



High Performance Homes

A Simpler Design Strategy

Presented By:
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Fox Blocks Regional Advisor



Objectives:

Identify the complexity in the assembly of wood framed walls to meet current and future high-performance standards.

Review the impact of thermal bridging versus thermal mass to achieve an efficient passive design strategy for sustained indoor comfort in all climate zones

This presentation will identify the building science and practical advantages of Fox Blocks insulated concrete forms for health, safety and comfort as a quality solution for your business, and your clients, in building a high-performance home, simply and more efficiently.

Defining High-Performance

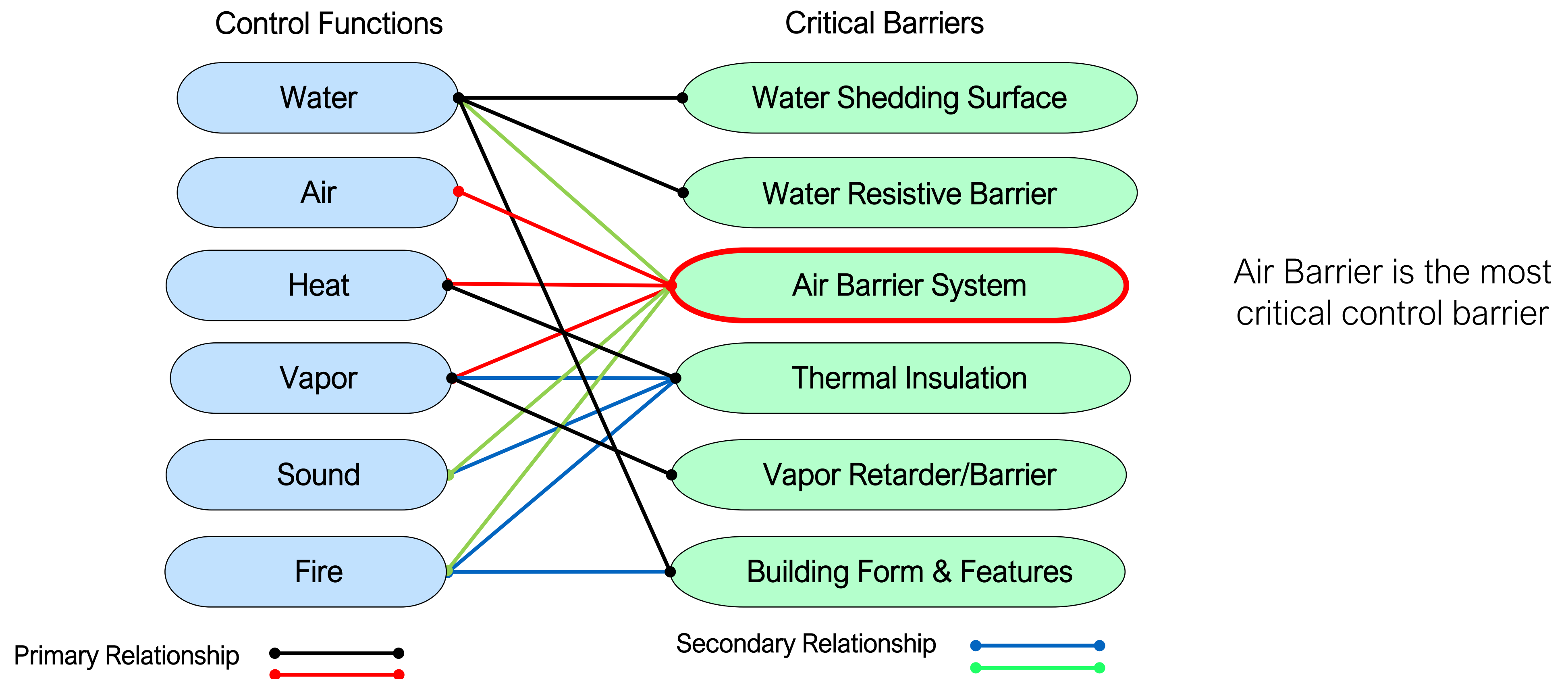
Keys to designing and building for 'high-performance' are applications that address *building science* enabling controls for the following:

- Infiltration of water, air, and vapor
- Thermal – stable comfort and operational efficiency
- Indoor Air Quality – healthy and safe
- Resiliency – weather event safety and durability
- Sustainability– life-cycle stability

Plus as a bonus – build for the future to be Net Zero Ready

Defining High-Performance

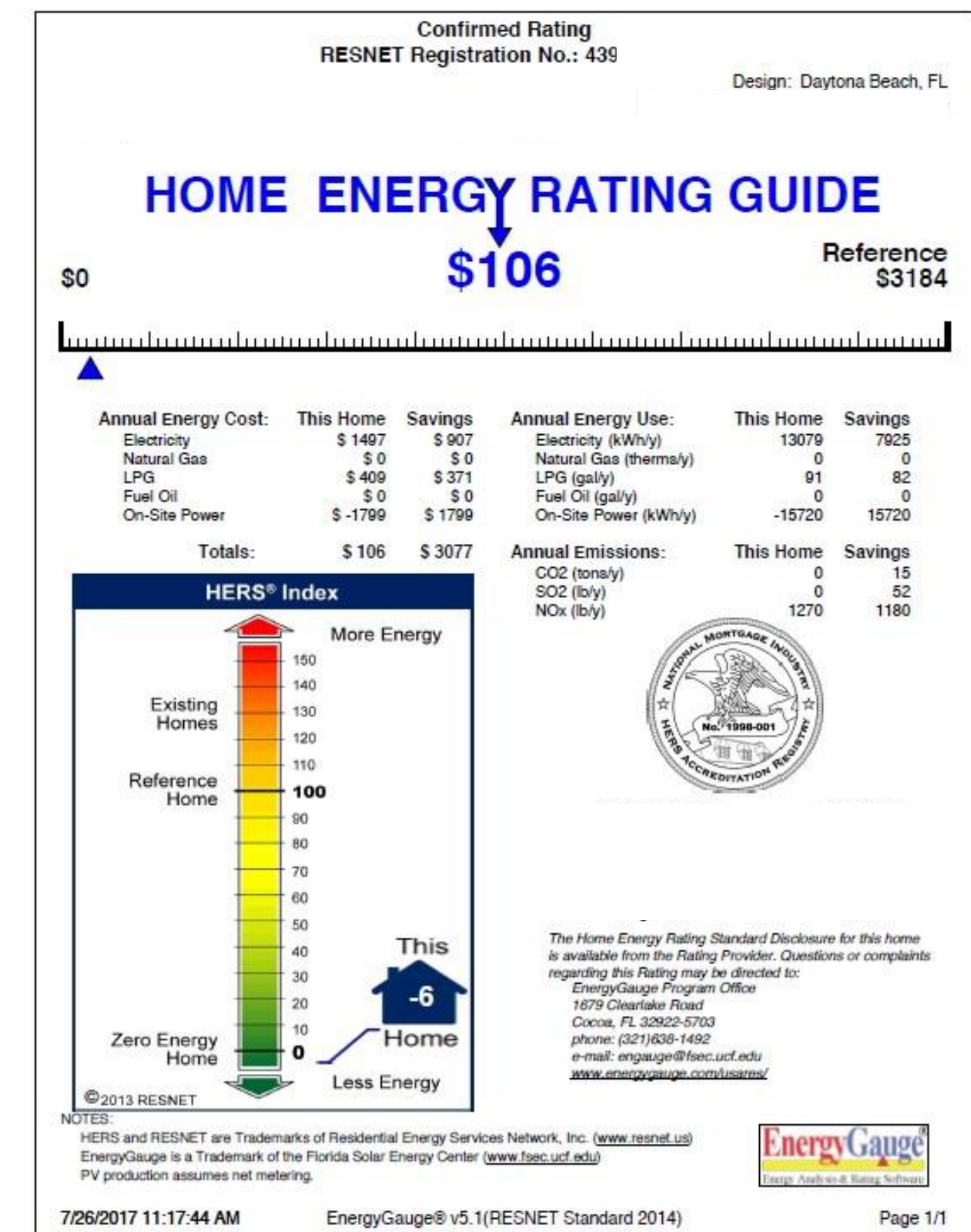
The building enclosure is a system of materials and assemblies that must act and react to separate the exterior and the interior environments. This diagram lists the major enclosure control functions and associated critical barriers.



Focus for High-Performance Homes

Markets and codes are driving for '*high-performance*' construction, forcing the building industry to move away from code minimum conventional construction in order to meet on-site evaluation and testing standards:

- Air Infiltration
- Enclosure evaluation and testing
- Improved efficiencies for windows and doors
- Continuous insulation to combat thermal bridging
- Energy Modeling, ERI, HERS, Energy Star Ratings



ICF Home HERS Rating

Defining Passive Design

Key building science principles for '*passive buildings*' are an advantage for high-performance by adding thermal mass to the envelope design:

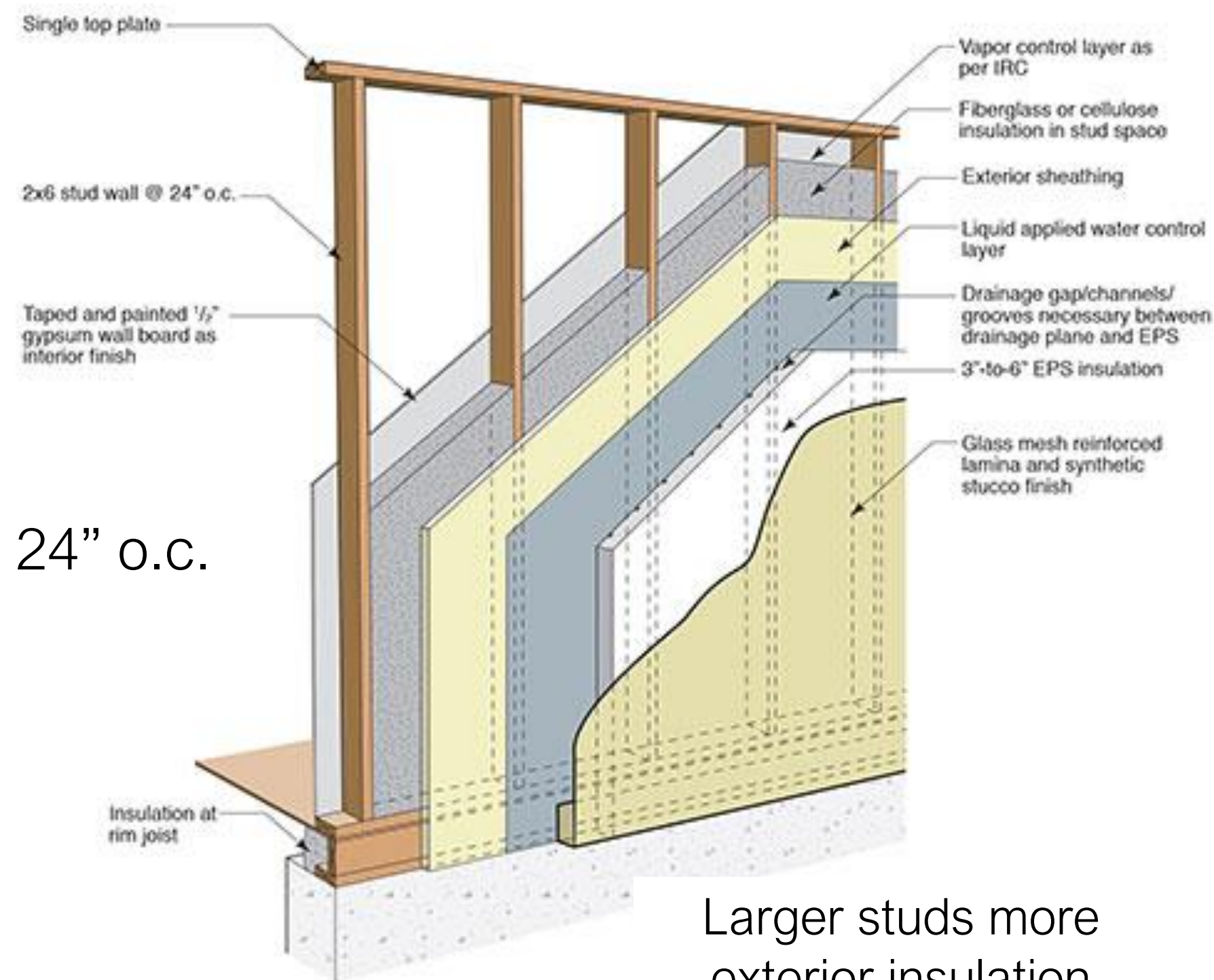
- Airtight building envelope
- Continuous insulation for whole building envelope
- No thermal bridging
- Utilize *Thermal Mass* to absorb and store heat energy
- Balanced heat and moisture recovery ventilation

Utilize thermal mass from solar gain

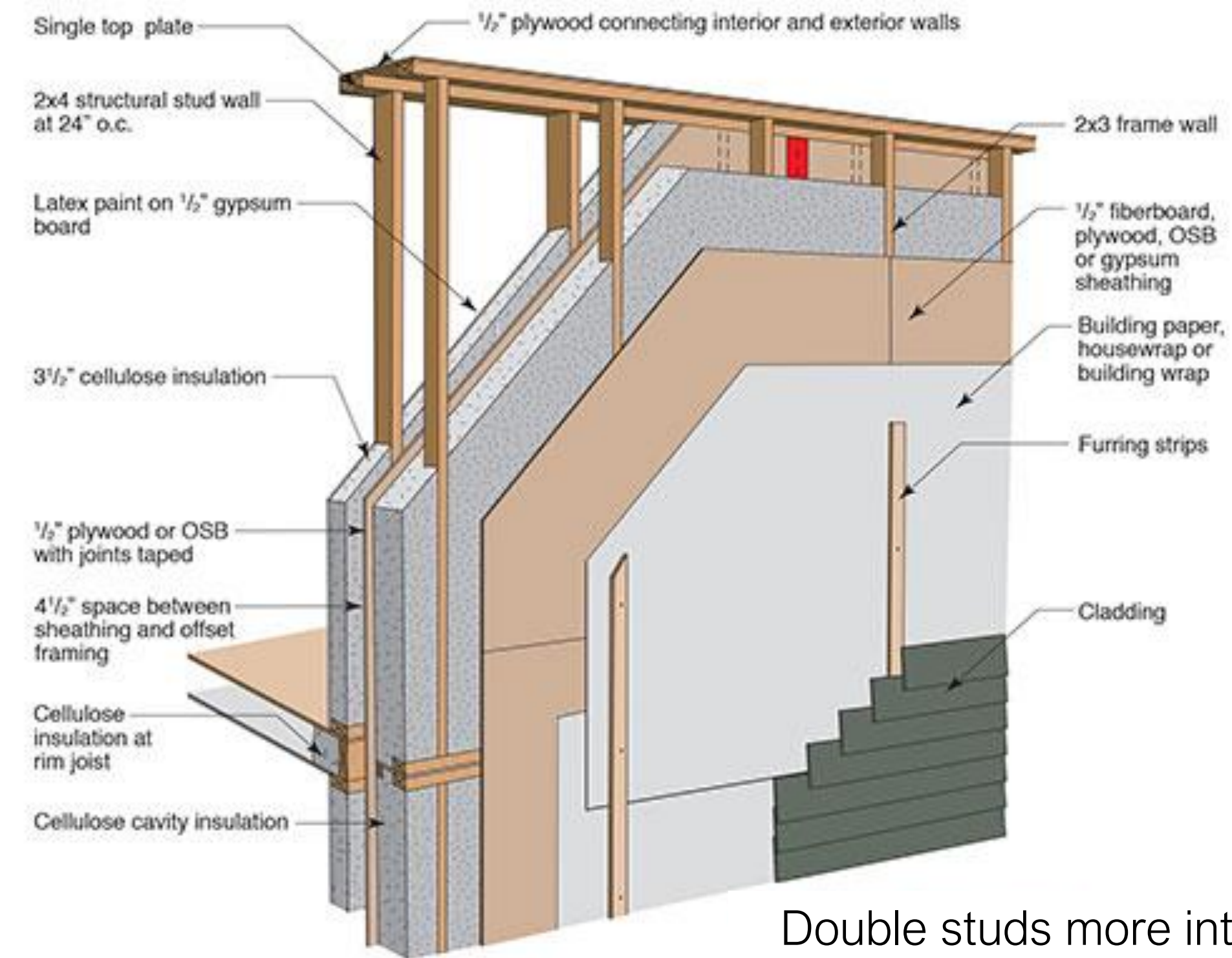
Energy Code Focus

Code focus is on conventional wood framed construction and how to improve the overall thermal performance and building science attributes by creating a more complex and costly - 'multiple component wall assembly.'

- ✓ Adding more materials and skilled labor to the building envelope



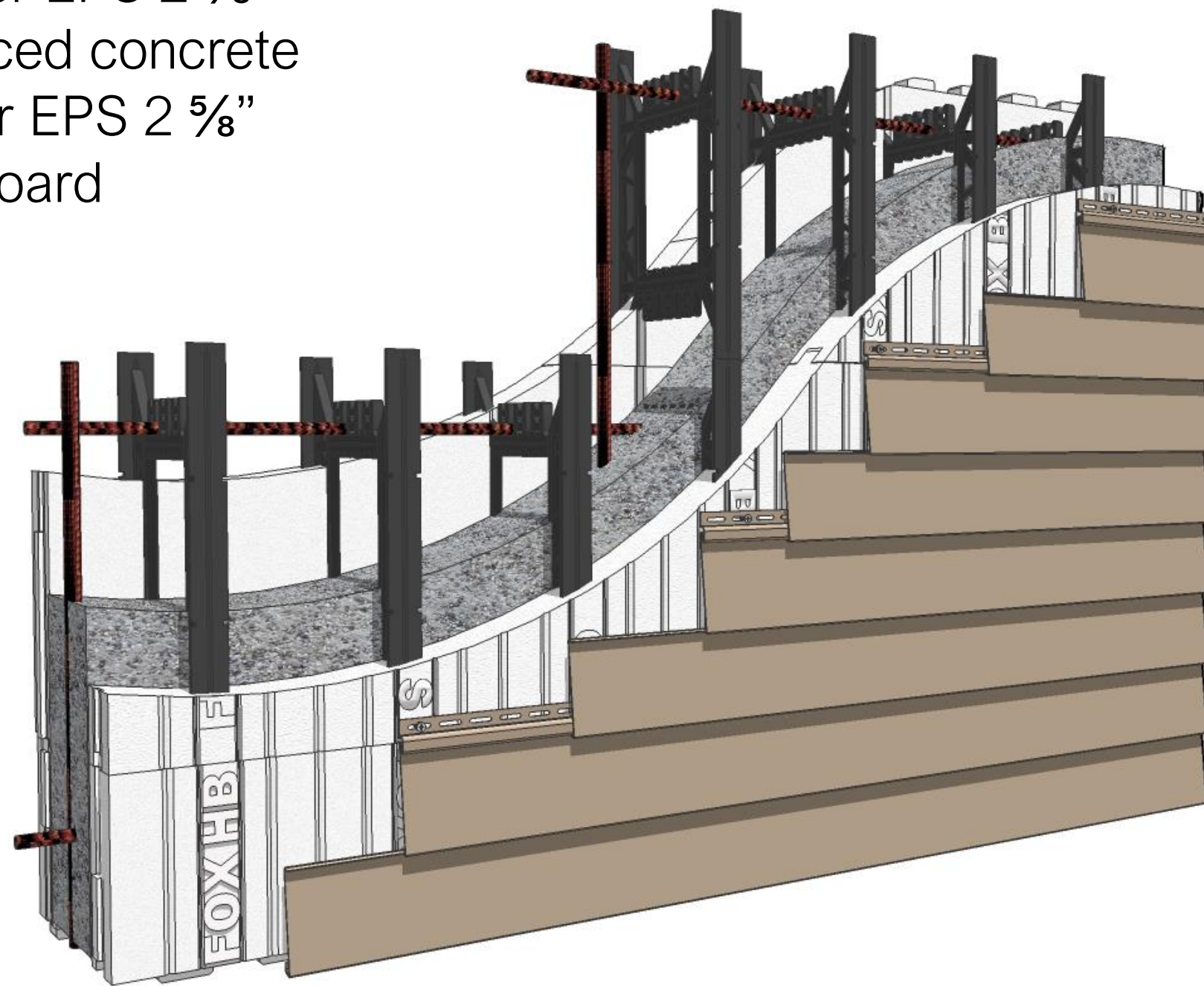
Larger studs more exterior insulation



Material Comparisons – Above Grade Walls

ICF

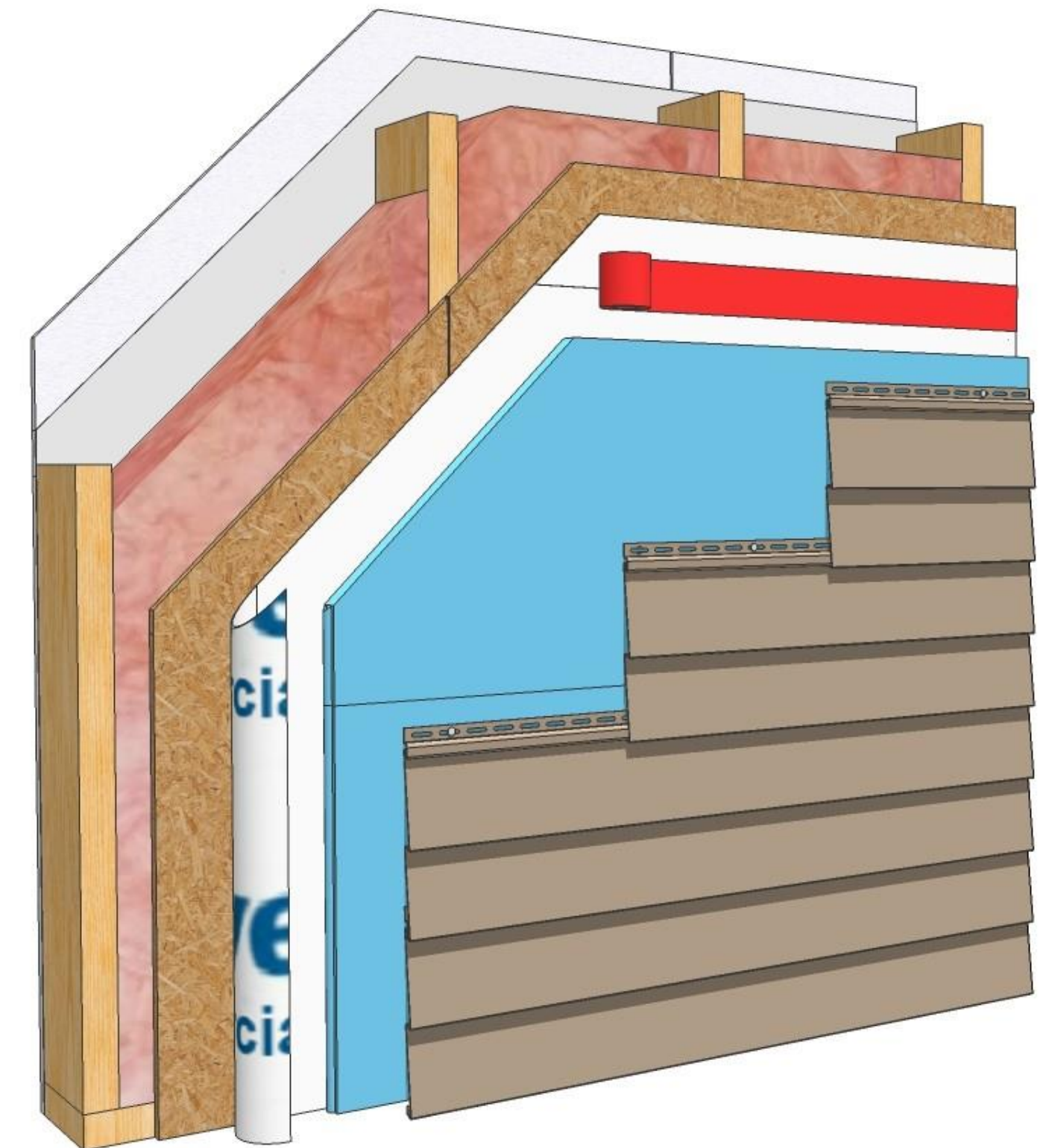
Vinyl siding
ICF Exterior EPS 2 5/8"
6" Reinforced concrete
ICF Interior EPS 2 5/8"
Gypsum board



4 Materials – 3 Trades

Simple Wood Frame

Vinyl siding
Exterior R5 insulation
Air / WRB
Sealant tape
OSB Exterior Sheathing
R20 Batt insulation
2x6 wood studs at 16" o.c
Poly vapor barrier
Tape on VB
Sealant
Gypsum board



11 Materials – possibly 6 Trades

Path Toward High-Performance

Factors that are influencing the construction industry on this path to change:

- Status Quo – don't rock the boat
- Business Realities – perceived cost, training
- Local Policies / Regulations not moving forward
- Adoption of latest Building and Energy Codes
- Local climate – all climate zones
- Local Market – cost, design.....
- Customers focus – frills, price,
- Influence by material suppliers and manufacturers
- Traditional Builders – complexity in of building science for new assemblies



Path Toward High-Performance

For the **Contractor** - Factors in changing from conventional:

- Complexity of changes in home design and construction
- Training
- Complexity of changes in building materials
- Application / interface techniques for new building materials
- Complexity of mechanical systems and air circulation
- Supervision of trades for proper material installation
- Supervision of trades for integrated air sealing
- Liability on contractor to meet evaluation standards



Path Toward High-Performance

Main focus for high-performance for conventional construction is on three main attributes of a wall assembly:

- Addressing thermal bridging with wood framing
- Thermal transmittance of the whole wall assembly
- Air tightness – membranes, sealants, tapes

Plus the requirement for testing and evaluation
to meet specific standards

Thermal Bridging - R-Value

Realistic / Effective R-Values for Wood Framing

Wood has a R-Value of 1.41 per inch

- 2x4 = R 4.9
- 2x6 = R 7.7

Batt Insulation R-20 installed perfectly

- 67 to 70% Effective = \pm R14

Wood framing wall assembly operational overall R-Value is less than R-14

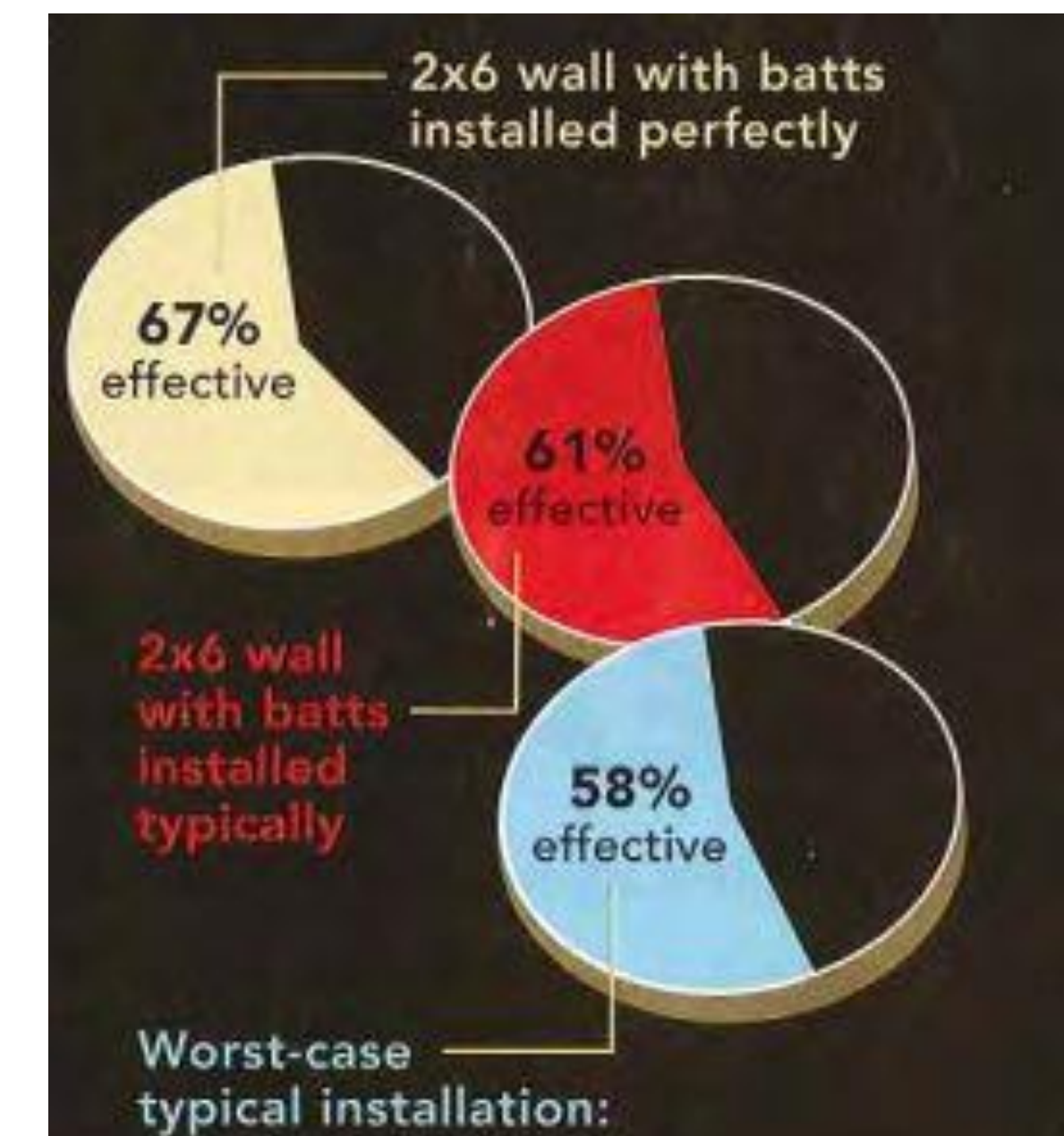
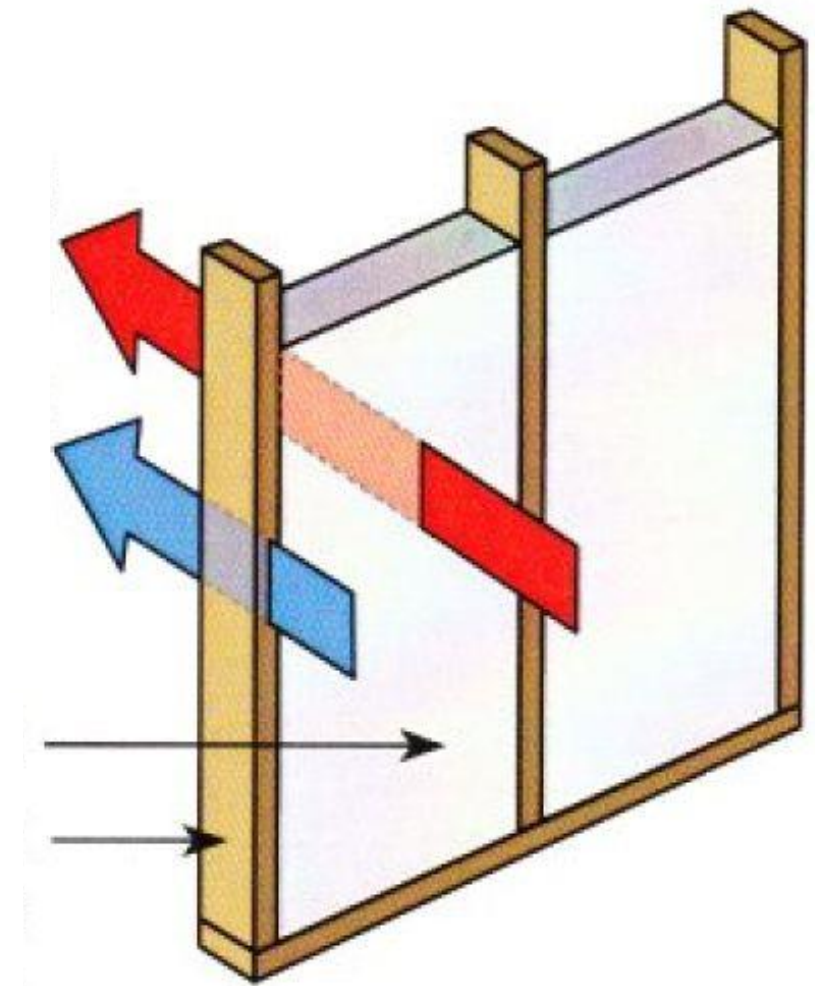
Add R-5 on the exterior bumps up the presumed effective thermal resistance to R 19

Thermal Bridging

Batt Insul. 77% (area of cavity)

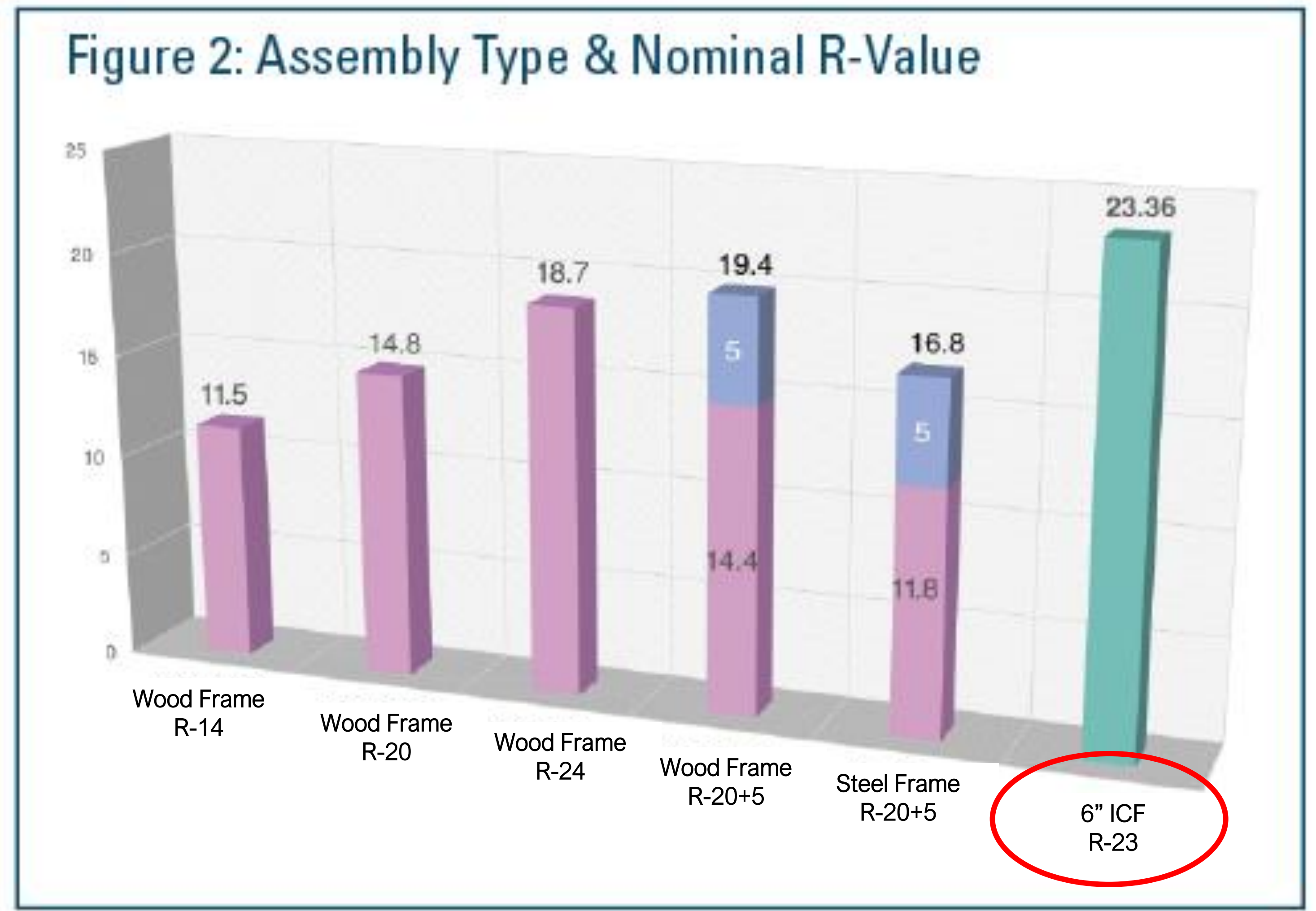
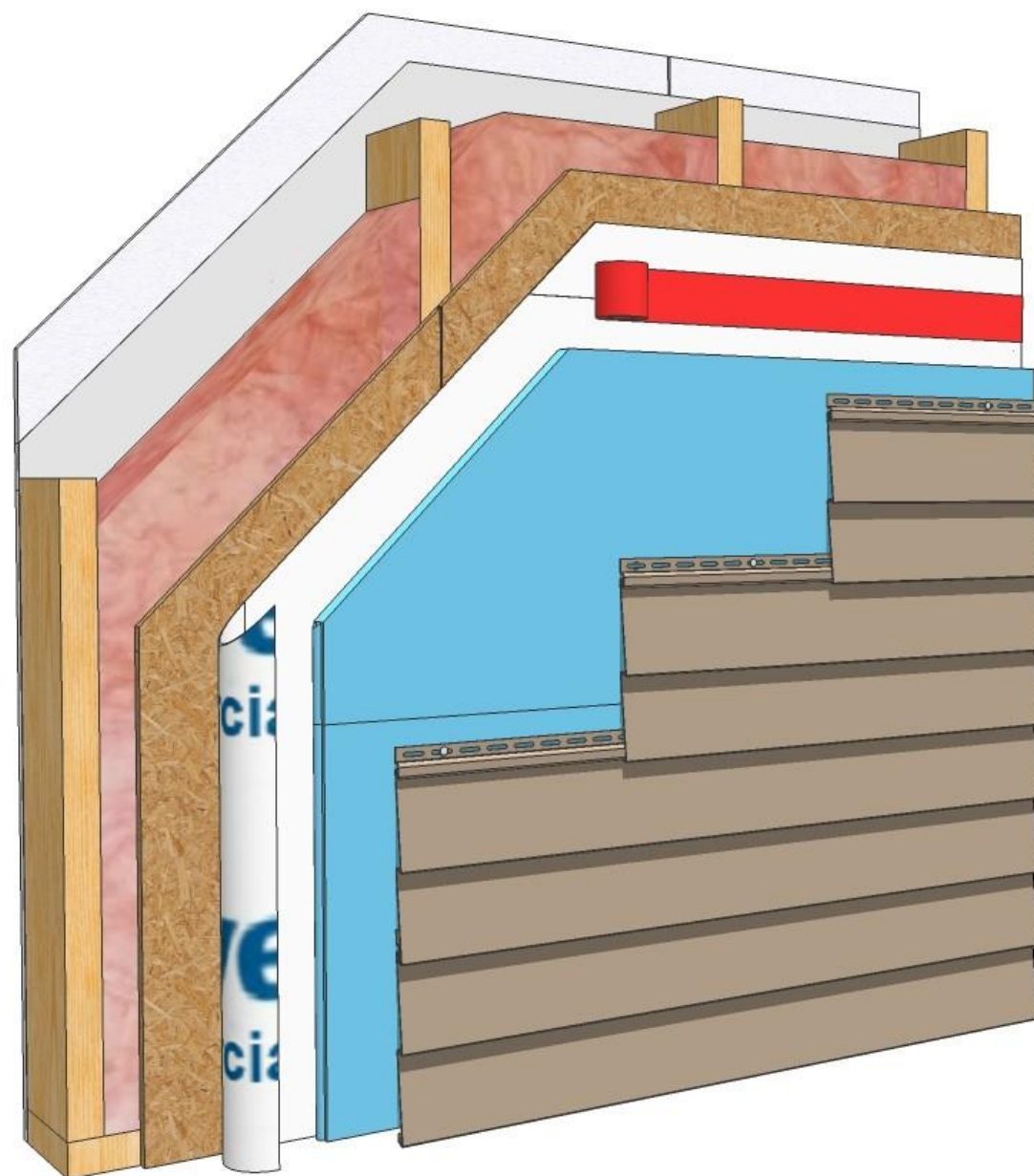
R 7.7 - 23% (area of framing)

R-20 Batt
2x6 wood studs
@ 16" o.c.



Thermal Bridging

Evaluations have come to recognize the influence of thermal bridging and poor installation of batt insulation on the effective thermal resistance of a wood framed wall assembly.



CAN Best Laboratories – Hot Box Testing, 2017 (icfma.org)

Thermal Bridging - Fox Blocks

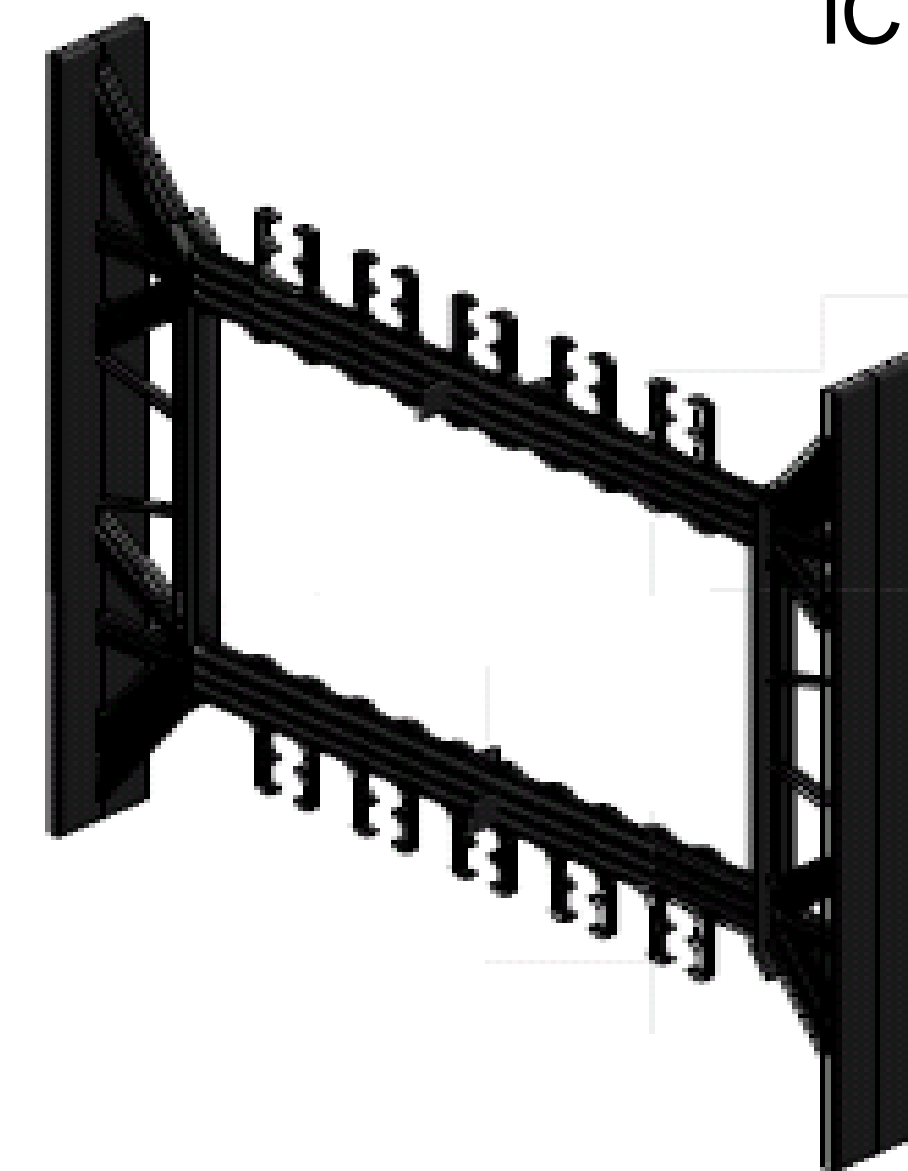
Plastic ties (webs) –

- Made from 100% recycled post industrial polypropylene plastic
- Molded into the EPS panel
- 6 webs per blocks at 8" o.c.
- Continuous fastening strip for interior and exterior finish attachment

NO THERMAL BRIDGING



ICF Cut-away View



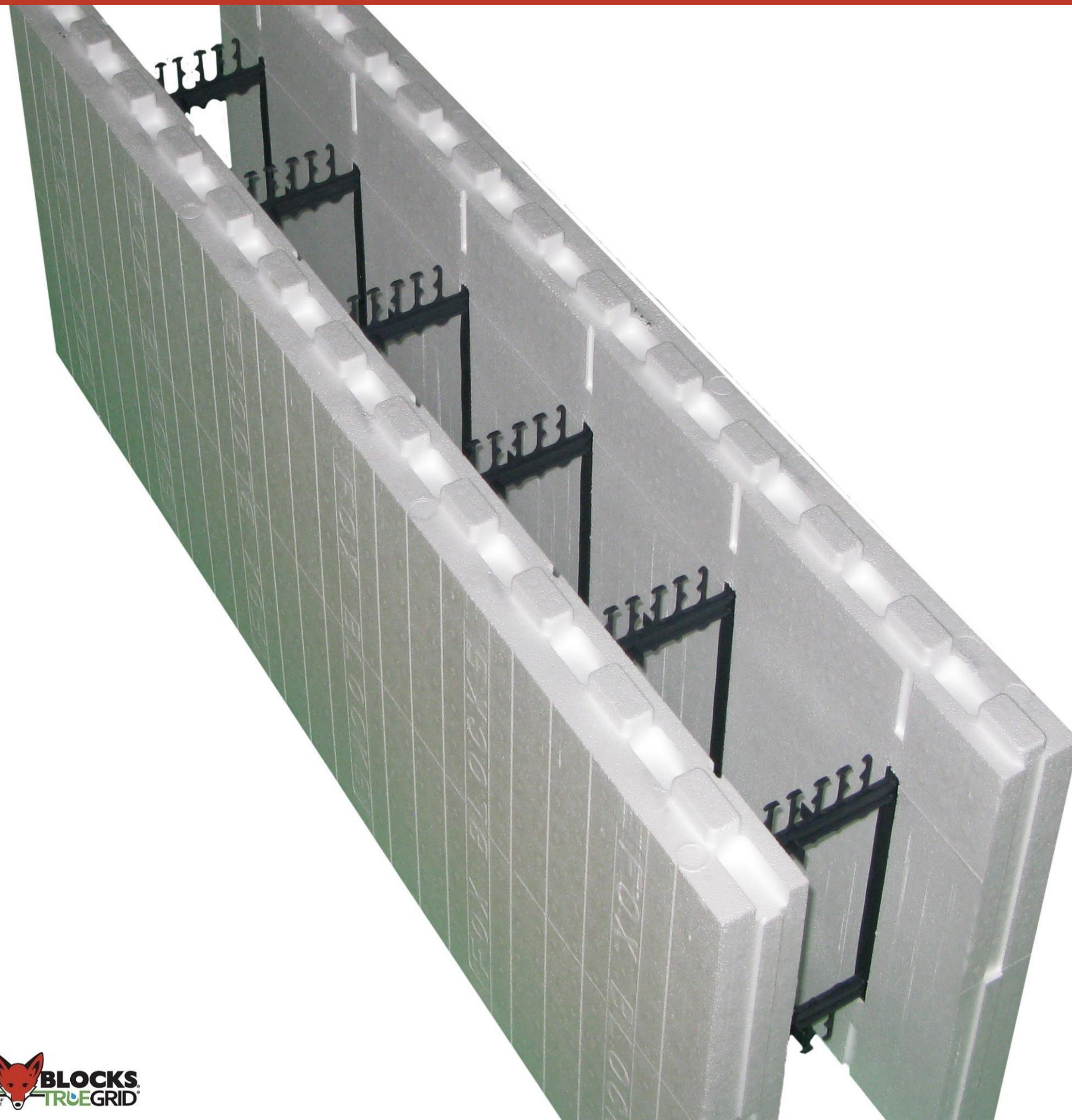
Fox Blocks
Plastic Tie (Web)

Thermal Transmittance

Building and Energy Codes include and recognize the advantage of mass walls construction.

ICFs are recognized as a Mass Wall :

- Monolithic reinforced concrete
- No thermal bridging
- Continuous high-performance insulation
- Hot box tested assembly 6" ICF effective R-23.3



ICF Insulation Advantage

EPS Insulation Panels –

- Type II Expanded Polystyrene
- 2 5/8" thick panels
- Reversible interlock
- EPS is molded into panels around the webs
- Standard block 16" x 48"
- Two panels have an R-value of 21.4

EPS is an inert product:

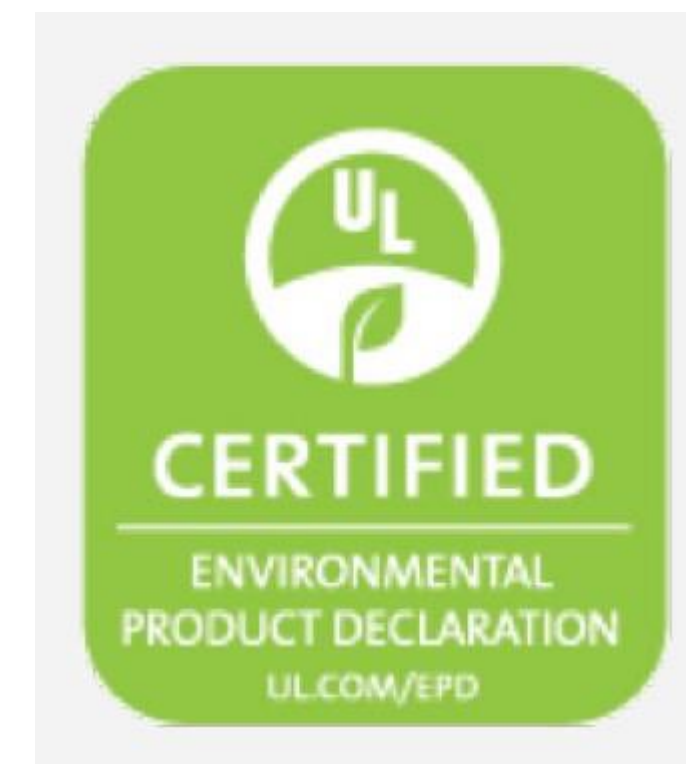
- Does not absorb water
- Does not promote mold or mildew growth
- Does not deteriorate over time
- UL Certified as an Environmental Product



EPS beads



Steam molded form



UL Certified
Environmental Product
www.epsindustry.org



Recyclable Product

ICF Construction Advantages - Fox Blocks

- Simple and fast, modular building system
- Innovative product for below and above grade
- Versatile for all building types and heights
- Sustainable, healthy product
- Resilient building system
- Provides Life Cycle operational cost savings
- Proven track record of fantastic buildings – residential and commercial



Fox Blocks - 6 in 1 Design Advantages



- Structure
- Insulation – Thermal Resistance
- Air Barrier / WRB
- Vapour Barrier
- Attachment
- Reversible Interlock - Speed



Structure

- Reinforced concrete wall assembly
- Residential is typically 6" or 8" concrete core size for below and above grade walls
- Reinforcement – typically #4 or #5 rebar
- Engineering is for *flat wall* concrete design
- Engineering tables for residential are in the building code, commercial follow ACI 318
- Designs for seismic requirements and high winds
- Building with strength adds resiliency and safety



Fox Blocks is a code compliant product





Structure

Inherent values of **Concrete** within the ICF as a building envelope:

- Resiliency and strength as a monolithic enclosure
- Does not rot or deteriorate (always enclosed)
- Provides a continuous air barrier
- Provides *thermal mass* which does influence energy efficiency
- Does not promote mold or mildew
- Has the ability to handle condensation (dew point) within the ICF cavity
- Non-combustible





Structure

“ICF Walls have always been structurally conforming with lateral load provisions in high wind and seismic zones”

Murray Frank

- Fox Blocks provide reinforced concrete walls, the strongest wall assembly available
- Reinforced concrete engineering for 200 mph high-winds and seismic zones
- Fox Blocks is endorsed by the NRMCA in the ‘Build with Strength’ program

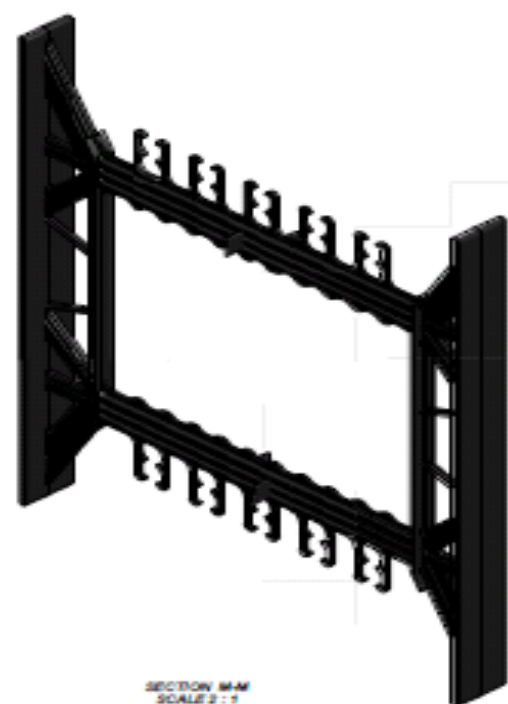
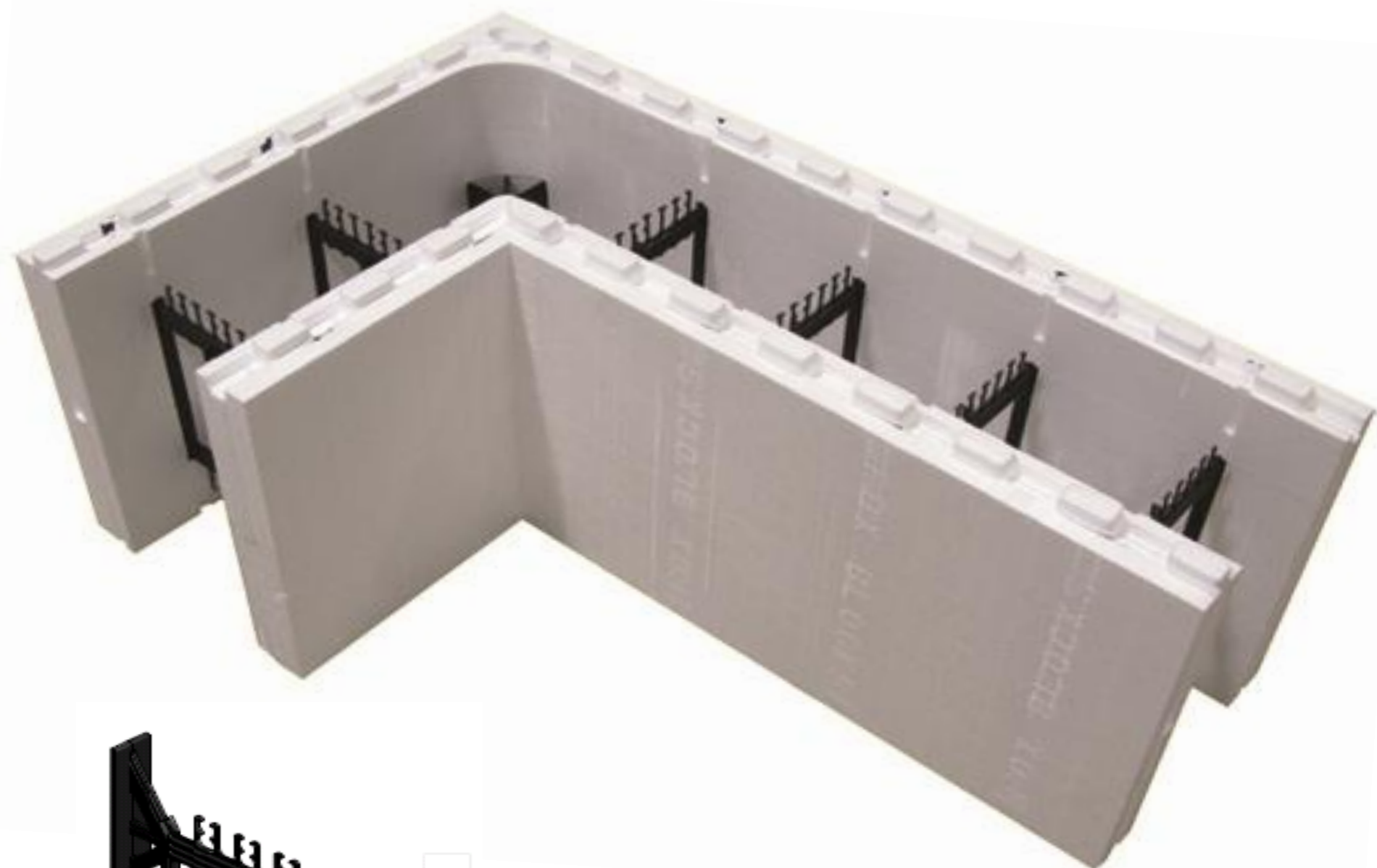


A COALITION OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION





Insulation - EPS



- Webs are polypropylene plastic
- 100% recycled material
- **NO THERMAL BRIDGING**

- Expanded polystyrene rigid insulation
- 2 panels 2 5/8" thick
- R-value of R4.1 per inch
- Two continuous layers – exterior and interior
- Does not deteriorate or lose thermal resistance
- Does not absorb moisture
- Does not promote mold or mildew
- Does not off gas, healthy foam
- Recyclable





Insulation – Effective Thermal Resistance

Below Grade Wall Assembly Components	Fox Block 6" (150mm)		Fox Block 8" (200mm)	
	R	U _f	R	U _f
Exterior air film	0.17	5.88	0.17	5.88
Waterproofing Membrane	0.08	12.50	0.08	12.50
EPS Insulation 2 5/8"	10.8	0.09	10.8	0.09
Concrete Core	0.38	2.63	0.5	2.00
EPS Insulation 2 5/8"	10.8	0.09	10.8	0.09
Gypsum board 1/2"	0.46	2.17	0.46	2.17
Interior air film	0.68	1.47	0.68	1.47
Totals	23.37	0.0428	23.49	0.0426
Equivalent U-Factor	0.0428		0.0426	

Above Grade Wall Assembly Components	Fox Block 6" (150mm)		Fox Block 8" (200mm)	
	R	U _f	R	U _f
Exterior air film	0.17	5.88	0.17	5.88
Siding	0.15	6.67	0.15	6.67
EPS Insulation 2 5/8"	10.8	0.09	10.8	0.09
Concrete Core	0.38	2.63	0.5	2.00
EPS Insulation 2 5/8"	10.8	0.09	10.8	0.09
Gypsum board 1/2"	0.46	2.17	0.46	2.17
Interior air film	0.68	1.47	0.68	1.47
Totals	23.44	0.0427	23.56	0.0424
Equivalent U-Factor	0.0427		0.0424	

- Simple ICF wall assembly exceeds code minimum requirements on below and above grade wall assemblies – EPS insulation R-Value 21.6
- No deductions in effective thermal resistance calculations
- ICF recognized as *MASS* walls

IECC Equivalent U-Factor		
Climate Zones	Basements	Mass Walls Above Grade
1	0.360	0.197
2	0.360	0.165
3	0.091	0.098
4	0.059	0.098
5	0.050	0.082
6	0.050	0.060
7 & 8	0.050	0.057
Fox Blocks	0.042	0.042
Fox Blocks +	0.032	0.032

Energy Stick adds R8 >



Insulation – Added Thermal Resistance

Above Grade Wall Assembly Components	Fox Blocks 10"	
	R	U _f
Exterior air film	0.17	5.88
Stucco	0.04	25.00
EPS Insulation 2 5/8"	10.8	0.09
Fox Energy Stick 2" EPS	8.0	0.13
Concrete Core 8"	0.5	2.00
EPS Insulation 2 5/8"	10.8	0.09
Gypsum board 1/2"	0.46	2.17
Interior air film	0.68	1.47
Totals	31.45	0.0318
Equivalent U-Factor	0.0318	

Options for Enhanced Thermal Resistance:

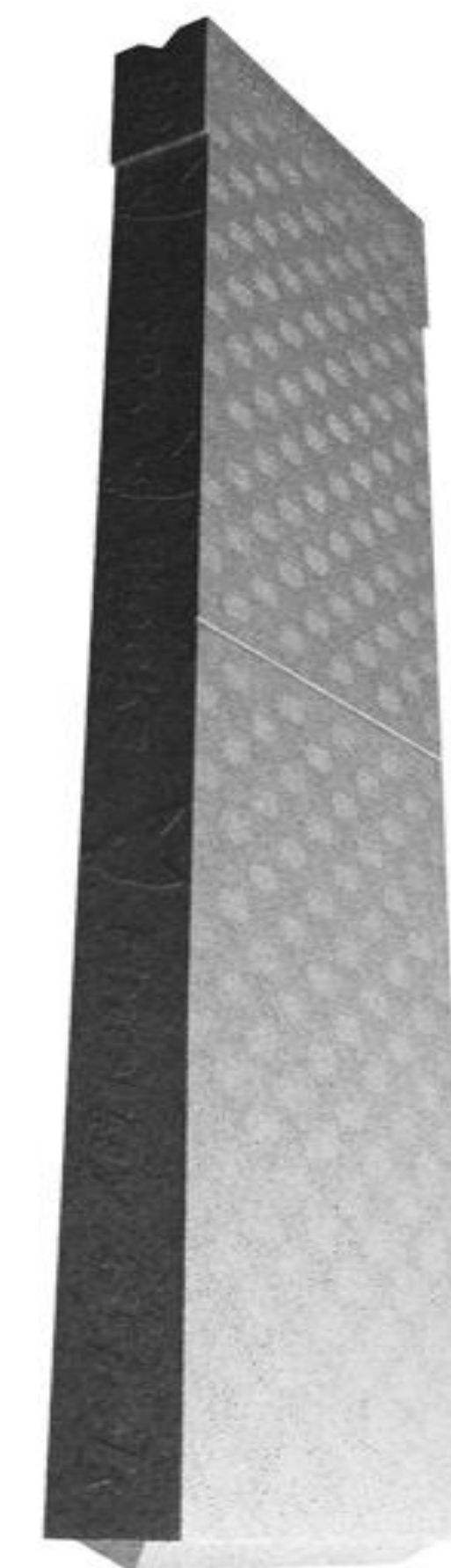
- Add Fox Blocks Energy Sticks or Panels

Fox Blocks Energy Stick –

- 2" EPS insert, adds R-8 reaching an R-30 value
- Additional EPS exterior layer
- Add 2 Energy Sticks = R-40 wall assembly



Fox Blocks Energy Stick

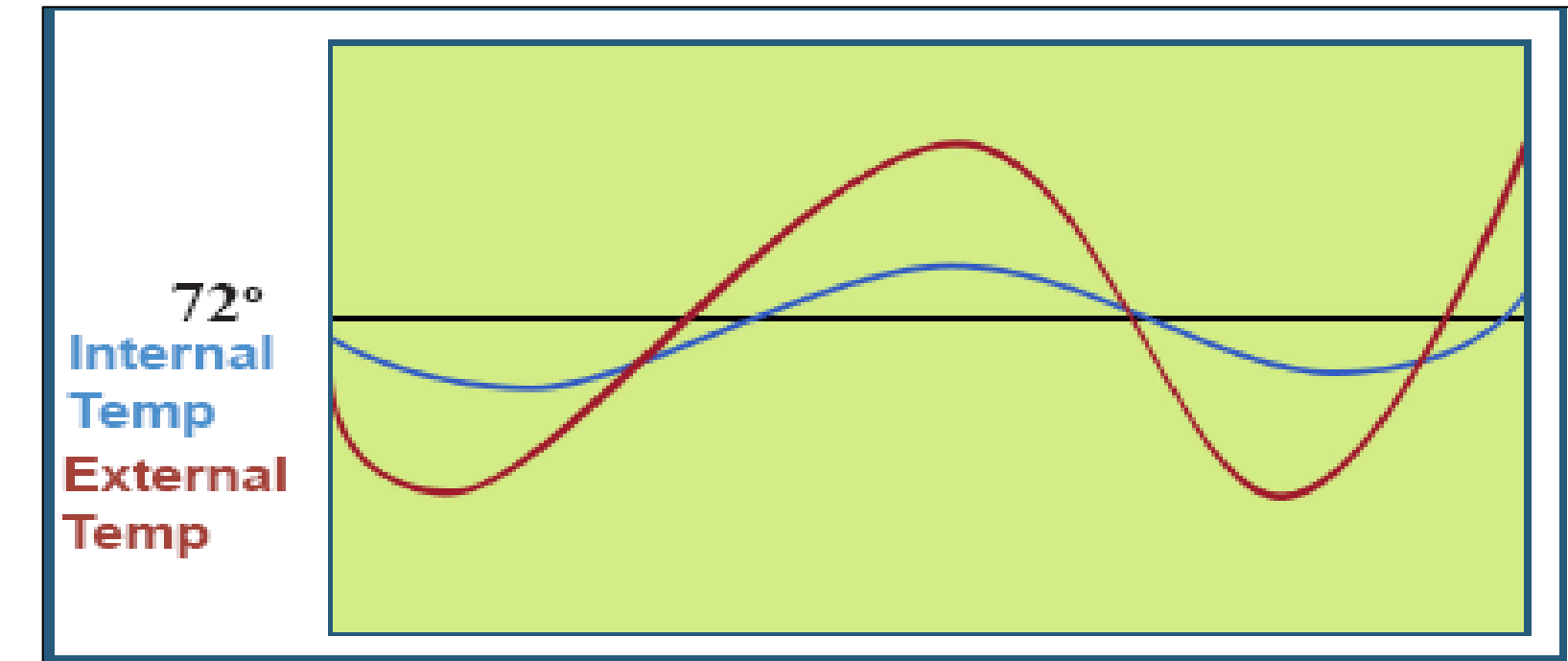




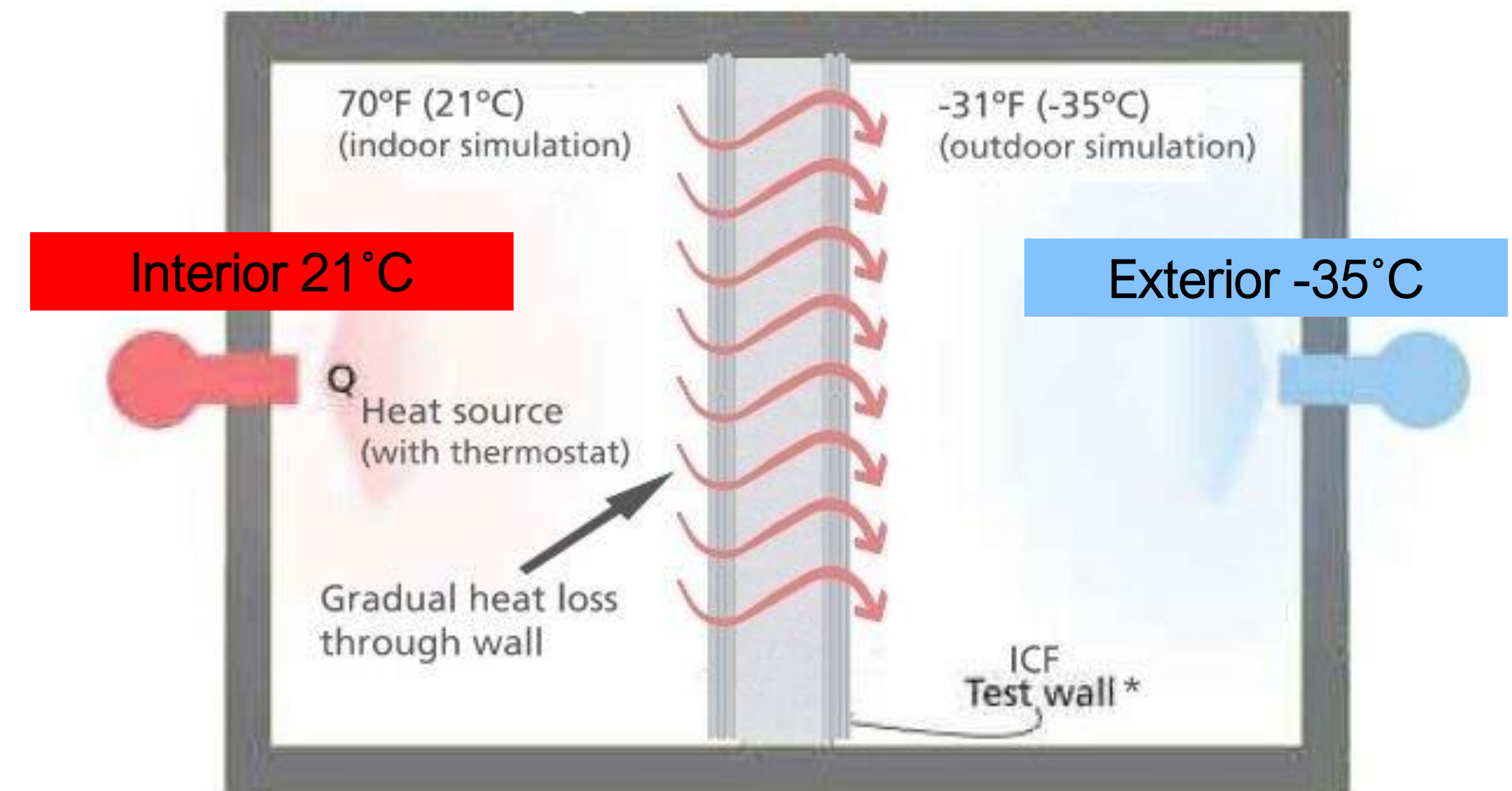
Insulation – Thermal Lag

Current studies on ICF wall assemblies have proven that the insulated thermal mass within an ICF does influence the temperature change through the wall assembly.

Test concluded that a 2x6, R-20 wood framed wall would consume more than 40% energy than an ICF wall to maintain the indoor temperature over a 13.5 day period.



Minimizes temperature changes, less load on HVAC



CLEB Thermal Performance Testing – ICFMA 2016



Insulation – Wall Assembly Energy Input

ICFMA has conducted comparative thermal performance studies on various wall assemblies. Tests identify heat energy W(Btu/hr) required to maintain a steady state temperature for one hour.

2x6 – R20 Batt + R5 Rigid on Exterior

Measured Temperatures and Heat Input at Steady State		SI	IP
t_a	Ambient Temperature - Weather Side, °C (°F)	-35.06	-31.1
t_r	Ambient Temperature - Room Side, °C (°F)	22.14	71.9
t_1	Surface Temperature - Room Side, °C (°F)	19.29	66.7
t_{sp1}	Surround Panel Temperature - Room Side, °C (°F)	20.52	68.9
t_2	Surface Temperature - Weather Side, °C (°F)	-34.27	-29.7
t_{sp2}	Surround Panel Temperature - Weather Side, °C (°F)	-34.06	-29.3
Q_f	Fan Heat Input, W (Btu/h)		
Q_h	Heaters Heat Input, W (Btu/h)		
Q_{in}	Total Energy Input, W (Btu/h)	101.48	346.2
Q_{sp}	Surround Panel Correction, W (Btu/h)	4.51	0.11
E	Metering Box Thermopile Output, mV	-1.06	-1.06
Q_{mv}	Metering Box Walls Correction, W (Btu/h)	0.64	2.2
Q_s	Specimen Heat Flow, W (Btu/h)	97.60	333.0

Total Energy Input - 346.2 W(Btu/h)
Overall Thermal Resistance – R19.43

6" Standard ICF

Measured Temperatures and Heat Input at Steady State		SI	IP
t_a	Ambient Temperature - Weather Side, °C (°F)	-35.03	-31.1
t_r	Ambient Temperature - Room Side, °C (°F)	22.26	72.1
t_1	Surface Temperature - Room Side, °C (°F)	20.81	69.5
t_{sp1}	Surround Panel Temperature - Room Side, °C (°F)	21.47	70.6
t_2	Surface Temperature - Weather Side, °C (°F)	-31.04	-23.9
t_{sp2}	Surround Panel Temperature - Weather Side, °C (°F)	-34.10	-29.4
Q_f	Fan Heat Input, W (Btu/h)		
Q_h	Heaters Heat Input, W (Btu/h)		
Q_{in}	Total Energy Input, W (Btu/h)	52.01	177.6
Q_{sp}	Surround Panel Correction, W (Btu/h)	4.60	0.11
E	Metering Box Thermopile Output, mV	30.12	30.12
Q_{mv}	Metering Box Walls Correction, W (Btu/h)	30.48	104.0
Q_s	Specimen Heat Flow, W (Btu/h)	77.94	265.9

Total Energy Input 177.6 W(Btu/h)
Overall Thermal Resistance – R23.3

6" ICF
requires half the
energy input as
compared to the
wood framed wall
assembly

This Thermal Report available on ICFMA website
www.icfma.org



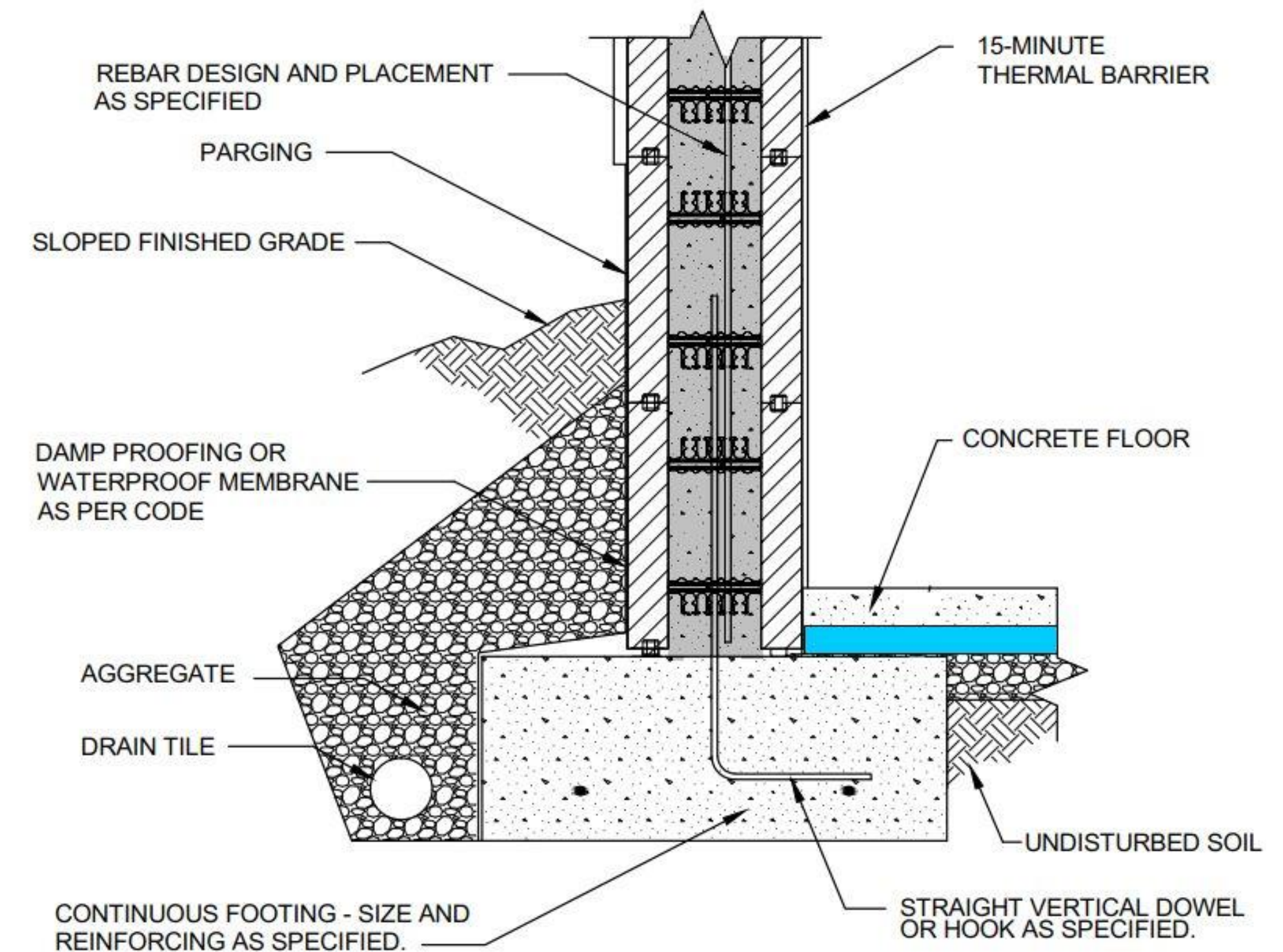
Simplicity for Basements

Codes have increased the thermal requirements for below grade walls

Basements require full height insulation which requires strapping, vapor barrier, Extra material and labor:

- 2x6 stud walls with full height batt insulation

ICFs with a 6" or 8" concrete core exceeds building code with R21+ thermal rating

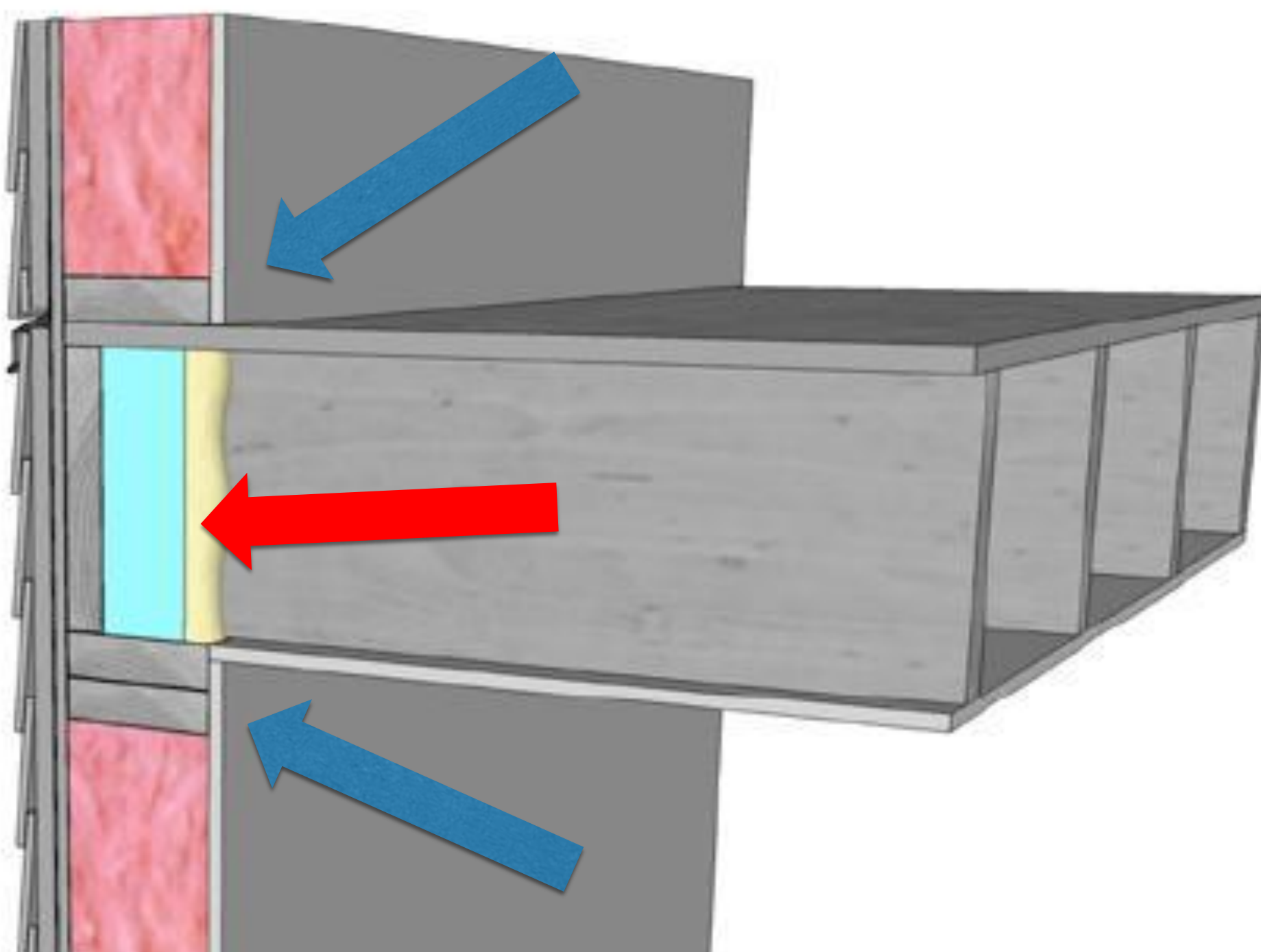


ICFs Simple Foundation Solution

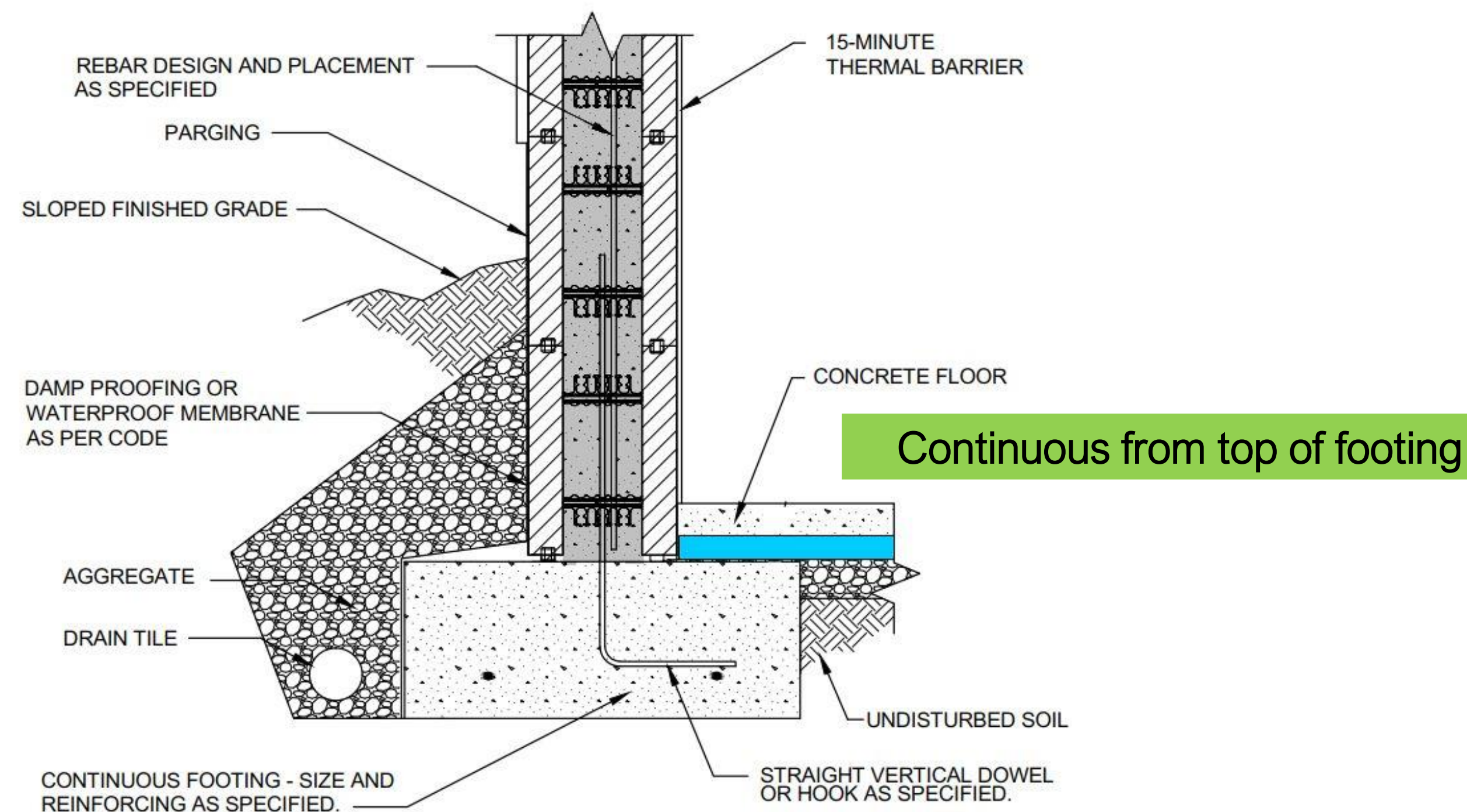
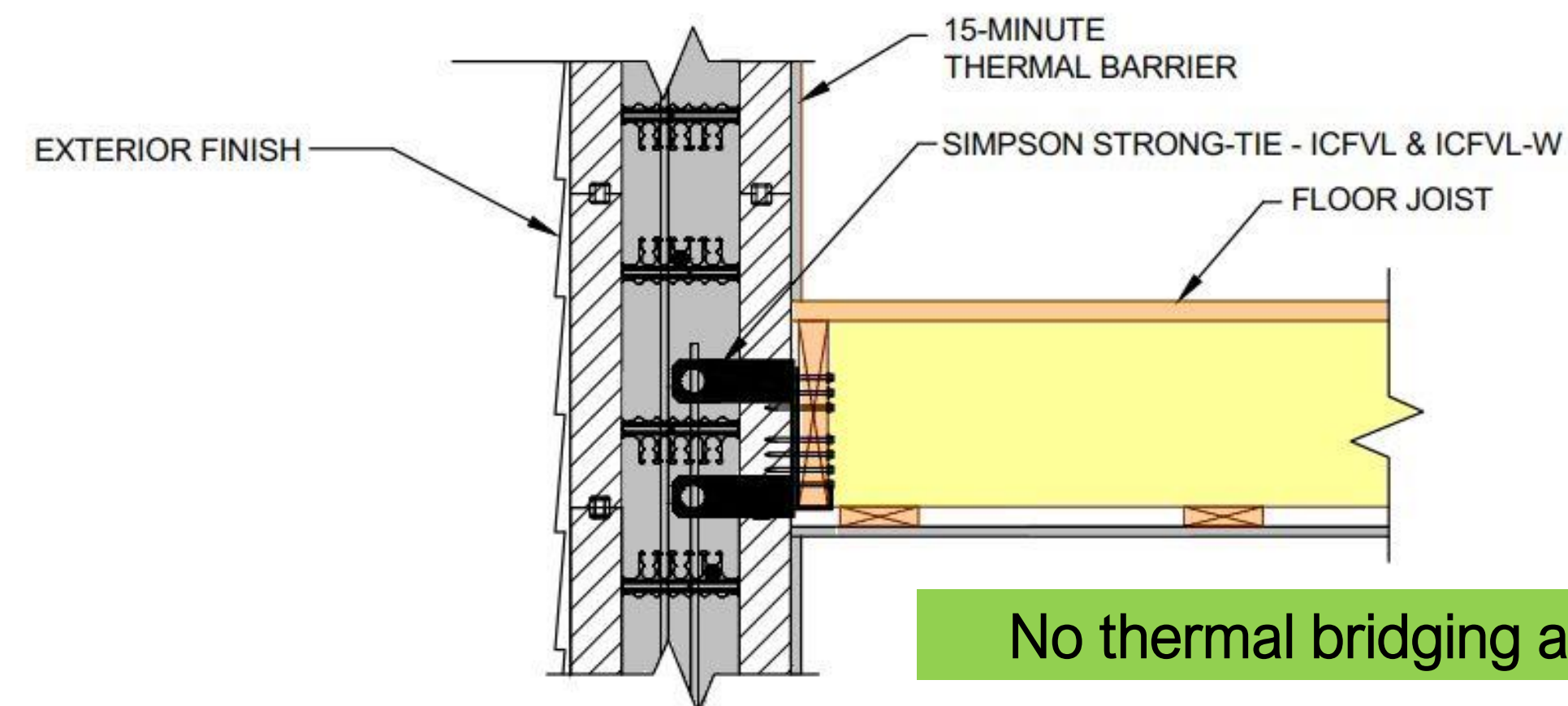




Insulation – Continuous Insulation

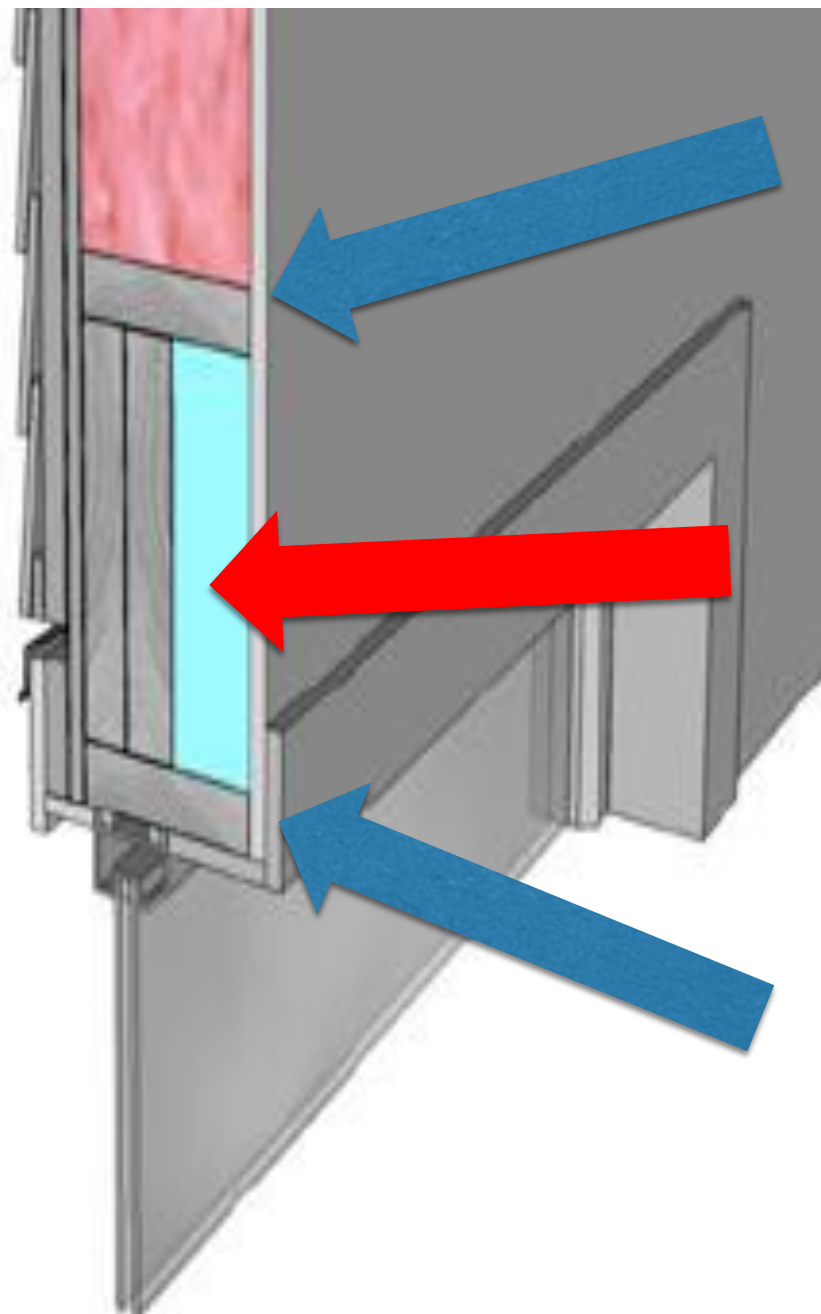


Wood Framing -
Thermal bridging at floor connections
plus additional material and labour to
insulate and seal joist cavity

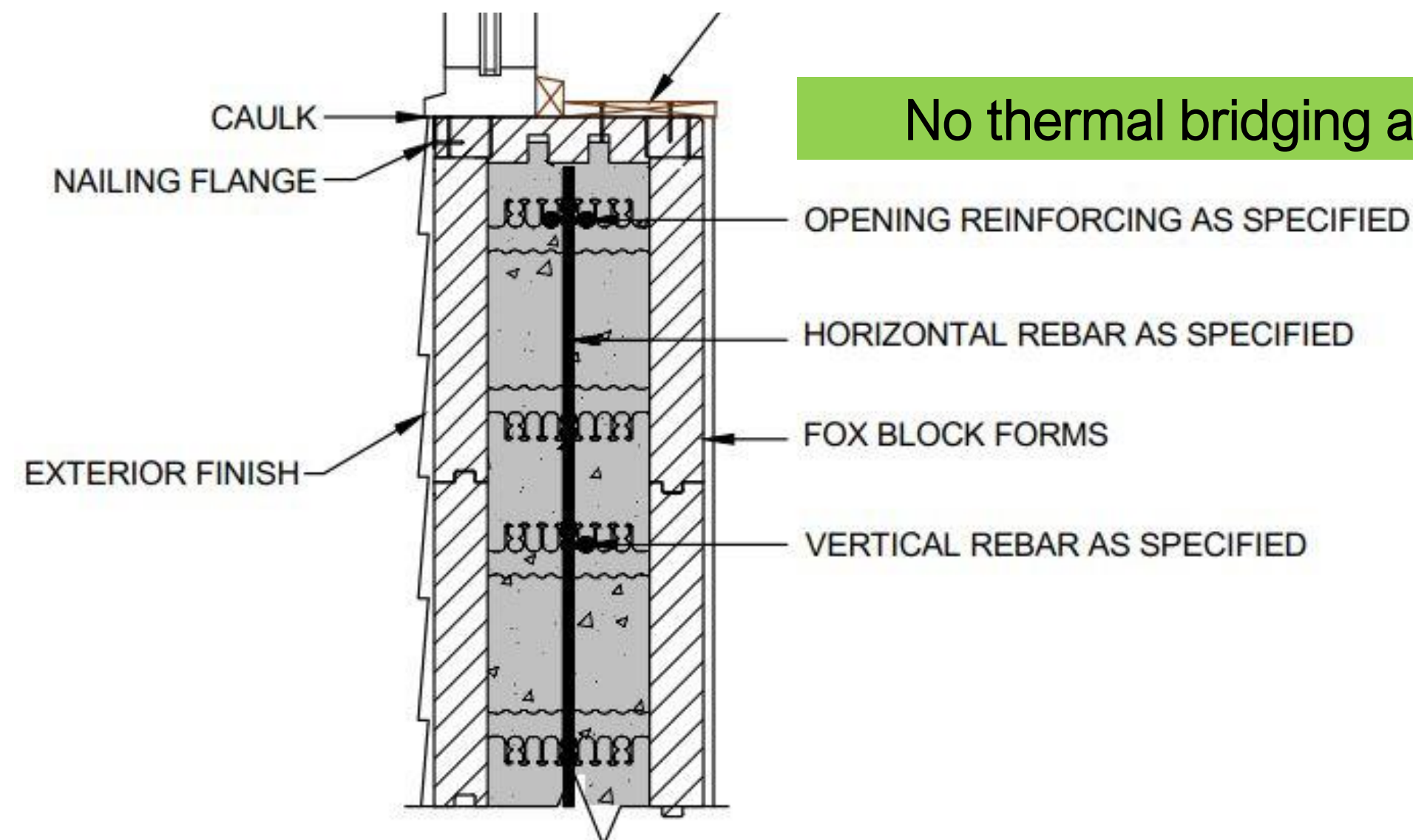
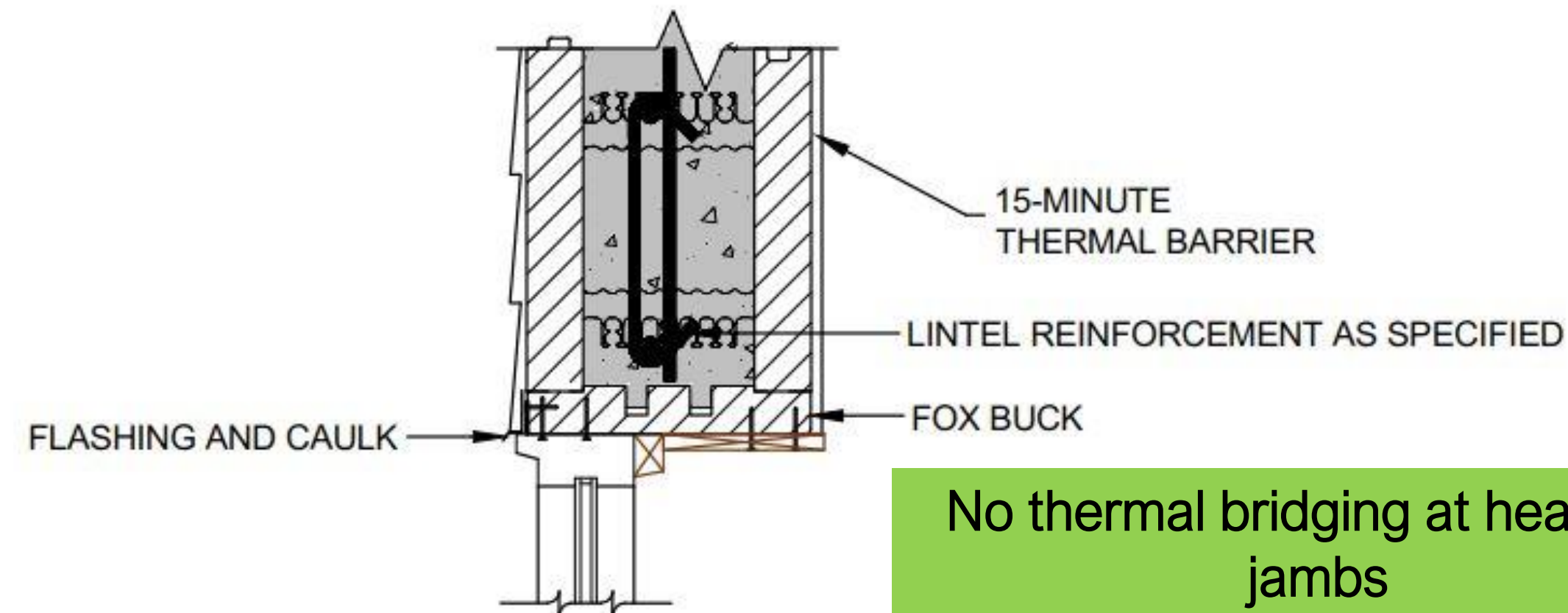




Continuous Insulation - Openings



Wood Framing –
Thermal bridging at lintel,
jamb and sill, plus
additional material and
labour to air seal



Fox Buck – EPS Insulation



Fox Buck – Continuous Insulation



Weather Resistant Barrier

- ICF concrete core provides a continuous air barrier from top of footing to underside of roof
- ICF continuous air barrier eliminates the requirements for caulking, sealants and tape on interior and exterior
- ICF have passed testing as a weather resistant barrier, (ASTM E2634, E331)
- No additional WRB membranes are required.
- Exterior finishes may be directly applied to the ICF

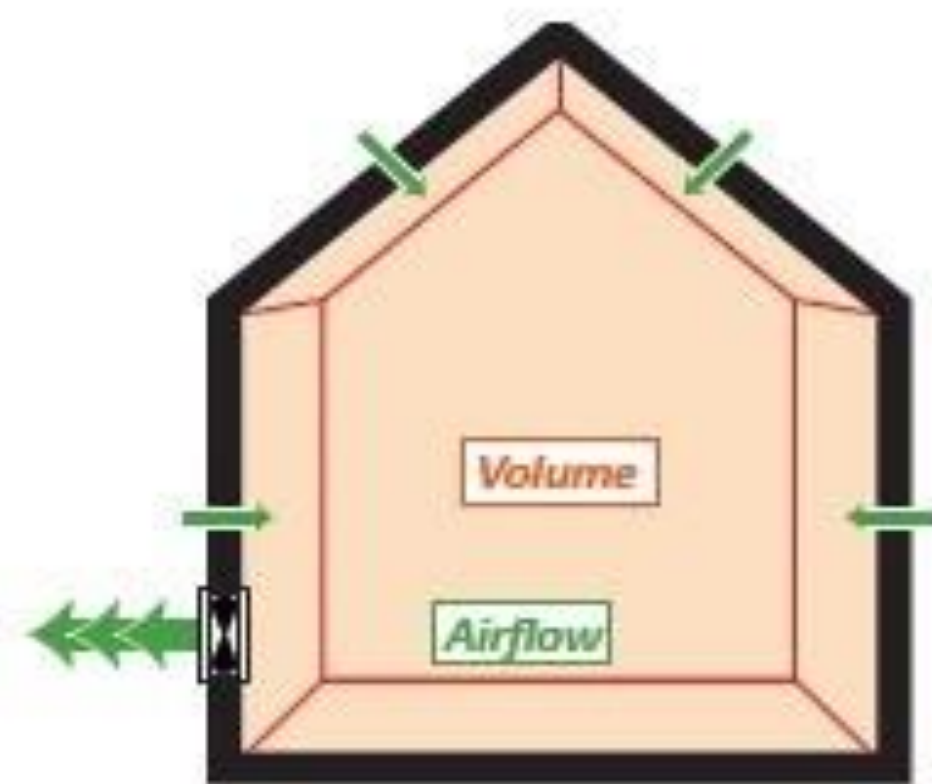


Eliminate labor and material for WRB and sealants



Air Tightness

'Airtightness has been determined as the single most cost-effective way to reduce heating energy consumption.' Code Consultant



IECC 2018 code testing:

- ✓ Climate Zones 1 – 2: 5 ACH @ 50 Pa
- ✓ Climate Zones 3 – 8: 3 ACH @ 50 Pa

Wood Framing Tools of the Trade Publication on where to look for air leaks:

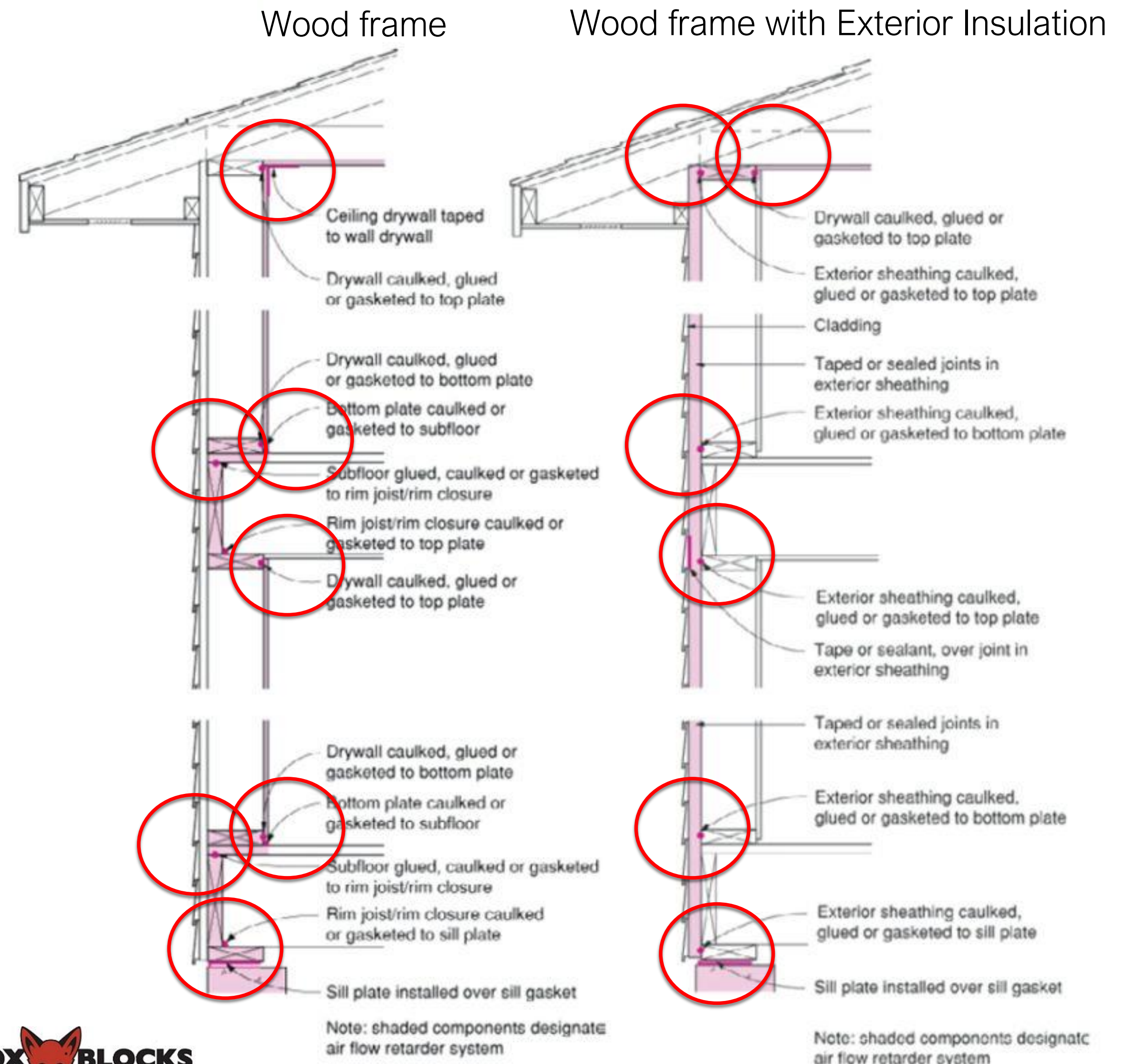
- ☐ Top and bottom plates
- ☐ Sill plates, rim boards and band joists
- ☐ Partition intersections
- ☐ Subfloor and wallboard joints
- ☐ Exterior wall corners
- ☐ Door frames and thresholds
- ☐ Window frames
- ☐ Soffits
- ☐ Service penetrations
- ☐ Electrical outlets in exterior walls
- ☐ Exterior wall at bathtubs and showers

Combination of materials required to fix or seal air leaks:

- ☐ Spray foam
- ☐ Caulking, backer rods
- ☐ Gaskets
- ☐ Weatherstripping
- ☐ House wrap
- ☐ Sealant tape
- ☐ Mastic

Air Tightness – Framing Use of Sealants

- Code upgrades focus on required applications of sealant in multiple locations on wood framed buildings
- This adds considerable material, labour and time to the construction of the building envelope, plus responsibility and liability
- Wood framing requires exterior and interior sealant and taping to maintain a continuous air barrier



Air Tightness – Material Durability

Complexity of design and application for the long-term

- Durability of air barrier materials - house wraps, sealants and tapes
- Strength, and possible degradation from weather and mechanical forces created by wind and stack effect pressures
- Interface degradation with other materials
- Correct installation techniques



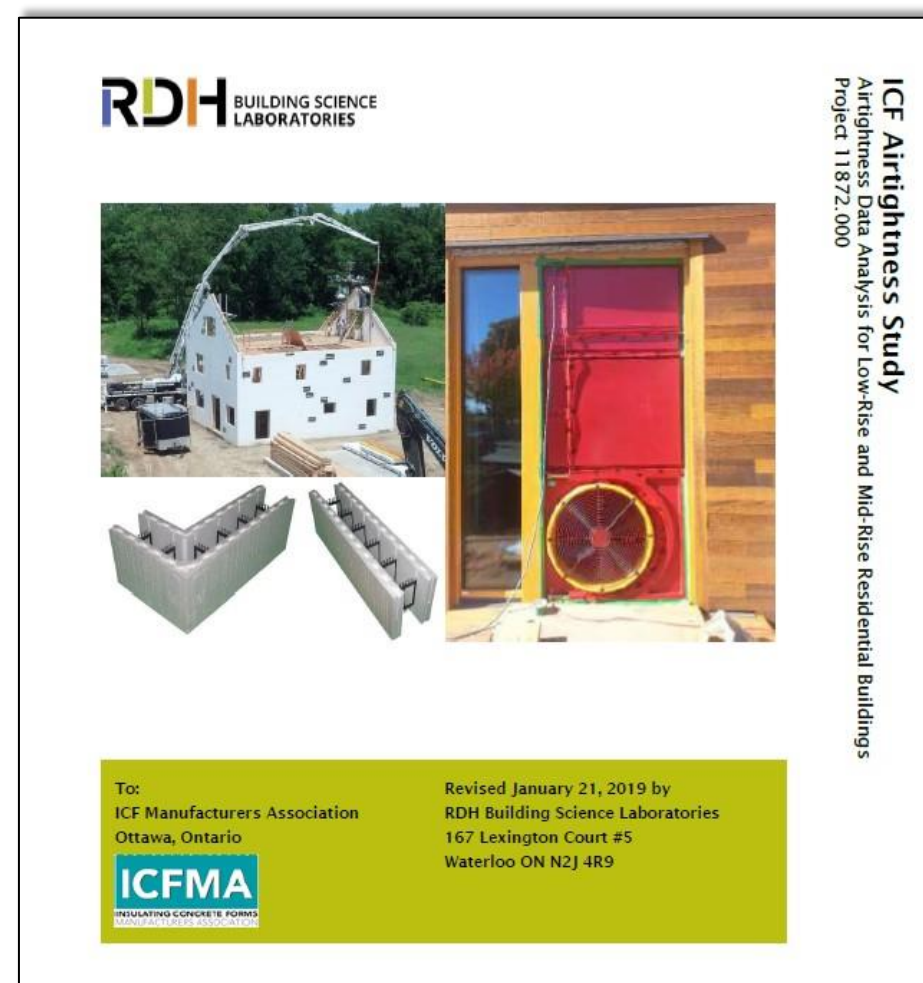
ICFs and concrete as an air barrier do not degrade over time



Air Tightness

An ICF home and building will have a high-performance building envelope complimenting the energy efficient windows, doors and roof assembly

Air infiltration rates on ICF homes are exceeding the proposed code minimums for Net Zero Ready Homes and Energy Star ratings.



ICF homes typically -
change rate not greater than
1.5 ACH @ 50Pa

RDH Airtightness
Testing for ICFs Report
www.foxblocks.com



Air Tightness

ICFMA 2019 survey, identified in an Airtightness Study, by a recognized third-party lab - RDH found on average, over 50 typical ICF homes with the following results:

- ✓ Average airtightness was 1.26 ACH@50 Pa.
- ✓ All the ICF data results an average of 2.57 ACH @50 with a median of 1.56 ACH@50

The following are ICF homes blower door test results:

Hampton, Fl	ACH 1.44
Bancroft, Fl	ACH 0.15
Biscayne, Fl	ACH 1.09
Ferrier, Fl	ACH 0.95
Gardiner, NY	ACH 0.28
Valley, Fl	ACH 1.65
Glenridge, Fl	ACH 1.81
Ontario, Can	ACH 0.85
Sedona, Az	ACH.058



Gardener



Hampton



Bancroft



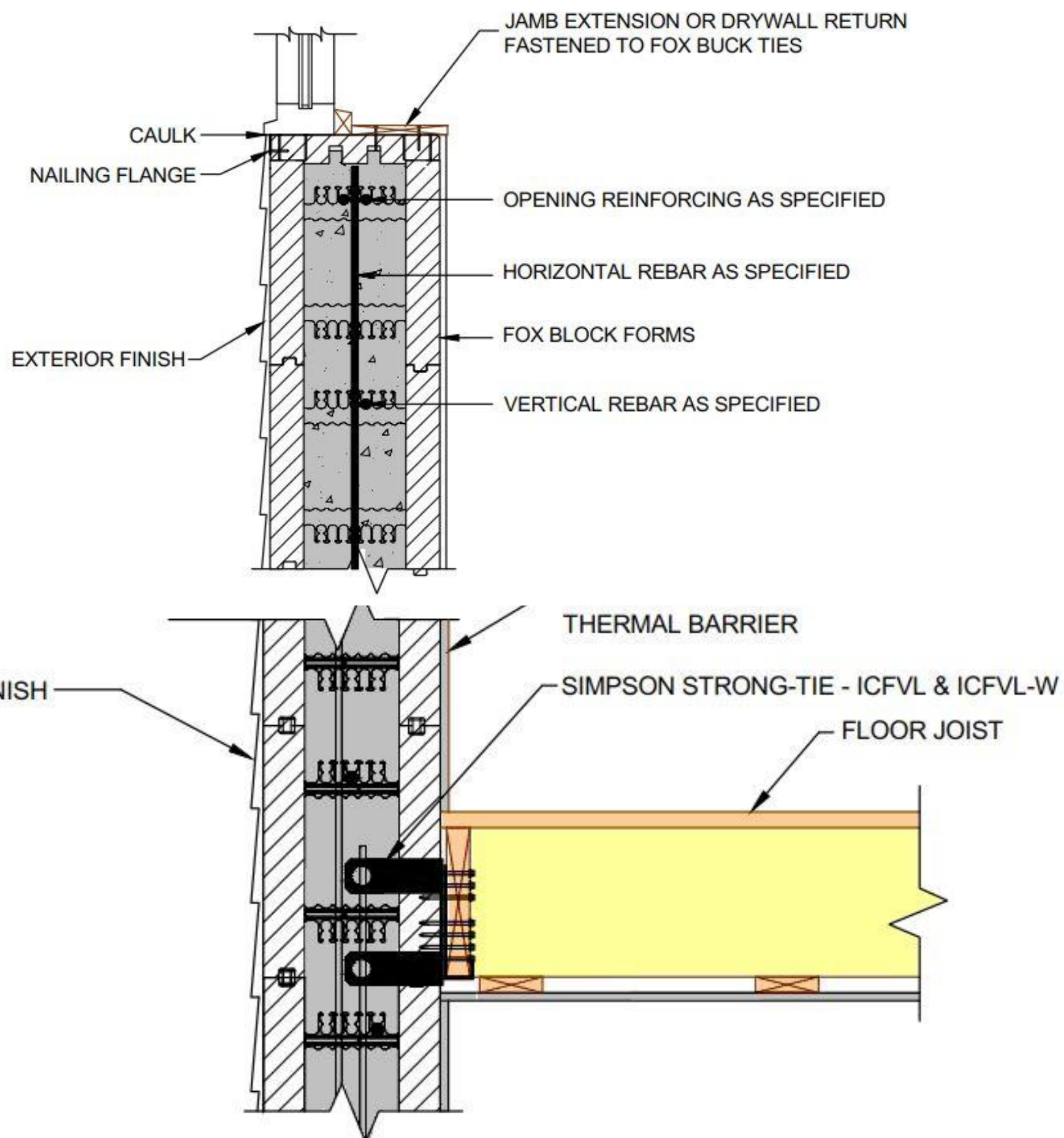
Glenridge



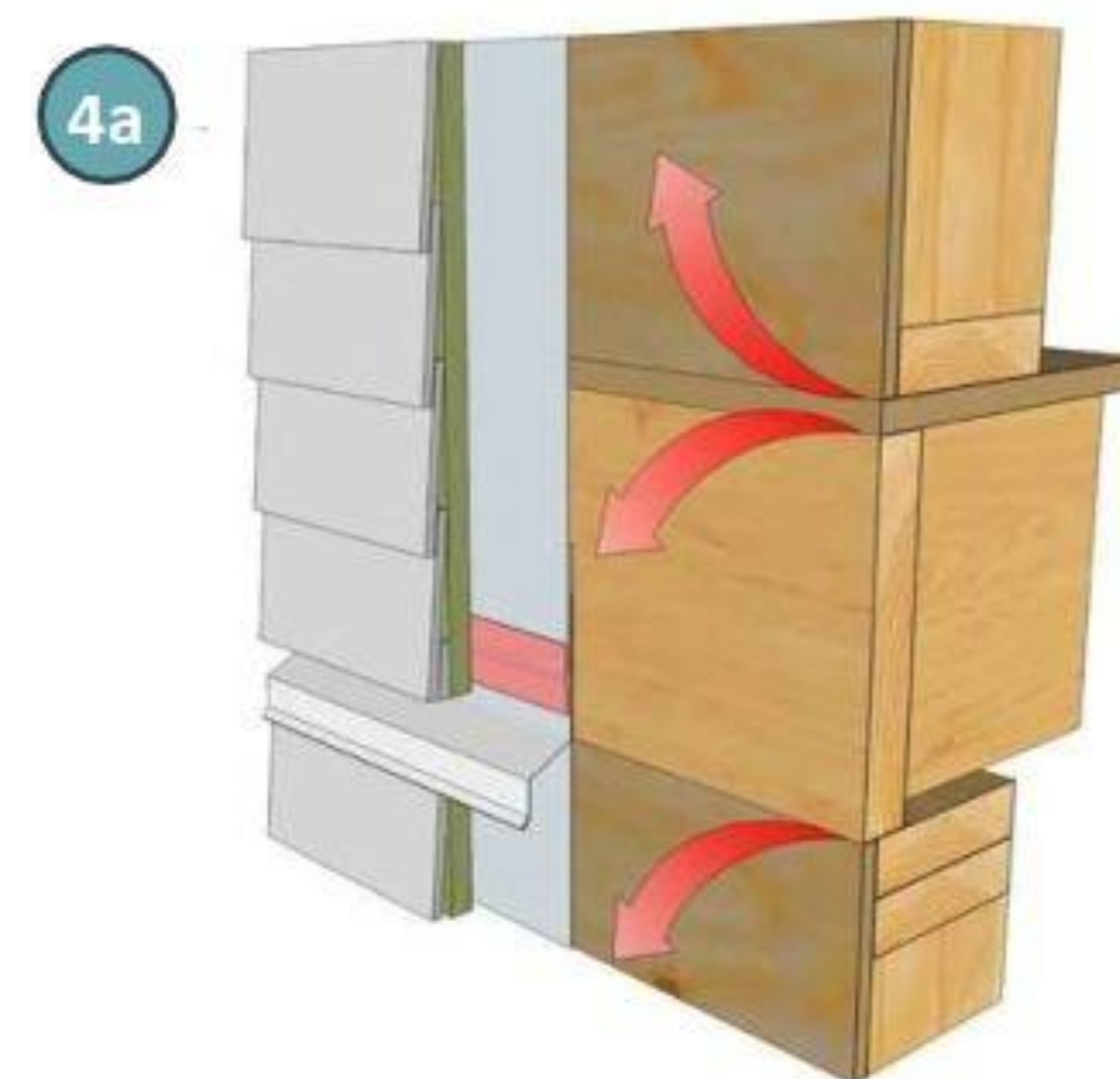
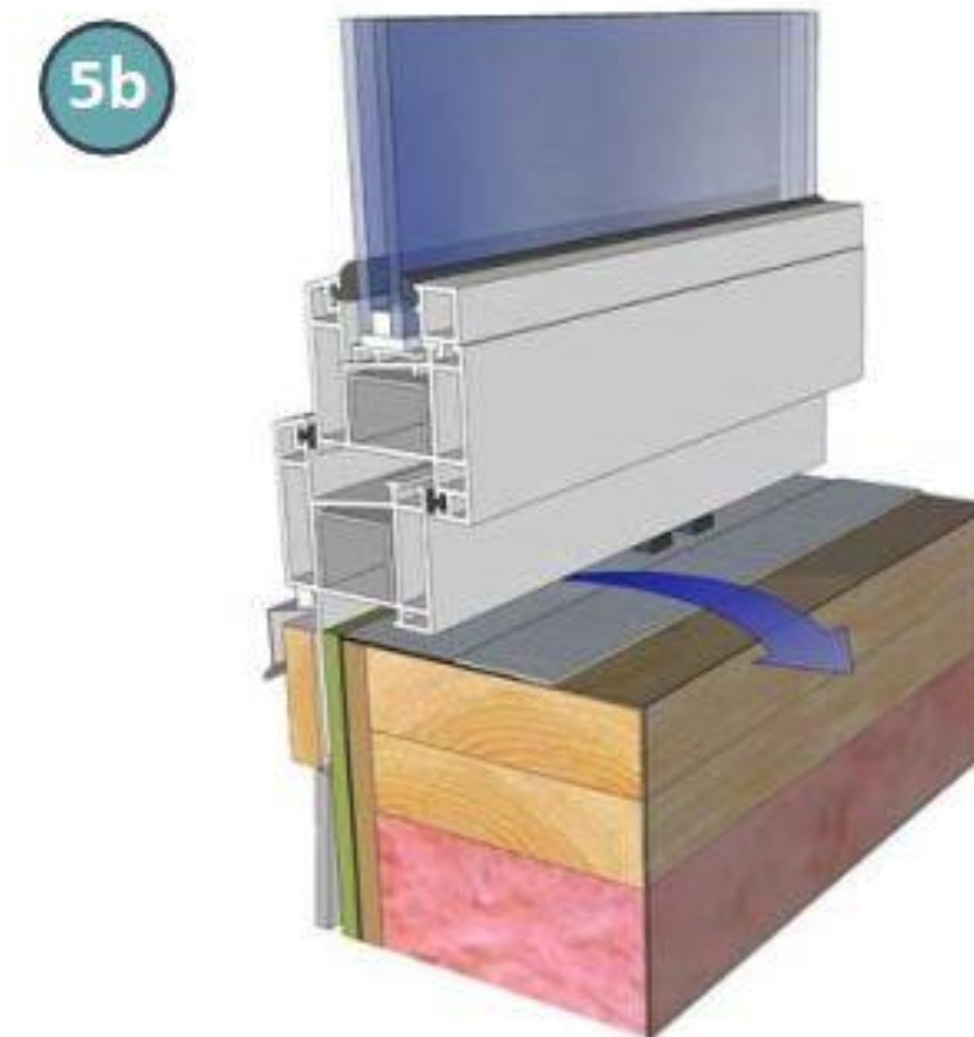
Air Leakage

ICF – Advantages

- Continuous concrete air barrier
- No thermal bridging
- No caulking required except sealant around openings
- Concrete will not deterioration
- Concrete is resilient to high winds and pressure



NO Air Barrier or Weather Barrier required

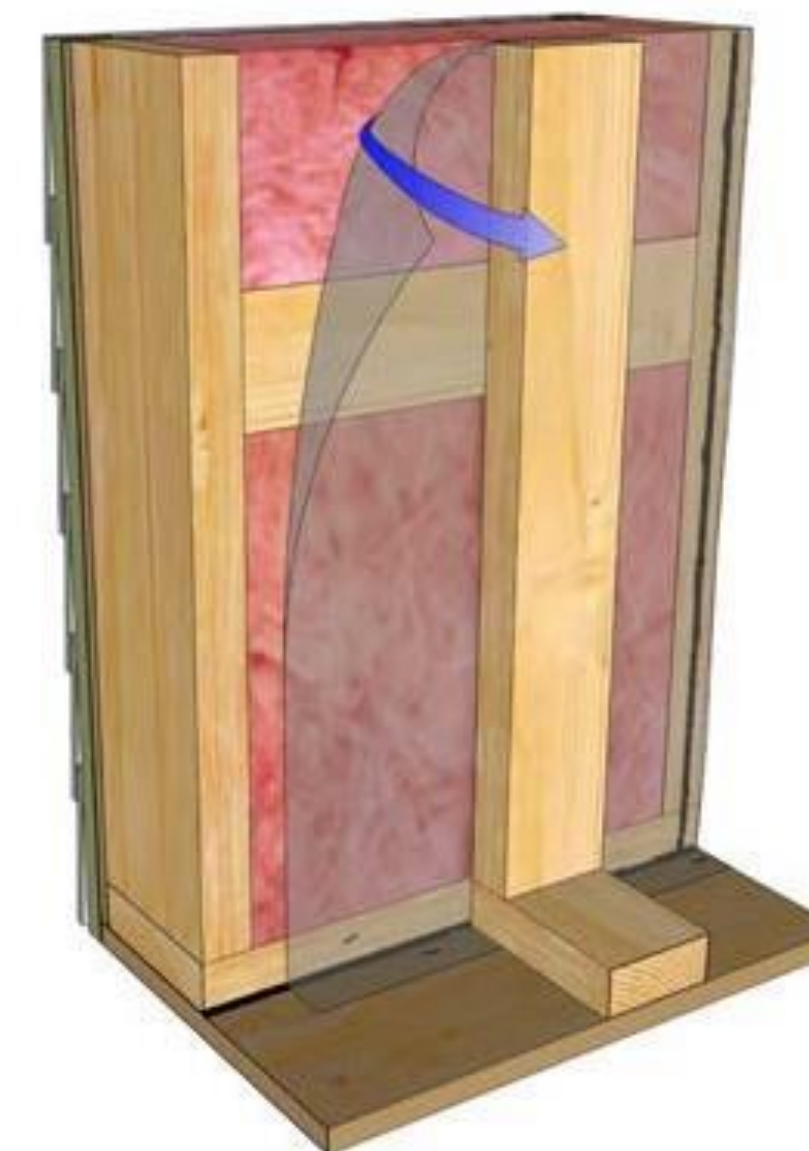


Wood Frame Air Leakage Paths



Vapour Barrier

3



ICFs have been tested per ASTM E96 for a Permeability

ICF permeance rating is - 47.76 ng/(Pa.s.m²) which exceeds code requirements

ICFs directly apply gypsum board to walls



No Vapour Barrier or poly is required over a Fox Blocks wall assembly



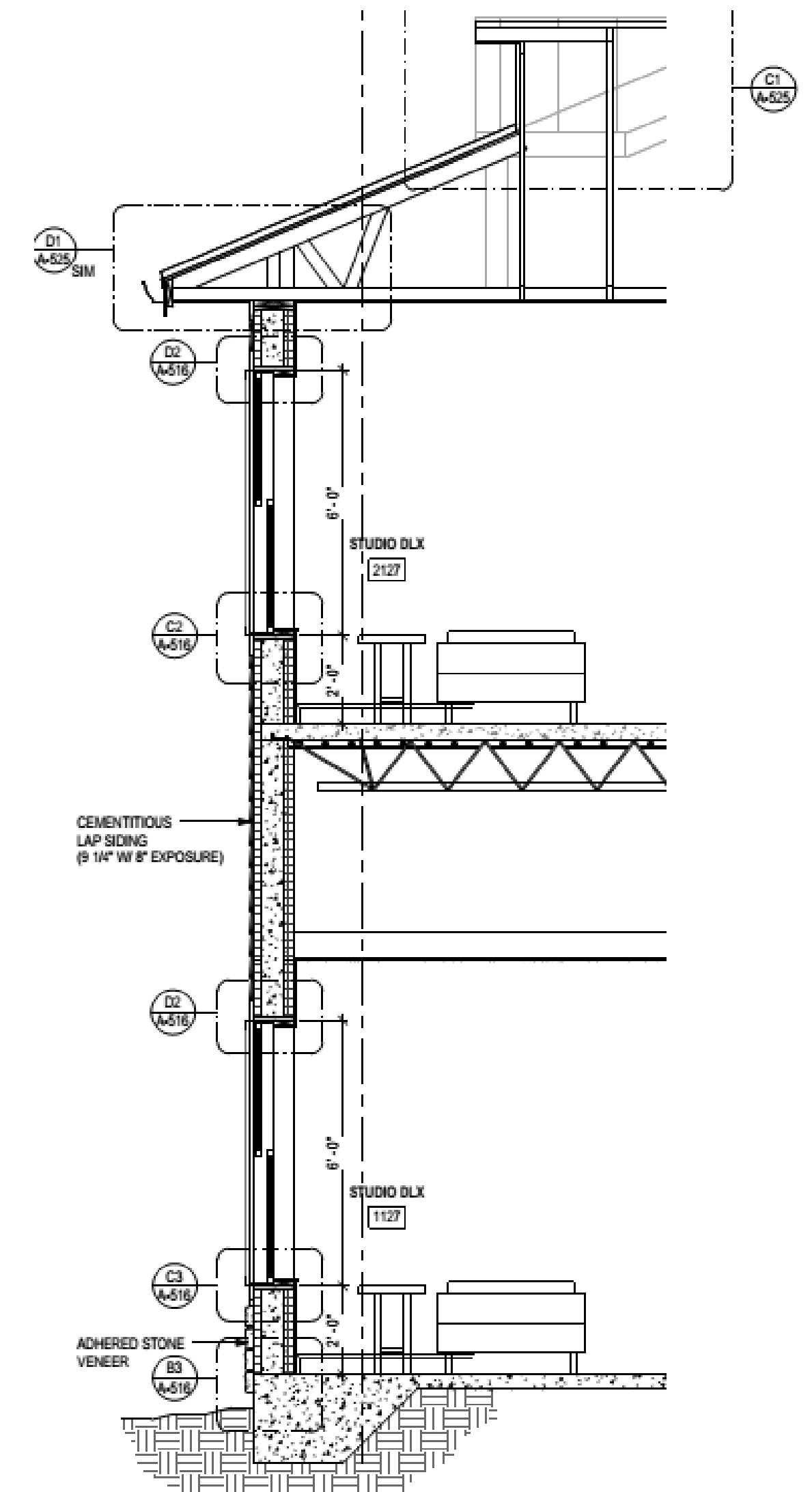
Vapour Barrier

Large temperature changes through an ICF wall assembly may create a *Dew Point* near the exterior face of concrete within the ICF

Concrete has the ability to maintain and dry out this moisture

There is NO condensation near the interior face of the ICF wall in cold or hot climates

This is recognized in the building code as part of mass wall construction



EXTERIOR WALL SECTION @ RESIDENT ROOMS W/STONE WAINSCOT



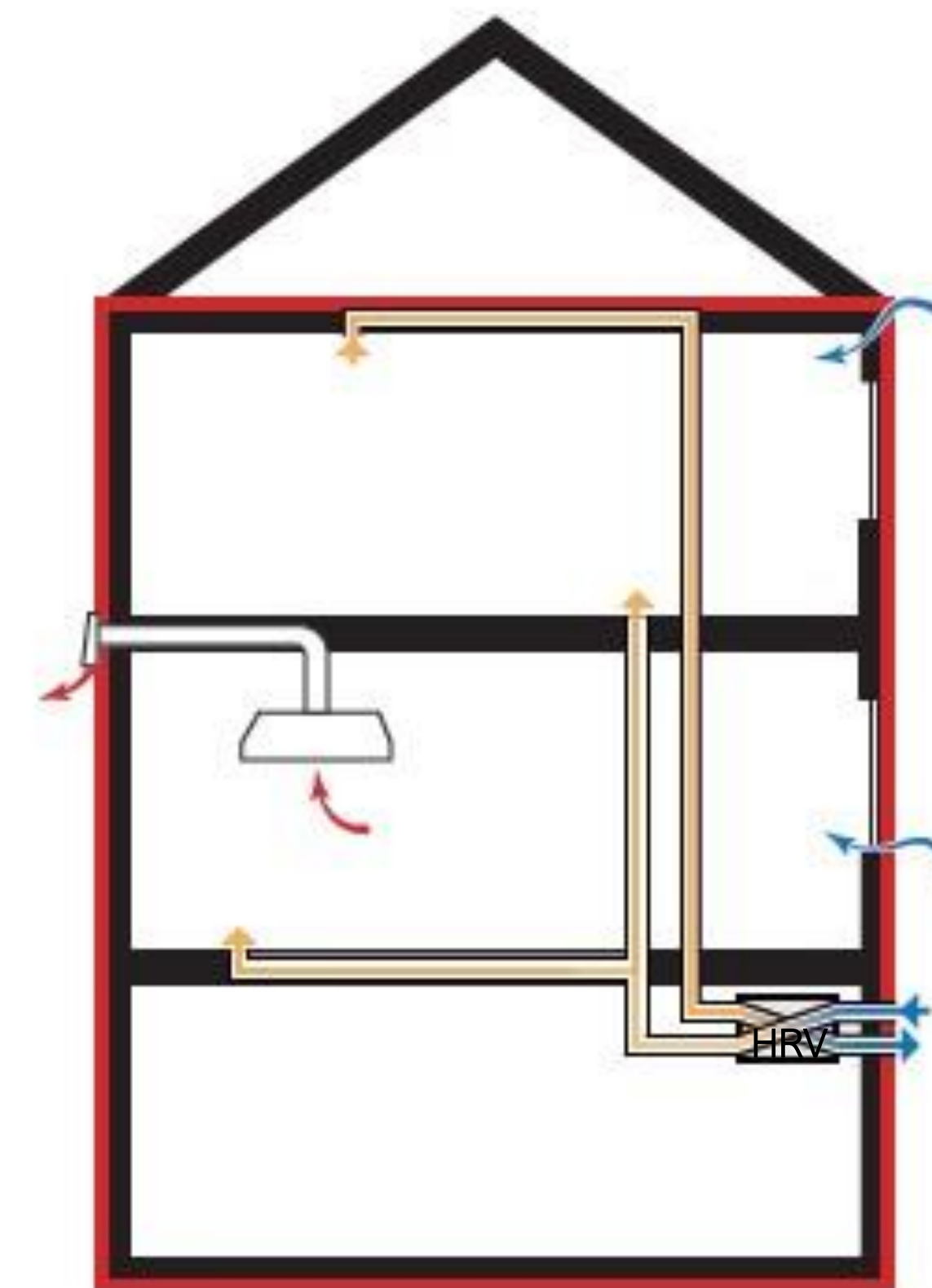
IAQ – Indoor Air Quality

Increased air and vapour protection, from an ICF, increases the need for effective mechanical ventilation.

HRVs are recommended for high-performance in ICF homes

Better control over the indoor air environment provides a more comfortable and healthy environment

Better environment for control by HVAC systems



High-Performance Building

Airtight enclosure and mechanical
ventilation with or without heat recovery

=

High thermal performance



Health and Comfort from ICFs

The ability of a simple **Fox Blocks** wall assembly to control air infiltration, vapour diffusion, sound plus effective high-performance thermal resistance provides:

- Better Indoor Air Quality
- Better Comfort with minimal temperature swings, no drafts
- Resiliency and security
- Reduction in HVAC equipment sizing due to air tightness and thermal efficiency
- Reduction in HVAC demand and operations = monthly operational cost savings



Health and Comfort

'When designing high-performance buildings, an enclosure – first approach is commonly chosen. This entails a highly insulated and airtight building enclosure.'

The ability of a simple ICF wall assembly to control air infiltration, vapour diffusion and effective thermal resistance creates a high-performance building envelope that contributes to:

- Healthy indoor environment
- Comfort, safety and security
- Indoor Air Quality

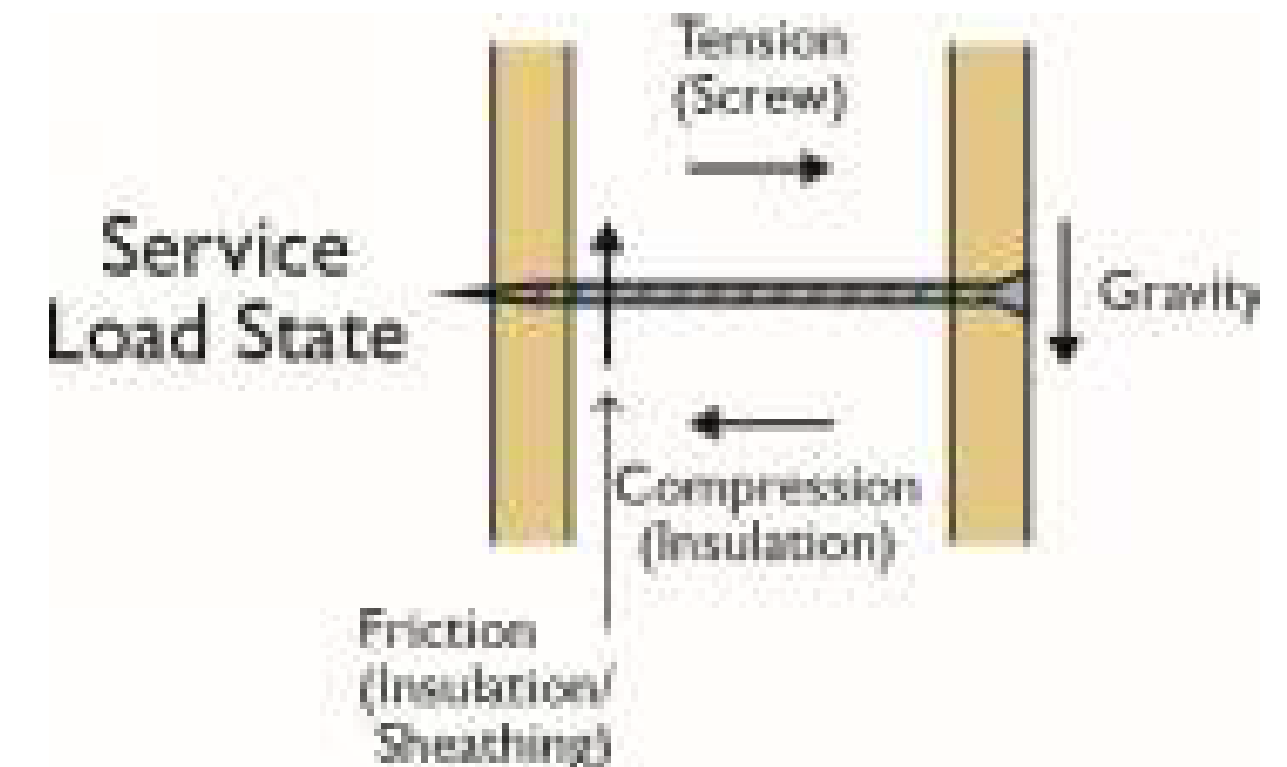


Framing - Exterior Finish Attachment

In new high-performance wood 'Component Method' the increased thickness of additional exterior insulation is creating an issue for the attachment of the exterior finishes

Longer and stronger screws are being required to address the increased deflection and stress on the attachment points to secure the finishing materials

This adds material and labor costs





Attachment – Continuous

Fox Blocks fastening strips:

- 1 ½" wide, (similar to wood stud)
- 8" on center, embedded in concrete
- Continuous for height of wall
- On exterior and interior side of wall
- Buried ⅝" beneath EPS
- ASTM approved testing for pull-out and lateral shear for various fasteners
- No thermal bridging
- No deterioration from moisture





Direct Attachment of Finishes

Fox Blocks EPS provides a continuous and solid substrate for the direct application of exterior and interior finishes such as:

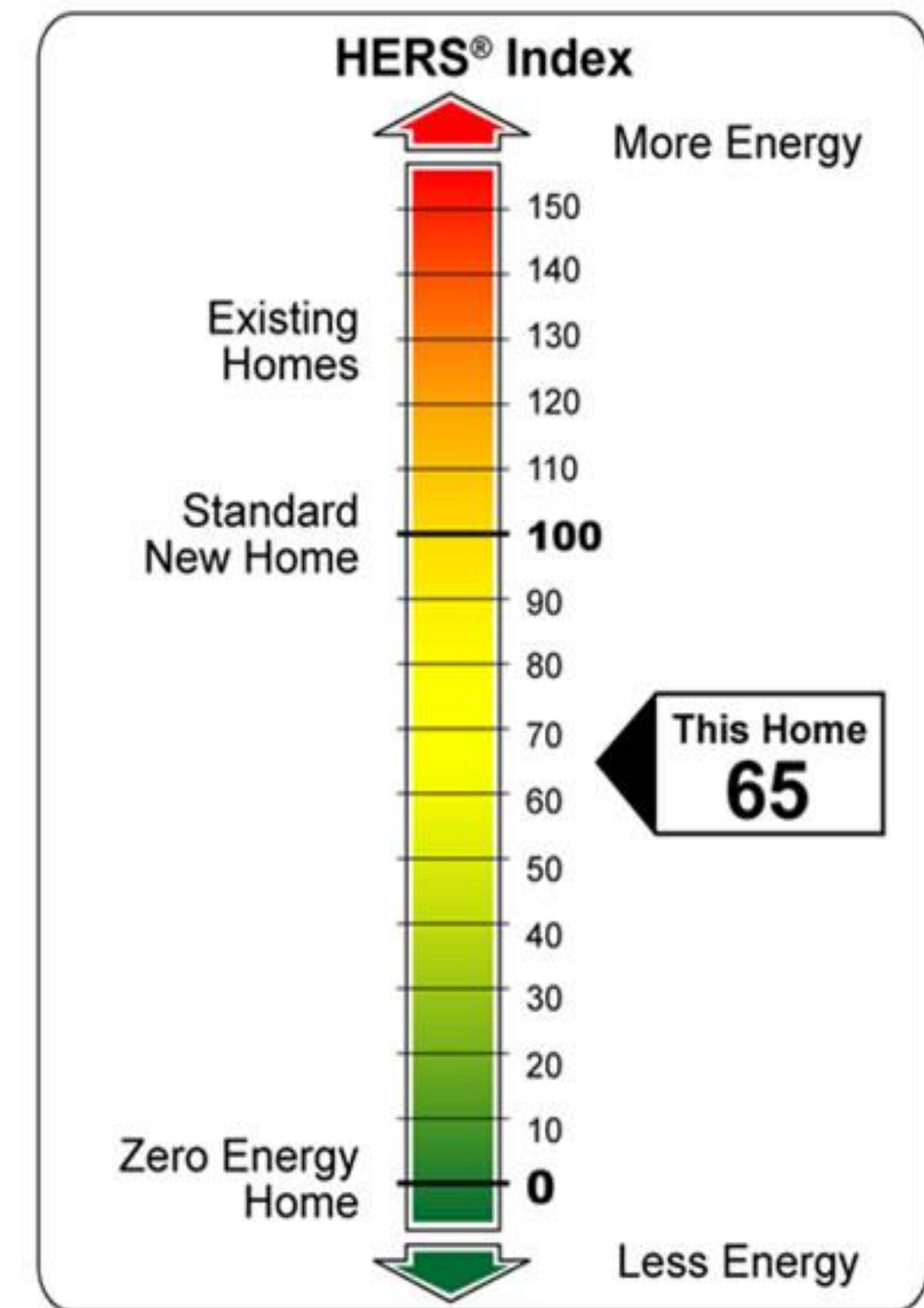
- Acrylic stucco
- Lath and cementitious stucco
- Simulated stone
- Decorative concrete
- Masonry
- Siding
- Gypsum Board



High-Performance and Net Zero Ready

Fox Blocks homes with an integrated design are high-performance homes and can meet criteria to be Net Zero Ready.

- Third party tested – Energy Rating
- Insulated with no thermal bridging
- Airtight envelope design
- Indoor air quality with HRV to meet 'airPlus' standards
- Design for renewable energy source – PV systems
- Balanced HVAC designed for ICF mass walls



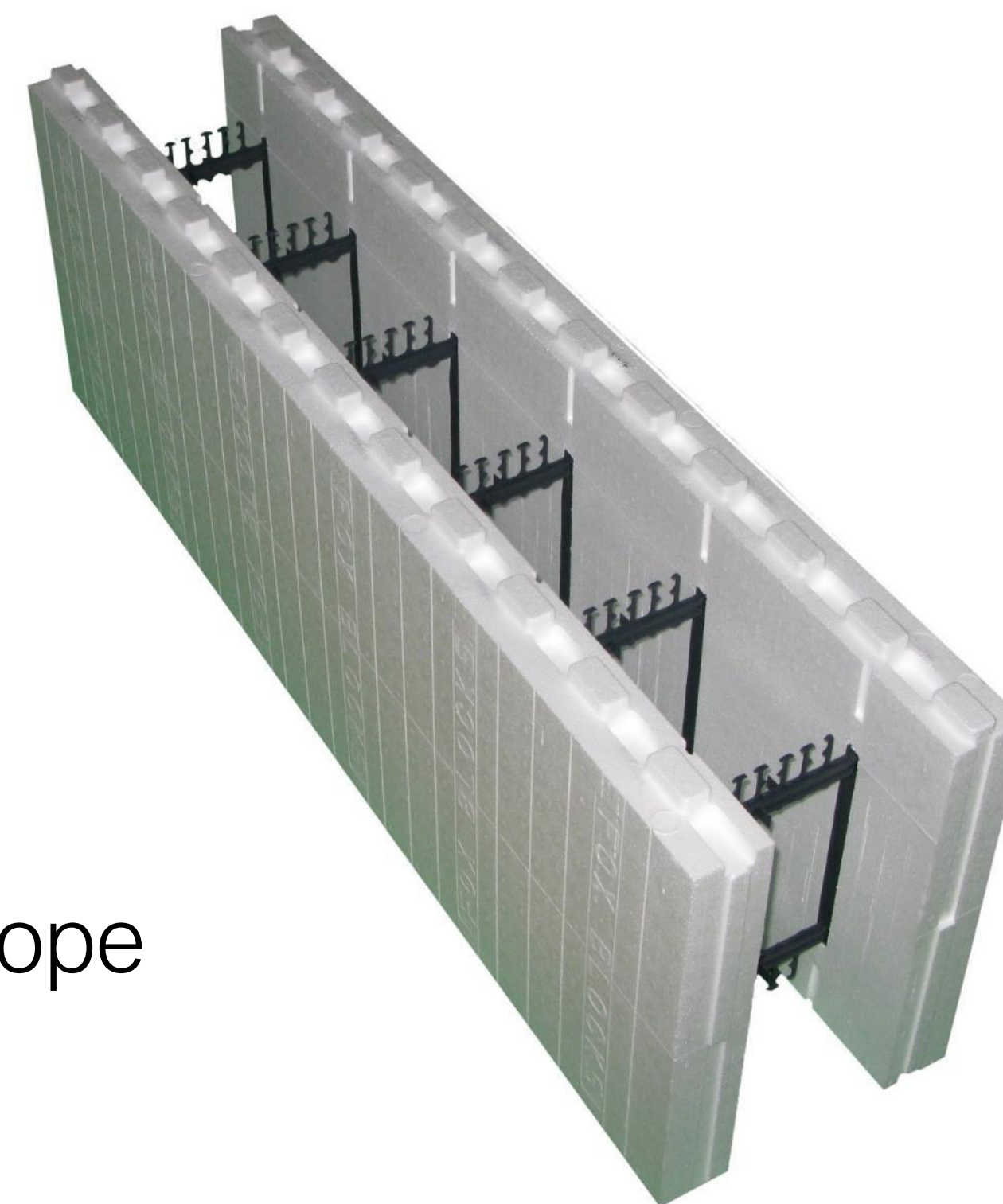
New code homes < 55
High-performance ICF homes < 40
Net Zero – 0



Net Zero Ready Homes (NZRH)

Fox Blocks as the building wall envelope enables NZRHs certification

- High performance, thermal resistance mass wall
- Continuous insulation
- No thermal bridging
- Minimal air infiltration
- Vapor and moisture control
- Better control on indoor air quality with a tight building envelope
- Structurally capable for PV systems
- Resilient, fortified structure





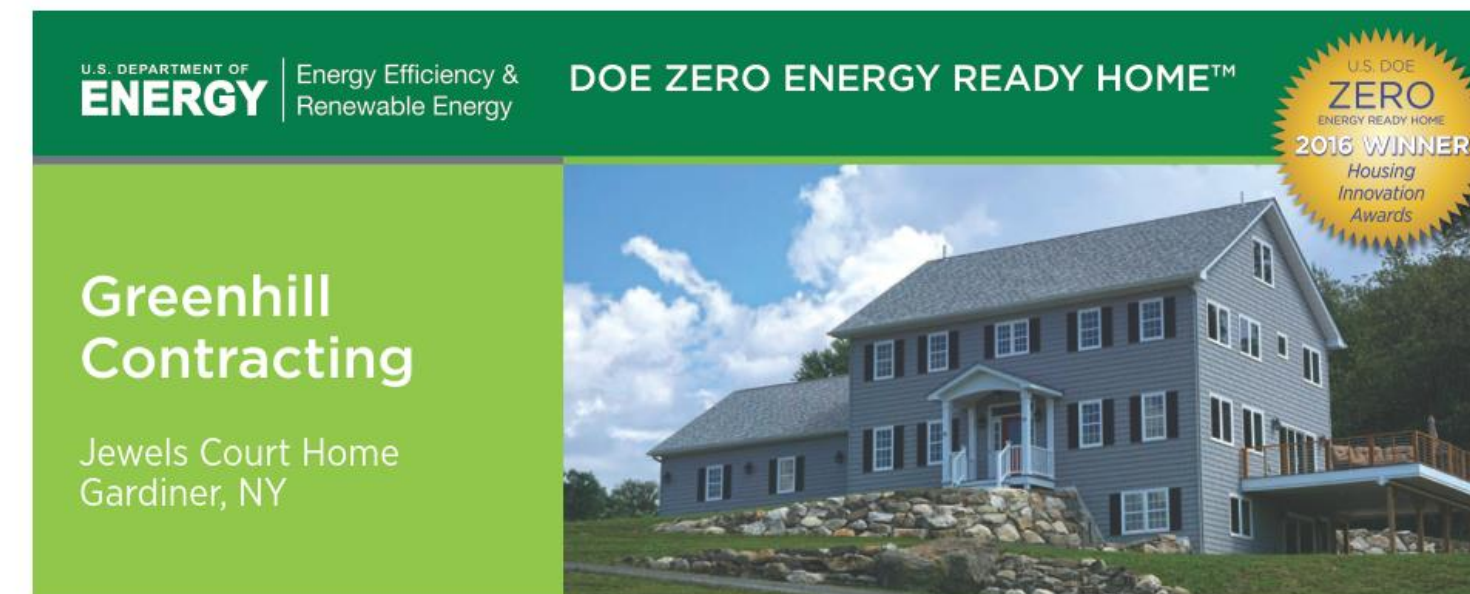
Net Zero Ready Homes (NZRH)

FOX BLOCKS has been building NZRH homes and commercial buildings for years

Winning Innovation Energy Awards

- very low, even minus Energy Ratings
- 5 Star Energy Star certifications

Fox Blocks rated homes can easily have HERS ratings well below the national average and with an integrated design can and have met NZR criteria.



BUILDER PROFILE

Greenhill Contracting, Esopus, NY
Anthony Aebi, greenhillcontracting@yahoo.com
845-594-5076, www.zeronetnow.com
Rater: Integral Building & Design, Inc.
Pasquale Strocchia
pasquale@integralbuilding.com

FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Jewels Court Home
- Location: Gardiner, NY
- Layout: 3 bdrm, 3.5 bath, 3 fl + bsmt, 3,912 ft²
- Climate Zone: IECC 6A, cold
- Completion: May 2016
- Category: custom for buyer

Modeled Performance Data:

- HERS Index: without PV 29, with PV -11
- Projected Annual Energy Costs: without PV \$1,875, with PV -\$322
- Projected Annual Energy Cost Savings (vs home built to 2009 IECC): without PV \$3,200, with PV \$5,397
- Projected Annual Energy Savings: without PV 24,615 kWh, with PV 41,518 kWh
- Added Construction Cost: without PV \$45,000, with PV \$87,000

This custom home perched on a hillside overlooking the Hudson River Valley near Gardiner, New York, has terrific views outside and terrific news inside. The home was built by Anthony Aebi of Greenhill Contracting in Esopus, New York, to the exacting specifications of the U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH) program. With high-performance walls and HVAC inside, plus 13.4 kW of solar panels on the roof, the home owners should have zero energy bills. In fact they may get enough credit on their utility bills to power an electric car with the surplus.

The 3,912-ft² home achieved a Home Energy Rating System (HERS) score of -11. That is better than net zero (a home that produces as much power as it consumes in a year) and far better than a typical new home, which would score roughly 80 to 100. This equates to energy savings of \$5,400 a year compared to a home just built to local code, which in New York is equivalent to the 2009 International Energy Conservation Code (IECC).

Even without the PV added, the home would achieve a HERS 29, thanks to the highly efficient shell and high-performance features. Like all DOE Zero Energy Ready homes, this home met the requirements of ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS program, as well as the hot water distribution requirements of the EPA's WaterSense program and the insulation requirements of the 2012 IECC. Certified homes are also required to have a solar electric system installed or have the conduit and electrical panel space in place for it.

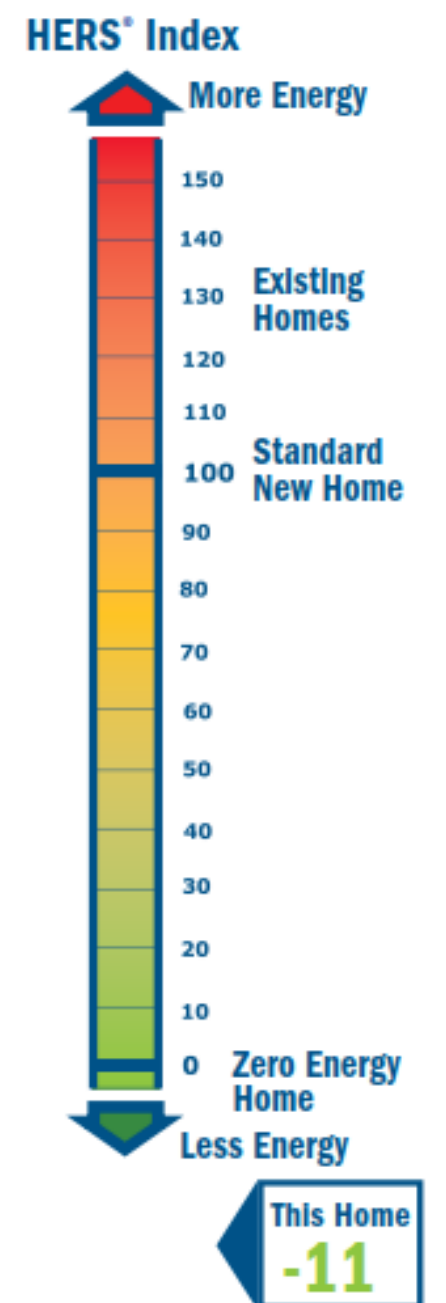
All of Aebi's homes are certified through the DOE Zero Energy Ready Home program. "I started building in 1995 but didn't 'really' start building until 2007 when I started building zero energy 'homes of the future,'" said Aebi. Aebi became a partner of the DOE program in 2007 and completed his first certified



The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

What makes a home a DOE ZERO ENERGY READY HOME?

- 1 BASELINE**
ENERGY STAR
Certified Homes
Version 3.0
- 2 ENVELOPE**
meets or exceeds
2012 IECC levels
- 3 DUCT SYSTEM**
located within the
home's thermal
boundary
- 4 WATER
EFFICIENCY**
meets or
exceeds the EPA
WaterSense
Section 3.3 specs
- 5 LIGHTING AND
APPLIANCES**
ENERGY STAR
qualified
- 6 INDOOR AIR
QUALITY**
meets or exceeds the EPA Indoor
airPLUS Verification Checklist
- 7 RENEWABLE READY**
meets EPA Renewable Energy-
Ready Home.

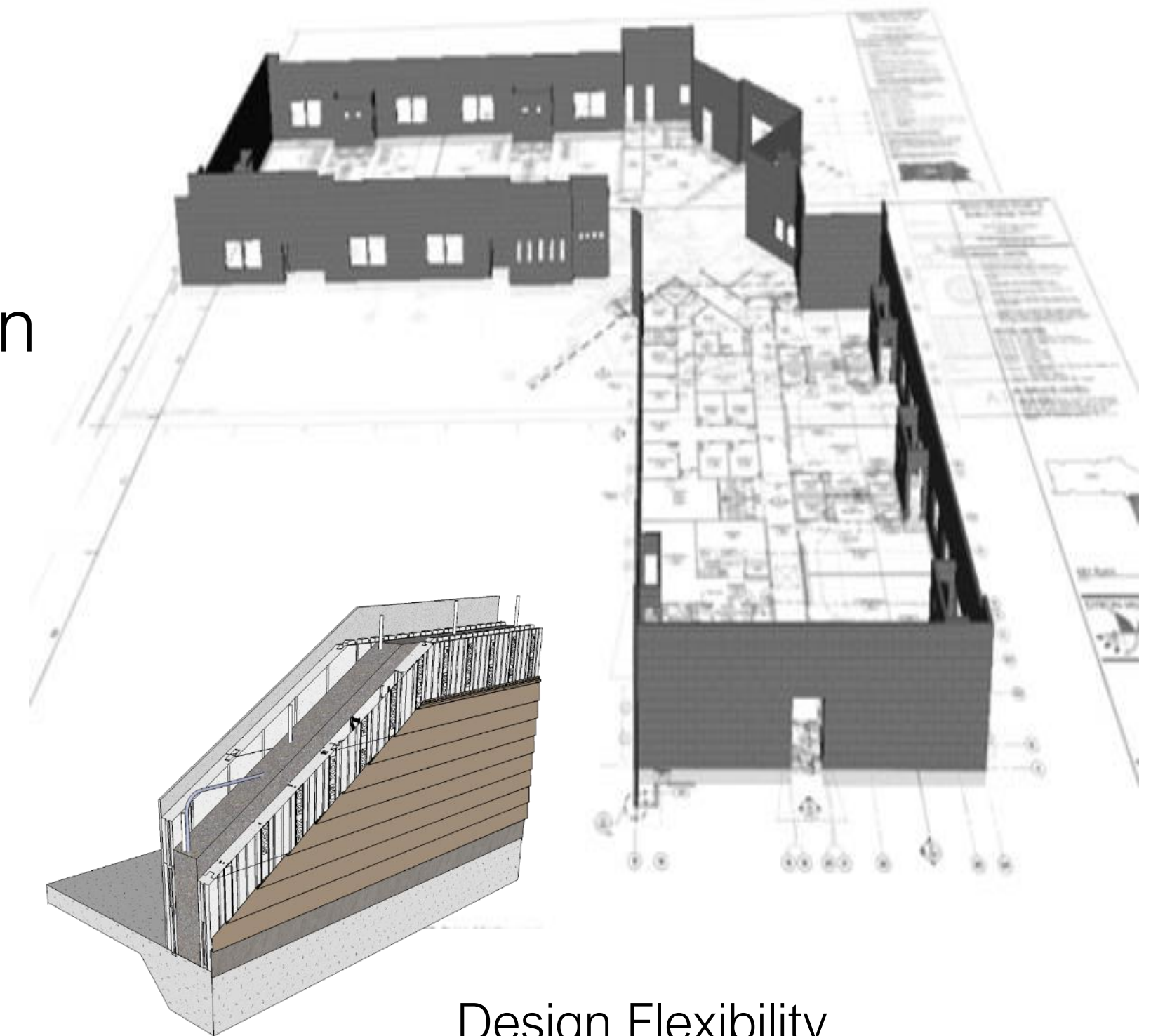


Greenhill Contracting has won this innovation energy award 4 years in row, building with Fox Blocks in the New York area.

Construction Simplicity – Flexibility

Design and Construction Flexibility - Residential and Commercial

- ✓ Full line of block shapes and sizes for any design configuration
- ✓ Full library of CAD, BIM, specifications and technical support
- ✓ Modular product, 1 ICF block = 5.33 sq.ft. of wall area
- ✓ Full line of ICF accessories
- ✓ Less materials and labour for the building envelope (no air, vapour barrier, sealant, no tape)
- ✓ Reduced crew size, faster completion and occupancy
- ✓ Ability for year construction
- ✓ Compatible for any building type, any wall height



Resiliency



A CHARTER OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION

5 Key Elements to Building with Strength:

Stands the test of time

Concrete structures are designed to last for centuries. Unlike other materials, concrete only gets stronger over time.

Sustainable

Concrete's strength, durability and energy efficiency make it an environmentally friendly material—especially when you consider the entire lifecycle of the building.

Simple to use

If a material isn't easy to use, it doesn't matter how strong it is. Good thing concrete can be molded into any shape, size or design you can imagine.



Safe and strong

Building with concrete gives you a fire resistant structure. When combined with other fire safety systems, you can exceed building requirements—instead of just meeting them.



Value that lasts

Concrete won't rot, mold, rust or deteriorate. It's energy efficient and virtually maintenance-free—which means the resources you invest now will last for decades to come.



Fire Rated Wall Assemblies

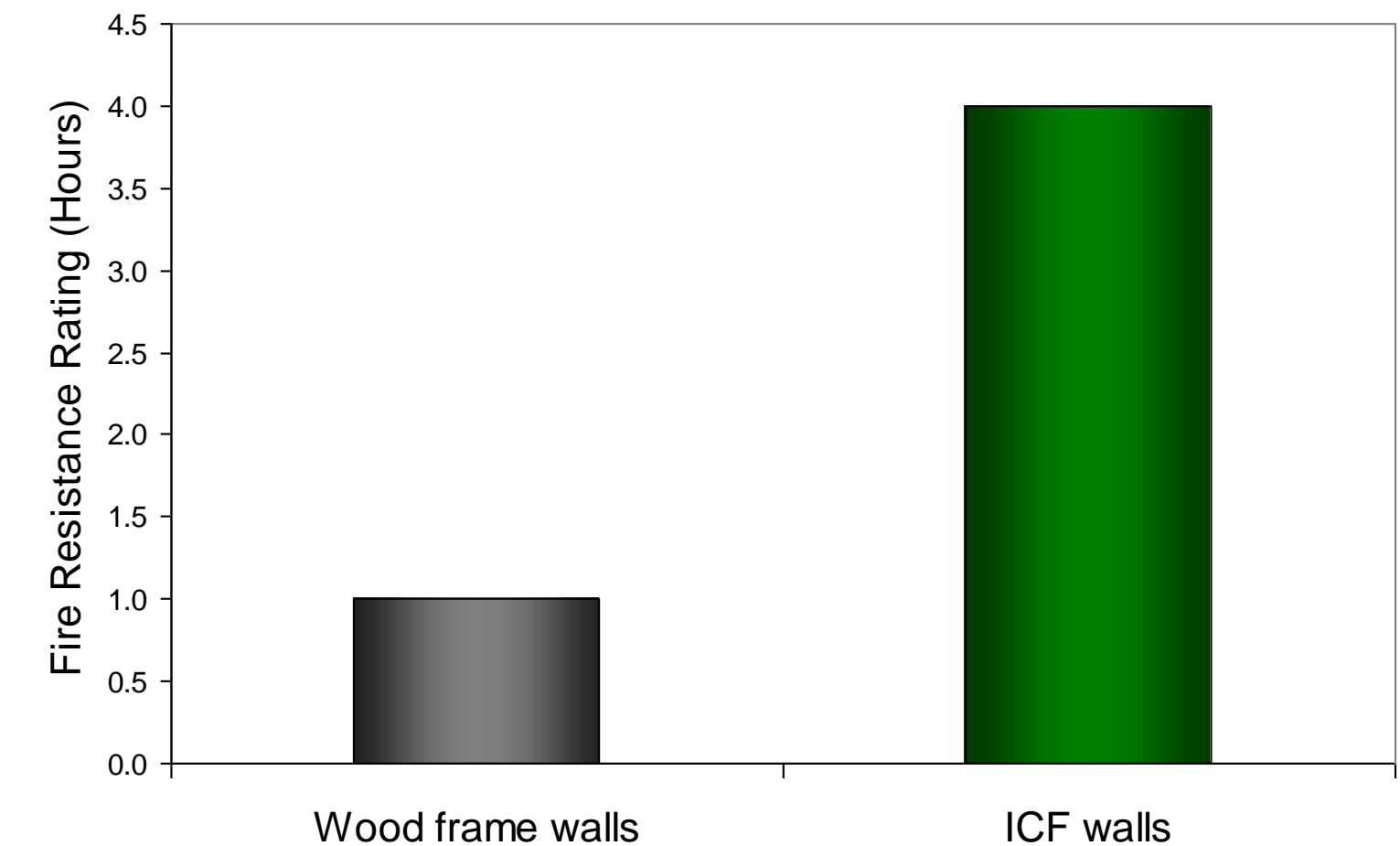
ICF wall assemblies have fire resistant(FRR) listings from a 2 to 4-hour fire rating

Third Party Testing & Performance-Expanded Polystyrene:

ICF Flame Spread / Smoke Development Index

Flame Spread Index (FSI) is less than 25
Max. per Code is 75

Smoke Development Index (SDI) is less than 450
Max. per Code is 450



Fire Resistance – Wood vs ICF



Comfort and Sustainability

Residential and Commercial:

- ✓ Excellent Sound Attenuation (STC50+)
- ✓ Energy efficiency from double insulation layers and thermal mass
- ✓ Security from resiliency of reinforced concrete structure
- ✓ Longevity, life span of the EPS and Concrete – no deterioration
- ✓ Typical ICF form, by weight, contains 40% + recycled material
- ✓ Modular product means less construction waste
- ✓ Compatibility with all exterior finishes

Reduction of Labor Rates

- ❑ Associated General Contractors of America claim 80 % of construction companies report problems finding skilled workers, causing delays and increased labor costs
- ❑ Report also found that 46 % of construction firms are taking longer than initially scheduled to complete projects
 - Success in construction is based on the completion timeline
 - Strategy for success is to use less materials and labor to achieve the same or better deliverables

Fox Blocks is an easy product to learn the installation techniques

Fox Blocks can advance completion timelines by 3 weeks or more

Reduction of Labor Rates

- Light material, minimal heavy transport equipment and no heavy metal concrete forms to transport, strip and maintain
- ICF job sites are generally clean and safe for the crew
- Laborers can be quickly trained to become certified ICF installers. Installer training is available
- Reduce staging timeframes by eliminating subtrade labor for other building elements such as - air barrier, vapor barrier, insulation, and strapping for finishes.
- Proven record for substantially reducing completion times to advance occupancy
- Expected labor rates:
 - ✓ \$0.075 to \$0.085 per gross sq. ft. of ICF



ICFs are much lighter than traditional form systems. This photo shows one man handling a full bundle of ICFs.

One ICF block equals 5.33 ft² of wall area.

Fox Blocks Markets

Unlimited markets for high-performance in all building types across North America:

- Below and above grade walls
- Residential, commercial, agricultural
- Multi-family, townhouses
- Tall walls
- Fire walls
- Multi-story buildings (tallest 22 floors)



Simple Design Strategy with Fox Blocks

- Flat, monolithic reinforced concrete wall
- Concrete core sizes – 4", 6", 8", 10" and 12"
- Engineering available in IRC code or ACI 318
- ICFs are covered in the IRC building code
- Continuously insulated *mass wall* assembly
- One block equals 5.33 sq.ft. of wall area
- Full line of block products and accessories
- Meets or exceeds current energy codes for all climate zones

FOX BLOCKS INSULATING CONCRETE FORM FEATURES

FOX BLOCKS TRUEGRID
Sustainable Solutions for Your Project and Our Environment

Reversible
Universal forms with no top or bottom, no right or wrong side and no left or right corner make stacking easy.

Engineered Ties
Fox Blocks ties has stout strength along with an open truss design that allows for proper concrete consolidation.

Ties Stack on Top of Each Other
Eliminates the settling of forms during concrete placement. Also, creates a continuous vertical fastening strip - No Gaps!

True 1.5 Density EPS Foam
The form always feels solid and you'll have less damage to forms during handling.

Furring Strip is a Full 1 1/2" Wide and 16" Tall
Allowing for easy attachment of drywall and exterior finishes. Tested fastener pullout strength equal to or greater than wood.

Other Form Configurations

- 90° Corner
- 45° Corner
- T-Block
- Corbel Ledge
- Taper
- Radius

5 Core Sizes Available
4", 6", 8", 10", 12"

Simple Design Strategy

6 in 1 product attributes *for high-performance*:

- Easy constructability for below and above grade walls
- Minimize materials and sub-contractors
- Business advantages – faster, cheaper, better
- No call backs, over satisfy your customers
- Step into High-Performance and NZR home construction

Progress away from conventional
'Multiple Component Wall Assemblies' to a simpler
more effective wall assembly with ICFs



- Structure
- Insulation
- Air Barrier
- Vapour Barrier
- Attachment
- Reversible Interlock



Fox Blocks Experience

- 22+ years experience manufacturing and building with Fox Blocks
- Over 11 million +, ICF blocks produced to date
- Over 60 million plastic webs/ties
- Over 55 million square feet of ICF walls successfully installed to date
- Fox Blocks Technical Team with over 300 Years ICF experience
- Multiple manufacturing locations throughout North America





Thank You

Feel free to ask us any questions.

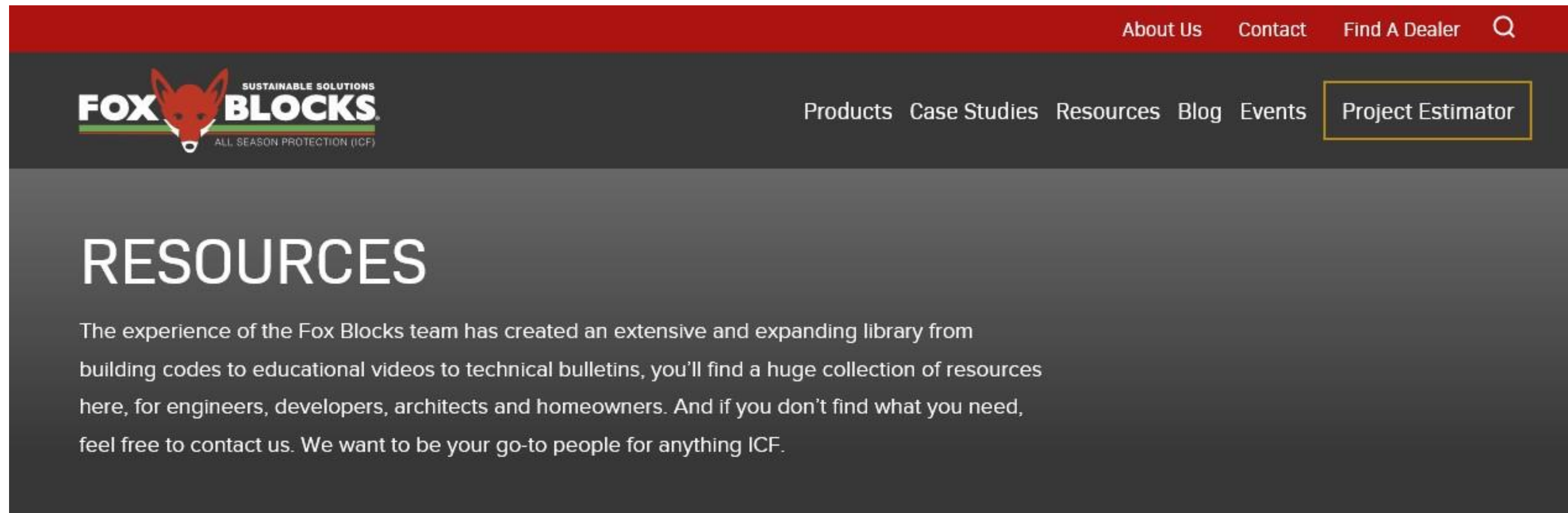
info@foxblocks.com

www.FoxBlocks.com

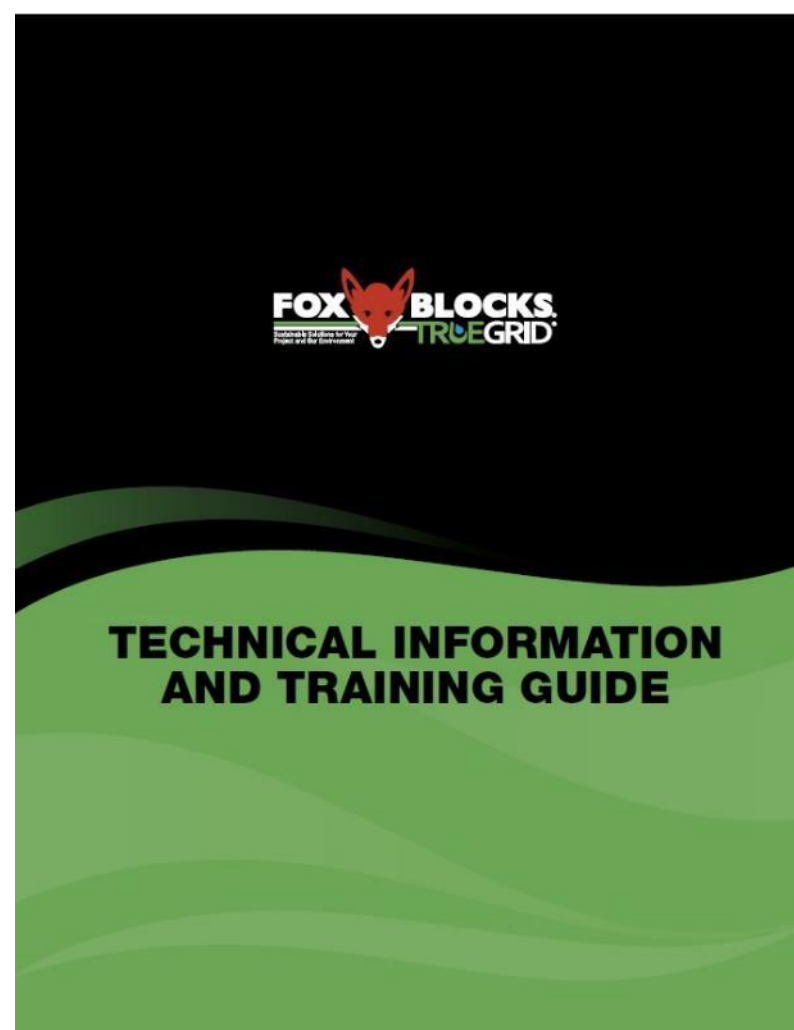
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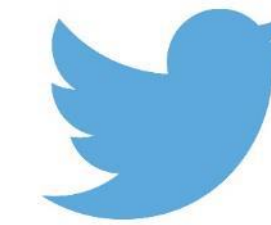
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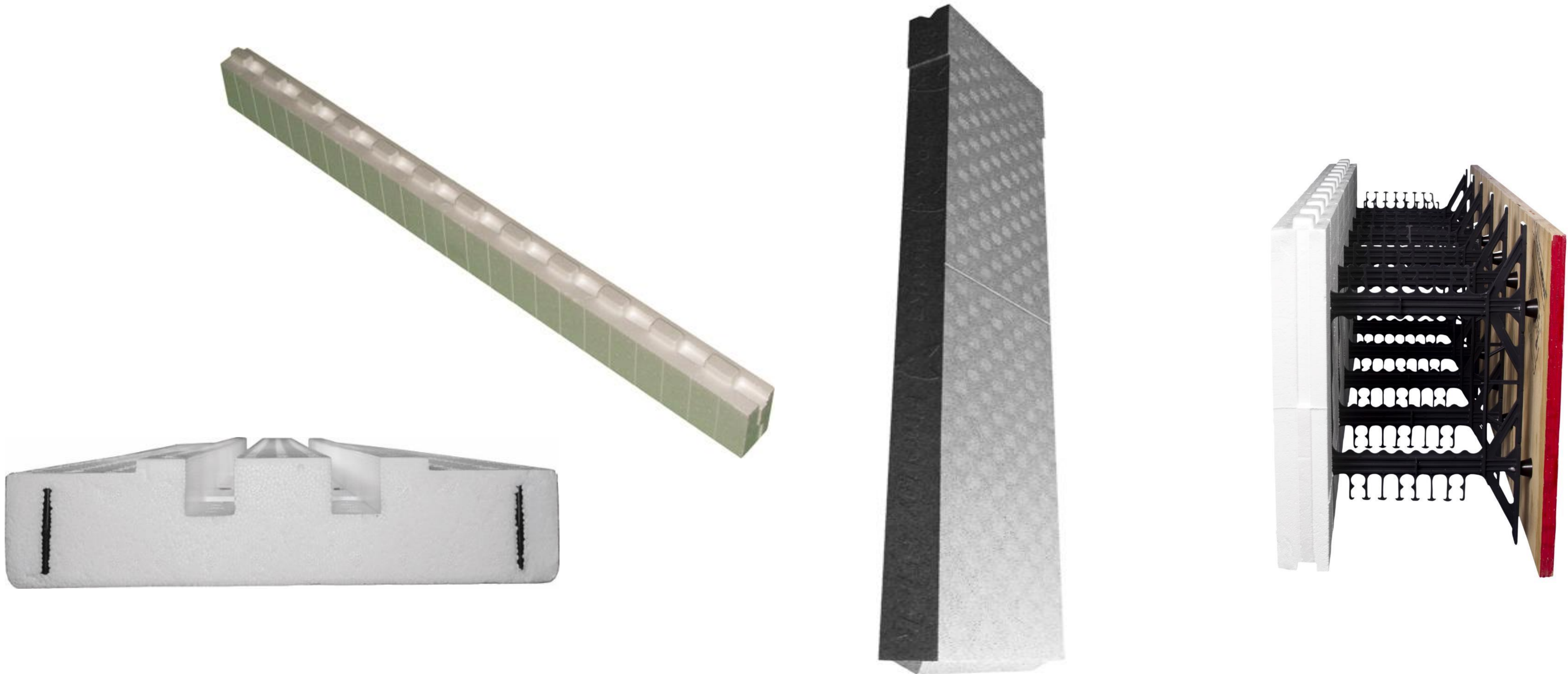
Caddetails.com



Bimsmith.com



Fox Blocks Specialty Products



Fox Buck, 4" Riser, Energy Stick and Reveal One-side Block



Fox Blocks Accessories



HV Clips, Tie Key Masonry Anchor, xLerator Reinforcing

Material and Labor Estimating

Fox Blocks Estimator Pro for accurate project quotes:

- Blocks
- Accessories
- Concrete
- Reinforcement
- Labor Rates
- Ordering

Available for download on Fox Blocks website

MAN HOUR RATES

- To budget a job properly for efficiency in crew size
- To budget a job properly to land job
- To be profitable

Man Hour Rates (MHR) have been around for decades. Most contractors document their production rates without realizing that time / square footage built will give them a man hour rate similar to one found in most cost estimating programs, such as RS Means. For most Insulated Concrete Forms (ICF) this has become a common practice. Over 20 years of history have established accurate numbers to budget future jobs with.

	MHR	JOB TYPE
1	.055 or less	Very efficient crew building a simple job with less than six corners, less than four openings and few or no embeds.
2	.06	Average job with less than eight corners,

NOTES:

Size of job is not as big of a factor as you would think. Size of job when the crew is building, MHR. This will be the same.

Fox Blocks Project Estimator

File Workbook Help

FOX BLOCKS Be Clever...Build Green
EstimatorPRO5


Date: 04-19-2020 Project Name: Client Name: Project Notes
Project Version: 1.0 Distributor Name: Worksheet: Worksheet 1
Get the latest tech bulletins @ www.foxblocks.com New Rename Delete

Wall Openings Wall Data Parts Workbook Summary Rebar Concrete 1440 Tilt Man Hours Job Summary

WALL HEIGHT

Wall Height (Not Including 1/2 Block) 8' 0"
☐ Add Row of Cut Half Block
(Top row of block cut in half. 4' block gives you 8' due to reversability)
☐ Add Row of Molded Half Block
(Molded Half Block can be placed anywhere within the wall)
☐ Add Row of 4" Extenders
HEIGHT OF WALL USED IN ESTIMATE 8' 0"

OPTIONAL

Linear Feet of 6" Radius Block 0
At What Radius (In Feet)? 10
Layers of 2" Thick R9 Energy Sticks 0
☐ Add xLerator Ledge Reinforcement
tieKey
Linear Feet of Brick 0
Height of Brick (in Feet) 0
tieKey per Block 2
Click the  icons to view details about each product

PROJECT INFORMATION

Wall Length (Total Linear Feet) 0
Concrete Thickness (Block Size) 8"
Number of Inside 90° Corner Locations 0
Number of Outside 90° Corner Locations 0
Number of 45° Angle Locations 0
Number of T-Block Locations 0
Linear Feet of Corbel Block 0
Linear Feet of Curb Block 0
Number of 90° Curb Block Locations 0
Linear Feet of Tapered Block 0
Total Square Footage of Openings 0
Total Linear Feet of Fox Buck 0

MANUAL ADD / SUBTRACT BLOCK
For Waste. Will not affect concrete volumes from above calculations

Number of Straight Blocks 0
Number of 90° Corner Blocks 0