



# #63—CONVENTIONAL LIGHT-FRAME CONSTRUCTION

## What is Prescriptive Conventional Light-Frame Construction? (CLFC)

In very general terms, wood construction came long before engineering design and analysis; therefore, there is a large residual body of building methods and techniques considered to satisfy standards of structural stability without additional substantiating data. These are the traditional methods of construction we elect to call prescriptive conventional construction and we may accept their worth, within the prescribed limits, without further challenge.



## When can I use Conventional Light-Frame Construction?

CLFC may only be used to construct:

1. One or two-story residential buildings
2. One-story, commercial buildings, constructed on a slab-on-grade floor.
3. Miscellaneous general-purpose accessory buildings (e.g., garages, carports, etc.)
4. Interior nonload-bearing partitions, ceilings and curtain walls

## Foundation Plates or Sills

Foundations and footings shall be designed by a professional engineer or be in accordance with Kitsap County Prescriptive Foundation Details (see brochure #61—Foundations). Foundation plates or sills resting on concrete or masonry foundations shall be pressure treated and fastened to the foundation with minimum 1/2" diameter anchor bolts, spaced no more than 6' on center, (4' if two story) embedded into the concrete at least 7", and provided with a nut and a 3" x 3" x 1/4" thick hot dipped galvanized square plate washers. Each piece of sill plate shall have at least two bolts, and must have a bolt within 12" of each end.

Kitsap County Department of Community Development  
614 Division Street, MS-36  
Port Orchard, WA 98366-4682  
[www.kitsapgov.com](http://www.kitsapgov.com)

## Girders

See IRC Table R502.5(1) and (2). Girders for single-story construction or girders supporting loads from a single floor shall not be less than 4" x 6" for girder spans 6' or less, and provided that the girders are spaced not more than 8' on center. Other girders shall be designed to support their actual loads as specified in the IBC. Girder end joints shall only occur over supports and shall be provided with an adequate tie. The end of beams or girders supported on masonry or concrete shall not have less than 3" of bearing and shall have at least a 1/2" of air space surrounding the sides and end.

## Floor Joists

See IRC R502.3. Spans for joists shall be in accordance with IRC R502.3.1 (1) and (2) (see Table 1 on the following page).

### Bearing

**The ends of every joist shall have at least 1.5" of solid bearing on wood or on metal hangers, except where supported on a 1" x 4" ribbon strip and nailed to the adjoining stud, or 3" of bearing on concrete or masonry.**

### Framing Details

Floor joists shall be supported laterally at the ends and at each bearing point by solid blocking except where the ends of joists are nailed to a header, band or rim joist, an adjoining stud, or by other approved means. Solid blocking shall not be less than 2" thick and shall be the full depth of the joist.

Notches on the ends of joists shall not exceed one-fourth of the joist depth. Holes bored in joists shall not be within 2" of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth of the depth shall not be longer than one third of the depth of the joist, and shall not be located in the middle third of the span (Fig 1—Joist Notches and Holes (pg 6)).

Joist framing from opposite sides of a beam, girder or partition shall be lapped at least 3" or the opposing joists shall be tied together in an approved manner. (At least 3-10d face nails)

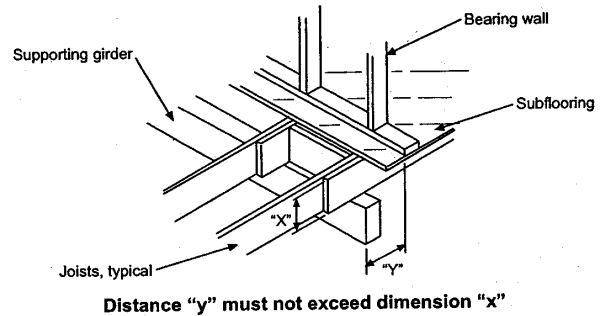
Joists framing into the side of a wood girder shall be supported by framing anchors or on ledger strips not less than 2" x 2".

**Framing Around Openings**

See R502.10. Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, when the span of the header exceeds 4'. The ends of header joists longer than 6' shall be supported by framing anchors or joist hangers, unless bearing on a beam, partition or wall. Tail joists over 12' long shall be supported at header by framing anchors or on ledger strips not less than 2" x 2".

Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth. (See Fig 2—Supporting Bearing Partitions).

**Fig 2: Supporting Bearing Partitions**



| TABLE 1: RESIDENTIAL FLOOR JOIST              |                                     |                            |
|---|-------------------------------------|----------------------------|
| Joist Size* (Inches)                          | Joist Spacing (On center in inches) | Maximum Span (Feet-inches) |
| 2x6<br>(1,310 Fb)                             | 12                                  | 10 – 9                     |
|   | 16                                  | 9 – 9                      |
|   | 24                                  | 8 – 1                      |
| 2x8<br>(1,210 Fb)                             | 12                                  | 14 – 2                     |
|   | 16                                  | 12 – 7                     |
|   | 24                                  | 10 – 3                     |
| 2x10<br>(1,105 Fb)                            | 12                                  | 17 – 9                     |
|   | 16                                  | 15 – 5                     |
|   | 24                                  | 12 – 7                     |
| 2x12<br>(1,005 Fb)                            | 12                                  | 20 – 7                     |
|   | 16                                  | 17 – 10                    |
|   | 24                                  | 14 – 7                     |
| *Doug Fir #2 (40lb live load, 10lb dead load) |                                     |                            |
| Note: See IRC Tables R502.3.1(1) and (2)      |                                     |                            |

**Wall Framing**

For information on required wall bracing, see brochures #62—Braced Wall Panels and #60—Does My Building Design Need Engineering?

**Foundation Cripple Walls**

Cripple walls (sometimes referred to as foundation stud walls or knee walls) shall be framed of studs not smaller than the studs above with a minimum length of 14", or shall be framed of solid blocking. When exceeding 4' high, such walls shall be framed of studs having the size required for an additional story. If alternate braced wall panels occur over a cripple wall, the cripple wall must contain hold-downs and double studs such as an alternate braced wall panel of the first level of a two-story building (3,000 lb. capacity) (see brochure # 62—Braced Wall Panels).

Spacing of boundary nailing for required wall bracing shall not exceed 6" on center along the foundation plate and the top plate of the cripple wall. Nail size, and nail spacing shall be as required elsewhere in the IRC for the specific bracing materials used.

## Headers

All openings 4' wide or less in bearing walls shall be provided with headers consisting of either two pieces of 2" framing lumber placed on edge and securely fastened together or 4" lumber of equivalent cross section. All openings more than 4' wide shall be provided with headers or lintels sized to support all floor and roof loads from above. Each end of a lintel or header shall be supported by studs or hangers at least 1.5" wide for the full bearing width of the lintel.

## Pipes in Walls

Stud walls and partitions containing plumbing, heating, or other pipes shall be so framed and the joists underneath so spaced as to give proper clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of such pipes and shall be bridged. Where plumbing, heating or other pipes are placed in or partly in a partition, necessitating the cutting of the soles or plates, a metal tie not less than 0.054" (16 galvanized gage) and 1.5" wide shall be fastened to each plate across and to each side of the opening with not less than eight 16d nails on each side.

## Cutting and Notching

In exterior walls and bearing partitions, any wood stud may be cut or notched to a depth not exceeding 25% of its width. Cutting or notching of studs to a depth not greater than 40% of the width of the stud is permitted in nonbearing partitions supporting no loads other than the weight of the partition (see Fig 3 – Cutting and Notching (pg 7)).

## Bored Holes

A hole not greater in diameter than 40% of the stud width may be bored in any wood stud. Bored holes not greater than 60% of the width of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored. In no case shall the edge of the bored hole be nearer than 5/8" to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

## Roof and Ceiling Framing

### Spans

Allowable spans for ceiling joists shall be in accordance with IRC Tables R802.4 (1) and (2). Allowable spans for rafters shall be in accordance with IRC Tables R805.1(3) and (5) , where applicable. For typical Doug Fir #2 ceiling joist and rafter spans, see Table 2.

| Joist Size *<br>(Inches)  | Joist Spacing<br>(On center in<br>inches) | Maximum Span<br>Ceiling Joist<br>(Feet – inches) | Maximum<br>Span Rafters<br>(Feet –<br>inches) |
|---|---|--|---|
| 2x6<br>(1,310 Fb)   | 12  | 14 – 10  | 13 – 9  |
|   | 16  | 12 – 10  | 11 – 11                                       |
|   | 24  | 10 – 6   | 9 – 9   |
| 2x8<br>(1,210 Fb)   | 12  | 18 – 9   | 17 – 5  |
|   | 16  | 16 – 3   | 15 – 1  |
|   | 24  | 13 – 3   | 12 – 4  |
| 2x10<br>(1,105 Fb)  | 12  | 22 – 11  | 21 – 4  |
|   | 16  | 19 – 10  | 18 – 5  |
|   | 24  | 16 – 3   | 15 – 1  |
| 2x12<br>(1,005 Fb)  | 12  |  | 24 – 8  |
|   | 16  |  | 21 – 5  |
|   | 24  |  | 17 – 6  |
| Doug Fir # 2 (10lb dead load, 20lb live load ceiling, 30lb live (snow) load rafters)      |   |  |   |
| Note: See IRC Tables R802.4 (1) and (2) for other ceiling combinations, grades or species |   |  |   |

## Framing

See R802.3 Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at least 1" nominal thickness at all ridges and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a single valley or hip rafter not less than 2" nominal thickness and not less in depth than the cut end of the rafter. Where roof pitch is less than 3/12, ridge beams, hips and valleys shall be designed as beams.

## Notches and Holes

Notching at the ends of rafters or ceiling joists shall not exceed one-fourth the depth. Notches in the top or bottom of the rafter or ceiling joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span, except that a notch not exceeding one-third of the depth is permitted in the top of the rafter or ceiling joist not further from the face of the support than the depth of the member.

## Framing Around Openings

Trimmer and header rafters shall be doubled, or of lumber of equivalent cross-section, when the span of the header exceeds 4'. The ends of header rafters more than 6' long shall be supported by framing anchors or rafter hangers unless bearing on a beam, partition or wall.

## R802.10 Wood trusses.

**R802.10.1 Truss design drawings.** Truss design drawings, prepared in conformance with Section R802.10.1, shall be provided to the building official and approved prior to installation.

Truss design drawings shall include, at a minimum, the information specified below. Truss design drawing shall be provided with the shipment of trusses delivered to the jobsite.

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
  - 4.1. Top chord live load (including snow loads).
  - 4.2. Top chord dead load.
  - 4.3. Bottom chord live load.
  - 4.4. Bottom chord dead load.
  - 4.5. Concentrated loads and their points of application.
  - 4.6. Controlling wind and earthquake loads.
5. Adjustments to lumber and joint connector design

- values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thicken ss or gauge) and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
  - 9.1. Truss to truss girder.
  - 9.2. Truss ply to ply.
  - 9.3. Field splices.
10. Calculated deflection ratio and/or maximum description for live and total load.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents.
12. Required permanent truss member bracing location.

**R802.10.2 Design.** Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal plate connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered professional where required by the statutes of the jurisdiction in which the project is to be constructed in accordance with Section R106.1.

**R802.10.3 Bracing.** Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with TPI/HIB.

**R802.10.4 Alterations to trusses.** Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater) that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

**R802.10.5 Truss to wall connection.** Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (79.45kg.) and shall be installed in accordance with the manufacturer's specifications. For

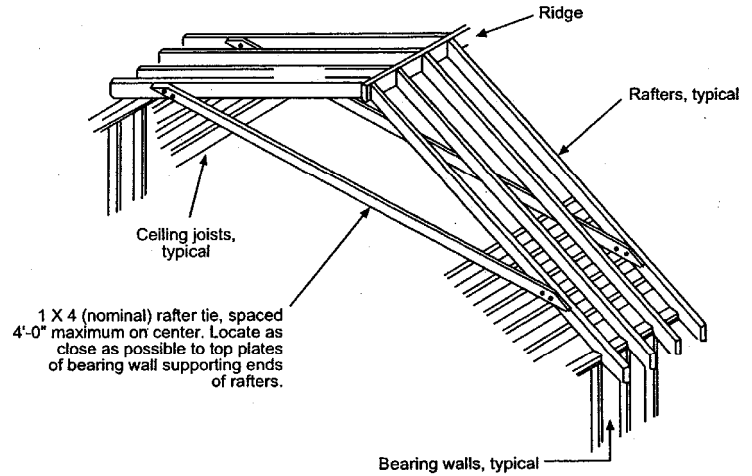
roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m<sup>2</sup>) or greater, as established in Table R301.2(2), adjusted for height and exposure per Table R301.2(3), see section R802.11.

### R802.11 Roof tie-down.

**R802.11.1 Uplift resistance.** Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m<sup>2</sup>) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in Table R802.11. Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3m<sup>2</sup>) and Zone 1 in Table R301.2(2), as adjusted for height and exposure per Table R301.2(3). A continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation.

### Rafter Ties

See R802.3.1. All pitched rafters require rafter ties unless both ends (at the wall and the ridge) are supported by bearing walls or beams. Rafter ties shall be nailed to adjacent ceiling joists to form a continuous tie between exterior walls when such joists are parallel to the rafters. Where not parallel, rafters shall be tied to 1" x 4"



**Ceiling Joists Perpendicular to Rafters**

(nominal) minimum-size crossties spaced as close to the bottom of the rafters as practical. Rafter ties shall be spaced not more than 4' on center (see Fig 4 above).

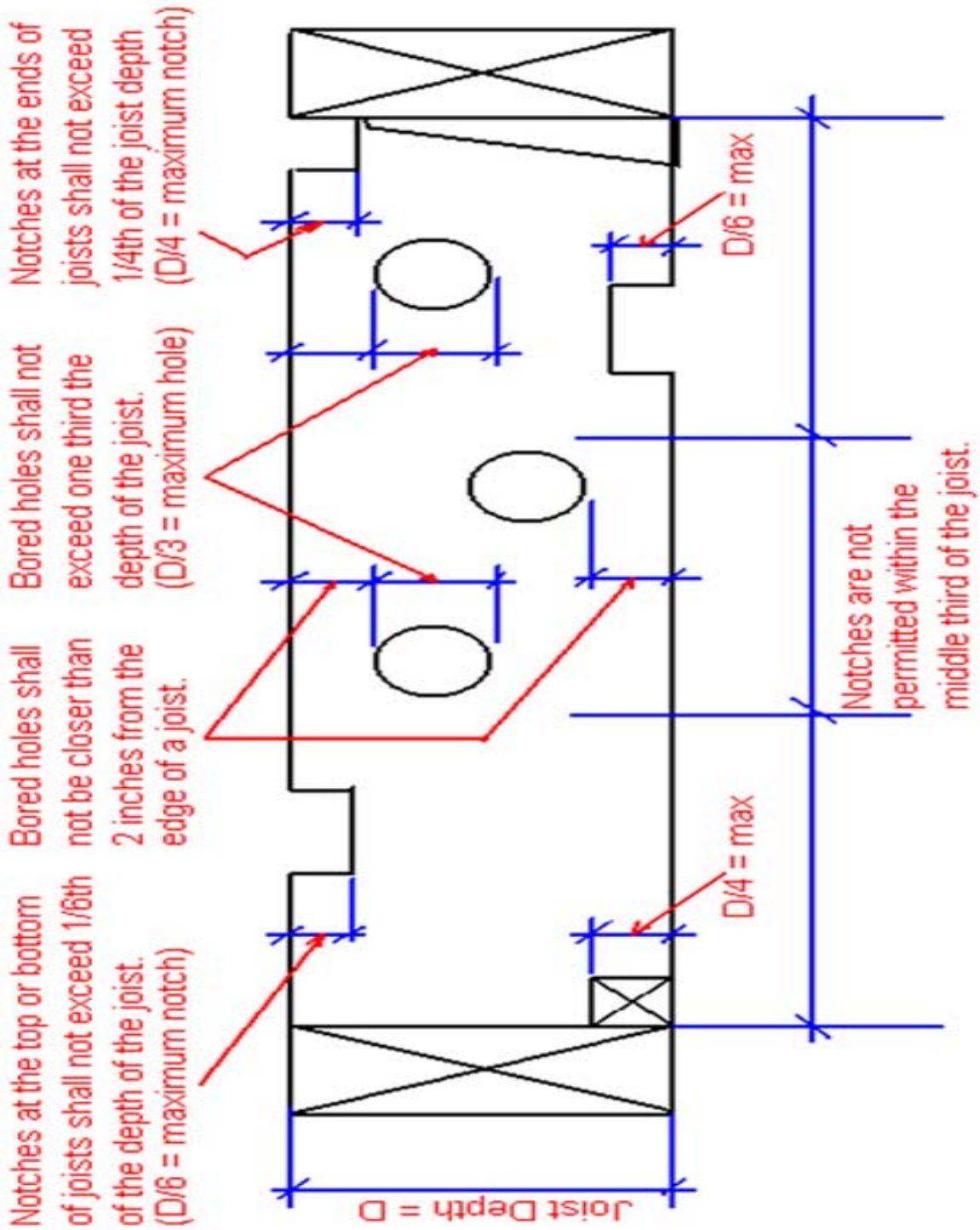
### Blocking

Roof rafters, roof trusses and ceiling joists shall be supported laterally at each bearing point by solid blocking to prevent rotation and lateral displacement.

### Roof Sheathing

All roof diaphragms shall be solidly sheathed. Roof sheathing shall be in accordance with IRC Tables R503.2.1.1 and R602 3(1) for wood structural panels, and Table R803.1 for lumber. Typical nailing of wood structural panels requires 8d nails at 6" on center at all panel edges and 12" on center in the panel field. Sheathing must be nailed to the solid blocking at all bearing points and diaphragm boundaries (at walls, gable end trusses, etc.).

**Figure 1: Joist Notches and Holes**



## Figure 3: Cutting, Notching and Bored Holes In Studs

