

# **Section 9**

## **Reinforcing**

Following are excerpts from the *Prescriptive Method for Insulating Concrete Forms in Residential Construction* (second edition) published by the U.S. Department of Housing and Urban Development. The complete document is available for download at [www.huduser.org](http://www.huduser.org).

Included are commonly used tables for standard applications only. This information is not complete. Consult the entire document and/or seek the help of an engineer or experienced construction professional for more information.





**U.S. Department of Housing and Urban Development**  
**Office of Policy Development and Research**

***PRESCRIPTIVE METHOD FOR  
INSULATING CONCRETE  
FORMS IN RESIDENTIAL  
CONSTRUCTION***  
**Second Edition**

## 3.0 Foundations

### 3.1 Footings

All exterior ICF walls shall be supported on continuous concrete footings or other approved systems of sufficient design to safely transmit the loads imposed directly to the soil. Except when erected on solid rock or otherwise protected from frost, the footings shall extend below the frost line as specified in the local building code. Footings shall be permitted to be located at a depth above the frost line when protected from frost in accordance with the *Design and Construction of Frost-Protected Shallow Foundations* [18]. Minimum sizes for concrete footings shall be as set forth in Table 3.1. In no case shall exterior footings be less than 12 inches (305 mm) below grade. Footings shall be supported on undisturbed natural soil or approved structural fill. Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings. Foundations erected on soils with a bearing value of less than 2,000 psf (96 kPa) shall be designed in accordance with accepted engineering practice.

### 3.2 ICF Foundation Wall Requirements

The minimum wall thickness shall be greater than or equal to the wall thickness of the wall story above. A minimum of one No. 4 bar shall extend across all construction joints at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have a minimum of 12 inches (305 mm) embedment on both sides of all construction joints.

**Exception:** Vertical wall reinforcement required in accordance with this section is permitted to be used in lieu of construction joint reinforcement.

Vertical wall reinforcement required in this section and interrupted by wall openings shall be placed such that one vertical bar is located within 6 inches (152 mm) of each side of the opening. A minimum of one No. 4 vertical reinforcing bar shall be placed in each interior and exterior corner of exterior ICF walls. Horizontal wall reinforcement shall be required in the form of one No. 4 rebar within 12 inches (305 mm) from the top of the wall, one No. 4 rebar within 12 inches (305 mm) from the finish floor, and one No. 4 rebar near one-third points throughout the remainder of the wall.

#### 3.2.1 ICF Walls with Slab-on-Grade

ICF stem walls and monolithic slabs-on-grade shall be constructed in accordance with Figure 3.1. Vertical and horizontal wall reinforcement shall be in accordance with Section 4.0 for the above- and below-grade portions of stem walls.

#### 3.2.2 ICF Crawlspace Walls

ICF crawlspace walls shall be constructed in accordance with Figure 3.2 and shall be laterally supported at the top and bottom of the wall in accordance with Section 6.0. A minimum of one continuous horizontal No. 4 bar shall be placed within 12 inches (305 mm) of the top of the crawlspace wall. Vertical wall reinforcement shall be the greater of that required in Table 3.2 or, if supporting an ICF wall, that required in Section 4.0 for the wall above.

### 3.2.3 ICF Basement Walls

ICF basement walls shall be constructed in accordance with Figure 3.3 and shall be laterally supported at the top and bottom of the wall in accordance with Section 6.0. Horizontal wall reinforcement shall be provided in accordance with Table 3.3. Vertical wall reinforcement shall be provided in accordance with Tables 3.4 through 3.9.

### 3.2.4 Requirements for Seismic Design Categories C, D<sub>1</sub>, and D<sub>2</sub>

Concrete foundation walls supporting above-grade ICF walls in Seismic Design Category C shall be reinforced with minimum No. 5 rebar at 24 inches (610 mm) on center (both ways) or a lesser spacing if required by Tables 3.2 through 3.9.

Concrete foundation walls supporting above grade ICF walls in Seismic Design Categories D<sub>1</sub> and D<sub>2</sub> shall be reinforced with minimum No. 5 rebar at a maximum spacing of 18 inches (457 mm) on center (both ways) or a lesser spacing if required by Tables 3.2 through 3.9 and the minimum concrete compressive strength shall be 3,000 psi (20.5 MPa). Vertical reinforcement shall be continuous with ICF above grade wall vertical reinforcement. Alternatively, the reinforcement shall extend a minimum of  $40d_b$  into the ICF above grade wall, creating a lap-splice with the above-grade wall reinforcement or extend 24 inches (610 mm) terminating with a minimum 90° bend of 6 inches in length.

## 3.3 ICF Foundation Wall Coverings

### 3.3.1 Interior Covering

Rigid foam plastic on the interior of habitable spaces shall be covered with a minimum of 1/2-inch (13-mm) gypsum board or an approved finish material that provides a thermal barrier to limit the average temperature rise of the unexposed surface to no more than 250 degrees F (121 degrees C) after 15 minutes of fire exposure in accordance with ASTM E 119 [19].

The use of vapor retarders shall be in accordance with the authority having jurisdiction.

### 3.3.2 Exterior Covering

ICFs constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an approved exterior covering. All ICFs shall be covered with approved materials installed to provide an adequate barrier against the weather. The use of vapor retarders and air barriers shall be in accordance with the authority having jurisdiction.

ICF foundation walls enclosing habitable or storage space shall be dampproofed from the top of the footing to the finished grade. In areas where a high water table or other severe soil-water conditions are known to exist, exterior ICF foundation walls enclosing habitable or storage space shall be waterproofed with a membrane extending from the top of the footing to the finished grade. Dampproofing and waterproofing materials for ICF forms shall be nonpetroleum-based and compatible with the form. Dampproofing and waterproofing materials for forms other than foam insulation shall be compatible with the form material and shall be applied in accordance with the manufacturer's recommendations.

### 3.4 Termite Protection Requirements

Structures consisting of materials subject to termite attack (i.e., untreated wood) shall be protected against termite infestation in accordance with the local building code. When materials susceptible to termite attack are placed on or above ICF construction, the ICF foundation walls in areas subject to termite infestation shall be protected by approved chemical soil treatment, physical barriers (i.e., termite shields), borate-treated form material, or any combination of these methods in accordance with the local building code and acceptable practice.

**TABLE 3.1**  
**MINIMUM WIDTH OF ICF AND CONCRETE**  
**FOOTINGS FOR ICF WALLS<sup>1,2,3</sup> (inches)**

MAXIMUM NUMBER OF STORIES <sup>4</sup>	MINIMUM LOAD-BEARING VALUE OF SOIL (psf)				
	2,000	2,500	3,000	3,500	4,000
<b>5.5-Inch Flat, 6-Inch Waffle-Grid, or 6-Inch Screen-Grid ICF Wall Thickness<sup>5</sup></b>					
One Story <sup>6</sup>	15	12	10	9	8
Two Story <sup>6</sup>	20	16	13	12	10
<b>7.5-Inch Flat or 8-Inch Waffle-Grid, or 8-Inch Screen-Grid ICF Wall Thickness<sup>5</sup></b>					
One Story <sup>7</sup>	18	14	12	10	8
Two Story <sup>7</sup>	24	19	16	14	12
<b>9.5-Inch Flat ICF Wall Thickness<sup>5</sup></b>					
One Story	20	16	13	11	10
Two Story	27	22	18	15	14

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 47.8804 Pa

<sup>1</sup>Minimum footing thickness shall be the greater of one-third of the footing width, 6 inches (152 mm), or 11 inches (279 mm) when a dowel is required in accordance with Section 6.0.

<sup>2</sup>Footings shall have a width that allows for a nominal 2-inch (51-mm) projection from either face of the concrete in the wall to the edge of the footing.

<sup>3</sup>Table values are based on 32 ft (9.8 m) building width (floor and roof clear span).

<sup>4</sup>Basement walls shall not be considered as a story in determining footing widths.

<sup>5</sup>Actual thickness is shown for flat walls while nominal thickness is given for waffle- and screen-grid walls. Refer to Section 2.0 for actual waffle- and screen-grid thickness and dimensions.

<sup>6</sup>Applicable also for 7.5-inch (191-mm) thick or 9.5-inch (241-mm) thick flat ICF foundation wall supporting 3.5-inch (88.9-mm) thick flat ICF stories.

<sup>7</sup>Applicable also for 9.5-inch (241-mm) thick flat ICF foundation wall story supporting 5.5-inch (140-mm) thick flat ICF stories.

**TABLE 3.2  
MINIMUM VERTICAL WALL REINFORCEMENT FOR  
ICF CRAWLSPACE WALLS<sup>1,2,3,4,5,6</sup>**

SHAPE OF CONCRETE WALLS	WALL THICKNESS <sup>7</sup> (inches)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
Flat	3.5 <sup>8</sup>	#3@16" #4@32"	#3@18"; #4@28"; #5@38"	#3@12"; #4@22"; #5@28"
	5.5	#3@24" #4@48"	#3@24" #4@48"	#3@24" #4@48"
	7.5	N/R	N/R	N/R
Waffle-Grid	6	#3@24" #4@48"	#3@24" #4@48"	#3@12"; #4@24"; #5@36"
	8	N/R	N/R	N/R
Screen-Grid	6	#3@24" #4@48"	#3@24" #4@48"	#3@12"; #4@24"; #5@36"

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 pcf = 16.0179 kg/m<sup>3</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>N/R indicates no vertical wall reinforcement is required.

<sup>3</sup>Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement, when required, shall not be less than one #4 bar at 48 inches (1.2 m) on center.

<sup>4</sup>Applicable only to crawlspace walls 5 feet (1.5 m) or less in height with a maximum unbalanced backfill height of 4 feet (1.2 m).

<sup>5</sup>Interpolation shall not be permitted.

<sup>6</sup>Walls shall be laterally supported at the top before backfilling.

<sup>7</sup>Actual thickness is shown for flat walls while nominal thickness is given for waffle- and screen-grid walls. Refer to Section 2.0 for actual waffle- and screen-grid thickness and dimensions.

<sup>8</sup>Applicable only to one-story construction with floor bearing on top of crawlspace wall.

**TABLE 3.3  
MINIMUM HORIZONTAL WALL REINFORCEMENT FOR  
ICF BASEMENT WALLS**

MAXIMUM HEIGHT OF BASEMENT WALL FEET (METERS)	LOCATION OF HORIZONTAL REINFORCEMENT
8 (2.4)	One No. 4 bar within 12 inches (305 mm) of the top of the wall story and one No. 4 bar near mid-height of the wall story
9 (2.7)	One No. 4 bar within 12 inches (305 mm) of the top of the wall story and one No. 4 bar near third points in the wall story
10 (3.0)	One No. 4 bar within 12 inches (305 mm) of the top of the wall story and one No. 4 bar near third points in the wall story

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 pcf = 16.0179 kg/m<sup>3</sup>

<sup>1</sup>Horizontal reinforcement requirements are for reinforcing bars with a minimum yield strength from 40,000 psi (276 MPa) and concrete with a minimum concrete compressive strength 2,500 psi (17.2 MPa).

**TABLE 3.5**  
**MINIMUM VERTICAL WALL REINFORCEMENT FOR**  
**7.5-inch- (191-mm-) THICK FLAT ICF BASEMENT WALLS** <sup>1,2,3,4,5,6</sup>

MAX. WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>7</sup> (feet)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
8	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	#4@14"; #5@20"; #6@28"	#4@10"; #5@16"; #6@20"
9	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#4@14"; #5@20"; #6@28"
	7	N/R	#4@12"; #5@18"; #6@26"	#4@8"; #5@14"; #6@18"
	8	#4@14"; #5@22"; #6@28"	#4@8"; #5@14"; #6@18"	#4@6"; #5@10"; #6@14"
10	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#4@12"; #5@18"; #6@26"
	7	N/R	#4@12"; #5@18"; #6@24"	#4@8"; #5@12"; #6@18"
	8	#4@12"; #5@20"; #6@26"	#4@8"; #5@12"; #6@16"	#4@6"; #5@8"; #6@12"
	9	#4@10"; #5@14"; #6@20"	#4@6"; #5@10"; #6@12"	#4@4"; #5@6"; #6@10"

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 pcf = 16.0179 kg/m<sup>3</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement, when required, shall not be less than one #4 bar at 48 inches (1.2 m) on center.

<sup>3</sup>N/R indicates no reinforcement is required.

<sup>4</sup>Deflection criterion is  $L/240$ , where  $L$  is the height of the basement wall in inches.

<sup>5</sup>Interpolation shall not be permitted.

<sup>6</sup>Walls shall be laterally supported at the top before backfilling.

<sup>7</sup>Refer to Section 1.0 for the definition of unbalanced backfill height.

**TABLE 3.6**  
**MINIMUM VERTICAL WALL REINFORCEMENT FOR**  
**9.5-inch- (241-mm-) THICK FLAT ICF BASEMENT WALLS** <sup>1,2,3,4,5,6</sup>

MAX. WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>7</sup> (feet)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
8	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	N/R	N/R
9	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	N/R	#4@12"; #5@18"; #6@26"
	8	N/R	#4@12"; #5@18"; #6@26"	#4@8"; #5@14"; #6@18"
10	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#4@18"; #5@26"; #6@36"
	7	N/R	N/R	#4@10"; #5@18"; #6@24"
	8	N/R	#4@12"; #5@16"; #6@24"	#4@8"; #5@12"; #6@16"
	9	N/R	#4@8"; #5@12"; #6@18"	#4@6"; #5@10"; #6@12"

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 pcf = 16.0179 kg/m<sup>3</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement, when required, shall not be less than one #4 bar at 48 inches (1.2 m) on center.

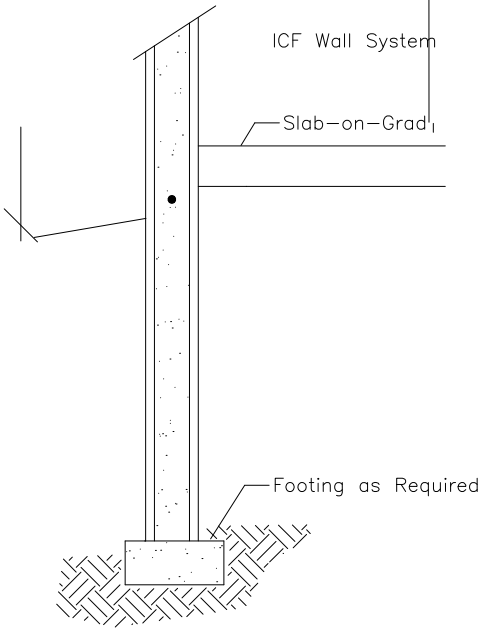
<sup>3</sup>N/R indicates no reinforcement is required.

<sup>4</sup>Deflection criterion is  $L/240$ , where  $L$  is the height of the basement wall in inches.

<sup>5</sup>Interpolation shall not be permitted.

<sup>6</sup>Walls shall be laterally supported at the top before backfilling.

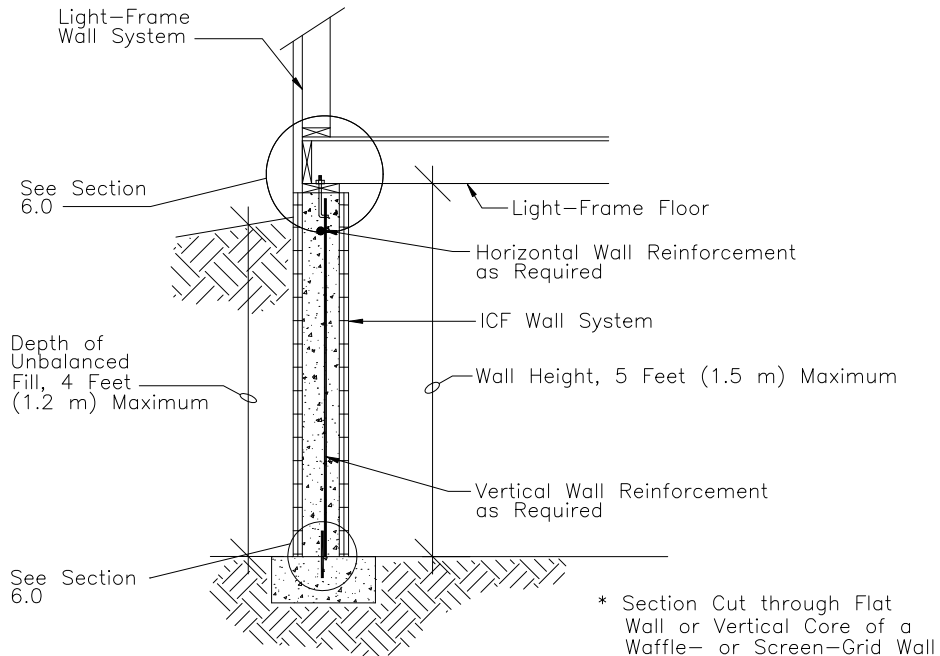
<sup>7</sup>Refer to Section 1.0 for the definition of unbalanced backfill height.



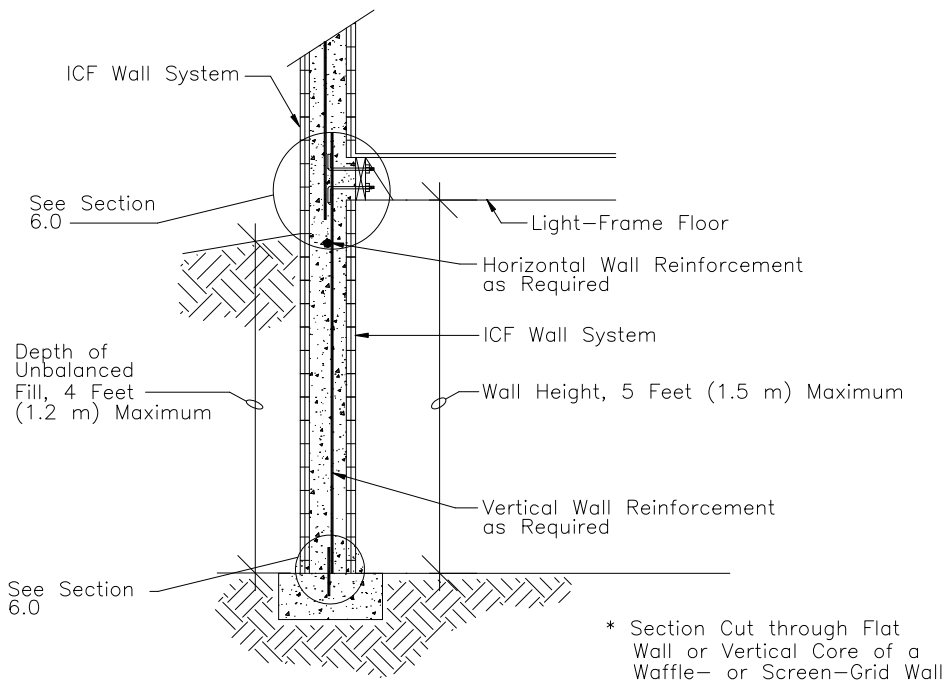
(a) Stem Wall

(b) Thickened Slab

**Figure 3.1 ICF Stem Wall and Monolithic Slab-on-Grade Construction**



(a) Supporting Light-Frame Construction



(b) Supporting ICF Construction

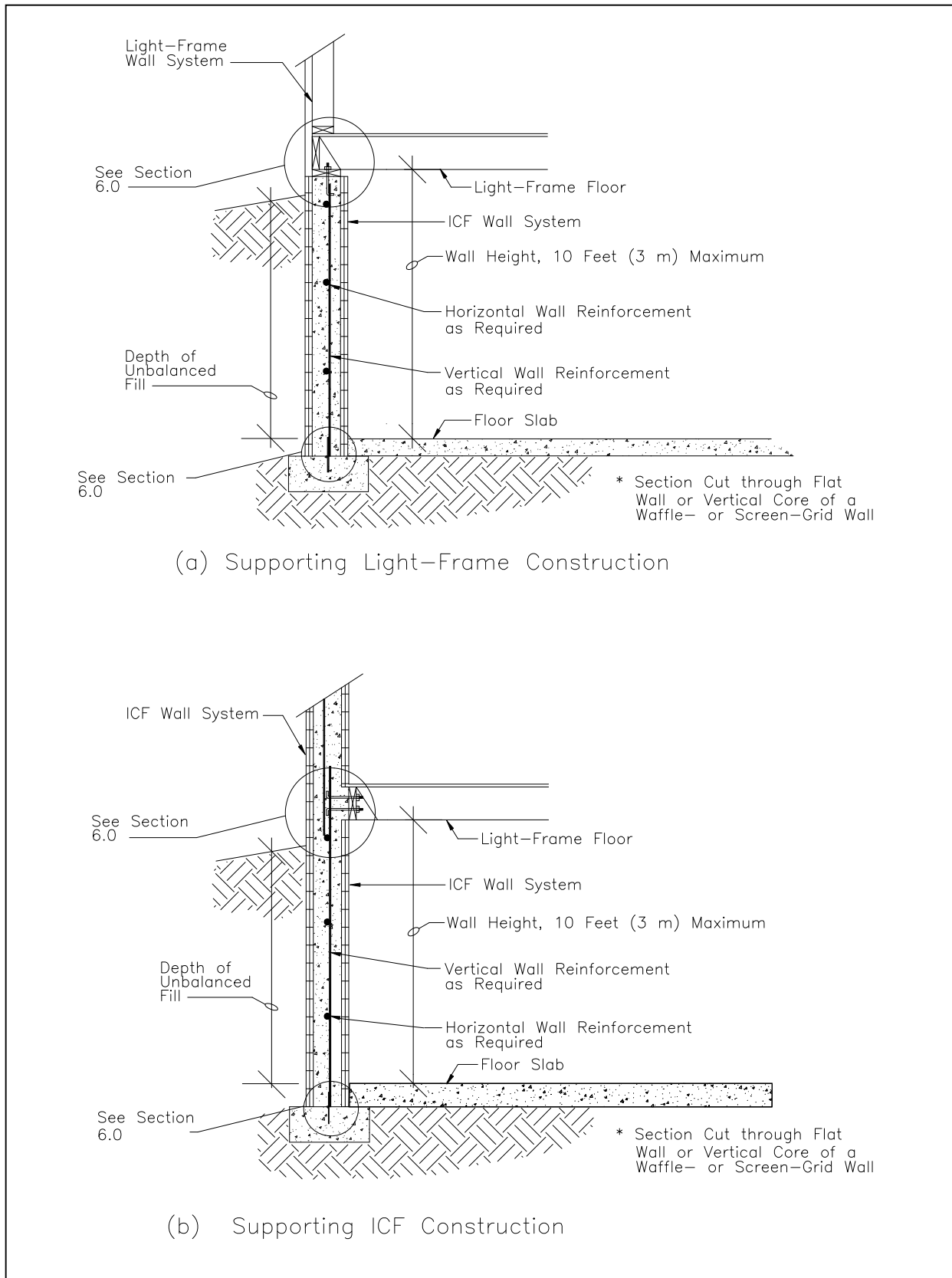


Figure 3.3 ICF Basement Wall Construction

## 4.0 ICF Above-Grade Walls

### 4.1 ICF Above-Grade Wall Requirements

ICF above-grade walls shall be constructed in accordance with Figures 4.1, 4.2, or 4.3 and this section. The minimum length of ICF wall without openings, reinforcement around openings, and lintel requirements above wall openings shall be in accordance with Section 5.0. Lateral support for above-grade ICF walls shall be provided by the roof and floor framing systems in accordance with Section 6.0. The minimum wall thickness shall be greater than or equal to the wall thickness of the wall above.

Design wind pressures of Table 4.1 shall be used to determine the vertical wall reinforcement requirements in Tables 4.2, 4.3, and 4.4. The minimum vertical reinforcement shall be one No. 4 rebar (Grade 40) at 48 inches (1.2 m) on center and at all inside and outside corners of exterior ICF walls. Horizontal wall reinforcement shall be required in the form of one No. 4 rebar within 12 inches (305 mm) from the top of the wall, one No. 4 rebar within 12 inches (305 mm) from the finish floor, and one No. 4 rebar near one-third points throughout the remainder of the wall.

In Seismic Design Category C, the minimum vertical and horizontal reinforcement shall be one No. 5 rebar at 24 inches (610 mm) on center. In Seismic Design Categories D<sub>1</sub> and D<sub>2</sub>, the minimum vertical and horizontal reinforcement shall be one No. 5 rebar at a maximum spacing of 18 inches (457 mm) on center and the minimum concrete compressive strength shall be 3,000 psi (20.5 MPa).

For design wind pressure greater than 40 psf (1.9 kPa) or Seismic Design Category C or greater, all vertical wall reinforcement in the top-most ICF story shall be terminated with a 90 degree bend. The bend shall result in a minimum length of 6 inches (152 mm) parallel to the horizontal wall reinforcement and lie within 4 inches (102 mm) of the top surface of the ICF wall. In addition, horizontal wall reinforcement at exterior building corners shall be terminated with a 90 degree bend resulting in a minimum lap splice length of  $40d_b$  with the horizontal reinforcement in the intersecting wall. The radius of bends shall not be less than 4 inches (102 mm).

**Exception:** In lieu of bending horizontal or vertical reinforcement, separate bent reinforcement bars shall be permitted provided that the minimum lap splice with vertical and horizontal wall reinforcement is not less than  $40d_b$ .

### 4.2 ICF Above-Grade Wall Coverings

#### 4.2.1 Interior Covering

Rigid foam plastic on the interior of habitable spaces shall be covered with a minimum of 1/2-inch (13-mm) gypsum board or an approved finish material that provides a thermal barrier to limit the average temperature rise of the unexposed surface to no more than 250 degrees F (139 degrees C) after 15 minutes of fire exposure in accordance with ASTM E 119 [19]. The use of vapor retarders and air barriers shall be in accordance with the authority having jurisdiction.

4.2.2 Exterior Covering

ICFs constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an approved exterior covering. All ICFs shall be covered with approved materials installed to provide a barrier against the weather. Use of air barriers and vapor retarders shall be in accordance with the authority having jurisdiction.

**TABLE 4.1  
DESIGN WIND PRESSURE FOR USE WITH MINIMUM VERTICAL WALL REINFORCEMENT  
TABLES FOR ABOVE GRADE WALLS<sup>1</sup>**

<b>WIND SPEED (mph)</b>	<b>DESIGN WIND PRESSURE (psf)</b>					
	<b>ENCLOSED<sup>2</sup></b>			<b>PARTIALLY ENCLOSED<sup>2</sup></b>		
	<b>Exposure<sup>3</sup></b>			<b>Exposure<sup>3</sup></b>		
	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>	<b>D</b>
85	18	24	29	23	31	37
90	20	27	32	25	35	41
100	24	34	39	31	43	51
110	29	41	48	38	52	61
120	35	48	57	45	62	73
130	41	56	66	53	73	85 <sup>4</sup>
140	47	65	77	61	84 <sup>4</sup>	99 <sup>4</sup>
150	54	75	88 <sup>4</sup>	70	96 <sup>4</sup>	114 <sup>4</sup>

For SI:      1 psf = 0.0479 kN/m<sup>2</sup>;                      1 mph = 1.6093 km/hr

<sup>1</sup>This table is based on ASCE 7-98 components and cladding wind pressures using a mean roof height of 35 ft (10.7 m) and a tributary area of 10 ft<sup>2</sup> (0.9 m<sup>2</sup>).

<sup>2</sup>Enclosure Classifications are as defined in Section 1.5.

<sup>3</sup>Exposure Categories are as defined in Section 1.5.

<sup>4</sup>For wind pressures greater than 80 psf (3.8 kN/m<sup>2</sup>), design is required in accordance with accepted practice and approved manufacturer guidelines.

**TABLE 4.2**  
**MINIMUM VERTICAL WALL REINFORCEMENT**  
**FOR FLAT ICF ABOVE-GRADE WALLS<sup>1,2,3</sup>**

DESIGN WIND PRESSURE (TABLE 4.1) (psf)	MAXIMUM WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT <sup>4,5</sup>					
		SUPPORTING ROOF OR NON-LOAD BEARING WALL		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF	
		MINIMUM WALL THICKNESS (inches)					
		3.5	5.5	3.5	5.5	3.5	5.5
20	8	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	9	#4@48	#4@48	#4@48	#4@48	#4@48	#4@48
	10	#4@38	#4@48	#4@40	#4@48	#4@42	#4@48
30	8	#4@42	#4@48	#4@46	#4@48	#4@48	#4@48
	9	#4@32; #5@48	#4@48	#4@34; #5@48	#4@48	#4@34; #5@48	#4@48
	10	Design Required	#4@48	Design Required	#4@48	Design Required	#4@48
40	8	#4@30; #5@48	#4@48	#4@30; #5@48	#4@48	#4@32; #5@48	#4@48
	9	Design Required	#4@42	Design Required	#4@46	Design Required	#4@48
	10	Design Required	#4@32; #5@48	Design Required	#4@34; #5@48	Design Required	#4@38
50	8	#4@20; #5@30	#4@42	#4@22; #5@34	#4@46	#4@24; #5@36	#4@48
	9	Design Required	#4@34; #5@48	Design Required	#4@34; #5@48	Design Required	#4@38
	10	Design Required	#4@26; #5@38	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46
60	8	Design Required	#4@34; #5@48	Design Required	#4@36	Design Required	#4@40
	9	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46	Design Required	#4@34; #5@48
	10	Design Required	#4@22; #5@34	Design Required	#4@22; #5@34	Design Required	#4@26; #5@38
70	8	Design Required	#4@28; #5@46	Design Required	#4@30; #5@48	Design Required	#4@34; #5@48
	9	Design Required	#4@22; #5@34	Design Required	#4@22; #5@34	Design Required	#4@24; #5@36
	10	Design Required	#4@16; #5@26	Design Required	#4@18; #5@28	Design Required	#4@20; #5@30
80	8	Design Required	#4@26; #5@38	Design Required	#4@26; #5@38	Design Required	#4@28; #5@46
	9	Design Required	#4@20; #5@30	Design Required	#4@20; #5@30	Design Required	#4@21; #5@34
	10	Design Required	#4@14; #5@24	Design Required	#4@14; #5@24	Design Required	#4@16; #5@26

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 mph = 1.6093 km/hr

<sup>1</sup>This table is based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Deflection criterion is  $L/240$ , where  $L$  is the height of the wall story in inches.

<sup>3</sup>Interpolation shall not be permitted.

<sup>4</sup>Reinforcement spacing for 3.5 inch (88.9 mm) walls shall be permitted to be multiplied by 1.6 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.

<sup>5</sup>Reinforcement spacing for 5.5 inch (139.7 mm) walls shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.

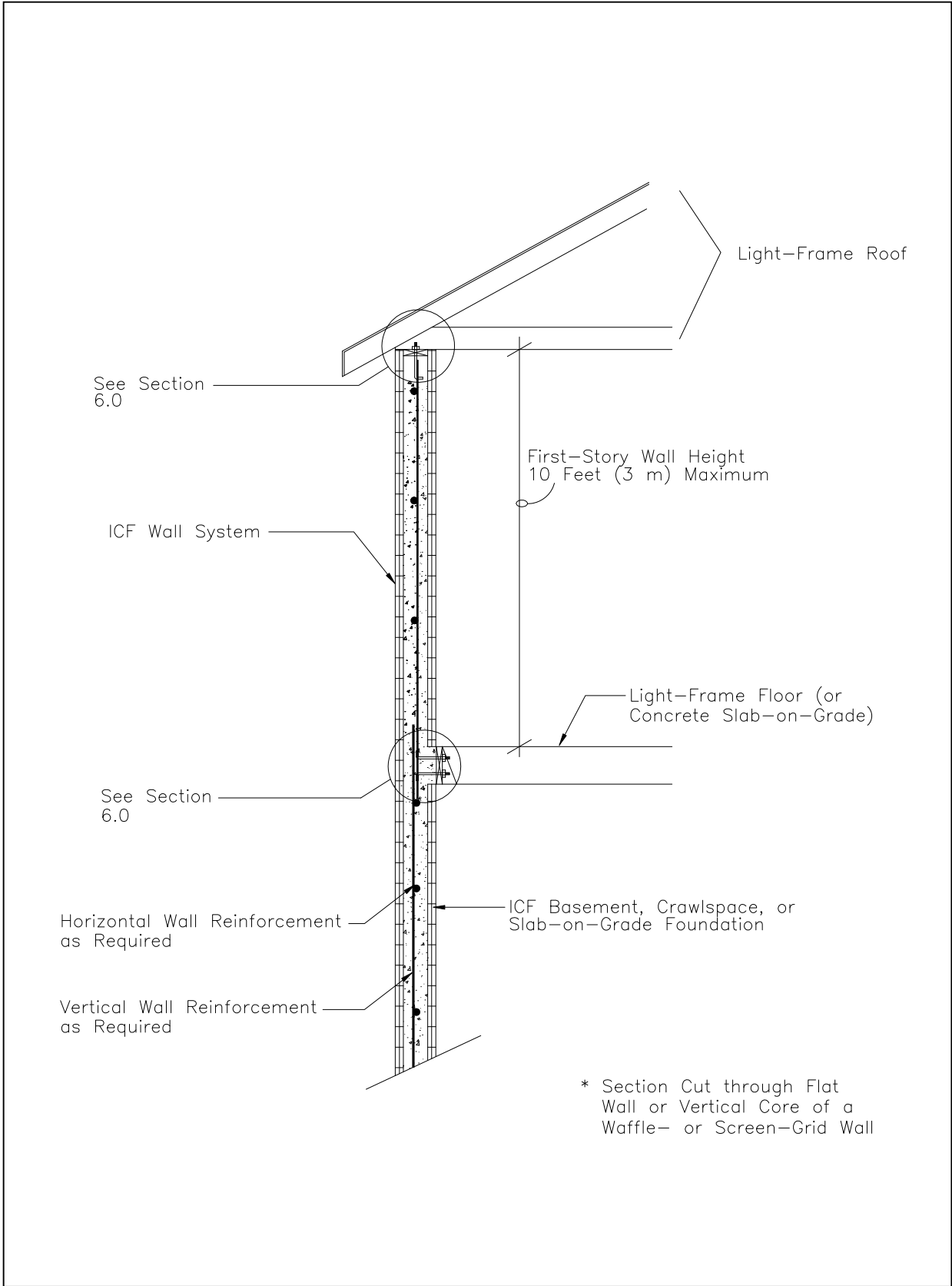
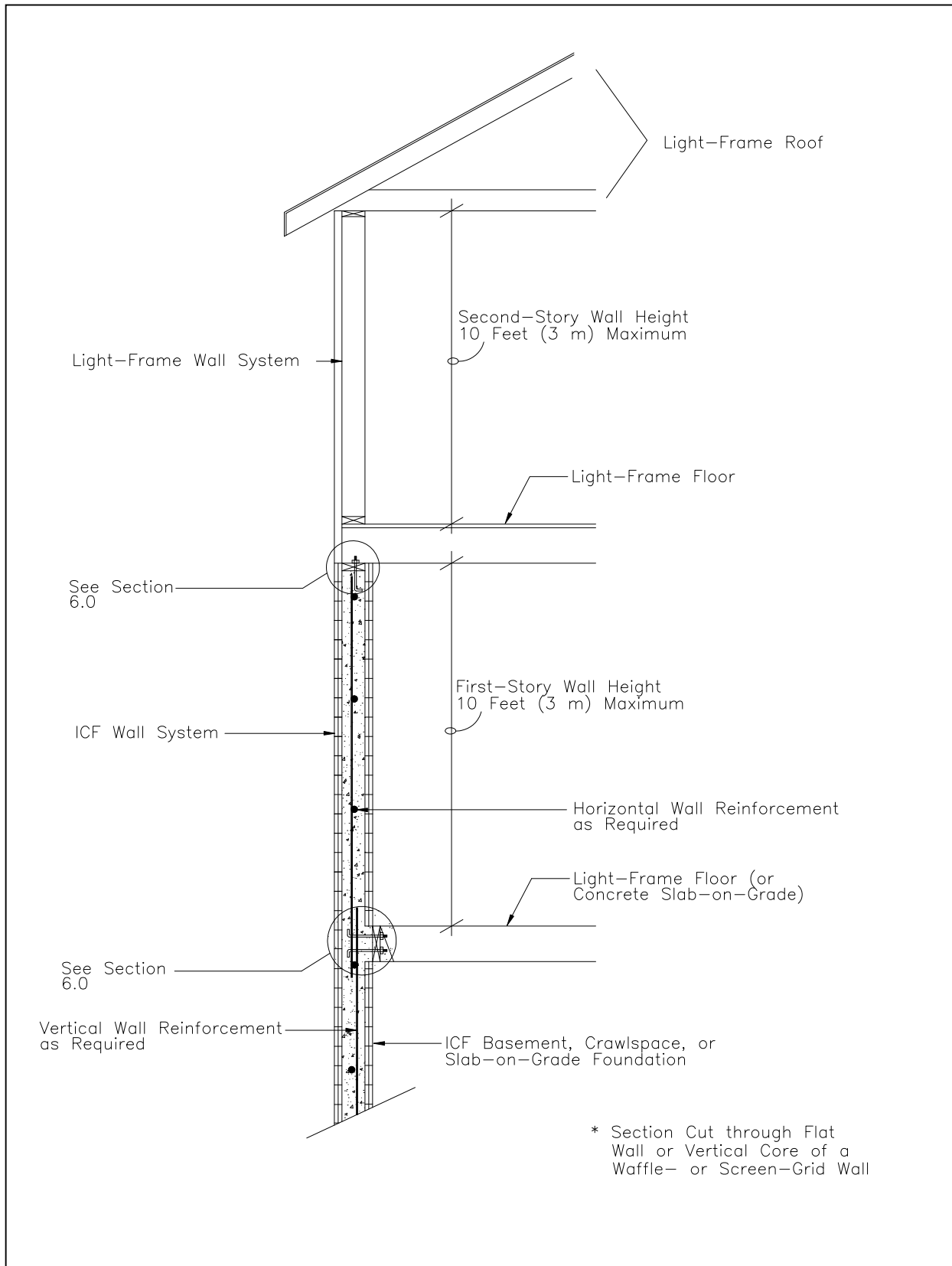


Figure 4.1 ICF Wall Supporting Light-Frame Roof



**Figure 4.2 ICF Wall Supporting Light-Frame Second Story and Roof**

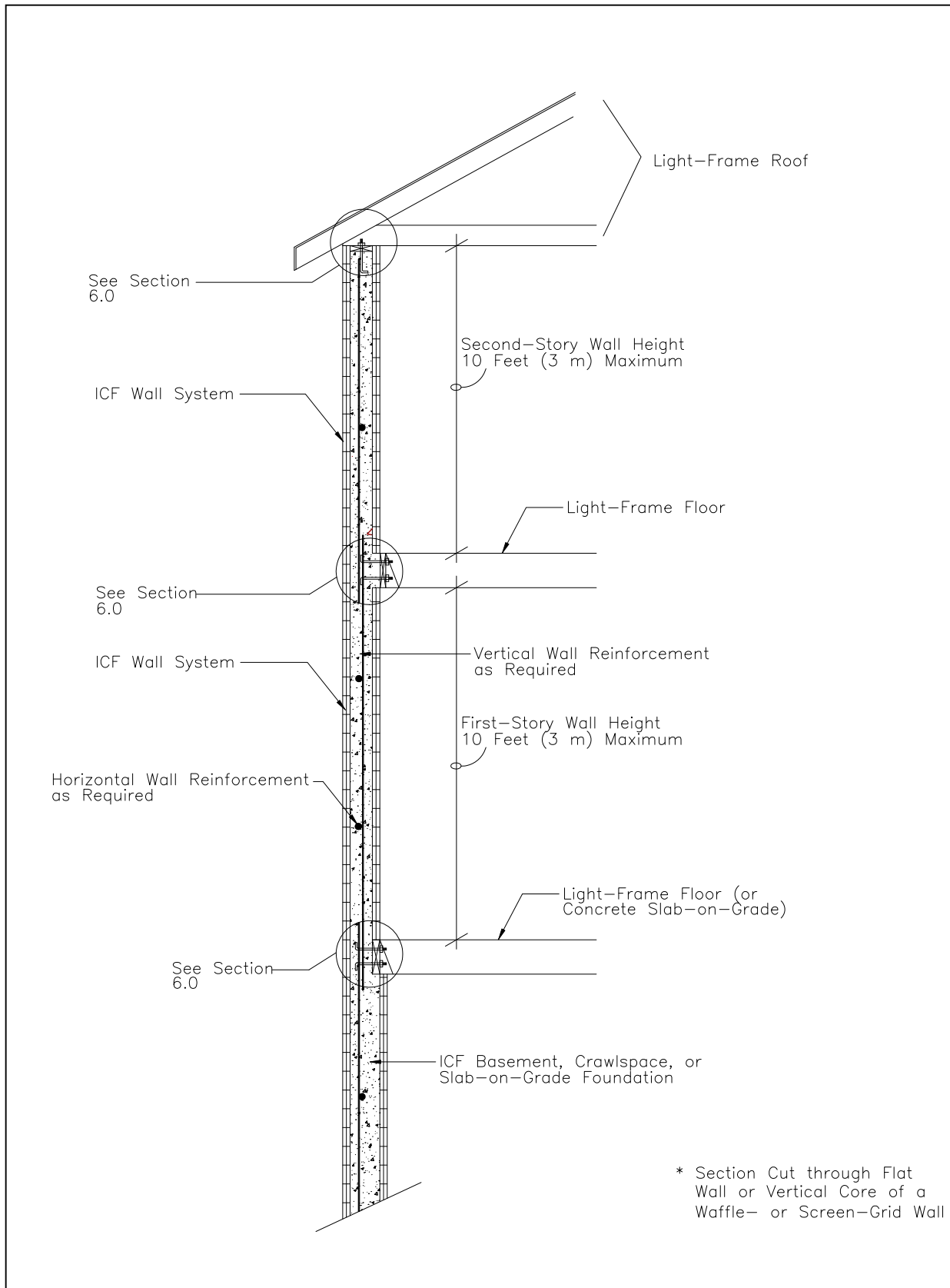


Figure 4.3 ICF Wall Supporting ICF Second Story and Light-Frame Roof

## 5.0 ICF Wall Opening Requirements

### 5.1 Minimum Length of ICF Wall without Openings

The wind velocity pressures of Table 5.1 shall be used to determine the minimum amount of solid wall length in accordance with Tables 5.2 through 5.4 and Figure 5.1. Table 5.5 shall be used to determine the minimum amount of solid wall length for Seismic Design Categories C, D<sub>1</sub>, and D<sub>2</sub>. The greater amount of solid wall length required by Tables 5.2 through 5.5 shall apply.

The amount of solid wall length shall include only those solid wall segments that are a minimum of 24 inches (610 mm) in length. The maximum allowable spacing of wall segments at least 24 inches (610 mm) in length shall be 18 feet (5.5 m) on center. A minimum length of 24 inches (610 mm) of solid wall segment, extending the full height of each wall story, shall occur at all interior and exterior corners of exterior walls.

For Seismic Design Categories D<sub>1</sub> and D<sub>2</sub>, the amount of solid wall length shall include only those solid wall segments that are a minimum of 48 inches (1.2 m) in length. A minimum length of 24 inches (610 mm) of solid wall segment, extending the full height of each wall story, shall occur at all interior and exterior corners of exterior walls. The minimum nominal wall thickness shall be 5.5 inches (140 mm) for all wall types.

### 5.2 Reinforcement around Openings

Openings in ICF walls shall be reinforced in accordance with Table 5.6 and Figure 5.2 in addition to the minimum wall reinforcement of Sections 3 and 4. Wall openings shall have a minimum depth of concrete over the length of the opening of 8 inches (203 mm) in flat and waffle-grid ICF walls and 12 inches (305 mm) in screen-grid ICF wall lintels. Wall openings in waffle- and screen-grid ICF walls shall be located such that no less than one-half of a vertical core occurs along each side of the opening.

**Exception:** Continuous horizontal wall reinforcement placed within 12 (305 mm) inches of the top of the wall story as required in Sections 3.0 and 4.0 is permitted to be used in lieu of top or bottom lintel reinforcement provided that the continuous horizontal wall reinforcement meets the location requirements specified in Figures 5.3, 5.4, and 5.5 and the size requirements specified in Tables 5.7 through 5.14.

All opening reinforcement placed horizontally above or below an opening shall extend a minimum of 24 inches (610 mm) beyond the limits of the opening. Where 24 inches (610 mm) cannot be obtained beyond the limit of the opening, the bar shall be bent 90 degrees in order to obtain a minimum 12-inch (305-mm) embedment.

**5.3 Lintels**

**5.3.1 Load-Bearing ICF Wall Lintels**

Lintels shall be provided in load-bearing walls over all openings greater than or equal to 2 feet (0.6 m) in width. Lintels without stirrup reinforcement shall be permitted for flat or waffle-grid ICF construction in load-bearing walls in accordance with Table 5.7. Lintels with stirrups for flat ICF walls shall be constructed in accordance with Figure 5.3 and Tables 5.8A and 5.8B. Lintels with stirrups for waffle-grid ICF walls shall be constructed in accordance with Figure 5.4 and Tables 5.9A and 5.9B. Lintels for screen-grid ICF walls shall be constructed in accordance with Figure 5.5 and Tables 5.10A and 5.10B. Lintel construction in accordance with Figure 5.3 and Tables 5.8A and 5.8B shall be permitted to be used with waffle-grid and screen-grid ICF wall construction. Lintels spanning between 12 feet – 3 inches (3.7 m) to 16 feet – 3 inches (5.0 m) shall be constructed in accordance with Table 5.11.

When required, No. 3 stirrups shall be installed in lintels at a maximum spacing of  $d/2$  where  $d$  equals the depth of the lintel,  $D$ , less the bottom cover of the concrete as shown in Figures 5.3, 5.4, and 5.5. For flat and waffle-grid lintels, stirrups shall not be required in the middle portion of the span,  $A$ , in accordance with Figure 5.2 and Tables 5.12 and 5.13.

**5.3.2 ICF Lintels Without Stirrups in Non Load-Bearing Walls**

Lintels shall be provided in non-load bearing walls over all openings greater than or equal to 2 feet (0.6 m) in length in accordance with Table 5.14. Stirrups shall not be required for lintels in gable end walls with spans less than or equal to those listed in Table 5.14.

**TABLE 5.1  
WIND VELOCITY PRESSURE FOR DETERMINATION OF MINIMUM  
SOLID WALL LENGTH<sup>1</sup>**

<b>WIND SPEED (mph)</b>	<b>VELOCITY PRESSURE (psf)</b>		
	<b>Exposure<sup>2</sup></b>		
	<b>B</b>	<b>C</b>	<b>D</b>
85	14	19	23
90	16	21	25
100	19	26	31
110	23	32	37
120	27	38	44
130	32	44	52
140	37	51	60
150	43	59	69 <sup>3</sup>

For SI: 1 psf = 0.0479 kN/m<sup>2</sup>; 1 mph = 1.6093 km/hr

<sup>1</sup>Table values are based on ASCE 7-98 Figure 6-4 wind velocity pressures for low-rise buildings using a mean roof height of 35 ft (10.7 m).

<sup>2</sup>Exposure Categories are as defined in Section 1.5.

<sup>3</sup>Design is required in accordance with acceptable practice and approved manufacturer guidelines.

**TABLE 5.2A**  
**MINIMUM SOLID END WALL LENGTH**  
**REQUIREMENTS FOR FLAT ICF WALLS**  
**(WIND PERPENDICULAR TO RIDGE)<sup>1,2,3,4,5</sup>**

DESIGN VELOCITY PRESSURE (psf)			20	25	30	35	40	45	50	60	
WALL CATEGORY	BUILDING SIDE WALL LENGTH, L (feet)	ROOF SLOPE	MINIMUM SOLID WALL LENGTH ON BUILDING END WALL (feet)								
One-Story or Top Story of Two-Story	16	≤ 1:12	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
		5:12	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50
		7:12 <sup>4</sup>	4.00	4.25	4.25	4.50	4.75	4.75	4.75	5.00	5.50
		12:12 <sup>4</sup>	4.25	4.50	4.75	5.00	5.25	5.50	5.50	5.75	6.25
	24	≤ 1:12	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.25	4.50
		5:12	4.00	4.00	4.00	4.25	4.25	4.25	4.50	4.50	4.75
		7:12 <sup>4</sup>	4.25	4.50	4.75	5.00	5.25	5.50	5.50	5.75	6.25
		12:12 <sup>4</sup>	4.75	5.00	5.25	5.75	6.00	6.50	6.50	6.75	7.50
	32	≤ 1:12	4.00	4.00	4.00	4.00	4.25	4.25	4.25	4.50	4.75
		5:12	4.00	4.00	4.25	4.50	4.50	4.50	4.75	5.00	5.25
		7:12 <sup>4</sup>	4.50	5.00	5.25	5.50	6.00	6.25	6.25	6.50	7.25
		12:12 <sup>4</sup>	5.00	5.50	6.00	6.50	7.00	7.25	7.25	7.75	8.75
	40	≤ 1:12	4.00	4.00	4.25	4.25	4.50	4.50	4.50	4.75	5.00
		5:12	4.00	4.25	4.50	4.75	4.75	4.75	5.00	5.25	5.50
		7:12 <sup>4</sup>	4.75	5.25	5.75	6.00	6.50	7.00	7.00	7.25	8.00
		12:12 <sup>4</sup>	5.50	6.00	6.50	7.25	7.75	8.25	8.25	8.75	10.00
	50	≤ 1:12	4.00	4.25	4.25	4.50	4.75	4.75	4.75	5.00	5.50
		5:12	4.25	4.50	4.75	5.00	5.25	5.25	5.50	5.75	6.00
		7:12 <sup>4</sup>	5.25	5.75	6.25	6.75	7.25	7.25	7.75	8.25	9.25
		12:12 <sup>4</sup>	6.00	6.75	7.50	8.00	8.75	9.50	9.50	10.25	11.50
	60	≤ 1:12	4.00	4.25	4.50	4.75	5.00	5.00	5.25	5.25	5.75
		5:12	4.50	4.75	5.00	5.25	5.50	5.50	5.75	6.00	6.75
		7:12 <sup>4</sup>	5.50	6.25	6.75	7.50	8.00	8.50	8.50	9.25	10.25
		12:12 <sup>4</sup>	6.50	7.25	8.25	9.00	9.75	10.50	10.50	11.50	13.00

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Table values are based on a 3.5 in (88.9 mm) thick flat wall. For a 5.5 in (139.7 mm) thick flat wall, multiply the table values by 0.9. The adjusted values shall not result in solid wall lengths less than 4 ft.

<sup>3</sup>Table values are based on a maximum unsupported wall height of 10 ft (3.0 m).

<sup>4</sup>Values are based on a 30 feet (9.1 m) building end wall width. For a 45 ft (13.7 m) building end wall and roof pitches greater than 7:12, multiply the table values by 1.2. For a 60 ft (18.3 m) building end wall and roof pitches greater than 7:12, multiply the table values by 1.4.

<sup>5</sup>Linear interpolation shall be permitted.

**PRESCRIPTIVE METHOD FOR INSULATING CONCRETE FORMS  
IN RESIDENTIAL CONSTRUCTION, Second Edition**

**5.0 - ICF Wall Opening Requirements**

**TABLE 5.2B  
MINIMUM SOLID END WALL LENGTH  
REQUIREMENTS FOR FLAT ICF WALLS  
(WIND PERPENDICULAR TO RIDGE)<sup>1,2,3,4,5</sup>**

DESIGN VELOCITY PRESSURE (psf)		20	25	30	35	40	45	50	60	
WALL CATEGORY	BUILDING SIDE WALL LENGTH, L (feet)	ROOF SLOPE	MINIMUM SOLID WALL LENGTH ON BUILDING END WALL (feet)							
First Story of Two-Story	16	≤ 1:12	4.00	4.25	4.50	4.75	5.00	5.25	5.25	5.75
		5:12	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.75
		7:12 <sup>4</sup>	4.50	5.00	5.25	5.75	6.00	6.25	6.75	7.25
		12:12 <sup>4</sup>	5.00	5.25	5.75	6.25	6.50	7.00	7.25	8.25
	24	≤ 1:12	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.75
		5:12	4.75	5.25	5.50	6.00	6.25	6.75	7.00	7.75
		7:12 <sup>4</sup>	5.25	5.75	6.25	6.75	7.00	7.50	8.00	9.00
		12:12 <sup>4</sup>	5.50	6.25	6.75	7.25	8.00	8.50	9.00	10.25
	32	≤ 1:12	4.75	5.00	5.50	5.75	6.25	6.50	6.75	7.50
		5:12	5.25	5.75	6.25	6.75	7.25	7.50	8.00	9.00
		7:12 <sup>4</sup>	5.75	6.50	7.00	7.75	8.25	9.00	9.50	10.75
		12:12 <sup>4</sup>	6.25	7.00	7.75	8.50	9.25	10.00	10.75	12.25
	40	≤ 1:12	5.00	5.50	5.75	6.25	6.75	7.25	7.50	8.50
		5:12	5.50	6.25	6.75	7.25	8.00	8.50	9.00	10.25
		7:12 <sup>4</sup>	6.25	7.00	7.75	8.75	9.50	10.25	11.00	12.50
		12:12 <sup>4</sup>	7.00	8.00	8.75	9.75	10.75	11.50	12.50	14.25
	50	≤ 1:12	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.50
		5:12	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.75
		7:12 <sup>4</sup>	7.00	8.00	9.00	10.00	10.75	11.75	12.75	14.50
		12:12 <sup>4</sup>	7.75	9.00	10.00	11.25	12.25	13.50	14.75	17.00
	60	≤ 1:12	5.75	6.50	7.00	7.50	8.25	8.75	9.50	10.75
		5:12	6.75	7.50	8.25	9.25	10.00	10.75	11.75	13.25
		7:12 <sup>4</sup>	7.75	9.00	10.00	11.00	12.25	13.25	14.50	16.75
		12:12 <sup>4</sup>	8.75	10.00	11.50	12.75	14.00	15.50	16.75	19.50

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Table values are based on a 3.5 in (88.9 mm) thick flat wall. For a 5.5 in (139.7 mm) thick flat wall, multiply the table values by 0.9. The adjusted values shall not result in solid wall lengths less than 4 ft.

<sup>3</sup>Table values are based on a maximum unsupported wall height of 10 ft (3.0 m).

<sup>4</sup>Values are based on a 30 feet (9.1 m) building end wall width. For a 45 ft (13.7 m) building end wall and roof pitches greater than 7:12, multiply the table values by 1.2. For a 60 ft (18.3 m) building end wall and roof pitches greater than 7:12, multiply the table values by 1.4.

<sup>5</sup>Linear interpolation shall be permitted.

**TABLE 5.2C**  
**MINIMUM SOLID SIDE WALL LENGTH**  
**REQUIREMENTS FOR FLAT ICF WALLS**  
**(WIND PARALLEL TO RIDGE)<sup>1,2,3,4,5</sup>**

DESIGN VELOCITY PRESSURE (psf)		20	25	30	35	40	45	50	60
WALL CATEGORY	BUILDING END WALL WIDTH, W (feet)	MINIMUM SOLID WALL LENGTH ON BUILDING SIDE WALL (feet)							
One-Story or Top Story of Two-Story	16	4.00	4.00	4.00	4.00	4.25	4.25	4.50	4.75
	24	4.00	4.25	4.50	4.75	4.75	5.00	5.25	5.50
	32	4.50	4.75	5.00	5.25	5.50	6.00	6.25	6.75
	40	5.00	5.50	5.75	6.25	6.75	7.00	7.50	8.25
	50	5.75	6.25	7.00	7.50	8.25	8.75	9.50	10.75
	60	6.50	7.50	8.25	9.25	10.00	10.75	11.75	13.25
First Story of Two-Story	16	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.50
	24	4.75	5.25	5.50	6.00	6.25	6.75	7.00	8.00
	32	5.50	6.00	6.50	7.00	7.50	8.00	8.75	9.75
	40	6.25	7.00	7.50	8.25	9.00	9.75	10.50	12.00
	50	7.25	8.25	9.25	10.25	11.25	12.25	13.25	15.25
	60	8.50	9.75	11.00	12.25	13.50	15.00	16.25	18.75

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>

<sup>1</sup>Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).

<sup>2</sup>Table values are based on a 3.5 in (88.9 mm) thick flat wall. For a 5.5 in (139.7 mm) thick flat wall, multiply the table values by 0.9. The adjusted values may not result in solid wall lengths less than 4 ft.

<sup>3</sup>Table values are based on a maximum unsupported wall height of 10 ft (3.0 m).

<sup>4</sup>Table values are based on a maximum 12:12 roof pitch.

<sup>5</sup>Linear interpolation shall be permitted.

**TABLE 5.5  
MINIMUM PERCENTAGE OF SOLID WALL LENGTH  
ALONG EXTERIOR WALL LINES FOR SEISMIC DESIGN CATEGORY C AND D<sup>1,2</sup>**

ICF WALL TYPE AND MINIMUM WALL THICKNESS (inches)	MINIMUM SOLID WALL LENGTH (percent)		
	ONE-STORY OR TOP STORY OF TWO-STORY	WALL SUPPORTING LIGHT FRAME SECOND STORY AND ROOF	WALL SUPPORTING ICF SECOND STORY AND ROOF
Seismic Design Category C <sup>3</sup>	20 percent	25 percent	35 percent
Seismic Design Category D <sub>1</sub> <sup>4</sup>	25 percent	30 percent	40 percent
Seismic Design Category D <sub>2</sub> <sup>4</sup>	30 percent	35 percent	45 percent

For SI: 1 inch = 25.4 mm; 1 mph = 1.6093 km/hr

<sup>1</sup>Base percentages are applicable for maximum unsupported wall height of 10-feet (3.0-m), light-frame gable construction, all ICF wall types in Seismic Design Category C, and all ICF wall types with a nominal thickness greater than 5.5 inches (140 mm) for Seismic Design Category D<sub>1</sub> and D<sub>2</sub>.

<sup>2</sup>For all walls, the minimum required length of solid walls shall be based on the table percent value multiplied by the minimum dimension of a rectangle inscribing the overall building plan.

<sup>3</sup>Walls shall be reinforced with minimum No. 5 rebar (grade 40 or 60) spaced a maximum of 24 inches (609.6 mm) on center each way or No. 4 rebar (Grade 40 or 60) spaced at a maximum of 16 inches (406.4 mm) on center each way.

<sup>4</sup>Walls shall be constructed with a minimum concrete compressive strength of 3,000 psi (20.7 MPa) and reinforced with minimum #5 rebar (Grade 60, ASTM A706) spaced a maximum of 18 inches (457.2 mm) on center each way or No. 4 rebar (Grade 60 ASTM A706) spaced at a maximum of 12 inches (304.8 mm) on center each way.

**TABLE 5.6  
MINIMUM WALL OPENING REINFORCEMENT  
REQUIREMENTS IN ICF WALLS**

WALL TYPE AND OPENING WIDTH, L feet (m)	MINIMUM HORIZONTAL OPENING REINFORCEMENT	MINIMUM VERTICAL OPENING REINFORCEMENT
Flat, Waffle-, and Screen-Grid: L < 2 (0.61)	None Required	None Required
Flat, Waffle-, and Screen-Grid: L ≥ 2 (0.61)	Provide lintels in accordance with Section 5.3. Top and bottom lintel reinforcement shall extend a minimum of 24 inches (610 mm) beyond the limits of the opening.  Provide one No. 4 bar within of 12 inches (305 mm) from the bottom of the opening. Each No. 4 bar shall extend 24 inches (610 mm) beyond the limits of the opening.	In locations with wind speeds less than or equal to 110 mph (177 km/hr) or in Seismic Design Categories A and B, provide one No. 4 bar for the full height of the wall story within 12 inches (305 mm) of each side of the opening.  In locations with wind speeds greater than 110 mph (177 km/hr) or in Seismic Design Categories C, D <sub>1</sub> and D <sub>2</sub> , provide two No. 4 bars or one No. 5 bar for the full height of the wall story within 12 inches (305 mm) of each side of the opening.

**TABLE 5.7**  
**MAXIMUM ALLOWABLE CLEAR SPANS FOR**  
**ICF LINTELS WITHOUT STIRRUPS IN LOAD-BEARING WALLS<sup>1,2,3,4,5,6,7</sup>**  
**(NO. 4 OR NO. 5 BOTTOM BAR SIZE)**

MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN (feet – inches)					
		SUPPORTING LIGHT-FRAME ROOF ONLY		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF <sup>8</sup>	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
<b>Flat ICF Lintel</b>							
3.5	8	2-6	2-6	2-6	2-4	2-5	2-2
	12	4-2	4-2	4-1	3-10	3-10	3-7
	16	4-11	4-8	4-6	4-2	4-2	3-10
	20	6-3	5-3	4-11	4-6	4-6	4-3
	24	7-7	6-4	6-0	5-6	5-6	5-2
5.5	8	2-10	2-6	2-6	2-5	2-6	2-2
	12	4-8	4-4	4-3	3-11	3-10	3-7
	16	6-5	5-1	4-8	4-2	4-3	3-10
	20	8-2	6-6	6-0	5-4	5-5	5-0
	24	9-8	7-11	7-4	6-6	6-7	6-1
7.5	8	3-6	2-8	2-7	2-5	2-5	2-2
	12	5-9	4-5	4-4	4-0	3-10	3-7
	16	7-9	6-1	5-7	4-10	4-11	4-5
	20	8-8	7-2	6-8	5-11	6-0	5-5
	24	9-6	7-11	7-4	6-6	6-7	6-0
9.5	8	4-2	3-1	2-9	2-5	2-5	2-2
	12	6-7	5-1	4-7	3-11	4-0	3-7
	16	7-10	6-4	5-11	5-3	5-4	4-10
	20	8-7	7-2	6-8	5-11	6-0	5-5
	24	9-4	7-10	7-3	6-6	6-7	6-0
<b>Waffle-Grid ICF Lintel</b>							
6 or 8	8	2-6	2-6	2-6	2-4	2-4	2-2
	12	4-2	4-2	4-1	3-8	3-9	3-5
	16	5-9	5-8	5-7	5-1	5-2	4-8
	20	7-6	7-4	6-9	6-0	6-3	5-7
	24	9-2	8-1	7-6	6-7	6-10	6-2

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>; 1 ft = 0.3 m

<sup>1</sup>Table values are based on tensile reinforcement with a minimum yield strength of 40,000 psi (276 MPa), concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa), and a building width (floor and roof clear span) of 32 feet (9.8m).

<sup>2</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>3</sup>Linear interpolation shall be permitted between ground snow loads and between lintel depths.

<sup>4</sup>Lintel depth,  $D$ , shall be permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the opening.

<sup>5</sup>Spans located in shaded cells shall be permitted to be multiplied by 1.05 when concrete with a minimum compressive strength of 3,000 psi (20.7 MPa) is used or by 1.1 when concrete with a minimum compressive strength of 4,000 psi (27.6 MPa) is used.

<sup>6</sup>Spans shall be permitted to be multiplied by 1.05 for a building width (floor and roof clear span) of 28 feet (8.5 m).

<sup>7</sup>Spans shall be permitted to be multiplied by 1.1 for a building width (floor and roof clear span) of 24 feet (7.3 m) or less.

<sup>8</sup>Supported ICF wall dead load varies based on wall thickness using 150 pcf (2403 kg/m<sup>3</sup>) concrete density.

**TABLE 5.8A  
MAXIMUM ALLOWABLE CLEAR SPANS FOR  
FLAT ICF LINTELS WITH STIRRUPS IN LOAD-BEARING WALLS<sup>1,2,3,4,5,6,7</sup>  
(NO. 4 BOTTOM BAR SIZE)**

MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN (feet – inches)					
		SUPPORTING LIGHT-FRAME ROOF ONLY		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF <sup>8</sup>	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
3.5	8	4-9	4-2	3-10	3-4	3-5	3-1
	12	6-8	5-5	5-0	4-5	4-6	4-0
	16	7-11	6-5	6-0	5-3	5-4	4-10
	20	8-11	7-4	6-9	6-0	6-1	5-6
	24	9-10	8-1	7-6	6-7	6-9	6-1
5.5	8	5-2	4-2	3-10	3-5	3-5	3-1
	12	6-8	5-5	5-0	4-5	4-6	4-1
	16	7-10	6-5	6-0	5-3	5-4	4-10
	20	8-10	7-3	6-9	6-0	6-1	5-6
	24	9-8	8-0	7-5	6-7	6-8	6-0
7.5	8	5-2	4-2	3-11	3-5	3-6	3-2
	12	6-7	5-5	5-0	4-5	4-6	4-1
	16	7-9	6-5	5-11	5-3	5-4	4-10
	20	8-8	7-2	6-8	5-11	6-0	5-5
	24	9-6	7-11	7-4	6-6	6-7	6-0
9.5	8	5-2	4-2	3-11	3-5	3-6	3-2
	12	6-7	5-5	5-0	4-5	4-6	4-1
	16	7-8	6-4	5-11	5-3	5-4	4-10
	20	8-7	7-2	6-8	5-11	6-0	5-5
	24	9-4	7-10	7-3	6-6	6-7	6-0

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>; 1 ft = 0.3 m

<sup>1</sup>Table values are based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa), reinforcing steel with a minimum yield strength of 40,000 psi (276 MPa), and a building width (floor and roof clear span) of 32 feet (9.8m).

<sup>2</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>3</sup>Linear interpolation is permitted between ground snow loads and between lintel depths.

<sup>4</sup>Lintel depth,  $D$ , is permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

<sup>5</sup>Spans located in shaded cells shall be permitted to be multiplied by 1.2 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used.

<sup>6</sup>Spans shall be permitted to be multiplied by 1.05 for a building width (floor and roof clear span) of 28 feet (8.5 m).

<sup>7</sup>Spans shall be permitted to be multiplied by 1.1 for a building width (floor and roof clear span) of 24 feet or less (7.3 m).

<sup>8</sup>Supported ICF wall dead load is 69 psf (3.3 kPa).

**TABLE 5.8B**  
**MAXIMUM ALLOWABLE CLEAR SPANS FOR**  
**FLAT ICF LINTELS WITH STIRRUPS IN LOAD-BEARING WALLS<sup>1,2,3,4,5,6,7</sup>**  
**(NO. 5 BOTTOM BAR SIZE)**

MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN (feet – inches)					
		SUPPORTING LIGHT-FRAME ROOF ONLY		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF <sup>8</sup>	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
3.5	8	4-9	4-2	3-11	3-7	3-7	3-5
	12	7-2	6-3	5-11	5-5	5-5	5-0
	16	9-6	8-0	7-4	6-6	6-7	5-11
	20	11-1	9-1	8-4	7-5	7-6	6-9
	24	12-2	10-0	9-3	8-2	8-4	7-6
5.5	8	5-6	4-10	4-7	4-2	4-2	3-10
	12	8-3	6-9	6-3	5-6	5-7	5-0
	16	9-9	8-0	7-5	6-6	6-7	6-0
	20	10-11	9-0	8-4	7-5	7-6	6-9
	24	12-0	9-11	9-3	8-2	8-3	7-6
7.5	8	6-1	5-2	4-9	4-3	4-3	3-10
	12	8-2	6-9	6-3	5-6	5-7	5-0
	16	9-7	7-11	7-4	6-6	6-7	6-0
	20	10-10	8-11	8-4	7-4	7-6	6-9
	24	11-10	9-10	9-2	8-1	8-3	7-5
9.5	8	6-4	5-2	4-10	4-3	4-4	3-11
	12	8-2	6-8	6-2	5-6	5-7	5-0
	16	9-6	7-11	7-4	6-6	6-7	5-11
	20	10-8	8-10	8-3	7-4	7-5	6-9
	24	11-7	9-9	9-0	8-1	8-2	7-5

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>; 1 ft = 0.3 m

<sup>1</sup>Table values are based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa), reinforcing steel with a minimum yield strength of 40,000 psi (276 MPa), and a building width (floor and roof clear span) of 32 feet (9.8m).

<sup>2</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>3</sup>Linear interpolation is permitted between ground snow loads and between lintel depths.

<sup>4</sup>Lintel depth,  $D$ , is permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

<sup>5</sup>Spans located in shaded cells shall be permitted to be multiplied by 1.2 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used.

<sup>6</sup>Spans shall be permitted to be multiplied by 1.05 for a building width (floor and roof clear span) of 28 feet (8.5 m).

<sup>7</sup>Spans shall be permitted to be multiplied by 1.1 for a building width (floor and roof clear span) of 24 feet (7.3 m) or less.

<sup>8</sup>Supported ICF wall dead load is 69 psf (3.3 kPa).

**TABLE 5.11**  
**MINIMUM BOTTOM BAR ICF LINTEL REINFORCEMENT FOR**  
**LARGE CLEAR SPANS WITH STIRRUPS IN LOAD-BEARING WALLS<sup>1,2,3,4,5</sup>**

MINIMUM LINTEL THICKNESS, T <sup>6</sup> (inches)	MINIMUM LINTEL DEPTH, D (inches)	MINIMUM BOTTOM LINTEL REINFORCEMENT (quantity – size)					
		SUPPORTING LIGHT-FRAME ROOF ONLY		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF <sup>7</sup>	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
<b>Flat ICF Lintel, 12 feet – 3 inches Maximum Clear Span</b>							
3.5	24	1-#5	D/R	D/R	D/R	D/R	D/R
5.5	20	1-#6; 2-#4	2-#5	D/R	D/R	D/R	D/R
	24	1-#5	2-#5	2-#5	2-#6	2-#6	D/R
7.5	16	2-#5	D/R	D/R	D/R	D/R	D/R
	20	1-#6; 2-#4	2-#5	2-#6	D/R	D/R	D/R
	24	1-#6; 2-#4	2-#5	2-#5	2-#6	2-#6	2-#6
9.5	16	2-#5	D/R	D/R	D/R	D/R	D/R
	20	1-#6; 2-#4	2-#5	2-#6	2-#6	2-#6	2-#6
	24	1-#6; 2-#4	2-#5	2-#5	2-#6	2-#6	2-#6
<b>Flat ICF Lintel, 16 feet – 3 inches Maximum Clear Span</b>							
5.5	24	2-#5	D/R	D/R	D/R	D/R	D/R
7.5	24	2-#5	D/R	D/R	D/R	D/R	D/R
9.5	24	2-#5	2-#6	2-#6	D/R	D/R	D/R
<b>Waffle-Grid ICF Lintel, 12 feet – 3 inches Maximum Clear Span</b>							
6	20	1-#6; 2-#4	D/R	D/R	D/R	D/R	D/R
	24	1-#5	2-#5	2-#5	2-#6	2-#6	D/R
8	16	2-#5	D/R	D/R	D/R	D/R	D/R
	20	1-#6; 2-#4	2-#5	2-#6	D/R	D/R	D/R
	24	1-#5	2-#5	2-#5	2-#6	2-#6	2-#6
<b>Screen-Grid ICF Lintel, 12 feet – 3 inches Maximum Clear Span</b>							
6	24	1-#5	D/R	D/R	D/R	D/R	D/R

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>; 1 ft = 0.3 m

<sup>1</sup>Table values are based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa), reinforcing steel with a minimum yield strength of 40,000 psi (276 MPa), and a building width (floor and roof clear span) of 32 feet (9.8m).

<sup>2</sup>D/R indicates design is required.

<sup>3</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>4</sup>Linear interpolation is permitted between ground snow loads and between lintel depths. Lintel depth,  $D$ , is permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

<sup>5</sup>The required reinforcement(s) in the shaded cells shall be permitted to be reduced to the next smallest bar diameter when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used.

<sup>6</sup>Actual thickness is shown for flat lintels while nominal thickness is given for waffle-grid and screen-grid lintels. Refer to Section 2.0 for actual wall thickness of waffle-grid and screen-grid ICF construction.

<sup>7</sup>Supported ICF wall dead load varies based on wall thickness using 150 pcf (2403 kg/m<sup>3</sup>) concrete density.

**TABLE 5.12**  
**MIDDLE PORTION OF SPAN, *A*, WHERE STIRRUPS ARE NOT REQUIRED FOR**  
**FLAT ICF LINTELS<sup>1,2,3,4,5,6,7</sup>**  
**(NO. 4 or NO. 5 BOTTOM BAR SIZE)**

MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MIDDLE SPAN NOT REQUIRING STIRRUPS (feet – inches)					
		SUPPORTING LIGHT-FRAME ROOF ONLY		SUPPORTING LIGHT-FRAME SECOND STORY AND ROOF		SUPPORTING ICF SECOND STORY AND LIGHT-FRAME ROOF	
		MAXIMUM GROUND SNOW LOAD (psf)					
		30	70	30	70	30	70
3.5	8	1-2	0-9	0-8	0-6	0-6	0-5
	12	1-11	1-3	1-1	0-10	0-10	0-8
	16	2-7	1-9	1-6	1-2	1-2	1-0
	20	3-3	2-3	1-11	1-6	1-6	1-3
	24	3-11	2-8	2-4	1-10	1-10	1-6
5.5	8	1-10	1-2	1-0	0-9	0-10	0-8
	12	3-0	2-0	1-8	1-4	1-4	1-1
	16	4-1	2-9	2-4	1-10	1-11	1-6
	20	5-3	3-6	3-0	2-4	2-5	2-0
	24	6-3	4-3	3-8	2-10	2-11	2-5
7.5	8	2-6	1-8	1-5	1-1	1-1	0-11
	12	4-1	2-9	2-4	1-10	1-10	1-6
	16	5-7	3-9	3-3	2-6	2-7	2-1
	20	7-1	4-10	4-1	3-3	3-4	2-9
	24	8-6	5-9	5-0	3-11	4-0	3-3
9.5	8	3-2	2-1	1-9	1-4	1-5	1-2
	12	5-2	3-5	2-11	2-3	2-4	1-11
	16	7-1	4-9	4-1	3-2	3-3	2-8
	20	9-0	6-1	5-3	4-1	4-2	3-5
	24	10-9	7-4	6-4	4-11	5-1	4-2

For SI: 1 inch = 25.4 mm; 1 psf = 0.0479 kN/m<sup>2</sup>; 1 ft = 0.3 m

<sup>1</sup>This table is applicable to Tables 5.8A and 5.8B. The values are based on concrete with a minimum specified compressive strength of 2,500

psi (17.2 MPa), reinforcing steel with a minimum yield strength of 40,000 psi (276 MPa), and a building width (floor and roof clear span) of 32 feet (9.8m).

<sup>2</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>3</sup>Linear interpolation is permitted between ground snow loads and between lintel depths. Lintel depth,  $D$ , is permitted to include the available height of ICF wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

<sup>4</sup>The middle portion of the span,  $A$ , shall be permitted to be multiplied by 1.09 when concrete with a minimum compressive strength of 3,000 psi (20.7 MPa) is used.

<sup>5</sup>The middle portion of the span,  $A$ , shall be permitted to be multiplied by 1.26 when concrete with a minimum compressive strength of 4,000 psi (27.6 MPa) is used.

<sup>6</sup>The middle portion of the span,  $A$ , shall be permitted to be multiplied by 1.1 for a building width (floor and roof clear span) of 28 feet (8.5 m).

<sup>7</sup>The middle portion of the span,  $A$ , shall be permitted to be multiplied by 1.2 for a building width (floor and roof clear span) of 24 feet (7.3 m).

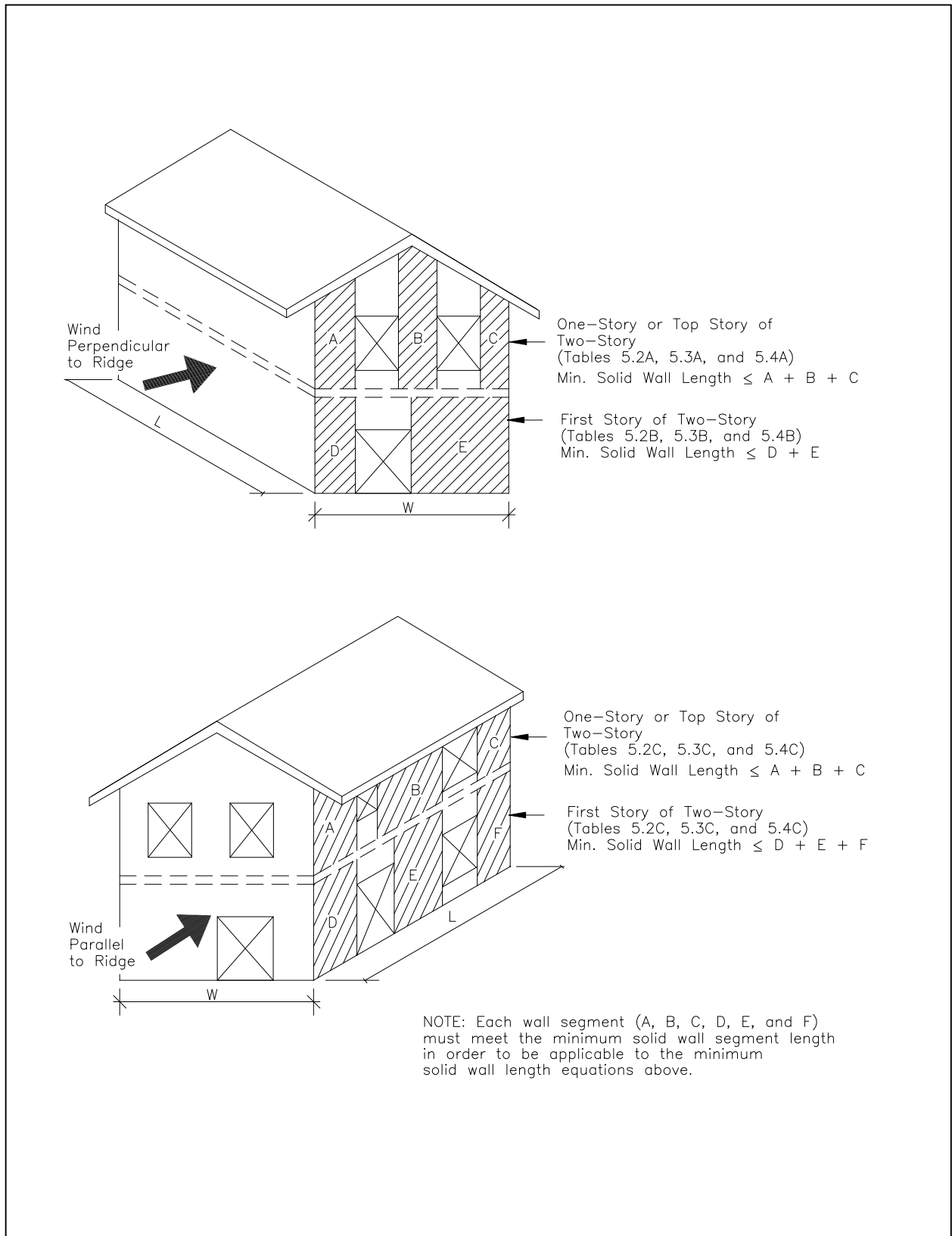
**TABLE 5.14  
MAXIMUM ALLOWABLE CLEAR SPANS FOR  
ICF LINTELS IN GABLE END (NON-LOAD-BEARING) WALLS WITHOUT STIRRUPS<sup>1,2</sup>  
(NO. 4 BOTTOM BAR SIZE)**

MINIMUM LINTEL THICKNESS, T (inches)	MINIMUM LINTEL DEPTH, D (inches)	MAXIMUM CLEAR SPAN	
		SUPPORTING LIGHT-FRAME GABLE END WALL (feet-inches)	SUPPORTING ICF SECOND STORY AND GABLE END WALL (feet-inches)
<b>Flat ICF Lintel</b>			
3.5	8	11-1	3-1
	12	15-11	5-1
	16	16-3	6-11
	20	16-3	8-8
	22	16-3	10-5
5.5	8	16-3	4-4
	12	16-3	7-0
	16	16-3	9-7
	20	16-3	12-0
	22	16-3	14-3
7.5	8	16-3	5-6
	12	16-3	8-11
	16	16-3	12-2
	20	16-3	15-3
	22	16-3	16-3
9.5	8	16-3	6-9
	12	16-3	10-11
	16	16-3	14-10
	20	16-3	16-3
	22	16-3	16-3
<b>Waffle-Grid ICF Lintel</b>			
6 or 8	8	9-1	2-11
	12	13-4	4-10
	16	16-3	6-7
	20	16-3	8-4
	22	16-3	9-11
<b>Screen-Grid Lintel</b>			
6	12	5-8	4-1
	24	16-3	9-1

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 psf = 47.8804 Pa

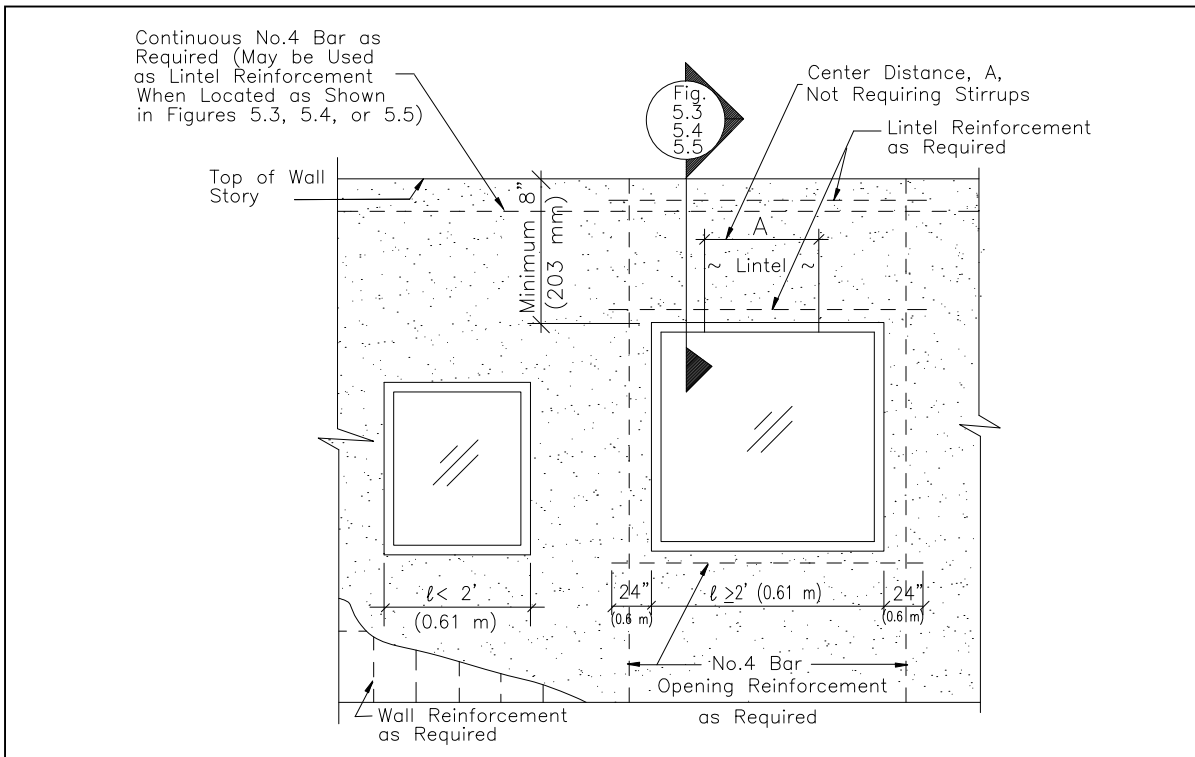
<sup>1</sup>Deflection criterion is  $L/240$ , where  $L$  is the clear span of the lintel in inches.

<sup>2</sup>Linear interpolation is permitted between lintel depths.

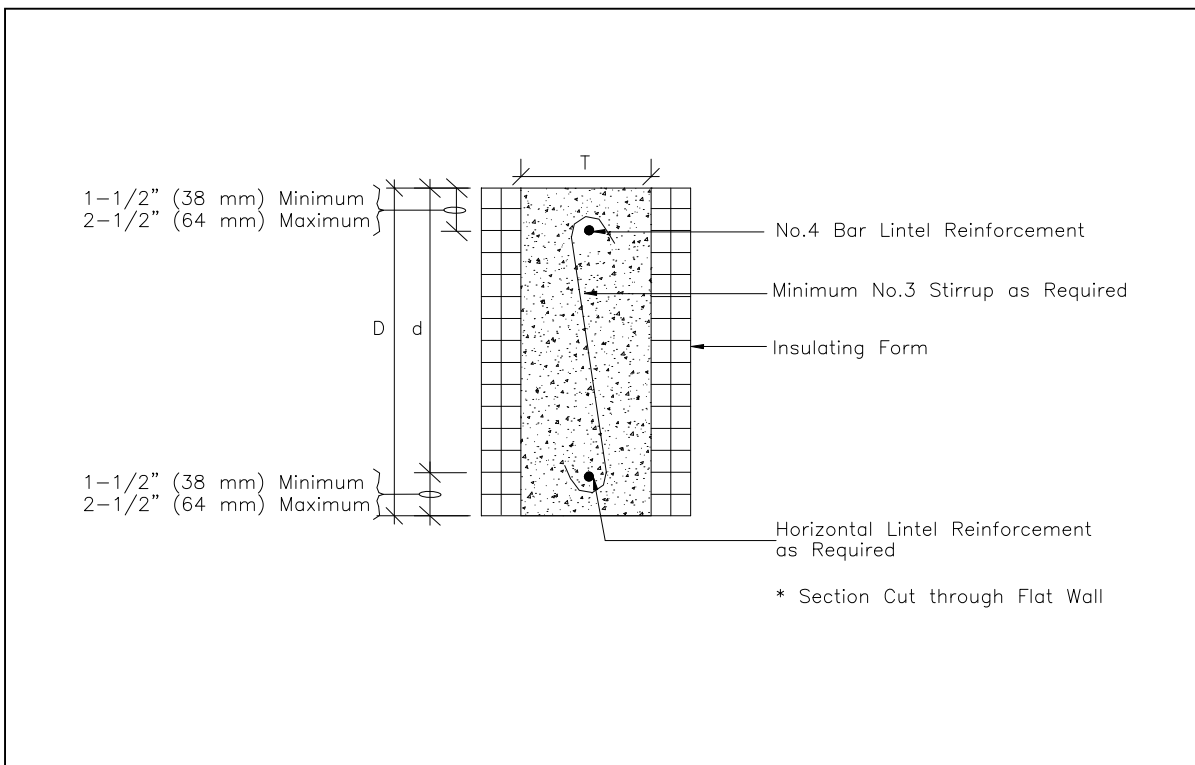


**Figure 5.1 Variables for Use with Tables 5.2 through 5.4**

**5.0 - ICF Wall Opening Requirements**



**Figure 5.2 Reinforcement of Openings**



**Figure 5.3 Flat ICF Lintel Construction**

## 6.0 ICF Connection Requirements

All ICF walls shall be connected to footings, floors, and roofs in accordance with this section. Requirements for installation of brick veneer and other finishes on exterior ICF walls and other construction details not covered in this section shall comply with the manufacturer's approved recommendations, applicable building code requirements, and accepted practice.

### 6.1 ICF Foundation Wall-to-Footing Connection

No vertical reinforcement (i.e., dowels) across the joint between the foundation wall and the footing is required when one of the following exists:

- The unbalanced backfill height does not exceed 4 feet (1.2 m).
- The interior floor slab is installed in accordance with Figure 3.3 before backfilling.
- Temporary bracing at the bottom of the foundation wall is erected before backfilling and remains in place during construction until an interior floor slab is installed in accordance with Figure 3.3 or the wall is backfilled on both sides (i.e., stem wall).

For foundation walls that do not meet one of the above requirements, vertical reinforcement (i.e., dowel) shall be installed across the joint between the foundation wall and the footing at 48 inches (1.2 m) on center in accordance with Figure 6.1. Vertical reinforcement (i.e., dowels) shall be provided for all foundation walls for buildings located in regions with 3-second gust design wind speeds greater than 130 mph (209 km/hr) or located in Seismic Design Categories D<sub>1</sub> and D<sub>2</sub> at 18 inches (457 mm) on center.

**Exception:** The foundation wall's vertical wall reinforcement, at intervals of 4 feet (1.2 m) on center, shall extend 8 inches (203 mm) into the footing in lieu of using a dowel as shown in Figure 6.1.

### 6.2 ICF Wall-to-Floor Connection

#### 6.2.1 Floor on ICF Wall Connection (Top-Bearing Connection)

Floors bearing on ICF walls shall be constructed in accordance with Figure 6.2 or 6.3. The wood sill plate or floor system shall be anchored to the ICF wall with 1/2-inch- (13-mm-) diameter bolts placed at a maximum spacing of 6 feet (1.8 m) on center and not more than 12 inches (305 mm) from joints in the sill plate.

A maximum anchor bolt spacing of 4 feet (1.2 m) on center shall be required when the 3-second gust design wind speed is 110 mph (177 km/hr) or greater. Anchor bolts shall extend a minimum of 7 inches (178 mm) into the concrete and a minimum of 2 inches beyond horizontal reinforcement in the top of the wall. Also, additional anchorage mechanisms shall be installed connecting each joist to the sill plate. Light-frame construction shall be in accordance with the applicable building code.

In Seismic Design Category C, wood sill plates attached to ICF walls shall be anchored with Grade A 307, 3/8-inch (9.5 mm) diameter anchor bolts embedded a minimum of 7 inches (178 mm) and placed at a maximum spacing of 36 inches (914 mm) on center. In Seismic Design Category D<sub>1</sub>, wood sill plates attached to ICF walls shall be anchored with Grade A 307, 3/8-inch (9.5 mm) diameter anchor bolts embedded a minimum of 7 inches (178 mm) and placed at a maximum spacing of 24 inches (610 mm) on center. In Seismic Design Category D<sub>2</sub>, wood sill plates attached to ICF walls shall be anchored with Grade A 307, 3/8-inch (9.5 mm) diameter anchor bolts embedded a minimum of 7 inches (178 mm) and placed at a maximum spacing of 16 inches (406 mm) on center. The minimum edge distance from the edge of concrete to edge of anchor bolt shall be 2.5 inches (63.5 mm).

In Seismic Design Category C, each floor joist shall be attached to the sill plate with an 18-gauge angle bracket using 3 – 8d common nails per leg. In Seismic Design Category D<sub>1</sub>, each floor joist shall be attached to the sill plate with an 18-gauge angle bracket using 4 – 8d common nails per leg. In Seismic Design Category D<sub>2</sub>, each floor joist shall be attached to the sill plate with an 18-gauge angle bracket using 6 – 8d common nails per leg.

#### 6.2.2 Floor Ledger-ICF Wall Connection (Side-Bearing Connection)

Wood ledger boards shall be anchored to flat ICF walls having a minimum thickness of 5.5 inches (140 mm) thickness and to waffle- or screen-grid ICF walls having a minimum nominal thickness of 6 inches (152 mm) in accordance with Figure 6.4 or 6.5 and Table 6.1. Wood ledger boards shall be anchored to flat ICF walls having a minimum thickness of 3.5 inches (89 mm) in accordance with Figure 6.6 or 6.7 and Table 6.1. Minimum wall thickness shall be 5.5 inches (140 mm) in Seismic Design Category C, D<sub>1</sub>, and D<sub>2</sub>.

Additional anchorage mechanisms shall be installed at a maximum spacing of 6 feet (1.8 m) on center for Seismic Design Category C and 4 feet (1.2 m) on center for Seismic Design Categories D<sub>1</sub> and D<sub>2</sub>. The additional anchorage mechanisms shall be attached to the ICF wall reinforcement and joist, rafters, or blocking in accordance with Figures 6.4 through 6.7. The blocking shall be attached to floor or roof sheathing in accordance with sheathing panel edge fastener spacing. Such additional anchorage shall not be accomplished by the use of toe nails or nails subject to withdrawal nor shall such anchorage mechanisms induce tension stresses perpendicular to grain in ledgers or nailers. The capacity of such anchors shall result in connections capable of resisting the design values listed in Table 6.2. The diaphragm sheathing fasteners applied directly to a ledger shall not be considered effective in providing the additional anchorage required by this section.

#### 6.2.3 Floor and Roof diaphragm Construction in Seismic Design Categories D<sub>1</sub> and D<sub>2</sub>.

Edge spacing of fasteners in floor and roof sheathing shall be 4 inches (102 mm) on center for Seismic Design Category D<sub>1</sub> and 3 inches (76 mm) on center for Seismic Design Category D<sub>2</sub>. In Seismic Design Categories D<sub>1</sub> and D<sub>2</sub>, all sheathing edges shall be attached to framing or blocking. Minimum sheathing fastener size shall be 0.113 inch (2.8 mm) diameter with a minimum penetration of 1-3/8 inches (35 mm) into framing members supporting the sheathing. Minimum wood structural panel thickness shall be 7/16 inch (11 mm) for roof sheathing and 23/32 inch (18 mm) for floor sheathing.

### **6.3 ICF Wall-to-Roof Connection**

Wood sill plates attaching roof framing to ICF walls shall be anchored to the ICF wall in accordance with Table 6.3 and Figure 6.8. Anchor bolts shall be located in the middle one-third of the flat ICF wall thickness or the middle one-third of the vertical core thickness of the waffle-grid and screen-grid ICF wall system and shall have a minimum embedment of 7 inches (178 mm). Roof framing attachment to wood sill plates shall be in accordance with the applicable building code.

In conditions where the 3-second gust design wind speed is 110 mph (177 km/hr) or greater, an approved uplift connector (i.e., strap or bracket) shall be used to attach roof assemblies to wood sill plates in accordance with the applicable building code. Embedment of strap connectors shall be in accordance with the strap connector manufacturer's approved recommendations.

In Seismic Design Category C, wood sill plates attaching roof framing to ICF walls shall be anchored with a Grade A 307, 3/8 inch (9.5 mm) diameter anchor bolt embedded a minimum of 7 inches (178 mm) and placed at a maximum spacing of 36 inches (914 mm) on center. Wood sill plates attaching roof framing to ICF walls shall be anchored with a minimum Grade A 307, 3/8 inch (9.5 mm) diameter anchor bolt embedded a minimum of 7 inches (178 mm) and placed at maximum spacing of 24 inches (609 mm) on center for Seismic Design Category D<sub>1</sub> and a maximum spacing of 16 inches (406 mm) on center for Seismic Design Category D<sub>2</sub>. The minimum edge distance from the edge of concrete to edge of anchor bolt shall be 2.5 inches (63.5 mm).

In Seismic Design Category C, each rafter or truss shall be attached to the sill plate with an 18-gauge angle bracket using 3 – 8d common nails per leg. For all buildings in Seismic Design Category D<sub>1</sub>, each rafter or truss shall be attached to the sill plate with an 18-gauge angle bracket using 4 – 8d common nails per leg. For all buildings in Seismic Design Category D<sub>2</sub>, each rafter or truss shall be attached to the sill plate with an 18-gauge angle bracket using 6 – 8d common nails per leg.

**TABLE 6.1  
FLOOR LEDGER-ICF WALL CONNECTION (SIDE-BEARING CONNECTION)  
REQUIREMENTS<sup>1,2,3</sup>**

MAXIMUM FLOOR CLEAR SPAN <sup>4</sup> (feet)	MAXIMUM ANCHOR BOLT SPACING <sup>5</sup> (inches)			
	STAGGERED 1/2-INCH- DIAMETER ANCHOR BOLTS	STAGGERED 5/8-INCH- DIAMETER ANCHOR BOLTS	TWO 1/2-INCH- DIAMETER ANCHOR BOLTS <sup>6</sup>	TWO 5/8-INCH- DIAMETER ANCHOR BOLTS <sup>6</sup>
8	18	20	36	40
10	16	18	32	36
12	14	18	28	36
14	12	16	24	32
16	10	14	20	28
18	9	13	18	26
20	8	11	16	22
22	7	10	14	20
24	7	9	14	18
26	6	9	12	18
28	6	8	12	16
30	5	8	10	16
32	5	7	10	14

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm

<sup>1</sup>Minimum ledger board nominal depth shall be 8 inches (203 mm). The actual thickness of the ledger board shall be a minimum of 1.5 inches (38 mm). Ledger board shall be minimum No. 2 Grade.

<sup>2</sup>Minimum edge distance shall be 2 inches (51 mm) for 1/2-inch- (13-mm-) diameter anchor bolts and 2.5 inches (64 mm) for 5/8-inch- (16-mm-) diameter anchor bolts.

<sup>3</sup>Interpolation is permitted between floor spans.

<sup>4</sup>Floor span corresponds to the clear span of the floor structure (i.e., joists or trusses) spanning between load-bearing walls or beams.

<sup>5</sup>Anchor bolts shall extend through the ledger to the center of the flat ICF wall thickness or the center of the horizontal or vertical core thickness of the waffle-grid or screen-grid ICF wall system.

<sup>6</sup>Minimum vertical clear distance between bolts shall be 1.5 inches (38 mm) for 1/2-inch- (13-mm-) diameter anchor bolts and 2 inches (51 mm) for 5/8-inch- (16-mm-) diameter anchor bolts.

**TABLE 6.2**  
**MINIMUM DESIGN VALUES (plf) FOR FLOOR JOIST-TO-WALL ANCHORS REQUIRED IN**  
**SEISMIC DESIGN CATEGORIES C, D<sub>1</sub>, AND D<sub>2</sub>**

WALL TYPE	SEISMIC DESIGN CATEGORY		
	C	D <sub>1</sub>	D <sub>2</sub>
Flat 3.5	193	320	450
Flat 5.5	303	502	708
Flat 7.5	413	685	965
Flat 9.5	523	867	1,223
Waffle 6	246	409	577
Waffle 8	334	555	782
Screen 6	233	387	546

For SI: 1plf = 14.59 N/m

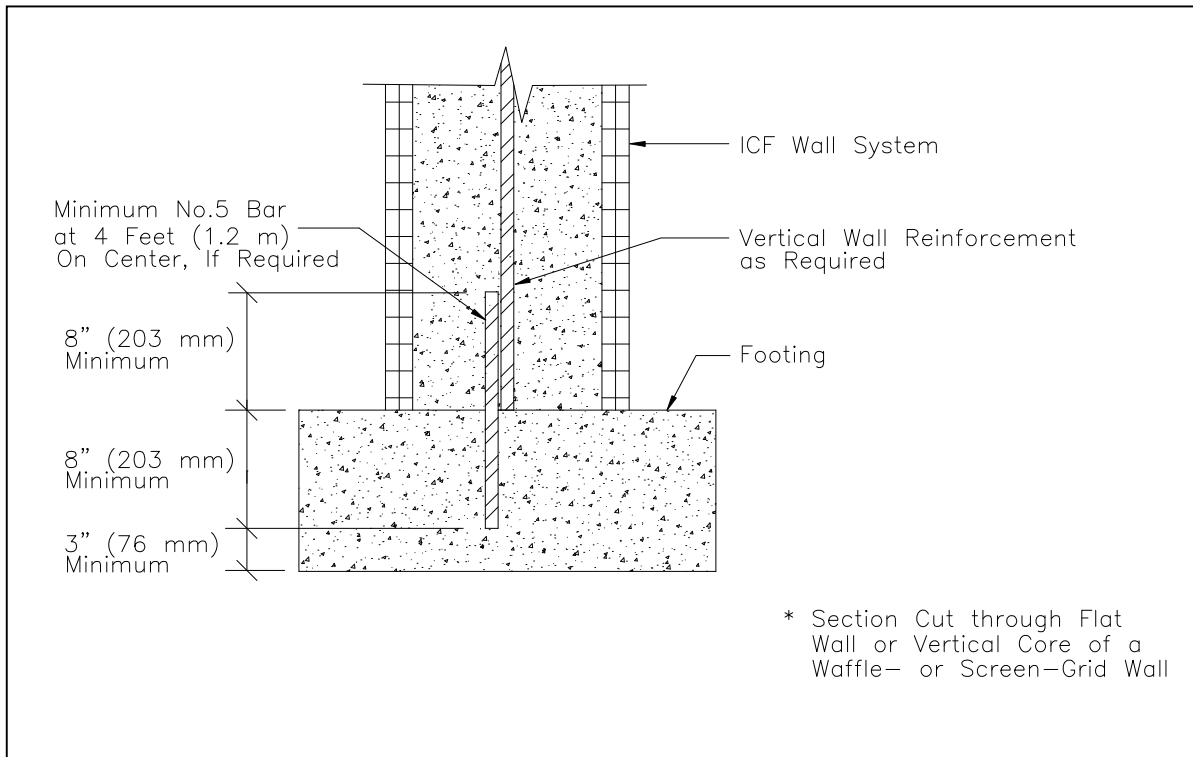
1. Table values are based on IBC Equation 16-63 using a tributary wall height of 11 feet (3,353 mm). Table values may be reduced for tributary wall heights less than 11 feet (3.3 m) by multiplying the table values by X/11, where X is the tributary wall height.
2. Table values may be reduced by 30 percent to determine minimum allowable stress design values for anchors.

**TABLE 6.3**  
**TOP SILL PLATE-ICF WALL CONNECTION REQUIREMENTS**

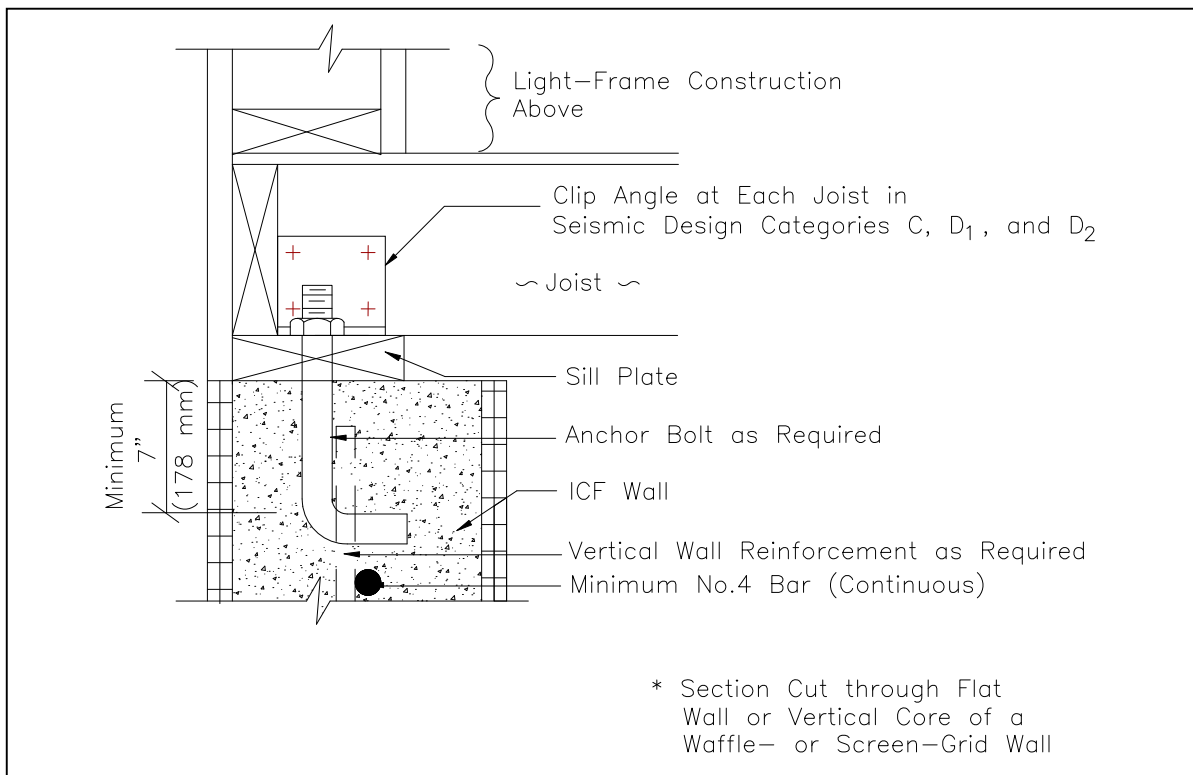
MAXIMUM WIND SPEED (mph)	MAXIMUM ANCHOR BOLT SPACING 1/2-INCH-DIAMETER ANCHOR BOLT
90	6'-0"
100	6'-0"
110	6'-0"
120	4'-0"
130	4'-0"
140	2'-0"
150	2'-0"

For SI: 1 foot = 0.3048 m; 1 inch = 25.4 mm; 1 mph = 1.609344 km/hr

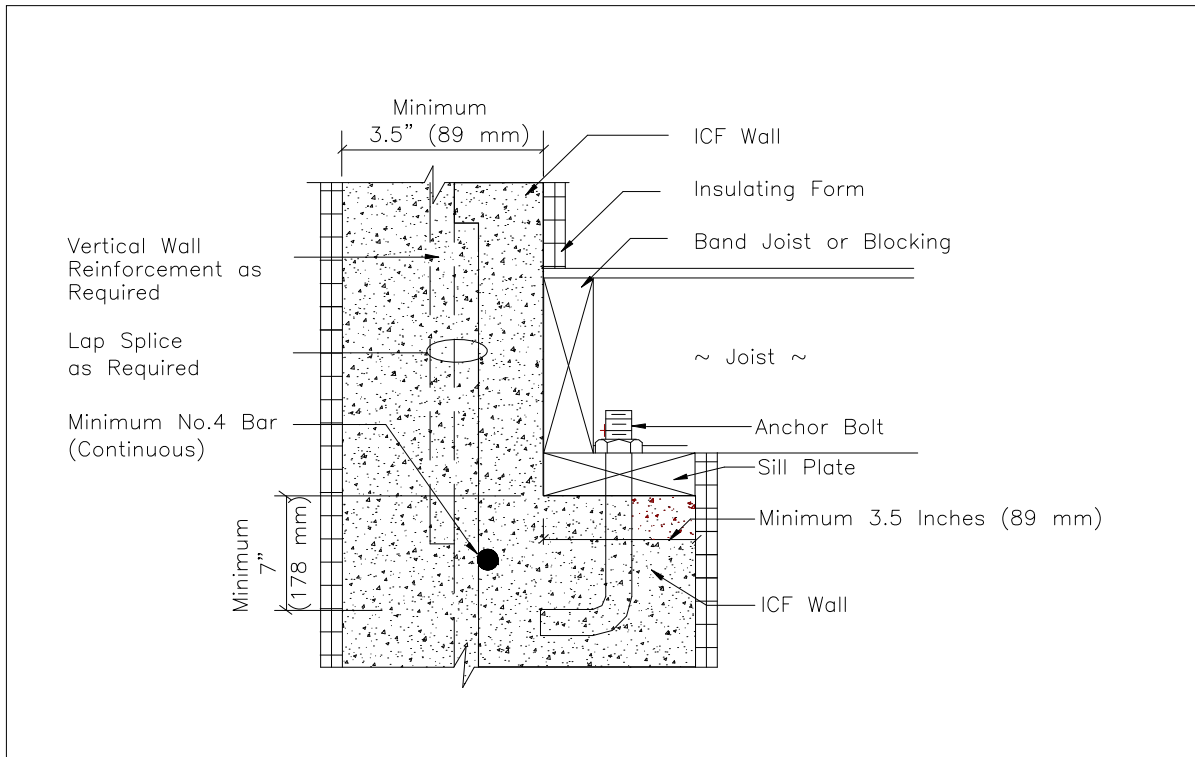
**6.0 - ICF Connection Requirements**



**Figure 6.1 ICF Foundation Wall-to-Footing Connection**

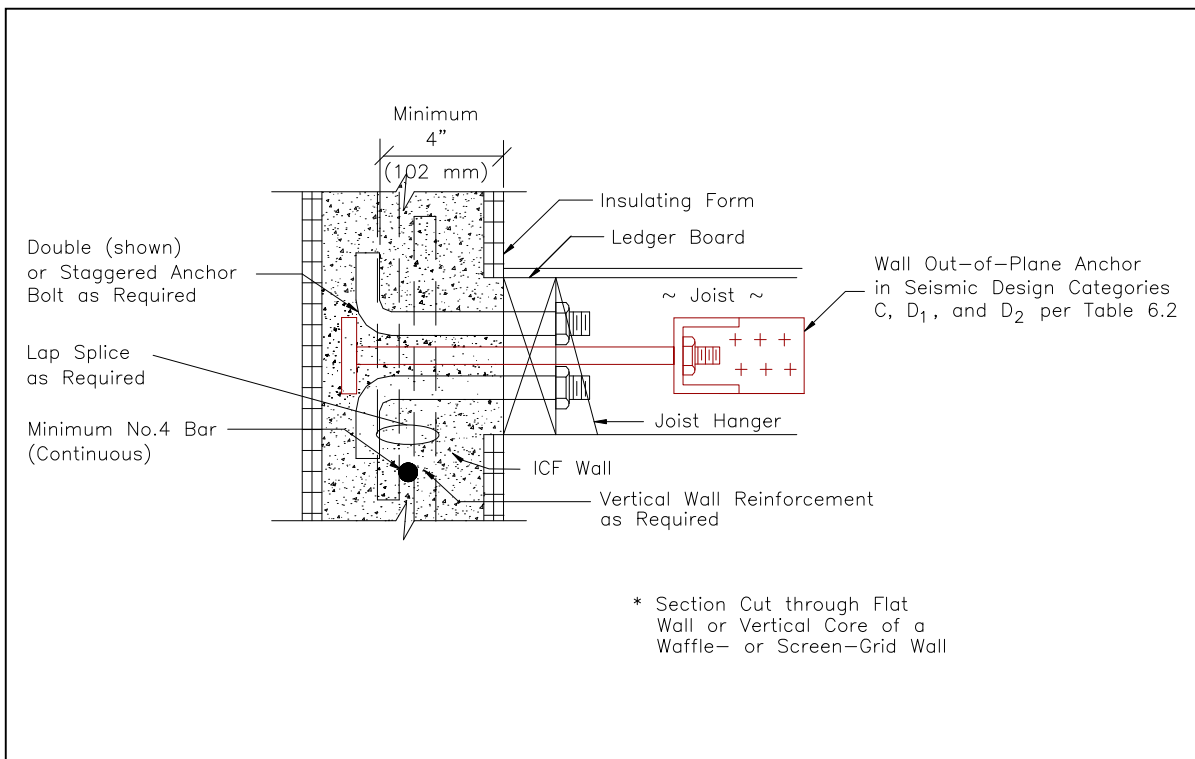


**Figure 6.2 Floor on ICF Wall Connection (Top-Bearing Connection)**



**Figure 6.3 Floor on ICF Wall Connection (Top-Bearing Connection)**

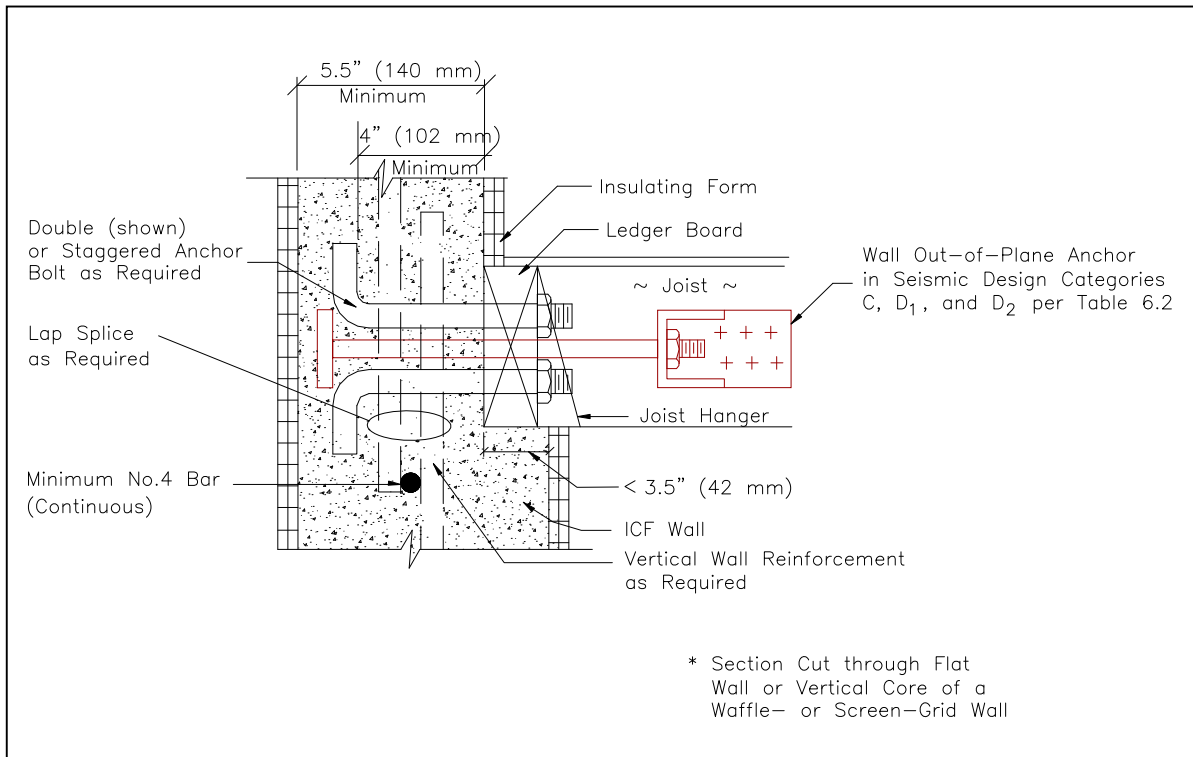
(Not Permitted in Seismic Design Categories C, D<sub>1</sub>, or D<sub>2</sub> Without Use of Out-of-Plane Wall Anchor in Accordance with Figure 6.5)



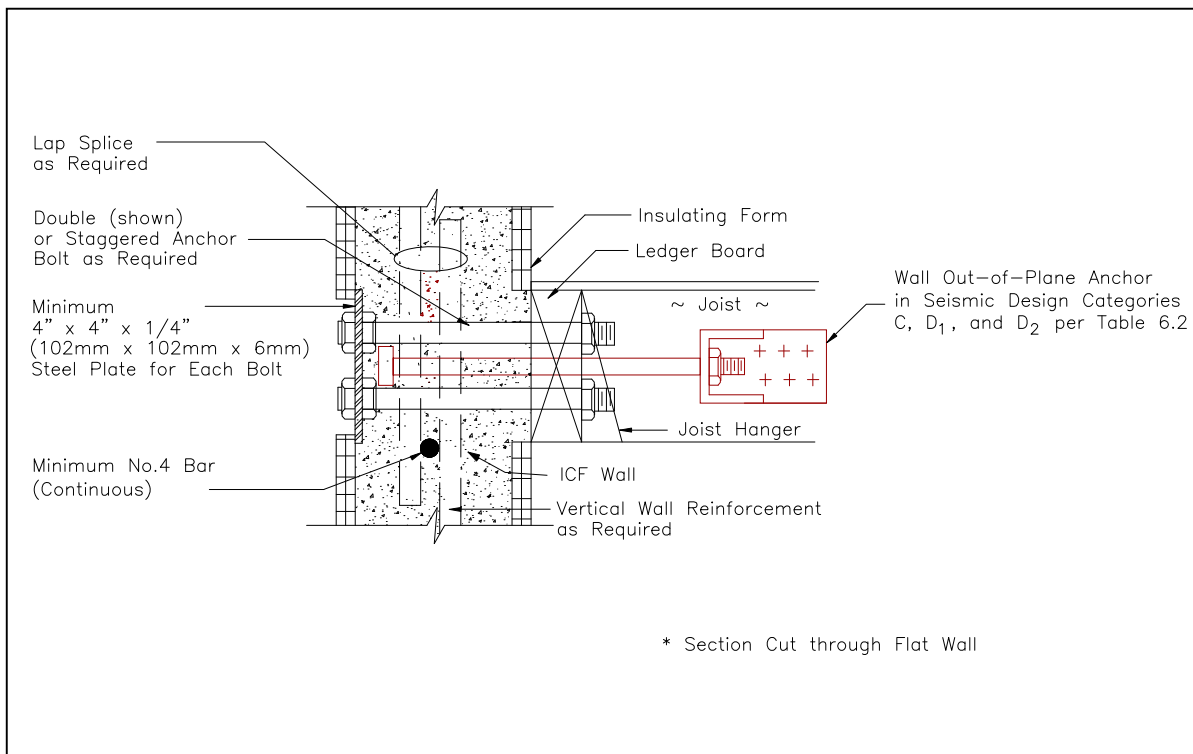
**Figure 6.4 Floor Ledger-ICF Wall Connection (Side-Bearing Connection)**

**PRESCRIPTIVE METHOD FOR INSULATING CONCRETE FORMS  
IN RESIDENTIAL CONSTRUCTION, Second Edition**

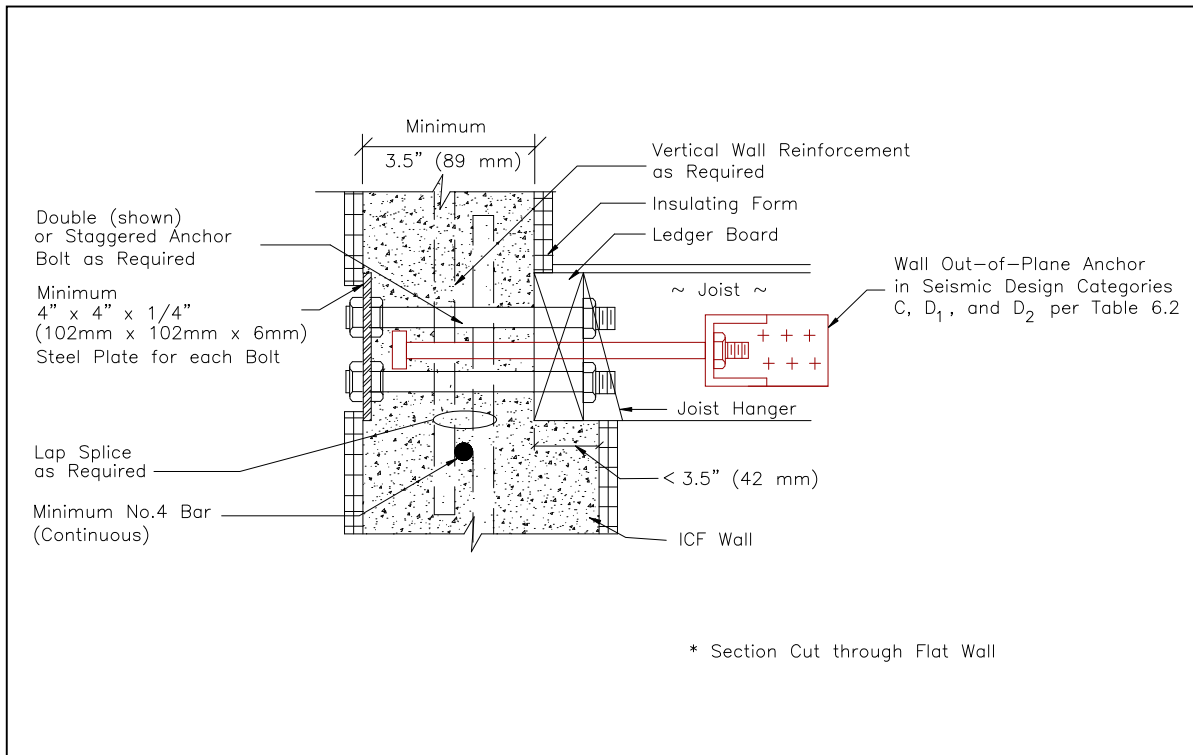
**6.0 - ICF Connection Requirements**



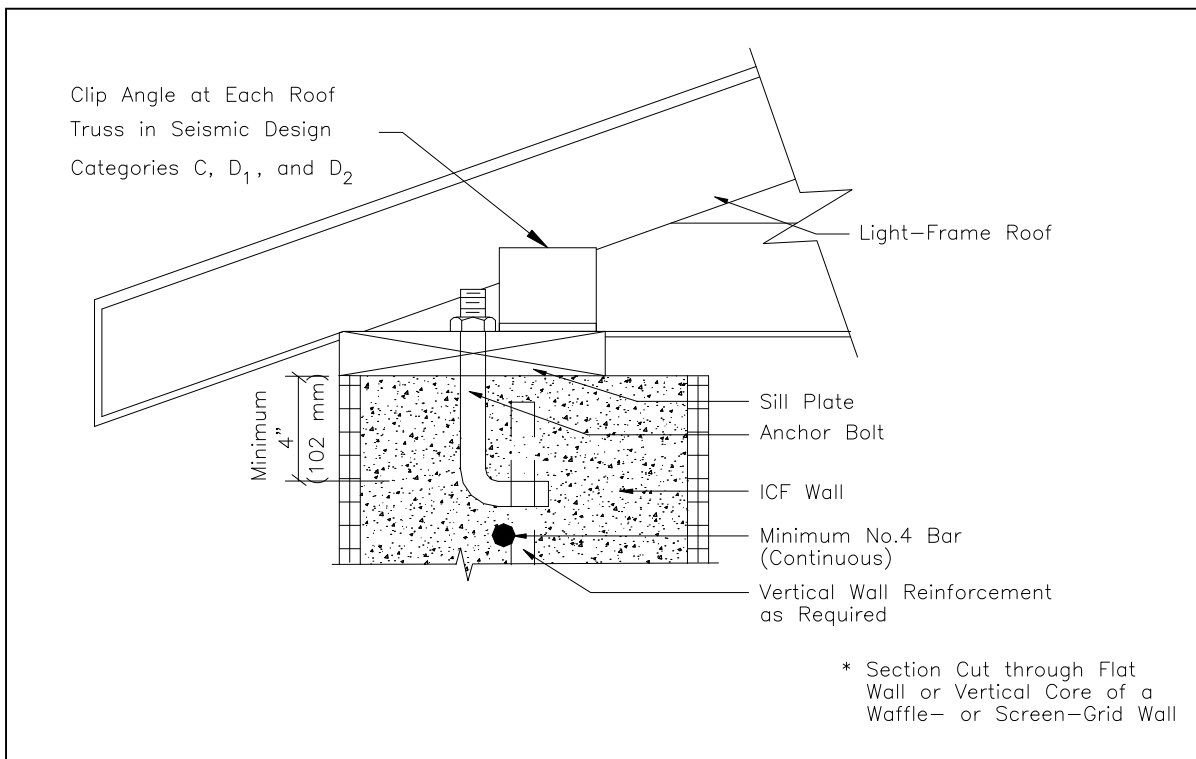
**Figure 6.5 Floor Ledger-ICF Wall Connection (Side-Bearing Connection)**



**Figure 6.6 Floor Ledger-ICF Wall Connection (Through-Bolt Connection)**



**Figure 6.7 Floor Ledger-ICF Wall Connection (Through-Bolt Connection)**



**Figure 6.8 Top Wood Sill Plate-ICF Wall System Connection**

## **7.0 Utilities**

### **7.1 Plumbing Systems**

Plumbing system installation shall comply with the applicable plumbing code.

### **7.2 HVAC Systems**

HVAC system installation shall comply with the applicable mechanical code.

### **7.3 Electrical Systems**

Electrical system installation shall comply with the National Electric Code.

## **8.0 Construction and Thermal Guidelines**

### **8.1 Construction Guidelines**

Before placing concrete, formwork shall be cleaned of debris and shall be free from frost. Concrete shall not be deposited into formwork containing snow, mud, or standing water or on or against any frozen material.

Before placing concrete, vertical and horizontal reinforcement shall be secured in place within the insulating concrete form as required in Section 2.0. Concrete placing methods and equipment shall be such that the concrete is conveyed and deposited at the specified slump, without segregation and without significantly changing any of the other specified qualities of the concrete.

An adequate method shall be followed to prevent freezing of concrete in cold-weather during the placement and curing process. The insulating form shall be considered as adequate protection against freezing when approved.

### **8.2 Thermal Guidelines**

#### **8.2.1 Energy Code Compliance**

The insulation value (R-value) of all ICF wall systems shall meet or exceed the applicable provisions of the local energy code or the Model Energy Code [20].

#### **8.2.2 Moisture**

Form materials shall be protected against moisture intrusion through the use of approved exterior wall finishes in accordance with Sections 3.0 and 4.0.

#### **8.2.3 Ventilation**

The natural ventilation rate of ICF buildings shall not be less than that required by the local code or 0.35 ACH. When required, mechanical ventilation shall be provided to meet the minimum air exchange rate of 0.35 ACH in accordance with the Model Energy Code [20] or ASHRAE 62 [21].

