



FEMA Foundation Design

Prepared by

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The foundation system design for the FEMA test MHUs consists of piers and footings for gravity loads and ground anchors and straps for lateral resistance.

Footings: Choose one of the following materials for the footings:

- Pre-Cast Concrete Pad
- ABS (acrylonitrile butadiene styrene) pad

If pre-cast concrete pads are being installed, use 16" X 16" x 4 sized pads, arranged in the configuration stated in Table 1 based on the unit size. The double pad and the quad pad configurations are shown in Figure 1.

Table 1 Pre-Cast Concrete Pad Configurations

Home Type	Pier Spacing	Min. Pier Capacity	Configuration (Soil bearing capacity: min. 1000 psf)
3 Bedroom	8 ft.	4950 lbs.	quad
Express	8 ft.	3050 lbs.	double

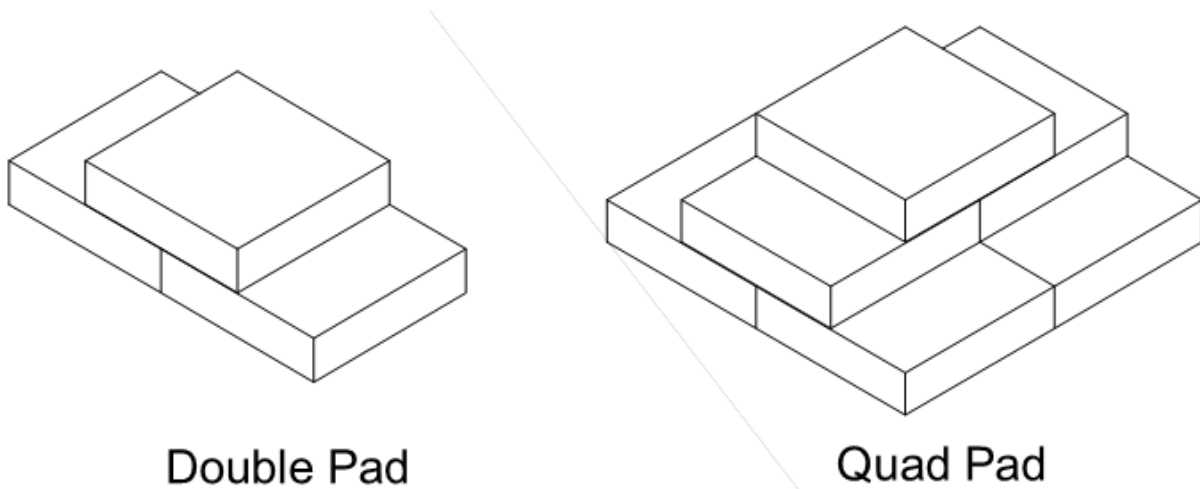


Figure 1 Configurations of the Concrete Pad

If ABS (acrylonitrile butadiene styrene) pads are to be installed, select a pad size (or configuration of pads) that exceeds that minimum required footing size shown in Table 2. Ensure that the pad(s) are approved and listed by a certified third party agency.

Table 2 Minimum Footing Sizes for ABS Pads

Home Width (Nominal)	Max. Pier Spacing	Min. Pier Capacity	Pier Size (Soil bearing capacity: min. 1000 psf)
3 Bedroom	8 ft.	4950 lbs.	710 sq. in
Express	8 ft.	3050 lbs.	436 sq.in

Piers: Choose one of the two pier types listed below and size accordingly:

- **Concrete Blocks:** 8"x 8"x 16", min. 8,000lbs capacity (min. ASTM C90, grade N)
- **Commercial metal piers or jack stands:** Piers that are listed and approved for pier capacity exceeding the minimums listed in Table 3.

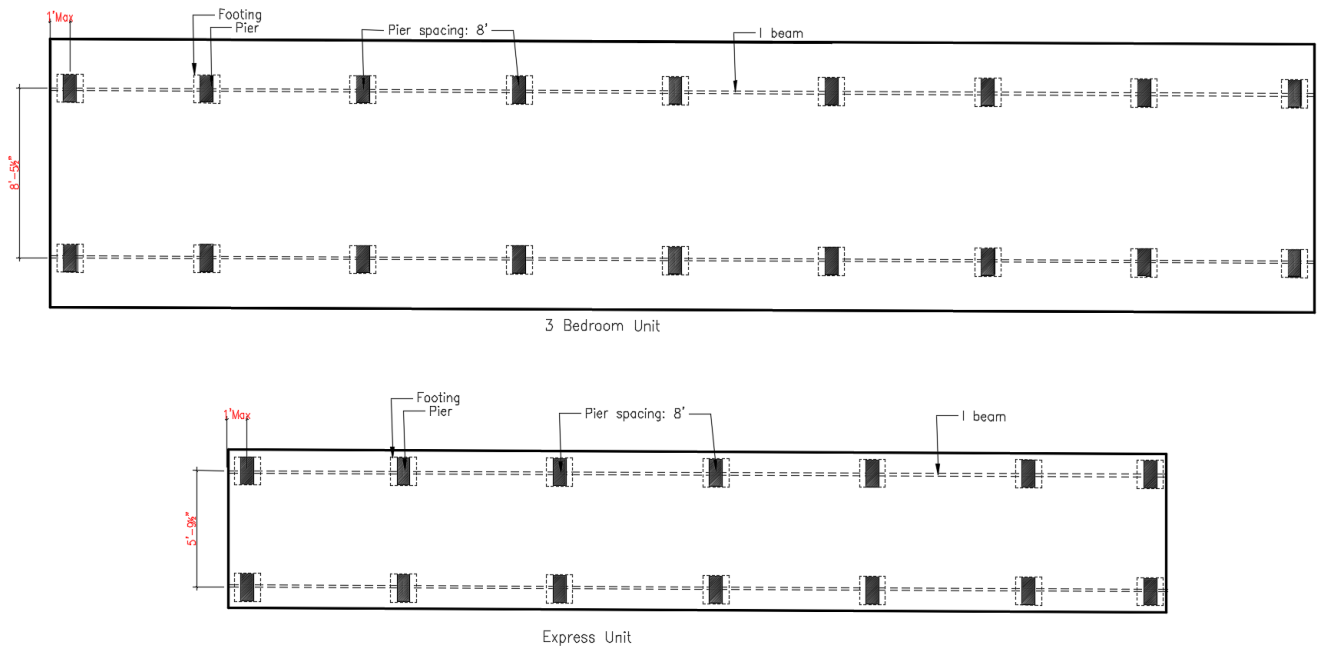


Figure 2 Pier and Footing Layouts

Piers shall be spaced at 8' O.C and may not exceed 36" in height. (excluding footing, cap block and shims).

Table 3 Minimum Pier Capacity

Home Type	Pier Spacing	Min. Pier Capacity
3 Bedroom	8 ft.	4950 lbs.
Express	8 ft.	3050 lbs.

Anchors and tie-downs

All MHUs shall have anchoring based on the Wind Zone (WZ1 to WZ3) of the site where they shall be installed. The anchoring system shall have the following components:

- Ground Anchors:** The anchors shall be tested and listed for the minimum working load capacity of 3150 lbs., and minimum ultimate load capacity of 4,725 lbs. They must be installed to full depth with a stabilizer plate in accordance with manufacturer's instructions. Table 4 shows the types of anchors, minimum number and the maximum spacing requirements. See 3280.306(a) & (g) of the HUD code for additional details on ground anchoring.
- Stabilizer Plates:** Stabilizer plates, used in conjunction with ground anchors, reduce the movement of the anchor head and therefore improve the overall structural performance of a system. They must be installed with each ground anchor of size, shape and material specified by the ground anchor manufacturer's installation instructions. Weatherization of the plates in accordance with 3280.306(g) of the HUD code must also be provided.
- Tie-Down Straps:** In all wind zones, tie down straps between I-beams and anchors are required. The straps shall be minimum 0.035" thick x 1-1/4" wide with minimum working load capacity of 3150 lbs, and min. ultimate load capacity of 4,725 lbs. See 3280.306(g) of the HUD code for additional details.

Ground Anchors:

The MHUs shall have both sidewall and end wall ground anchors that meet the requirements stated in Table 4. The type of anchoring depends on the Wind Zone in which the MHU is being installed. The three types of anchoring methods – titled as type A, type B and type C are illustrated in Figure 3 to Figure 5.

Table 4 Requirements of Ground Anchors

Nominal Width	Ground Anchor Type	Requirements		
		WZ1	WZ2	WZ3
14 ft (3 bed)	Sidewall Anchors - Max. Spacing	8'-0" - Type A	4'-0" - Type B	4'-0" - Type B
	End wall Anchors - Number Required	2 per end	2 per end	2 per end
8 ft (Express)	Sidewall Anchors - Max. Spacing	8'-0" - Type B	4'-0" - Type C	4'-0" - Type C
	End wall Anchors - Number Required	2 per end	2 per end	2 per end

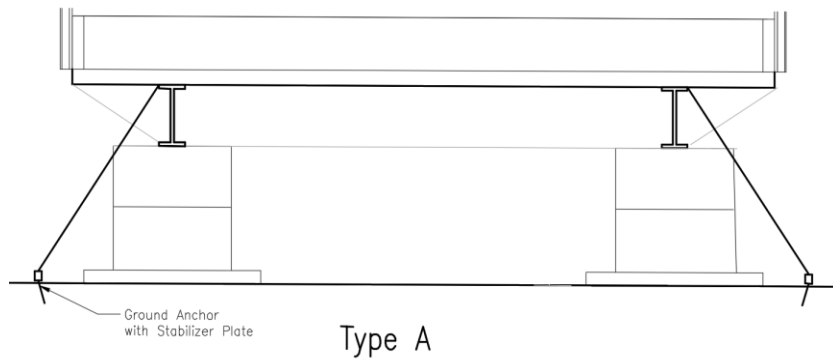


Figure 3 Type A Anchoring

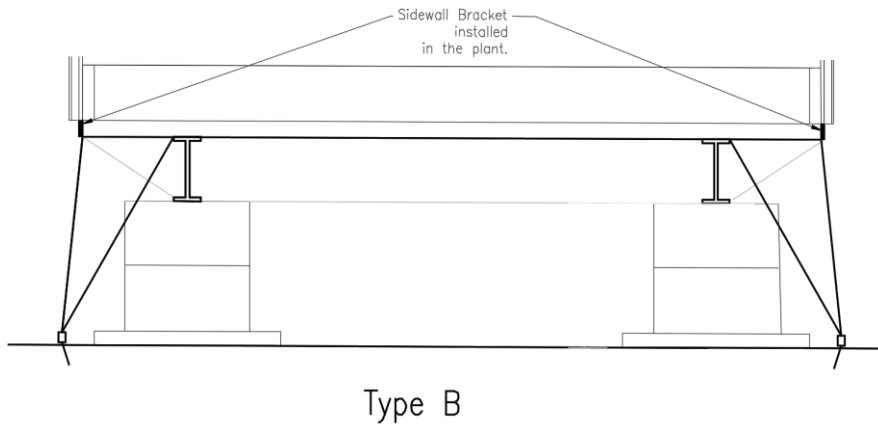


Figure 4 Type B Anchoring

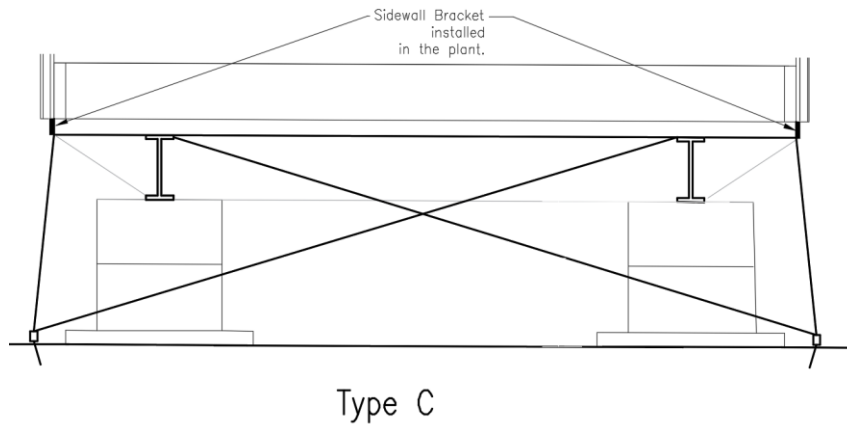


Figure 5 Type C Anchoring

Sidewall anchors shall meet the maximum spacing requirements, ranging from 8' to 4' as shown in Table 4. Two end wall anchors shall be installed at each end of the home, at 48" from the ends, as shown in Figure 6. For the extreme seismic zones (Zones E & F), that consist of the following regions, WZ3 shall be adhered to.

- All of California, Oregon, Washington
- Within 100 miles of New Madrid, MO
- Within 75 miles of Charleston, SC

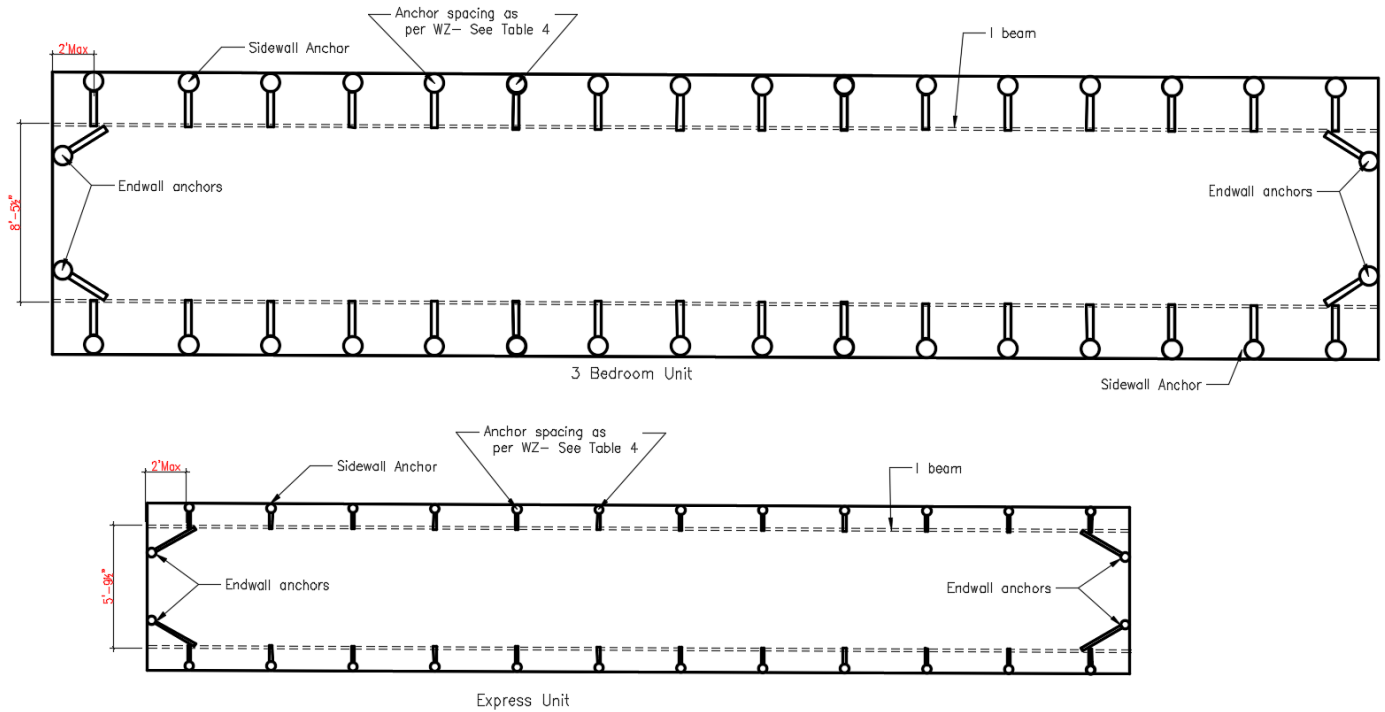


Figure 6 Anchoring Plans