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Manufactured Dwelling Anchoring Requirements

Overview:

Each manufactured home must be designed according to the federal Manufactured Home Construction and Safety Standards at 24 CFR 3280, commonly called the HUD Code and installed to the 2010 Oregon Manufactured Dwelling Code. Excerpts of both these codes are included in this document to clarify the seismic and wind anchoring requirements for a manufactured home installation. The HUD Code stipulates, at §3280.305(c)(1) and §3280.305(c)(2), that the home shall be designed and constructed to conform to one of three wind load zones. The appropriate wind zone used in design is dependent on where the home will be initially installed. Homes designed and constructed to a higher Wind Zone can be installed in a lower Wind Zone (a Wind Zone III home can be installed in a Wind Zone I or II location). However, a Wind Zone I home cannot be installed in either a Wind Zone II or III area. The State of Oregon is located in Wind Zone 1 and therefore all manufactured homes are compliant in this aspect as long as the appropriate anchoring methods are employed.

Wind loads (a lateral load) must be resisted by the home. The home must be capable of transferring these imposed lateral loads to the home's stabilizing devices without exceeding the allowable stresses and other deflection requirements. The manufactured home producer designs the home to resist the wind load, which is measured in pounds per square foot. Wind Zone I equates to a 70-mph fastest-mile wind speed.

It is important to note that all manufactured dwelling installations in Oregon require both wind and earthquake anchoring to meet the requirements as listed in the attached Oregon Manufactured Dwelling Code sections. Generally speaking, anchoring requirements for new home installations can be accomplished in accordance with the manufacturer's installation instructions. Secondary installations can be accomplished with either the manufacturer's installation instructions or Section 3.26.

Excerpted from the 2010 Oregon Manufactured Dwelling Installation Code:

3-2.5.4 Earthquake-Resistant Bracing. When required, manufactured dwellings shall be anchored or braced to resist seismic forces by any of the following:

- (1) Installing an approved earthquake-resistant bracing system.
- (2) Installing an approved anchoring system designed to resist seismic conditions.
- (3) Installing positive connection piers at the main frame and anchoring with approved ground anchors.
- (4) Supporting and securing to a foundation wall, basement wall, or positive connection piers.
- (5) Supporting and securing to an approved structural skirting system designed to resist seismic conditions.
- (6) Supporting and securing to a foundation system capable of resisting seismic forces designed by a registered design professional and approved by the building official.

3-2.6 Anchoring. Anchoring of a manufactured dwelling shall be according to one of the following:

- (1) The initial installation of all new manufactured dwellings shall be according to one of the following methods:
 - (a) Installation of approved ground anchors that comply with all the requirements for Wind Zone I in 24 CFR 3285.402 contained within the manufacturer's installation instructions.
 - (b) Structural attachment to a foundation system, structural skirting, basement wall, or footing when designed by a registered design professional and approved by the building official. See Section 3-2.6(2)(b) and Figure 3-2.6 for examples of a typical approved anchoring systems.
 - (c) An earthquake-resistant bracing system shall be installed at a maximum of 24 ft. on center and have a capacity of at least 5,000 lbs. in the lateral and longitudinal directions and 35,000 lbs. vertically, and are limited for use with multi-section manufactured dwellings only having a roof slope of 20 degrees or less and supported on piers not greater than 24 in. in height.
- (2) The secondary installation of a manufactured dwelling shall be according to one of the following methods, see Figure 3-2.6:
 - (a) Ground anchors shall be sized and spaced according to the equipment manufacturer's instructions. The mechanical connections of the anchoring equipment shall be made according to the equipment manufacturer's instructions.
 - (b) Foundation footing U-Bar anchoring ties shall be sized and the U-Bars spaced according to the manufacturer's instructions. The mechanical connections of the anchoring ties shall be made according to the equipment manufacturer's instructions.
 - (A) In the absence of manufacturer's instructions, the U-Bar attachments shall be installed 11 ft. on center and no more than 12 in. from each end on both sides of the manufactured dwelling.
 - (B) Tie materials and strapping shall be capable of resisting an allowable working load of 3,150 lbs. with no more than two percent elongation, and shall withstand a 50 percent overload. Tie-downs and ground anchors shall have protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of .30 oz./ft² of surface coat.
 - (c) Connector Plate anchoring:
 - (A) At least 3-1/2 in. x 7 in., 20 gage connector plates no more than 12 in. from each end on both sides and 4 ft. on center for single wide dwellings, and 5 ft. on center for multiple section dwellings.
 - (B) Plates shall be fastened with a combined total of 32 8d nails into the rim joist and foundation wall top plate.
 - (d) Plywood trim board anchoring:
 - (A) Exterior type 15/32 in. grade B plywood at least 3-1/2 in. wide and continuous on both sides of the dwelling.
 - (B) Trim board shall be secured to the rim joist and the foundation wall top plate with 8d nails 6 in. on center in each row and caulked for weather seal.

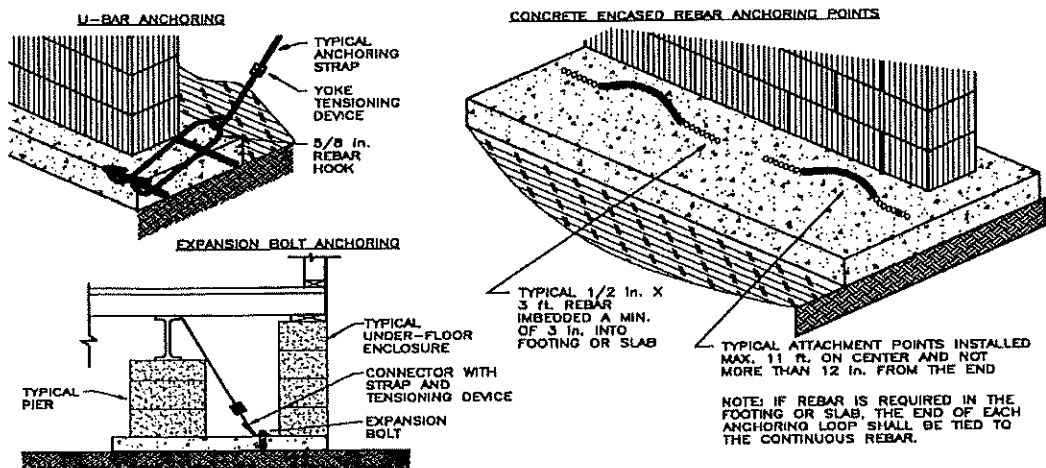


Figure 3-2.6 Typical Foundation Anchoring

Excerpted from HUD Federal Code 3285:

§ 3285.402 Ground anchor installations.

(a) *Ground anchor certification and testing.* Each ground anchor must be manufactured and provided with installation instructions, in accordance with its listing or certification. A nationally recognized testing agency must list, or a registered professional engineer or registered architect must certify, the ground anchor for use in a classified soil (refer to § 3285.202), based on a nationally recognized testing protocol, or a professional engineer or registered architect must certify that the ground anchor is capable of resisting all loads in paragraph (b) of this section for the soil type or classification.

(b) *Specifications for tie-down straps and ground anchors—*

(1) Ground anchors.

Ground anchors must be installed in accordance with their listing or certification, be installed to their full depth, be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated, and be capable of resisting a minimum ultimate load of 4,725 lbs. and a working load of 3,150 lbs., as installed, unless reduced capacities are noted in accordance with note 11 of Table 1 to this section or note 12 of Tables 2 and 3 to this section. The ultimate load and working load of ground anchors and anchoring equipment must be determined by a registered professional engineer, registered architect, or tested by a nationally recognized third-party testing agency in accordance with a nationally recognized testing protocol.

(2) Tie-down straps.

A 1¼ inch x 0.035 inch or larger steel strapping conforming to ASTM D 3953—97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4), Type 1, Grade 1, Finish B, with a minimum total capacity of 4,725 pounds (lbs.) and a working capacity of 3,150 pounds (lbs.) must be used. The tie-down straps must be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated. Slit or cut edges of coated strapping need not be zinc coated.

(c) *Number and location of ground anchors.*

(1) Ground anchor and anchor strap spacing must be:

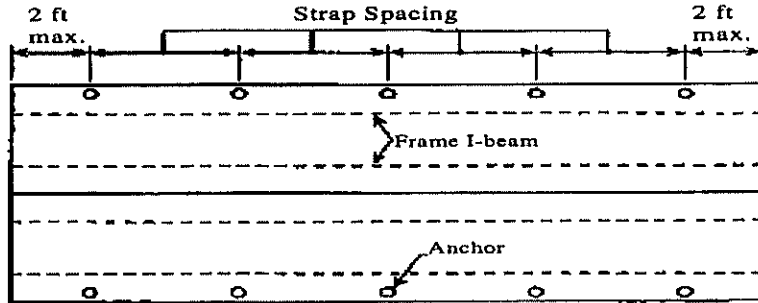
- i. No greater than the spacing shown in Tables 1 through 3 to this section and Figures A and B to this section; or
- ii. Designed by a registered engineer or architect, in accordance with acceptable engineering practice and the requirements of the MHCSS for any conditions that are outside the parameters and applicability of the Tables 1 through 3 to this section.

(2) The requirements of this section must be used to determine the maximum spacing of ground anchors and their accompanying anchor straps, based on the soil classification determined in accordance with § 3285.202:

- i. The installed ground anchor type and size (length) must be listed for use in the soil class at the site and for the minimum and maximum angle permitted between the diagonal strap and the ground; and
- ii. All ground anchors must be installed in accordance with their listing or certification and the ground anchor manufacturer installation instructions; and
- iii. If required by the ground anchor listing or certification, the correct size and type of stabilizer plate is installed. If metal stabilizer plates are used, they must be provided with protection against weather deterioration and corrosion at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz./ft.² of surface coated. Alternatively, ABS stabilizer plates may be used when listed and certified for such use.

(3) *Longitudinal anchoring.* Manufactured homes must also be stabilized against wind in the longitudinal direction in all Wind Zones. Manufactured homes located in Wind Zones II and III must have longitudinal ground anchors installed on the ends of the manufactured home transportable section(s) or be provided with alternative systems that are capable of resisting wind forces in the longitudinal direction.

Figure A to § 3285.402 Ground Anchor Locations and Spacing – Plan View.



- Notes:
1. Refer to Tables 1 for maximum ground anchor spacing.
 2. Longitudinal anchors not shown for clarity
 3. Vertical Straps are not required in Wind Zone I.
 4. The frame must be designed to prevent rotation of the main chassis beam, when the

TABLE 1 TO § 3285.402—MAXIMUM DIAGONAL TIE-DOWN STRAP SPACING, WIND ZONE I

Nominal floor width, single section/multi-section	Max. height from ground to diagonal strap attachment	I-beam spacing 82.5 in.	I-beam spacing 99.5 in.
12/24 ft. 144 in. nominal section(s)	25 in.	14 ft. 2 in	N/A
	33 in.	11 ft. 9 in	N/A
	46 in.	9 ft. 1 in	N/A
	67 in.	N/A	N/A
14/28 ft. 168 in. nominal section(s)	25 in.	18 ft. 2 in	15 ft. 11 in.
	33 in.	16 ft. 1 in	13 ft. 6 in.
	46 in.	13 ft. 3 in	10 ft. 8 in.
	67 in.	10 ft. 0 in	N/A
16/32 ft. 180 in. to 192 in. nominal section(s)	25 in.	N/A	19 ft. 5 in.
	33 in.	19 ft. 0 in	17 ft. 5 in.
	46 in.	16 ft. 5 in	14 ft. 7 in.
	67 in.	13 ft. 1 in	11 ft. 3 in.

NOTES:

1. Table is based on maximum 90 in. sidewall height.
2. Table is based on maximum 4 in. inset for ground anchor head from edge of floor or wall.
3. Table is based on main rail (I-beam) spacing per given column.
4. Table is based on maximum 4 in. eave width for single-section homes and maximum 12 in. for multi-section homes.
5. Table is based on maximum 20-degree roof pitch (4.3/12).
6. Table is based upon the minimum height between the ground and the bottom of the floor joist being 18 inches. Interpolation may be required for other heights from ground to strap attachment.
7. Additional tie-downs may be required per the home manufacturer instructions.
8. Ground anchors must be certified for these conditions by a professional engineer, architect, or listed by a nationally recognized testing laboratory.
9. Ground anchors must be installed to their full depth, and stabilizer plates, if required by the ground anchor listing or certification, must also be installed in accordance with the listing or certification and in accordance with the ground anchor and home manufacturer instructions.
10. Strapping and anchoring equipment must be certified by a registered professional engineer or registered architect, or listed by a nationally recognized testing agency to resist these specified forces, in accordance with testing procedures in ASTM D 3953-97, Standard Specification for Strapping, Flat Steel and Seals (incorporated by reference, see § 3285.4).
11. A reduced ground anchor or strap working load capacity will require reduced tie down strap and anchor spacing.
12. Ground anchors must not be spaced closer than the minimum spacing permitted by the listing or certification.
13. Table is based on a 3,150 lbs. working load capacity, and straps must be placed within 2 ft. of the ends of the home.
14. Table is based on a minimum angle of 30 degrees and a maximum of 60 degrees between the diagonal strap and the ground.
15. Table does not consider flood or seismic loads and is not intended for use in flood or seismic hazard areas. In those areas, the anchorage system is to be designed by a professional engineer or architect.