Closed Wall Systems: *Building with Structural Insulated Panels (SIPs)*

Systems-Built Construction 101
9:45 am – 12 noon

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Meet Your Speakers…

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Closed Wall Systems: Building with Structural Insulated Panels

Overview

Understand how SIP building envelopes are quickly and simply designed & assembled to surpass the latest 2021 energy codes to meet high-performance, net-zero energy/low carbon mandates at an affordable price – in most cases at an installed cost lower than traditional construction. Superior comfort, improved indoor air quality & occupant health are all amplified by the extremely low air leakage rates of less than 2 ACH50 down to 0.35 ACH50 putting HERS values of 45 or less and qualifying for Passive House performance within reach using less skilled labor and reduced jobsite waste.

Learning Outcomes

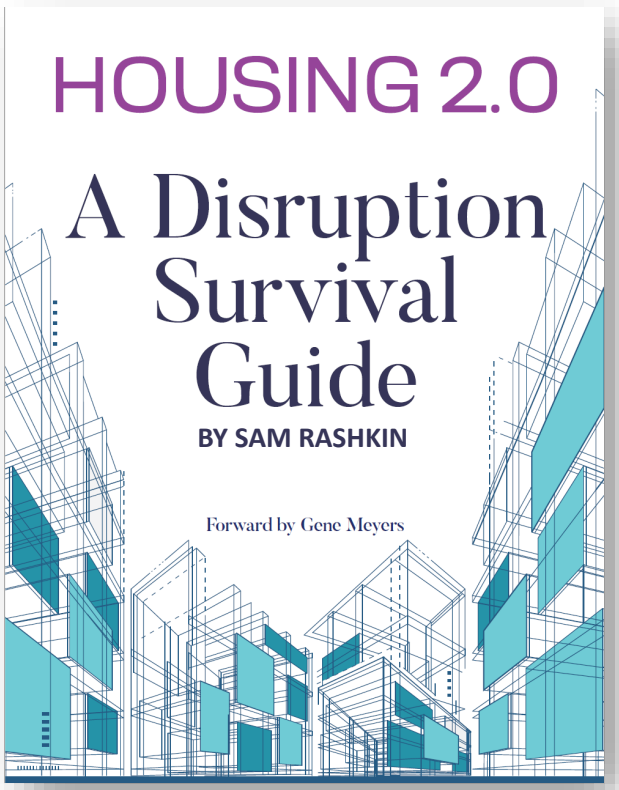
- Understand what a SIP is and how it is flexibly used for single family, multifamily, and light commercial Type 5 construction in both 180 + mph hurricane and high seismic (D,E,F) zones.

- Explore the best practice resource guides and training available to earn Registered and Master SIP Builder Certifications and design your first project confidently.

- Tour the SIP True Value Bid Interactive Tool developed by former U.S. Dept. of Energy & Zero Energy Ready Home Leader, Sam Rashkin, for the Housing 2.0 Industry practitioners that shows how SIP construction and added value is significantly less expensive than traditional high-performance construction methods.

Section Break – mid way

~ 10:45 am



Goal:

Make high-performance housing professionals UX leaders including:

- 420+ pages
- 150+ UX best practices
- 100's graphics
- 360+ citations
- 7 guest expert essays

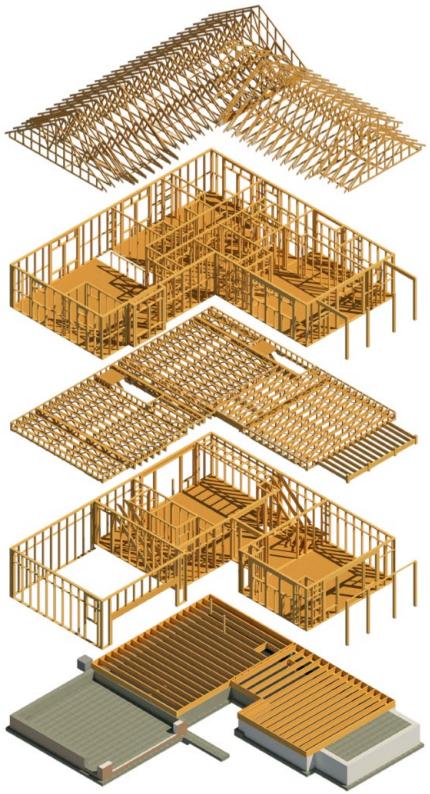
Housing 2.0 Website:

https://www.greenbuildermedia.com/housing-2.0

retooling the U.S. Housing Industry

Why 7 steps instead of 3?

SIPA



vs.

Benefits:

- Speed
- Quality
- Accuracy
- Efficiency
- Waste Reduction
- System Integration
- Machine Learning
- Automated BOM
- Automated Scheduling

retooling the U.S. Housing Industry

SIPA

150-Year-Old Framing

Typical Framing

Contrast & Experience

Contrast & Experience

Strong "Why"

Build Better with Total Protection Panels

On-time Protection:

- Less Construction Time
- Less Defects

Live Better Protection:

- Stronger Construction
- Dimensional Accuracy
- Assured Comfort
- Reduced Noise
- Reduced Pests
- Storm Resistance
- Wildfire Resistant

Power Words Build on Why

Affordability Protection:

- Lower Cost
- Ultra-Low Energy Bills
- Reduced Maintenance

retooling the U.S. Housing Industry

SIPA

EEBA

HIGH PERFORMANCE HOME SUMMIT 2022

SEPT 20 - 22 | SCOTTSDALE, AZ

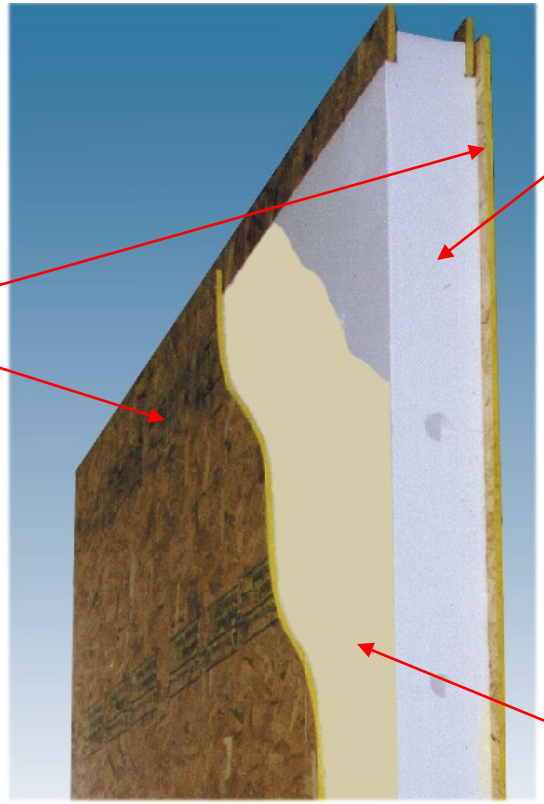
HIGH PERFORMANCE HOME ENCLOSURES: FASTER, BETTER, & CHEAPER

Sam Rashkin and Jack Armstrong

History of SIPs

Ancient Egyptians
Frank Lloyd Wright – 1930
Forest Product Labs-1935
Alden B. Dow – 1950
Timber Framing
SIPA- 1980
OSB Jumbo skins
CNC fabrication

Anatomy of a SIP



Facings

OSB

Metal

Concrete

MgO

Composite

Rigid Insulation

Expanded Polystyrene (EPS)
or
Polyurethane (PU)
Or
Extruded Polystyrene (XPS)

Structural Adhesive

Floors

- *A Superior Building Product for Floors*
  - *Floors that are pre-insulated*
  - *Efficient over unconditioned garages*
  - *Floors that will not squeak*

Walls

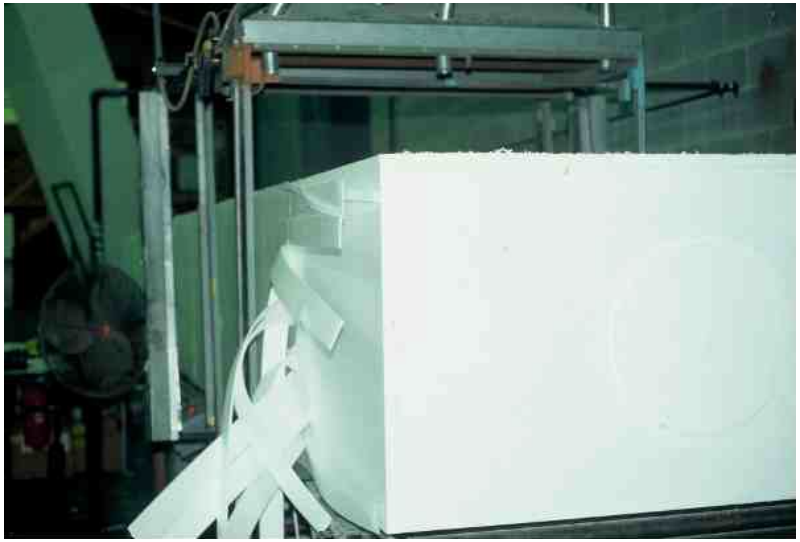
- *A Superior Building Product for Walls:*
  - *Fast*
  - *Control over materials and labor*
  - *Solves problems prior to construction*
  - *Straighter and truer walls*
  - *Tighter construction*

Roofs

- *A Superior Building Product for Roofs*
  - *Cathedral and vaulted ceilings*
  - *Much faster dry-in*
  - *Shed roof designs*
  - *Open vaulted hip roofs*
  - *Greater spans*
  - *Pre-insulated*
  - *Engineered*

Manufacturing (EPS)

Manufacturing (EPS)



Lamination

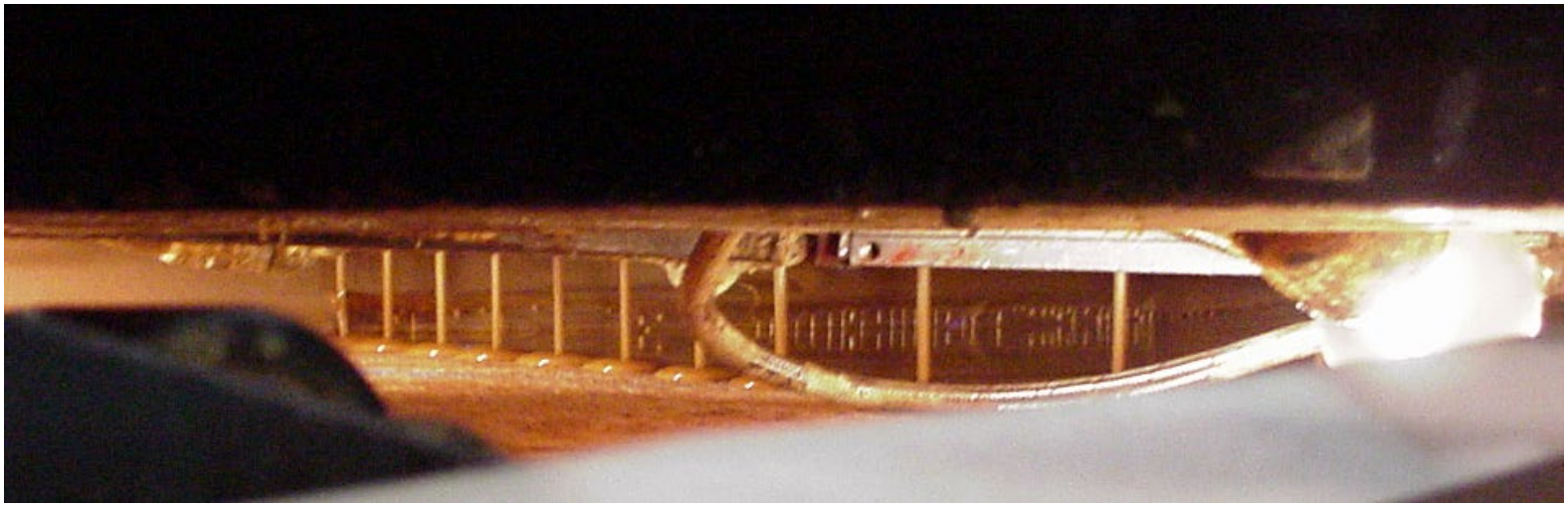
Pneumatic Pod Press

Other press options include:

- Vacuum
- Hydraulic
- Nip Roller

Urethane manufacturing

Urethane manufacturing



Nozzle injecting two-part foam inside the press

Urethane manufacturing

EPS vs. PU vs. XPS

- R-Value
- Compressive Strength
- Perm ratings
- Fire Resistance
- Available sizes and thickness
- Butt joint (EPS)
- Bug proof

4 by VS Jumbo

- Sizes
- Fit to design
- Right for site
- Material Handling
- Philosophy of a tight structure
- # of lifts

OSB vs. Metal vs. Cement

- moisture
- Ease of assembly
- Field modifications
- Finish material
- Fire
- Termites
- Size of panel
- Weight of panel

Blank SIPs

- Waste
- Inefficient
- Design concerns
- Messy jobsite
- Time
- Tool investment
- Flexible to site conditions

Pre-cut SIPs

- Cost
- Lead time
- Panel layout drawings
- Allocation drawings
- Loading/ shipping concerns

Ready to Assemble

- Edge treatment
- Pre-cut lumber
- Pre-install lumber
- Pre-assemble components

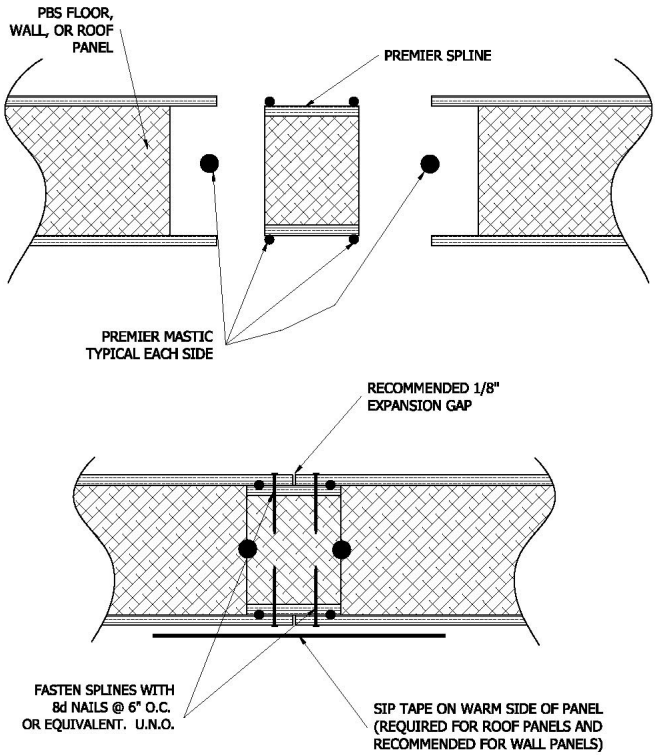
Automation vs. Hand Cutting

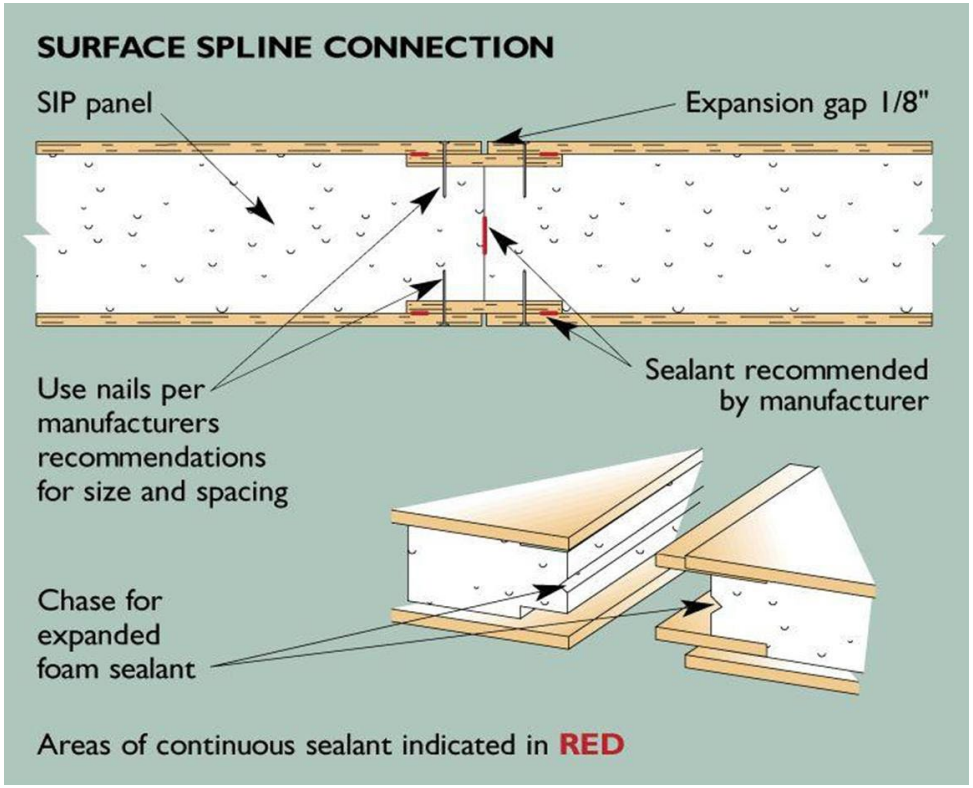
Automated Cutting (CNC)

Stiles

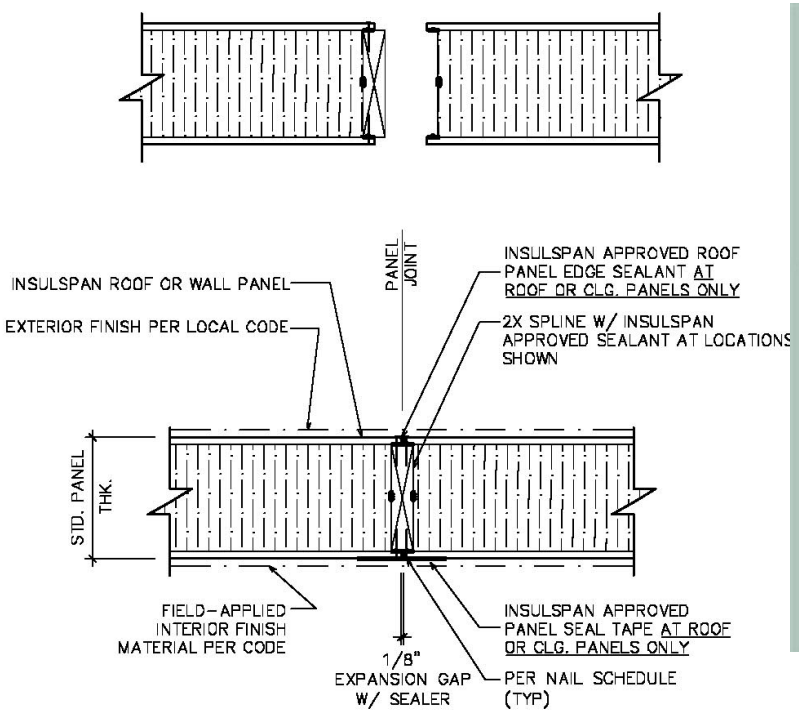
Hundegger

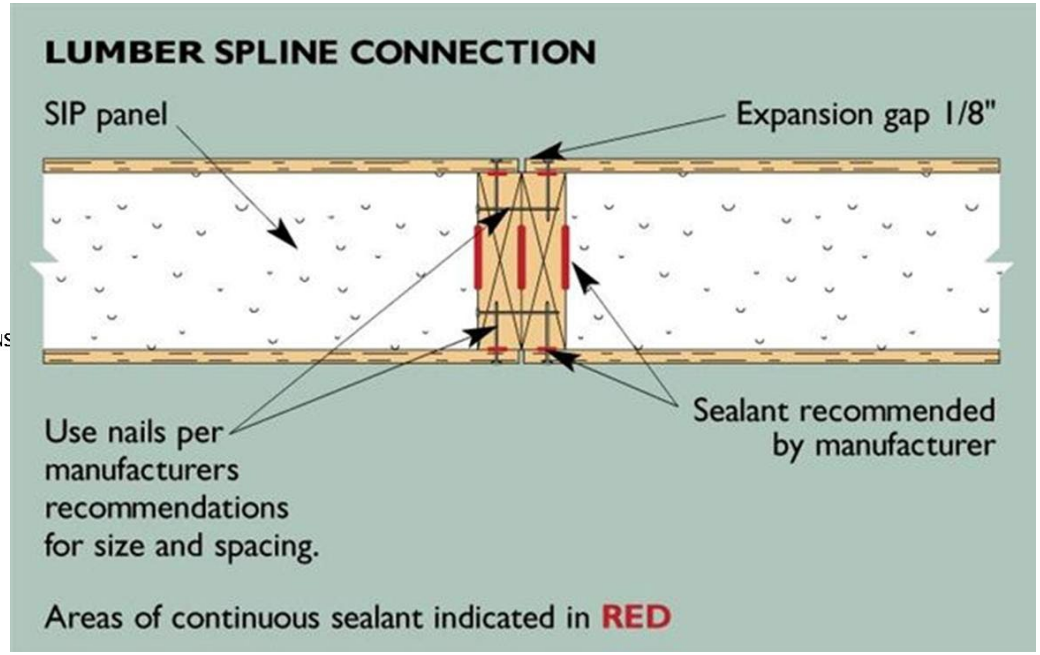
OSB/Plywood Spline Connection



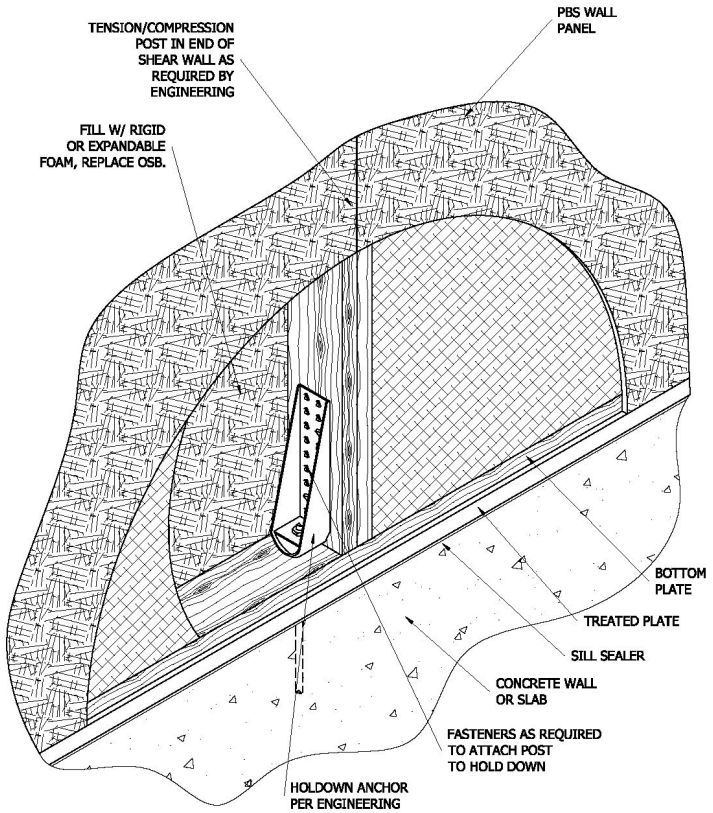


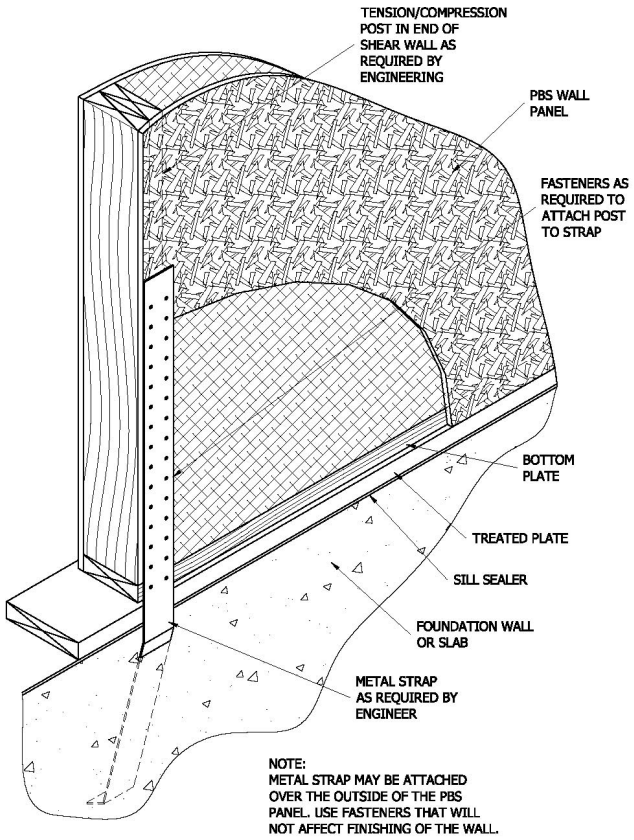
Lumber/EWP Spline Connection





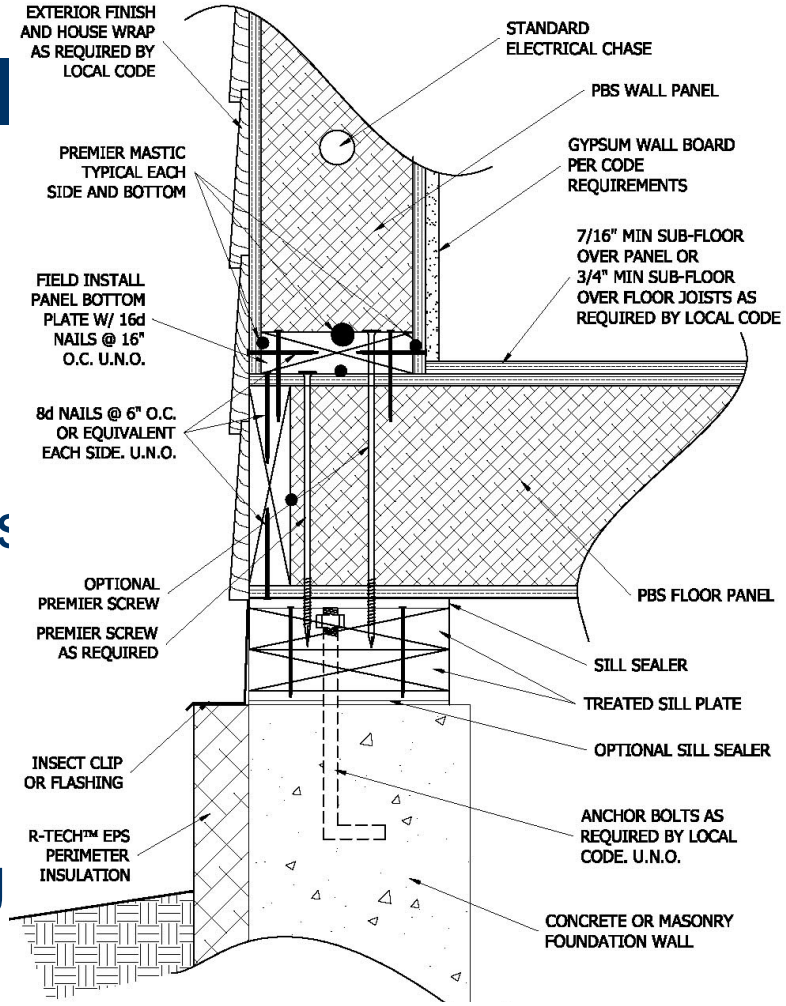
Hold Down Connections



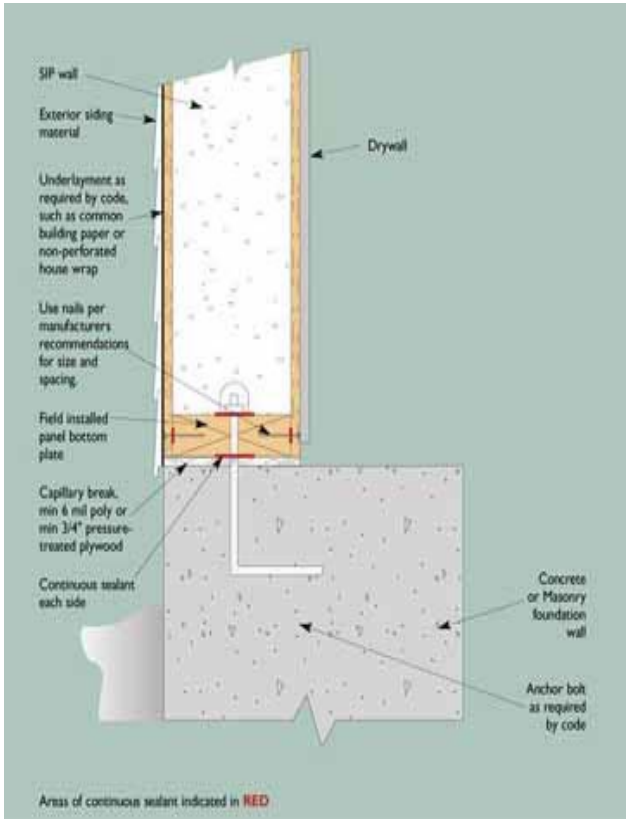


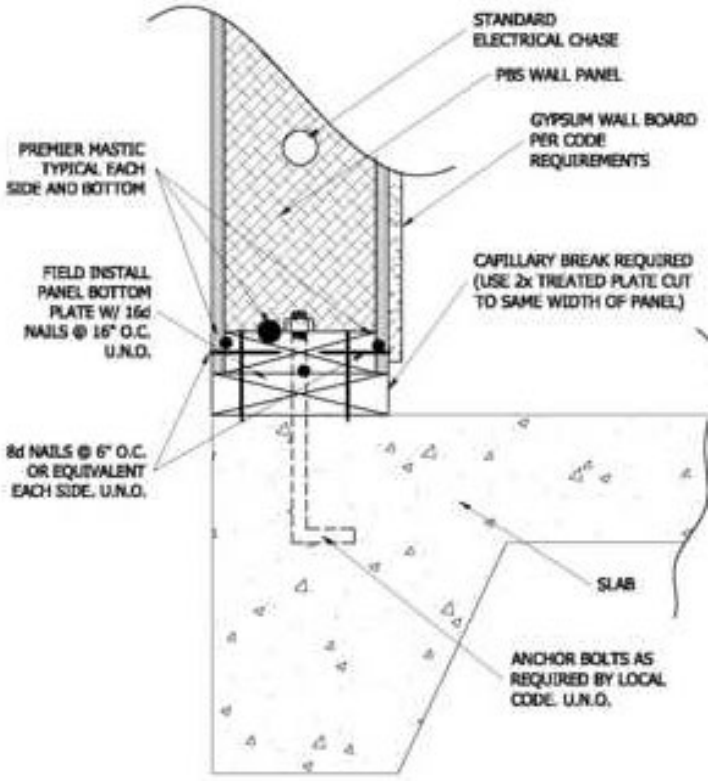
Floor SIPs

- Span determines thickness
- Substructure/girder system
- Foundation connections
- Second layer of sheathing
- Utility runs
- Proper weather sealing

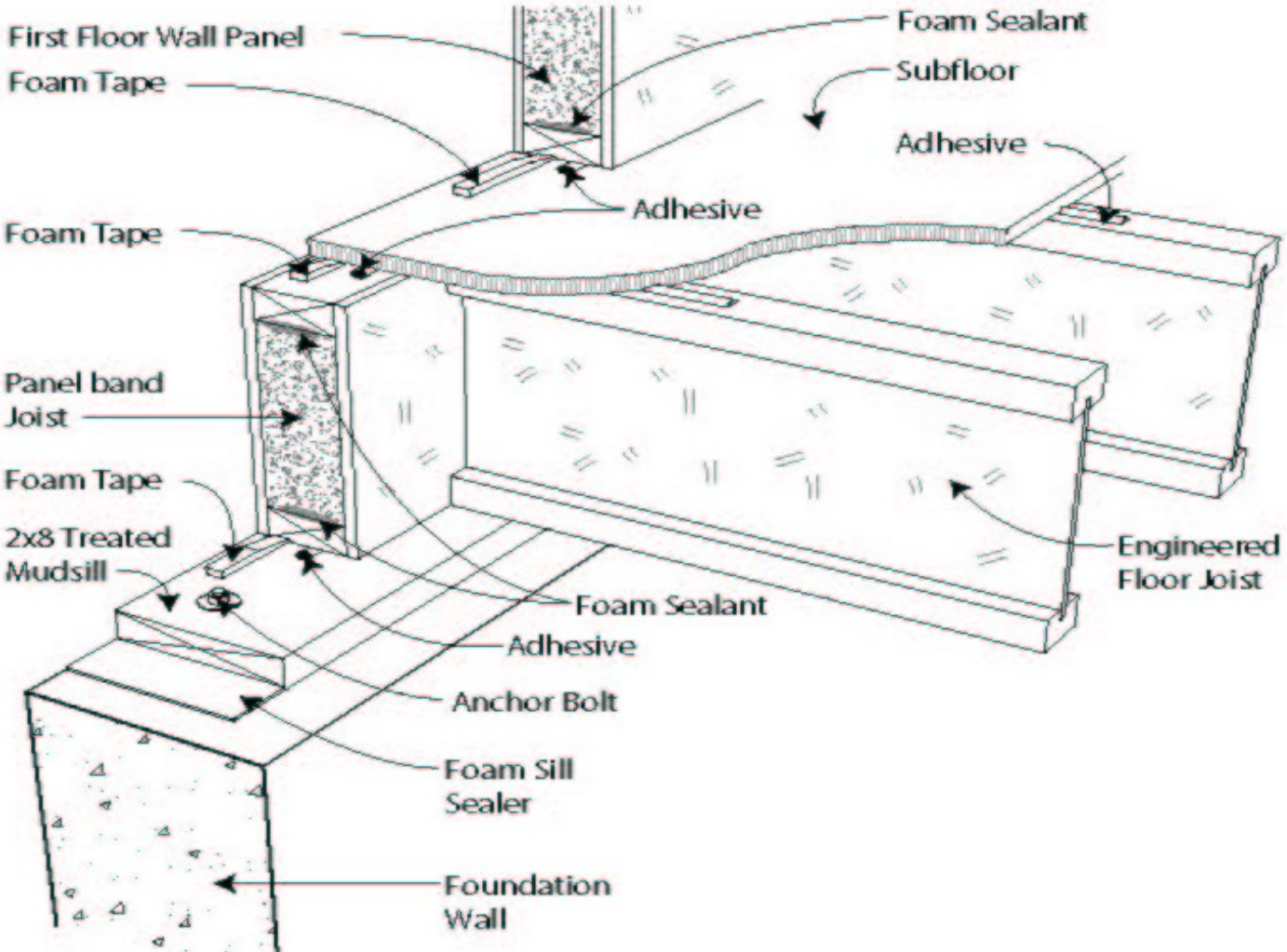


Wall to Floor Connection

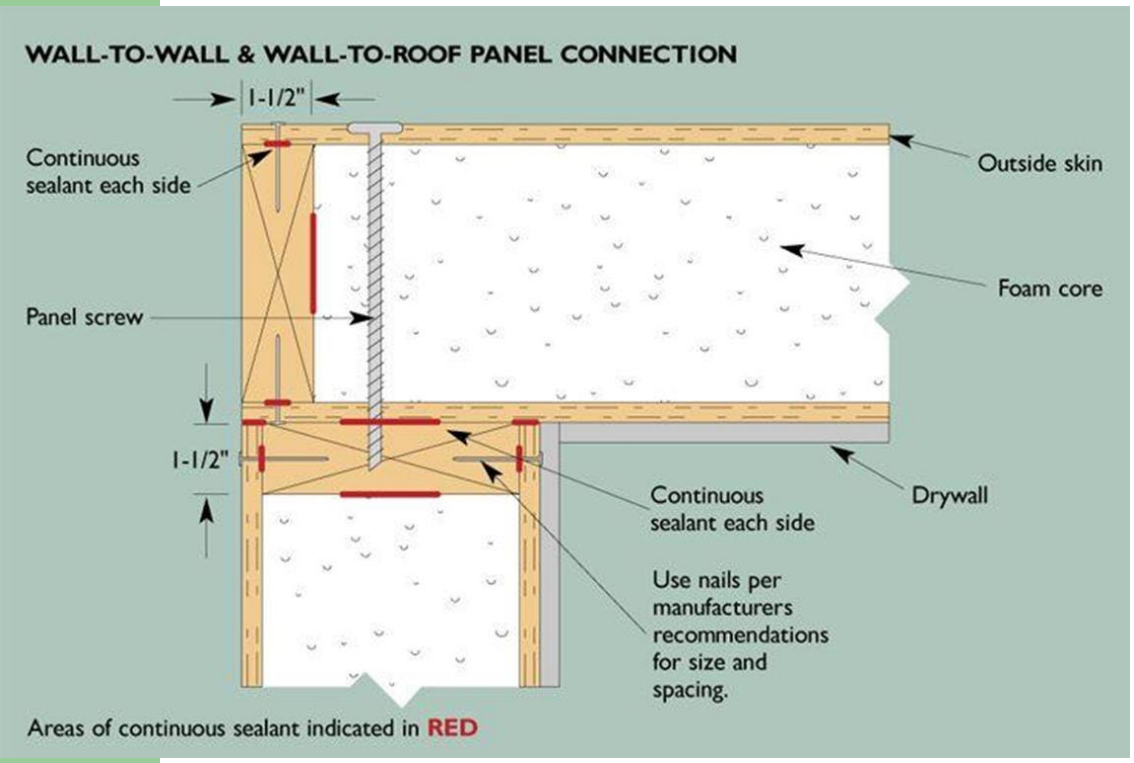


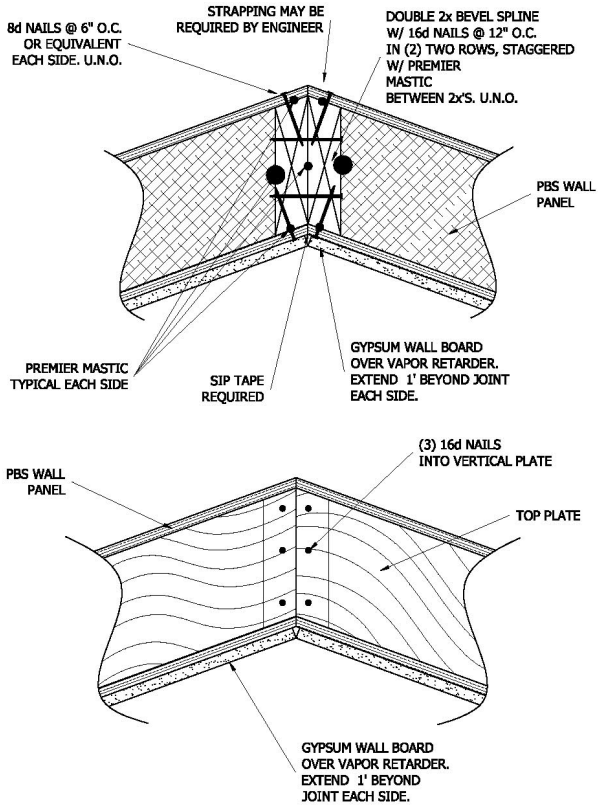


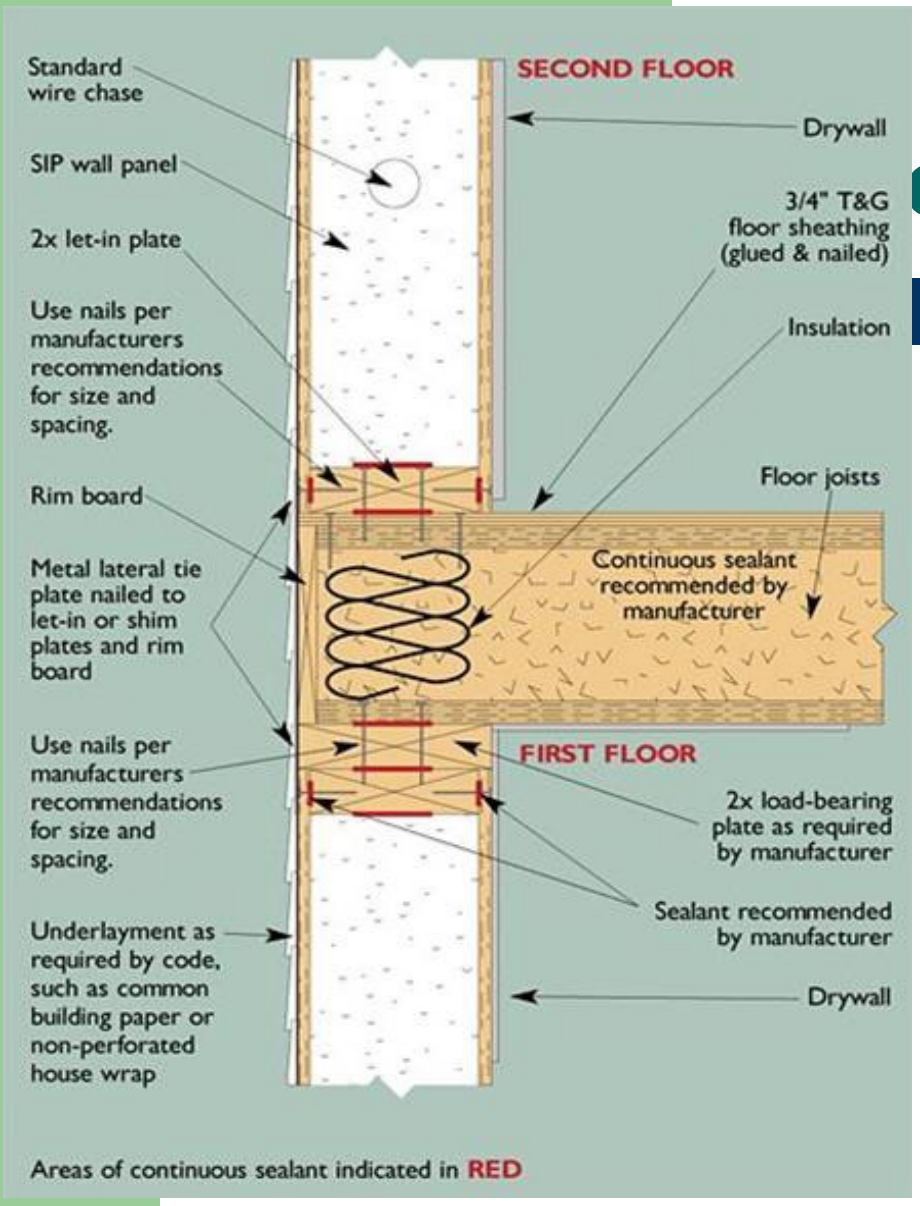
Insulated Rim SIP

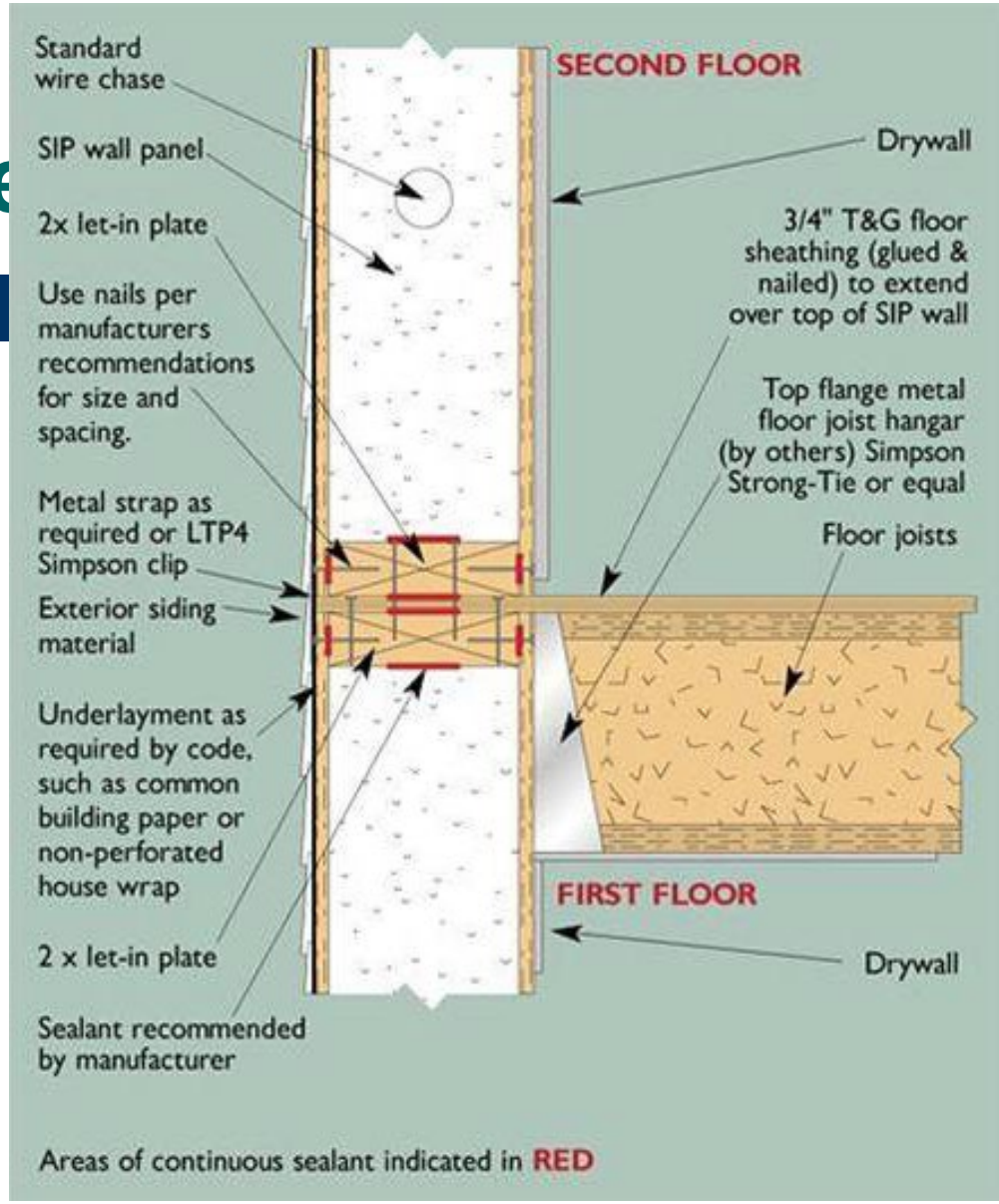


Wall Corner Connections

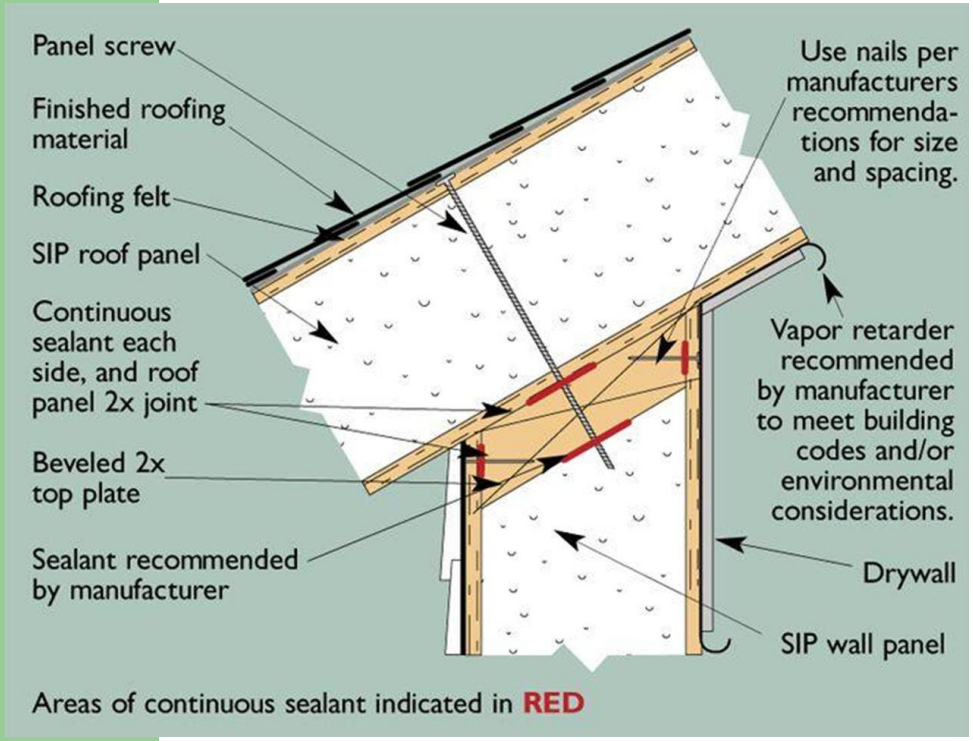





Standard wire chase
SECOND FLOOR
Drywall
SIP wall panel
3/4" T&G floor sheathing (glued & nailed)
2x let-in plate
Insulation
Use nails per manufacturers recommendations for size and spacing.
Floor joists
Rim board
Continuous sealant recommended by manufacturer
Metal lateral tie plate nailed to let-in or shim plates and rim board
FIRST FLOOR
Use nails per manufacturers recommendations for size and spacing.
2x load-bearing plate as required by manufacturer
Sealant recommended by manufacturer
Underlayment as required by code, such as common building paper or non-perforated house wrap
Drywall
Areas of continuous sealant indicated in RED


Standard wire chase
SECOND FLOOR
SIP wall panel
Drywall
2x let-in plate
3/4" T&G floor sheathing (glued & nailed) to extend over top of SIP wall
Use nails per manufacturers recommendations for size and spacing.
Top flange metal floor joist hangar (by others) Simpson Strong-Tie or equal
Floor joists
Metal strap as required or LTP4 Simpson clip
Exterior siding material
Underlayment as required by code, such as common building paper or non-perforated house wrap
FIRST FLOOR
2 x let-in plate
Drywall
Sealant recommended by manufacturer
Areas of continuous sealant indicated in RED

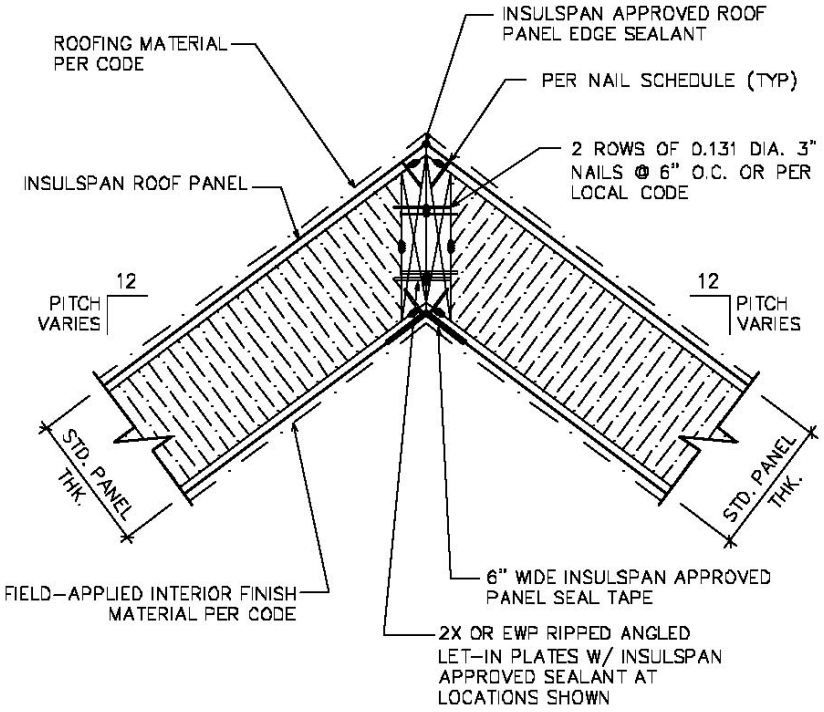
Bevel Cut Top of Wall

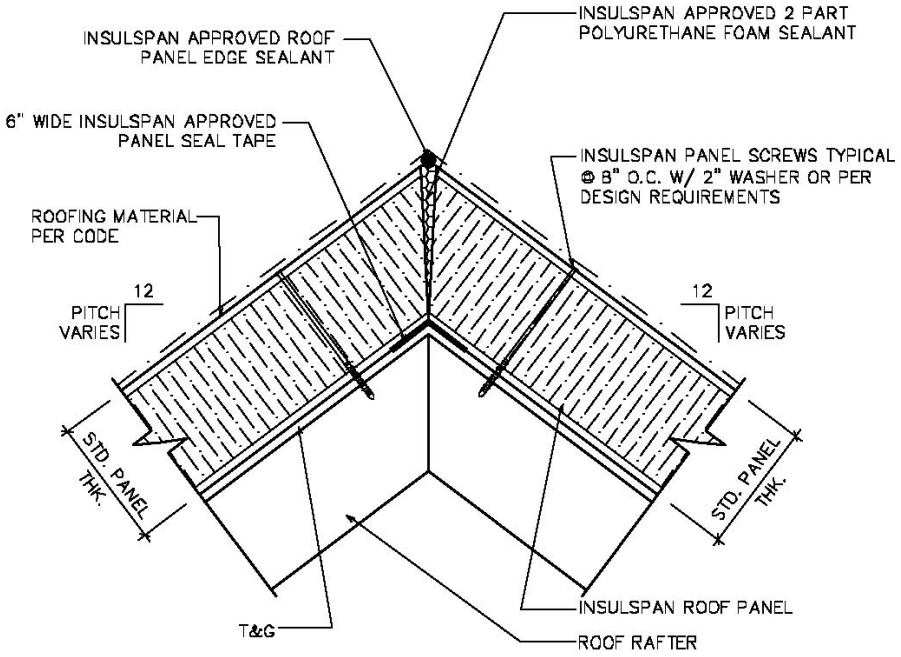


Roof SIP Support

- Single Ridge Beam
- Cantilevered Ridges
- Purlin/Mid-span
- Bearing Walls
- Timber Rafters
- Timber Trusses
- Plated Trusses

Ridge Details





Installation Basics

- Crew Size
- Tools
- Training

Tools of the Trade

Equipment Requirements

- Crane
- Forklift
- Hand-Set

Site management

Rigging Wall Panels

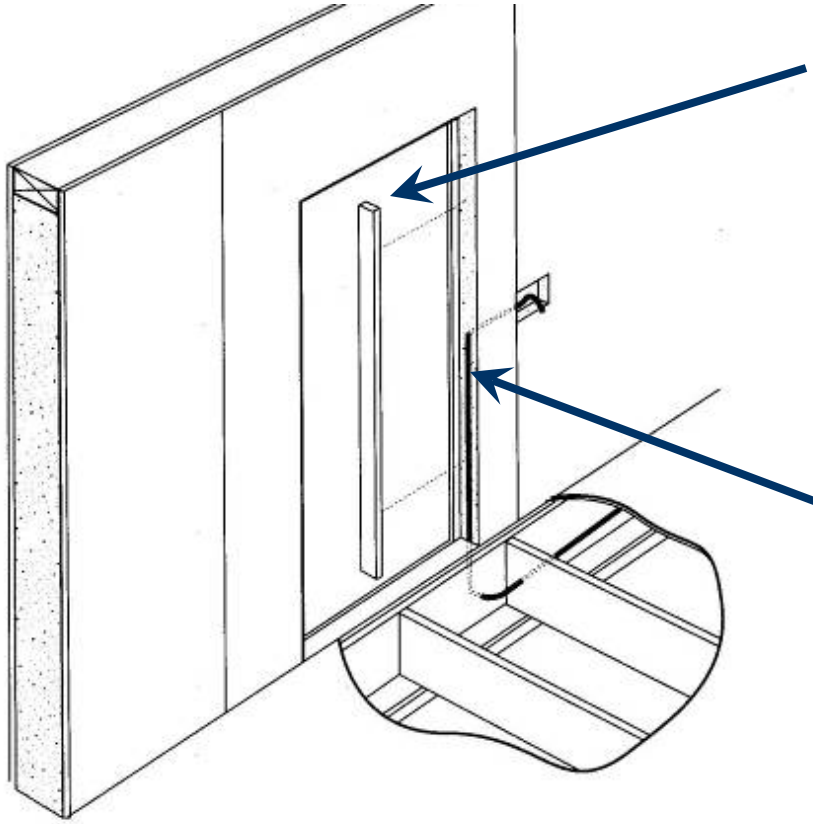
Pre-assembly

Pre-assembly


JERSEY
CONTRACTORS


JERSEY

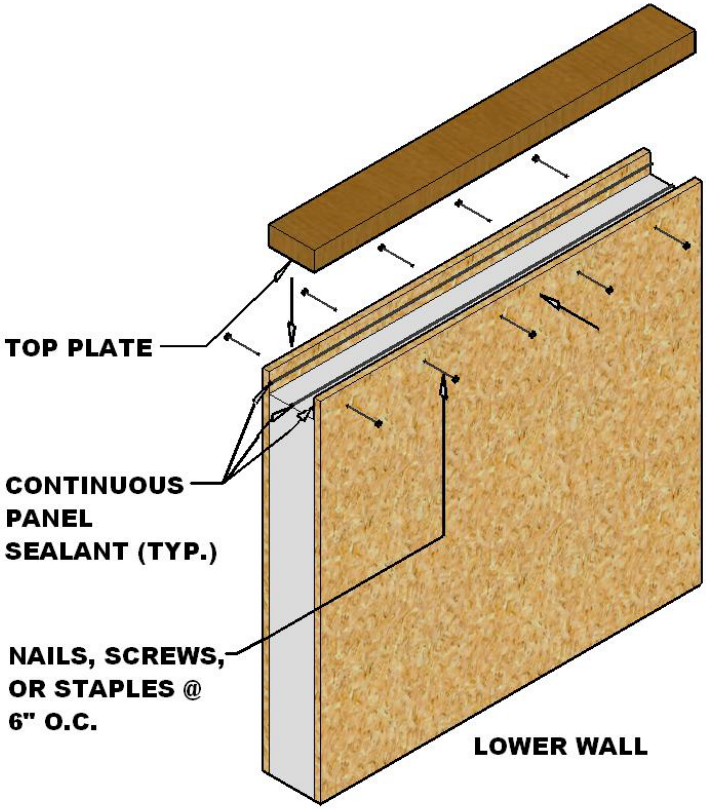
Electrical

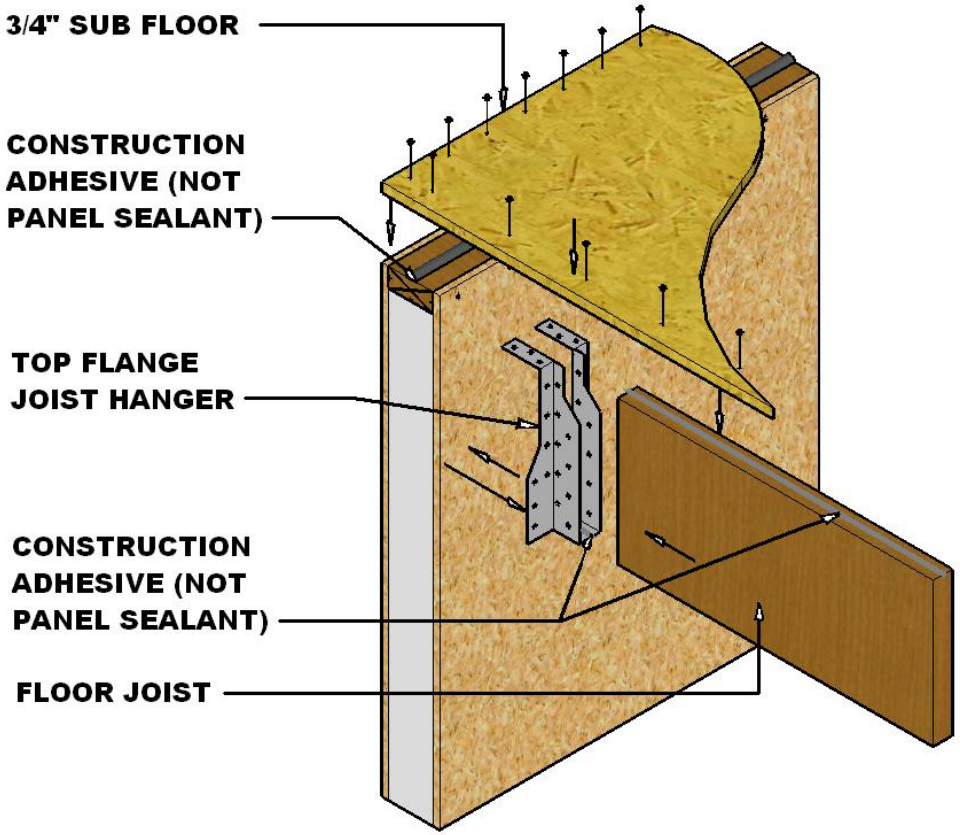


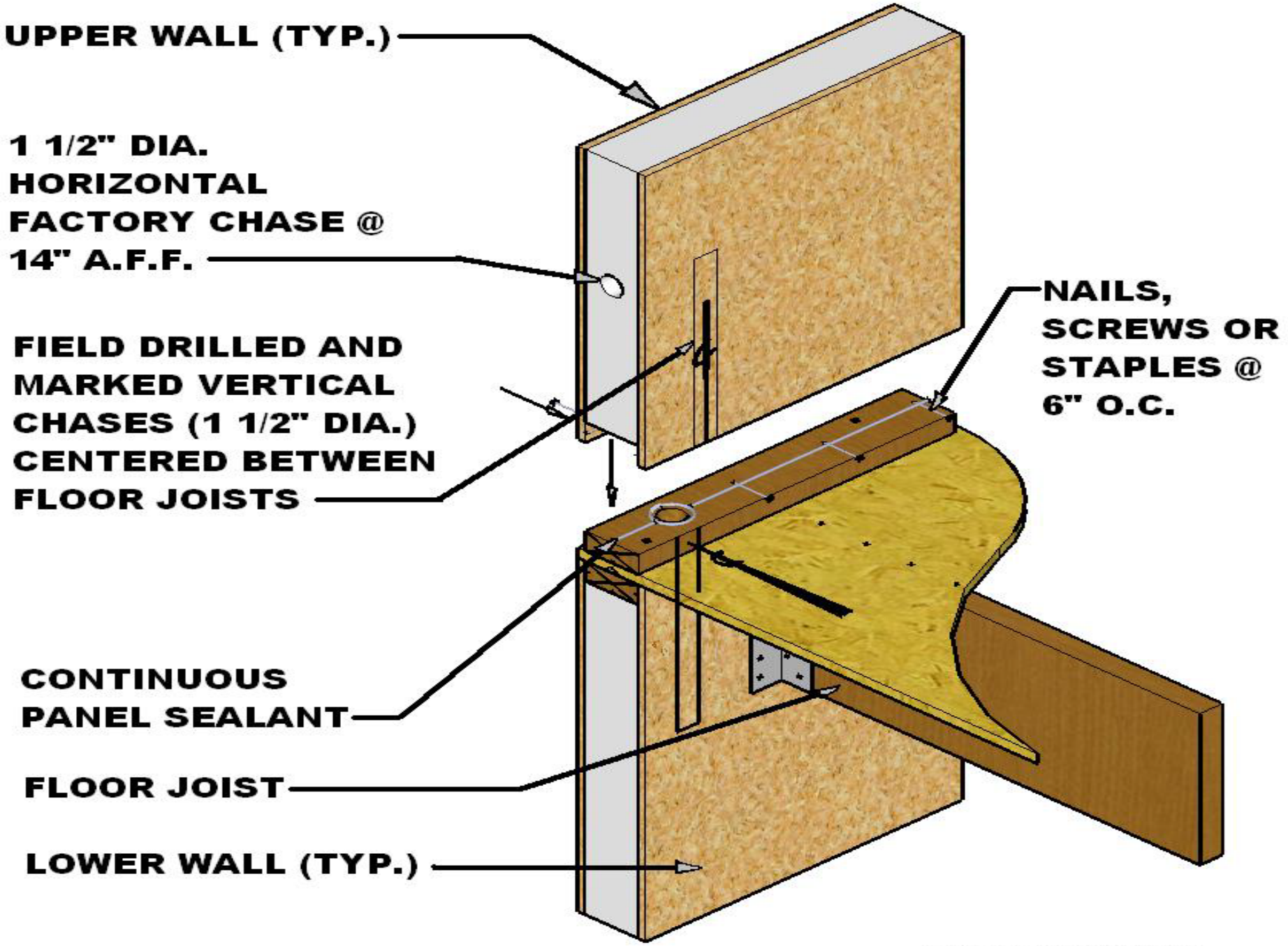
Door buck left out for electrical access

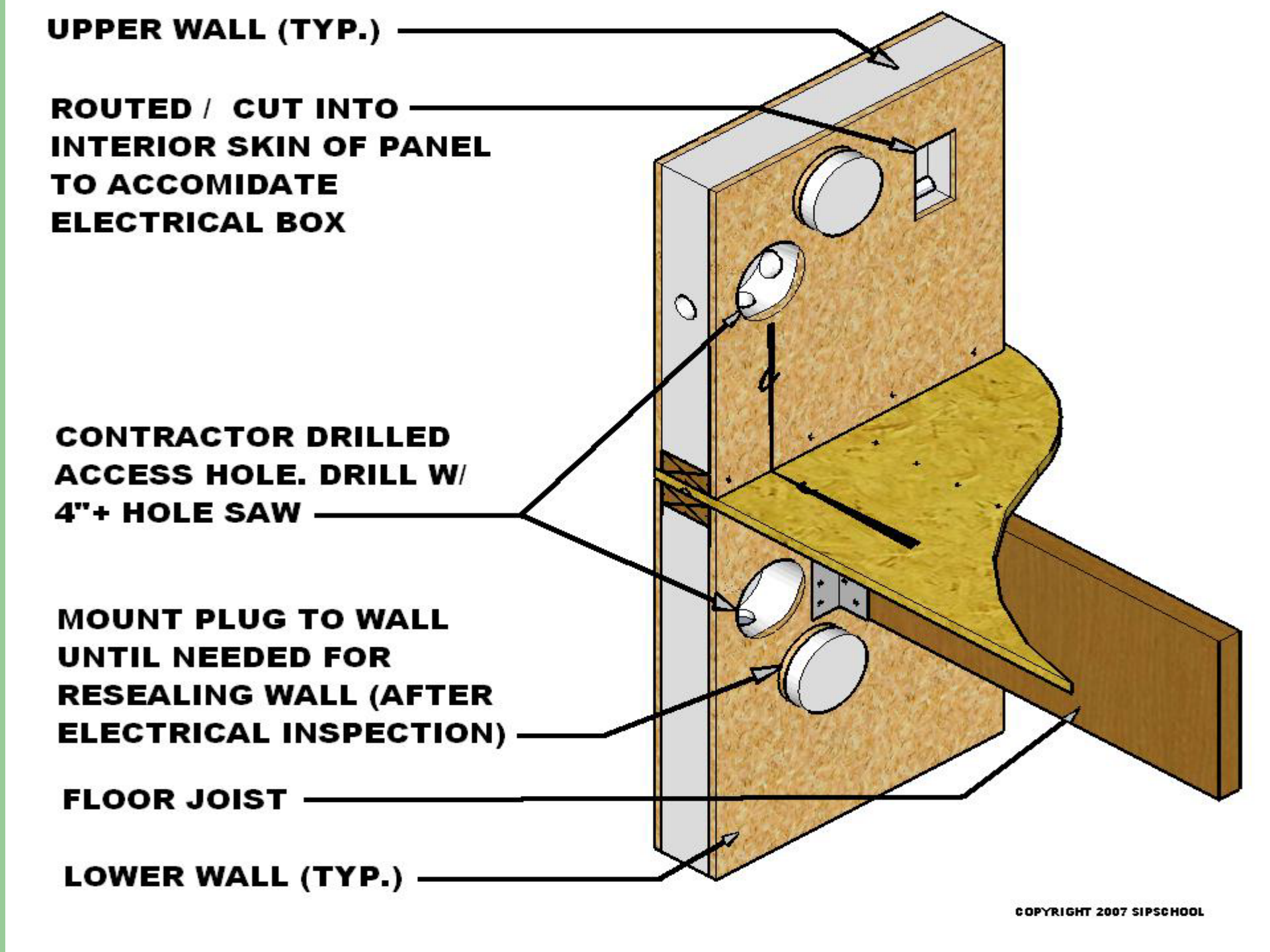
Route foam behind buck for wire raceway

Electrical between floors





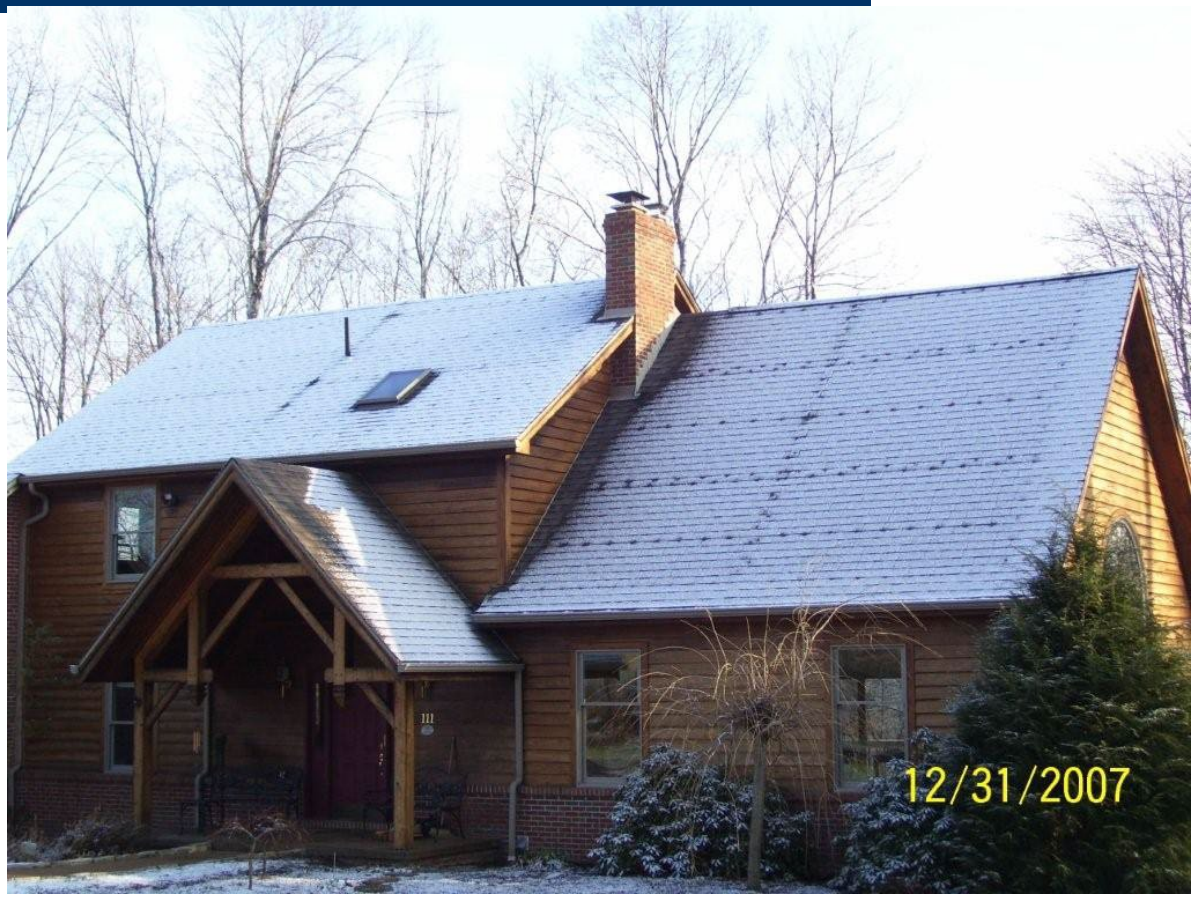



UPPER WALL (TYP.)
ROUTED / CUT INTO INTERIOR SKIN OF PANEL TO ACCOMIDATE ELECTRICAL BOX
CONTRACTOR DRILLED ACCESS HOLE. DRILL W/ 4"+ HOLE SAW
MOUNT PLUG TO WALL UNTIL NEEDED FOR RESEALING WALL (AFTER ELECTRICAL INSPECTION)
FLOOR JOIST
LOWER WALL (TYP.)
COPYRIGHT 2007 SIPSCHOOL

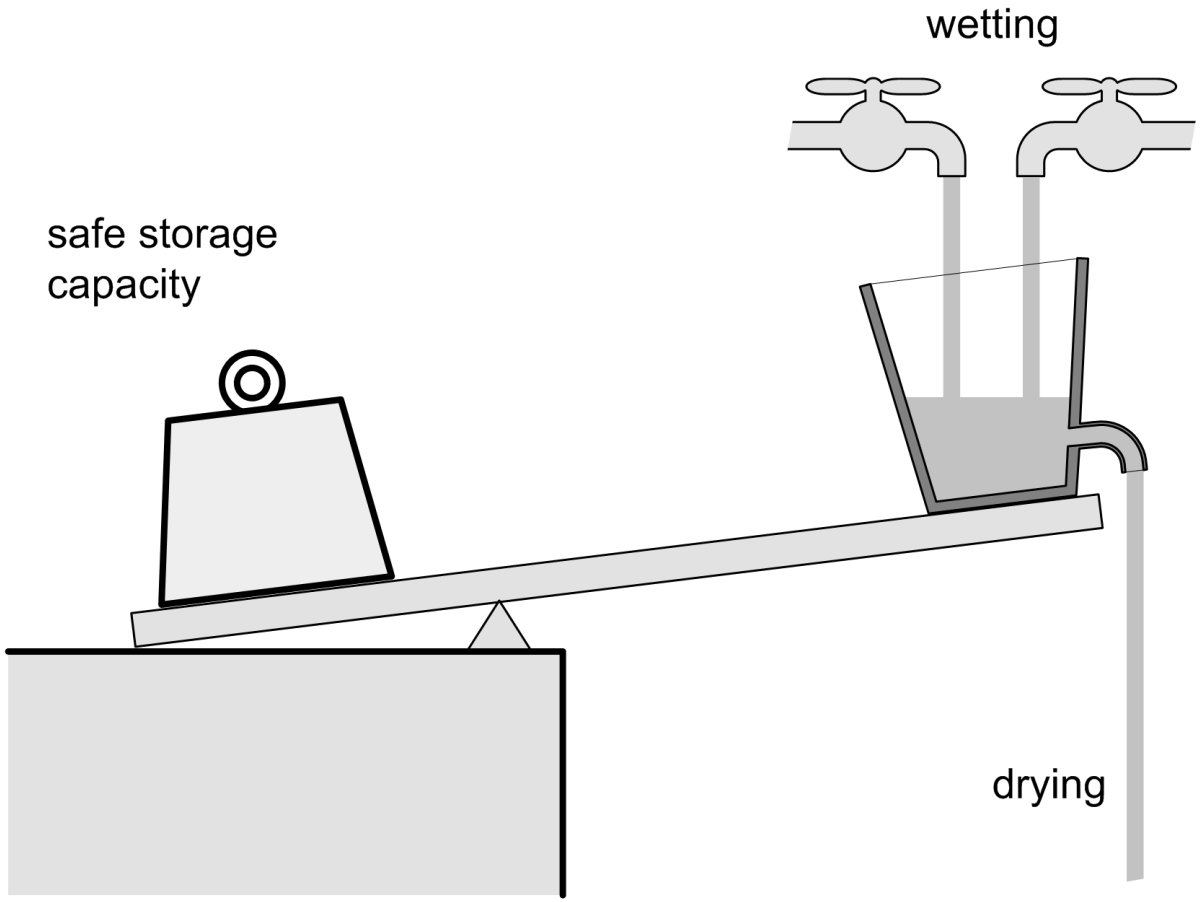
No Sparky- Bad Boy

Roof Venting

- Cold roof
  vs.
  Hot Roof
- Dry roof
  vs.
  Wet Roof



Wetting Vs. Drying



Diagonal lath under metal

Back-ventilating

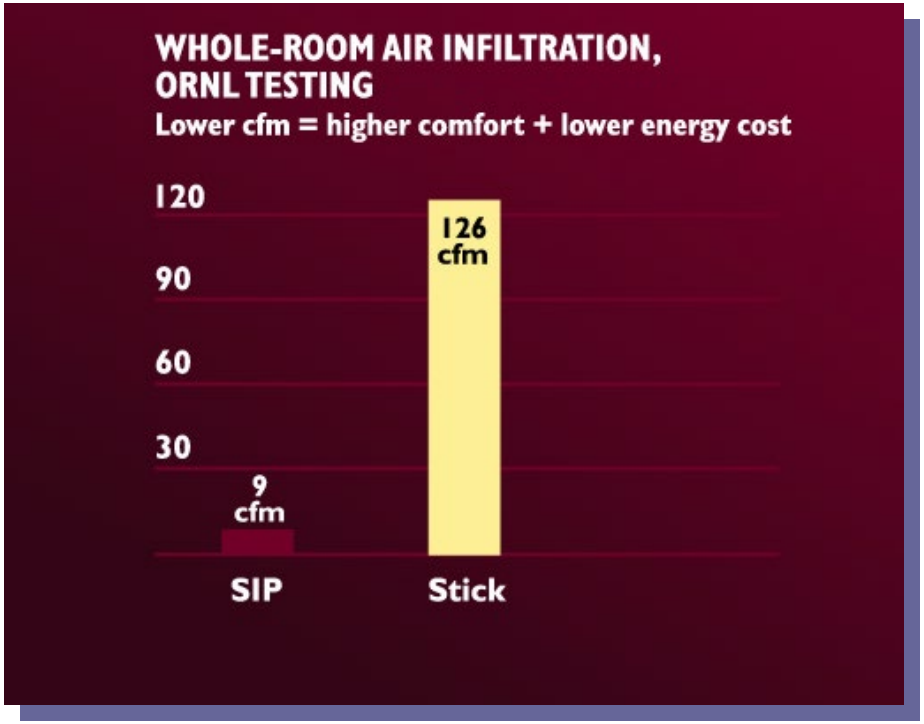
Shingle ridging

- Heat
- Moisture
- Substrate movement

Philosophy of a Tight Structure

- Tight Structures Reduce
  - Drafts
  - Noise
  - Dust
  - Outdoor air pollutants
- Improperly Ventilated Structures Lead to
  - Poor Indoor Air Quality (IAQ)
  - Moisture Problems
  - Mold
  - Occupant Illness

Oak Ridge National Laboratory Studies



"SIP test room is 15 times tighter"

2 part foaming

- Froth Pak
- Fomo
- Temperature sensitive
- Off ratio problems

Single component foaming

- Requires moisture to cure
- Inexpensive
- Fills 1” max gaps

HVAC Analysis

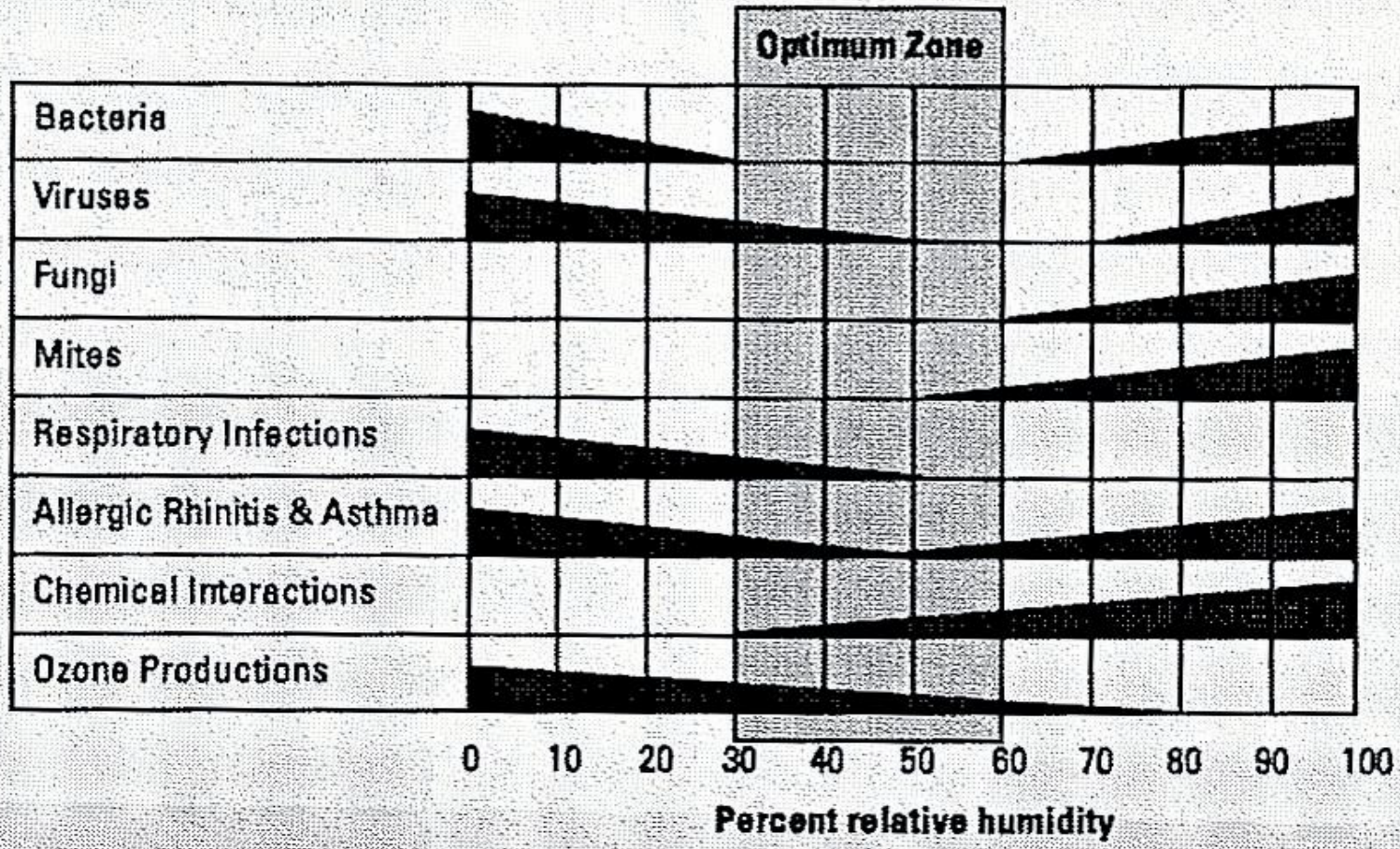
- Proper Equipment Sizing
  - Prevents short-cycling
  - Contributes to a durable structure
  - Occupant health
  - Affordable to operate
- BTU Requirements
  - Heating and cooling
- Room by Room Air Distribution
- Low infiltration vs. high R-value

HVAC Design

- Duct leakage
- Equipment in conditioned space
- Supply duct location
- Ventilation (make-up air)
  - Purposeful
  - Introduce “fresh” outdoor air through return ducts to be filtered/conditioned prior to delivery
  - Remove polluted air with kitchen and bathroom fans controlled by humidistats

Optimum relative humidity range to minimize harmful contaminants

(a decrease in bar height indicates a decrease in effect for each of the items)



Source: ASHRAE, Adapted from Sterling et al., 1985

Data released by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) demonstrates that keeping relative humidity in the optimum humidity zone limits the effects of many unwanted conditions.

Blower Door & Duct Blast Test

HRV vs. ERV

Heat recovery ventilator
Recovers heat

Energy recovery ventilator
Recovers moisture via desiccant wheel

How do SIPs compare in cost to Stick Framing?

- More
- Less
- Same
- All of the above

What is the performance standard?

- Energy Performance Standard
- Less than MEC
- MEC
- Energy Star 30%>MEC
- Energy Star Plus 50%>MEC
- Zero Energy Buildings ZEB

retooling the U.S. Housing Industry

SIPA

Communicating HPH Innovation: SIPA True Cost Bidding Tool

Still doing it the *OLD* way?

SIPs Innovation: Effectively Translate Value

150-Year-Old Framing

Typical Framing

Build Better with Total Protection Panels

On-time Protection:

- Less Construction Time
- Less Defects

Live Better Protection:

- Stronger Construction
- Dimensional Accuracy
- Assured Comfort
- Reduced Noise
- Reduced Pests
- Storm Resistance
- Wildfire Resistant

Power Words Build on Why

Affordability Protection:

- Lower Cost
- Ultra-Low Energy Bills
- Reduced Maintenance

SIPs True Cost Bidding Tool

Cost Assumptions:	Metrics:	Source
Carrying Cost per day of construction	$ 400	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
Percent Cost Savings Installing Drywall w/SIPS	2%	Estimate
Pecent Cost Savings Installing Cabinets w/SIPs	1%	Estimate
Percent Cost Savings Installing Trim w/SIPS	1%	Estimate
Framing Waste in # Dumpsters Per 1,000 Sq. ft.	2.0	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
SIPs Waste in # Dumpsters Per 1,000 Sq. ft.	0.67	SIPA Meeting
Cost Per Dumpster	$ 500	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
Cost of Schematics for Optimizing MEP with SIPs	$ 1,000	

SIPs Added Value Assumptions:	Metrics:	Source
Base Price of Home	$ 450,000	Builder
Conditioned Square Feet of Home	2000	Builder
Retail Cost per Sq. Ft. Above-Grade Condtioned space	$ 250	Builder
Retail Cost per Sq. Ft. Below-Grade Condtioned space	$ 130	Builder
Additional Conditioned Square Feet with Thinner Walls	25	Take-Off
Sq. Ft. of SIP Attic Traded Off for Basement	0	Take-Off
Additional Conditioned Square Feet with SIP Attic	0	Take-Off
Annual Home Insurance Cost	$ 1,200	Insurance Company

Summary: SIPs Savings/Value vs. Conventional Framing

Cost Savings	Added Value	Total
$ 13,175	$ 13,000	$ 26,175

This cost comparison is based on an actual bid for SIPs and estimated costs for conventional framing based on standard cost data available. Work with your SIPs sales rep to integrate actual bids for conventional framing to get a more precise comparison for your project.

Stairs	$950	$950		
Attic Venting	$750	$750		
Concrete Foundation - Material and Labor	$12,000	$12,000		
Insulation	**$7,304**	**$0.00**	**4.0**	**0.0**
Wall - Cavity	$7,304	$0		
Wall - Rigid	$0	$0		
Attic Ceiling	$0	$0		
Band Joists	$0	$0		
Air Flow Control	**$2,750**	**$1,350**	**3.0**	**1.0**
Air Barriers	$1,000	$700		
Air Sealing	$1,500	$400		

Higher Appraisals to Base Price	$ 450,000	$0
Reduced Home Insurance Annual Insurance Cost	$ 1,200	$0
Additional Square Footage with Thinner Walls	25	$6,250
Sq. Ft. of SIP Attic Traded Off for Basement	0	$0
Additional Conditioned Space with SIP Attic	0	$0
45 L Tax Credit		$0
Utility Rebate		$0
30-year Energy Savings		$0

SIPs True Cost Bidding Tool

Cost Assumptions:	Metrics:	Source
Carrying Cost per day of construction	$ 400	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
Percent Cost Savings Installing Drywall w/SIPS	2%	Estimate
Pecent Cost Savings Installing Cabinets w/SIPs	1%	Estimate
Percent Cost Savings Installing Trim w/SIPS	1%	Estimate
Framing Waste in # Dumpsters Per 1,000 Sq. ft.	2.0	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
SIPs Waste in # Dumpsters Per 1,000 Sq. ft.	0.67	SIPA Meeting
Cost Per Dumpster	$ 500	Cost of Quality, Glenn Cottrell w/IBACOS - $500 - $800/day
Cost of Schematics for Optimizing MEP with SIPs	$ 1,000	
HVAC Cost Difference for SIPs vs. Conventional Framing	$0	Assume "$0" but Enter a Cost from Builder
Electric Cost Difference for SIPs vs. Conventional Framing	$0	Assume "$0" but Enter a Cost from Builder
Plumbing Cost Difference for SIPs vs. Conventional Framing	-$500	Assume "-$1,000" with Optimized Schmatics, but Enter Builder Cost

SIPs Added Value Assumptions:	Metrics:	Source
Base Price of Home	$ 450,000	Builder
Conditioned Square Feet of Home	2000	Builder
Retail Cost per Sq. Ft. Above-Grade Condtioned space	$ 250	Builder
Retail Cost per Sq. Ft. Below-Grade Condtioned space	$ 130	Builder
Additional Conditioned Square Feet with Thinner Walls	25	Take-Off
Sq. Ft. of SIP Attic Traded Off for Basement	0	Take-Off
Additional Conditioned Square Feet with SIP Attic	0	Take-Off
Annual Home Insurance Cost	$ 1,200	Insurance Company
Discounted Home Insurance with SIPS (%)	0%	Insurance Company
Higher Appraisal Value (%)	0.0%	Al Cobb Study
Value of Greater Resilience (e.g., Impact, Wind, Earthquake) (%)	1.0%	Estimate
Value of Greater Strength/Dimensional Accuracy (%)	0.5%	Estimate
45 L Tax Credit	$ -	IRS Language
Utility Rebate	$ -	Local Utility where available
30-year Energy Savings (from HERS report x 0.7)	$ -	HERS Report x 0.7 correction for 2006 IECC baseline

Application: SIP Walls Only, Basement	Costs		# Days	
Scope of Work	Framing	SIPs	Framing	SIPs
TOTAL	$182,065	$168,890	31.0	14.9
Structure	**$120,811**	**$129,947**	**12.0**	**5.0**
SIP Panels - Material and Labor	$0	$34,121		
Framing - Material	$46,756	$26,271		
Framing - Labor	$20,050	$15,550		
Floor Framing/Trusses - Material	$6,000	$6,000		
Raised-Heel Roof Trusses - Material	$8,400	$8,400		
Beams	$4,981	$4,981		
Exterior Trim - Materials	$13,524	$13,524		
Exterior Trim - Labor	$7,400	$7,400		
Stairs	$950	$950		
Attic Venting	$750	$750		
Concrete Foundation - Material and Labor	$12,000	$12,000		
Insulation	**$7,304**	**$0.00**	**4.0**	**0.0**
Wall - Cavity	$7,304	$0		
Wall - Rigid	$0	$0		
Attic Ceiling	$0	$0		
Band Joists	$0	$0		
Air Flow Control	**$2,750**	**$1,350**	**3.0**	**1.0**
Air Barriers	$1,000	$700		
Air Sealing	$1,500	$400		

Summary: SIPs Savings/Value vs. Conventional Framing		
Cost Savings	Added Value	Total
$ 13,175	$ 13,000	$ 26,175

This cost comparison is based on an actual bid for SIPs and estimated costs for conventional framing based on standard cost data available. Work with your SIPs sales rep to integrate actual bids for conventional framing to get a more precise comparison for your project.

SIPs Improved User Experience	Metric	Value
Total Added Value		$ 13,000
Stronger/More Dimensionally Accurate Enclosure	$ 450,000	$2,250
Greater Resilience to Fire, Wind, Impact, Pests	$ 450,000	$4,500
Higher Appraisals to Base Price	$ 450,000	$0
Reduced Home Insurance Annual Insurance Cost	$ 1,200	$0
Additional Square Footage with Thinner Walls	25	$6,250
Sq. Ft. of SIP Attic Traded Off for Basement	0	$0
Additional Conditioned Space with SIP Attic	0	$0
45 L Tax Credit		$0
Utility Rebate		$0
30-year Energy Savings		$0

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