

# 2x6 ADVANCED FRAME WALL CONSTRUCTION

## 2x6 ADVANCED FRAME WALL CONSTRUCTION DETAILS

(Walls 2A and 2B)<sup>1</sup>

- 2x6 framing
- XPS insulating sheathing
- Fiberglass or cellulose cavity insulation in stud space

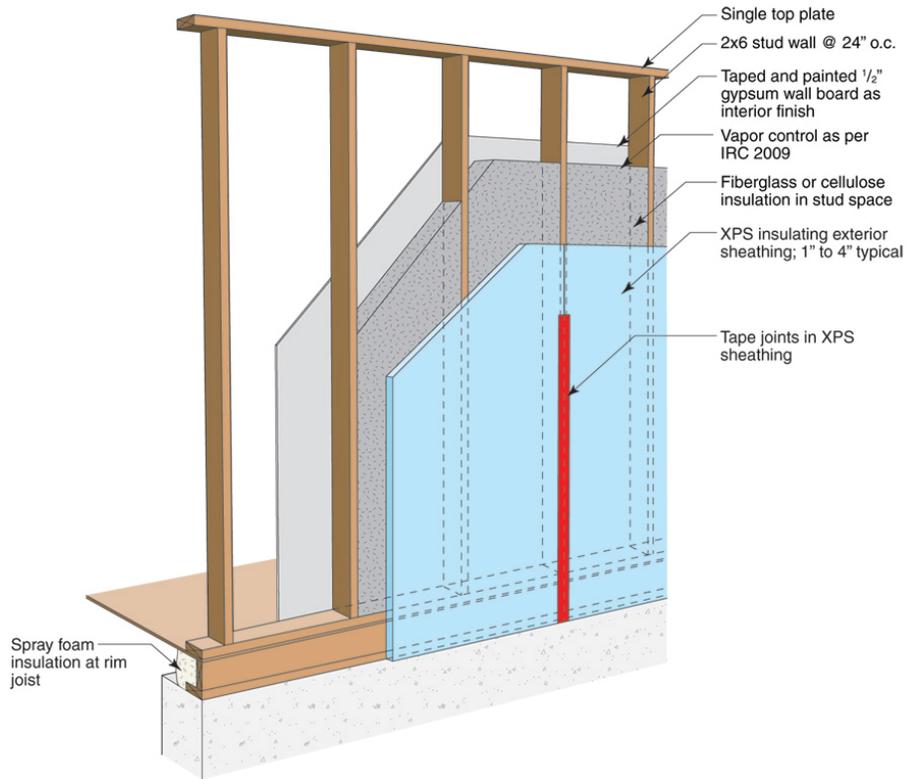


## SCORING: HOW IT RATES

The scoring of each wall system is based on the following five categories. A score of 1 is the lowest score in each category and represents the worst possible technology for each category or highest possible relative cost. A score of 5 is the highest score available in each category, and is representative of the best available technology available on the market or lowest relative cost.

Thermal Control	4
Durability	4
Buildability	4
Cost	4
Material Use	4
<b>Total</b>	<b>20</b>

Advanced framing with insulated sheathing significantly reduces the thermal bridging through the enclosure and improves the thermal efficiency of the fiberglass batt in the stud space. Using insulated sheathing decreases the potential for both wintertime condensation, and summer inward vapor drives, and helps mitigate issues caused by poor construction practices.



## INTRODUCTION

This overview summarizes 2x6 advanced frame wall construction including the advantages and disadvantages of this construction strategy. A more detailed analysis and direct comparison to several other walls can be found online.<sup>1</sup> The scoring system is subjective based on the relative performance and specifications between different wall systems. Complex two dimensional heat flow analysis and one dimensional hygrothermal modeling were used to determine moisture related durability risks for analysis.

For a more complete analysis of this and other wall constructions, go to [www.buildingscience.com](http://www.buildingscience.com).

## THERMAL CONTROL

**Installed Insulation R-value:** There is a range of installed insulation R-values in commercially available fiberglass batts for the stud space insulation in this wall system. The installed insulation R-value for 2x4 fiberglass batt ranges between R-11 and R-15 and for 2x6 the range is R-19 and R-21. When blown or sprayed cellulose insulation is used, the R-values are typically R-13 for 2x4 walls and R-20 for 2x6 walls.

Exterior insulating sheathing is typically added as expanded polystyrene (EPS) at R-4/inch, extruded polystyrene (XPS) at R-5/inch or foil-faced polyisocyanurate at R-6.5/inch.

**Whole-wall R-value:** Two-dimensional heat flow analysis with thermal bridging effects and average framing factors (16%) shows increases to the R-value of the assembly and improvements to the efficiency of the fiberglass batt in the stud space by decreasing the thermal bridging effects. Advanced framing walls with 1" and 4" of XPS insulated sheathing have whole wall R-values of R-20 and R-34 respectively.<sup>1</sup>

**Air Leakage Control:** Fiberglass, blown and sprayed cellulose are air permeable materials used in the stud space of the wall allowing possible air paths between the interior and exterior as well as convective looping in the insulation. Densepack cellulose has less air permeance but

does not control air leakage. Insulating sheathing (EPS, XPS and foil-faced polyisocyanurate board foam) products are air impermeable. When joints between panels of insulation and the insulation and framing are properly sealed with tape, mastic, caulk, etc., an effective air barrier system can be created at the exterior sheathing.

**Typical Insulation Products:** Fiberglass batt, blown cellulose, sprayed cellulose, and sprayed fiberglass are typically used to insulate the stud space. Expanded polystyrene (EPS), extruded polystyrene (XPS) and foil-faced polyisocyanurate (PIC) board foam are used as the exterior insulating sheathing. Spray foam is used at the rim joist to control air leaks.

## DURABILITY

**Rain Control:** Rain leakage into the enclosure is the leading cause of premature building enclosure failure. Rain control is typically addressed using a shingle lapped and/or taped drainage plane such as building paper or a synthetic WRB (i.e. homewrap). It is possible to use insulated sheathing as the drainage plane if all the intersections, windows, doors and other penetrations are connected to the surface of the insulated sheathing in a watertight manner, and the seams of the insulation are taped or flashed to avoid water penetration.<sup>2</sup>

**Air Leakage Control:** Air leakage condensation is the second largest cause of premature building enclosure failure with this type of wall construction. It is very important to control air leakage to minimize air leakage condensation durability issues. Using insulating sheathing decreases the risk of air leakage condensation by increasing the temperature of the condensation plane, but condensation is still possible with insulated sheathing in cold climates. An air barrier is required in this wall system to ensure that through-wall air leakage is eliminated (ideally) or at least minimized.<sup>3</sup> An air barrier should be stiff and strong enough to resist wind forces, continuous, durable, and air impermeable.<sup>4</sup>

**Vapor Control:** Fiberglass or cellulose in the stud cavity are vapor permeable, while EPS, XPS and PIR are moderately permeable, moderately impermeable and completely impermeable respectively.

Insulated sheathing reduces the risk of wintertime condensation by increasing the temperature of the condensation plane, and reduces the risk of summer time inward vapor drives by slowing the vapor movement into the enclosure from storage claddings such as masonry or stucco. The level of vapor control in insulated sheathing walls is determined in the IRC and should be consulted as installing the incorrect vapor control layer or installing the vapor control layer in the incorrect location can lead to building enclosure failure.<sup>5</sup>

**Drying:** Insulating sheathing limits the drying to the exterior, and the wall must be able to dry to the interior. Poly vapor barriers are typically avoided so

that this drying can occur. The minimum level of vapor control on the interior surface is determined by the IRC. Installing a vapor barrier on both sides of the enclosure will seal any moisture into the stud space, resulting in low drying potential, and possibly resulting in moisture-related durability risks. Ventilation behind vapor impermeable claddings and interior components (e.g. kitchen cabinets) can encourage drying.

**Built-in Moisture:** Care should always be taken to build with dry materials where possible, and allow drying of wet materials before close in. Cellulose is often sprayed in damp, and manufacturers recommend drying before close in and moisture content limits.

**Durability Summary:** The primary durability risks associated with these wall assemblies involve moisture damage related to rain water penetration. Condensation (most likely the result of air leakage, but also potentially the result of vapor diffusion) is decreased with insulated sheathing but may still occur, although the insulating sheathing is less susceptible to moisture related risks than structural OSB sheathing.

## BUILDABILITY

Exterior insulation up to 1.5" requires minimal changes to standard enclosure construction practices. Exterior insulation in excess of 1.5" requires changes to window and wall construction and detailing which requires training and monitoring during the initial implementation.

Cladding can be easily attached to the studs directly through 1" of insulated sheathing. Thicker levels of insulation (>2") require strapping or furring strips anchored to the framing with long fasteners. Some cladding manufacturers allow their cladding to be fastened to the strapping directly.

## COST

Advanced framing wall construction decreases the cost required for framing. There is a slight increase in cost for the insulating sheathing to replace most of the structural wood sheathing, but there are measureable cost benefits of saving energy, as well as improvements to comfort, which is difficult to quantify.

## MATERIAL USE

If advanced framing is applied correctly (single top plates, correctly sized headers, two stud corners, etc.) the redundant wood framing from standard construction is removed, and the amount of framing will decrease. Using insulated sheathing instead of structural wood sheathing may require using structural panels or bracing in some locations.

## TOTAL SCORE

Advanced framing with insulating sheathing is a logical choice as the minimum level of construction in most climates considering the more demanding insulation levels required for new construction in many climates. Using insulated sheathing can decrease the potential for both wintertime condensation, and summer inward vapor drives, and help mitigate issues caused by poor construction practices.

## REFERENCES

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