DRAFT #1

ADMINISTRATIVE BULLETIN

NO. AB-084

DATE : **October 12, 2010**

SUBJECT : **Plan Check; Inspection**

TITLE : **Guidelines for the Structural Review of Continuous Tiedown Systems Used to Resist Overturning of Light-Framed Wood Shear Walls**

PURPOSE : The purpose of this Administrative Bulletin is to establish guidelines for the structural design, analysis, and plan check review and approval of continuous tiedown systems used to resist overturning forces within light-framed wood shear walls caused by wind and seismic loads. This Administrative Bulletin is not applicable to light-framed wood shear walls framed with cold formed steel studs, nor to shear walls sheathed with material other than wood structural panels.

REFERENCES : 2010 *San Francisco Building Code (SFBC)*
2010 *California Building Code (CBC)*
Product Standard PS 1-95 (for Construction and Industrial Plywood) of the United States Department of Commerce, and National Institute of Science and Technology Calculation of Diaphragm Action, an Engineering Standard of the International Code Council
(1997 *Uniform Building Code (UBC), Volume 3, UBC Standard 23-2 "Construction and Industrial Plywood"*)
Federal Emergency Management Agency, *FEMA-450-1/2003 Ed., NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, Part 1: Provisions*
Federal Emergency Management Agency, *FEMA-450-2/2003 Ed., NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, Part 2: Commentary*
Nelson, R. F., Patel, S. T., *"Continuous Tie-Down Systems . . . for Wood Panel Shear Walls in Multi Story Structures"*, Structure, March 2003, pages 18 - 20.
Ghosh, A., Pryor, S., Arevalo, R., *"Multi-Story Light-Frame Construction, Understanding Continuous Tiedown Systems"*, Structure, June 2006, pages 14 – 19.

DISCUSSION : Light-framed wood shear walls, when incorporated into a structure's lateral

force resisting system, will experience overturning forces arising from wind and seismic loads on the structure. These overturning forces are typically resisted by the use of tiedown devices that anchor the ends of the shear walls to the foundation. A "conventional" tiedown system typically utilizes cold-formed metal hardware bolted to the wood end posts of the shear wall and anchored to the foundation. Tensile overturning forces are carried by the wood end posts. A "continuous tiedown" system utilizes a continuous or coupled rod or cable assembly comprising bearing plates, shrinkage compensating devices, and couplers, wherein tensile overturning forces are carried by the rod(s) or cable(s), not the wood end posts. Continuous tiedown systems are not explicitly addressed by current prescriptive code requirements.

Requirements

Plan check review and approval of continuous tiedown systems for any project shall be on a case-by-case basis in accordance with this Administrative Bulletin. The following requirements shall be the basis for plan check review and approval of continuous tiedown systems used within light-framed wood shear wall systems.

1. Shear walls shall be designed to comply with the drift requirements of ASCE 7-05 Section 12.8.6. Shear wall displacements shall be computed in accordance with UBC 23.223, found in UBC Volume 3. The component "d_a" of UBC 23.223 shall include, but not be limited to, elongation of the rod or cable, and deformations and displacements of shrinkage compensating devices, coupling hardware and steel bearing plates.

2. In a multi-story shear wall installation, the continuous tiedown system shall be restrained by bearing plates at each story of the multi-story shear wall. Skipping of stories, where bearing plates are omitted at intermediate stories, resulting in multiple stories being tied together, is prohibited. Shrinkage compensating devices shall be provided at each story of the shear wall.

3. The computed rod or cable elongation or stretch, together with computed deformations of shrinkage compensating device, coupling hardware and steel bearing plate, within any story under strength level (Load and Resistance Factor Design) short-term duration loading, such as wind or earthquake loads, shall not exceed 0.185 inch. For working stress level (Allowable Stress Design) short-term loading, elongation or stretch within any story shall not exceed 0.132 inch. Elongation or stretch shall be computed as the product PL/EA, where P is the axial load (pounds), L is the initial rod or cable length at the story under consideration (inches), E is the rod or cable modulus of elasticity (psi), and A is the nominal cross sectional area of the rod or cable (in^2).

4. Calculations demonstrating compliance with the foregoing shall be provided for plan check review.

5. Construction documents, signed and sealed by the engineer of record for the design of the building, shall specify the particular proprietary system or systems.

6. Any modification to the tiedown system proposed after a building permit has been approved shall require filing of a new permit application documenting the proposed modification. Plan check review of the proposed modification shall be in accordance with the requirements of this Administrative Bulletin.

7. Mixing of conventional and continuous tiedown systems within a common shear wall is prohibited.

8. In addition to other inspections required by SFBC 1704 ~~1701~~, special inspection of continuous tiedown systems shall be provided. In addition to structural observations required by SFBC 1709 ~~1702~~, the engineer of record for the design of the building shall provide structural observation of continuous tiedown installations, including shear wall boundary nailing, shear wall end post sizes, bearing plates, couplers, shrinkage compensating devices, and anchor bolts, to verify conformance of the installed tiedown system to the structural design intent.

_____

Vivian L. Day, C.B.O. Date
Director
Department of Building Inspection

Approved by the Building Inspection Commission

_____