TOOLBASE℠
TECHSPECS

PROFILE

Advanced Framing Techniques

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TECH @ A GLANCE

BENEFITS (+) / DRAWBACKS (-)

+ AFFORDABILITY: Reduces lumber cost; potentially save on tipping fees
+ ENVIRONMENTAL PERFORMANCE: Reduces landfill waste and quantity of lumber used
+ ENERGY EFFICIENCY: Reduced number of wall studs; use of 2x6 at 24" on center (oc) wall studs; insulated headers will improve insulation and lower energy costs.
– AFFORDABILITY: May have higher up-front cost; initial labor costs for carpentry crews to alter standard practice; higher costs for planning, design, and code approval (in some areas)
– DURABILITY: May not be suitable for high wind and seismic areas
– MARKETABILITY: Some trade contractors and code officials have negative perceptions regarding OVE techniques

INITIAL COST

Cost may increase for first home, but should decrease with subsequent homes. Cost savings of hundreds (even thousands) of dollars is possible once designs have been updated, and crews are familiar with the techniques.

OPERATIONAL COST

Can reduce energy use of a home by several percent.

CODE ACCEPTANCE

Section R602 of the International Residential Code (IRC) covers wood wall framing requirements. Specific provisions are provided for single top plates with rafters or joints centered over studs (R602.3.2), studs spaced 24" oc (R602.2.4), and two stud corners (Figure R602.3(2)). Special designs may be required in seismic or high-wind zones.

RESULTS FROM THE FIELD

PATH Field Evaluation for Habitat for Humanity in Anne Arundel County, Maryland evaluated use of in-line framing; lining up joists and roof rafters with wall studs eliminated need for a double top plate; saved time and money during construction without sacrificing structural strength

WARRANTY

Warranties are not affected by OVE advanced framing techniques.

MAKING THE SWITCH

- Framing crew will need to review and follow framing plans specifically as designed in order to implement techniques
- Use 2 x 4 at 24" oc when framing single-story construction, and 2 x 6 at 24" oc for 2-story construction in most regions
- Design 24" oc framing to resist hurricane, high wind, or earthquake forces; some jurisdictions may not allow 24" oc framing

THE BASICS

Advanced Framing, also known as Optimum Value Engineering (OVE), refers to a series of techniques designed to use less lumber in framing a house, thereby reducing material cost and use of natural resources, and increasing the level of insulation as a result.

OVE advanced framing techniques include studs spaced at 24" oc ; 2-foot modular design that reduces cut-off waste from standard-sized building materials; in-line framing that reduces the need for double top plates; building corners with two studs; and using insulated headers over exterior building openings (or using no headers for non-load bearing walls).

Spacing studs at 24" oc rather than 16" oc reduces the amount of framing lumber required to construct a home and replaces framing members with insulation. Therefore, the wall has a higher overall insulating value and costs less to construct than a conventionally-framed wall, while still meeting the structural needs of the home.

Modular construction refers to designing a building on 2-foot increments to make the most efficient use of building materials (e.g., framing lumber, wood sheathing, drywall, and trim) that typically are stocked in multiples of 2-foot dimensions. This technique reduces waste associated with making cuts in lumber.

DOLLARS AND SENSE

Initial Cost - Using OVE techniques can result in reduction of cut-off waste from standard-sized building materials; reduction in the number of top plates needed, and reduction of number of studs in building corners and exterior bearing walls. **Cost savings of hundreds of dollars (and even thousands) are possible**. The NRDC estimates advanced framing techniques can reduce framing costs as much as $1.20 per square foot, and reduce the amount of wood used for framing by 11 to 19 percent. The Building America project cited showed **framing cost reductions of approximately $1.05 per square foot**.

Operational Cost – Higher energy efficiency resulting from decreased thermal bridging across structural members can have a measurable impact on heating and cooling costs. In the Building America project, **annual heating and cooling costs were reduced by 29.2%, or $293**.

THE BASICS *continued*

Building corners can be constructed with two studs. This technique not only reduces framing lumber, but also allows for insulation at the building corner (eliminating a commonly un-insulated area).

Insulated headers are formed by adding rigid insulation between header members, or by applying insulation on one side of header lumber. Manufactured header products with interior insulation are also available.

MAKING THE SWITCH

What training, tools, and home design changes are required to switch from your current building practices to using this technology?

- **Select the OVE framing techniques that are right for you –** Not all advanced framing techniques are appropriate or worthwhile in all areas. Pick and choose the techniques that will provide the most benefit for you home designs, and structural and insulation needs.
- **Consult the local codes** – Determine whether the OVE framing techniques are appropriate in your area and permitted by your local codes. For example, jurisdictions in hurricane- or earthquake-prone areas may not allow 24" oc framing.
- **Update home designs –** Refine existing home designs, and label member sizing and spacing on design drawings. Specifically call out elements such as insulated headers. Select doors and windows that fit within the 2' spacing increment to maximize savings.

RESULTS FROM THE FIELD

This technology has been evaluated by other builders in real-world building projects – learn from their experiences. For more information on these Technologies in Practice, visit www.toolbase.org.

In the beginning, implementing advanced framing techniques may need training and special attention for framing crews, and may incur an additional cost for the first house. However, once crews learn the new techniques, advanced framing takes less labor time because fewer framing members are required. Field demonstrations have shown that they can reduce labor costs, material costs, and even improve energy efficiency of homes.

Annapolis, Maryland, Habitat for Humanity (PATH Field Evaluation)

- In-line framing used to line up joists and roof rafters with walls studs to eliminate the need for a double top plate; two-story urban infill home built economically using Habitat for Humanity volunteers
- Single top plate construction saved over 16 2"x4"x14' pieces per unit, valued at roughly $75; added insulation from use of OVE framing, and other energy saving techniques, lead to a home that only used 25.5% of annual utility costs to heat and cool
- Habitat for Humanity building crews were able to quickly learn and implement OVE framing techniques in the field

Victoria, Minnesota, Centex Homes (Building America Research Project*)

- Case study comparing two identical 2,000-s.f. homes using standard wall framing and OVE framing; techniques included single top plates, 24" oc 2x6s, and standardization of window and door openings to match 24" layout
- Installation and material costs were $4,039 for the standard wall framing, $1,927 for the advanced framing system; at the same time, amount of wall that could be insulated increased from 68% to 75% with the advanced framing
- Heating and cooling costs for two homes also showed a savings; the standard framed home had heating and cooling costs of $1,003, while the advanced framed home costs were reduced to $710

FOOD FOR THOUGHT

This section provides some things to think about before switching to this building technology – make sure it's the right choice for you.

- Subcontractors and customers may have pre-conceived notions that a 24" oc wall is of lower quality than a conventionally framed wall.
- OVE requires framer to pay attention to plans instead of simply using a standard practices, training and quality control are important.
- Drywall clips used to attach drywall in a 2-stud corner wall are unfamiliar to some builders and subcontractors.
- Use 2x4 at 24" oc for single-story construction, and 2x6 at 24" oc for 2-story construction in most areas.
- Jurisdictions in hurricane- or earthquake-prone areas may not allow 24" oc framing.

TECH CHECK

Below is a checklist of steps to follow in order to implement this technology in each of your projects.

- ☐ **Work with the building designer to design on 2-foot increments.** Consider roofing dimensions in addition to walls and floors.
- ☐ **Line up joists and roof rafters with wall studs** to eliminate double top plate.
- ☐ **Work with the framing crew** on the first several homes built with advanced framing techniques.
- ☐ **Inspect insulation installation** to ensure that insulation is installed correctly in all cavities.

In order to be successful with advanced framing techniques, the contractor needs to be a "thinker rather than just an assembler."

Walt Holton, Holton Homes, Boise, Idaho
2005 EnergyValue Housing Award-winner

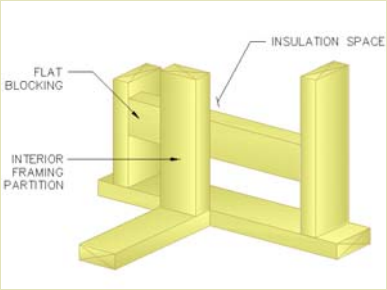
MAKING THE SWITCH ***continued***

- **Review OVE framing with framers -** Use a framing crew that is attentive to details and have the crew review and follow framing plans as designed, in order to implement advanced framing techniques. Educate the crew on the basic practices of OVE framing in advance.
- **Work with your trade contractors –** Make insulation contractors aware of the advanced framing techniques in order to ensure that insulation is installed in all locations, such as two-stud corners.
- **Tools –** No additional tools will be necessary to implement OVE framing techniques

DEFINITIONS

Drywall Clips
(also called Drywall Stops)
small pieces of hardware that function as backing to fasten drywall. To attach drywall in a 2-stud corner, drywall clips are fitted onto edge of drywall before being attached to wood or steel studs. The clips eliminate the need for an additional stud.

California Corner (2-stud corner) A building corner framed using only two studs, saving material and providing space for additional insulation in the corner.



RESOURCES

ToolBase Services
Information on this building technology and many others brought to you by PATH and the building scientists at the NAHB Research Center.
www.toolbase.org

Cost Effective Home Building, 1994. NAHB Research Center, Upper Marlboro, MD
www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=917&DocumentID=2584

Advanced Wall Framing, 2002.
6-page fact sheet by the U.S. Department of Energy
www.nrel.gov/docs/fy01osti/26449.pdf

EEBA Builder Guides (organized by climate)
www.eeba.org

Efficient Use of Wood in Residential Construction, 1998. Natural Resources Defense Council, Washington, DC
www.nrdc.org/cities/building/rwoodus.asp

***** Featured in: Lstiburek, Joseph, Fine Homebuilding, **"The Future of Framing Is Here,"** November 2005, No. 174, p. 50-55.

The Partnership for Advancing Technology in Housing (PATH) is dedicated to accelerating the development and use of technologies that radically improve the quality, durability, energy efficiency, and affordability of America's housing. Managed by HUD, the PATH partnership includes the homebuilding, manufacturing, insurance and financial industries, and Federal agencies concerned with housing.

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Tech Specs are Prepared for PATH by the NAHB Research Center.