Bureau of Development Services FROM CONCEPT TO CONSTRUCTION

CODE GUIDE

TOPIC: Prefabricated Structures – OSSC/18/#1

CODE: Oregon Structural Specialty Code: 2014 Edition

APPROVED: September 1, 2015 *[Paul L. Scarlett]*, Director

REFERENCE: Oregon Structural Specialty Code (OSSC) – Chapter 18

SUBJECT: Soils and Foundation Requirements for Prefabricated Structures

QUESTION: What are the geotechnical and structural engineering requirements relating to soils and foundations for plan review of prefabricated structures?

RESPONSE: The engineering requirements relating to soils and foundations for plan review of prefabricated structures are as follows:

A. Geotechnical

1. **Placement of foundations directly on site soils without embedment.** Minimum footing embedment depth for single-story structures is 12 inches. Alternatively, footings for single-story structures may be placed on a thickness of at least 12 inches of non-frost-susceptible material such as 1½-inch minus crushed rock with less than 5 percent fines or on an existing asphalt or PCC pavement section. Footings for multi-story prefabricated structures shall be in accordance with the OSSC or an approved building code appeal.

2. **Proof-load testing of earth anchors used to resist wind and seismic loads.**
   a. Earth anchors used to resist wind and seismic loads must be proof load tested to verify adequate capacity. When a geotechnical engineering report is submitted and approved which includes a site-specific subsurface investigation and project specific recommendations for earth anchors, at least 50 percent of the earth anchors shall be proof load tested. When a geotechnical engineering report is not submitted or not approved, 100 percent of the earth anchors shall be proof load tested.

b. The permit drawings submitted shall specify the proof load testing equipment, procedures and acceptance criteria.

c. The equipment required for the proof load testing program is as follows:
   (1) Test equipment shall be capable of applying a load to the anchor equal to 200% of the design load (DL) indicated on the drawings.
   (2) The test equipment shall be capable of increasing or decreasing the applied load incrementally. The incremental control shall be sufficiently sensitive to make small adjustments necessary to maintain an applied load for a sustained period of time.
   (3) The test equipment shall employ a reaction system suitable for the range of test loads (up to 200% of DL) for the project. The direction of the applied load shall be collinear with the anchor at all times.
   (4) The test equipment shall include measuring devices sufficient to detect anchor movements of 0.01 inches in a direction collinear with the anchor shaft.
   (5) The test equipment shall be maintained in good working order and safe to operate at all times.

d. The proof load testing procedure is as follows:
   (1) All proof load tests shall be to at least 150% of DL.
   (2) The alignment load (AL) shall be between 2% and 10% of the DL. At the AL load, the total anchor movement (S_{T0}) shall be set to 0.00 inches.
   (3) The structural engineer shall determine the maximum acceptable values of total movement ($S_{T4\ MAX}$) at 1.00 DL.
   (4) The proof test sequence shall be as shown in Table 1, below. At load increments other than the maximum test load, the load shall be held just long enough to obtain the reading. The maximum load shall be held for ten (10) minutes. The jack shall be adjusted as necessary in order to maintain a constant load. The load-hold period shall start as soon as the maximum test load is applied. The ground anchor movement with respect to a fixed reference (S_{TN}) shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6, and 10 minutes.

Table 1

Load	Total Movement	Notes
AL	$S_{T0} = 0.00$	
0.25 DL	S_{T1}	
0.50 DL	S_{T2}	
0.75 DL	S_{T3}	
1.00 DL	S_{T4}	
1.50 DL	S_{T5}	
	S_{TN}	Readings during load hold

e. The proof load test shall be considered successful if the ground anchor movement at 1.00 DL is less than or equal to $S_{T4\ MAX,}$ the anchor can sustain the maximum load of 1.50 DL without continuous anchor movement, and the movement between the 1 minute and 10 minute reading at 1.50 DL is 0.04 inches or less. If the movement between 1 and 10 minutes exceeds 0.04 inches, the load may be held an additional 50 minutes and a creep curve plotted of movement versus the logarithm of time. If the creep curve shows a decreasing creep rate that is less than 0.08 inches per log cycle of time, the test may be considered successful.

f. Proof load testing records shall include the following:
   (1) Record anchor installation data including depth and installation torque (when available).
   (2) Record all load test anchor movements to the nearest 0.01 inch.
   (3) Submit a complete test record to the Engineer.

B. Structural

1. Foundation types for vertical support.

a. A single course of unreinforced, un-grouted CMU block is permitted to support pre-manufactured structures. A positive mechanical connection is required between each CMU block and any wood sleepers or bearing plates provided.

b. A single timber bearing plate is permitted for the support of pre-manufactured structures. All lumber in contact with soil, masonry or concrete or within 6 inches of exposed soil must be pressure treated or of naturally durable lumber. If multiple wood plates are provided they must be mechanically fastened to provide a composite member.

c. Jack stands are permitted for the permanent gravity support of modular structures. The allowable load capacity for jack standards may be based upon either: (1) a current evaluation report (ICC or equivalent) with a

rated capacity applicable to the intended installation, (2) the results of independent third-party testing (with an appropriate safety factor), or (3) engineering analysis.

d. Regardless of the foundation type utilized (masonry, timber, or jack stands), the required minimum foundation embedment depth shall be per the Geotechnical section above.

2. **Lateral bracing of foundations.**
When tie bracing straps are used to resist temporary lateral loads, their allowable load capacity shall be based upon either:

a. A current evaluation report (ICC or equivalent) with a rated capacity applicable to the intended installation;
b. The results of independent third party testing (with an appropriate safety factor); or
c. Engineering analysis. Ties shall have a turnbuckle or ratcheting system for tensioning the braces. Bracing ties shall be attached to a foundation anchor with a tested load capacity per the Geotechnical section above.

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