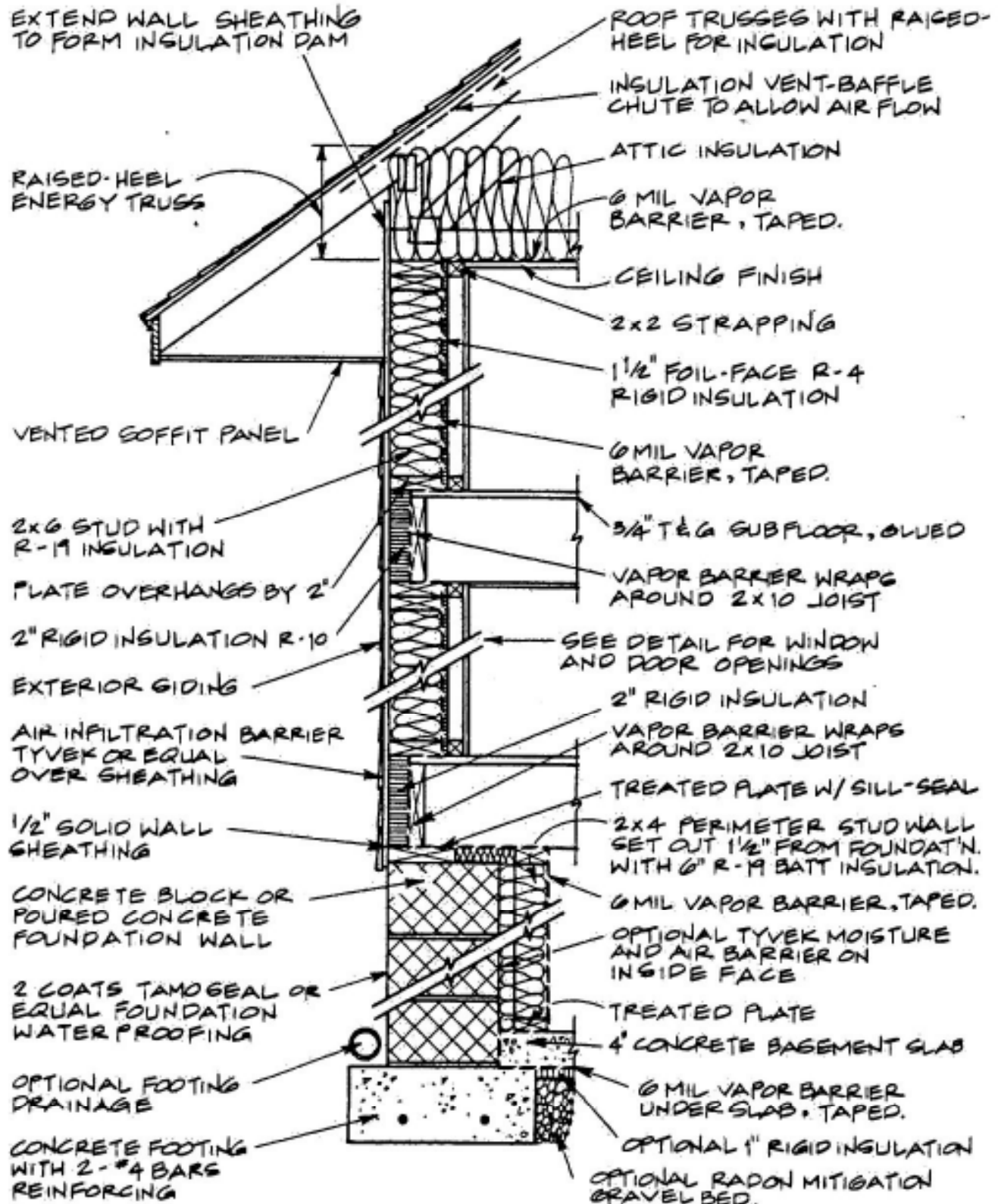


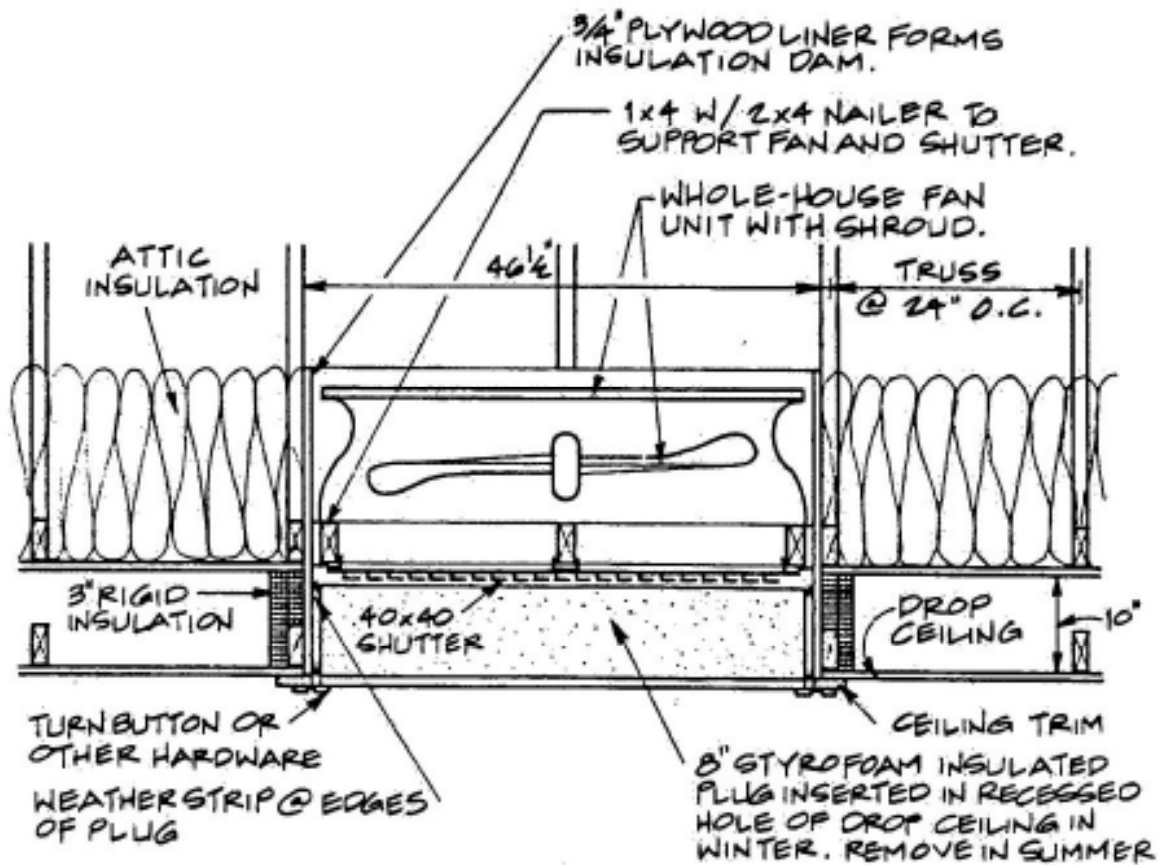
# Construction Notes for Energy-Efficient Wall Design

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by Thomas Brown

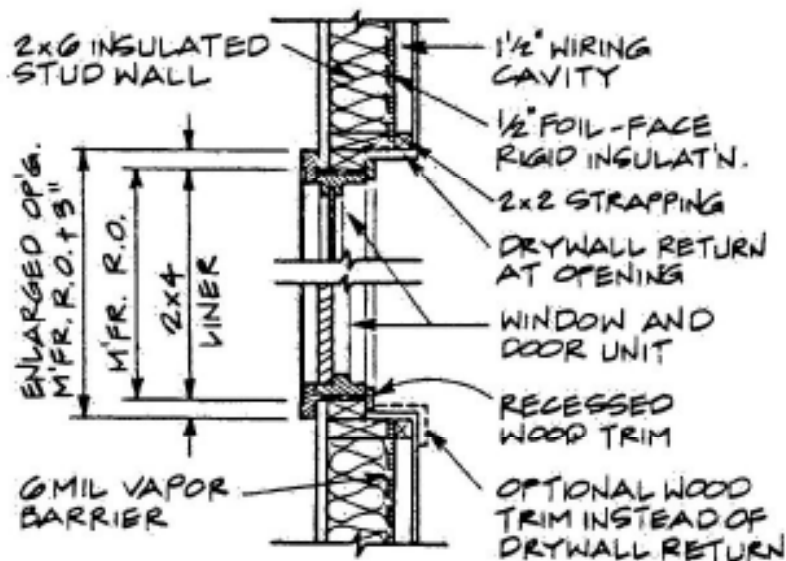


STRAPPED WALL SECTION DETAIL (TYPICAL)

## WHOLE-HOUSE FAN/HATCH DETAIL



## WINDOW/DOOR OPENING DETAIL



This strapped-wall detail applies state-of-the-art, energy-conserving construction practices to conventional framing methods. Most of the energy-conservation measures are additions to a standard 2x6 wall, while foundation, wall, and roof are built in standard fashion. The intent is to allow the builder to achieve high energy performance without learning a whole new and possibly alien construction method.

**B**elow are the construction notes I include with my building plans. These notes describe the construction sequences that are critical to the ultimate tightness and performance of the building envelope. *Items highlighted in bold indicate significant departures from commonly accepted construction practices and should be clearly understood when reviewing the drawings.*

### Basement

- Provide optional sub-slab radon-mitigation system if directed by owner.
- Install 6-mil poly or 3-mil **Tu-Tuf** vapor barrier below slab.
- Lap the edge of the vapor barrier 24 inches up each side of the foundation wall to ensure a continuous vapor barrier. Seal the vapor barrier around all penetrations and at all laps and seams with an approved tape (3M #8086, **Conserve Insulape**, or equal) or with a non-hardening acoustical sealant (**Tremco** or equal).
- Install 1-inch (R-5) extruded polystyrene insulation (**Styrofoam**, **Foamular**, **Amofoam** or equal). Two to four inches of sand may be used to cover this sub-slab insulation, if desired, to allow easier finishing. If used, maintain the specified slab elevation.
- Pour concrete slab directly over the rigid insulation or sand overlay, being careful not to damage vapor barrier.
- **Tool** exposed edge of slab, joints, and penetrations to accept 1/4-inch bead of polyurethane-based caulk.
- For insulated basement (after floor deck is installed above), provide an interior 2x4 stud wall around the perimeter. Install a treated sole plate 1 1/2 inches from foundation wall on top of the flap from the sub-slab vapor barrier. Insulate with 6 inches (R-19) fiberglass batt or blown fiberglass (**BIBS**) insulation. Install 6-mil poly or 3-mil **Tu-Tuf** vapor barrier over the face of the studs after wiring with specialty,

vapor-barrier electrical boxes (**R&S**, **Nu-Tek**, or equal), or box enclosures (**Lessco** or equal). Lap with sub-slab and floor deck vapor barriers. Seal all seams with an approved tape and caulk.

### First-Floor Deck

- Before laying floor deck and rim joist, lay down a 48-inch-wide vapor barrier strip across the top of the sill plate on the foundation wall. This will be folded up over the top of the floor deck, and around the recessed rim joist to ensure a continuous vapor barrier.
- Indent rim joist and floor deck framing 2 inches inside the exterior face of the foundation wall. This will allow the vapor barrier strip to be protected by a 2-inch band of rigid insulation to reduce the potential for condensation. Provide 6 inches (R-19) insulation in box sill.
- Fold rim-joist vapor-barrier strip up over the floor deck. Set 2x6 wall framing on top of this vapor barrier strip.
- **Overhang** 2x6 wall framing 2 inches over the rim joist and flush with the outside edge of the sill plate. Fill in 2-inch recessed gap below with 2-inch (R-10) rigid insulation.
- Lap structural, exterior wall sheathing across the rim joist to tie the sill plate to the wall framing above.
- Provide an air-infiltration barrier such as Tyvek or Tytar underneath the siding, unless an impermeable exterior rigid insulation is used.
- Where exterior rigid insulation is used, it should be installed over, and not in place of, structural sheathing. Where joints in the insulation are taped, Tyvek or Tytar may be omitted. Follow industry guidelines for installing wood siding over rigid exterior insulation, or attach siding to vertical furring strips, creating a "rain screen."
- Before laying the upper floor deck, install a 48-inch-wide vapor barrier strip across the top of the 2x6 wall framing. A 2x4 top plate may be sub-

stituted for a 2x6, and the vapor barrier sandwiched between top plates to prevent damage to the vapor barrier and ensure better footing during construction on the top of the wall. If a 2x4 top plate is substituted, it should be recessed 2 inches so it is flush with the interior face of the wall for drywall corner nailing.

### Wall Openings

- In the thicker wall, window and door openings may be treated traditionally with deep extension jambs or with drywall returns. Where extension jambs are used, the exact depth of the completed wall must be known prior to ordering.
- For drywall returns, rough openings must be oversized and standard 2x4 width window and door units may be used. Oversize the 2x6 rough openings 3 or 6 inches in height and width over manufacturer's listed rough opening, depending on the interior effect desired.
- When rough opening is oversized 3 inches, provide a 2x4 liner set flush to the outside face of studs inside the rough opening. Install a window made for a 2x4 wall and install drywall returns along the interior edges of the oversized 2x6 rough opening. Seal the joint between the window and the 2x4 liner, and cover the exposed edge of the 2x4 with narrow trim. For a wider interior casing indented between drywall returns, oversize the 2x6 rough opening by 6 inches to allow for a double 2x4 liner inside the rough opening. Wider trim may be installed over the interior face of the double 2x4 liner.
- Where no interior casing is desired, a strip of 1/2-inch plywood can be attached around the perimeter of the window unit to ensure drywall returns that are square and plumb to the recessed window jamb. This plywood strip should be the full wall depth

and the 2x6 rough opening oversized 1 inch to accommodate it.

- Wrap window and door units with a perimeter vapor barrier strip to be lapped with wall vapor barrier, or seal gaps with foam sealant.
- Piece in additional vapor barrier strips at the corners of windows and doors, and in the inside corners of recessed window framing for a continuous vapor barrier, as needed.

### Second-Floor Deck and Walls

- Frame floor deck and second-story wall with recessed rim joist, as before. If a 2x4 top plate is used, it should be recessed 2 inches so the rim joist is flush with the outside edge, as before. Fold vapor barrier strip over the rim joist and floor deck. Exterior structural sheathing should always extend across the rim joist area, tying upper and lower walls together. Sheathing splices should occur at midwall.
- Set the upper wall on vapor barrier strip and overhang 2 inches over rim joist.
- Provide 2-inch rigid insulation band at recessed rim joist.
- Provide wall openings as before.
- Omit vapor barrier strip at the top of upper wall. The strip is unnecessary since the wall vapor barrier will lap directly with the ceiling vapor barrier.

### Roof Framing

- Where roof trusses are used, provide raised-heel "energy trusses" to allow for adequate insulation depth at outside walls.
- Where conventional rafter framing is used, a rim joist must be used at the ends of the ceiling joists. Install the rafters on a second top plate placed on top of the ceiling rim joist after the ceiling joists have been installed. This will raise the roof framing to allow for adequate insulation depth.
- Extend the exterior sheathing above the ceiling line to truss or rafter tails. This will create a dam to contain attic insulation and deflect wind entering the soffit vents up and over insulation.
- Provide ventilation chutes between the rafters or trusses to ensure adequate soffit-to-ridge ventilation and prevent insulation contact with underside of

roof sheathing. On cathedral ceilings, these should extend the entire length from soffit to ridge; otherwise they should extend at least 2 feet in from exterior walls.

- Provide continuous ridge vent with weather filter and exterior deflection fins. Do not use "mushroom cap" vents, wind turbines, or gable vents, except where additional venting sized for attic or whole-house fans is required.

### Interior Partitions

- Install the ceiling vapor barrier before installing interior partitions, or provide a 24-inch-wide vapor barrier strip between the top plates of interior partitions to ensure continuity.
- To minimize truss uplift damage to drywall joints, do not secure the ceiling drywall within 12 inches of interior partitions and secure drywall to top plate of the partition with drywall clips.

### Interior Strapping and Vapor Barrier

- Install continuous 6-mil poly or 3-mil Tu-Tuf vapor barrier on the interior face of the exterior wall studs after cavity insulation is installed. Lap vapor barrier with adjacent ceiling, rim joist, and wall opening vapor barrier strips, and seal all seams with an approved tape (3M #8086, *Conserve Insultape* or equal) or nonhardening acoustical sealant (*Tremco* or equal).
- Install 1/2-inch foil-faced rigid R-4 insulation over vapor barrier.
- Install 2x2 interior horizontal strapping over rigid insulation. Space 16 inches on-center with 2x4 strapping at midpoint (drywall break) and base for wider nail/screw base.
- Provide reversed metal corner bead at corners and drywall clips to secure drywall instead of extra studs and blocking.
- Install drywall horizontally over strapping to create reflective air space and wiring cavity.
- Do not use keyhole saws, or similar tools which might damage vapor barrier, to cut openings in drywall for outlet boxes or other items.
- Tape or seal all tears and penetrations,

• Electricians shall use shallow electrical boxes or 4-inch junction boxes with plaster half-covers for wiring in strapped-wall cavity. Route all wires inside vapor barrier and seal all penetrations.

- Where wiring must penetrate vapor barrier, use plastic boxes and caulk holes where wires enter box. Stretch vapor barrier with undersized hole across face of box and use gasketed cover. Alternatively, specially designed boxes (R&S, Nutek or equal) or vapor barrier box enclosures (Lessco or equal) may be used.
- Use wall fixtures wherever possible instead of ceiling fixtures to avoid vapor barrier penetration. Where fixtures are used with a ceiling vapor barrier, provide 2x6 blocking, recessed 1 1/2 inches. Cover this blocked area with a piece of vapor barrier material recessed at least 1 1/2 inches above the finished ceiling and provide strips to lap the ceiling vapor barrier to ensure continuity. Drill hole for wire through blocking and vapor barrier and caulk where the wire enters the blocked area.
- Where plumbing stacks penetrate the ceiling vapor barrier, provide a rubber roof "boot" around stack, and seal edges to the vapor barrier. Alternatively, provide an offset (dogleg) in the stack below the ceiling line to allow for expansion and contraction of the pipe. Secure the stack at ceiling and seal with an approved caulk or tape.

### Pressure Test

- Provide a "blower-door" house pressure test to evaluate tightness of construction and quality control. Air infiltration shall not exceed 2.5 air changes per hour at 50 Pascals pressure. During pressurization or depressurization, exterior envelope shall be inspected for air leakage. All gaps, joints or openings demonstrating air leakage shall be sealed with approved caulk or tape. Where gaps exceed 3/8 inch, provide a nonsticking "backer rod" or foam sealant before caulking.

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