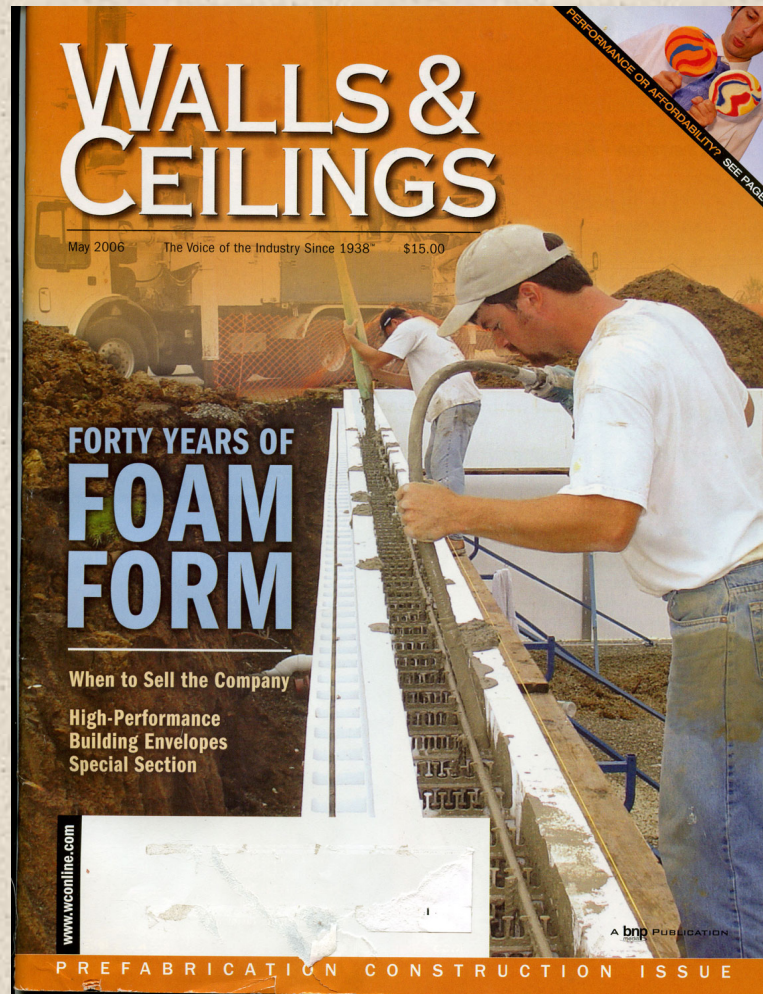
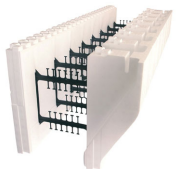
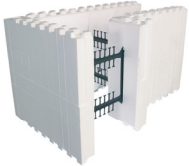
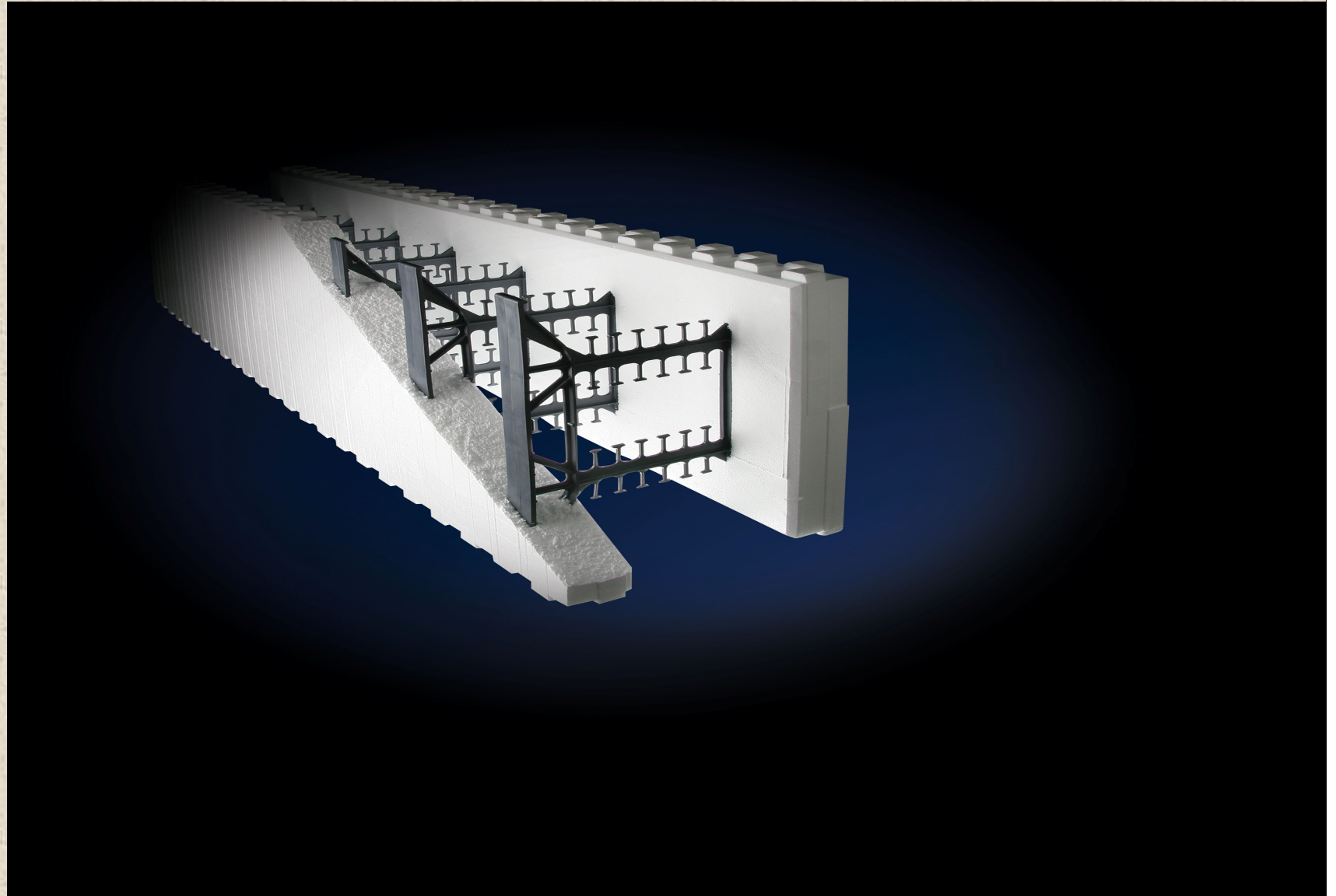
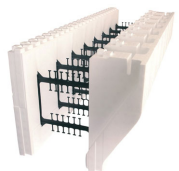
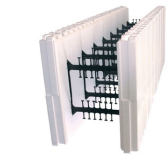


Insulated Concrete Forms (ICFs)



- Cover of Walls & Ceilings Magazine May 2006

ICF OVERVIEW



Exterior Design Institute



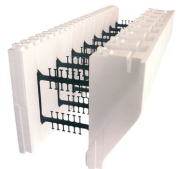
What Are Insulating Concrete Forms?

A forming system for steel-reinforced,
poured concrete walls.

The forms stay in place and become
part of the wall after the concrete is
placed.

Exterior Design Institute

ICFs – Getting Attention



Cover of Construction
Dimensions Magazine
June 2006



Question

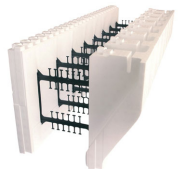
What Is An IFC?

A. A typographical error; they really meant ICF

C. Insulation applied over Concrete Freeze Walls

B. Insulation applied over Concrete Footers

D. Insulation applied over Foundation Walls



AWCI's

CONSTRUCTION DIMENSIONS

PUBLISHED FOR CONTRACTORS BY THE ASSOCIATION OF THE WALL AND CEILING INDUSTRY

AWCI ONLINE
www.awci.org

JUNE 2006
VOLUME 34 ISSUE 1

FEATURES

BLOW ME DOWN!

Hurricane Season Is Here

By Craig Wood Contractors are doing everything from sharing truck loads of wallboard to finding temporary housing for their employees in anticipation of the 2006 hurricane season.



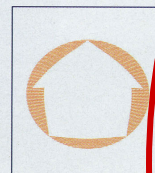
AWCI's Award Winners

If you're counting by state, the big winners were in Kentucky, Ohio, Michigan and New York.



Industry Award Winners

AWCI isn't the only group handing out awards. Find out who else has to clear out a spot in his trophy case.



Housing Bubble

By Jody Ortiz

The housing bubble is bringing more jobs to the construction industry, says topbuilding-jobs.com.



Growing ICFs

By Steven Ferry

At \$8 to \$12 a square foot, ICFs may be giving wood framing a run for its money.

46

67

76

79

COLUMNS

5 **PRESIDENT'S MESSAGE**
By Burke Nicholson

8 **WHAT'S INSIDE**
By Laura M. Porinchak

17 **UP NORTH**
By Don Procter

18 **MANAGEMENT DESK**
By L. Douglas Mault

21 **SUPERVISION**
By Norb Slowikowski

23 **ESTIMATOR'S EDGE**
By Charles Mahaffey

24 **WACHUWANNANO**
By Donald E. Smith, CCS

DEPARTMENTS

Construction Trends 11

New Products 27

The Exchange 93

Advertiser Resource Index 95

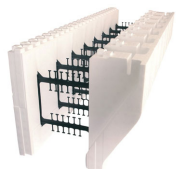
Problem Solved 96

ON THE COVER

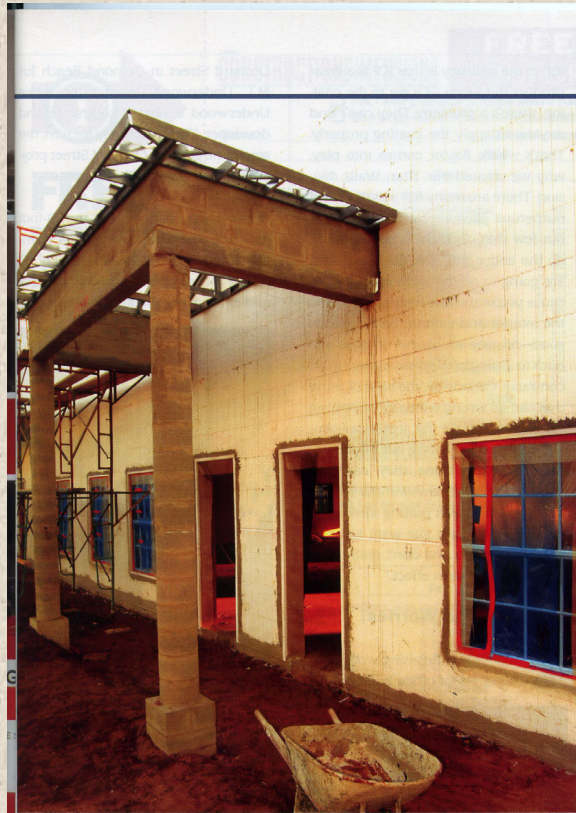
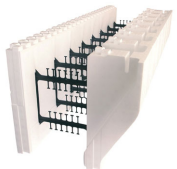
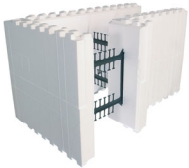


Mark Nability is AWCI's Man of the Year

Table of Contents Construction Dimensions Magazine June 2006



ICF Article – Construction Dimensions June 2006



You would think that in an industry impacted by various major issues—

- Buildings and works-in-progress destroyed by hurricanes and tornadoes, earthquakes and (wild)fires.
- Significantly rising energy prices.
- Lawsuits over mold and health concerns over sick buildings.
- Speed of construction, meeting collapsed deadlines as general contractors pant over lost dollars the longer the clock ticks.
- Concern over the environment and dwindling/increasingly costly resources would jump boots-first into using an exterior-wall construction system that delivered seriously on

- Strength against the worst nature or life can throw at a building.
- Greatly reduced energy requirements.
- Eliminating mold and insect infestations.
- Speeding up construction and earning federal tax credits for builders.

And all for a price tag (\$8 to \$12 per square foot, including labor and materials, with the inside wall left unfin-

ICF:

AN IDEA WHOSE TIME HAS COME BY STEVEN FERRY

Question

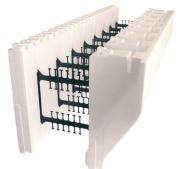
What Material Is An ICF?

A. Polyurethane Foam

C. Cellular polyethylene

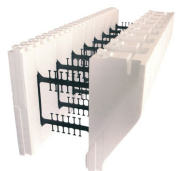
B. Polyurea Foam

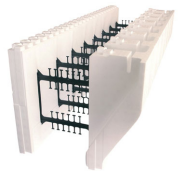
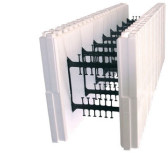
D. Extruded or expanded Polystyrene



Insulating Concrete Forms

- **Expanded or Extruded Polystyrene forms receive poured concrete and steel reinforcement**
- **Replace traditional poured and CMU walls (foundation, infill, or shear, etc.)**
- **Used primarily for exterior, interior, load-bearing and separation walls**
- **Residential and commercial**

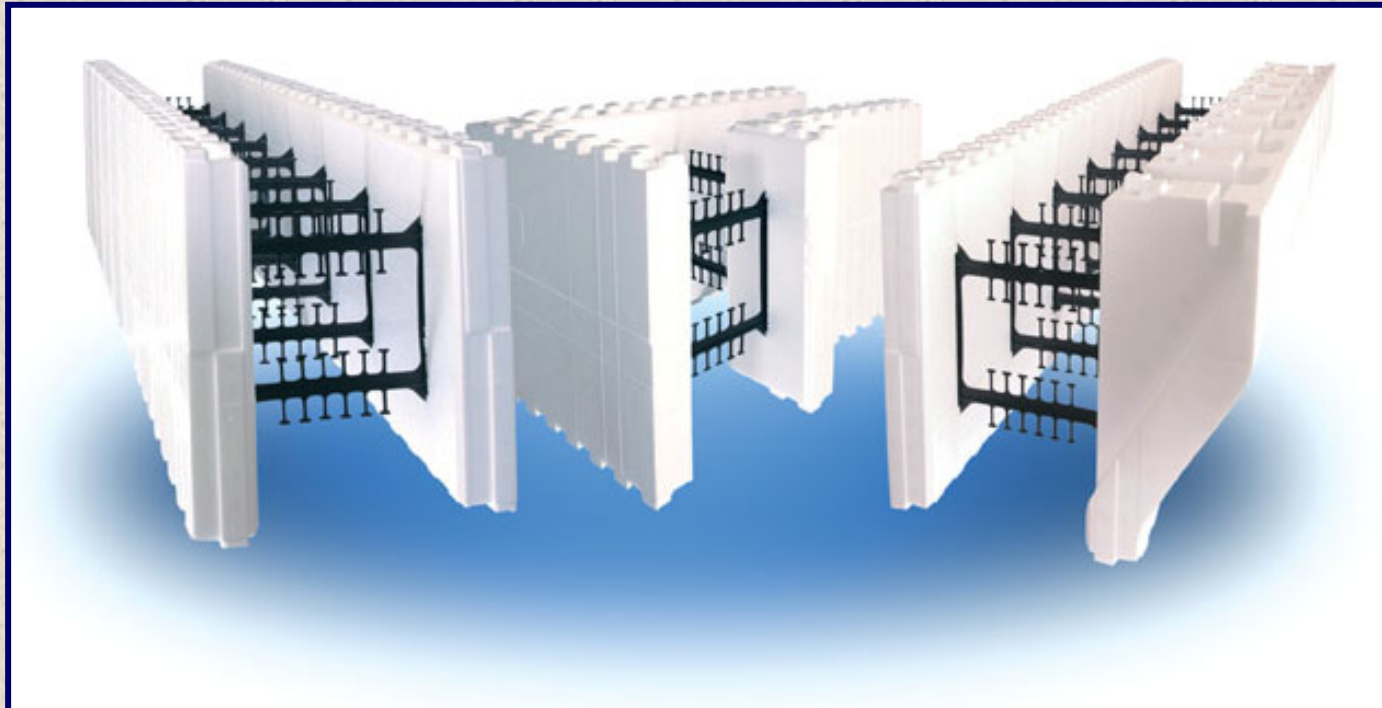
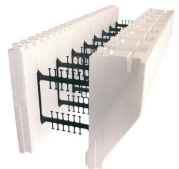




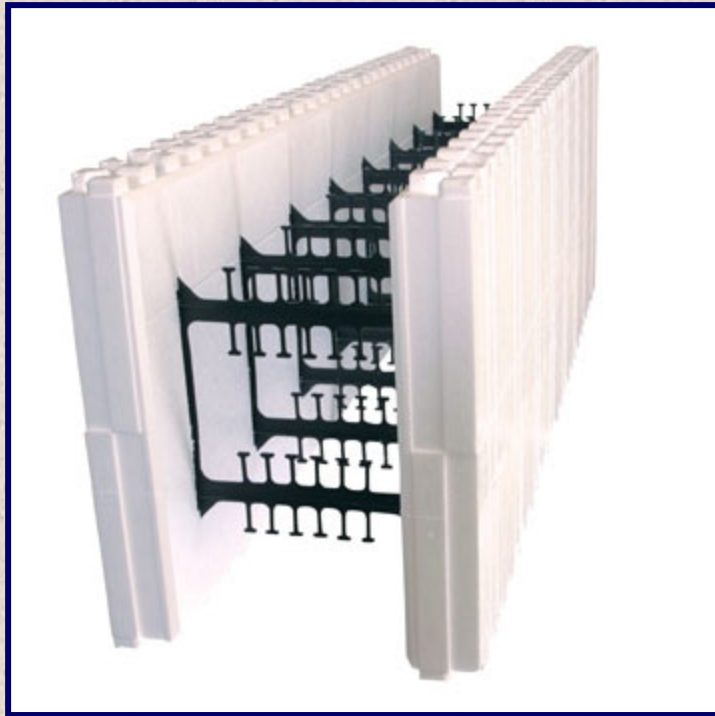
Insulating Concrete Forms

Assembly

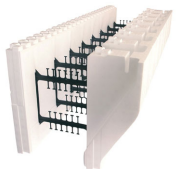
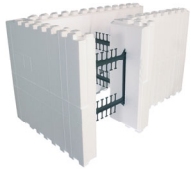
- **ICF forms are typically made with 1.5 pound density EPS although XPS is also used.**
- **The ties are usually plastic (one molder uses steel)**
- **The ICF block is available in different widths and shapes.**



The most common configuration:

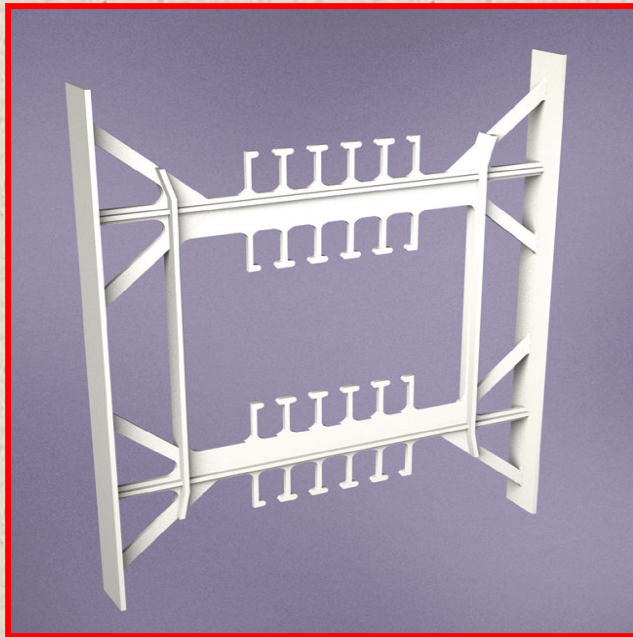


- Two pieces of expanded polystyrene (EPS)
- Held together with plastic ties
- Stacked like building blocks, aligned and braced
- Strengthened with steel rebar and filled with concrete



Inner Tie

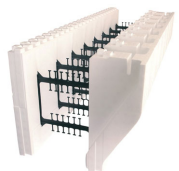
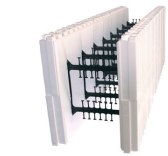
- Polypropylene material
- Open web design—free flow of concrete
- Continuous fastening surface
- Easy to cut—no sharp edges



1 ¼" wide, 6" on center

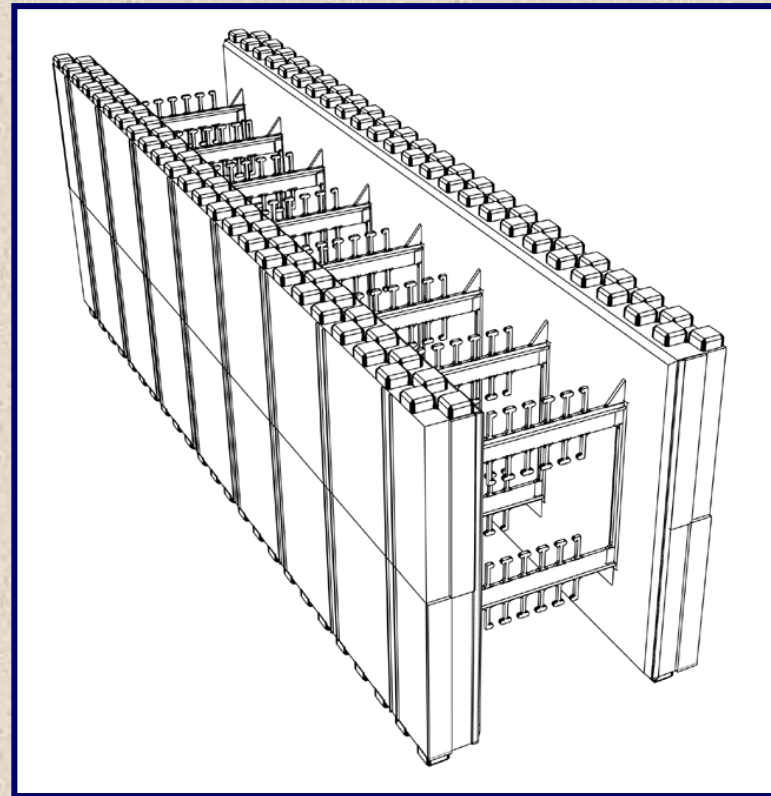


Corner Tie



Typical Form Dimensions:

- Length: 48"
- Height: 16"
- Three forms = 4' wall
- Six forms = 8' wall
- Width: 4" core, 9"
6" core, 11"
8" core, 13"
10" core, 15"



Exterior Design Institute

Most ICFs Are Approved With Building Code Agencies

•Revised August 2005

ESR-1552*

Issued May 1, 2005 This report is subject to re-examination in one year.

ICC Evaluation Service, Inc.

www.icc-es.org

less/Regional Office • 5360 WokmaiMi Road, Whittier, Caffomia 90601 • (562) 69&0543 Regional Office • 900 Montdar Road, Suite A, Birmingham, Alabama 35213 • (20
Office • 4051 West Rossmoor Road, Country dub Hte, Illinois 60478 • (708) 799-2305

DIVISION: 03—CONCRETE Section: 03130—Permanent Forms

REPORT HOLDER:

REWARD WALL SYSTEMS, INC.

9931 SOUTH 136™ STREET, SUITE 100

OMAHA, NEBRASKA 68136

(402) 592-7077

www.rewardwalls.com

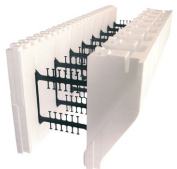
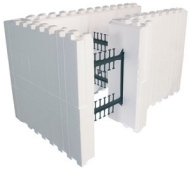
kdoerr@rewardwalls.com

EVALUATION SUBJECT:

Exterior Design Institute

Question

What Fire Rating is Required
for the Interior Wall?



A. There is no
Requirement

C. Class A Fire Rating
(ASTM E-84)

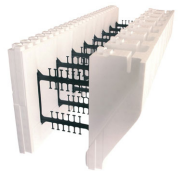
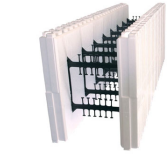
B. A 15-minute thermal
barrier
(ASTM E119)

D. Any material with a
flame spread index
less than 25



Interior – 15 minute thermal barrier

4.2.8.1.4 Interior Finish: The forms shall be finished on the interior with an approved 15-minute thermal barrier such as 1/2-inch-thick (12.7 mm) gypsum board as required by the applicable code. The gypsum board shall be installed vertically and attached to the flanges of the plastic ties with No. 6 by 2-inch-long (3.9 mm by 51 mm) coarse-thread gypsum wallboard screws spaced 12 inches (305 mm) on center in the field of the board and 8 inches (203 mm) on center on the perimeter.



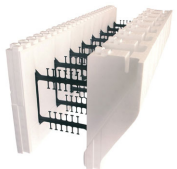
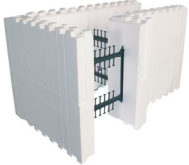
INSTALLATION OVERVIEW

Exterior Design Institute

Footings

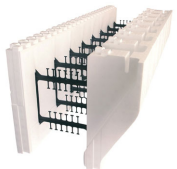


1. **Footings are prepared according to local codes.**
 - **A conventional concrete footing has stone and pipe drainage.**
 - **Slab on grade construction has no stone and pipe drainage.**
 - **If frost is an issue, a frost wall is constructed from 2' deep (VA) to 3' deep (NY) up to 7' deep (ME).**

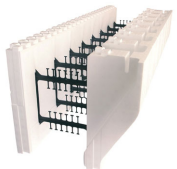
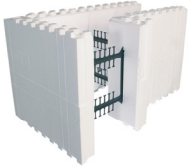


Secure Forms to the Footing

INSTALLATION
OVERVIEW

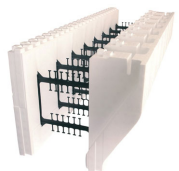


The Slab is Poured

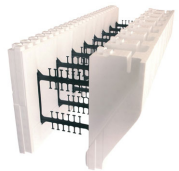
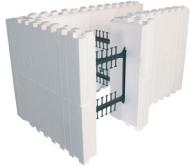


Below Grade Waterproofing

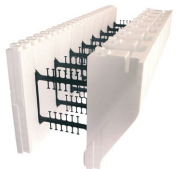
- The most common waterproofing material is a low petroleum content peel N' Stick 60 mil membrane – available from Carlisle, W. R. Grace, and others.
- The peel N' stick is membrane is applied to the ICF and lapped over the footing.
- These membranes are not used with slab on grade construction.



Peel and Stick Membrane



Stacking

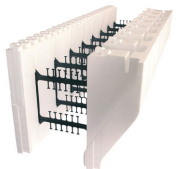
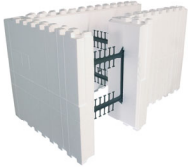


2. Forms are stacked.

Reinforcement

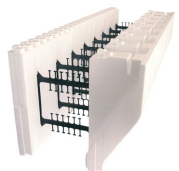
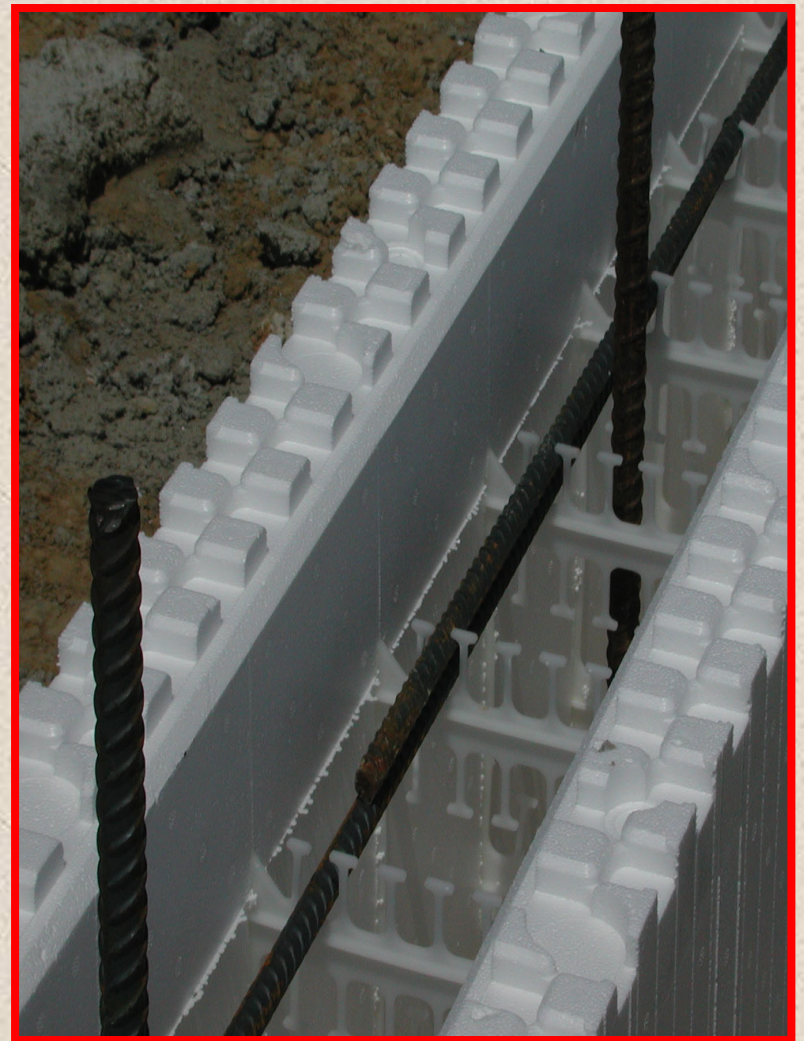


3. Vertical and horizontal rebar is added and secured as the walls are stacked.



More on Rebar:

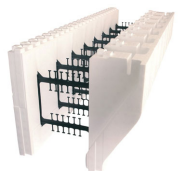
- Rebar can be snapped into place in multiple locations within the wall
- Horizontal rebar can be placed two deep or overlapping
- Loose-fit rebar holders eliminate strain if using bent rebar



Windows and Doors

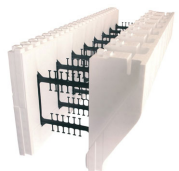


4. **Windows and doors are added to the emerging walls where needed.**



Windows and Doors

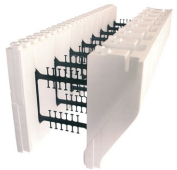
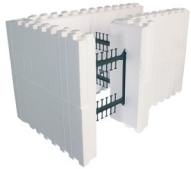
INSTALLATION
OVERVIEW





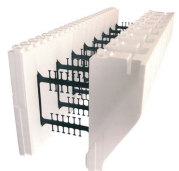
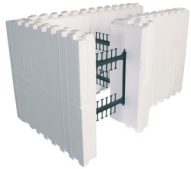
Three Types of Window Bucks

1. Removable metal bucks (more often found in commercial construction)
2. Plastic bucks (typically PVC)
3. Wooden bucks (common)



INSTALLATION
OVERVIEW

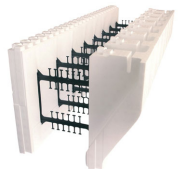
Typical Wood Bucks



Intermediate Floors

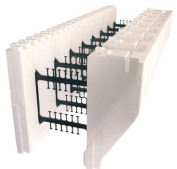
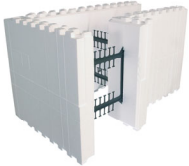
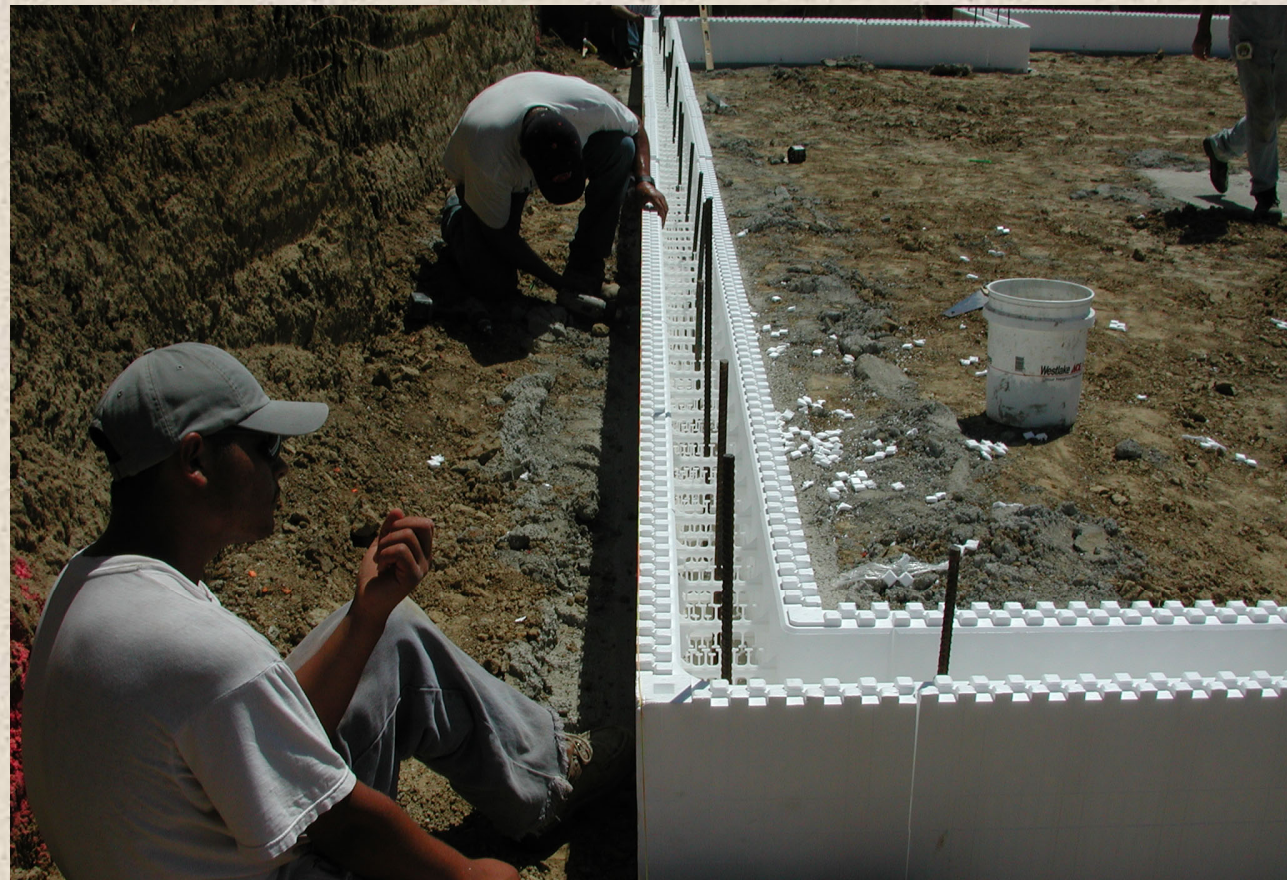


- 5. Intermediate floor attachments are put in place.**
- Anchor tunnels, embedded joist hangers, etc.
 - Ledger and floor joists are added after the concrete is placed.

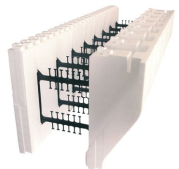
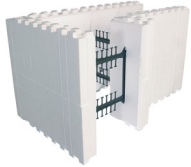


Alignment

6. Once the desired wall height is achieved, the walls are aligned and a final check is made for straight, plumb and square.



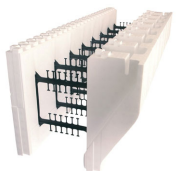
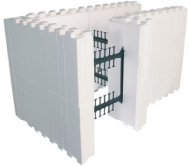
Bracing is Installed



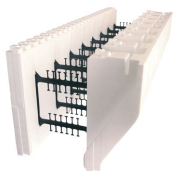
Placing the Concrete

7. Concrete is placed into the forms in several ways. The easiest and most typical placement method is with a concrete pump. Average pour lifts are 4 feet.

Recommend 3,000 psi, 5.5 – 6.5 slump, 3/8 aggregate – standard mix

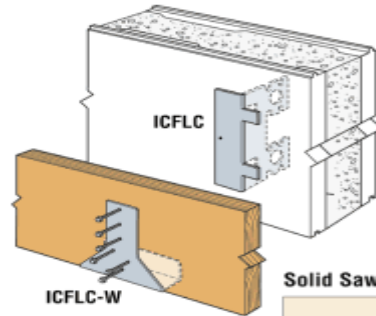


Roof Systems



8. Once the concrete begins to cure, roof systems are put into place.

Steel and Wood Ledger Boards

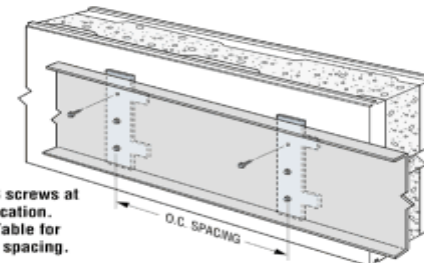


Solid Sawn Wood Ledger (1½" thick)

ICFLC w/ICFLC-W Spacing to Replace Anchor Bolts							
½" diameter bolts at				¾" diameter bolts at			
12" o.c.	24" o.c.	36" o.c.	48" o.c.	12" o.c.	24" o.c.	36" o.c.	48" o.c.
4'	4'	4'	4'	4'	4'	4'	4'
2-5/8" diameter bolts at				¾" diameter bolts at			
12" o.c.	24" o.c.	36" o.c.	48" o.c.	12" o.c.	24" o.c.	36" o.c.	48" o.c.
2'	4'	4'	4'	4'	4'	4'	4'

Anchor Bolt Size	Allowable Bolt Load (lbs) Perpendicular to Grain	
	DF	SPF
½"	365	330
¾"	515	415
1"	565	450

1. Maximum allowable down load is 2235 lbs. Allowable load is based on a safety factor of 3.
2. Spacing shown applies to vertical loads only.
3. No load duration increase is allowed.
4. Use 6-D3 screws (provided).



Typical Steel Ledger Installation with ICFLC (Minimum 16 gauge steel ledger)

Steel Ledger

Ledger gauge (in)	ICFLC Spacing to Replace Anchor Bolts			
	½" diameter bolts at		¾" diameter bolts at	
	12" o.c.	24" o.c.	12" o.c.	24" o.c.
14 (0.075)	1'	2'	0-9"	1'-6"
16 (0.060)	1'-3"	2'-6"	1'	2'

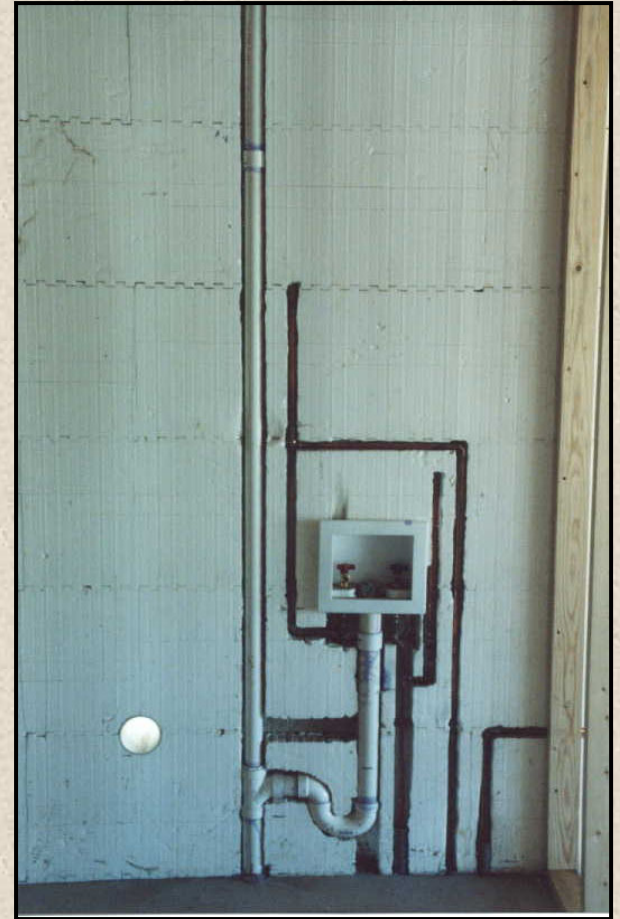
Anchor Bolt Size	Allowable Bolt Load (lbs) Ledger Gauge	
	14	16
½"	2165	1750
¾"	2705	2190

1. Maximum allowable down load for ICFLC is 2235 lbs. Allowable load is based on a safety factor of 3.
2. Spacing shown applies to vertical loads only.
3. No load duration increase is allowed.
4. Engineer of record may specify different ICFLC spacing based on load requirements.
5. Use three ¼"-14x¾", #3 drill point screws (not provided). Minimum screw shear capacity is 750 lbs.
6. Minimum tensile strength (Fu) of steel ledger is 60 ksi.

Utilities



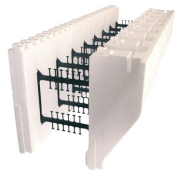
Electrical wiring outlets and plumbing are easily installed into the EPS foam.



Standard Interior Finishes



- **15-minute thermal barrier is required (1/2" drywall)**



Exterior Finishes

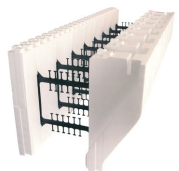
EIFS Lamina

Pluses

- Integrally colored
- standard mesh
- Easiest to apply
- Easiest to repair
- Most versatile

Minuses

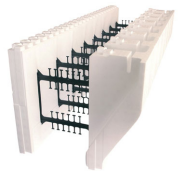
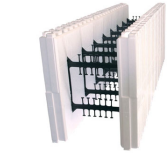
- Low impact res.
- Insurance Issues
- Environmental Issues - rasping



Typical EIFS Cladding

Class PB EIFS Lamina (PB Base, mesh, and Finish)

- Requires separate finish and base products
- Standard 4-ounce fiberglass reinforcing mesh only
- Moderate skill level
- Low RMC and labor
- Least impact res.
- Good versatility
- Low call-backs
- Insurance Issues?
- Fairly easy repair
- Detailing important



Other Exterior Finish Systems

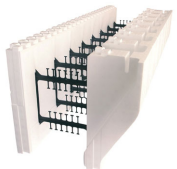
Hard Coat Stucco

Pluses

- Most effective at hiding deflections
- Not an EIFS?
- No rasping
- High impact res.

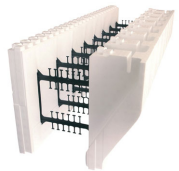
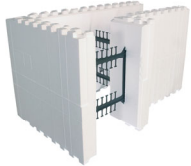
Minuses

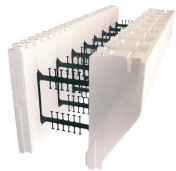
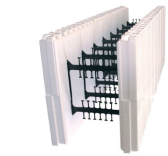
- Mechanical attachment
- Trim and Lath or netting
- Highest skill level
- High RMC and labor
- Hard but may crack
- Harder to repair



Exterior Finishes

Total Wall Hard Coat Stucco System over Reward ICF

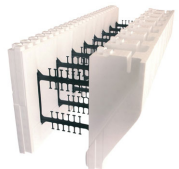
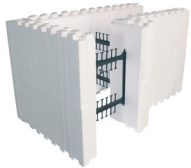


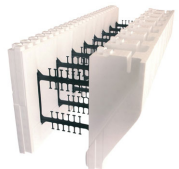
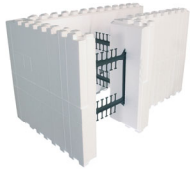


What Are Some of the Problems With ICF Construction?

Crooked Walls Are Common

- It is difficult to correct misaligned walls
- Wall alignment correction typically requires lamination of EPS foam sheets combined with heavy rasping and possibly hot-wire cutting.





Structural Failure

Where are the structural problems and why?

- Window lintels are one problem area
- Walls receiving back-fill pressure or shear load are a common failure area.
- **Structural failure is usually due to improper reinforcement during construction (not enough rebar and/or undersized rebar)**

Question

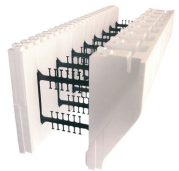
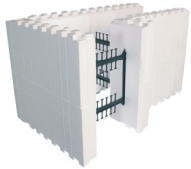
Which is NOT factored into window lintel performance?

A. Type of Window

C. Grade of rebar

B. Concrete PSI

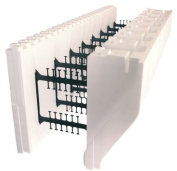
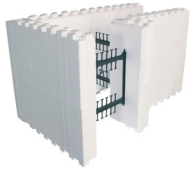
D. Lintel width



Lintel Reinforcement

What We Need to Know?

- ✓ Lintel Width
- ✓ Lintel Height
- ✓ Size ICF Block (width)
- ✓ Concrete Compressive PSI (3000 is spec)
- ✓ Factored Lintel Load Per Foot
- ✓ Rebar Grade
 1. Grade 40 = 40,000 psi
 2. Grade 60 = 60,000 psi
 3. Grade 76 = 75,000 psi



Question

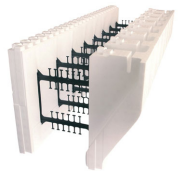
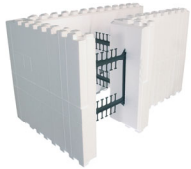
Which is NOT factored into window lintel performance?

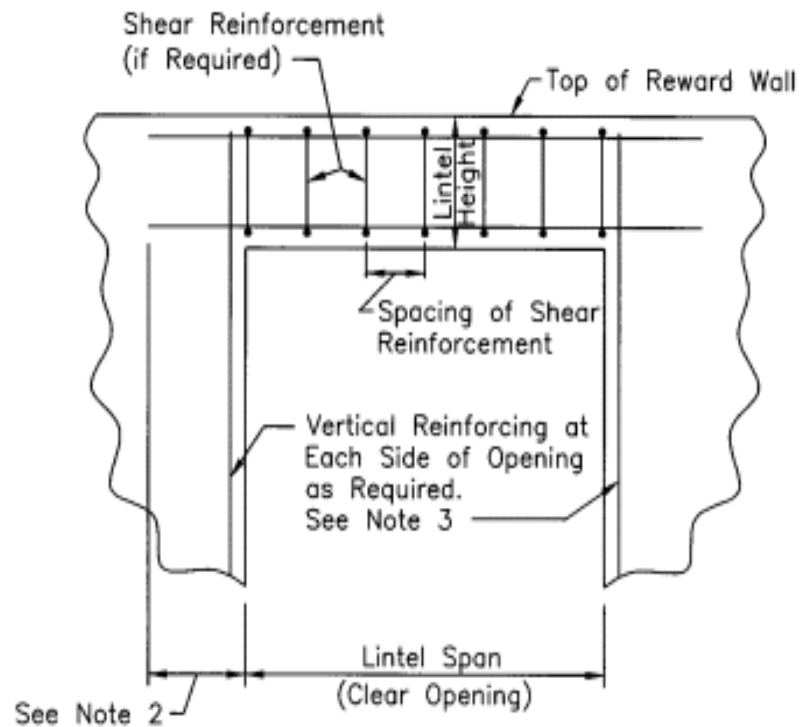
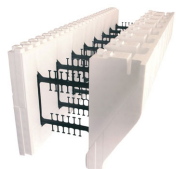
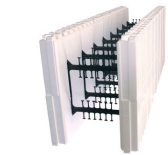
A. Type of Window

C. Grade of rebar

B. Concrete PSI

D. Lintel width





NOTES:

- 1) See Lintel Reinforcement Tables
- 2) Extend Lintel Reinforcement Beyond Edge of Opening as Required. See Lintel Reinforcement Table.
- 3) Minimum Required Reinforcement at Opening. See Reinforcement Table.

Example

Height	16"
Span	10'
ICF	11"
Rebar	40 Grade
Concrete	3000 psi
Load	750 lbs

16"

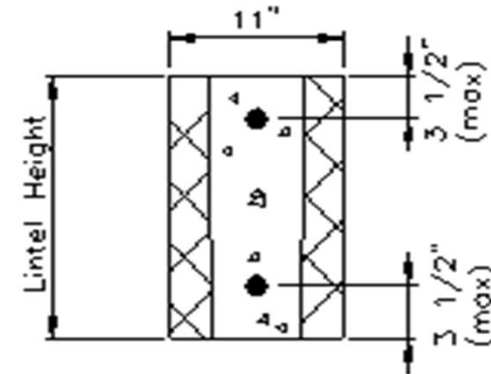
LINTEL HEIGHT

11"

IFORM

Design Parameters

Lintel Height	16 in.
Concrete strength at 28 days, f_c	3000 psi
Steel strength, f_y	40,000 psi
Spacing of shear reinforcement	6 in.



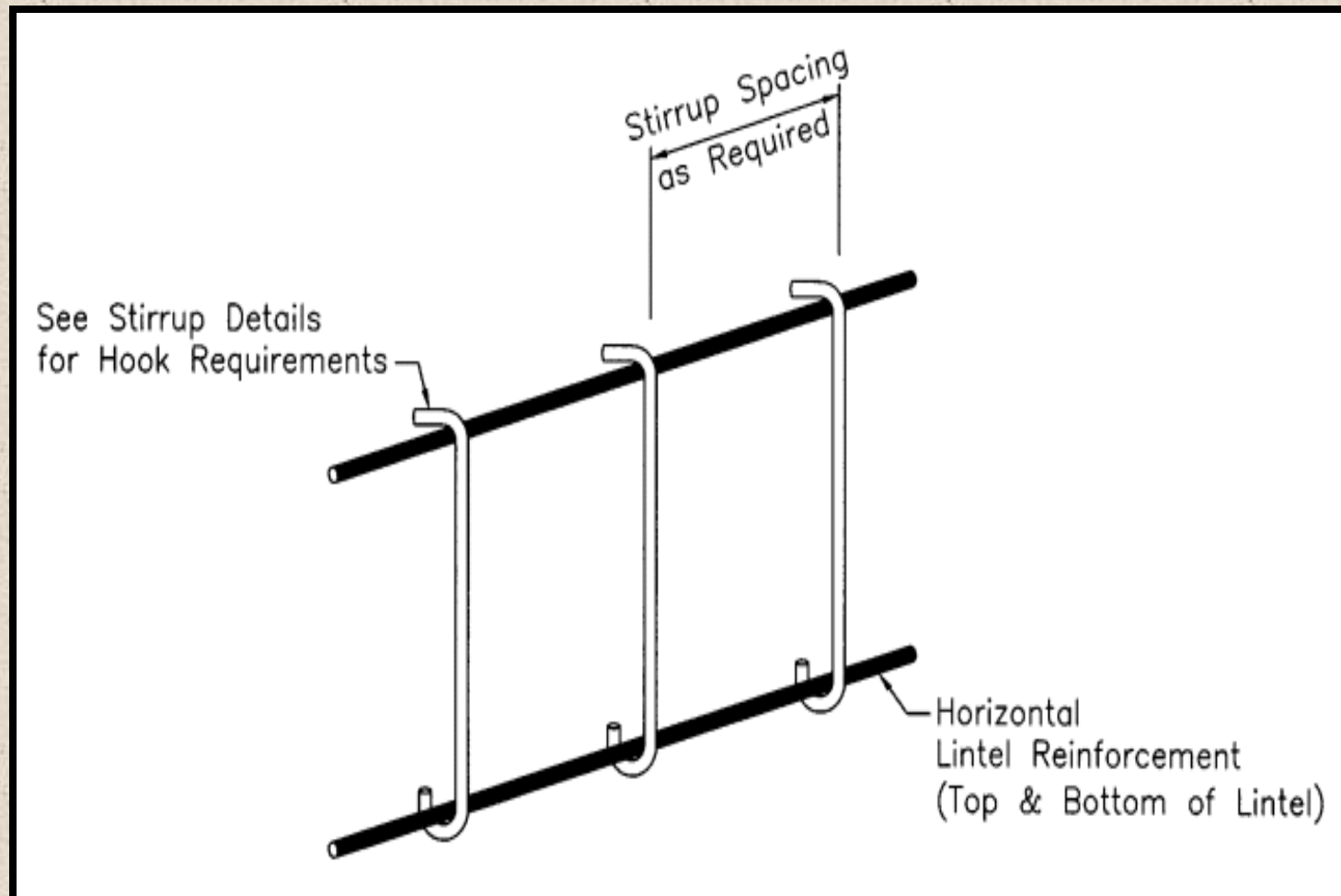
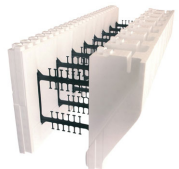
Legend:

1-#5	<-- Reinf. Req'd top and bottom of lintel
W/2.1	<-- Shear reinf. Required at 6" spacing

MINIMUM REINFORCEMENT REQUIRED

FACTORED LOAD PER FOOT OF LINTEL	Lintel Span (ft)									
	3	4	5	6	7	8	10	12	14	16
250 lb										
500	1 - # 5 top and bottom No Shear Reinforcement Required								1 - #5 # 3	1 - #5 # 3
750							1 - #5 # 3	1 - #5 # 3	2 - #5 # 3	2 - #5 # 3
1000							1 - #5 # 3	1 - #5 # 3	2 - #5 # 3	2 - #5 # 3
1500					1 - #5 # 3	1 - #5 # 3	1 - #5 # 3	2 - #5 # 3	2 - #5 # 3	
2000				1 - #5 # 3	1 - #5 # 3	1 - #5 # 3	2 - #5 # 3	2 - #5 # 3		
2500			1 - #5 # 3	1 - #5 # 3	1 - #5 # 3	1 - #5 # 3	2 - #5 # 3			
3000			1 - #5 # 3	1 - #5 # 3	1 - #5 # 3	2 - #5 # 3	2 - #5 # 3			

Rebar Stirrups = Shear Reinforcement

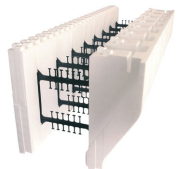


Wall Reinforcement

What We Need To Know?

Determine the stresses and use the tables

Maximum Equivalent Fluid Density pcf	UCS Classification	Soil Description
30	GW, GP, SW, SP, GM	Well-drained, cohesionless soils such as clean (few or no fines) sand and gravels
45	GC, SM	Well-drained, cohesionless soils such as sand and gravels containing silt or clay
60	SC, MH, CL, CH, ML-CL	Well-drained, inorganic silts and clays that are broken up into small pieces

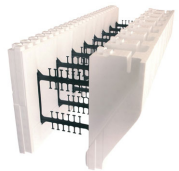


EXAMPLE

Wall Reinforcement

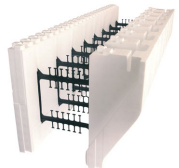
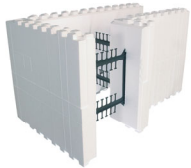
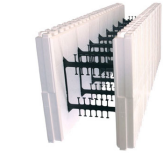
Scenario:

- 8' Foundation Wall
- 11" ICF Block
- 7' Backfill
- Clay Soil
- #4 Rebar Grade 60
- Concrete 3000 psi



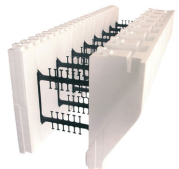
EXAMPLE

Table 6.1.1.1
Reward Below Grade Wall
11" iForm - No Brick and Brick
Vertical Reinforcement Table
 Concrete: **3,000 psi** Rebar: **Grade 60**



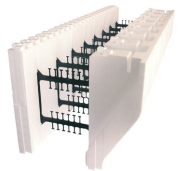
Max. Height of Basement Wall (ft)	Maximum Unbalanced Backfill Height (ft)	Required Spacing (in.) of Vertical Reinforcement														
		Maximum Equivalent Fluid Density 30 pcf					Maximum Equivalent Fluid Density 45 pcf					Maximum Equivalent Fluid Density 60 pcf				
		#4	#5	#6	#7	#8	#4	#5	#6	#7	#8	#4	#5	#6	#7	#8
8	4	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"				
	5	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					42	48	48	48	48
	6	Provide Minimum #4 @ 48"					36	48	48	48	48	24	36	48	48	48
	7	36	48	48	48	48	24	36	48	48	48	18	24	42	48	48
9	4	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"				
	5	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					36	48	48	48	48
	6	Provide Minimum #4 @ 48"					30	48	48	48	48	24	36	48	48	48
	7	30	48	48	48	48	18	30	48	48	48	12	24	36	48	48
	8	24	36	48	48	48	12	24	36	48	48	6	18	24	36	48
10	4	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"				
	5	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					36	48	48	48	48
	6	48	48	48	48	48	30	48	48	48	48	18	30	48	48	48
	7	30	48	48	48	48	18	30	42	48	48	12	18	30	42	48
	8	18	36	48	48	48	12	18	30	42	48	6	12	24	30	42
	9	12	24	36	48	48	6	12	24	30	42	6	12	18	24	30
11	4	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"				
	5	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					36	48	48	48	48
	6	48	48	48	48	48	30	42	48	48	48	18	30	48	48	48
	7	30	42	48	48	48	18	30	42	48	48	12	18	30	42	48
	8	18	30	48	48	48	12	18	30	42	48	6	12	18	30	36
	9	12	24	36	48	48	6	12	18	30	36	6	6	12	18	24
	10	12	18	24	36	48	6	6	12	24	30	6	6	12	18	24
	4	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"				
	5	Provide Minimum #4 @ 48"					Provide Minimum #4 @ 48"					48	48	48	48	48

Boring Insects



- **Does not create a structural problem in the ICF structure**
- **EPS has no food value**
- **Insects tunnel in EPS to get to food or make nests**
- **Some jurisdictions (GA) require EPS be held 12” above grade or alternatively use Borate impregnated EPS**
- **Borate only delays the infestation, it does not stop it.**

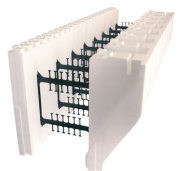
Woodpeckers and Flickers



- Can peck holes through EIFS lamina and nest in borrowed out EPS layer.
- Location related – if a woodpecker has a home in a tree – the tree is cut down and a home is built – the woodpecker returns to the most suitable site near the location of the former tree.
- Most species are Federally protected.

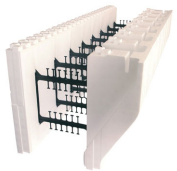
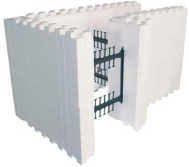
Deterring Woodpeckers and Flickers

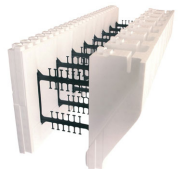
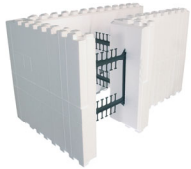
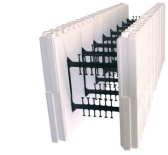
What Works?



- High impact EIFS lamina (high impact mesh, multiple layers and thicker base coat) or hard coat stucco systems are effective
- Stuffed or rubber predators hung on the walls – snakes, owls, haws, etc.
- Ropel spray – available at farm outlets – mist on at 1000 sq. ft. per gallon.
- Nesting cycle must be broken for two seasons.

Residential



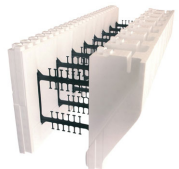
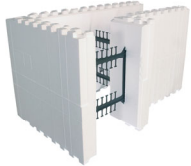


**Really
Big
Residential**

ICF Construction Advantages



- **Insulation Value**
- **Sound Deadening**
- **Not Moisture Sensitive**
- **Versatile**



Key Points to Remember

- ICF Construction is poured in place reinforced concrete sandwiched between two sheets of rigid polystyrene.
- Structural reinforcement and wall alignment are two important areas to watch.
- The interior requires a 15-minute thermal barrier for human occupancy.
- The exterior can receive a variety of claddings.
- Lamina and items requiring fastening must be fastened into the ties or into the concrete core.

