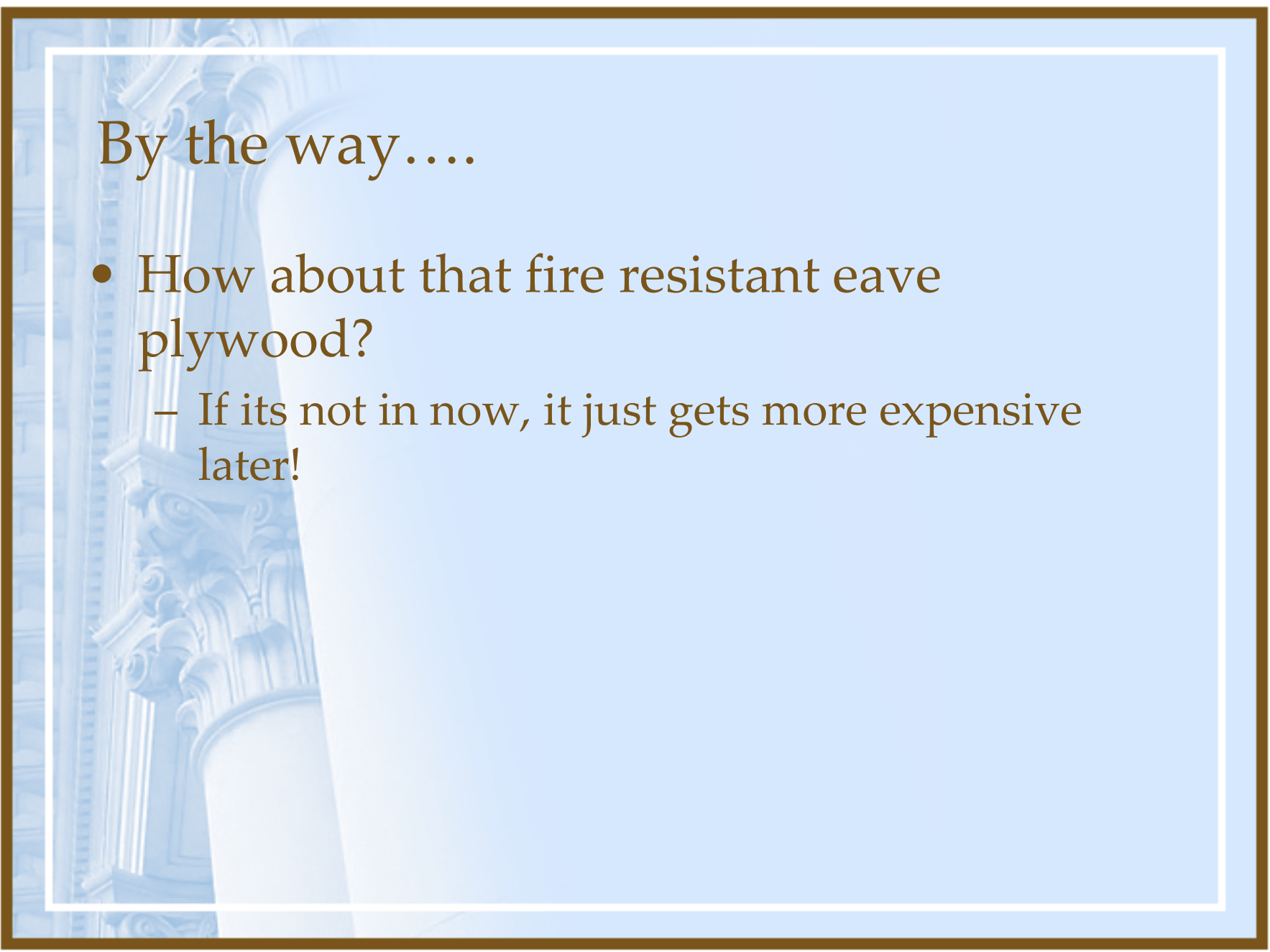
examples

Trusses

- Floor and Roof Trusses are inspected for:
 - Matching to engineered design
 - Correct wood specifications
 - If the calcs say Doug-fir and the truss is Hem-fir, someone made a mistake!
 - Proper location of Bracing
 - Proper alignment of:
 - Bearing Points
 - Connections to intersecting trusses
 - Damage
 - Stitch Nailing for laminated bearing trusses.
 - Metal Connectors

Roof Diaphragm

- Same principles as floor
- Collectors and drag struts
- The Usual Suspects
 - Gable end truss connections
 - Intersecting gables (truss connections)
 - Hip connections
 - Interior shear transfers
 - General Truss bearing issues
 - Minimum 24" plywood Panels

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By the way....

- How about that fire resistant eave plywood?
 - If its not in now, it just gets more expensive later!

Defensible Space is rechecked!



Green Building Compliance

- Construction waste management:
 - As of July 1, 2015 separate recyclables on site
 - Waste management plan and waste reporting on site for each inspection
 - Must be complete and correct for final
- SWPPP/Green Building Code Requirements
 - Storm water retention (BMP's)
 - Cover waste collection, stockpiles, and materials
 - WE WILL READ SWPPP PLANS!

GOOD NEWS!

- More Handouts Available!
 - Solid Waste Division
 - Building Division Templates
 - Construction Waste Management Plan
 - Construction Waste Report

When the inspection is not ready:

- Roof Diaphragm is not complete.
- More than 5 items found in garage or first room inspected.
- More than ten items in first floor of multi-story inspection.
- Driveway not at least to all-weather surface.
- Permit, Plans, and Specs not on site.
- ROOF ONLY inspection is allowed.
 - Trusses, nailing, and shear transfer connections to roof must be complete.

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Questions?