CICFI
COUNCIL OF ICF INDUSTRIES

Pacific NorthWest Economic Region

High Performance Concrete Building Design

Insulating Concrete Forms – a solution to current and future Energy and Building Codes in North America

Kevin Davis
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Quad-Lock Building Systems

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LOGIX®
INSULATED CONCRETE FORMS

NUDURA®
INTEGRATED BUILDING TECHNOLOGY
Building Value

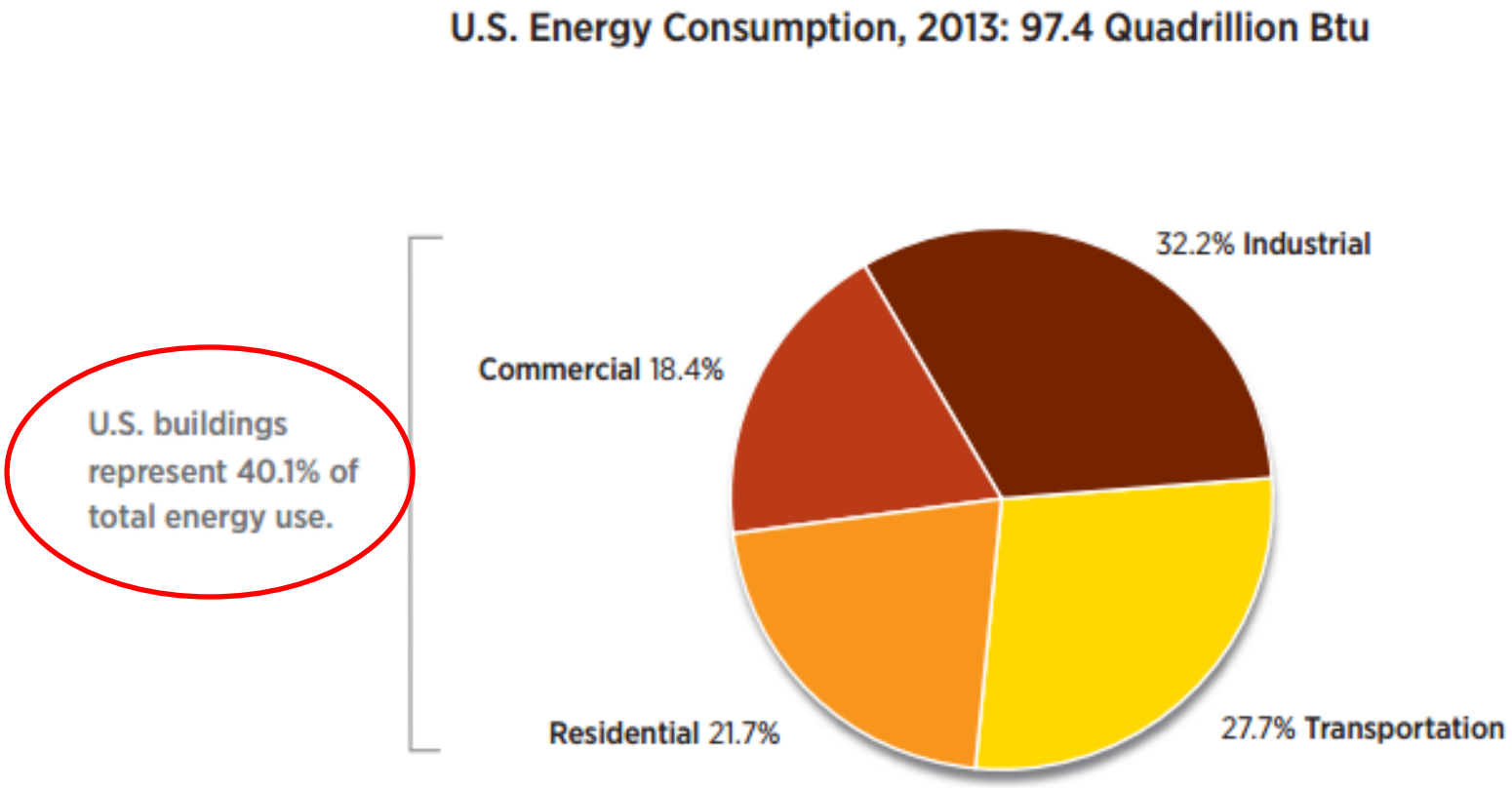
QUAD-LOCK®

SUPERform
FORMING THE FUTURE

A consortium operating under the auspices of the Ontario Ready Mix Association.

Environmental Role of Buildings

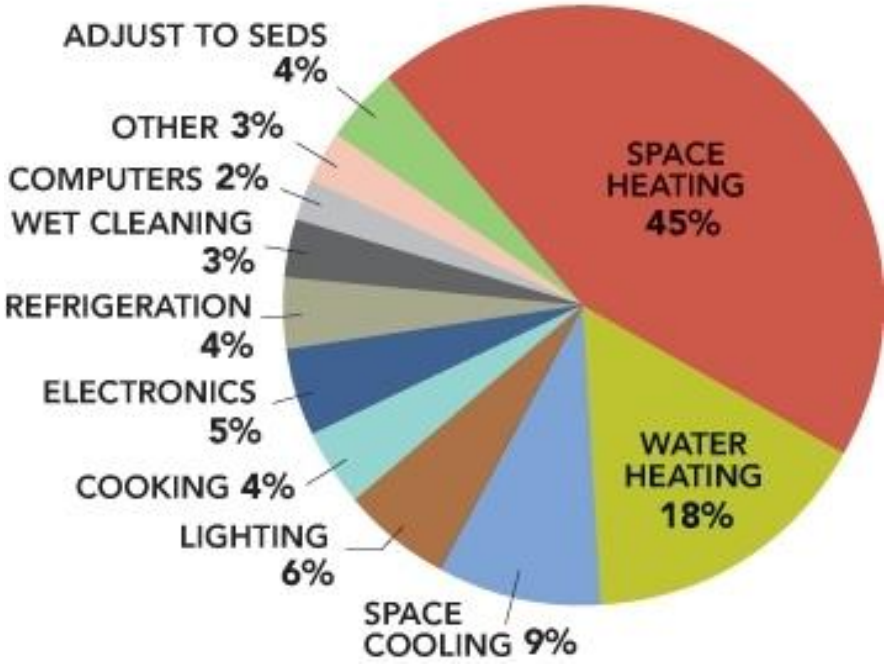
FACT #1: Our buildings consume the largest percentage of our total energy use



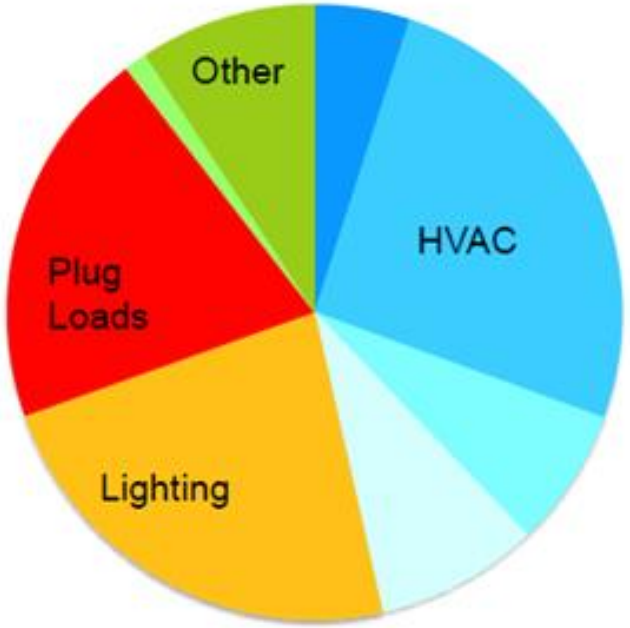
Source: US Energy Information Agency

Environmental Role of Buildings

FACT #2: The *"Appetite for Energy"* of our buildings is driven 50% by space heating & cooling demands



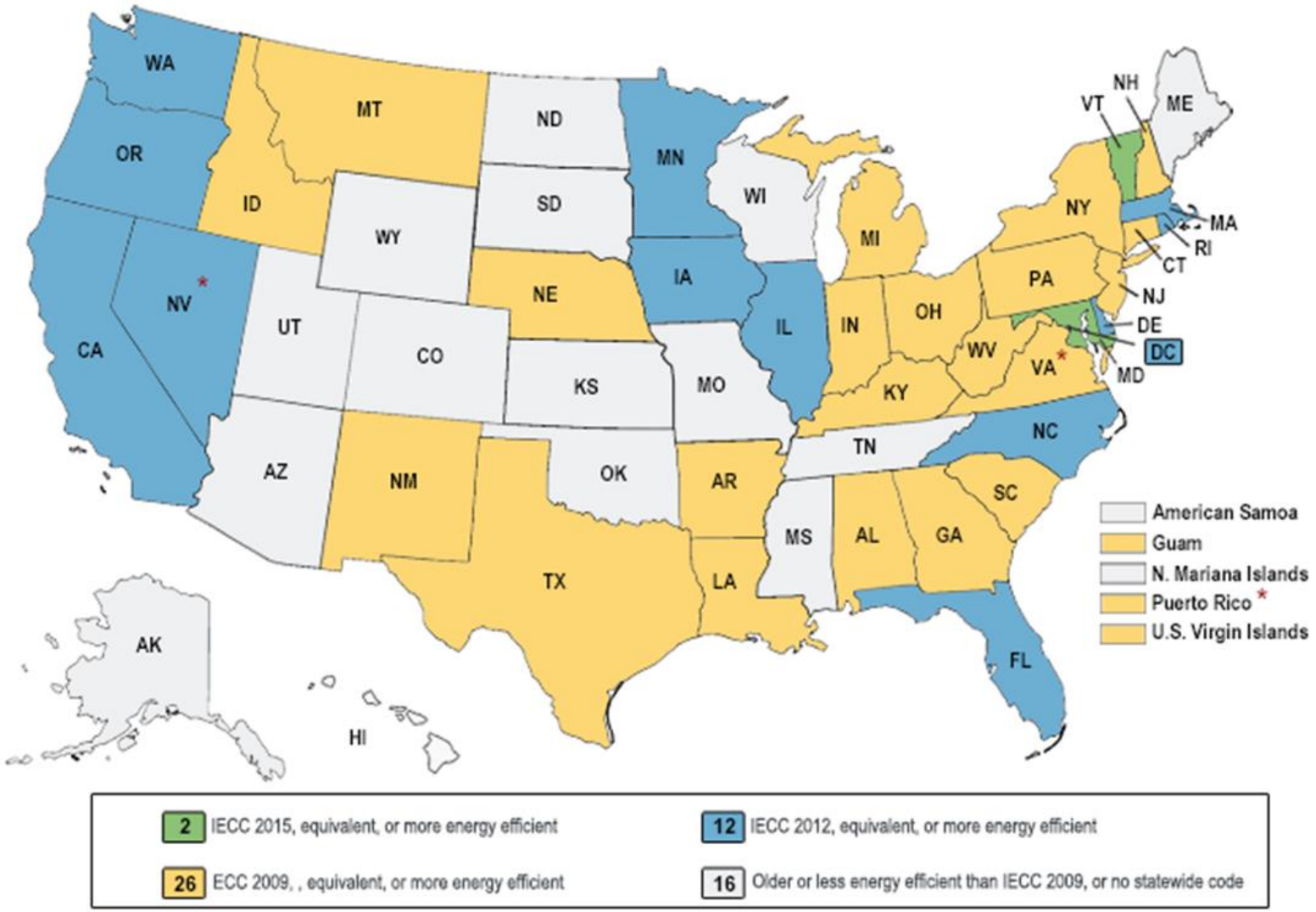
Residential Building



Standard Commercial Building

Source: US Energy Information Agency

Current Residential Energy Code Adoption Status



Can We Change Cultural Priorities?

Change a culture that is focused on the glittering amenities?

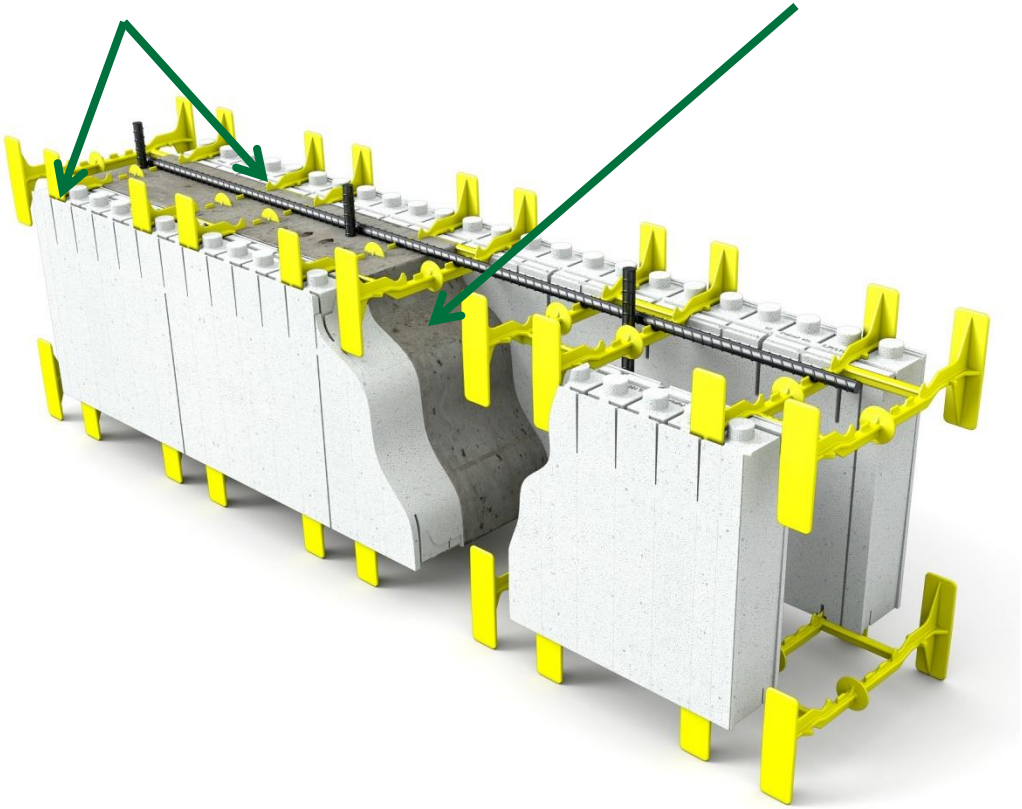
Change a culture that is focused on *"first-cost"* vs total cost of ownership?

Not very likely!

The Secret Is In Our Name

“Insulating”

Two layers of high value EPS insulation provide **continuous thermal barrier**

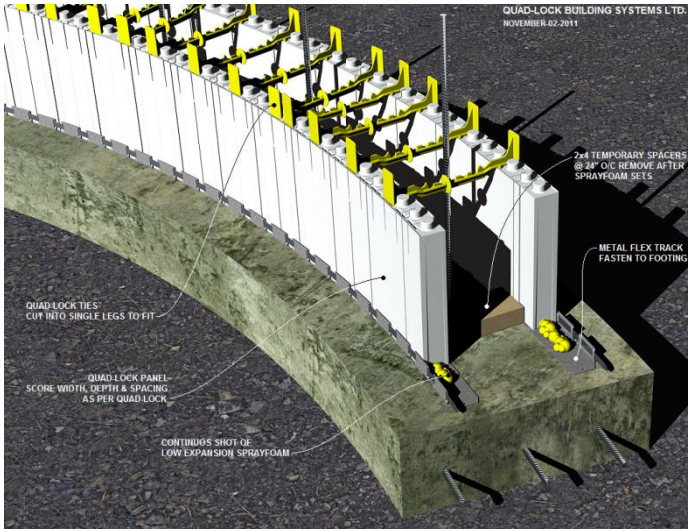


“Concrete”

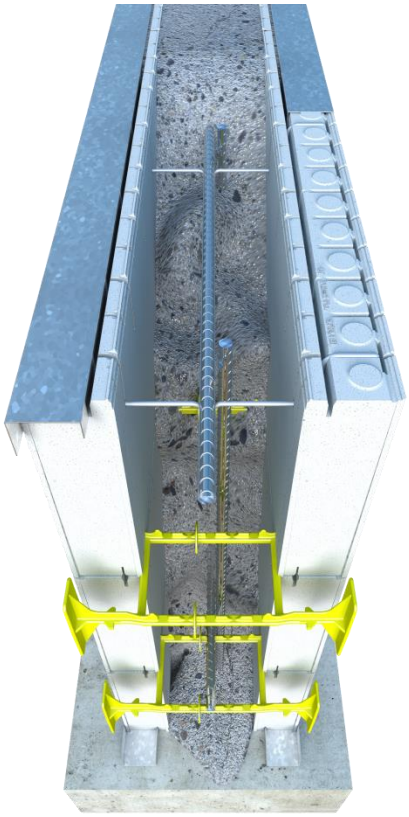
Reinforced concrete provides **durable structure** & protection of occupants

“Forms”

Lightweight EPS forms are **easily shaped** & adapted to architectural designs

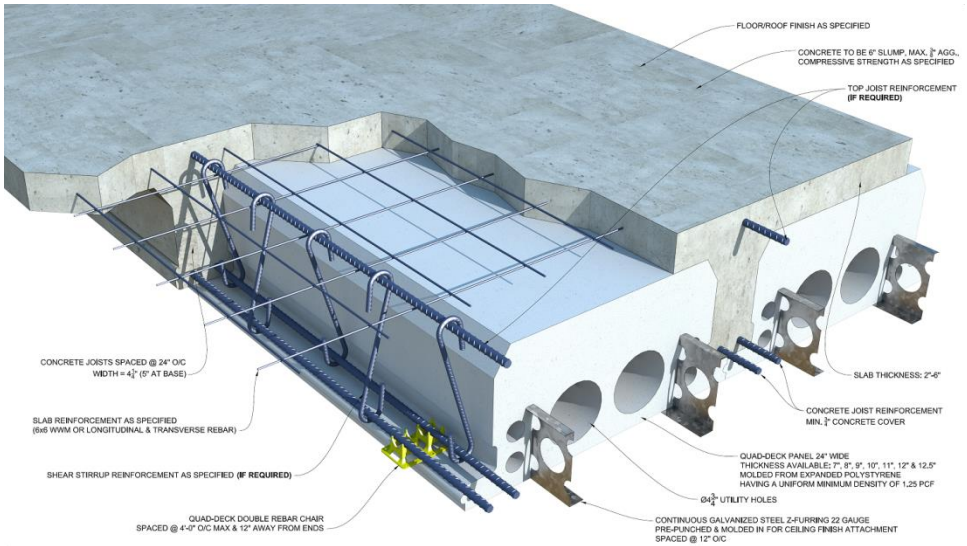


Two ICF Use-Categories:



Vertical concrete structures

- Two-sided ICFs



Flat, pitched or tilt-up concrete structures

- One-sided ICFs

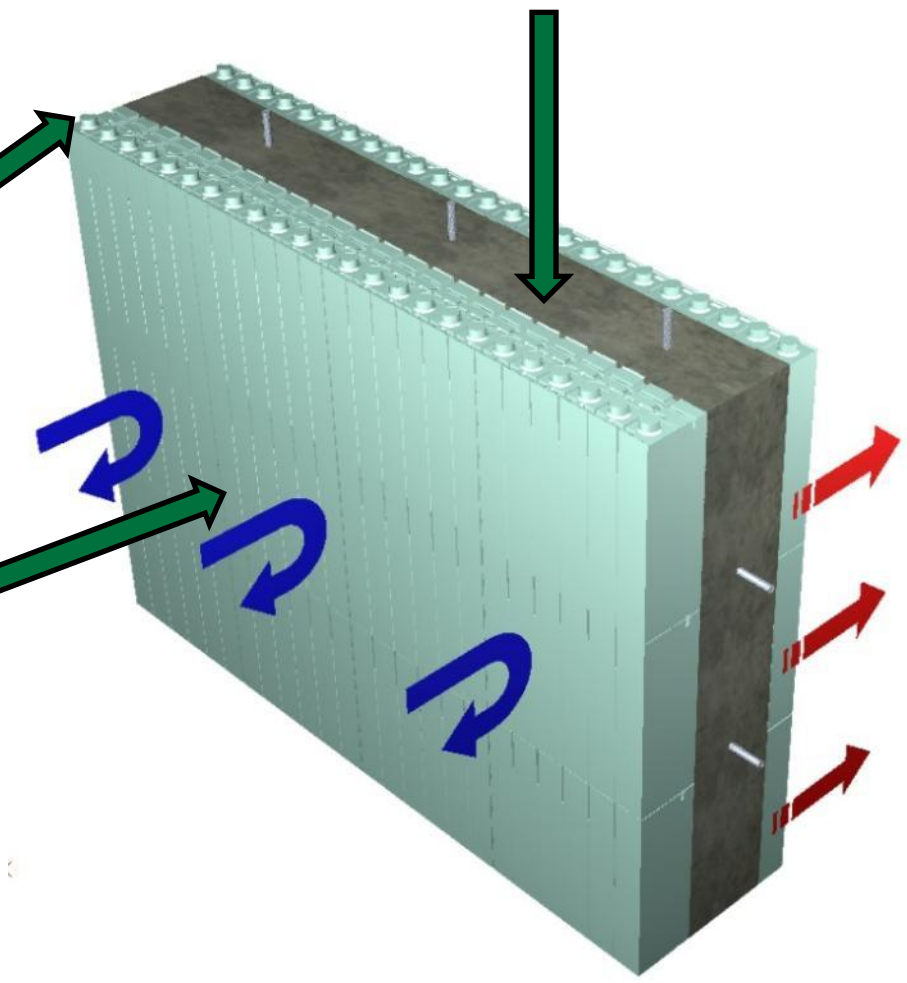
How do ICFs control heat gain/loss?

Strategic use of 3 unique qualities:

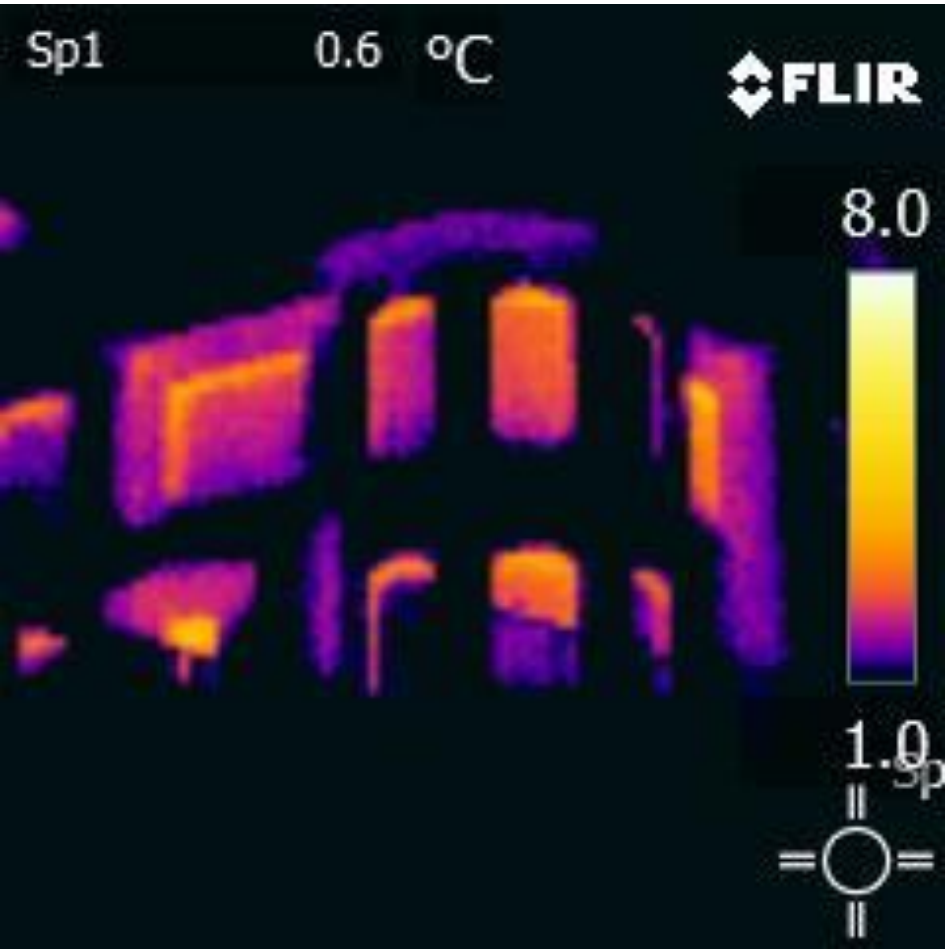
High Mass for Thermal Storage

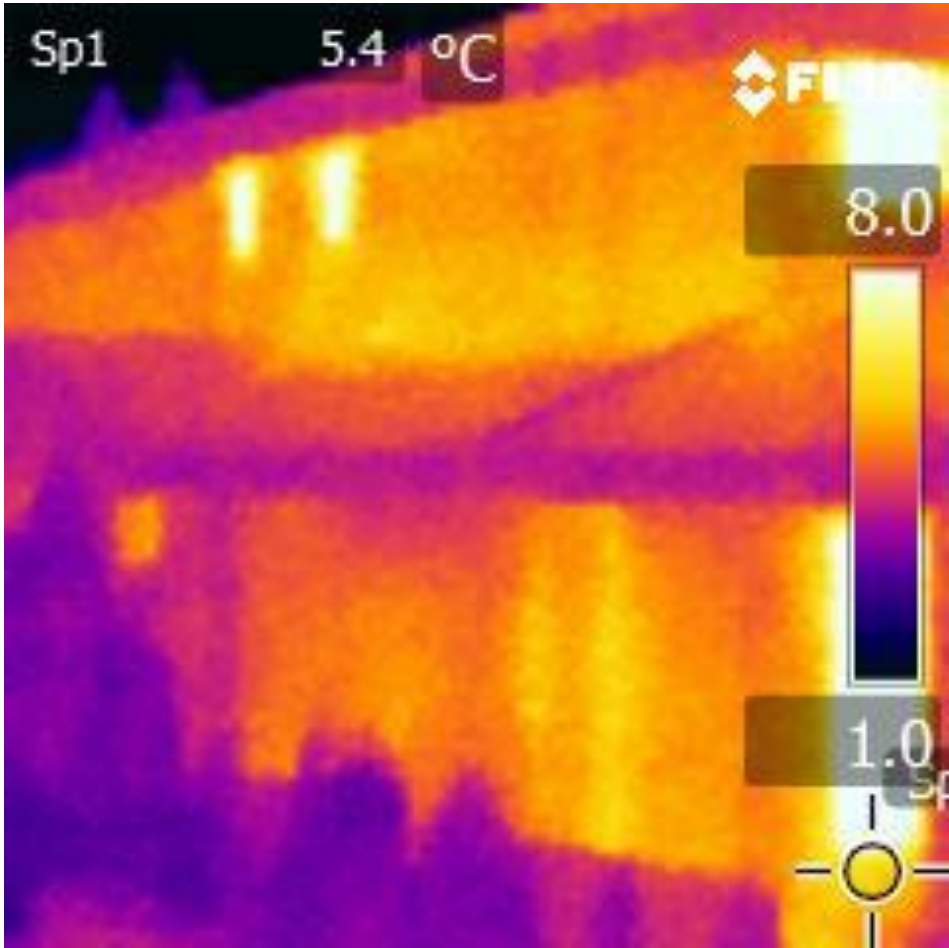
High R-Value & Unbroken Insulation Layers

Zero Porosity Concrete Air Barrier

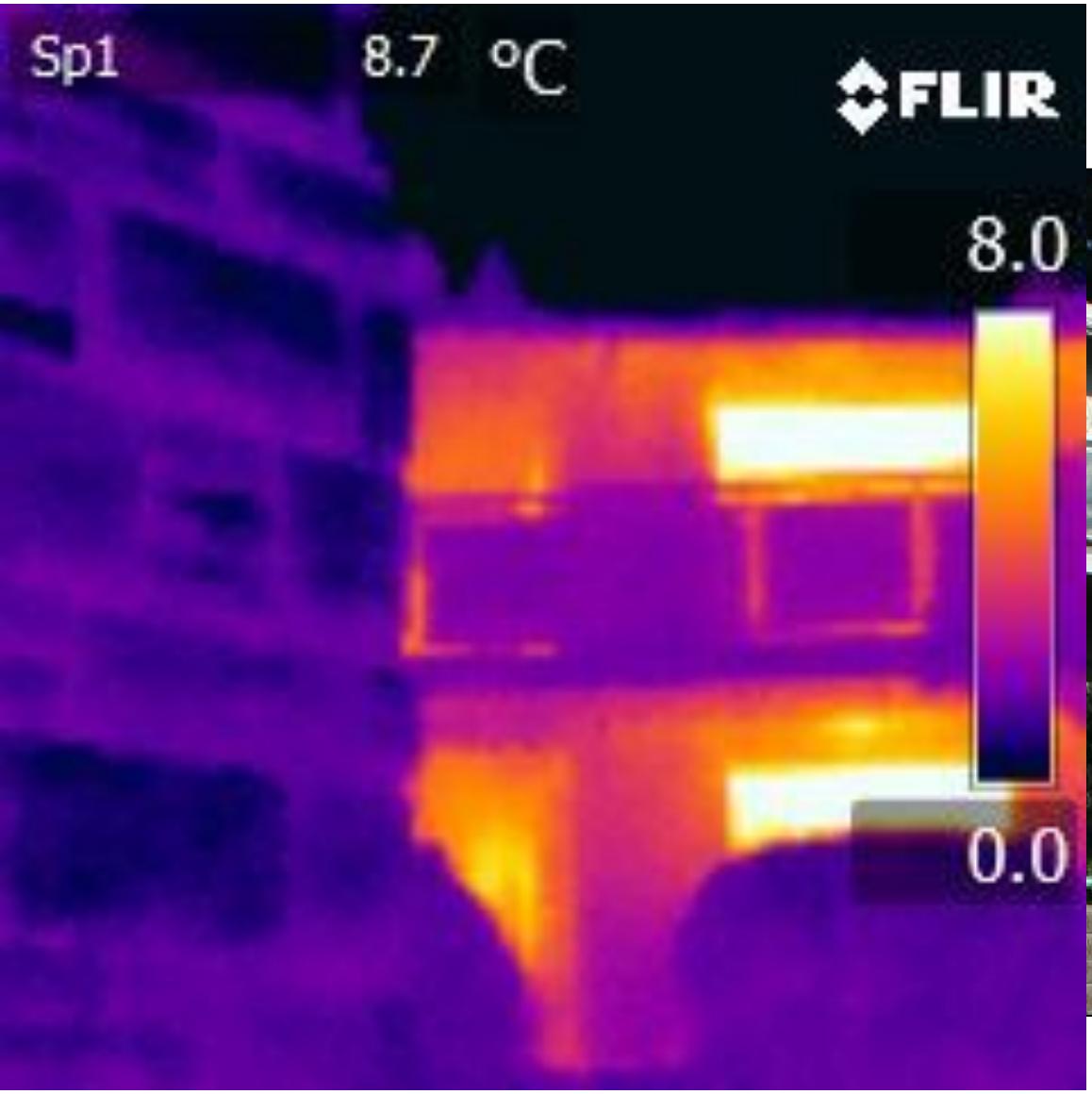


ICF vs. Neighbors

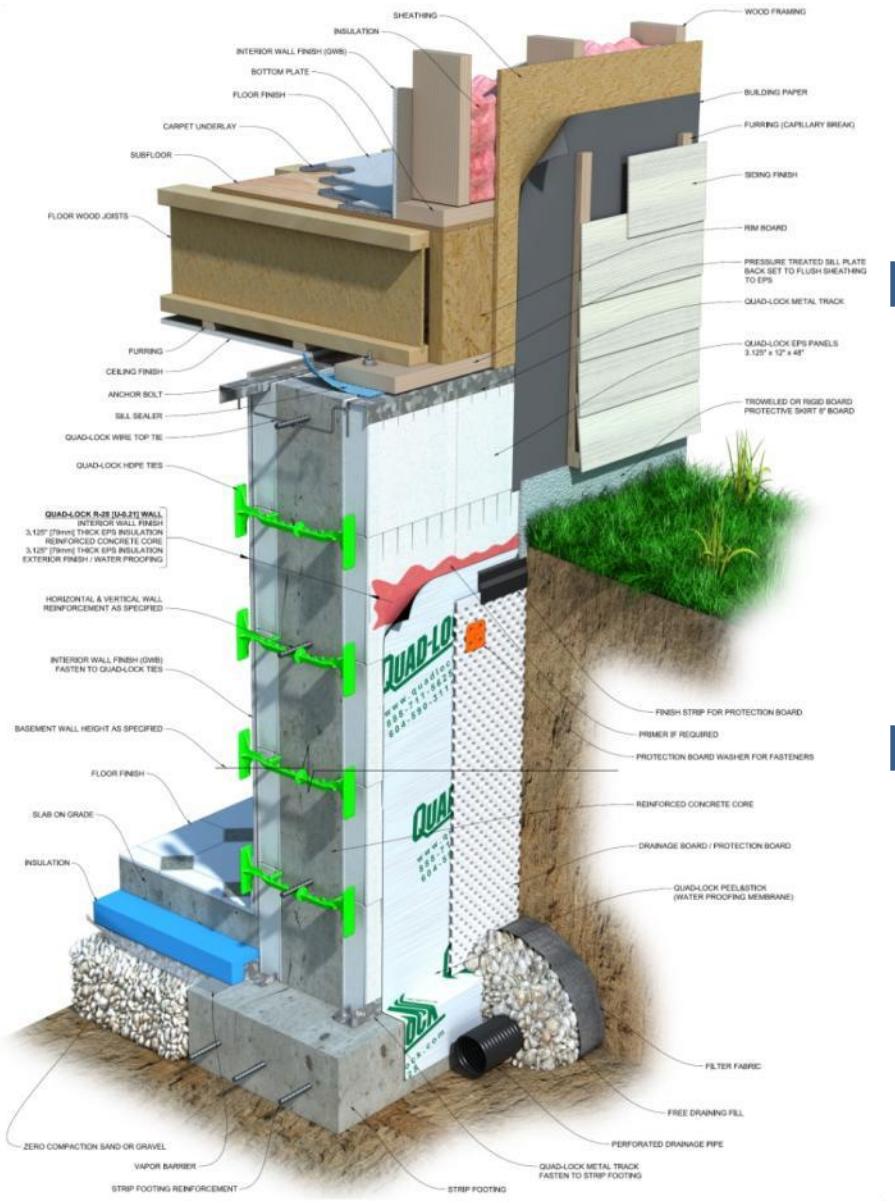


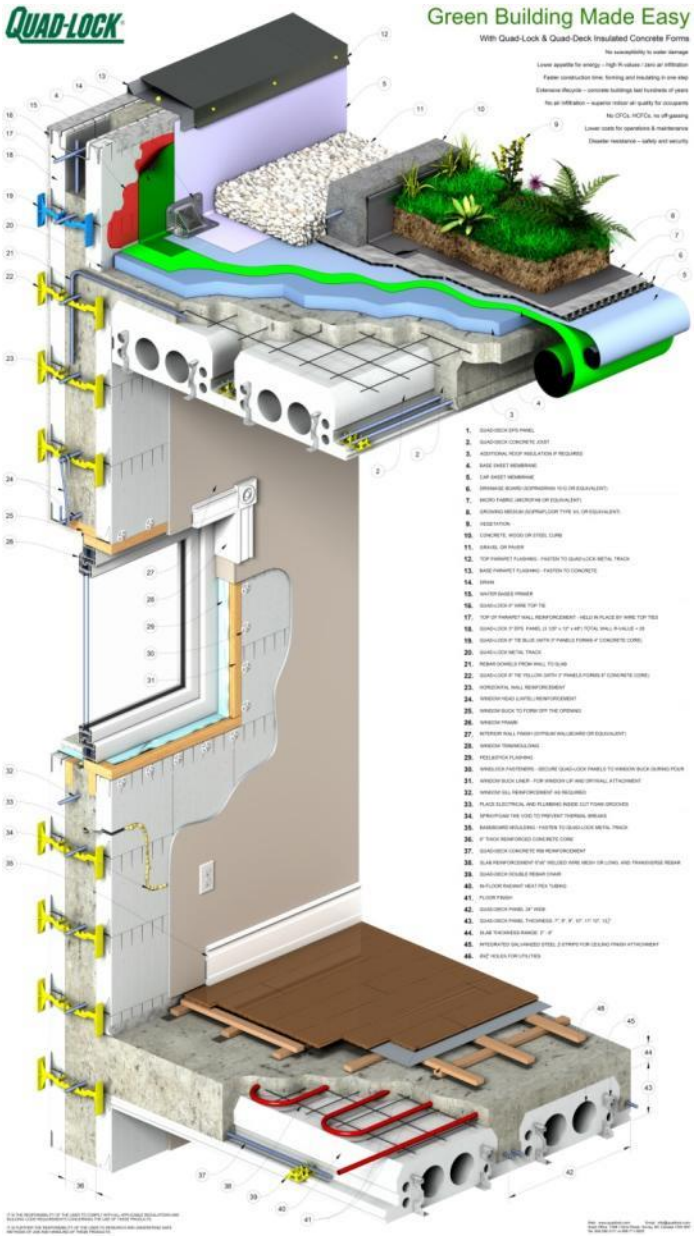


ICF vs. Neighbors



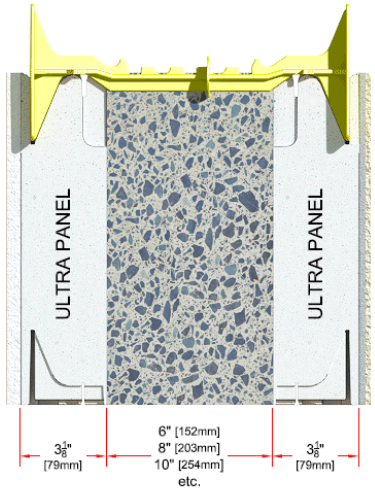
ICF Progress in the Market



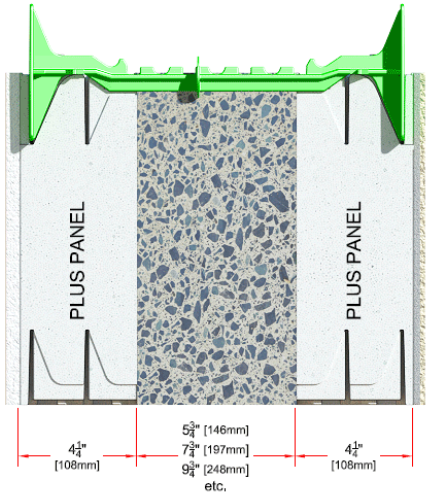


Available Insulation Options

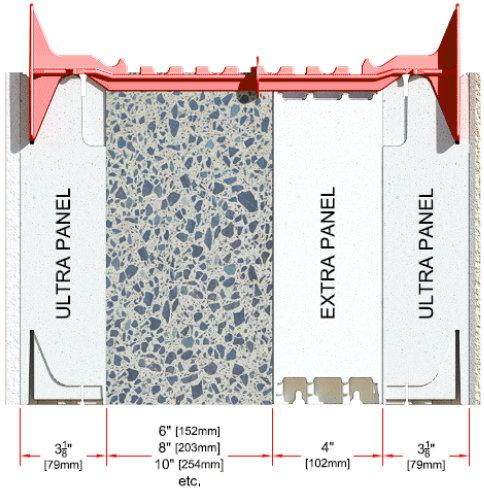
R-22 [U-0.28]



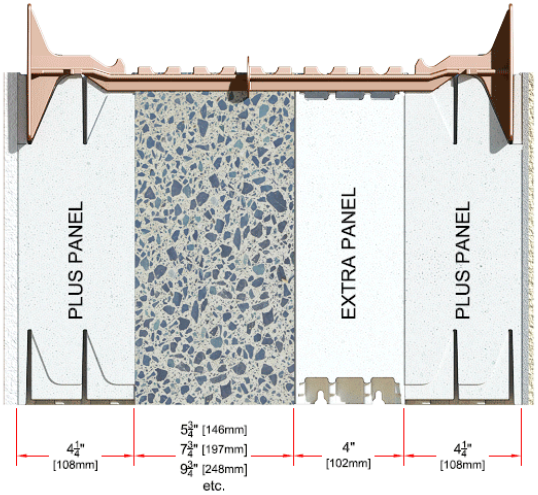
R-28 [U-0.21]



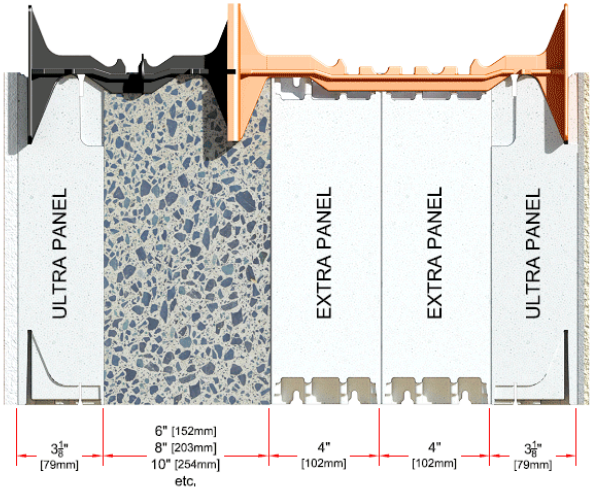
R-38 [U-0.15]



R-43 [U-0.14]

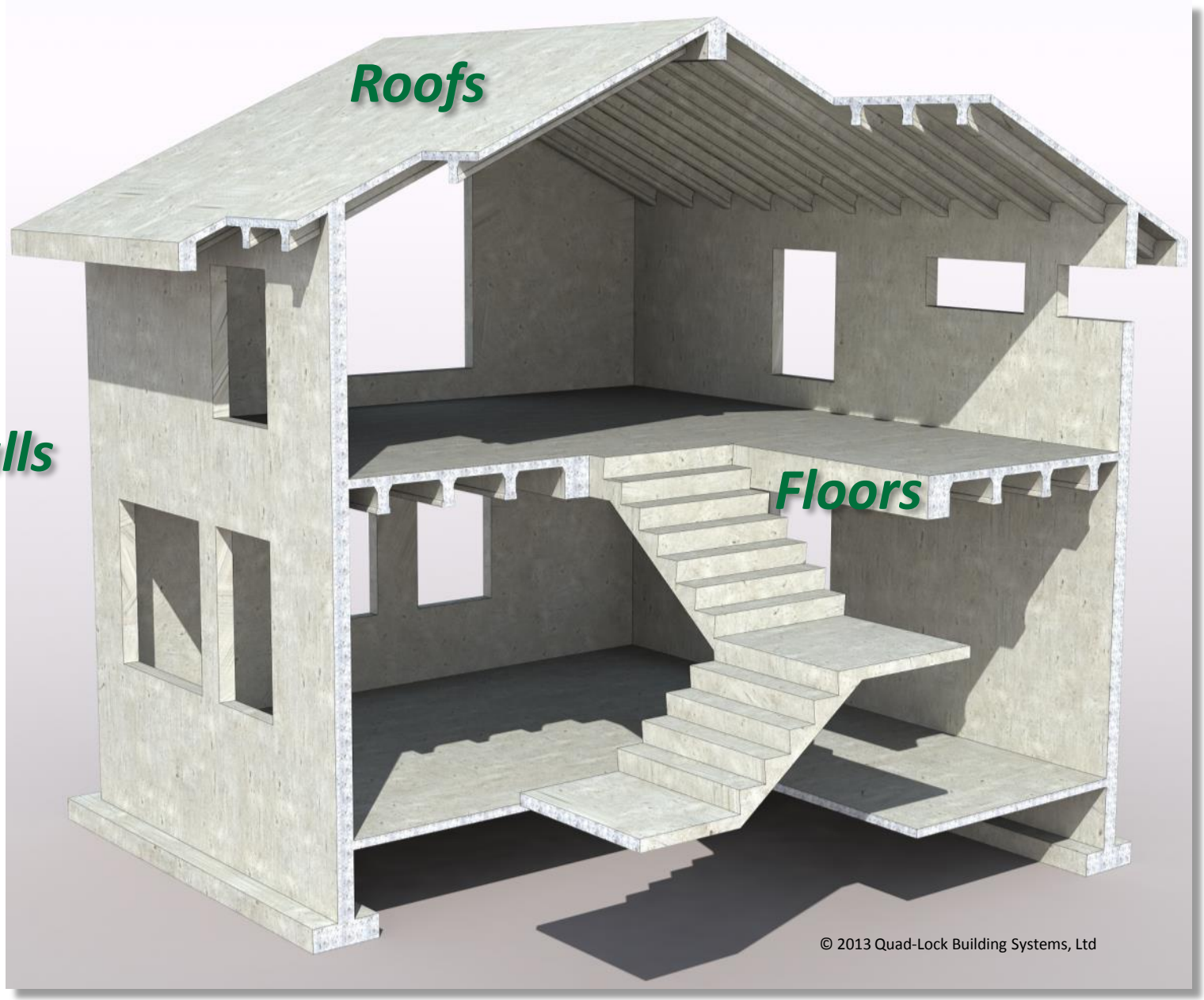


R-53 [U-0.11]



R-59 [U-0.10]

ICF Complete Concrete Building Enclosure



Desired Characteristics of Building Shells

Desired Characteristics *** Code Mandated*	Wood Frame	Steel Frame	Conv. Concrete	ICF Concrete
Moisture Resistant**	↓	$$	Yes	Yes
Wind Resistant**	$$	$	Yes	Yes
Seismic Resistant**	$$	$	Yes	Yes
Thermal Continuity**	$	$$	$$	Yes
Fire Resistant**	↓	$$	Yes	Yes
Safe/Non-toxic**	Yes	Yes	Yes	Yes
Impact Resistant	↓	↓	Yes	Yes
Adaptable to Design & Utilities	$	$$	$$	Yes

IRC Prescriptive Designs

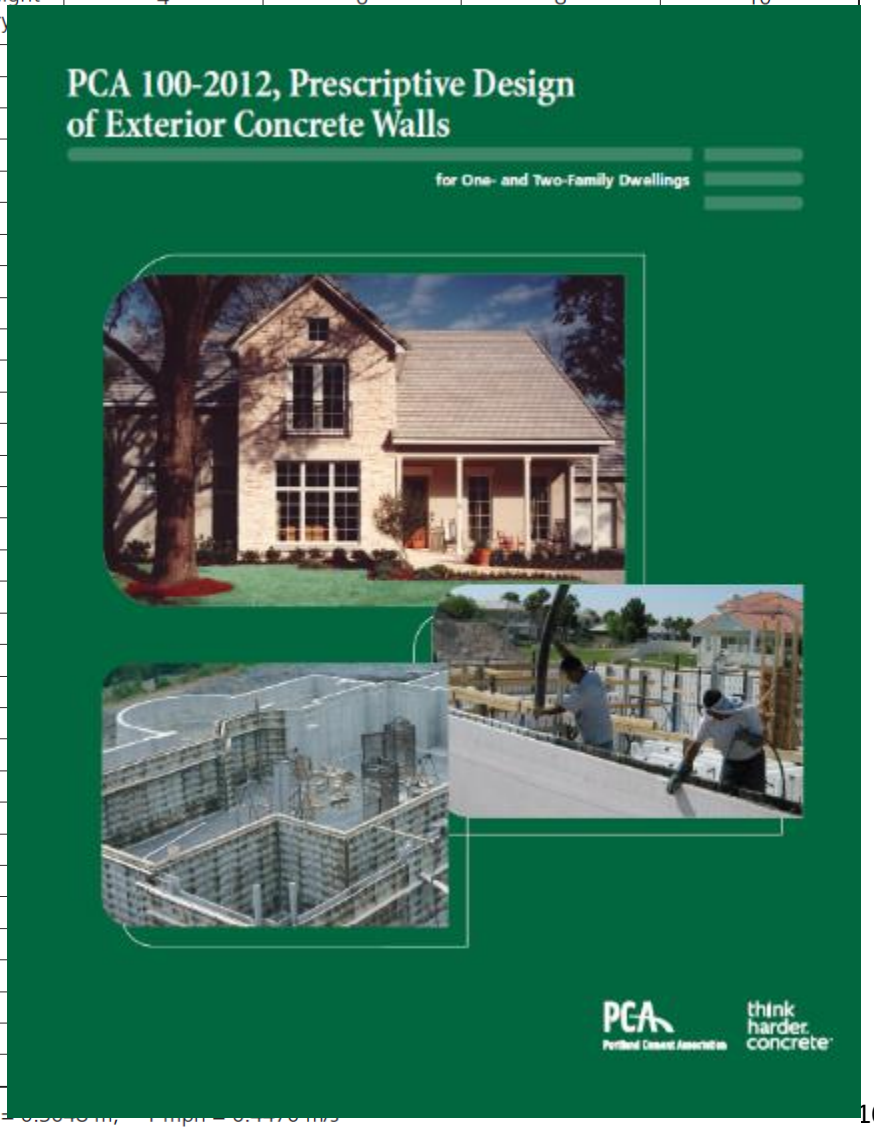
ICF/Concrete Wall Reinforcement

Prescriptive Designs to 150 mph *(all exposures)*

Table 4.1. Minimum Vertical Reinforcement for Flat Above-Grade Walls[1,2,3,4,5,11]

Basic wind speed (mph)			Maximum unsupported wall height per story	Minimum vertical reinforcement – bar size No. and spacing (in.)[6,7,8]			
Exposure category				Nominal[9] wall thickness (in.)			
B	C	D		4	6	8	10
85			8				
			9				
			10				
90			8				
			9				
			10				
100	85		8				
			9				
			10				
110	90	85	8				
			9				
			10				
120	100	90	8				
			9				
			10				
130	110	100	8				
			9				
			10				
140	120	110	8				
			9				
			10				
150	130	120	8				
			9				
			10				
166	140	130	8				
			9				
			10				
179	150	140	8				
			9				
			10				
192	163	150	8				
			9				
			10				

For SI: 1 inch = 25.4 mm; 1 foot =



Lateral Strength Comparison

	Wood Frame	ICF & Concrete	Concrete % Advantage
Global Lateral Stiffness (lbs/in)	**18,500**	**708,000**	**+3,827%**
Load at First Major Damage (lbs)	**3,500**	**8,500**	**+243%**
Displacement at First Major Damage (in)	**0.51**	**0.06**	**+850%**
Maximum Lateral Resistance (lbs)	**4,553**	**34,254**	**+752%**
Displacement at Max. Lateral Resist. (in)	**0.89**	**2.66**	**+299%**

Test performed by PCA based on ASTM E564-95

Relevant Codes and Standards: USA

International Residential Code
- Chapters 3, 6 & 11

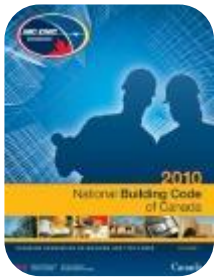
International Building Code
- Chapters 16 & 19

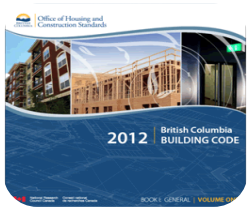
International Energy Conservation Code

ACI 318
- Building Requirements for Structural Concrete

ASCE 24-05
- Flood Resistant Design & Construction

Relevant Codes and Standards: Canada





National Building Code of Canada or Provincial Codes

- Parts 3, 4, 5 & 9
- Post-Disaster Category

CAN/CSA A23.3

- Design of Concrete Structures

2011 National Model Energy Code for Buildings

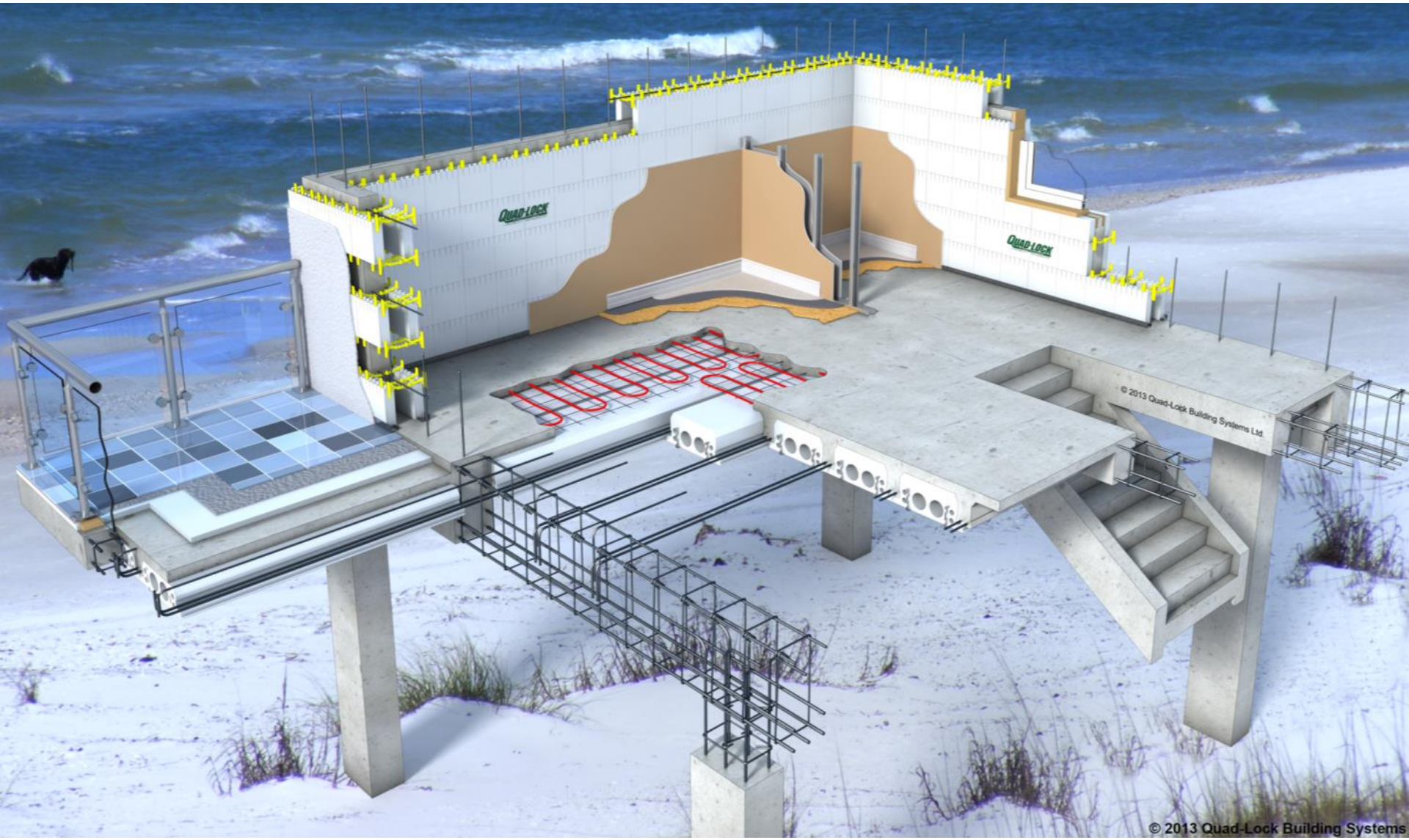
ASCE 7

- Minimum Design Loads for Buildings

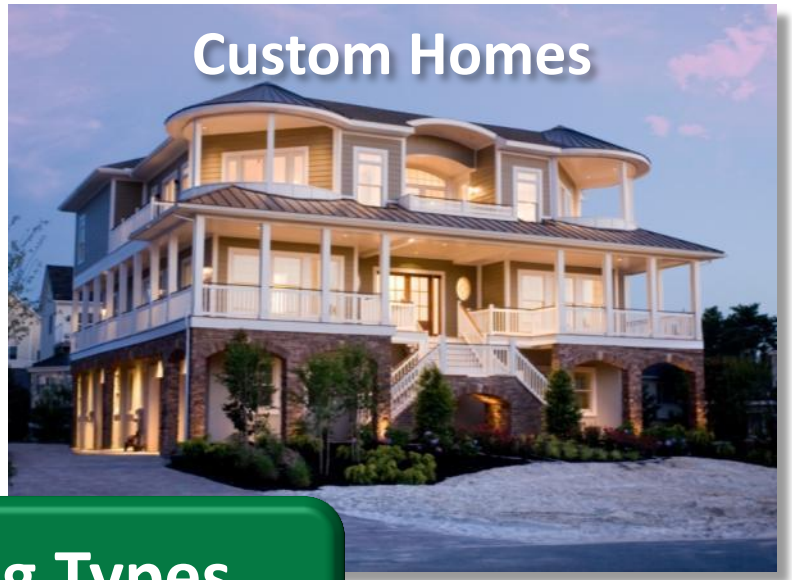
ASCE 24-05

- Flood Resistant Design & Construction

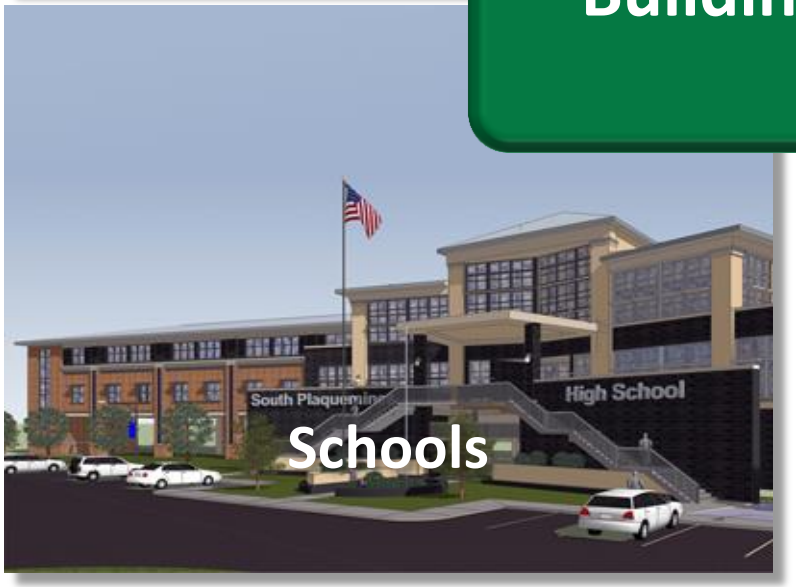
Disaster Resistant ICF/Concrete Designs



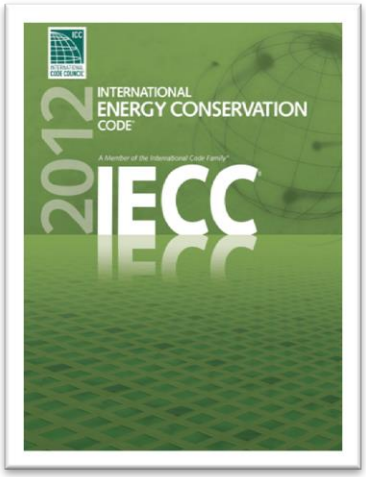
ICF Designs For Efficiency and Survivability



Building Types



Construction Time With ICF.



Thermal Resistance.

- ICFs are considered by ICC and IECC as mass walls with continuous insulation
- Typical whole wall ICF assembly has an R value of R24
- ICFs exceed the requirements for all climate zones for commercial thermal envelopes above and below grade.

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