# Chapter 3 Pre-Installation, Foundations and Piers

#### 3-1 Pre-Installation

Establishes the minimum requirements for the siting, design, materials, access, and installation of manufactured dwellings, accessory structures, accessory buildings, earthquake-resistant bracing, and wind and flood resistant anchoring.

# **Design Loads**

Except as otherwise stated, the manufactured dwelling siting, foundation, and installation requirements contained in this code are based on the following:

- o Minimum soil bearing capacity is 1,000 PSF
- o Minimum pier capacity of 4,000 lbs.
- o Roof live load of 30 lbs PSF
- Horizontal wind load of 15 PSF

**Note:** Additional design loads are specified in Section 3-1.5.

# **Basic Requirements**

Regardless of the type of foundation system provided, the foundation must assure the manufactured dwelling has adequate support, a level floor, flush roof, flush floor, and flush wall connections at the marriage lines of multi-section manufactured dwellings.

# **3-2 Geographical Requirements**

#### **Frost Line**

- Conventional footings in freezing climates. See the definition of "freezing climate" in Chapter 2. If the building official determines that the installation is within a freezing climate region of this state, then convention footings must be placed below the frost line, See Table 3-2.1.
- Foundation and retaining wall footings must be placed below the frost line.
- Insulated foundations and monolithic slabs are permitted above the frost line when certain site-specific conditions and characteristics are taken into consideration.

# **Special Snow Load Conditions**

• Manufactured dwellings are built to the federal Manufactured Home Construction and Safety Standards, established by HUD. Under this standard, Oregon's snow roof live load is 20 PSF. If the home is built to a higher roof live load, the home must be installed and inspected according to the manufacturer's installation instructions for ridge beam marriage line connection, ground anchors, or when an aspect of the installation is not covered by this code.

- This code is based upon a roof live load of 30 PSF.
- A building official may not require a manufactured dwelling to be built to a greater roof live load standard.

# **Wind Resistant Anchoring**

- As established by HUD, Oregon has one standard wind zone. This code requires all manufactured dwelling installations to be anchored against the wind (new or secondary installations).
- New home installations must be anchored according the manufacturer's installation instructions.
- Secondary installations may be anchored according to the manufacturer's installation instructions, or according to Section 3-2.6 of this code.
- Certain earthquake resistant bracing systems may comply with this requirement.

#### Flood Hazard Areas

- Manufactured dwellings may be installed in flood hazard areas when they are elevated and anchored according to the Oregon Residential Specialty Code, Section R324.1.8.
- Home installations shall be a minimum of 12 inches above the design flood elevation (DFE) according to Oregon Residential Specialty Code, Section R324.2.1.
- Lowest floor is the bottom of the longitudinal chassis frame beam (bottom of the I-beam) in A Zones.
- Anchoring the home shall be according to Oregon Residential Specialty Code, Appendix E, Section AE101 and AE102.

**Note:** Effective April 1, 2010 all home installations shall be anchored against the wind. Typical wind anchoring provisions in most cases is equivalent to typical flood hazard area anchoring requirements.

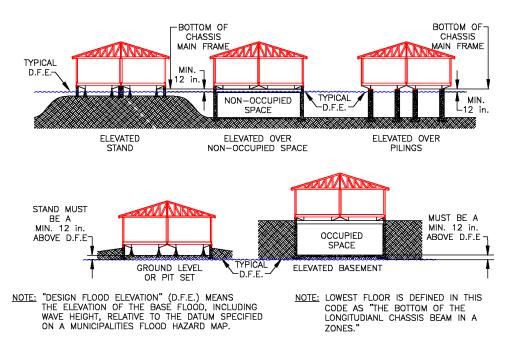
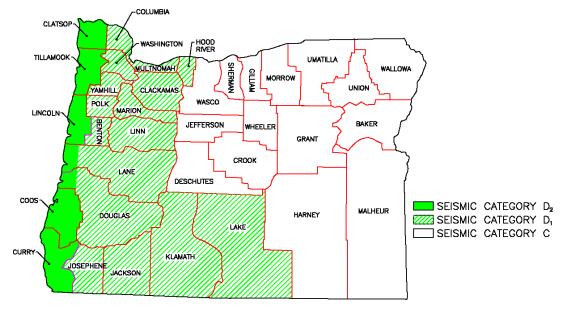


Figure 3-2.4 Typical Methods of Elevating Homes in Flood Hazard Areas

# Seismic Design Categories

To identify the different levels of earthquake activity three seismic design categories have been established in Oregon as shown on Figure 3-2.5(a).

- o Design Category C low risk
- o Design Category D<sub>1</sub>- medium risk
- o Design Category D<sub>2</sub> high risk



THE BOUNDARY OF SEISMIC DESIGN CATEGORY D2 IN DOUGLAS AND LANE COUNTIES IS THAT LAND WHICH LIES WESTERLY OF RANGE 10 WEST OF THE WILLAMETTE MERIDIAN.

Figure 3-2.5(a) Seismic Design Category Map

# Design category C and D<sub>1</sub>

- Manufactured dwellings are limited to<sup>(1)</sup>:
  - o 3 feet in height for 75% of the under-floor area, and
  - 5 feet 7 inches for 25% of the under-floor area.
- The fuel gas supply to the manufactured dwelling must be made with a minimum 6 foot flexible gas connector.

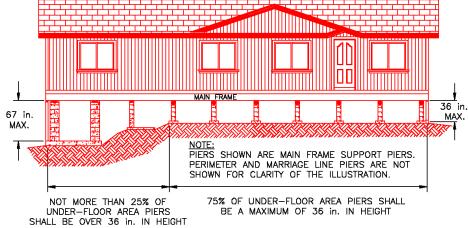


Figure 3-2.5(b) Maximum Pier Height for Seismic Zone C & D<sub>1</sub>

# Design category D<sub>2</sub>

- Manufactured dwellings are limited to<sup>(1)</sup>:
  - o 2 feet in height for 75 % of the under-floor area, and
  - o 5 feet inches for 25 % of the under-floor area.
- The fuel gas supply to the manufactured dwelling must be made with a minimum 6 foot flexible gas connector.

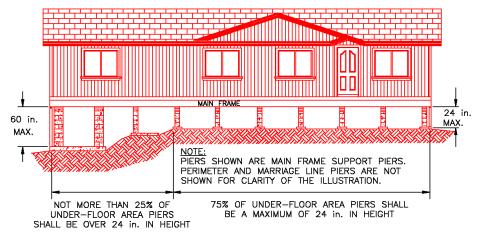


Figure 3-2.5(c) Maximum Pier Height for Seismic Zone D<sub>2</sub>

(1) The maximum height limitations identified may be exceeded when the support system is designed for the appropriate seismic design category by a registered design professional, or the manufacturer's Design Approval Primary Inspection Agency (DAPIA) approved plans, and accepted by the building official.

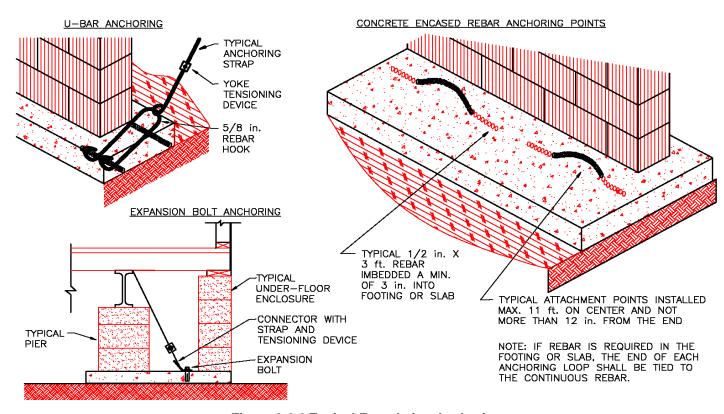
#### **Earthquake Resistant Bracing**

- When required, manufactured dwellings must be anchored or braced to resist seismic forces. The following are typical bracing systems:
  - o Approved earthquake-resistant bracing system.
  - o Approved anchoring system designed to resist seismic conditions.
  - o Installing positive connection piers at the main frame and anchoring with approved ground anchors.
- All prefabricated anchoring equipment must be approved for its intended use, and must be installed according to the equipment manufacturer's installation instructions.

# **Anchoring Requirements**

- New manufactured dwellings installations must anchored to one of the following:
  - According to the manufacturer's installation instructions. This anchoring meets HUD's minimum installation requirements for ground anchors for Zone 1 in 24 CFR 3285.402.
  - Attachment to a foundation system, structural skirting, basement wall, or footing when designed by a registered design professional.
  - An earthquake resistant bracing system meeting the requirements in 3-2.6(1)(c).

- Secondary manufactured dwelling installations must be anchored to one of the following:
  - o Manufacturer's installation instructions.
  - Foundation footing anchoring system. (2)
  - Connector plate anchoring.
  - o See Figure 3-2.6.
  - (2) The code specifies that U-bar attachments must be at 11 feet on center. This also applies to the expansion bolts, looped rebar, and any other acceptable anchoring point. The intent of the code is to require anchoring at 11 feet on center and within 1 foot of each end of the home.



**Figure 3-2.6 Typical Foundation Anchoring** 

# 3-3 Site and Stand Preparation

Each site must be suitable for its intended use and acceptable to the building official based on this code and local land use regulations.

# **Grading and Drainage**

- Site grading and drainage must provide adequate drainage to divert water away from the manufactured dwelling, including roof run-off from manufactured dwellings, cabanas, and accessory buildings and structures.
- Lots and stands must be provided with adequate drainage to prevent standing water, excessive soil saturation, or erosion from becoming detrimental to the lot, stand, or any structures.
- The ground within a 10 foot perimeter adjacent to a stand must be graded to a minimum fall of 1/2 inch per foot.
- Alternate grading methods may be used when needed and approved by the authority having jurisdiction.

#### **Stands**

Manufactured dwelling stands must be natural undisturbed soils or engineered fill. Stands must be free of grass, weeds, organic materials, and highly expansive, compressible or shifting soils.

# **Soil Bearing Capacity**

- For the purpose of this code, undisturbed soils have been determined to have a soil bearing capacity of 1,000 PSF.
- A stand with a soil bearing capacity of 1,000 PSF may be improved by:
  - o Adding 6 inches of 3/4 inch minus crushed rock increases soil bearing capacity to 1,250 PSF.
  - Adding 6 inch of 3/4 inch minus crushed rock compacted with two passes of a vibrating machine increases soil bearing capacity to 1,500 PSF.
  - o Installation of continuous concrete footings or a concrete slab increases soil bearing capacity to 2300 PSF.
- Engineered fill, when used for a manufactured dwelling stand, must have a soil compaction test to assure the stand is capable of supporting a minimum of 1,000 PSF. The soil report must be submitted to the building official. See Section 3-3.5.2.
- If the soil class or bearing capacity cannot be determined by test or soil records, but its type can be identified, Table 3-3.5 may be used to determine allowable pressures and torque values.

#### **Moisture Barrier**

- The entire area under the heated portion of the home must be covered with minimum 6 mil polyethylene membrane sheeting.
  - o Sheeting must be overlapped by at least 12 inches at all joints.
  - o All holes and tears must be adequately sealed or patched.
  - o The barrier must be on top of a poured in place concrete footing.
  - o The barrier must be removed from under porches, decks, or landings.
- If a concrete slab contains a foundation encased grounding electrode, there must not be sheeting under the concrete.

#### 3-4 Foundations

- Footings, piers, or other similar load bearing devices must be capable of individually supporting a minimum of 4,000 pounds.
- Concrete masonry units (CMU) must be capable of supporting 15,000 pounds.
- Footings must be a minimum area of 256 square inches.
- Alternate foundation designs must be designed by a registered design professional and constructed in accordance with the Oregon Residential Specialty Code.

#### 3-5 Clearance under Homes

# **Minimum Foundation Heights**

- There must be a minimum of 18 inches between the top of the footing and the bottom of the main frame for 75 % of the crawlspace.
- 25 % of the crawlspace may be a minimum of 12 inches in height between the top of the footing and the bottom of the main frame.
- No area under the home may have a clearance of less than 12 inches between the top of the footing and the bottom of the main frame.

# MAX. 25% OF THE CRAWLSPACE MAY BE A MINIMUM OF 12 in. HIGH UNDER THE MAIN FRAME MAX. 25% OF THE MAIN FRAME MAX. 25% OF THE MAIN FRAME MAX. 25% OF THE MAIN FRAME THE MAIN FRAME THE MAIN FRAME 18 in. High under THE MAIN FRAME

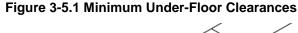
NOTE: CRAWLSPACE SHALL BE A MINIMUM OF 18 in. HIGH UNDER THE MAIN FRAME AT ALL MECHANICAL, ELECTRICAL, AND PLUMBING CONNECTIONS AND AT ACCESS LOCATIONS.

NOTE: DIMENSIONS SHOWN ARE FROM THE TOP OF THE FOOTINGS, TO THE BOTTOM OF THE I—BEAM.

# **3-6 Footings**

# **Foundation Footings**

- Must be made of approved materials.
- Must be equal to a greater in area than the base of the pier.
- Different types of individual footings may be used.
- Concrete must have a smooth and level top surface.
- If concrete footings or slabs are poured short or too narrow, they may be corrected by adding another continuous footing or slab along side. See Figure 3-6.1.



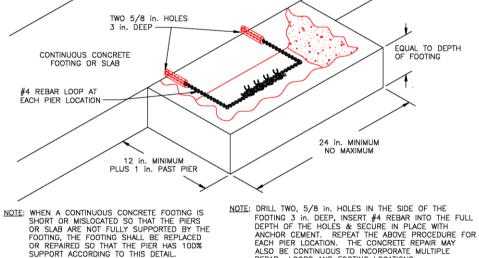
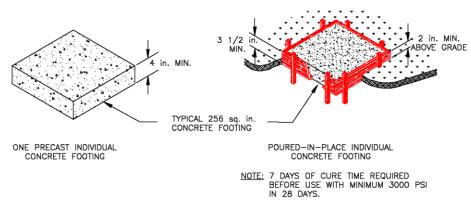


Figure 3-6.1 Continuous Concrete Footing or Slab Repair Detail

REBAR LOOPS AND FOOTING LOCATIONS.

# **Concrete Footings**

- Concrete footing may consist of:
  - One 4 inch thick individual precast concrete footing.
  - o Minimum 6 inch thick continuous concrete footings not less than 18 inches wide and reinforced with two continuous #4 rebar rods. See Figures 3-6.2(a) and 3-6.2(b).
  - O Minimum 3-1/2 inch thick continuous concrete slab footings not less than 48 inches and reinforced with approved fibers, or with 10 gage 6 inch x 6 inch wire fabric. See Figure 3-6.2(c).
  - o Minimum 3 ½ inch thick concrete slab (full slab) and reinforced with approved fibers, or with 10 gage 6 inch x 6 inch wire fabric. See Figure 3-6.2(d).
- Concrete must have a minimum 28-day compressive strength of 3,000 pounds.
- Concrete footings, when used to support a perimeter enclosure that supports greater than 8 inches of backfill, must be constructed as shown in figures 3-6.2(c) and 3-6.2(d).



**Example: Typical Individual Concrete Footings** 

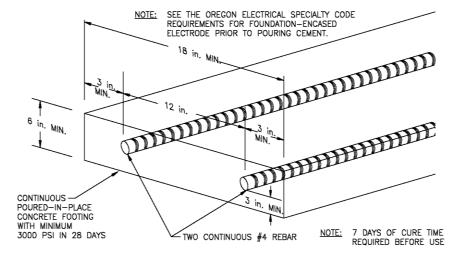


Figure 3-6.2(a) Typical Individual Continuous Concrete Footing

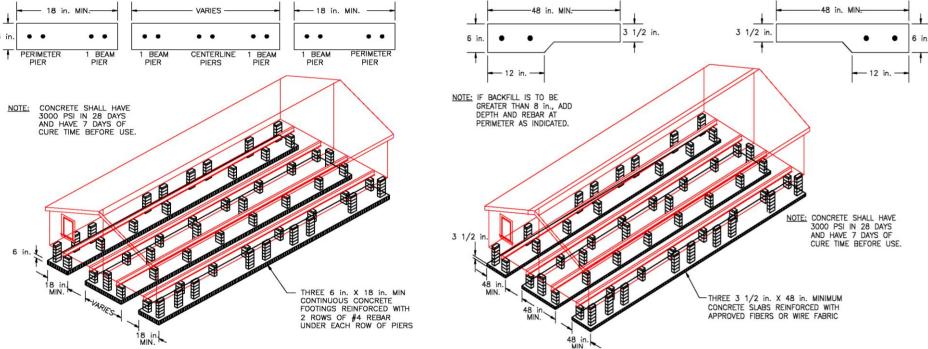
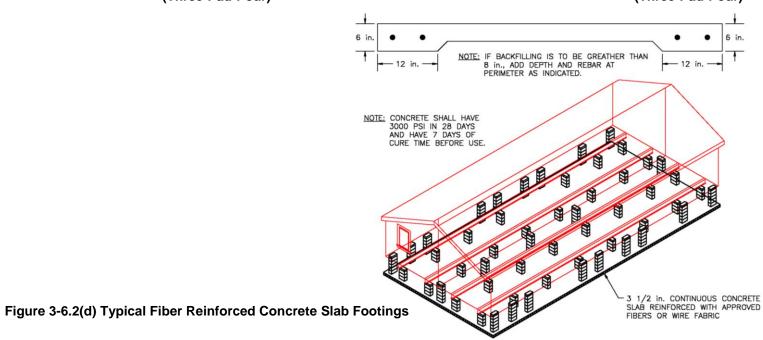


Figure 3-6.2(b) Typical Combined Continuous Concrete Footings (Three-Pad-Pour)

Figure 3-6.2(c) Typical Individual Fiber Reinforced Concrete Footings (Three-Pad-Pour)



# **Pressure Treated Permanent Wood**

- Pressure treated wood must be in accordance with AWPA U1.
- Typical uses include:
  - $\circ$  One layer of 1–1/2 inch thick lumber pressure treated on all six sides.
  - Two perpendicular layers of 1–1/2 inch thick foundation grade lumber pressure treated on all six sides.
- Other materials included in Section 3-6.3.

# **ABS Footing Pads**

ABS footing pads may be used provided they are listed or labeled for the required load capacity and are installed according to the pad manufacturer's installation instructions.

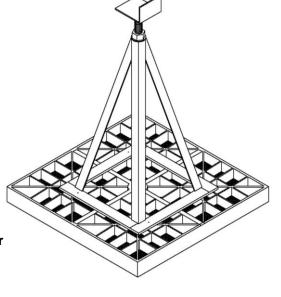
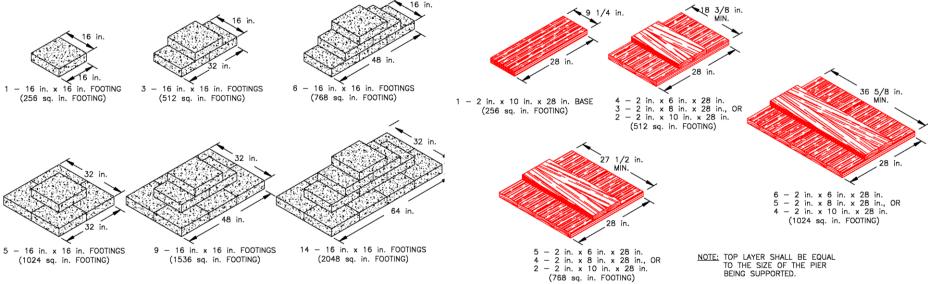


Figure 3-6.4 Typical ABS Footing with Typical Prefabricated Pier

# **Marriage Line Column Support Footings**

- Where the concentrated load of a column support post exceeds the capacity of an individual footing, multiple footing of the same material may be used to distribute the load evenly.
- Multiple footings may be layered in a pyramid shape to distribute the load evenly from the pier to the ground.
- Additional footings are not required on continuous concrete footings or slabs.



**Example: Typical Concrete Footing Pyramids** 

**Example: Typical Wood Footing Pyramids** 

#### 3-7 Piers

- Piers must be capable of supporting a minimum of 4,000 pounds as required by Section 3-4.2.
- Every pier must be supported by a footing.
- Typical pier types:
  - o Manufactured piers.
    - Manufactured piers must be listed or approved for its intended use and installed according to the pier manufacturer's
      installation instructions. Manufactured piers may not be installed in a manner that exceeds the maximum height limitation
      of the pier.
    - Manufactured piers must have protection against weather deterioration and corrosion equivalent to a coating of zinc on steel of .30 oz. per square foot. (*This requirement is not currently being enforced.*)
  - o ASTM rated concrete masonry unit (CMU) foundation piers, 8 inch x 8 inch x 16 inch, assembled according to this code and capable of supporting 15,000 pounds.
  - Other ASTM rated concrete when used in accordance with this code.
  - o Other materials or methods approved by the building official.
  - Non-rated or tested pumice and cinder block material may not be used to support vertical loads but may be used in skirting where no vertical loads are applied.

# Foundation (Pier) Heights

- Foundation heights are measured from the top of the footing to the bottom of the I-beam.
- For pier heights less than 36 inches high:
  - The long sides are at right angles to the supported I-beam. See Figure 3-7.2
  - Horizontal offsets may not exceed 1 inch top to bottom.
  - o Typically do not require mortar.
- Piers 36 inches to 67 inches must be double blocked and interlocked as shown in Figure 3-7.2.
- Piers over 67 inches high must be designed by a registered design professional.
- Concrete blocks must be stacked with the hollow cells aligned vertically.
- When stacked side-by-side, each layer must be at right angles to the preceding one.

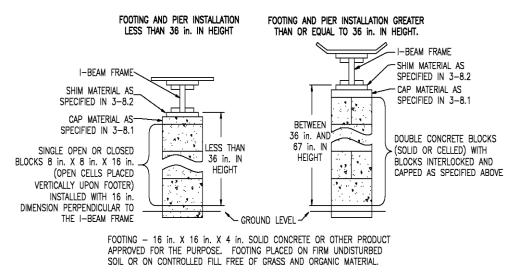


Figure 3-7.2 Typical Footing and Pier Installation

# **Marriage Line Column Support Piers**

- For the initial installation of new manufactured dwellings, the footings must be sized and piers spaced according to the manufacturer's installation instructions.
- For secondary installations, footings may be spaced and sized according to the manufacturer's installation instructions, and if not available, according to Table 3-7.3.
- Where the concentrated load of a column supports exceeds the capacity of single pier, multiple piers may be used to distribute the load.

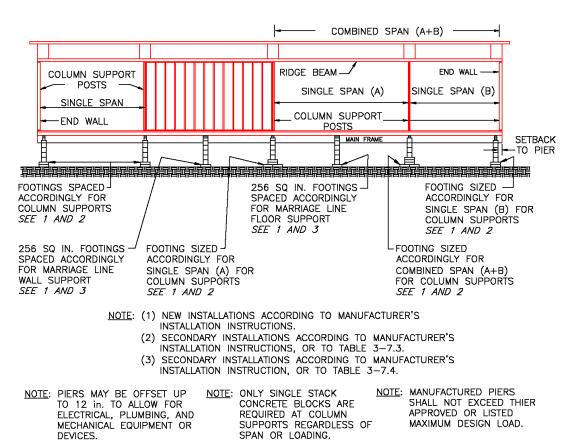


Figure 3-7.2 Typical Marriage Line Pier Layout

# Pier Location and Spacing

- Piers must be located and spaced according the manufacturer's installation instructions for new manufactured dwelling installations.
- Piers must be located and spaced according to Table 3-7.4 for secondary installations. New manufactured dwellings having floors 14 feet wide or less may have piers located and spaced according to Table 3-7.4.
- Location and spacing is based upon:
  - o Soil capacity.
  - o Minimum footing size of 256 square inches.
  - Offsets of up to 12 inches.
- For secondary installations, any horizontal spaces between column support posts must be supported under the marriage line floor and walls with intermediate piers spaced according to Table 3-7.4.

#### **Perimeter Piers**

- Required on all homes, except when the distance from the I-beam to the perimeter of the home is less than 16 inches.
- Required on each side of all doors, and any other opening 4 feet wide or greater.
- May be offset up to 12 inches under sidewalls and up to 16 inches from the end walls.
- Spaced according to Table 3-7.4.

#### **Recessed Perimeter Piers**

- For homes with a transverse floor system, recessed perimeter piers must support a single 4 inch x 4 inch horizontal wood beam, two 2 inch x 4 inch dimensional lumber nailed together, or equal, that spans a minimum of two floor joists.
- For homes with a longitudinal floor system, recessed perimeter piers must support the perimeter joist with a single 4 inch x 4 inch horizontal wood beam, two 2 inch x 4 inch dimensional lumber nailed together, or equal, that spans each floor joist. The support must fit tight against the bottom of the top flange of the I-beam.
- The pier may be recessed a maximum of 12 inches from the perimeter of the home.
- Installations must ensure support in a level position and a tight fit to prevent rocking or other movement.

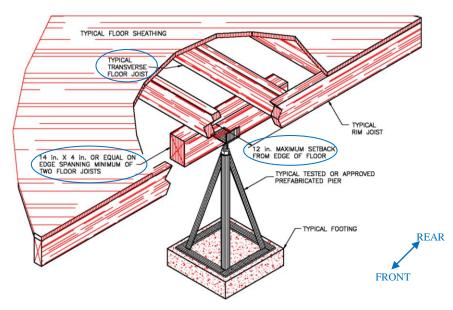


Figure 3-9.2(a) Typical Recessed Pier Detail for Transverse Floors

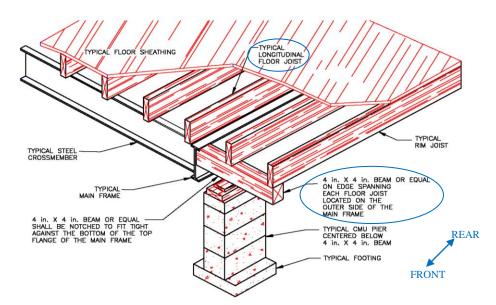


Figure 3-9.2(b) Typical Recessed Pier Detail for Longitudinal Floors

# 3-8 Pier Caps, Shims and Wedges

- Pier caps must be equal in size to the pier block and be made of material as specified in Section 3-8.1.
- Pier shims for CMU foundation piers must be a minimum of 5 1/2 inches by 16 inches constructed from any of the approved materials specified in Section 3-8.2.
- Wedges for CMU foundation piers must be made with one of the approved materials specified in Section 3-8.3.
- Shims and wedges may not exceed a combined height of 9 inches.

#### 3-10 Chassis

- Except for wheels, tires, axles, and hitches, transportation lights, or any parts specifically made to be removed, no portion of a manufactured dwelling chassis may be removed before, during, or after the manufactured dwelling installation.
- Chassis alterations or modifications to the chassis may only be performed according to manufacturer's Design Approval Primary Inspection Agency (DAPIA), or registered design professional, and with the approval of the Building Codes Division.

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**END** 

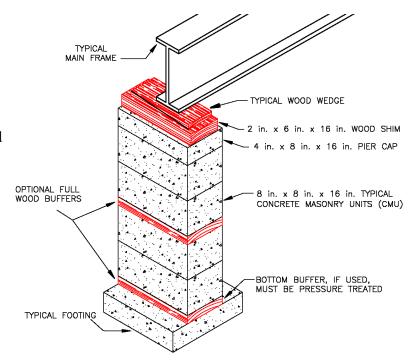


Figure 3-8 Typical Concrete Block (CMU) Pier