

# Install Footings

This chapter provides instructions for the design and construction of individual footings that transfer the load from a single pier to the ground. A footing and pier together (discussed in **Set the Home**) is referred to as a "support." A footing may also be designed to carry the load of multiple piers (often called "strip" footings). The design of strip footings is not covered in this manual.

## Follow the Steps below:

- ▼ STEP 1. DESIGN POINT LOAD SUPPORTS (p. 22)
- ▼ step 2. DESIGN FRAME SUPPORTS (Homes Without Perimeter Blocking) (p. 25)
- ▼ STEP 3. DESIGN FRAME AND PERIMETER SUPPORTS (Homes With Perimeter Blocking) (p.26)
- ▼ STEP 4. SELECT FOOTING MATERIALS (p.28)
- ▼ STEP 5. SIZE FOOTINGS (p.29)
- ▼ STEP 6. INSTALL FOOTINGS (p.31)

### REQUIRED SUPPORT PIERS

All homes will require support piers with footings to be installed under the frame steel beams, marriage line (for multi-section homes), exterior walls and any location where heavy loads (i.e., water beds, whirlpool tubs, etc.) are located.

Large concentrated loads or point-loads occur on each side of the marriage line openings and sidewall openings and at the locations where the heavy loads occur. The piers that support these large concentrated loads are called 'Point-Load Support Piers'.

Large snow loads from the roof (40 PSF and larger) also require support piers to be installed below the marriage line and exterior walls to help support these large roof snow loads. The piers that support these large snow loads are called 'Perimeter Support Piers'.

The frame steel beams which support both floor and roof loads must also be supported by support piers. The piers that support the frame steel beams are called 'Frame Support Piers'.

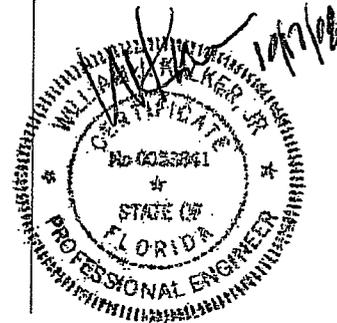
Highland Mfg. Co. may have provided a blocking diagram (or labels, tags, paint or other markings on the home) which indicate the required locations and/or loads for the exterior wall, marriage line, perimeter and/or frame support piers for your home. If so, the diagram, labels, tags or other marking provided on your home take precedence over the following directions provided in this manual.

The installer must create a sketch of the home that includes the exterior walls, the frame steel beams and the marriage line(s), if a multi-section home. This sketch will be used to locate each support pier and specify the size of the corresponding required footing. **Figure 6.5** is an example of such a support plan sketch.

*NOTE: When the roof load exceeds 40 psf, 'perimeter block piers' must also be installed below each sidewall and centered below the mate line. Piers should first be installed below each end of all openings for openings exceeding 48 inches in width (use standard pier sizing methods for these piers) and then additional 'perimeter block piers' should be installed within 2' of each end of the floor and at a maximum spacing not to exceed 8' o.c. between the opening piers. See Table C to determine the load requirements for these 'perimeter block piers'.*



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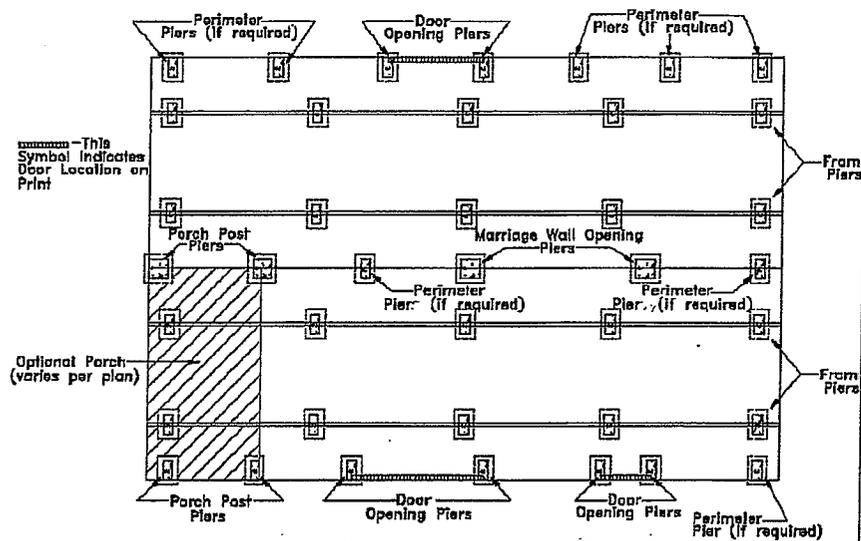
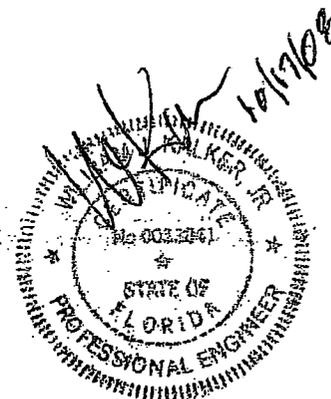


Figure 6.5 Example

As the location and load for each support pier is determined, note it on the support plan sketch. When selecting locations for supports, keep in mind that increasing the spacing between the frame and perimeter support piers will increase the loads which must be supported by those piers and the size of the footings required below the piers.



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Note: Maximum overhang dimensions are shown – smaller overhangs may be constructed.

Available home sizes manufactured by Highland Mfg. Co.

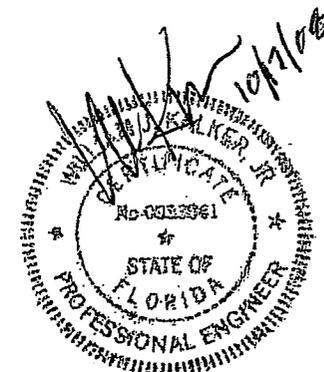
Highland Call Size	Box Width	Roof Overhang	Frame Spacing
"14 Wide" (single wide)	13'-8"	6"	82 1/2"
"16 Wide" (single wide)	15'-0"	7"	82 1/2"
"24 Wide" (double wide)	23'-8" (11'-10" per half)	16"	82 1/2"
"28 Wide" (double wide)	27'-4" (13'-8" per half)	10"	82 1/2"
"32 Wide" (double wide)	29'-0" (14'-6" per half)	16"	82 1/2"

## STEP 1: DESIGN POINT-LOAD SUPPORT PIERS

Point-loads exist when a support column in the sidewall or marriage wall (or other load bearing wall) is installed on each side of an opening in the wall and supports the roof loads from the opening or when a large, heavy object is installed on the floor. In all such cases, the load must be transmitted down to the ground and/or a point-load support pier must be installed below the load. Point-load support piers must be installed as noted below:

- On both side of exterior doors in the sidewalls or other load bearing exterior walls (piers are not required at the exterior doors in non-bearing walls such as endwalls)
- On both sides of other openings in exterior bearing walls when the opening is four feet or greater in width. This requirement includes multiple window openings when any opening width is four feet or greater without wall framing studs separating the window openings.
- On both sides of marriage wall (on marriage line) openings when the opening is four feet or greater in width.
- At marriage wall (on marriage line) isolated columns.(i.e., columns with openings on each side) when either of the spans is an opening four feet or greater in width.
- Load-bearing porch posts.
- Under heavy (400 lbs or greater) items, such as heavy furniture, waterbeds, fireplaces and large fish tanks.

Mark the required point-load support locations on the sketch. Supports are not required where the manufacturer has reinforced the floor (i.e., with additional outriggers or floor joists) and when the reinforcement is noted in the documentation provided with the home. See Figure #7 and Figure #8 to identify typical point-load support pier locations.



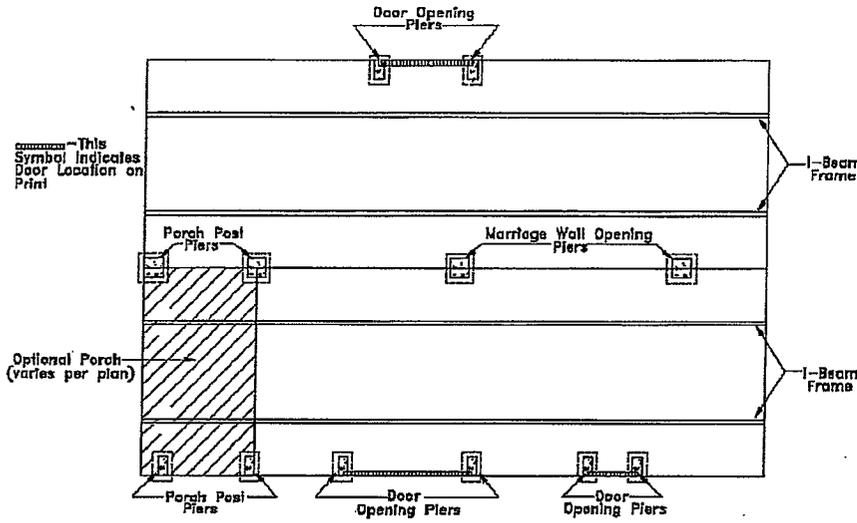


Figure 7. Typical point-load support locations

Note: .  
Perimeter Support Piers and Frame Support Piers are not shown in this detail.

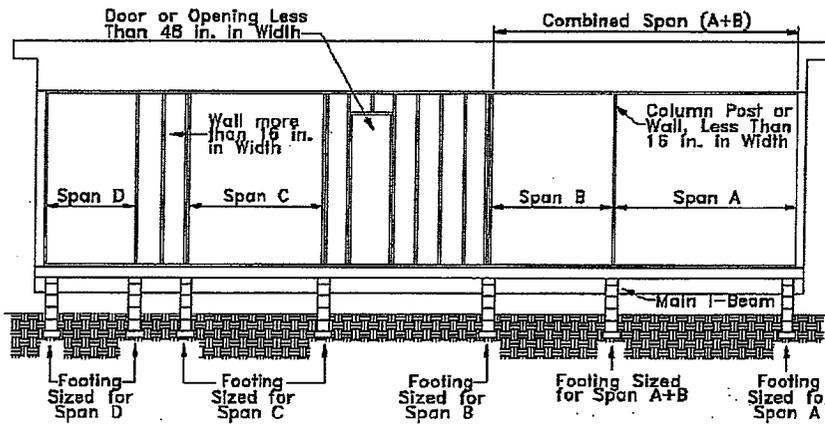
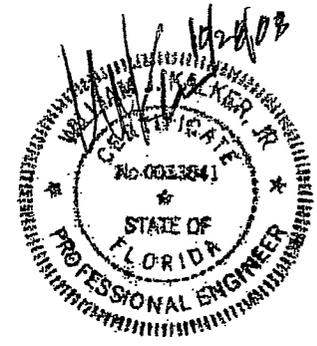


Figure 8. Typical point-load support locations along the marriage line – the point load schematic for the sidewalls would be similar

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### CALCULATE POINT-LOAD SUPPORT PIER LOADS

Use Table A to determine the loads to be supported by the piers installed below each point-load. First find the portion of the Table with the appropriate roof load zone and building width. Then find the row(s) corresponding to the opening spans (see for Figure #8 for guidance on determining the span dimensions) which exist in your home to determine the point loads to be supported at each end of the opening.

If the support stud(s) are supporting loads from spans on both sides of the stud(s), compute the load from each span and add the respective loads together to determine the total load to be supported at that location.

The numbers in the columns under the "M" and "S" headings are the loads on the supports located on each side of the marriage line openings (i.e., marriage wall openings) and sidewall openings, respectively. Interpolation for openings between the values shown in the Table is permitted.

The load to be supported by the piers installed below large floor loads must be determined from the manufacturer of the item installed on the floor.

Note the required loads next to each point-load support pier on the support pier sketch.

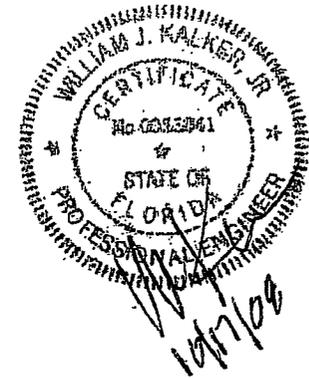
**TABLE A. POINT LOAD TABLE (POINT LOAD IS TO BE SUPPORTED BY FOOTING)**

Location		Roof load zone and maximum section width											
		MIDDLE (30 PSF)						NORTH (40 PSF or 45 PSF)					
		14' or 16' Single Wide		24' or 28' Double Wide		32' Double Wide		14' or 16' Single Wide		24' or 28' Double Wide		32' Double Wide	
Span in feet	M	S	M	S	M	S	M	S	M	S	M	S	
4'	n/a	646	*1094	614	*1160	686	n/a	889	*1504	844	*1595	944	
8'	n/a	1293	*2187	1227	*2320	1373	n/a	1178	*3007	1687	*3190	1888	
12'	n/a	1939	*3281	1841	*3480	2059	n/a	2666	*4511	2531	*4785	2831	
16'	n/a	2586	*4374	2454	*4640	2746	n/a	3555	*6015	3375	*6380	3775	
20'	n/a	---	*5468	---	*5800	---	n/a	---	*7519	---	*7975	---	
24'	n/a	---	*6562	---	*6960	---	n/a	---	*9022	---	*9570	---	

M=Marriage  
S=Sidewall  
Loads shown are in pounds

(Reference: Calc #3 \*PG 1/6 - K-822)  
(Reference: Calc #2 \*PG 1/10 - K-821)

\* 'M' or marriage wall opening pier loads consider the loads from each module of multi-wide buildings



Determine from the data plate and/or other documents if the home requires perimeter blocking.

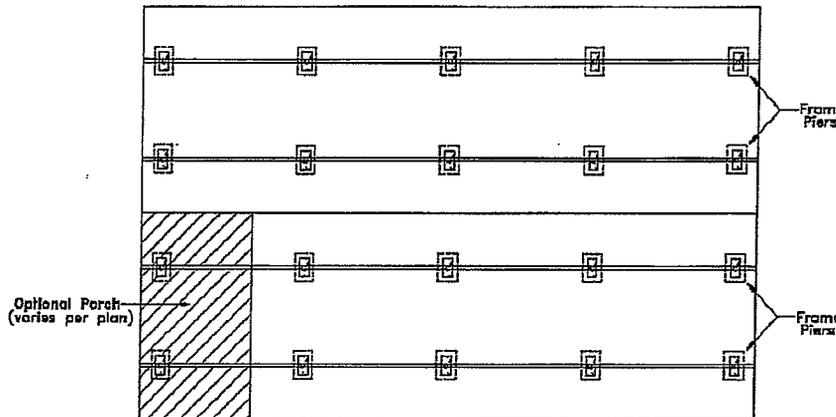
- ▶ If perimeter blocking is NOT required, go to **STEP 2, DESIGN FRAME SUPPORTS** (Homes Without Perimeter Blocking).
- ▶ If perimeter blocking is required, go to **STEP 3, DESIGN FRAME AND PERIMETER SUPPORTS** (Homes With Perimeter Blocking).

## STEP 2. DESIGN FRAME SUPPORT PIERS FOR HOMES WITHOUT PERIMETER SUPPORT PIERS

### DETERMINE LOCATIONS

All homes require regularly spaced supports to be installed below the main frame steel beams. Select a spacing to be used for these frame support piers and sketch them on the support plan. Keep in mind that frame support piers under homes with 10" or 12" deep steel beams cannot be spaced more than 10 feet on-center. Greater distances between the frame support piers will require larger footings to be installed below the piers.

Figure 9 shows typical frame support pier locations.



### Spacing frame supports.

There must be a support located near the end of each I-beam such that there is no more than 12 inches of beam past the edge of the support.

**Figure 9. Typical support locations for homes not requiring regularly spaced perimeter supports**

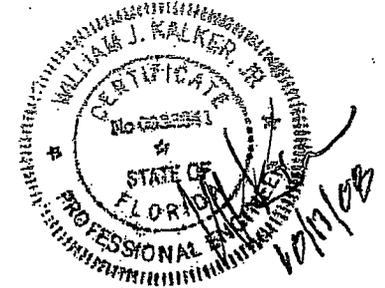
Note: Perimeter Support Piers and Point-Load Support Piers are not shown in this detail.

Note: Perimeter Support Piers and Point-Load Support Piers are not shown in this detail

### CALCULATE FRAME SUPPORT PIER LOADS

Use **Table B** to determine the loads on frame support piers. Find the column with the appropriate roof load zone and building width. Find the row corresponding to the selected frame support (pier) spacing. The number in the intersecting cell is the load.

Loads on all frame support piers can be assumed to be equal if the support pier spacing's are equal. However, if different frame support pier spacing's are used than each support pier with a different spacing should have its load calculated separately.



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Note the location and load required of each support pier on the support pier sketch.

**TABLE B. LOAD ON FRAME SUPPORT PIERS FOR HOMES NOT REQUIRING PERIMETER BLOCKING**

		Roof load zone and maximum section width				
		MIDDLE (30 PSF)				
Maximum Support Spacing		14'	16'	24'	28'	32'
		Single Wide	Single Wide	Double Wide	Double Wide	Double Wide
	4'	2768	3021	2572	2822	3051
	6'	4153	4531	3858	4233	4576
	8'	5537	6042	5144	5644	6102
10'	6921	7552	6430	7056	7627	

*Loads shown are in pounds (Reference: Calc #1 \*PG 1/10 - K-820)*

### STEP 3. DESIGN FRAME SUPPORT PIERS AND PERIMETER SUPPORT PIERS FOR HOMES WITH PERIMETER SUPPORT PIERS

#### DETERMINE SUPPORT PIER LOCATIONS

When the roof snow load equals or exceeds 40 PSF, Perimeter Support Piers must be installed below the load bearing exterior walls and centered below the mate lines. This requirement for Perimeter Support Piers will be indicated on the data plate and/or documents included with the home.

Perimeter Support Piers must be installed within 2' of each end of the floor and at a spacing not to exceed 8 feet on-center. Homes which required a Perimeter Support Pier spacing less than 8 feet will have the maximum spacing indicated on the data plate and/or other documents included with the home.

Perimeter Support Piers are only to be installed below the bearing walls. Bearing walls are those walls that support the ends of roof trusses or rafters (typically sidewalls and marriage walls are bearing walls, but not the endwalls of main units or non-load bearing sidewalls in tag units).

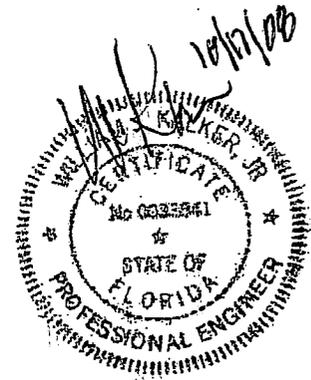
To minimize the number of required Perimeter Support Piers, first install the Point-Load Support Piers (use method noted earlier in the Section) and then install the required Perimeter Support Piers at each end of the home. A Point Load Support Pier installed within 2 feet of the end of the home will take the place of the required Perimeter Support Pier (an additional Perimeter Support Pier will not be required at that location)

Between these piers, install additional Perimeter Support Piers at a spacing not exceeding the maximum allowable spacing described above. Note, Perimeter Support Piers are not required in areas where a marriage wall opening occurs and/or where the roof loads are not transmitted to the floor construction. The figure below identifies



#### Spacing frame supports.

There must be a support located near the end of each I-beam such that there is no more than 12 inches of beam past the edge of the support.



typical support pier locations for homes requiring perimeter support piers..

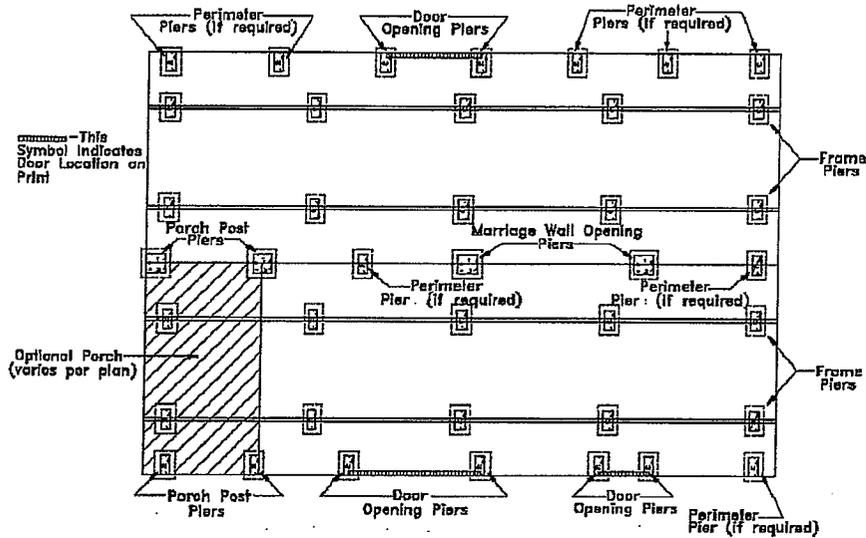


Figure 10. Typical support locations for homes requiring perimeter supports

Note: Perimeter Support Piers, Point-Load Support Piers and Frame Support Piers are shown in this detail

### CALCULATE SUPPORT PIER LOADS

Use Table C to determine the loads on the Frame Support Piers and Perimeter Support Piers (below the sidewalls and mate lines) for homes which require Perimeter Support Piers. Find the column with the appropriate roof load zone and building width. Find the rows corresponding to the selected support (pier) spacing. The values in the intersecting cells are the loads to be supported by the Frame Support Piers, Sidewall Perimeter Support Piers ('Perimeter' row) and Marriage Wall Perimeter Support Piers ('Marriage' row).

Loads on support piers of a given type (Frame, Sidewall Perimeter or Marriage Wall Perimeter) can be assumed to be equal if the support pier spacing's are equal. However, if different support pier spacing's are used then each support pier with a different spacing should have its load calculated separately.

Note the location and load required of each support pier on the support pier sketch.

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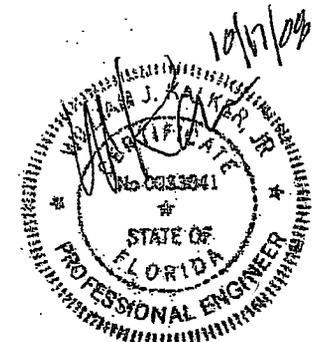
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TABLE C. LOAD ON FRAME AND PERIMETER SUPPORTS FOR HOMES REQUIRING PERIMETER BLOCKING

		Roof load zone and maximum section width					
		NORTH (40 PSF or 45 PSF)					
		14' Single Wide	16' Single Wide	24' Double Wide	28' Double Wide	32' Double Wide	
Maximum Support Spacing	4'	Frame	3209	3506	3007	3282	3566
		Perimeter	1615	1778	1596	1688	1888
		Marriage	n/a	n/a	2603	3007	3190
	6'	Frame	4813	5258	4511	4924	5348
		Perimeter	2422	2666	2392	2532	2832
		Marriage	n/a	n/a	3904	4511	4785
	8'	Frame	6418	7011	6014	6565	7131
		Perimeter	3230	3556	3190	3374	3776
		Marriage	n/a	n/a	5205	6015	6380

Loads shown are in pounds

(Reference: Calc #1 \*PG 1/10 - K-820)  
 (Reference: Calc #2 \*PG 1/10 - K-821)  
 (Reference: Calc #3 \*PG 1/10 - K-822)



## STEP 4. SELECT FOOTING MATERIAL

Select one of the products and materials from Table 5 for the footings.

**TABLE 5. FOOTING MATERIALS**

Material	Appropriate Use	Specification
Poured concrete	All soil types	Minimum 6" thick poured-in-place concrete pads, slabs, or ribbons with at least a 28 day compressive strength of 3,000 psi. Cast-in-place concrete footings may also require reinforcing steel based on acceptable engineering practice, the design loads, and site specific soil conditions.
Pre-cast concrete	All soil types	Minimum 4" thick nominal precast concrete pads meeting or exceeding ASTM C 90-02a, Standard Specification for Load Bearing Concrete Masonry Units, without reinforcement, with at least a 28-day compressive strength of 2,500 psi.
ABS plastic	Stable soils	Use in accordance with the pad manufacturer's instructions. Must be certified for use in the soil classification at the site, listed and labeled for the required load capacity.
Proprietary systems	Consult system manufacturer	Consult system manufacturer.

### Will footings be concrete?

- ▶ **YES, go to STEP 5, SIZE FOOTING,**
- ▶ **NO, see footing system manufacturer's instructions. For on-grade footings, the ground moisture barrier may be installed now – see Complete Exterior Work, STEP 2. INSTALL GROUND MOISTURE RETARDER (p. 106) then go to Set the Home (p. 37).**

## STEP 5. SIZE FOOTINGS

Once the load on the footing and the soil-bearing capacity are known, calculate the size of each footing as follows:

1. From Table 6 determine if the pier is to be of single-stack blocks (8 inch x 16 inch) or double-stack blocks (16 inch x 16 inch) pier.
2. Locate the group of rows in Table 7 with the soil-bearing capacity determined in **Prepare the Site, STEP 5. DETERMINE SOIL-BEARING CAPACITY AND FROST LINE (p. 16)**. Use the next lowest value if the exact value does not appear.
3. Read across the table to determine the minimum required footing area and the minimum footing thickness for the corresponding footing type (single or double-stacked blocks).
4. The required footing size may be changed by selecting another support spacing. (Table A, B, or C)

**TABLE 6. PIER CONFIGURATION**

Pier location	Height	Configuration	Maximum load
Frame	Less than 36 in (except corner piers more than 3 blocks high)	Single-stack blocks with long side perpendicular to I-beam	8,000 lbs.
	Between 36 in and 67 in and corner piers over 3 blocks high	Double, interlocked blocks	16,000 lbs.
	Over 67 in	Double, interlocked blocks	16,000 lbs.
Perimeter	54 in or less	Single-stack blocks with long side parallel to perimeter rail (rim joist)	8,000 lbs.
Marriage line	54 in or less	Single-stack blocks with long side perpendicular to the marriage line	8,000 lbs.
Perimeter and Marriage	Between 54 in and 80 in	Double, interlocked blocks	16,000 lbs.



**Frost protection.** When selecting footing materials, bear in mind the need for frost protection. Not all footing materials are suitable for freezing climates..

**TABLE 7. FOOTING DIMENSIONS**

Soil Bearing Capacity	Minimum Footing Area (sq. in.)	Minimum Footing Dimensions (in.)	8 in. x 16 in. pier (single-stack blocks)		16 in. x 16 in. pier (double-stack blocks)	
			Unreinforced cast-in-place min. thickness (in.)	Maximum footing capacity (lbs)	Unreinforced cast-in-place min. thickness (in.)	Maximum footing capacity (lbs)
1000	256	16 x 16	6	1680	6	1680
	384	24 x 16	6	2530	6	2530
	576	24 x 24	8	3600	6	3800
	1024	32 x 32	12	6040	8	6400
	1296	36 x 36	14	7420	10	7870
	2304	48 x 48	20	8000	16	12800
1500	256	16 x 16	6	2570	6	2570
	384	24 x 16	6	3860	6	3860
	576	24 x 24	8	5600	6	5800
	1024	32 x 32	12	8000	8	9950
	1296	36 x 36	-	-	10	12370
	2304	48 x 48	-	-	16	16000
2000	256	16 x 16	6	3406	6	3460
	384	24 x 16	6	5200	6	5200
	576	24 x 24	8	7600	6	7800
	1024	32 x 32	12	8000	8	13510
	1296	36 x 36	-	-	10	16000
	2304	48 x 48	-	-	-	-
2500	256	16 x 16	6	4350	6	4350
	384	24 x 16	6	6530	6	6530
	576	24 x 24	8	8000	6	9800
	1024	32 x 32	-	-	8	16000
	1296	36 x 36	-	-	-	-
	2304	48 x 48	-	-	-	-
3000	256	16 x 16	6	5240	6	5240
	384	24 x 16	6	7860	6	7860
	576	24 x 24	8	8000	6	11800
	1024	32 x 32	-	-	8	16000
	1296	36 x 36	-	-	-	-
	2304	48 x 48	-	-	-	-
4000	256	16 x 16	6	7020	6	5240
	384	24 x 16	6	8000	6	7860
	576	24 x 24	-	-	8	11800
	1024	32 x 32	-	-	10	16000
	1296	36 x 36	-	-	-	-
	2304	48 x 48	-	-	-	-

Note: The capacity values listed have been reduced by the dead load of the concrete footing.

Design footings to comply with the following additional requirements:

- Design each footing at least slightly larger than the base of the pier it supports.



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