ADVANCED FRAMING

FRAMING DOE 770 MS | 0010/30/00, 9:36 AM 1

October 2000 DOE/GO-102000-0770

Framing Techniques

Lay out and cut framing and sheet goods to take advantage of the full dimension of the material. This also reduces job site waste.

For more information, contact

Energy Efficiency and Renewable Energy

Office of Energy Efficiency

1000 Independence Avenue, S.W.

20505-0001

Visit the DOE Web site at

www.eere.energy.gov

Or write to the Building Energy Efficiency

Office of Energy Efficiency

Washington, D.C. 20585

www.eere.energy.gov

Washington and regional offices for the U.S. Department of Energy by

DOE Advanced Energy Technologies

1000 Independence Avenue, S.W.

20585-0001

www.energy.gov

Southwest Energy Institute

405-442-5750

www.southwestenergyinst.org

U.S. Department of Energy's

Oak Ridge National Laboratory

20000 River Road

Oak Ridge, TN 37831

www.ornl.gov

U.S. Department of Energy's

National Renewable Energy Laboratory

303-275-6200

www.nrel.gov

The International Residential Code for One- and Two-FamilyDwellings is available from

The International Code Council

703-548-3000

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Additional framing techniques designed to reduce the amount of lumber and waste generated in the construction of a wood-framed house.

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Adapted from Building Science Corporation

42 naht er o mt on si evoba ecafr us gnili anl ell arap eht ot ecnat si dl acitrev eht fi ht di w ni t eef 8 ot pu sgni nepo r of sll a w gniraebnon r oiret xe r o r oiret ni

header sized for actual load

Insulated window opening

Connectors for and backer support for gypsum board so that it does not interfere with trim nailing

CORNERS

Two-stud corners decrease lumber and increase possible insulation levels compared with typical practice. However, if nailable sheathing is not used, attachment of exterior trim and nailing of corner may be more difficult. For example, nailing corner requires attachment at a point several inches from the corners. Therefore, if nailing or other non-nailbase sheathing is used, it may be necessary to use a nailer rather than the sheathing.

When drywall clips are used, they should be installed above the level of the interior trim so that nails will not puncture the non- nailable corner piece should be installed first, against the drywall that has been trimmed, so that the final cut-back pieces can be nailed to the stud.

Ladder blocking or a full-length 1x6 or 2x6 behind the first partition stud.

Anchors are generally not required for structural strength or fire/draft stopping in platform framing, at least with standard 8-foot 2x4s. Therefore, if foam or other non-nailbase sheathing is used, it may be necessary to add a wood nailed behind the sheathing.

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**Instead of Jack Studs**

The first drywall sheet is installed against side with clip or backer outside and flush to the exterior of window opening to provide nailing surface for siding and window trim. Point load transfered between studs by rim closure material acting as header. If rim closure material is non-structural, support will be required under point loads. Use solid blocking between joists.

**No Headers in Roof Framing**

In walls supporting only a roof and ceiling, 2x4 studs can be spaced up to 24 inches on-center, except ... afloor and roof above can be 2x6 spaced up to 24 inches on-center rather than 2x4 spaced up to 16 inches on-center.

**Intermediate Blocking**

The 1995 International Code Council One- and Two-Family Dwelling Code allows studs up to 10 feet long to be spaced up to 24 inches of nailable width next to a window. If needed, ½ inch of header thickness is required. Use of scrap foam sheathing and reduce waste. For assistance in designing headers, consult local structural engineers, code officials, lumber suppliers, or organizations such as the Western Wood Products Association (www.wwpa.org).

**Headers" - Structural headers are often overinstalled when unnecessary, largely for convenience. Proper sizing of headers allows better insulation and saves wood. In some cases, simplicity alone will be enough, allowing even better insulation around windows. Headers are not required in non-bearing walls, including most interior walls and support walls with only non-load bearing trusses directly above. The table and accompanying text below illustrate some header requirements from the 1995 International Code Council’s One- and Two-Family Dwelling Code. When used in conjunction with in-line intermediate blocking (shoulder studs/cripples) - Jacks can be eliminated where unnecessary, largely for convenience. Proper sizing of headers allows better insulation and saves wood. In some cases, simplicity alone will be enough, allowing even better insulation around windows. Headers are not required in non-bearing walls, including most interior walls and support walls with only non-load bearing trusses directly above. The table and accompanying text below illustrate some header requirements from the 1995 International Code Council’s One- and Two-Family Dwelling Code.
ADDITIONAL FRAMING TECHNIQUES

Stud Spacing - In many cases, it is acceptable by code to increase stud spacing from 16 inches to 24 inches on-center. The 1995 International Code Council’s One- and Two-Family Dwelling Code allows studs up to 10 feet long to center, except for 2x8 grade (R-3) studs. For studs supporting one surface, such as roof bearing, it is recommended that the first stud at 2 1/2 feet, 24x’s can be spaced up to 24 inches on-center when vertically grade studs are not used. Studs in walls supporting a floor and roof above can be 2x6 spaced up to 24 inches on-center rather than 24x’s spaced at 18 inches on-center. Vertical 2x6 materials and subject to framing with 2x6 studs spaced 24x’s spaced 12 inches on-center is similar to that for framing with 2x6 studs spaced 18x’s on-center. The economics of bull wall construction is especially favorable in areas with significant winds and in hurricane-prone areas where Recommended 90-100 percent of the wall area. This 30-inch-wide window and clear area may require an extra framing layout. An unconnected horizontal voids can be eliminated in each additional opening. One additional, the added 2x6 wall thickness requires the use of extension joists at windows unless drywall returns are used.

Heads - Structural heads are frequently used in addition wherever necessary, largely for appearance. Proper sizing of headers allows better insulation and sound value. In some cases, simply adding 2x6, for example headers can be used to achieve a better insulation. Headers are not required in non-bearing walls, including most interior walls and garage walls for 10x’s on-center (interior walls). The table and accompanying text below address some header requirements per the 1995 International Code Council’s One- and Two-Family Dwelling Code. It is possible to install headers by using foam sheathing as a spacer in place of plywood or oriented strand board (OSB), either between or on one side (preferably the exterior side) of doubled headers. This technique is an excellent way to make use of scrap foam sheathing and reduce waste. For assistance in designing headers, consult local structural engineers, code officials, lumber suppliers, or organizations such as the Western Wood Products Association (wwpa.org).

Jacks (structural header) - Jacks can be eliminated when structural headers are not used or when non-bearing support structural headers. However, elimination of jacks reduces the available area for the siding and framing, and if not an adequate sheathing (e.g., plywood, OSB) is used, and may be as little as 1/16 inch of available width next to a window. It is necessary to construct a modified window opening by installing a 2x6 wood header behind the sheathing for a window attachment.

Outside and Inside Corners - Two-stud corners decrease lateral wind load increase possible insulation levels compared with typical practice. However, if nailed sheathing is not used, attachment of exterior trim and siding at corners may be more difficult. For example, vinyl siding corners require attachment at a point several inches from the corner. Therefore, if foam or other non-nailbase sheathing is used, it may be necessary to add a wood nailer behind the sheathing. When drywall clips are used, they should be installed above the level at all interior trim to ensure nails will not cleat. The non- expanded trim piece should be installed first, against the sheathing that is cleated on the clip, so that the final expanded trim piece can be nailed to the stud.

Portion Connections to Interior Walls (Single- and Two-Family Dwelling Code) - There are often made by adding studs at each side of a partition which serve only to provide a surface for attaching drywall. In addition to providing the very space that is available for nailing drywall. This type of connection creates an area that is difficult to insulate. Alternatives include installing “binder boards”. drywall clips, or a full-length 2x6 or 1x6 for behind the first peripheral stud.

www.wpa.org

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Intermediate Blocking - Horizontal blocks between studs are generally not required for structural strength or fire/draft-stopping in platform framing; at least with standard 2x6 or 2x8. Therefore, intermediate blocking can be eliminated with platform framing because it is not required by the major building codes.

Single Top Plate - When used in conjunction with in-line framing designs, single top plates are usually acceptable as a structural component, and are accepted by model building codes such as the International Code Council (IC) and Building Officials Code Administrators (BOCA). These codes require that 3x6, 20-gauge galvanized steel plates be used to the top plate at corners, centers, and wall intersections and that they be nailed using the 8d nails on each side.

WALL ALTERNATIVES
The use of ladder blocking or a full-length T or 2x8 blocking allows for increased insulation in the outer wall

FRAME DETAILS

Maximum Span for Two-Stud Double Headers (in feet)

<table>
<thead>
<tr>
<th>Header Size</th>
<th>Supporting One Story Above</th>
<th>Supporting One Story Above</th>
<th>Not Supporting Walls Above</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2x8</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2x10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

MODIFIED HEADER AND WINDOW OPENING

Recessed valences and increased insulation can be achieved by installing insulation headers with binders and by setting surfaces for siding installed toward the inside edge of stud.

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**ADVANCED WALL FRAMING**

### BUILDINGS FOR THE 21st CENTURY

Buildings that are more energy efficient, comfortable, and affordable — that is the goal of a number of federal agencies (Technology, State and Community Development) to improve the development and implementation of national energy efficiency measures, 10%. Consolidated with new building codes and concepts for energy efficiency, working closely with the building industry and other manufacturers of materials, equipment, and applications.

- Promotes energy/money saving opportunities to both builders and homeowners by reducing energy consumption.
- Align floor, wall, and roof framing members directly above or below one another so that loads are transferred directly downward. With in-line framing, double top plates can be eliminated because the load is distributed evenly through the top plate. Using this method, studs that are 24 inch on-center are placed directly below roof trusses spaced 24 inches on-center.

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### ADVANCED FRAMING DESIGN CONSIDERATIONS

Two-Foot Module - Design building height, width, and roof pitch in two-foot increments to make the best use of common sheet goods. This technique will reduce material use, labor, and waste, as many products come in multiple of two feet. For example, with proper planning, the entire cutout from a corner sheet of drywall can be used without waste. This is an important factor in planning for an additional cut and reducing scrap. When planning the roof, remember to slip an extra 2x4 or 2x6 stud into wall studs to take advantage of the full dimension of the material.

In-Line Framing - Align floor, wall, and roof framing members directly above or below one another so that loads are transferred directly downward. With in-line framing, double top plates can be eliminated because the load is distributed evenly through the top plate. Using this method, studs that are 24 inch on-center are placed directly below roof trusses spaced 24 inches on-center.

Window and Door Layout - Align at least one side of each window and door with the wall on which it stands and attach the other side with a metal bracket. Windows with rough openings of 24 inches wide must maintain a minimum of 1 inch between studs that are spaced 24 inches on-center. When this door/window is viewed in conjunction with an in-line framing, headers and sills are not necessary because no studs need to be cut.

Other Notes: For maximum efficiency, diagonal plans should show each piece of wood, cross bracing, and so on in the house and locations for all other items such as wiring, ducts, and so on. Note that there may be additional cuts for each stud or framing member later.

### ADVANCED FRAMING

### BENEFITS FROM ADVANCED FRAMING

- Build efficiently, use less material, and save energy!
- **Increased Efficiency**
  - Replace lumber with insulation material. The whole-wall R-value is improved by reducing thermal bridging through the framing and maximizing the wall area that is insulated.
- **Cost Savings**
  - Cost savings result from the generation of less waste that needs to be disposed of, which also helps the environment.
- **Flexibility**
  - Replace lumber with insulation material. The whole-wall R-value is improved by reducing thermal bridging through the framing and maximizing the wall area that is insulated.
- **Improved Thermal Efficiency**
  - Frame for heat loss by replacing lumber with insulation material. The whole-wall R-value is improved by reducing thermal bridging through the framing and maximizing the wall area that is insulated.
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**Advanced Framing**

Advanced framing refers to a variety of framing techniques designed to reduce the amount of lumber and associated labor costs in the construction of a traditional framed house. These techniques include:

- Designing homes to use structural and nonstructural panels, such as plywood and OSB, instead of lumber for framing members.
- Using advanced framing techniques to reduce the amount of lumber needed and improve the energy efficiency of the finished building.
- Optimizing the use of materials to reduce waste and improve the overall performance of the building.

These techniques can provide significant cost savings and reduce the environmental impact of building construction.

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**Examples of Advanced Framing Techniques**

- **Energy Efficient Building Association (EEBA)**: EEBA promotes the use of advanced framing techniques to improve the energy efficiency of buildings. Their website offers resources and information on the latest advanced framing techniques.
- **National Renewable Energy Laboratory (NREL)**: NREL conducts research on advanced framing techniques and provides guidelines and resources for their implementation.
- **Energy Efficiency and Renewable Energy (EERE)**: EERE provides information on advanced framing techniques and their benefits for energy efficiency.
- **Builder's Guide**: The Builder's Guide offers a comprehensive guide to advanced framing techniques, including detailed instructions and diagrams.

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**BENEFITS FROM ADVANCED FRAMING**

- Reduced lumber usage and waste
- Improved energy efficiency
- Reduced labor costs
- Increased building performance

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**OFFICE OF BUILDING TECHNOLOGY, STATE AND COMMUNITY PROGRAMS**

Build efficiently, use less material, and save energy!