Framing Methods, Exterior Wall Construction

References:


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FRAMING METHODS

The most common framing systems used with wood are:

- Balloon
- Platform
- Post and beam
BALLOON FRAMING (EASTERN)

Is not widely used except for gable end walls

The exterior studs run from the top of the foundation to the top of the highest level

Because the wall members are continuous from foundation to roof, fewer horizontal members are used - thus less shrinkage of wood as it dries.

Brick veneer or stucco is often applied to the exterior surface thus the reduced shrinkage of the balloon system helps to keep the finish from cracking.
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BALLOON FRAMING (EASTERN)

A two-story structure is the maximum that can be built easily using balloon framing.

Floor framing at the midlevel is supported by a ledger set into the studs.

Spaced at 12”, 16”, or 24” (305, 406, or 610 mm) on center (O.C).

The major flaw with balloon framing is the danger of fire. A blocking or smoke activated dampers are now required by building codes at all levels to rest the spread of fire.
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PLATFORM FRAMING (Western)

Most common framing system now in use

Platform created by each floor as the building is being framed

grew out of the need for fireblocks in the balloon framing System
FIGURE 25.6 - Structural members of the platform framing system.
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PLATFORM FRAMING (Western)

Sub-flooring

T&G pattern in the edge to help minimize floor squeaking

Gluing the plywood to the supporting members in addition to the normal nailing also helps eliminate squeaks
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PLATFORM FRAMING  (Western)

Walls are typically built flat on the floor using a bottom plate, studs, and two top plates.

Sheathing can be nailed to the exterior face of the wall, and then the wall tilted up into place.

Studs are typically placed at 12”, 16”, or 24” (305, 406, or 610 mm), with 16” (406 mm) O.C. the most common spacing.
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PLATFORM FRAMING (Western)

IRC (International Residential Code) does not allow studs for each level to be taller than 10’ (3048 mm), 12’ (3658 mm) under special conditions.

IRC does not allow a wood-frame residence to be more than three stories above grade.
### TABLE R602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO WIND SPEEDS OF LESS THAN 100 MPH

<table>
<thead>
<tr>
<th>HEIGHT (feet)</th>
<th>24 ON-CENTER SPACING (inches)</th>
<th>16</th>
<th>12</th>
<th>8</th>
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<tr>
<td></td>
<td>Supporting a roof only</td>
<td></td>
<td></td>
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<tr>
<td>&gt;10</td>
<td>2 x 4</td>
<td>2 x 4</td>
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<tr>
<td>12</td>
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<td>24</td>
<td>NA</td>
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<td>NA</td>
<td>2 x 6</td>
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<tr>
<td></td>
<td>Supporting one floor and a roof</td>
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<td>&gt;10</td>
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<td>NA</td>
<td>NA</td>
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<td>2 x 6</td>
</tr>
<tr>
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<tr>
<td>&gt;10</td>
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</tr>
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</table>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m², 1 pound per square inch = 6.895 kPa, 1 mile per hour = 1.609 km/h.

- a. Design required.
- b. Applicability of this table assumes the following: $f_2$ not less than 1310 psi determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine, E not less than 1.6 by 106 psi, tributary dimensions for floors and roofs not exceeding 6 feet, maximum span for floors and roof not exceeding 12 feet, eaves not greater than 2 feet in dimension and exterior sheathing. Where the conditions are not within these parameters, design is required.
- c. Utility, standard, stud and No. 3 grade lumber of any species are not permitted.

*(continued)*
FIGURE R602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING
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PLATFORM FRAMING (Western)
Energy-Efficient Platform

Since the early 1980s, many framers have substituted 2 X 6 (51 X 152) studs at 24” (610 mm) spacing to allow for additional insulation in the wall cavity.

Advanced Framing Techniques (AFT) systems eliminate nonstructural wood from the building shell and replace it with insulation.

Wood has an average resistive value for heat loss of R-1 per inch of wood compared with 3.5 through R-8.3 per inch of insulation.
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PLATFORM FRAMING (Western)
Energy-Efficient Platform

AFT (Advanced Framing Techniques):

- 24” stud spacing
- Insulated corners
- Insulation of exterior walls behind partition intersections
- Insulated headers
Framing Methods, Exterior Wall Construction

PLATFORM FRAMING (Western)
Energy-Efficient Platform

Engineered Lumber Framing
Products are made by turning small pieces of wood into framing members

Made from fast-growing tree species grown on tree farms specifically for the purpose of being used to make structural materials.
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PLATFORM FRAMING (Western)

Energy-Efficient Platform

Commonly engineered:

- laminated veneered lumber
- oriented strand board
- engineered studs
- I-joists,
- laminated beams

provides efficient use of each log that enters the mill
Framing Methods, Exterior Wall Construction

PLATFORM FRAMING (Western)
Energy-Efficient Platform

Laminated Strand Lumber (LSL)
Assembles small sections of wood approximately 12” (305 mm) long into larger members.

Laminated veneer lumber (LVL)
Created by stacking thin veneers of wood peeled from a log and cutting them into lumber-sized members

Framing members can also be created by using small pieces of lumber that would have been scraps, and joining them together with finger joints and adhesive
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PLATFORM FRAMING (Western)  
Structural Engineered Panels (SIP)

Composed of a continuous core of rigid foam insulation, which is laminated between two layers of structural board with an adhesive to form a single, solid panel.

Typically, expanded polystyrene (EPS) foam is used as the insulation material, and oriented strand board (OSB) is used as the outer shell of the panel.
Framing Methods, Exterior Wall Construction

PLATFORM FRAMING (Western)  
Structural Engineered Panels (SIP)

A very environmentally friendly product suitable for wall, floor, and roof construction

Also available with a steel structural framework with no OSB facing

panels can be shipped with ½” gypsum board preinstalled over the OSB panel – One or Two Sides

R value of 4.35 per inch of EPS is common.
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PLATFORM FRAMING (Western)
Structural Engineered Panels (SIP)

Because the panels do not contain studs, the SIPs do not create a thermal bridge from the exterior face to the interior face.

Panels can be made in sizes ranging from 4’ through 24’ (1219-7315 mm) long and 8’ (2438 mm) high.

SIPs can be precut and custom-fabricated for use on the most elaborately shaped structures.
Framing Methods, Exterior Wall Construction

PLATFORM FRAMING (Western)
Structural Engineered Panels (SIP)

Door and window openings can be precut during assembly or cut at the job site

A chase is typically installed in the panels to allow for electrical wiring

**New** to the SIP market is a honeycomb panel core made of paper with OSB face panels

Honeycomb panels consist of approximately 5 percent paper and 95 percent air and offer great potential for strong, energy-efficient SIPs
POST-AND-BEAM FRAMING

Framing members are at greater distances apart than with platform methods

Usually spaced at 48” (1200 mm) on center

Beams of 4” or 6” (102-152 mm) wide are typically used
POST-AND-BEAM FRAMING

The sub-flooring and roofing over the beams are commonly 2 X 6, 2 X 8, lumber or 1 1/8 (51 X 152, 51 X 203 or 29) T&G plywood.

Post-and-beam construction can offer great savings in both lumber and nonstructural material.

Savings result from careful planning of the locations of the posts, and doors and windows that will be located between them.
TIMBER CONSTRUCTION

The method of joining the beams at joints affects the frame size.

SIPs with an EPS core and drywall skin are available for use with timber-frame structures.
FIGURE 25.18  Typical components of a post-and-beam home. Courtesy Timberpeg Post and Beam Homes.
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STEEL FRAMING

Lower energy cost, higher strength, and insurance considerations

Steel framing also has excellent properties for resisting stress from snow, wind, and seismic forces, as well as termite and fire damage

50 percent recycled metal
STEEL FRAMING

A disadvantage to steel framing materials is the amount of energy required in the initial manufacturing process.

Steel framing increases the risk of thermal bridging through the exterior walls.

This conductivity can be overcome by using insulated exterior sheathing.
STEEL FRAMING

Construction techniques similar to western platform construction methods

Steel trusses are typically used to provide design flexibility because they require no interior bearing walls.
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Sheathing

OSB and plywood sheathing are primarily used as an insulator against the weather and also as a backing for the exterior siding.

Sheathing may be considered optional, depending on your area of the country.

When sheathing is used on exterior walls, it provides what is called double-wall construction.
SHEATHING

Single-wall

Wall sheathing is not used

Siding is attached over a vapor barrier such as Tyvek, Pinkwrap, Typar, or the traditional 15# felt placed over the studs

Many builders prefer to use ½” (13 mm) OSB for sheathing in place of plywood

An alternative to plywood for shear panels is to use let-in braces.
CONCRETE MASONRY CONSTRUCTION

Used primarily in warmer climates, from Florida to southern California, CMUs can be waterproofed with cement based paints and used as the exterior finish.

Waterproof wood furring strips are normally attached to the interior side of the block to support sheetrock.
FIGURE 25.22  Components of concrete masonry construction.
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CONCRETE MASONRY
CONSTRUCTION

Four Classifications:
- Hollow
- Load Bearing
- Solid Load Bearing
- Non-Load Bearing

Solid or Hollow
- Solid - 75% material in any cross section

Weight
- Normal
- Medium
- Lightweight
  Determined by aggregate

Use of lightweight aggregate will produce approximately 50% decrease in weight
CONCRETE MASONRY CONSTRUCTION

Many patterns and shapes
Sizes

- 8x8x16
- 8x4x16
- 8x12x16

Widths

- 4, 6, 8, 10, 12

Lengths

- 6, 8, 12, 16, 24

3/8” smaller to allow for mortar
CONCRETE MASONRY CONSTRUCTION

Shapes allow for placement of reinforcing steel bars or mesh

Typically required at 48” spacing

Specified on framing plan

Shown on section and detail
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SOLID MASONRY CONSTRUCTION

The position in which the brick is placed will determine what it is called

Bricks can be placed in various positions to form a variety of bonds and patterns

A bond is the connecting of two wythes to form stability within the wall

Wythe - A single unit thickness of a masonry wall
SOLID MASONRY CONSTRUCTION

The pattern is the arrangement of the bricks within one wythe.

The Flemish and English bonds are the most common methods of bonding two wythes or vertical section of a wall that is one brick thick.

The Flemish bond consists of alternating headers and stretchers in every course.
SOLID MASONRY CONSTRUCTION

An **English bond** consists of alternating courses of headers and stretchers

The headers span between wythes to keep the wall from separating
SOLID MASONRY CONSTRUCTION

Masonry walls must be reinforced using methods similar to those used with concrete blocks.

Joists are usually required to be strapped to the wall so that the wall and floor will move together under lateral stress.

The end of the joist must be cut on an angle, called a fire cut. If the floor joist is damaged by fire, the fire cut will allow the floor joist to fall out of the wall, without destroying the wall.
SOLID MASONRY CONSTRUCTION

Because brick is very porous and absorbs moisture easily, some method must be provided to protect the end of the joist from absorbing moisture from the masonry.

When a roof framing system is to be supported on masonry, a pressure-treated plate is usually bolted to the brick.
SOLID MASONRY CONSTRUCTION

Another method of using brick is to form a cavity between each wythe of brick.

The cavity is typically 2” (51 mm) wide and creates a wall approximately 10” (254 mm) wide with masonry exposed on the exterior and interior surfaces.

The airspace between wythes provides an effective barrier to moisture penetration to the interior wall.
SOLID MASONRY CONSTRUCTION

**Weep holes** in the lower course of the exterior wythe will allow moisture that collects to escape.

**Rigid insulation** can be applied to the interior wythe to increase the insulation value of the airspace in cold climates.

**Metal ties** are typically embedded in mortar joints at approximately 16” (406 mm) to tie each wythe together.
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MASONRY VENEER

Care must be taken to protect the wood frame from moisture in the masonry.

Typically brick is installed over a 1” (25.4 mm) airspace and a 15# layer of felt applied to the framing.

The veneer is attached to the framing with 26-gage metal ties at 24” (610 mm) O.C.
INSULATED CONCRETE FORM CONSTRUCTION

Used to provide an energy-efficient framing system for an entire structure

Poured concrete is placed in expanded polystyrene (EPS) forms that are left in place to create a super-insulated concrete wall system

Forms 6 and 8” (152 and 203 mm) wide X 16” (406 mm) high X 48” (1219 mm) long are available from most manufacturers
INSULATED CONCRETE FORM CONSTRUCTION

Vertical posts are created at 12” (305 mm) on center, and horizontal beams are created at 16” (406 mm) O.C.

Total R-value can range from R-30 to R-50.

Reduces air leakage and air infiltration into the structure.