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| i n n o v a t i o n |

High Performance Enclosure Strategies: Part I, Existing Home

Deep Energy Retrofits

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IBACOS

Project Partners



Manufacturers, Contractors, NYSEERDA, Engineers



Goals of Research Project:

- Evaluate cost and performance trade offs between:
 - Spray-foam exterior walls
 - Rigid foam exterior walls
 - Home Performance with Energy Star Home (HPwES) on steroids
- 50% peak load and annual heating load reduction
- R-30 Target for Center of Wall
- .25 CFM50 per SSF (Shell Square Foot)
- \$10/SSF insulation strategies
- 20% minimum cost contribution from homeowners

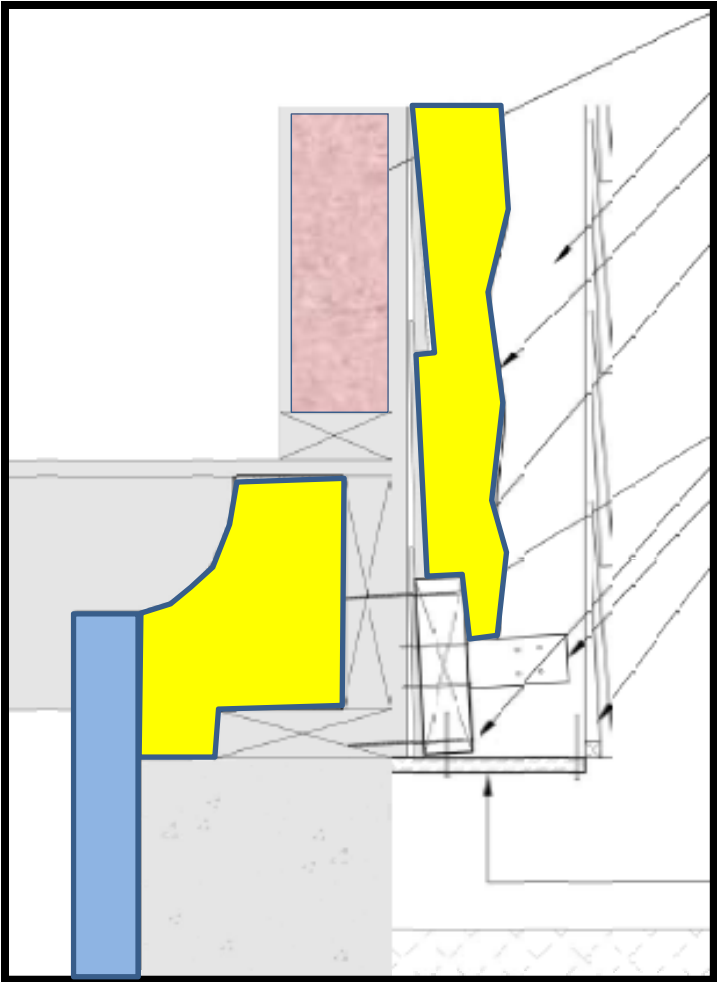
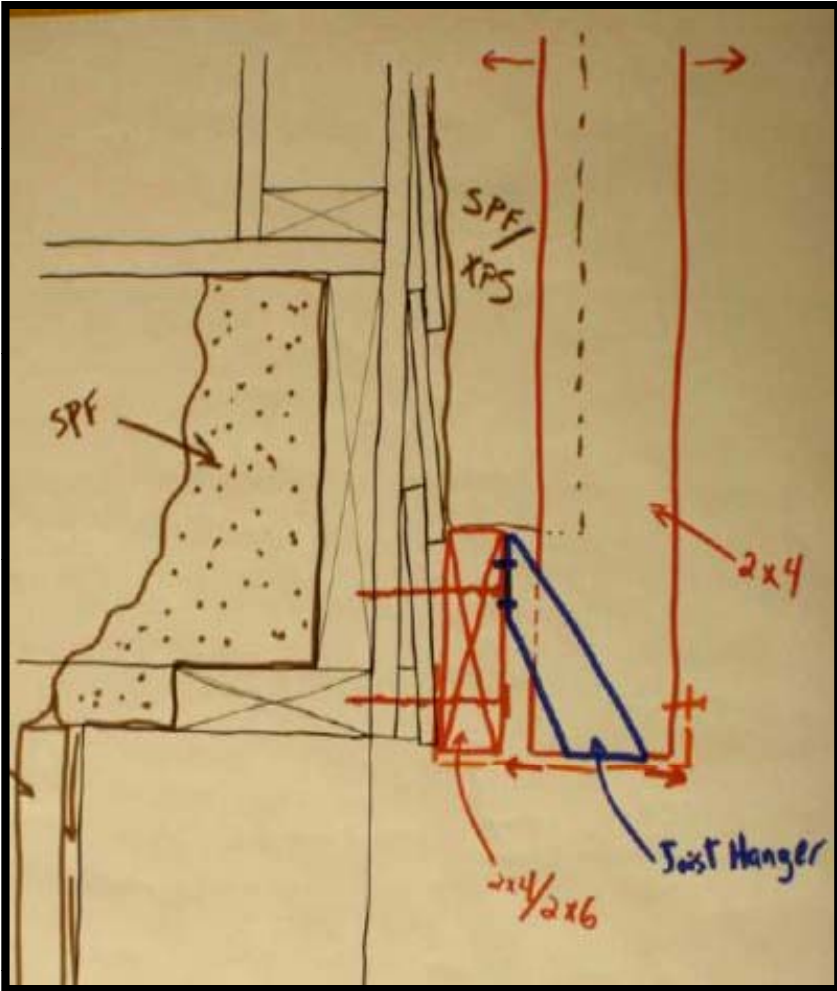
Assumptions about the Homeowner:

- Homeowner has an older house so they were already going to re-side and possibly install new windows
- This could lead to other energy upgrade opportunities:
 - HVAC
 - Air sealing
 - Upgraded Windows
 - Insulation
 - Water heating

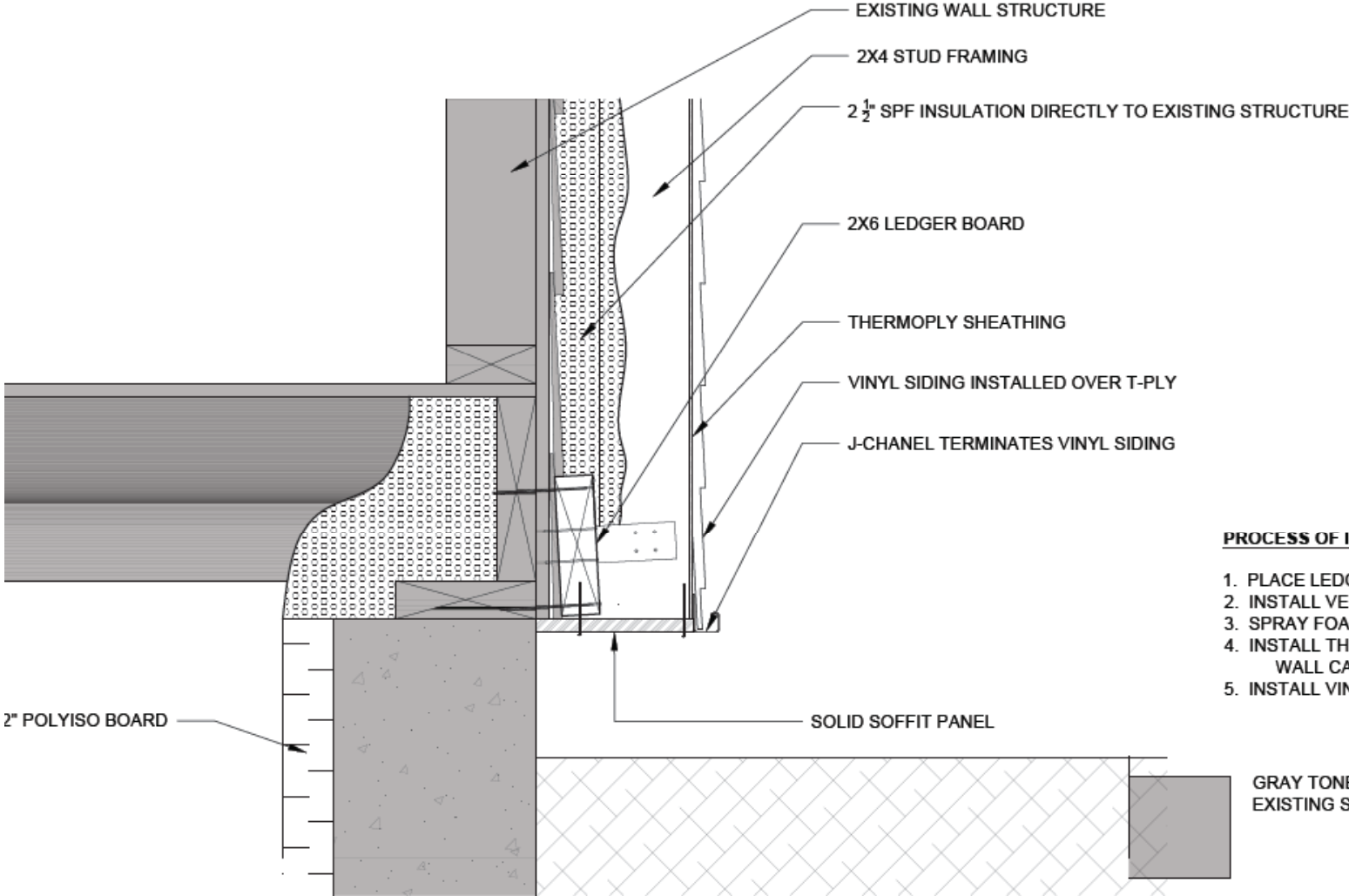
Why do this?

- Why cover existing siding?
 - Minimize need for disturbing existing construction that includes lead paint (Spray foam encapsulates it)
 - Allows for re-skinning building without having to remove existing siding
- Why use spray foam?
 - Spray foam is an integral insulation, air sealing and draining plane material in one application
 - No taping and flashing like you would with rigid

Brainstorming Ideas: Bottom of Wall



First House Construction Detail: Bottom of Wall

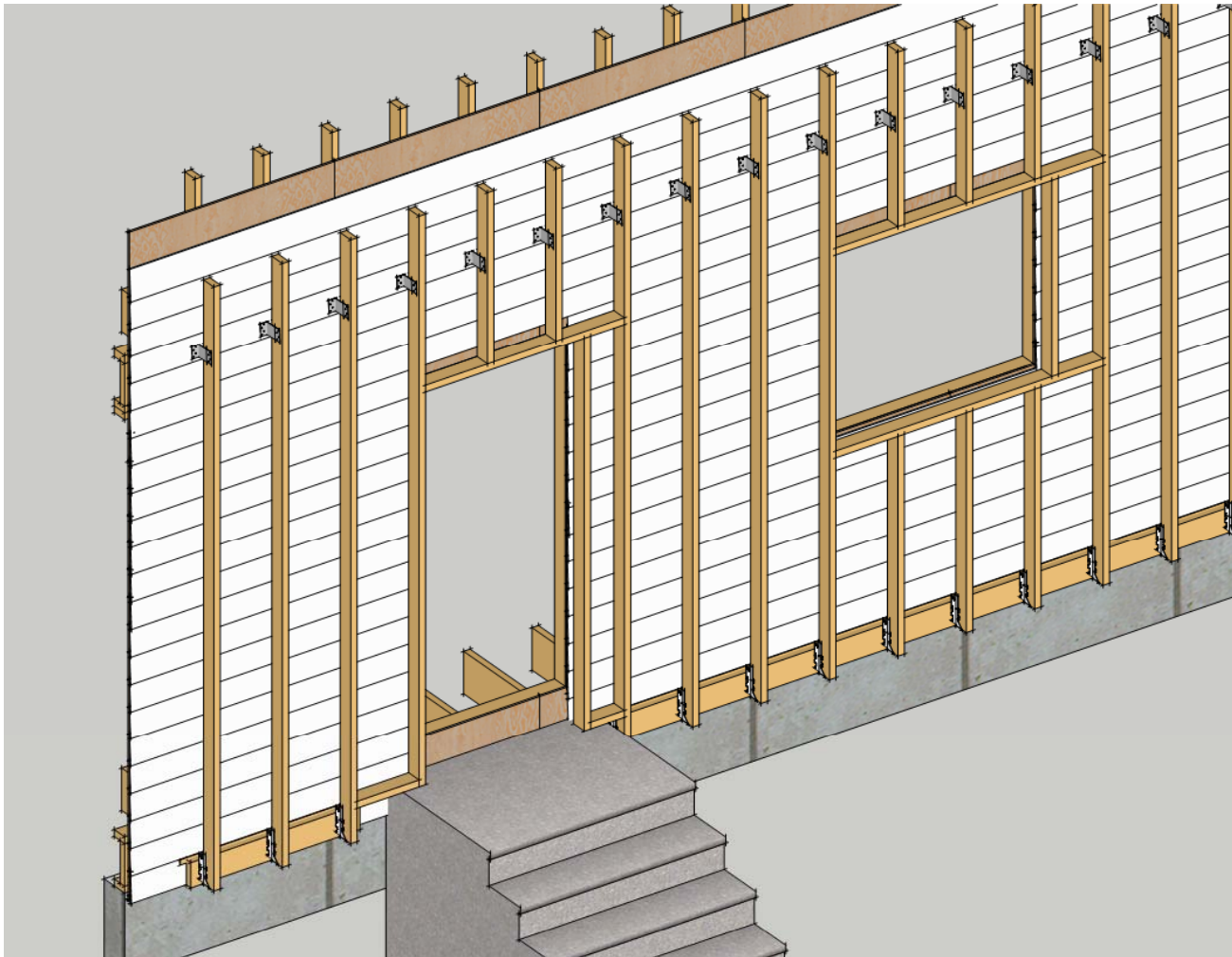


PROCESS OF INSTALLATION

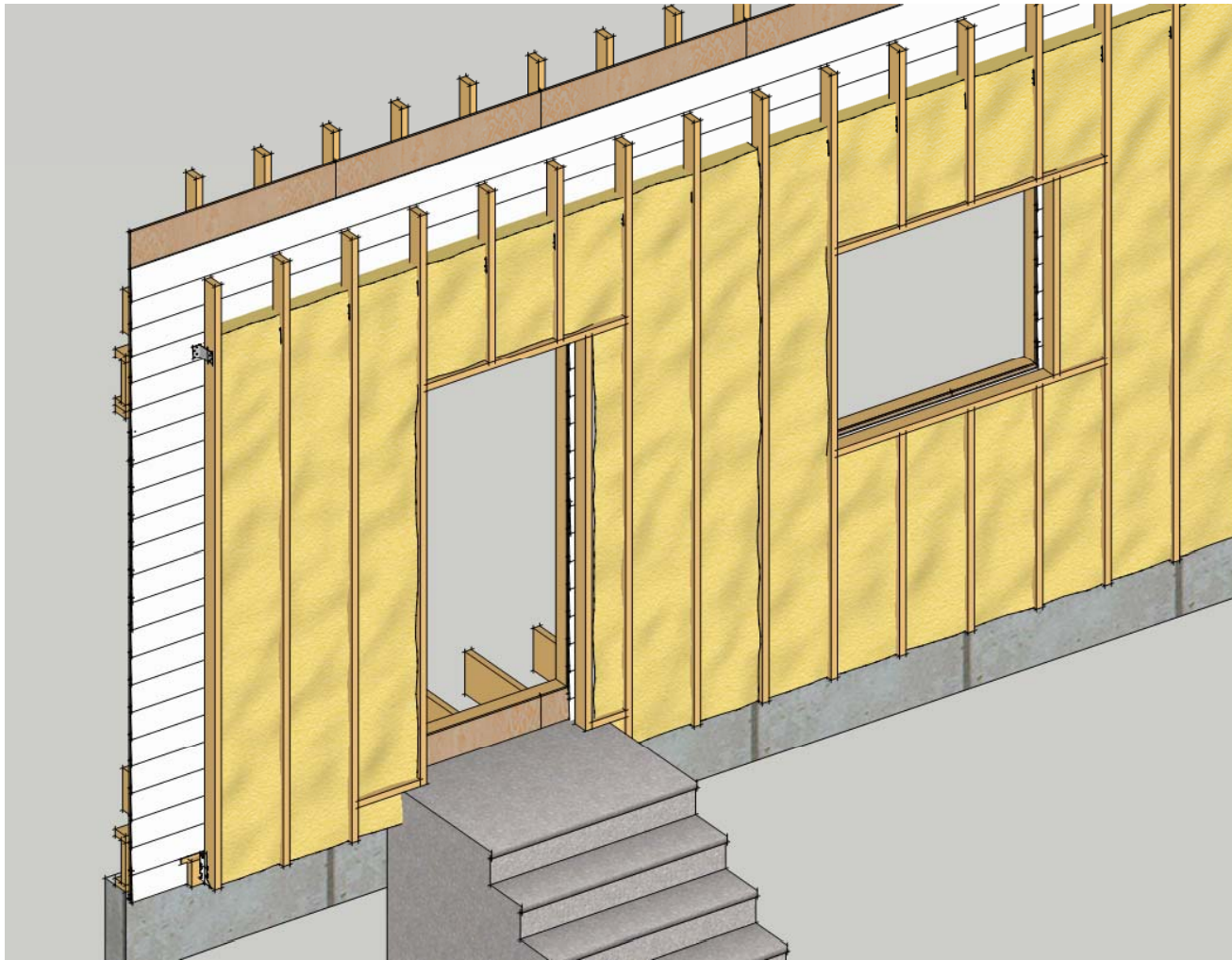
1. PLACE LEDGER BOARDS
2. INSTALL VERTICAL 2X4 MEMBER
3. SPRAY FOAM
4. INSTALL THERMOPLY TO CLOSE WALL CAVITY
5. INSTALL VINYL SIDING

GRAY TONE INDICATES EXISTING STRUCTURE

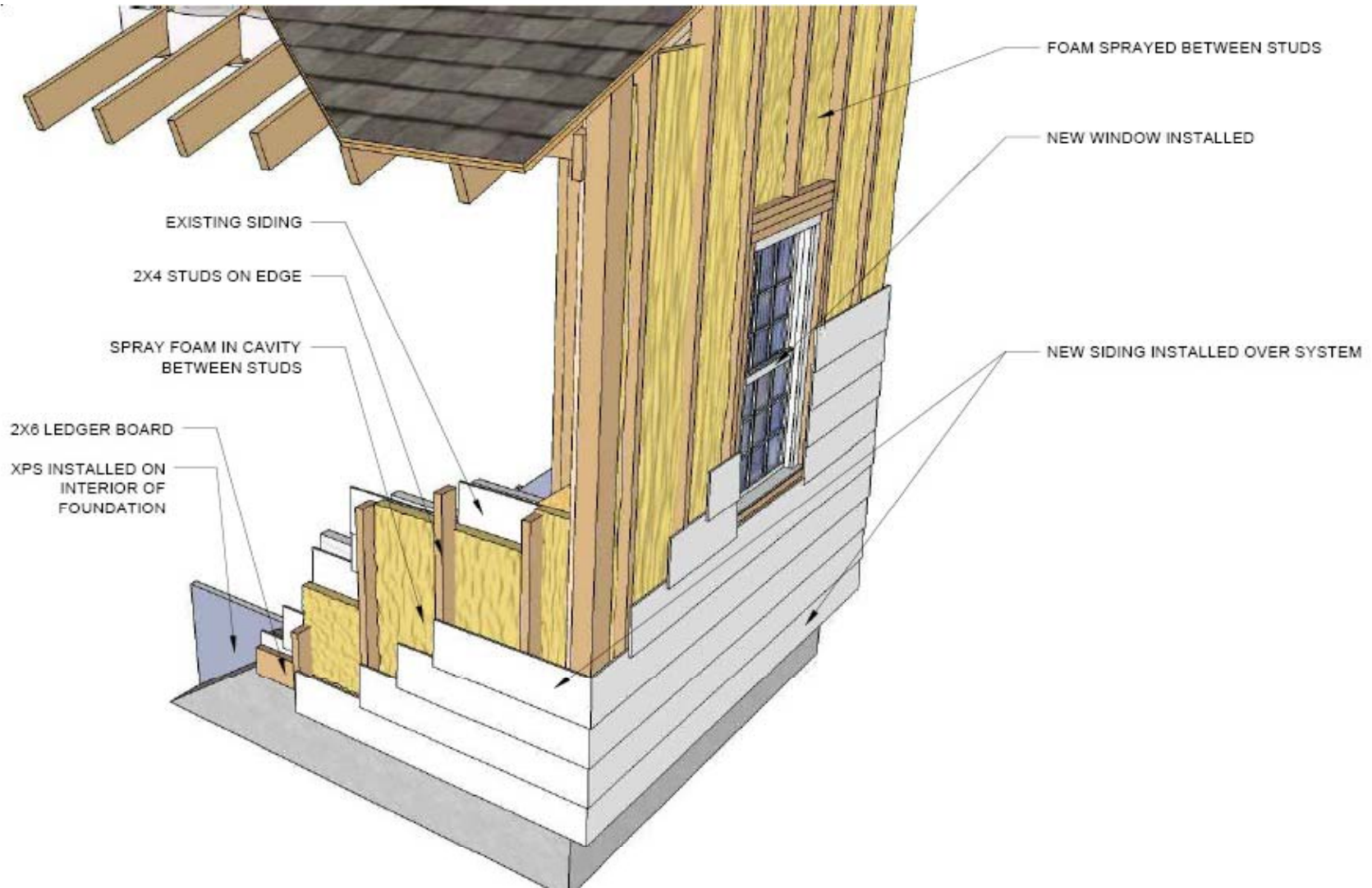
Initial concept



Initial concept



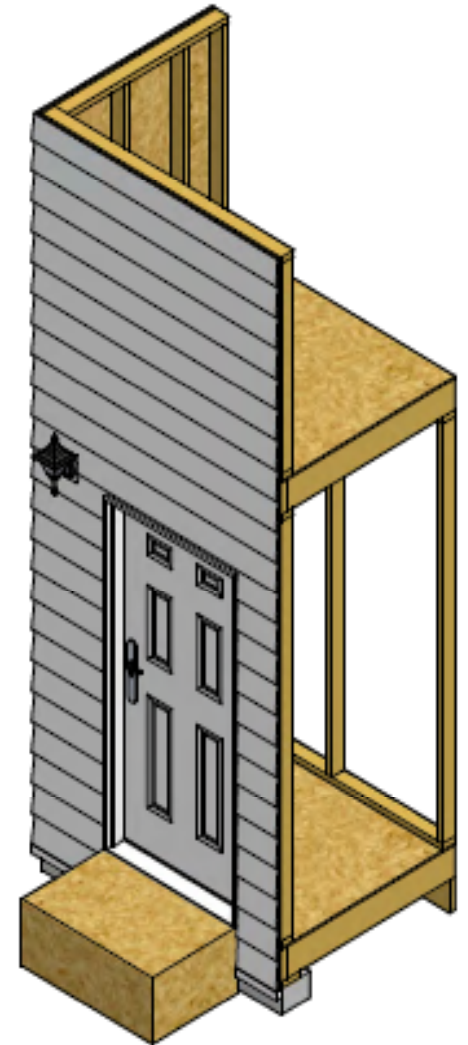
Sketchup Ideas



Mockups: Door/ Electrical/ 1st-2nd Floor



- 2-Story
- Rim/band Joist Detail
- Rim/band Joist Attachment
- Door Frame Detail
- Electrical Detail



Mockups: Window Details/ Top of Wall



- New Wall to Roof Detail
- Window Installation Detail
- Top of New Wall Detail
- Exterior Corner Detail
- Electrical Detail



Mockups: Window Details/ Top of Wall



Test House: Existing Condition



New wall framing



Front of home



Installation of Spray Foam



New Wall Intersection at Roof



New Wall with Full Insulation



Installation of Thin Profile Structural Sheathing and New Siding



Test House: Final



Air Sealing Improvements

| Improvement Stage | CFM50 | CFM50 Reduction from Start | % Reduction from Start | ACH50 | CFM50/SSF |
|--|-------|----------------------------|------------------------|-------|-----------|
| Start | 2675 | 0 | 0% | 8.8 | 0.40 |
| Air Seal Attic | 1925 | 750 | 28% | 6.3 | 0.29 |
| Wall Build-Out (Including Windows and Foam) | 1800 | 875 | 33% | 5.9 | 0.27 |
| Spray Foam Band Joist/ERV Installed | 1625 | 1050 | 39% | 5.4 | 0.25 |
| Air Sealing Between Basement and First Floor | 1590 | 1085 | 41% | 5.2 | 0.24 |

Peak Load Reductions:

| | <i>Test House</i> | | | |
|-----------------------|-------------------|---------------|--------------------|--------------|
| Location | Pre Retrofit BTUH | | Post Retrofit BTUH | |
| | Heat | Cool | Heat | Cool |
| Basement | 15141 | 2988 | 13890 | 2547 |
| Living Room | 12714 | 6858 | 2998 | 2222 |
| Dining Room | 3834 | 1899 | 264 | 103 |
| Kitchen | 6034 | 3691 | 1828 | 1701 |
| Study/ Office | 4322 | 1801 | 726 | 237 |
| Master Bedroom | 7009 | 4097 | 1488 | 1398 |
| Bedroom 1 | 5931 | 2546 | 1199 | 502 |
| Bath | 1187 | 520 | 198 | 29 |
| TOTALS | 56,172 | 24,400 | 22,591 | 8,739 |

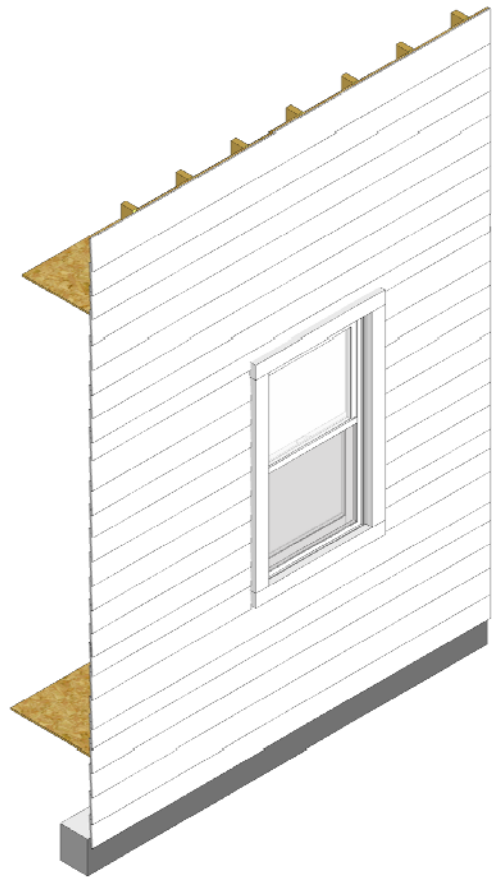
Test House: Costing

| House 1 Pro | | vs Actuals | | |
|----------------|-----------------|----------------|----------------|----------------------------------|
| Wall Work | Contract Amount | Wall Work | Actual Cost/sf | |
| Remove Siding | | Remove Siding | \$0.70 | Total Actual w/ Donated Material |
| New Framing | \$6,8 | New Framing | \$2.57 | Actual % vs Projected |
| Remove windows | | Remove windows | \$0.31 | Actual Cost/sf |
| Window Trim | \$4,0 | Window Trim | \$2.17 | \$1,534 NA \$0.70 |
| Spray foam | \$8,1 | Spray foam | \$3.81 | \$5,625 81.8% \$2.57 |
| Install T-ply | \$3,2 | Install T-ply | \$1.70 | \$671 NA \$0.31 |
| Box bottom | \$2,1 | Box bottom | \$0.53 | \$4,737 117.0% \$2.17 |
| Install siding | \$14,7 | Install siding | \$7.21 | \$8,329 101.6% \$3.81 |
| TOTALS | \$39,3 | TOTALS | \$19.01 | \$3,717 113.3% \$1.70 |
| | | | | \$1,167 53.4% \$0.53 |
| | | | | \$15,772 106.8% \$7.21 |
| | | | | \$41,552 105.6% \$19.01 |

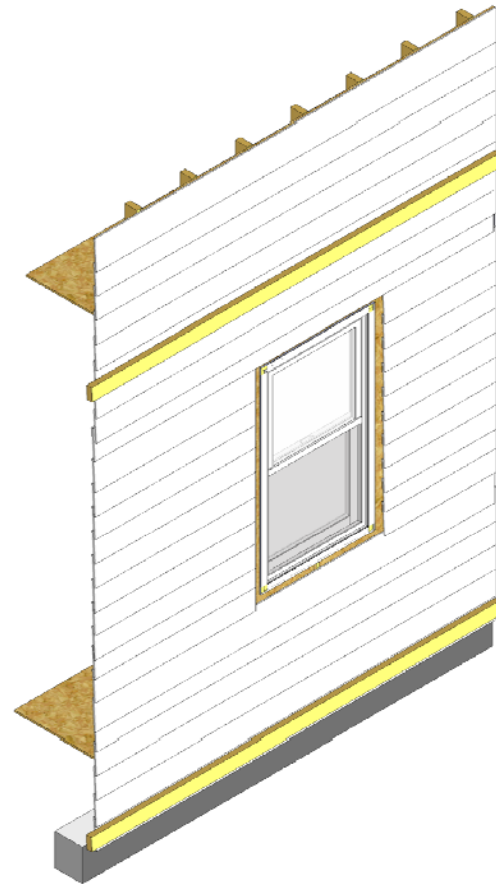
Test House: Lessons Learned

- ✓ Installation of Ledger Boards
- ✓ Brackets and Spray Foam
- ✓ Extending timing with construction
- ✓ Permitting process
- ✓ Order of installation
- ✓ The challenge of staging construction for testing
- ✓ Integrating utility logistics

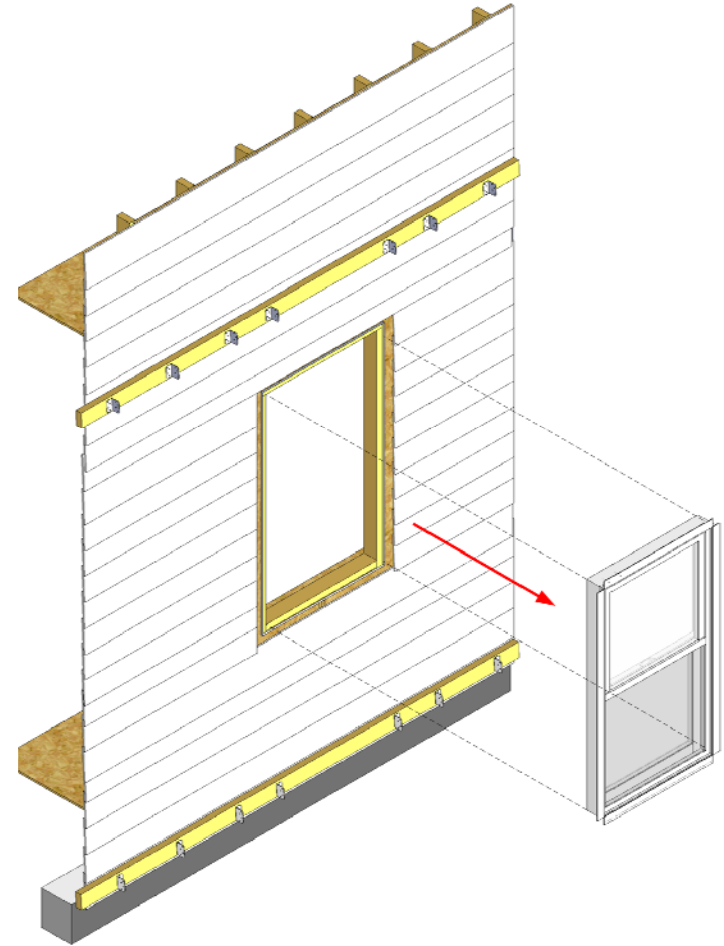
Step-by-step Installation Process



Step 1

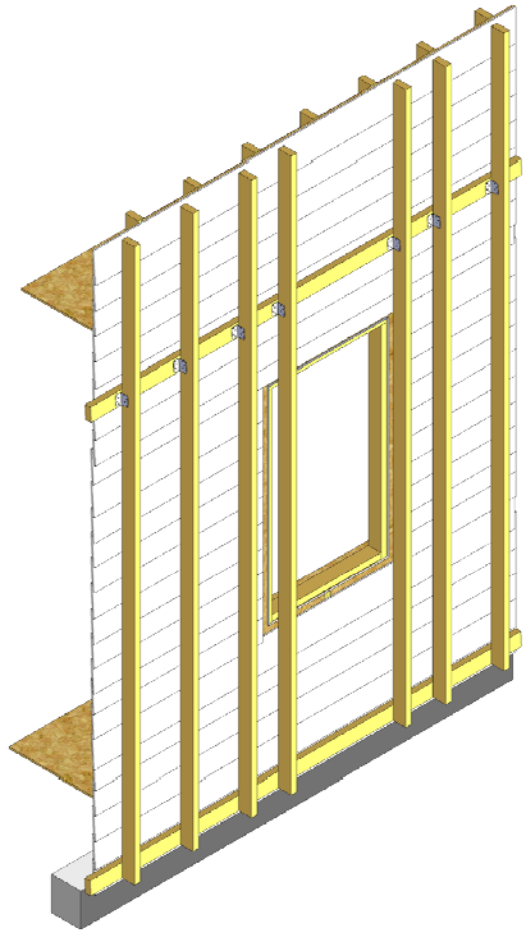


Step 2

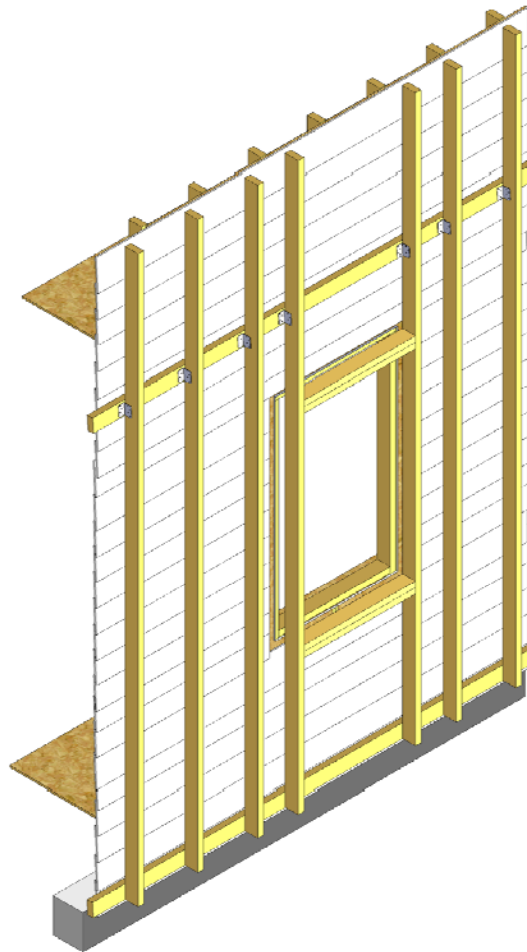


Step 3

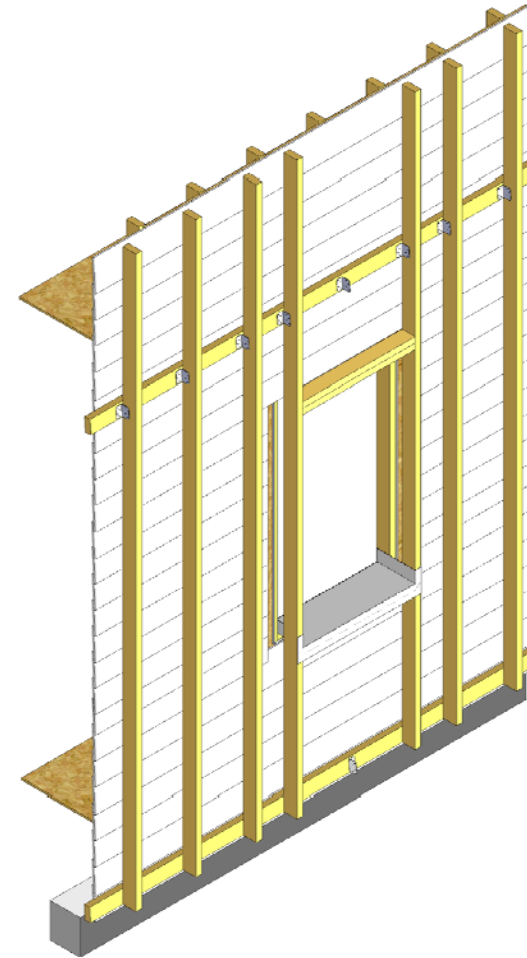
Step-by-step Installation Process



Step 4

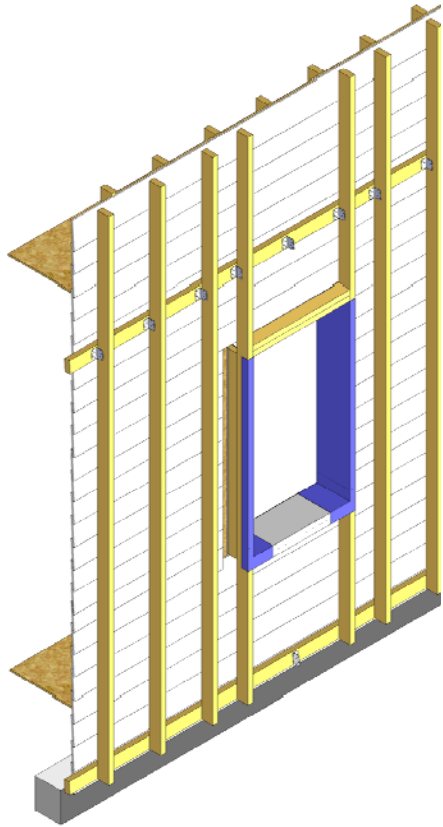


Step 5

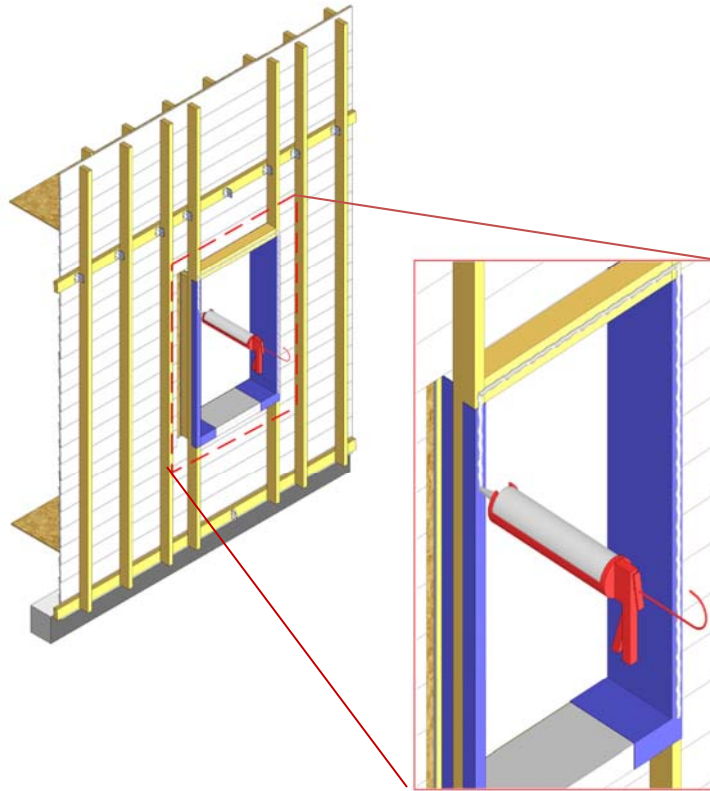


Step 6

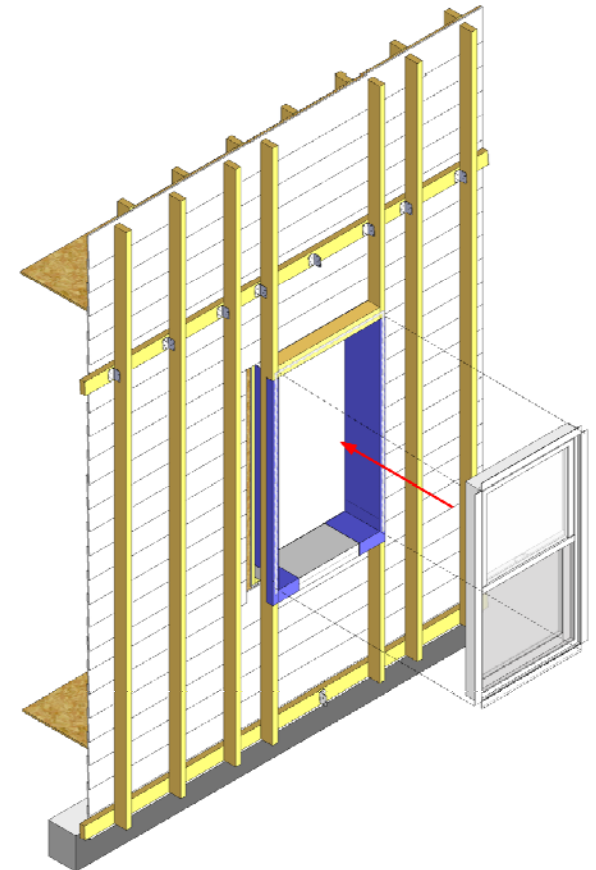
Step-by-step Installation Process



Step 7

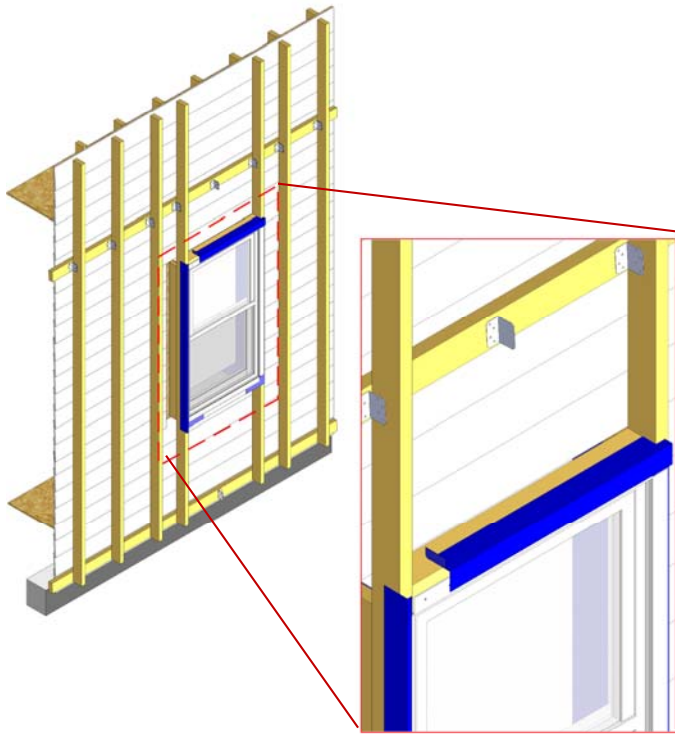


Step 8

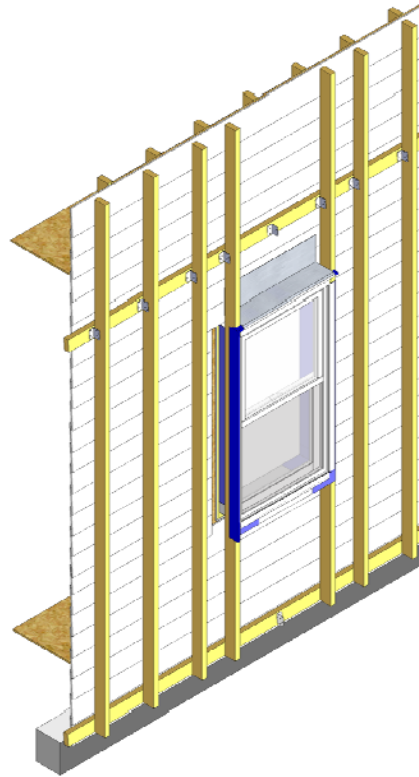


Step 9

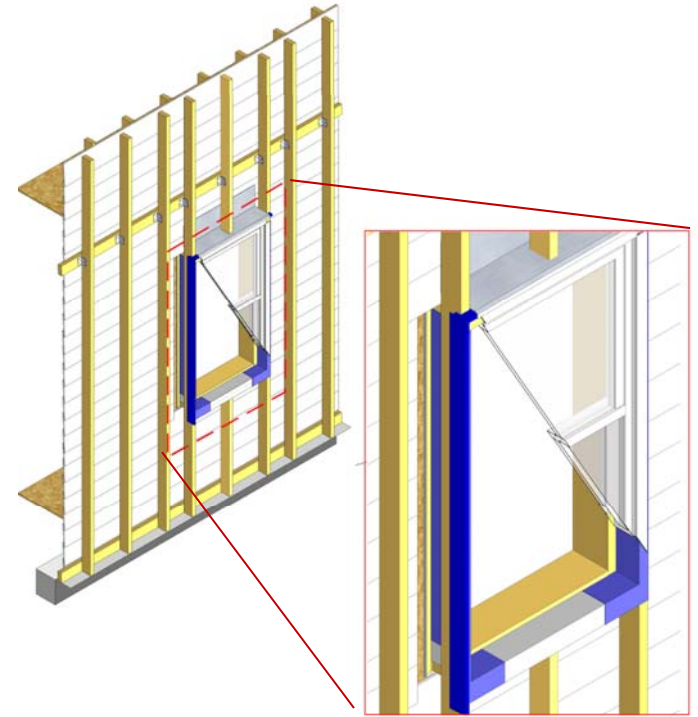
Step-by-step Installation Process



Step 10



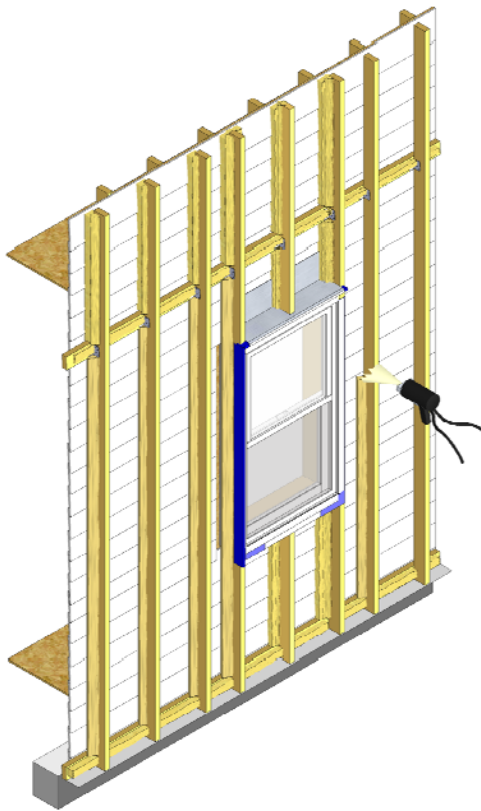
Step 11



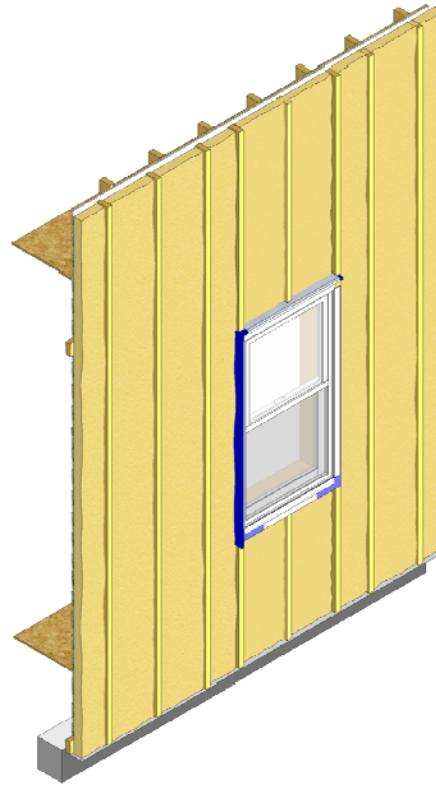
Step 12

Step-by-step Installation Process

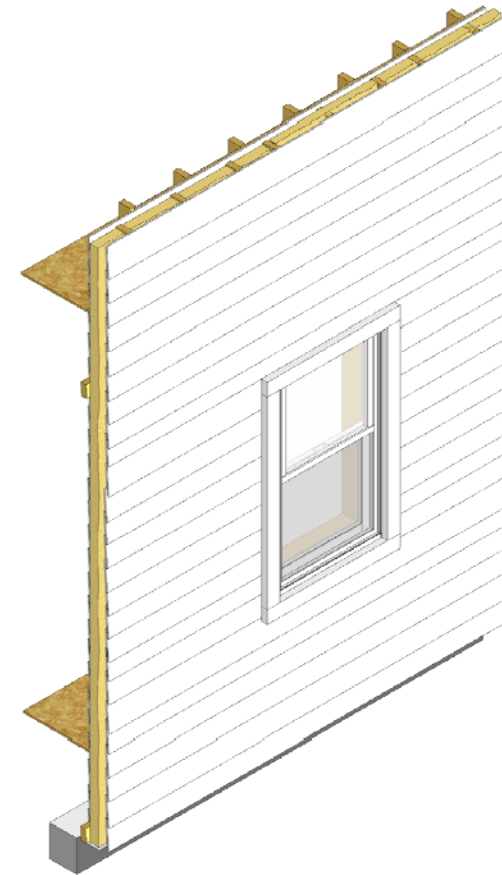
Note: Some siding profiles may require thin profile structural sheathing



Step 13



Step 14



Step 15

The logo for IBACOS, featuring the company name in a white, serif font on a dark blue background. The letters are large and bold, with a registered trademark symbol (®) to the upper right of the 'S'.

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