



LOS ANGELES REGIONAL UNIFORM CODE PROGRAM

PROPOSED STRUCTURAL AMENDMENTS TO THE 2007 CALIFORNIA BUILDING CODE

Final Draft: October 22, 2007

PREPARED BY:



**ICC LA BASIN CHAPTER
STRUCTURAL CODE COMMITTEE**

This is a working document under consideration by the ICC LA Basin Chapter Structural Code Committee.

It is made available solely to solicit comments from interested parties, and may NOT be relied upon or utilized for any other purpose.

Draft documents may change significantly in subsequent versions.

PREFACE

The City of Los Angeles Department of Building and Safety, Los Angeles County Building and Safety Division, the City of Long Beach Department of Planning and Building, and the City of Santa Monica Building and Safety Division, in cooperation with major jurisdictions in the region, are continuing efforts to create uniformity of Building Codes and regulation in the entire Los Angeles region. This is an exciting regulatory streamlining effort that:

1. Creates uniformity of building, plumbing, mechanical and electrical codes in most of the jurisdictions in the region.
2. Reduces the total number of local amendments to the codes from over 1000 to less than 50 (96% reduction in local amendments).
3. Has received support from 85 jurisdictions representing over 98% of the population in Los Angeles County.
4. Over 58 jurisdictions have actively participated in formulation and implementation of this program.
5. Major jurisdictions in the region have been active participants in the program including: City of Los Angeles, County of Los Angeles, Long Beach, Santa Monica, Torrance, San Marino and Simi Valley.
6. With construction valuation of over \$5 billion in the region, conservatively assuming that this program produces a 1% construction cost savings, there will be an estimated cost saving of \$50 million per year.

STATEMENT ON USE OF DOCUMENT

The primary purpose of the ICC LA Basin Chapter Structural Code Committee is to serve and benefit its members. To this end, the Structural Code Committee provides a forum for the exchange, consideration, and discussion of ideas and proposals that are relevant to the construction industry and the consensus of which forms the basis for the proposed amendments contained in this document.

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September 14, 2007

TO: ICC LA BASIN CHAPTER
BOARD MEMBERS

FROM: ICC LA BASIN CHAPTER
STRUCTURAL CODE COMMITTEE

SUBJECT: Proposed Structural Amendments to the 2007 Edition of the California Building Codes for Consideration of Local Adoption in the Los Angeles Region

DISCUSSION

Section 17958 of the California Health and Safety Code requires that the latest California Building Standards Codes apply to local construction 180 days after they become effective at the State level. The California Building Standards Commission has adopted the 2007 Edition of the California Building Codes. State Law requires that these Codes become effective at the local level on January 1, 2008.

State Law requires that local amendments to the California Building Standards Codes be enacted only when an express finding is made that such modifications or changes are reasonably necessary because of local climatic, geological or topographical conditions.

The ICC LA Basin Chapter Structural Code Committee is recommending that the 2007 LARUCP structural amendments contained in this document, some of which continues the amendments enacted during the 1999 and 2002 code adoption cycle, be considered for local adoption to protect the community within the Los Angeles region from the hazards of future earthquakes. In addition, the lessons learned from the 1994 Northridge Earthquake have been refined with studies and tests that continued since the last code adoption cycle. The results of these studies and tests necessitate adoption of further amendments to the structural requirement of the code. The proposed structural amendments language, reasons and findings are detailed in this document.

The recommended structural amendments have been widely circulated and/or discussed over the past several months with various local jurisdictional members, structural engineering associations or committees such as, but not limited to, Seismology, Steel, Light Frame Construction, Quality Assurance and Building Code Committee, design professionals in the construction/engineering industry, and other interested groups or individuals.

The ICC LA Basin Chapter Structural Code Committee would like to express its gratitude and appreciation to all the participating committee members and correspondents that spent countless hours over the past several months assisting in the review, discussion, evaluation and drafting of the proposed structural amendments to the 2007 Edition of the California Building Codes.

Special thanks goes out to the following individuals without whose support and effort the recommendations presented herein would not be possible.

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2007 LARUCP 16-01. Section 1613.6.1 of the 2007 California Building Code is amended to read as follows:

1613.6.1 Assumption of flexible diaphragm. Add the following text at the end of Section 12.3.1.1 of ASCE 7:

Diaphragms constructed of wood structural panels or untopped steel decking shall also be permitted to be idealized as flexible, provided all of the following conditions are met:

1. Toppings of concrete or similar materials are not placed over wood structural panel diaphragms except for nonstructural toppings no greater than 1 ½ inches (38 mm) thick.
2. Each line of vertical elements of the lateral-force-resisting system complies with the allowable story drift of Table 12.12-1.
3. Vertical elements of the lateral-force-resisting system are light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheets.
4. Portions of wood structural panel diaphragms that cantilever beyond the vertical elements of the lateral-force-resisting system are designed in accordance with Section 2305.2.5 of the *California Building Code*.

Exception: *In lieu of Section 2305.2.5, flexible diaphragm assumption is permitted to be used for buildings up to two stories in height provided cantilevered diaphragms supporting lateral-force-resisting elements from above does not exceed 15 percent of the distance between lines of lateral-force-resisting elements from which the diaphragm cantilevers nor one-fourth the diaphragm width perpendicular to the overhang.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This local amendment carries forward the previous 1999 and 2002 LARUCP amendment to limit the maximum span of cantilevered diaphragms supporting lateral-force-resisting elements from above, thereby addressing the problem of poor performance of diaphragms transmitting seismic loads to lateral-force-resisting elements below. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to limit the maximum span of cantilevered diaphragms that supports lateral-force-resisting elements from above need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-02. Section 1613.7 is added to Chapter 16 of the 2007 California Building Code to read as follows:

1613.7 Suspended Ceilings. *Minimum design and installation standards for suspended ceilings shall be determined in accordance with the requirements of Chapter 25 of this Code and this subsection.*

1613.7.1 Scope. *This part contains special requirements for suspended ceilings and lighting systems. Provisions of Section 13.5.6 of ASCE 7 shall apply except as modified herein.*

1613.7.2 General. *The suspended ceilings and lighting systems shall be limited to 6 feet (1828 mm) below the structural deck unless the lateral bracing is designed by a licensed engineer or architect.*

1613.7.3 Design and Installation Requirements.

1613.7.3.1 Bracing at Discontinuity. *Positive bracing to the structure shall be provided at changes in the ceiling plane elevation or at discontinuities in the ceiling grid system.*

1613.7.3.2 Support for Appendages. *Cable trays, electrical conduits and piping shall be independently supported and independently braced from the structure.*

1613.7.3.3 Sprinkler Heads. *All sprinkler heads (drops) except fire-resistance-rated floor/ceiling or roof/ceiling assemblies, shall be designed to allow for free movement of the sprinkler pipes with oversize rings, sleeves or adaptors through the ceiling tile, in accordance with Section 13.5.6.2.2 (e) of ASCE 7.*

Sprinkler heads penetrating fire-resistance-rated floor/ceiling or roof/ceiling assemblies shall comply with Section 712 of this Code.

1613.7.3.4 Perimeter Members. *A minimum wall angle size of at least a two inch (51 mm) horizontal leg shall be used at perimeter walls and interior full height partitions. The first ceiling tile shall maintain 3/4 inch (19 mm) clear from the finish wall surface. An equivalent alternative detail that will provide sufficient movement due to anticipated lateral building displacement may be used in lieu of the long leg angle subject to the approval of the Superintendent of Building.*

1613.7.4 Special Requirements for Means of Egress. *Suspended ceiling assemblies located along means of egress serving an occupant load of 30 or more shall comply with the following provisions.*

1613.7.4.1 General. *Ceiling suspension systems shall be connected and braced with vertical hangers attached directly to the structural deck along the means of egress serving an occupant load of 30 or more and at lobbies accessory to Group A Occupancies. Spacing of vertical hangers shall not exceed 2 feet (610 mm) on center along the entire length of the suspended ceiling assembly located along the means of egress or at the lobby.*

1613.7.4.2 Assembly Device. *All lay-in panels shall be secured to the suspension ceiling assembly with two hold-down clips minimum for each tile within a 4-foot (1219 mm) radius of the exit lights and exit signs.*

1613.7.4.3 Emergency Systems. *Independent supports and braces shall be provided for light fixtures required for exit illumination. Power supply for exit illumination shall comply with the requirements of Section 1006.3 of this Code.*

1613.7.4.4 Supports for Appendage. *Separate support from the structural deck shall be provided for all appendages such as light fixtures, air diffusers, exit signs, and similar elements.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The California Building Code has no information regarding the design requirements for ceiling suspension systems for seismic loads. It is through the experience of prior earthquakes, such as the Northridge Earthquake, that this amendment is proposed so as to minimize the amount of bodily and building damage within the spaces in which this type of ceiling will be installed.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification requiring design requirements for ceiling suspension systems to resist seismic loads need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-03. Section 1613.8 is added to Chapter 16 of the 2007 California Building Code to read as follows:

1613.8 Seismic Design Provisions for Hillside Buildings.

1613.8.1 Purpose. *The purpose of this section is to establish minimum regulations for the design and construction of new buildings and additions to existing buildings when constructing such buildings on or into slopes steeper than one unit vertical in three units horizontal (33.3%). These regulations establish minimum standards for seismic force resistance to reduce the risk of injury or loss of life in the event of earthquakes.*

1613.8.2 Scope. *The provisions of this section shall apply to the design of the lateral-force-resisting system for hillside buildings at and below the base level diaphragm. The design of the lateral-force-resisting system above the base level diaphragm shall be in accordance with the provisions for seismic and wind design as required elsewhere in this division.*

EXCEPTION: *Non-habitable accessory buildings and decks not supporting or supported from the main building are exempt from these regulations.*

1613.8.3 Definitions. *For the purposes of this section certain terms are defined as follows:*

BASE LEVEL DIAPHRAGM *is the floor at, or closest to, the top of the highest level of the foundation.*

DIAPHRAGM ANCHORS *are assemblies that connect a diaphragm to the adjacent foundation at the uphill diaphragm edge.*

DOWNHILL DIRECTION *is the descending direction of the slope approximately perpendicular to the slope contours.*

FOUNDATION *is concrete or masonry which supports a building, including footings, stem walls, retaining walls, and grade beams.*

FOUNDATION EXTENDING IN THE DOWNHILL DIRECTION *is a foundation running downhill and approximately perpendicular to the uphill foundation.*

HILLSIDE BUILDING *is any building or portion thereof constructed on or into a slope steeper than one unit vertical in three units horizontal (33.3%). If only a portion of the building is supported on or into the slope, these regulations apply to the entire building.*

PRIMARY ANCHORS *are diaphragm anchors designed for and providing a direct connection as described in Sections 1613.8.5 and 1613.8.7.3 between the diaphragm and the uphill foundation.*

SECONDARY ANCHORS *are diaphragm anchors designed for and providing a redundant diaphragm to foundation connection, as described in Sections 1613.8.6 and 1613.8.7.4.*

UPHILL DIAPHRAGM EDGE is the edge of the diaphragm adjacent and closest to the highest ground level at the perimeter of the diaphragm.

UPHILL FOUNDATION is the foundation parallel and closest to the uphill diaphragm edge.

1613.8.4 Analysis and Design.

1613.8.4.1 General. Every hillside building within the scope of this section shall be analyzed, designed, and constructed in accordance with the provisions of this division. When the code-prescribed wind design produces greater effects, the wind design shall govern, but detailing requirements and limitations prescribed in this and referenced sections shall be followed.

1613.8.4.2 Base Level Diaphragm-Downhill Direction. The following provisions shall apply to the seismic analysis and design of the connections for the base level diaphragm in the downhill direction.

1613.8.4.2.1 Base for Lateral Force Design Defined. For seismic forces acting in the downhill direction, the base of the building shall be the floor at or closest to the top of the highest level of the foundation.

1613.8.4.2.2 Base Shear. In developing the base shear for seismic design, the response modification coefficient (R) shall not exceed 4.5 for bearing wall and building frame systems. The total base shear shall include the forces tributary to the base level diaphragm including forces from the base level diaphragm.

1613.8.5 Base Shear Resistance-Primary Anchors.

1613.8.5.1 General. The base shear in the downhill direction shall be resisted through primary anchors from diaphragm struts provided in the base level diaphragm to the foundation.

1613.8.5.2 Location of Primary Anchors. A primary anchor and diaphragm strut shall be provided in line with each foundation extending in the downhill direction. Primary anchors and diaphragm struts shall also be provided where interior vertical lateral-force-resisting elements occur above and in contact with the base level diaphragm. The spacing of primary anchors and diaphragm struts or collectors shall in no case exceed 30 feet (9144 mm).

1613.8.5.3 Design of Primary Anchors and Diaphragm Struts. Primary anchors and diaphragm struts shall be designed in accordance with the requirements of Section 1613.8.8.

1613.8.5.4 Limitations. The following lateral-force-resisting elements shall not be designed to resist seismic forces below the base level diaphragm in the downhill direction:

1. Wood structural panel wall sheathing.

2. Cement plaster and lath.

3. Gypsum wallboard, and

4. Tension only braced frames.

Braced frames designed in accordance with the requirements of Section 2205.2.2 may be used to transfer forces from the primary anchors and diaphragm struts to the foundation provided lateral forces do not induce flexural stresses in any member of the frame or in the diaphragm struts. Deflections of frames shall account for the variation in slope of diagonal members when the frame is not rectangular.

1613.8.6. Base Shear Resistance-Secondary Anchors.

1613.8.6.1 General. In addition to the primary anchors required by Section 1613.8.5, the base shear in the downhill direction shall be resisted through secondary anchors in the uphill foundation connected to diaphragm struts in the base level diaphragm.

EXCEPTION: Secondary anchors are not required where foundations extending in the downhill direction spaced at not more than 30 feet (9144 mm) on center extend up to and are directly connected to the base level diaphragm for at least 70% of the diaphragm depth.

1613.8.6.2 Secondary Anchor Capacity and Spacing. Secondary anchors at the base level diaphragm shall be designed for a minimum force equal to the base shear, including forces tributary to the base level diaphragm, but not less than 600 pounds per lineal foot (8.76 kN/m). The secondary anchors shall be uniformly distributed along the uphill diaphragm edge and shall be spaced a maximum of four feet (1219 mm) on center.

1613.8.6.3 Design. Secondary anchors and diaphragm struts shall be designed in accordance with Section 1613.8.8.

1613.8.7 Diaphragms Below the Base Level-Downhill Direction. The following provisions shall apply to the lateral analysis and design of the connections for all diaphragms below the base level diaphragm in the downhill direction.

1613.8.7.1 Diaphragm Defined. Every floor level below the base level diaphragm shall be designed as a diaphragm.

1613.8.7.2 Design Force. Each diaphragm below the base level diaphragm shall be designed for all tributary loads at that level using a minimum seismic force factor not less than the base shear coefficient.

1613.8.7.3 Design Force Resistance-Primary Anchors. The design force described in Section 1613.8.7.2 shall be resisted through primary anchors from diaphragm struts provided in each diaphragm to the foundation. Primary anchors shall be provided and designed in accordance with the requirements and limitations of Section 1613.8.5.

1613.8.7.4 Design Force Resistance-Secondary Anchors.

1613.8.7.4.1 General. *In addition to the primary anchors required in Section 1613.8.7.3, the design force in the downhill direction shall be resisted through secondary anchors in the uphill foundation connected to diaphragm struts in each diaphragm below the base level.*

EXCEPTION: Secondary anchors are not required where foundations extending in the downhill direction, spaced at not more than 30 feet (9144 mm) on center, extend up to and are directly connected to each diaphragm below the base level for at least 70% of the diaphragm depth.

1613.8.7.4.2 Secondary Anchor Capacity. *Secondary anchors at each diaphragm below the base level diaphragm shall be designed for a minimum force equal to the design force but not less than 300 pounds per lineal foot (4.38 kN/m). The secondary anchors shall be uniformly distributed along the uphill diaphragm edge and shall be spaced a maximum of four feet (1219 mm) on center.*

1613.8.7.4.3 Design. *Secondary anchors and diaphragm struts shall be designed in accordance with Section 1613.8.8.*

1613.8.8 Primary and Secondary Anchorage and Diaphragm Strut Design. *Primary and secondary anchors and diaphragm struts shall be designed in accordance with the following provisions:*

- 1. Fasteners.** *All bolted fasteners used to develop connections to wood members shall be provided with square plate washers at all bolt heads and nuts. Washers shall be minimum 3/16 inch (4.8 mm) thick and two inch (51 mm) square for 1/2-inch (12.7 mm) diameter bolts, and 1/4-inch (6.4 mm) thick and 2-1/2-inch (64 mm) square for 5/8-inch (15.9 mm) diameter or larger bolts. Nuts shall be wrench tightened prior to covering.*
- 2. Fastening.** *The diaphragm to foundation anchorage shall not be accomplished by the use of toenailing, nails subject to withdrawal, or wood in cross-grain bending or cross-grain tension.*
- 3. Size of Wood Members.** *Wood diaphragm struts collectors, and other wood members connected to primary anchors shall not be less than three-inch (76 mm) nominal width. The effects of eccentricity on wood members shall be evaluated as required per Item 9.*
- 4. Design.** *Primary and secondary anchorage, including diaphragm struts, splices, and collectors shall be designed for 125% of the tributary force.*
- 5. Allowable Stress Increase.** *The one-third allowable stress increase permitted under Section 1605.3.2 shall not be taken when the working (allowable) stress design method is used.*

6. Seismic Load Factor. The seismic load factor shall be 1.7 for steel and concrete anchorage when the strength design method is used.
7. Primary Anchors. The load path for primary anchors and diaphragm struts shall be fully developed into the diaphragm and into the foundation. The foundation must be shown to be adequate to resist the concentrated loads from the primary anchors.
8. Secondary Anchors. The load path for secondary anchors and diaphragm struts shall be fully developed in the diaphragm but need not be developed beyond the connection to the foundation.
9. Symmetry. All lateral force foundation anchorage and diaphragm strut connections shall be symmetrical. Eccentric connections may be permitted when demonstrated by calculation or tests that all components of force have been provided for in the structural analysis or tests.
10. Wood Ledgers. Wood ledgers shall not be used to resist cross-grain bending or cross-grain tension.

1613.8.9 Lateral-Force-Resisting Elements Normal to the Downhill Direction.

1613.8.9.1 General. In the direction normal to the downhill direction, lateral-force-resisting elements shall be designed in accordance with the requirements of this section.

1613.8.9.2 Base Shear. In developing the base shear for seismic design, the response modification coefficient (R) shall not exceed 4.5 for bearing wall and building frame systems.

1613.8.9.3 Vertical Distribution of Seismic Forces. For seismic forces acting normal to the downhill direction the distribution of seismic forces over the height of the building using Section 12.8.3 of ASCE 7 shall be determined using the height measured from the top of the lowest level of the building foundation.

1613.8.9.4 Drift Limitations. The story drift below the base level diaphragm shall not exceed 0.005 times the story height. The total drift from the base level diaphragm to the top of the foundation shall not exceed 3/4 inch (19 mm). Where the story height or the height from the base level diaphragm to the top of the foundation varies because of a stepped footing or story offset, the height shall be measured from the average height of the top of the foundation. The story drift shall not be reduced by the effect of horizontal diaphragm stiffness.

Where code-prescribed wind forces govern the design of the lateral force resisting system normal to the downhill direction, the drift limitation shall be 0.0025 for the story drift and the total drift from the base level diaphragm to the top of the foundation may exceed 3/4 inch (19 mm) when approved by the Department. In no case, however, shall the drift limitations for seismic forces be exceeded.

1613.8.9.5 Distribution of Lateral Forces.

1613.8.9.5.1 General. *The design lateral force shall be distributed to lateral-force-resisting elements of varying heights in accordance with the stiffness of each individual element.*

1613.8.9.5.2 Wood Structural Panel Sheathed Walls. *The stiffness of a stepped wood structural panel shear wall may be determined by dividing the wall into adjacent rectangular elements, subject to the same top of wall deflection. Deflections of shear walls may be estimated by Section 2305.3.2. Sheathing and fastening requirements for the stiffest section shall be used for the entire wall. Each section of wall shall be anchored for shear and uplift at each step. The minimum horizontal length of a step shall be eight feet (2438 mm) and the maximum vertical height of a step shall be two feet, eight inches (813 mm).*

1613.8.9.5.3 Reinforced Concrete or Masonry Shear Walls. *Reinforced concrete or masonry shear walls shall have forces distributed in proportion to the rigidity of each section of the wall.*

1613.8.9.6 Limitations. *The following lateral force-resisting-elements shall not be designed to resist lateral forces below the base level diaphragm in the direction normal to the downhill direction:*

- 1. Cement plaster and lath.*
- 2. Gypsum wallboard, and*
- 3. Tension-only braced frames.*

Braced frames designed in accordance with the requirements of Chapter 22 of this Code may be designed as lateral-force-resisting elements in the direction normal to the downhill direction, provided lateral forces do not induce flexural stresses in any member of the frame. Deflections of frames shall account for the variation in slope of diagonal members when the frame is not rectangular.

1613.8.10 Specific Design Provisions.

1613.8.10.1 Footings and Grade Beams. *All footings and grade beams shall comply with the following:*

- 1. Grade beams shall extend at least 12 inches (305 mm) below the lowest adjacent grade and provide a minimum 24-inch (610 mm) distance horizontally from the bottom outside face of the grade beam to the face of the descending slope.*
- 2. Continuous footings shall be reinforced with at least two No. 4 reinforcing bars at the top and two No. 4 reinforcing bars at the bottom.*
- 3. All main footing and grade beam reinforcement steel shall be bent into the intersecting footing and fully developed around each corner and intersection.*

4. All concrete stem walls shall extend from the foundation and reinforced as required for concrete or masonry walls.

1613.8.10.2 Protection Against Decay and Termites. All wood to earth separation shall comply with the following:

1. Where a footing or grade beam extends across a descending slope, the stem wall, grade beam, or footing shall extend up to a minimum 18 inches (457 mm) above the highest adjacent grade.

EXCEPTION: At paved garage and doorway entrances to the building, the stem wall need only extend to the finished concrete slab, provided the wood framing is protected with a moisture proof barrier.

2. Wood ledgers supporting a vertical load of more than 100 pounds per lineal foot (1.46 kN/m) and located within 48 inches (1219 mm) of adjacent grade are prohibited. Galvanized steel ledgers and anchor bolts, with or without wood nailers, or treated or decay resistant sill plates supported on a concrete or masonry seat, may be used.

1613.8.10.3 Sill Plates. All sill plates and anchorage shall comply with the following:

1. All wood framed walls, including nonbearing walls, when resting on a footing, foundation, or grade beam stem wall, shall be supported on wood sill plates bearing on a level surface.
2. Power-driven fasteners shall not be used to anchor sill plates except at interior nonbearing walls not designed as shear walls.

1613.8.10.4 Column Base Plate Anchorage. The base of isolated wood posts (not framed into a stud wall) supporting a vertical load of 4000 pounds (17.8 kN) or more and the base plate for a steel column shall comply with the following:

1. When the post or column is supported on a pedestal extending above the top of a footing or grade beam, the pedestal shall be designed and reinforced as required for concrete or masonry columns. The pedestal shall be reinforced with a minimum of four No. 4 bars extending to the bottom of the footing or grade beam. The top of exterior pedestals shall be sloped for positive drainage.
2. The base plate anchor bolts or the embedded portion of the post base, and the vertical reinforcing bars for the pedestal, shall be confined with two No. 4 or three No. 3 ties within the top five inches (127 mm) of the concrete or masonry pedestal. The base plate anchor bolts shall be embedded a minimum of 20 bolt diameters into the concrete or masonry pedestal. The base plate anchor bolts and post bases shall be galvanized and each anchor bolt shall have at least two galvanized nuts above the base plate.

1613.8.10.5 Steel Beam to Column Supports. All steel beam to column supports shall be positively braced in each direction. Steel beams shall have stiffener plates installed

on each side of the beam web at the column. The stiffener plates shall be welded to each beam flange and the beam web. Each brace connection or structural member shall consist of at least two 5/8 inch (15.9 mm) diameter machine bolts.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This technical amendment is for buildings constructed on hillsides. Due to the local topographical and geological conditions of the sites within the Los Angeles/Long Beach region and their probabilities for earthquakes, this amendment is required to address and clarify special needs for buildings constructed on the hillside locations. A joint Structural Engineers Association of Southern California (SEAOSC), Los Angeles County and Los Angeles City Task Force investigated the performance of hillside building failures after the Northridge earthquake. Numerous hillside failures resulted in loss of life and millions of dollars in damage. These criteria were developed to minimize the damage to these structures and have been in use by the City of LA for several years. The proposed modification, which is an administrative revision of a previous 1999 and 2002 LARUCP provision, is amended here to clarify any issues that are omitted or left out of the California Building Code.

FINDINGS:

Local Topographical and Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification addresses special design criteria for hillside buildings, which is not address in the California Building Code, and need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-04. Section 1614, 1614.1 and 1614.1.1 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.1 ASCE 7, 12.2.3.1, Exception 3. *Modify ASCE 7 Section 12.2.3.1 Exception 3 to read as follows:*

3. Detached one and two family dwellings up to two stories in height of light frame construction.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Observed damages to one and two family dwellings of light frame construction after the Northridge Earthquake may have been partially attributed to vertical irregularities common to this type of occupancy and construction. In an effort to improve quality of construction and incorporate lesson learned from studies after the Northridge Earthquake, the proposed modification to ASCE 7-05 Section 12.2.3.1 by limiting the number of stories and height of the structure to two stories will significantly minimize the impact of vertical irregularities and concentration of inelastic behavior from mixed structural systems.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to limit mixed structural system to two stories need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-05. Section 1614, 1614.1 and 1614.1.2 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.2 ASCE 7, 12.3.1.1. *Modify ASCE 7 Section 12.3.1.1 to read as follows:*

12.3.1.1 Flexible Diaphragm Condition. Diaphragm constructed of untopped steel decking or wood structural panels are permitted to be idealized as flexible in structures in which the vertical elements are steel or composite steel and concrete braced frames, or concrete, masonry, steel, or composite shear walls. Diaphragms of wood structural panels or untopped steel decks in one- and two-family residential buildings of light-frame construction shall also be permitted to be idealized as flexible.

Flexible diaphragm assumption is permitted to be used for buildings up to two stories in height provided cantilevered diaphragms supporting lateral-force-resisting elements from above does not exceed 15 percent of the distance between lines of lateral-force-resisting elements from which the diaphragm cantilevers nor one-fourth the diaphragm width perpendicular to the overhang.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This local amendment carries forward the previous 1999 and 2002 LARUCP amendment to limit the maximum span of cantilevered diaphragms supporting lateral-force-resisting elements from above, thereby addressing the problem of poor performance of diaphragms transmitting seismic loads to lateral-force-resisting elements below. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to limit the maximum span of cantilevered diaphragms that supports lateral-force-resisting elements from above need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-06. Section 1614, 1614.1 and 1614.1.3 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.3 ASCE 7, Section 12.8.1.1. *Modify ASCE 7 Section 12.8.1.1 by amending Equation 12.8-5 as follows:*

$$C_s = 0.04 \underline{0.044} S_{DS} I \geq 0.01 \quad (\text{Eq. 12.8-5})$$

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Results from the 75% Draft of ATC-63, Quantification of Building System Performance and Response Parameters, indicate that tall buildings may fail at an unacceptably too low of a seismic level unless the minimum base shear level is increased to the value used in ASCE 7-02. Thus it is recommended that the adoption of the minimum base shear is appropriate due to the recent research in PEER and the ATC 63 project. The conclusion suggested that the reduction of the base shear in the previous code led to a trend in which tall buildings had decreasing safety with increasing height. To minimize the potential increased fire-life safety associated with such a seismic failure of tall buildings, this proposed modification increases the minimum base shear level to be consistent with previous edition of the building codes. The propose amendment to the current ASCE 7 is very well supported by the engineering community. Both SEAOSC and other structural engineer organizations from the state level are in support of adopting the revised minimum base shear.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Due to the large numbers of tall buildings in this region as well as the increased fire-life safety associated with such a seismic failure, the proposed modification to have a higher minimum base shear consistent with previous edition of the building codes need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-07. Section 1614, 1614.1 and 1614.1.4 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.4 ASCE 7, Table 12.8-2. *Modify ASCE 7 Table 12.8-2 by adding the following:*

Structure Type	C_t	x
Eccentrically braced steel frames <i>and buckling-restrained braced frames</i>	0.03 (0.0731) ^a	0.75

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The Buckling Restrained Steel Frame (BRBF) system was first approved for the 2003 NEHRP Provisions. The values for the approximate period perimeters C_t and x were also approved as part of that original BSSC Proposal 6-6R (2003). It seems to be a simple oversight that these parameters were not carried forward into the 2005 edition of ASCE 7-05. Currently, these two factors can be found in Appendix R of AISC 341-05. There, they function only as a placeholder that will be removed in the next version upon approval by ASCE 7 Task Committee on Seismic. The SEAOSC Steel Committee supports the proposed modification.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Clarification on the design parameters for BRBF members need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-08. Section 1614, 1614.1 and 1614.1.5 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.5 ASCE 7, Section 12.8.7. *Modify ASCE 7 Section 12.8.7 by amending Equation 12.8-16 as follows:*

$$\theta = \frac{P_x \Delta I}{V_x h_{sx} C_d}$$

(12.8-16)

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Importance Factor, I, seems to have been dropped from equation 12.8-16 by mistake while transcribing it from NEHRP Recommended Provisions (2003) equation 5.2-16. For buildings with importance factor, I, higher than 1.0, stability coefficient should include the importance factor. The proposed modification is recommended and adopted by OSPHD and DSA-SS as reflected in Section 1614A1.8 to Chapter 16 of the 2007 California Building Code. Furthermore, the SEAOSC Steel Committee supports the proposed modification.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Considering that certain important and critical buildings and structures must be operational in the event of an emergency, the need to incorporate this modification into the code will help to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-09. Section 1614, 1614.1 and 1614.1.6 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.6 ASCE 7, 12.11.2.2.3. *Modify ASCE 7 Section 12.11.2.2.3 to read as follows:*

12.11.2.2.3 Wood Diaphragms. In wood diaphragms, the continuous ties shall be in addition to the diaphragm sheathing. Anchorage shall not be accomplished by use of toe nails or nails subject to withdrawal nor shall wood ledgers or framing be used in cross-grain bending or cross-grain tension. The diaphragm sheathing shall not be considered effective as providing ties or struts required by this section.

For wood diaphragms supporting concrete or masonry walls, wood diaphragms shall comply with the following:

- 1. The spacing of continuous ties shall not exceed 40 feet. Added chords of diaphragms may be used to form subdiaphragms to transmit the anchorage forces to the main continuous crossties.*
- 2. The maximum diaphragm shear used to determine the depth of the subdiaphragm shall not exceed 75% of the maximum diaphragm shear.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

A joint Structural Engineers Association of Southern California (SEAOSC), Los Angeles County and Los Angeles City Task Force investigated the performance of concrete and masonry construction with flexible wood diaphragm failures after the Northridge earthquake. It was concluded at that time that continuous ties are needed at specified spacing to control cross grain tension in the interior of the diaphragm. Additionally, subdiaphragm shears need to be limited to control combined orthogonal stresses within the diaphragm. Recognizing the importance and need to continue the recommendation made by the task force, but also taking into consideration the improve performance and standards for diaphragm construction today, a proposal to increase the continuous tie spacing limit to 40 ft in lieu of 25 ft and to use 75% of the allowable code diaphragm shear to determine the depth of the sub-diaphragm in lieu of the 300 plf is deemed appropriate and acceptable.

These requirements are variations of Items 4 and 7 of Section 1633.2.9 from the previous 1999 and 2002 LARUCP structural provision that amended the California Building Code. The Los Angeles/Long Beach region is within a very active geological location. The various jurisdictions within this region have taken additional steps to prevent roof or floor diaphragms from pulling away from concrete or masonry walls. This decision was made due to the frequency of this type of failure during the past significant earthquakes. This section was portion of the previous code and has been adjusted to accommodate higher diaphragm shear allowable as noted above.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. This amendment is required to address and clarify special needs for concrete and masonry construction with flexible wood diaphragm. The proposed modification to improve design and construction methods for these type of structures need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-10. Section 1614, 1614.1 and 1614.1.7 is added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.7 ASCE 7, Section 12.12.3. *Replace ASCE 7 Section 12.12.3 as follows:*

12.12.3 Minimum Building Separation. *All structures shall be separated from adjoining structures. Separations shall allow for the maximum inelastic response displacement (Δ_M). Δ_M shall be determined at critical locations with consideration for both translational and torsional displacements of the structure as follows:*

$$\Delta_M = C_d \delta_{max} \quad \text{(Equation 16-45)}$$

where δ_{max} is the calculated maximum displacement at Level x as define in ASCE 7 Section 12.8.4.3.

Adjacent buildings on the same property shall be separated by at least a distance Δ_{MT} , where

$$\Delta_{MT} = \sqrt{(\Delta_{M1})^2 + (\Delta_{M2})^2} \quad \text{(Equation 16-46)}$$

and Δ_{M1} and Δ_{M2} are the maximum inelastic response displacements of the adjacent buildings.

Where a structure adjoins a property line not common to a public way, the structure shall also be set back from the property line by at least the displacement, Δ_M , of that structure.

Exception: Smaller separations or property line setbacks shall be permitted when justified by rational analysis.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Section 12.12.3 of ASCE 7-05 including Supplement No. 1 does not provide requirements for separation distances between adjacent buildings. Requirements for separation distances between adjacent buildings, not structurally connected, were included in previous editions of the IBC and UBC. However, when ASCE 7-05 was adopted by reference for IBC 2006, these requirements were omitted. In addition, ASCE 7-05 defines (δ_x) in Section 12.8.6 to refer to the deflection of Level x at the center of mass. The actual displacement that needs to be used for building separation is the displacement at critical locations with consideration of both the translational and torsional displacements. These values can be significantly different.

This code change fills the gap of this inadvertent oversight in establishing minimum separation distance between adjoining buildings that are not structurally connected. The purpose of seismic separation is to permit adjoining buildings, or parts thereof, to respond to earthquake ground motion independently and thus preclude possible structural and non-structural damage caused by pounding between buildings or other structures.

Reference:

1. IBC 2000 Section 1620.3.6, Building Separations; IBC 2003 Section 1620.4.5, Building Separations;
2. "Recommended Lateral Force Requirements and Commentary, – Section C108.2.11, Building Separations," Structural Engineers Association of California, Sacramento, CA, 1999 Edition;
3. CBC 2002 (UBC 1997) Section 1630.9.2, Determination of Δ_M ; Section 1630.10.1, General; and Section 1633.2.11, Building Separations.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The seismic separation is necessary to permit adjoining buildings, or parts thereof, to respond to earthquake ground motion independently and preclude possible structural damage due to pounding between buildings and other structures. The need to incorporate this modification into the code will help to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 16-11. Section 1614, 1614.1 and 1614.1.8 are added to Chapter 16 of the 2007 California Building Code to read as follows:

SECTION 1614
MODIFICATION TO ASCE 7.

1614.1 General. *The text of ASCE 7 shall be modified as indicated in this Section.*

1614.1.8 ASCE 7, 12.12.4. *Modify ASCE 7 Section 12.12.4 to read as follows:*

12.12.4 Deformation Compatibility for Seismic Design Category D through F. For structures assigned to Seismic Design Category D, E, or F, every structural component not included in the seismic force-resisting system in the direction under consideration shall be designed to be adequate for the gravity load effects and the seismic forces resulting from displacement to the design story drift (Δ) as determined in accordance with Section 12.8.6 (see also Section 12.12.1).

Exception: Reinforced concrete frame members not designed as part of the seismic force-resisting system shall comply with Section 21.9 of ACI 318.

Where determining the moments and shears induced in components that are not included in the seismic force-resisting system in the direction under consideration, the stiffening effects of adjoining rigid structural and nonstructural elements shall be considered and a rational value of member and restraint stiffness shall be used.

When designing the diaphragm to comply with the requirements stated above, the return walls and fins/canopies at entrances shall be considered. Seismic compatibility with the diaphragm shall be provided by either seismically isolating the element or by attaching the element and integrating its load into the diaphragm.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This local amendment carries forward the previous 1999 and 2002 LARUCP 16-5 amendment adopted by the cities and county of the Los Angeles region regulating return walls and fins/canopies at entrances to ensure the seismic compatibility of the diaphragm. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in 1994 Northridge Earthquake. The study concluded that stiffness incompatibility between entrance canopies need to be addressed. This decision was made due to the frequency of this type of failure during the past significant earthquakes.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. This amendment is required to address and clarify special needs for return walls and fins/canopies at entrances. The proposed modification requires seismic

compatibility of return walls and fins/canopies at entrances with the diaphragm need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 17-01. Section 1704.1 of the 2007 California Building Code is amended to read as follows:

1704.1 General. Where application is made for construction as described in this section, the owner or the registered design professional in responsible charge acting as the owner's agent shall employ one or more special inspectors to provide inspections during construction on the types of work listed under Section 1704. The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the building official, for inspection of the particular type of construction or operation requiring special inspection. These inspections are in addition to the inspections specified in *Section 109, Appendix Chapter 1*.

Exceptions:

1. Special inspections are not required for work of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. Special inspections are not required for building components unless the design involves the practice of professional engineering or architecture as defined by applicable state statutes and regulations governing the professional registration and certification of engineers or architects.
- ~~3. Unless otherwise required by the building official, special inspections are not required for occupancies in Group R-3 as applicable in Section 101.2 and occupancies in Group U that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.~~
- 4.3. *[HCD 1] The provisions of Health and Safety Code Division 13, Part 6 and the California Code of Regulations, Title 25, Division 1, Chapter 3, commencing with Section 3000, shall apply to the construction and inspection of factory-built housing as defined in Health and Safety Code Section 19971.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

One of the significant problems discovered from the studies after the Northridge Earthquake was the extent of poor quality in construction, especially for residential wood frame buildings and/or accessories structures. The requirement to require that special inspectors be provided for work listed under Section 1704 to observe the actual construction will ensure that acceptable standards of workmanship are provided.

FINDINGS:

Local Topographical and Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. One of the significant problems discovered from the studies after the Northridge Earthquake was the extent of poor quality in construction, especially for residential wood frame buildings and/or accessories structures. Requiring that special inspectors be provided for work listed under Section 1704 to observe the actual construction will ensure that

acceptable standards of workmanship are provided. The proposed modification need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 17-02. Section 1704.4 of the 2007 California Building Code is amended to read as follows:

1704.4 Concrete Construction. The special inspections and verifications for concrete construction shall be as required by this section and Table 1704.4.

Exceptions: Special inspection shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less in height that are fully supported on earth or rock, where the structural design of the footing is based on a specified compressive strength, f'_c , no greater than 2,500 pounds per square inch (psi) (17.2 Mpa).
2. Continuous concrete footings supporting walls of buildings three stories or less in height that are fully supported on earth or rock where:
 - 2.1. The footings support walls of light-frame construction;
 - 2.2. The footings are designed in accordance with Table 1805.4.2; or
 - 2.3. The structural design of the footing is based on a specified compressive strength, f'_c , no greater than 2,500 pounds per square inch (psi) (17.2 Mpa), regardless of the compressive strength specified in the construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 Mpa).
4. ~~Concrete foundation walls constructed in accordance with table 1805.5(5).~~ Not adopted.
5. Concrete patios, driveways and sidewalks, on grade.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Results from studies after the 1994 Northridge Earthquake indicated that a lot of the damages were attributed to lack of quality control during construction resulting in poor performance of the building or structure.

FINDINGS:

Local Topographical and Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Results from studies after the Northridge Earthquake indicated that a lot of the damages were attributed to lack of quality control during construction resulting in poor performance of the building or structure. The proposed modification to improve quality control during construction need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 17-03. Section 1704.8 of the 2007 California Building Code is amended to read as follows:

1704.8 Pile foundation and connecting grade beams. Special inspections shall be performed during installation and testing of pile foundations as required by Table 1704.8. The approved soils report, required by Section 1802.2, and the documents prepared by the registered design professional in responsible charge shall be used to determine compliance. Special inspections for connecting grade beams shall be in accordance with Section 1704.4.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The grade beams in the pile or caisson supported foundation system are designed to act like concrete beams and not like footings. Section 1704.4 requires concrete beams to have special inspection, but exempts the footings of buildings three stories or less in height. This amendment clarifies that the grade beams that connect piles or caissons are not exempt even though they are part of the foundation system. They are an essential part of the piles/caissons foundation system and should receive the same level of inspection. This amendment is for clarification purpose only. It does not change the intent of the code provisions.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Studies after the Northridge Earthquake revealed that great confusion exist in the field over what is required by the code in the way of special inspection beyond just piles and caissons. Grade and tie beams are essential components of a pile/caisson foundation system, especially for how such a system responds to earthquake loads. Special inspection is needed to ensure that construction complies with code requirements. The proposed modification need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 17-04. Section 1709.1 and 1709.2 of the 2007 California Building Code is amended to read as follows:

1709.1 General. Where required by the provisions of Section 1709.2 or 1709.3 the owner shall employ a the registered design professional in responsible charge for the structural design, or another registered design professional designated by the registered design professional in responsible charge for the structural design to perform structural observations as defined in Section 1702.

~~At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.~~

The owner or owner's representative shall coordinate and call a preconstruction meeting between the registered design professional in responsible charge for the structural design, structural observer, contractor, affected subcontractors and special inspectors. The structural observer shall preside over the meeting. The purpose of the meeting shall be to identify the major structural elements and connections that affect the vertical and lateral load resisting systems of the structure and to review scheduling of the required observations. A record of the meeting shall be included in the report submitted to the building official.

Observed deficiencies shall be reported in writing to the owner's representative, special inspector, contractor and the building official. Upon the form prescribed by the building official, the structural observer shall submit to the building official a written statement at each significant construction stage stating that the site visits have been made and identifying any reported deficiencies which, to the best of the structural observer's knowledge, have not been resolved. A final report by the structural observer which states that all observed deficiencies have been resolved is required before acceptance of the work by the building official.

1709.2 Structural observations for seismic resistance. Structural observations shall be provided for those structures included in Seismic Design Category D, E or F, as determined in Section 1613, where one or more of the following conditions exist:

1. The structure is classified as Occupancy Category III or IV in accordance with Section 1604.5.
2. The height of the structure is greater than 75 feet (22860 mm) above the base.
3. The structure is assigned to Seismic Design Category E, is classified as Occupancy Category I or II in accordance with Section 1604.5 and is greater than two stories one story in height a lateral design is required for the structure or portion thereof.

Exception: One-story wood framed Group R-3 and Group U Occupancies less than 2000 square feet in area, provided the adjacent grade is not steeper than 1 unit vertical in 10 units horizontal (10% sloped), assigned to Seismic Design Category D.

4. When so designated by the registered design professional in responsible charge of the design.
5. When such observation is specifically required by the building official.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

In Section 1709.1 and 1709.2 of the California Building Code, the owner can employ any registered design professional, including but not limited to the registered design professional in responsible charge for the structural design, to perform structural observation. However, only the registered design professional in responsible charge for the structural design has thorough knowledge of the building he/she designed. By requiring the registered design professional in responsible charge for the structural design to observe the actual construction, the quality will greatly be increased.

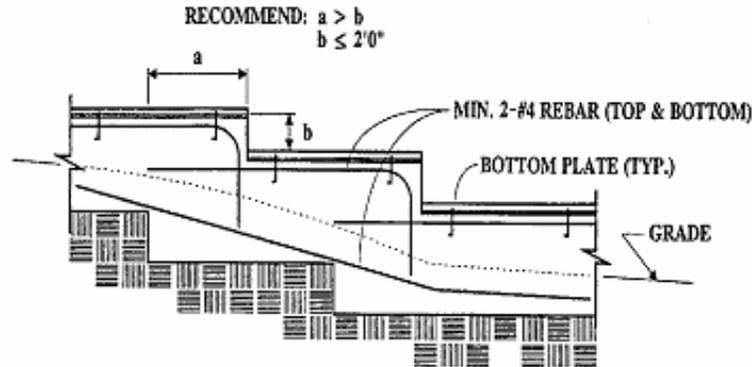
FINDINGS:

Local Topographical and Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. This local amendment expands the California Building Code requirements for structural observation of the construction of certain types of buildings by the registered design professional in responsible charge for the structural design. One of the significant problems discovered from the studies after the Northridge Earthquake was the extent of poor quality in construction, especially for wood frame buildings. By requiring that the registered design professional in responsible charge for the structural design observe the actual construction to ensure acceptable standards of workmanship, the quality will be greatly increased. The proposed modification need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 18-01. Section 1805.1 of the 2007 California Building Code is amended to read as follows:

1805.1 General. Footings and foundations shall be designed and constructed in accordance with Sections 1805.1 through 1805.9. Footings and foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1803.5. CLSM shall be placed in accordance with Section 1803.6.

The top surface of footings shall be level. The bottom surface of footings is permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope). This stepping requirement shall also apply to the top surface of grade beams supporting walls. Footings shall be reinforced with four 1/2-inch diameter (12.7 mm) deformed reinforcing bars. Two bars shall be placed at the top and bottom of the footings as shown in Figure 1805.1.



STEPPED FOUNDATIONS
Figure 1805.1

Table 1805.4.2 of the 2007 California Building Code is amended to read as follows:

TABLE 1805.4.2
FOOTINGS SUPPORTING WALLS OF LIGHT-FRAMED CONSTRUCTION ^{a, b, c, d, e}

NUMBER OF FLOORS SUPPORTED BY THE FOOTING ^f	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8 ^g

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

- a. Depth of footings shall be in accordance with Section 91.1805.2
- b. The ground under the floor is permitted to be excavated to the elevation of the top of the footing.
- c. ~~Interior stud-bearing walls are permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, can footings shall be spaced not more than 6 feet on center. Not adopted.~~
- d. See Section 1908 for additional requirements for footings of structures assigned to Seismic Design Category C, D, E or F.
- e. For thickness of foundation walls, see Section 91.1805.5
- f. Footings are permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
- g. ~~Plain concrete footings for Group R-3 occupancies are permitted to be 6 inches thick.~~

Section 1805.4.5 of the 2007 California Building Code is hereby deleted and replaced with the phrase "Not adopt".

Section 1805.4.6 of the 2007 California Building Code is hereby deleted and replaced with the phrase "Not adopt".

Section 1805.5 of the 2007 California Building Code is hereby deleted in their entirety.

Section 1805.5 is added to read as follows:

1805.5 Foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Wood foundations without proper protection have proven to be ineffective in supporting structures and buildings due to deterioration caused by presence of water in the soil as well as other material detrimental to wood foundations. Wood retaining walls, when they are not properly treated and protected against deterioration, have performed very poorly and have led to slope failures. Most contractors are typically accustomed to construction in dry weather in the Southern California region and are not generally familiar with the necessary precautions and treatment of wood that makes it suitable for wet applications.

With the higher seismic demand placed on buildings and structures in this region, coupled with the dryer weather conditions here as oppose to the northern and eastern part of the country, it is deemed necessary to take precautionary steps to reduce or eliminate potential problems that may result by following prescriptive design provision that does not take into consideration the surround environment. It was important that the benefit and expertise of a registered design professional be obtained to properly analysis the structure and takes these issues into consideration.

FINDINGS:

Local Climatic and Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Due to local climatic and geologic conditions of Southern California, this region is especially susceptible to more active termite activity and wood attacking insects and microorganisms. The proposed modification to prohibit the use of wood for foundation support or retaining earth lateral pressure as well as limit prescriptive design provisions need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 19-01. Section 1908.1 is amended to read as shown below and Section 1908.1.17 is added to Chapter 19 of the 2007 California Building Code to read as follows:

1908.1 General. The text of ACI 318 shall be modified as indicated in Sections 1908.1.1 through ~~1908.1.16~~ 1908.1.17.

1908.1.17 ACI 318, Section 14.8. *Modify ACI 318 Section 14.8.3 and 14.8.4 replacing equation (14-7), (14-8) and (14-9).*

1. Modify equation (14-7) of ACI 318 Section 14.8.3 as follows:

I_{cr} shall be calculated by Equation (14-7), and M_a shall be obtained by iteration of deflections.

$$I_{cr} = \frac{E_s}{E_c} \left(A_s + \frac{P_u}{f_y} \frac{h}{2d} \right) (d - c)^2 + \frac{l_w c^3}{3} \quad (14-7)$$

and the value E_s/E_c shall not be taken less than 6.

2. Modify ACI 318 Sec. 14.8.4 as follows:

14.8.4 – Maximum out-of-plane deflection, Δ_s , due to service loads, including $P\Delta$ effects, shall not exceed $l_c/150$.

If M_a , maximum moment at mid-height of wall due to service lateral and eccentric loads, including $P\Delta$ effects, exceed $(2/3) M_{cr}$, Δ_s shall be calculated by Equation (14-8):

$$\Delta_s = \frac{2}{3} \Delta_{cr} + \frac{M_a - \frac{2}{3} M_{cr}}{M_n - \frac{2}{3} M_{cr}} \left(\Delta_n - \frac{2}{3} \Delta_{cr} \right) \quad (14-8)$$

If M_a does not exceed $(2/3) M_{cr}$, Δ_s shall be calculated by Equation (14-9):

$$\Delta_s = \left(\frac{M_a}{M_{cr}} \right) \Delta_{cr} \quad (14-9)$$

where:

$$\Delta_{cr} = \frac{5 M_{cr} l_c^2}{48 E_c I_g}$$

$$\Delta_n = \frac{5 M_n l_c^2}{48 E_c I_{cr}}$$

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Section 14.8 was introduced in ACI 318-99 based on requirements of the Uniform Building Code and experimental research and on the basis that design of slender wall must satisfy both strength and serviceability requirements. ACI 318-05 provision was found to grossly underestimate service load deflection. This update reduces the differences in serviceability provisions. The revision will essentially replace equations (14-8) and (14-9) with two new equations to reflect the UBC procedure for service load out-of-pane deflection. The proposed revision will be included in ACI 318-08.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to ensure that the design of slender wall must satisfy both strength and serviceability requirements need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 19-02. Section 1908.1 is amended to read as shown below and Section 1908.1.18 thru 1908.1.21 is added to Chapter 19 of the 2007 California Building Code to read as follows:

1908.1 General. The text of ACI 318 shall be modified as indicated in Sections 1908.1.1 through ~~1908.1.16~~ 1908.1.21.

1908.1.18 ACI 318, Section 21.4.4.1. Modify ACI 318 Section 21.4.4.1 as follows:

Where the calculated point of contraflexure is not within the middle half of the member clear height, provide transverse reinforcement as specified in ACI 318 Sections 21.4.4.1, Items (a) through (c), over the full height of the member.

1908.1.19 ACI 318, Section 21.4.4. Modify ACI 318 by adding Section 21.4.4.7 as follows:

21.4.4.7 – At any section where the design strength, ϕP_n , of the column is less than the sum of the shears V_e computed in accordance with ACI 318 Sections 21.3.4.1 and 21.4.5.1 for all the beams framing into the column above the level under consideration, transverse reinforcement as specified in ACI 318 Sections 21.4.4.1 through 21.4.4.3 shall be provided. For beams framing into opposite sides of the column, the moment components may be assumed to be of opposite sign. For the determination of the design strength, ϕP_n , of the column, these moments may be assumed to result from the deformation of the frame in any one principal axis.

1908.1.20 ACI 318, Section 21.7.4. Modify ACI 318 by adding Section 21.7.4.6 as follows:

21.7.4.6 – Walls and portions of walls with $P_u > 0.35P_o$ shall not be considered to contribute to the calculated strength of the structure for resisting earthquake-induced forces. Such walls shall conform to the requirements of Section 1631.2, Item 4 ACI 318 Section 21.11.

1908.1.21 ACI 318, Section 21.9.4. Modify ACI 318 section 21.9.4 by adding the following:

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or $6 d_b$ thick, where d_b is the diameter of the largest reinforcement in the topping slab.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This amendment is intended to carry over critical provisions for the design of concrete columns in moment frames from the UBC. Increased confinement is critical to the integrity of such columns and these modifications ensure that is provided for when certain thresholds are exceeded.

In addition, this amendment carries over from the UBC a critical provision for the design of concrete shear walls. It essentially limits the use of very highly gravity-loaded walls in being included in the seismic load resisting system, since their failure could have catastrophic effect on the building.

Furthermore, this amendment was incorporated in the code based on observations from Northridge earthquake. Rebar placed in a very thin concrete topping slab in some instances popped out of the slab due to insufficient concrete coverage. The modification ensures that critical boundary and collector rebars are placed in sufficiently thick slab to prevent buckling of such reinforcement.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 19-03. Section 1908.1.15 of the 2007 California Building Code is amended to read as follows:

1908.1.15 ACI 318, Section 22.10. Delete ACI 318, Section 22.10, and replace with the following:

22.10 – Plain concrete in structures assigned to Seismic Design Category C, D, E or F.

22.10.1 – Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:

- (a) ~~Structural plain concrete basement, foundation or other walls below the base are permitted in detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall not be less than 7½ inches (190 mm), and the wall shall retain no more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 22.6.6.5. Concrete used for fill with a minimum cement content of two (2) sacks of Portland cement per cubic yard.~~
- (b) Isolated footings of plain concrete supporting pedestals or columns are permitted, provided the projection of the footing beyond the face of the supported member does not exceed the footing thickness.

~~Exception: In detached one- and two-family dwellings three stories or less in height, the projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.~~

- (c) Plain concrete footings supporting walls are permitted provided the footings have at least two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. ~~For footings that exceed 8 inches (203 mm) in thickness, a~~ A minimum of one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.

~~Exceptions:~~

- ~~1. In detached one- and two-family dwellings three stories or less in height and constructed with stud-bearing walls, plain concrete footings without longitudinal reinforcement supporting walls are permitted. with at least two continuous longitudinal reinforcing bars not smaller than No. 4 are permitted to have a total area of less than 0.002 times the gross cross-sectional area of the footing.~~
- ~~2. For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.~~
- ~~3. Where a slab on ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top of the slab or bottom of the footing.~~

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This local amendment carries forward the previous 1999 and 2002 LARUCP amendment to require minimum reinforcement in continuous footings, thereby addressing the problem of poor performance of plain or under-reinforced footings during a seismic event. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification that addresses the problem of poor performance of plain or under-reinforced footings during a seismic event need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 22-01. Section 2205.4 is added to Chapter 22 of the 2007 California Building Code to read as follows:

2205.4 Modifications to AISC 341.

2205.4.1 Part I, Structural Steel Building Provisions Modifications.

2205.4.1.1 Part I, Section 13, Special Concentrically Braced Frames (SCBF) Modifications.

2205.4.1.1.1 AISC 341, Part I, 13, Members. Add a new section as follows:

AISC 341, 13.2f – Member Types

The use of rectangular HSS are not permitted for bracing members, unless filled solid with cement grout having a minimum compressive strength of 3000 psi (20.7 MPa) at 28 days. The effects of composite action in the filled composite brace shall be considered in the sectional properties of the system where it results in the more severe loading condition or detailing.

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Recent test results on braces used in steel concentrically braced frames (SCBF) indicate that many commonly used sections and brace configurations do not meet seismic performance expectations. Specific parameters that were shown to affect the ductility of braces included net-section, section type, width-thickness ratio of the cross section and member slenderness. Square and rectangular cross-section HSS were shown to be particularly susceptible to fracture due to local buckling behavior of the cross section and, therefore, are not recommended by SEAOSC Seismology and Steel Committee for special concentric braced frame applications. Grout-filled HSS members exhibit more favorable local buckling characteristics, significantly altering the post-yield behavior of these sections. Both SEAOSC Seismology and Steel Committee recommend the proposed modification. Furthermore, OSPHD and DSA-SS has taken the same position and added Section 2205A.4.1.5.1 to Chapter 22 of the 2007 California Building Code to reflect this recommendation.

References:

1. AISC. 2005. Seismic Provisions for Structural Steel Buildings, American Institute of Steel Construction Inc., Chicago, IL.
2. Fell,B., Kanvinde,A., Deierlein, G., Myers,A., Fu, X. 2006. "Buckling and fracture of concentric braces under inelastic cyclic loading" Structural Steel Education Council, Steel Tips No.94.
3. Liu, Z., and Goel, S. C. 1988. "Cyclic Load Behavior of Concrete-Filled Tubular Braces." Journal of Structural Engineering 114 (7), 1488-1506.
4. Shaback, B., and Brown, T. 2003. "Behavior of square hollow structural steel braces with end connections under reversed cyclic axial loading." Canadian Journal of Civil Engineering 30, 745-753.

5. Tremblay, R., Archambault, M-H., and Filiatrault, A. 2003. "Seismic Response of Concentrically Brace Steel Frames Made with Rectangular Hollow Bracing Members." Journal of Structural Engineering 129 (12), 1626-1636.
6. Uriz, P., and Mahin, S.A. 2004. "Seismic Performance Assessment of Concentrically Braced Steel Frames." Proceedings of the 13th World Conference on Earthquake Engineering.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Recent test studies regarding rectangular and square brace frame members need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-01. Section 2305.2.5 of the 2007 California Building Code is amended to read as follows:

2305.2.5 Rigid Diaphragms. Design of structures with rigid diaphragms shall conform to the structure configuration requirements of Section 12.3.2 of ASCE 7 and the horizontal shear distribution requirements of Section 12.8.4 of ASCE 7.

Wood structural panel diaphragms shall not be considered as transmitting lateral forces by rotation.

~~Open front structures with rigid wood diaphragms resulting in torsional force distribution are permitted, provided the length, l , of the diaphragm normal to the open side does not exceed 25 feet (7620 mm), the diaphragm sheathing conforms to Section 2305.2.4 and the l/w ratio [as shown in Figure 2305.2.5(1)] is less than 1 for one-story structures or 0.67 for structures over one story in height.~~

~~Exception: Where calculations show that diaphragm deflections can be tolerated, the length, l , normal to the open end is permitted to be increased to a l/w ratio not greater than 1.5 where sheathed in compliance with Section 2305.2.4 or to 1 where sheathed in compliance with Section 2306.3.4 or 2306.3.5.~~

Rigid wood diaphragms are permitted to cantilever past the outermost supporting shear wall (or other vertical resisting element) a length, l , of not more than 25 feet (7620 mm) or two-thirds of the diaphragm width, w , whichever is smaller. Figure 2305.2.5(2) illustrates the dimensions of l and w for a cantilevered diaphragm.

~~Structures with rigid wood diaphragms having a torsional irregularity in accordance with Table 12.3-1, Item 1, of ASCE 7 shall meet the following requirements: the l/w ratio shall not exceed 1 for one-story structures or 0.67 for structures over one story in height, where l is the dimension parallel to the load direction for which the irregularity exists.~~

~~Exception: Where calculations demonstrate that the diaphragm deflections can be tolerated, the width is permitted to be increased and the l/w ratio is permitted to be increased to 1.5 where sheathed in compliance with Section 2305.2.4 or 1 where sheathed in compliance with Section 2306.3.4 or 2306.3.5.~~

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The proposed amendment continues the application of existing LARUCP amendment 23-2 by prohibiting the use of wood diaphragms in rotation based on numerous failures observed in the 1994 Northridge Earthquake.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to place limits on the design of buildings based on rotation and will thereby restrict potential soft-story designs and excessive

deflections, which was the cause of extensive damages in the Northridge Earthquake, need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-02. Section 2305.3.7.1 is added to Chapter 23 of the 2007 California Building Code to read as follows:

2305.3.7.1 Hold-down connectors. *Hold-down connectors shall be designed to resist shear wall overturning moments using approved cyclic load values or 75 percent of the allowable earthquake load values that do not consider cyclic loading of the product. Connector bolts into wood framing require steel plate washers on the post on the opposite side of the anchorage device. Plate size shall be a minimum of 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. Hold-downs shall be re-tightened just prior to covering the wall framing.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

Many of the hold-down devices currently used still does not have any acceptance report based on dynamic testing protocol. The amendment continues limiting the allowable capacity to 75% of the evaluation report to provide additional factor of safety for statically tested anchorage devices. Since the IBC now specify the minimum size of steel plate washer, this proposed amendment, for purpose of consistency and uniformity of requirement, revised the size of the steel plate washer used in hold-down connectors to match that in IBC Section 2305.3.11 from the previous 1999 and 2002 LARUCP amendments.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to establish certain performance requirements for hold-down connectors, which is essential to preventing failure of a shear wall due to excessive deflection, need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-03. Section 2305.3.12 is added to Chapter 23 of the 2007 California Building Code to read as follows:

2305.3.12 Quality of Nails. *Mechanically driven nails used in wood structural panel shear walls shall meet the same dimensions as that required for hand-driven nails, including diameter, minimum length and minimum head diameter. No clipped head or box nails permitted in new construction. The allowable design value for clipped head nails in existing construction may be taken at no more than the nail-head-area ratio of that of the same size hand-driven nails.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The amendment continues the application of existing LARUCP amendment LARUCP 23-7. The word “tolerances” is too broad a term. It is to be replaced with “dimensions”, including diameter, minimum length and minimum head diameter. The overdriving of nails into the structural wood panel still remains a concern when pneumatic nail guns are used for shear wall nailing. Box nails were observed to cause massive and multiple failures of the typical 3/8-inch thick plywood during the Northridge Earthquake.

The use of clipped head nails continues to be restricted from being used in shear wall panels where the minimum nail head size must be maintained in order to minimize nails from pulling through sheathing materials. Clipped or mechanically driven nails used in shear wall construction were found to perform much less in previous wood shear wall panel testing done at UCI. The existing test results indicated that, under cyclic loading, the shear panels were less energy absorbent and less ductile. The panels reached ultimate load capacity and failed at substantially less lateral deflection than those using same size hand driven nails.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to require mechanically driven nails to have the same dimension as hand driven nail resulting in improve quality of construction and performance of shear wall panels need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-04. Sections 2306.3.1, 2306.4.1 and Table 2306.4.1 of the 2007 California Building Code are amended to read as follows:

2306.3.1 Wood structural panel diaphragms. Wood structural panel diaphragms are permitted to resist horizontal forces using the allowable shear capacities set forth in Table 2306.3.1 or 2306.3.2. ~~The allowable shear capacities are permitted to be calculated by principles of mechanics without limitations by using values for fastener strength in the AF&PA NDS, structural design properties for wood structural panels based on DOC PS-1 and DOC PS-2 or wood structural panel design properties given in the APA Panel Design Specification (PDS).~~

Wood structural panel diaphragms using staples as fasteners shall not be permitted for structures assigned to Seismic Design Category D, E, or F.

Exception: Staples may be used for wood structural panel diaphragms when the allowable shear values are substantiated by cyclic testing and approved by the building official.

2306.4.1. Wood structural panel shear walls. The allowable shear capacities for wood structural panel shear walls shall be in accordance with Table 2306.4.1. These capacities are permitted to be increased 40 percent for wind design. ~~Shear walls are permitted to be calculated by principles of mechanics without limitations by using values for nail strength given in the AF&PA NDS and wood structural panel design properties given in the APA Panel Design Specification.~~ Wood shear walls shall be constructed of wood structural panels and not less than 4 feet by 8 feet (1219 mm by 2438 mm), except at boundaries and at changes in framing. Wood structural panel thickness for shear walls shall not be less than 3/8 inch thick and studs shall not be spaced at more than 16 inches on center.

The maximum allowable shear value for three-ply plywood resisting seismic forces is 200 pounds per foot (2.92 kN/m). Nails shall be placed not less than 1/2 inch (12.7 mm) in from the panel edges and not less than 3/8 inch (9.5mm) from the edge of the connecting members for shear greater than 350 pounds per foot (5.11kN/m). Nails shall be placed not less than 3/8 inch (9.5 mm) from panel edges and not less than 1/4 inch (6.4 mm) from the edge of the connecting members for shears of 350 pounds per foot (5.11kN/m) or less.

Wood structural panel shear walls using staples as fasteners shall not be permitted for structures assigned to Seismic Design Category D, E, or F.

Exception: Staples may be used for wood structural panel shear walls when the allowable shear values are substantiated by cyclic testing and approved by the building official.

Any wood structural panel sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members.

Exception: Wood structural panel sheathing in a horizontal diaphragm is permitted to be fastened over solid lumber planking or laminated decking, provided the panel joints and lumber planking or laminated decking joints do not coincide.

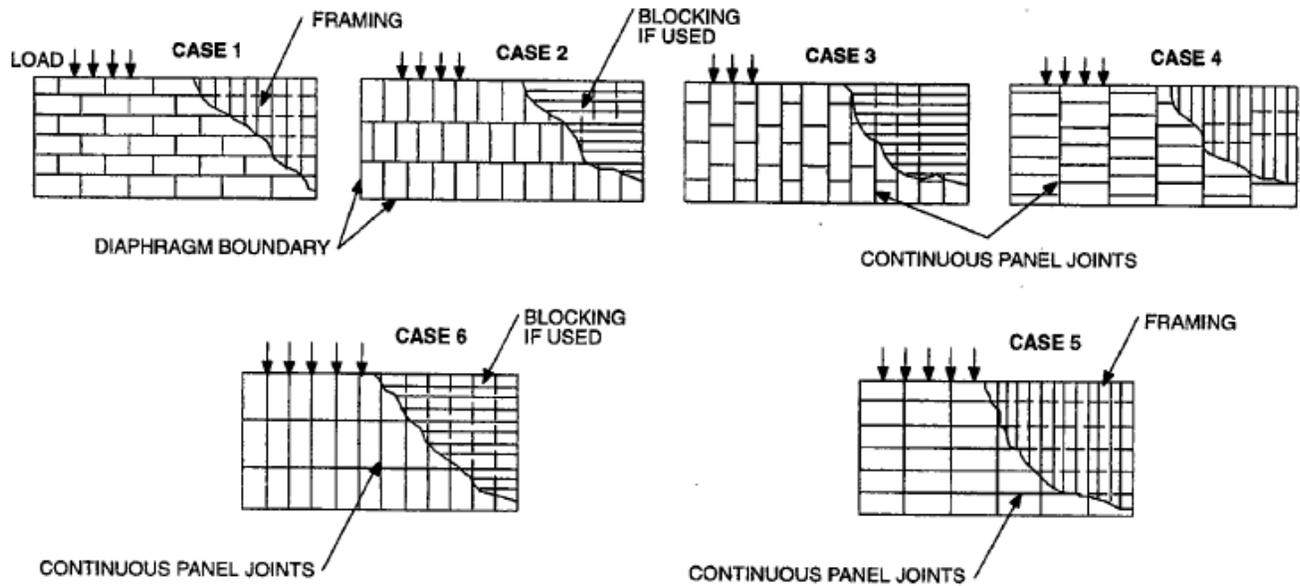
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Table 2306.3.1 of the 2007 California Building Code is hereby deleted in its entirety.
 Table 2306.3.1 is added to read as follows:

**TABLE 2306.3.1
 ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH
 FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^h**

PANEL GRADE	COMMON NAIL SIZE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES ^g (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS		
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3,4), and at all panel edges (Cases 5, 6) ^b				Fastener spaced 6" max. at supported edges ^b		
					6	4	2 1/2 ^c	2 ^c	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)	
					Fastener spacing (inches) at other panel edges (Cases 1,2,3 and 4) ^b						
6	6	4	3								
Structural I Grades	6d ^e (2" x 0.113")	1-1/4	5/16	2	185	250	375	420	165	125	
				3	210	280	420	475	185	140	
	8d (2 1/2" x 0.131")	1-3/8	3/8	2	270	360	530	600	240	180	
				3	300	400	600	675	265	200	
	10d ^d (3" x 0.148")	1-1/2	15/32	2	320	425	640	730	285	215	
				3	360	480	720	820	320	240	
Sheathing, single floor and other grades covered in DOC PS1 and PS2	6d ^e (2" x 0.113")	1-1/4	5/16	2	170	225	335	380	150	110	
				3	190	250	380	430	170	125	
	6d ^e (2" x 0.113")	1-1/4	3/8	2	185	250	375	420	165	125	
				3	210	280	420	475	185	140	
	8d (2 1/2" x 0.131")	1 3/8		2	240	320	480	545	215	160	
				3	270	360	540	610	240	180	
	8d (2 1/2" x 0.131")	1 3/8	7/16	2	255	340	505	575	230	170	
				3	285	380	570	645	255	190	
	8d (2 1/2" x 0.131")	1 3/8		15/32	2	270	360	530	600	240	180
					3	300	400	600	675	265	200
	10d ^d (3" x 0.148")		1 1/2		2	290	385	575	655	255	190
					3	324	430	650	735	290	215
10d ^d (3" x 0.148")	1 1/2	19/32	2		320	425	640	730	285	215	
			3		360	480	720	820	320	240	

TABLE 2306.3.1—continued
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL
PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR-LARCH,
OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^b



For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- a. For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. ~~(2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.~~ (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = $[1 - (0.5 \cdot SG)]$, where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.
- b. Space fasteners maximum 12 inches o.c. along intermediate framing members (6 inches o.c. where supports are spaced 48 inches o.c.).
- c. Framing at adjoining panel edges shall be 3 inches nominal or ~~wider~~ *thicker*, and nails shall be staggered where nails are spaced 2 inches o.c. or 2 ½ inches o.c.
- d. Framing at adjoining panel edges shall be 3 inches nominal or ~~wider~~ *thicker*, and nails shall be staggered where both of the following conditions are met: (1) 10d nails having penetration into framing of more than 1 ½ inches and (2) nails are spaced 3 inches o.c. or less.
- e. 8d is recommended minimum for roofs due to negative pressures of high winds.
- f. ~~Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members. *Not adopted.*~~
- g. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- h. For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

Table 2306.3.2 of the 2007 California Building Code is hereby deleted in its entirety.
 Table 2306.3.2 is added to read as follows:

**TABLE 2306.3.2
 ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS
 UTILIZING MULTIPLE ROWS OF FASTENERS (HIGH LOAD DIAPHRAGMS) WITH FRAMING OF
 DOUGLAS FIR-LARCH OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^{b,g,h}**

PANEL GRADE ^c	COMMON NAIL SIZE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES ^e (inches)	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2 ^d					
						Fastener Spacing Per Line at Boundaries (inches)					
						4	2-1/2				
						Fastener Spacing Per Line at Other Panel Edges (inches)					
6	4	4	3								
Structural I Grades	10d common nails	1-1/2	5/16	3	2	605	815	875	1150		
				4	2	700	915	1005	1290		
				4	3	875	1220	1285	1395		
			3/8	3	2	670	880	965	1255		
				4	2	780	990	1110	1440		
				4	3	965	1320	1405	1790		
		15/32	3	2	730	955	1050	1365			
			4	2	855	1070	1210	1565			
			4	3	1050	1430	1525	1800			
		Sheathing, single floor and other grades covered in DOC PS1 and PS2	10d common nails	1-1/2	15/32	3	2	525	725	765	1010
						4	2	605	815	875	1105
						4	3	765	1085	1130	1195
19/32	3				2	650	860	935	1225		
	4				2	755	965	1080	1370		
	4				3	935	1290	1365	1485		
23/32	3			2	710	935	1020	1335			
	4			2	825	1050	1175	1445			
	4			3	1020	1400	1480	1565			

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1-(0.5-SG)], where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.
- Fastening along intermediate framing members: Space fasteners maximum 12 inches on center, except 6 inches on center for spans greater than 32 inches.
- Panels conforming to PS1 or PS 2.
- This table gives shear values for Cases 1 and 2 as shown in Table 2306.3.1. The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.3.1, providing fasteners at all continuous panels edges are spaced in accordance with the boundary fastener spacing.
- The minimum nominal depth of framing members shall be 3 inches nominal. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- ~~Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members. Not adopted.~~
- High load diaphragms shall be subject to special inspection in accordance with Section 1704.6.1.
- For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

Table 2306.4.1 of the 2007 California Building Code is hereby deleted in its entirety.
 Table 2306.4.1 is added to read as follows:

TABLE 2306.4.1
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS WITH
FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^{b, h, i, j, l, m, n}

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	ALLOWABLE SHEAR VALUE FOR SEISMIC FORCES PANELS APPLIED DIRECTLY TO FRAMING				ALLOWABLE SHEAR VALUE FOR WIND FORCES PANELS APPLIED DIRECTLY TO FRAMING					
			NAIL (common) size	Fastener spacing at panel edges (inches)				NAIL (common) size	Fastener spacing at panel edges (inches)			
				6	4	3	2 ^e		6	4	3	2 ^e
Structural I Sheathing	3/8	1-3/8	8d (2½"x0.131" common)	200	200	200	200	8d (2½"x0.131" common)	230 ^d	360 ^d	460 ^d	610 ^d
	7/16	1-3/8	8d (2½"x0.131" common)	255	395	505	670	8d (2½"x0.131" common)	255 ^d	395 ^d	505 ^d	670 ^d
	15/32	1-3/8	8d (2½"x0.131" common)	280	430	550	730	8d (2½"x0.131" common)	280	430	550	730
		1-1/2	10d (3"x0.148" common)	340	510	665 ^f	870	10d (3"x0.148" common)	340	510	665 ^f	870
Sheathing, plywood siding ^g except Group 5 Species	3/8	1-1/4	6d (2"x0.113" common)	200	200	200	200	6d (2"x0.113" common)	200	300	390	510
		1-3/8	8d (2½"x0.131" common)	200	200	200	200	8d (2½"x0.131" common)	220 ^d	320 ^d	410 ^d	530 ^d
	7/16	1-3/8	8d (2½"x0.131" common)	240	350	450	585	8d (2½"x0.131" common)	240 ^d	350 ^d	450 ^d	585 ^d
	15/32	1-3/8	8d (2½"x0.131" common)	260	380	490	640	8d (2½"x0.131" common)	260	380	490	640
		1-1/2	10d (3"x0.148" common)	310	460	600 ^f	770	10d (3"x0.148" common)	310	460	600 ^f	770
	19/32	1-1/2	10d (3"x0.148" common)	340	510	665 ^f	870	10d (3"x0.148" common)	340	510	665 ^f	870
			Nail Size (galvanized casing)					Nail Size (galvanized casing)				
	3/8	1-3/8	8d (2½"x0.113")	160	200	200	200	8d (2½"x0.113")	160	240	310	410

For SI: 1 inch = 25.4 mm, 1 foot = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- a. For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. ~~(2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.~~ (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = $[1 - (0.5 - SG)]$, where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.
- b. Panel edges backed with 2-inch nominal or ~~wider~~ thicker framing. Install panels either horizontally or vertically. Space fasteners maximum 6 inches on center along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches on center. For other conditions and panel thickness, space fasteners maximum 12 inches on center on intermediate supports.
- c. 3/8-inch panel thickness or siding with a span rating of 16 inches on center is the minimum recommended where applied direct to framing as exterior siding.
- d. Allowable shear values are permitted to be increased to values shown for 15/32-inch sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
- e. Framing at adjoining panel edges shall be 3 inches nominal or ~~wider~~ thicker, and nails shall be staggered where nails are spaced 2 inches on center.
- f. Framing at adjoining panel edges shall be 3 inches nominal or ~~wider~~ thicker, and nails shall be staggered where both of the following conditions are met: (1) 10d (3"x0.148") nails having penetration into framing of more than 1-1/2 inches and (2) nails are spaced 3 inches on center.
- g. Values apply to all-veneer plywood. Thickness at point of fastening on panel edges governs shear values.
- h. Where panels applied on both faces of a wall and nail spacing is less than 6 inches o.c. on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3-inch nominal or thicker at adjoining panel edges and nails on each side shall be staggered.
- i. In Seismic Design Category D, E or F, where shear design values exceed 350 pounds per linear foot, all framing members receiving edge nailing from abutting panels shall not be less than a single 3-inch nominal member, or two 2-inch nominal members fastened together in accordance with Section 2306.1 to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered in all cases. See Section 2305.3.11 for sill plate size and anchorage requirements.
- j. Galvanized nails shall be hot dipped or tumbled.
- k. ~~Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members. Not adopted.~~
- l. For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.
- m. *[DSA-SS & OSHPD 1, 2 and 4] Refer to Section 2305.2.4.2, which requires any wood structural panel sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system to be applied directly to framing members.*
- n. The maximum allowable shear value for three-ply plywood resisting seismic forces is 200 pounds per foot (2.92 kn/m).

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This local amendment puts additional restrictions on the design of wood structural panel diaphragms and shear walls. The amendment continues the application of the previous 1999 and 2002 LARUCP 23-3 amendment by allowing shear value capacities based on testing only and not calculations alone. By deleting the words that allow calculation of shear wall values, it will no longer be possible to circumvent the reductions in allowable shear capacities established in the Table.

This local amendment carries forward the previous LARUCP amendment to limit the maximum shear capacity for 3-ply plywood along with requiring greater edge distance for nails in shear walls resisting high loads, thereby addressing the problem of nails pulling out of the edges of the plywood under seismic loading. This amendment reflects the recommendations by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force that investigated the poor performance observed in 1994 Northridge Earthquake.

Furthermore, the cities and county of the Los Angeles region has taken extra measures to maintain the structural integrity of the framing of the shear walls when designed for high levels of seismic loads by requiring wood sheathing be applied directly over framing members, thereby prohibiting the use of the second portion of Table 2306.4.1, which provides allowable values for panels placed over gypsum sheathing. This amendment is intended to prevent the undesirable performance of nails when gypsum board softens due to cyclic earthquake displacements and the nail ultimately does not have any engagement in a solid material within the thickness of the gypsum board.

In September 2007, limited cyclic testing data was provided to the structural code committee showing that stapled wood structural shear panels do not exhibit the same behavior as the nailed wood structural shear panels. As a matter of fact, the test results of the stapled wood structural shear panels appeared much lower in strength and drift than the nailed wood structural shear panel test results.

The allowable shear values for wood structural panel shear walls with stapled nails are based on monotonic testing. Earthquakes load shear walls in a repeating fully reversible manner. The Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force previously investigated, documented damages, and reviewed existing test reports. The proposed amendment to omit the allowable shear capacity of shear wall with stapled nail is consistent with the Task Force previous recommendations made after the 1994 Northridge Earthquake. At that time, the report to the Governor from the Seismic Safety Commission of the State of California recommended that code requirements be "more thoroughly substantiated with testing."

Therefore, the use of staples as fasteners for structural shear wall panels or diaphragms shall not be permitted without being substantiated by cyclic testing. Wood structural shear panels fastened with nails (common and galvanized box) have been tested using various cyclic testing protocols that substantiate their design values in Table 2306.4.1.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification to place certain design and construction limits on structural wood panel shear walls thus resulting in improved quality of construction and performance of structures need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-05. Section 2306.4.5 of the 2007 California Building Code is amended to read as follows:

2306.4.5 Shear walls sheathed with other materials. Shear wall capacities for walls sheathed with lath, plaster or gypsum board shall be in accordance with Table 2306.4.5. Shear walls sheathed with lath, plaster or gypsum board shall be constructed in accordance with Chapter 25 and Section 2306.4.5.1. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7. The allowable shear values shown in Table 2306.4.5 for material in Category 1 is limited to 90 pound per foot (1.31 kN/m); materials in Category 2 thru 4 are limited to 30 pound per foot (438 N/m). Shear walls sheathed with lath, plaster or gypsum board shall not be used below the top level in a multi-level building.

Shear walls sheathed with other materials using staples as fasteners shall not be permitted for structures assigned to Seismic Design Category D, E, or F.

Exception: Staples may be used for shear walls sheathed with other materials when the allowable shear values are substantiated by cyclic testing and approved by the building official.

Table 2306.4.5 of the 2007 California Building Code is hereby deleted in its entirety.
 Table 2306.4.5 is added to read as follows:

TABLE 2306.4.5
ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES FOR SHEAR WALLS OF LATH
AND PLASTER OR GYPSUM BOARD WOOD FRAMED WALL ASSEMBLIES

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	FASTENER SPACING ^b MAXIMUM (inches)	SHEAR VALUE ^{a,e} (plf)		MINIMUM FASTENER SIZE ^{c,d,j,k,l}
				Seismic	Wind	
1. Expanded metal, or woven wire lath and portland cement plaster	7/8"	Unblocked	6	90	180	No. 11 gage, 1-1/2" long, 7/16" head
2. Gypsum lath, plain or perforated	3/8" lath and 1/2" plaster	Unblocked	5	30	100	No. 13 gage, 1-1/8" long, 19/64" head, plasterboard nail 0.120" Nail, min. 3/8" head, 1-1/4" long
3. Gypsum sheathing	1/2" x 2' x 8'	Unblocked	4	30	75	No. 11 gage, 1-3/4" long, 7/16" head, diamond-point, galvanized
	1/2" x 4'	Blocked ^f Unblocked	4 7	30 30	175 100	
	5/8" x 4'	Blocked	4" edge/ 7" field	30	200	
4. Gypsum board, gypsum veneer base or water-resistant gypsum backing board	1/2"	Unblocked ^f	7	30	75	5d cooler (1-5/8" x 0.086") or wallboard 0.120" Nail, min. 3/8" head, 1-1/2" long
		Unblocked ^f	4	30	110	
		Unblocked	7	30	100	
		Unblocked	4	30	125	
		Blocked ^g	7	30	125	
		Blocked ^g	4	30	150	
		Unblocked	8/12 ^h	30	60	
		Blocked ^g	4/16 ^h	30	160	
		Blocked ^g	4/12 ^h	30	155	
		Blocked ^{f,g}	8/12 ^h	30	70	
	Blocked ^g	6/12 ^h	30	90		
	5/8"	Unblocked ^f	7	30	115	6d cooler (1-7/8" x 0.092") or wallboard 0.120" Nail, min. 3/8" head, 1-3/4" long
			4	30	145	
		Blocked ^g	7	30	145	
4			30	175		
Blocked ^g Two ply		Base ply: 9 Face ply: 7	30	250	Base ply-6d cooler (1-7/8" x 0.092") or wallboard 1-3/4" x 0.120" Nail, min. 3/8" head Face ply-8d cooler (2-3/8" x 0.113") or wallboard 0.120" Nail, min. 3/8" head, 2-3/8" long	
Unblocked		8/12 ^h	30	70		
Blocked ^g	8/12 ^h	30	90	No. 6- 1-1/4" screws ⁱ		

For SI: 1 inch = 25.4 mm, 1 foot = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. These shear walls shall not be used to resist loads imposed by masonry or concrete construction (see Section 2305.1.5). Values shown are for short-term loading due to wind or seismic loading. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7. Values shown shall be reduced 25 percent for normal loading.

- b. Applies to fastening at studs, top and bottom plates and blocking.
- c. Alternate fasteners are permitted to be used if their dimensions are not less than the specified dimensions. Drywall screws are permitted to substitute for the 5d (1-5/8" x 0.086"), and 6d (1-7/8" x 0.092")(cooler) nails listed above, and No. 6 1-1/4 inch Type S or W screws for 6d (1-7/8" x 0.092")(cooler) nails.
- d. For properties of cooler nails, see ASTM C 514.
- e. Except as noted, shear values are based on maximum framing spacing of 16 inches on center.
- f. Maximum framing spacing of 24 inches on center.
- g. All edges are blocked, and edge fastening is provided at all supports and all panel edges.
- h. First number denotes fastener spacing at the edges; second number denotes fastener spacing at intermediate framing members.
- i. Screws are Type W or S.
- j. ~~Staples shall have a minimum crown width of 7/16 inch, measure outside the legs, and shall be installed with their crowns parallel to the long dimension of the framing members. *Not adopted.*~~
- k. ~~Staples for the attachment of gypsum lath and woven wire lath shall have a minimum crown width of 3/4 inch, measured outside the legs. *Not adopted.*~~
- l. *This construction shall not be used below the top level of wood construction in a multi-level building.*

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

This amendment is consistent with the previous 1999 and 2002 LARUCP 25-2 amendment adopted by the cities and county of the Los Angeles region that reduced allowable shear values. Due to the high geologic activities in the Southern California area and the expected higher level of performance on buildings and structures, this local amendment continues to reduce the allowable shear values for shear walls sheathed with lath, plaster or gypsum board. The poor performance of such shear walls sheathed with other materials in the 1994 Northridge Earthquake was investigated by the Structural Engineers Association of Southern California (SEAOSC) and the Los Angeles City Task Force. The cities and county of the Los Angeles region has taken extra measures to maintain the structural integrity of the framing of the shear walls when designed for high levels of seismic loads.

In September 2007, limited cyclic testing data was provided to the structural code committee showing that stapled wood structural shear panels do not exhibit the same behavior as the nailed wood structural shear panels. As a matter of fact, the test results of the stapled wood structural shear panels appeared much lower in strength and drift than the nailed wood structural shear panel test results. Therefore, the use of staples as fasteners for shear walls sheathed with other materials shall not be permitted without being substantiated by cyclic testing.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. The proposed modification need to be incorporated into the code to assure that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.

2007 LARUCP 23-06. Section 2308 of the 2007 California Building Code is amended to read as follows:

2308.3.4 Braced wall line support. Braced wall lines shall be supported by continuous foundations.

~~*Exception: For structures with a maximum plan dimension not over 50 feet (15240 mm), continuous foundations are required at exterior walls only.*~~

2308.12.1 Number of stories. Structures of conventional light-frame construction shall not exceed one story in height in Seismic Design Category D or E.

~~*Exception: [HCD 1] Detached one and two family dwellings are permitted to be two stories high in Seismic Design Category D or E.*~~

2308.12.2 Concrete or masonry. Concrete or masonry walls or masonry veneer shall not extend above the basement.

Exception: Masonry veneer is permitted to be used in the first story above grade plane in Seismic Design Category D, provided the following criteria are met:

1. Type of brace in accordance with Section 2308.9.3 shall be Method 3 and the allowable shear capacity in accordance with Table 2306.4.1 shall be a minimum of 350 plf (5108 N/m).
2. The bracing of the first story shall be located at each end and at least every 25 feet (7620 mm) o.c. but not less than 45 percent of the braced wall line.
3. Hold-down connectors shall be provided at the ends of braced walls for the first floor to foundation with an allowable design of 2,100 pounds (9341 N).
4. Cripple walls shall not be permitted.
5. Anchored masonry and stone wall veneer shall not exceed 5 inches (127 mm) in thickness, shall conform to the requirements of Division 14 and shall not extend more than 5 feet (1524 mm) above the first story finished floor.

2308.12.4 Braced wall line sheathing. Braced wall lines shall be braced by one of the types of sheathing prescribed by Table 2308.12.4 as shown in Figure 2308.9.3. The sum of lengths of braced wall panels at each braced wall line shall conform to Table 2308.12.4. Braced wall panels shall be distributed along the length of the braced wall line and start at not more than 8 feet (2438 mm) from each end of the braced wall line. Panel sheathing joints shall occur over studs or blocking. Sheathing shall be fastened to studs, top and bottom plates and at panel edges occurring over blocking. Wall framing to which sheathing used for bracing is applied shall be nominal 2 inch wide [actual 1¹/₂ inch (38 mm)] or larger members, spaced a maximum of 16 inches on center. Nailing shall be minimum 8d common placed 3/8 inches from panel edges and spaced not more than 6 inches on center, and 12 inches on center along intermediate framing members.

~~Cripple walls having a stud height exceeding 14 inches (356 mm) shall be considered a story for the purpose of this section and shall be braced as required for braced wall lines in accordance with Table 2309.12.4. Where interior braced wall lines occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be one and one-half times the lengths required by Table 2308.12.4. Where the cripple wall sheathing type used is Type S-W and this additional length of bracing cannot be provided, the capacity of Type S-W sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) o.c.~~

Braced wall panel construction types shall not be mixed within a braced wall line.

Braced wall panels required by Section 2308.12.4 may be eliminated when all of the following requirements are met:

1. One story detached Group U occupancies not more than 25 feet in depth or length.
2. The roof and three enclosing walls are solid sheathed with 1/2-inch nominal thickness wood structural panels with 8d common nails placed 3/8 inches from panel edges and spaced not more than 6 inches on center along all panel edges and 12 inches on center along intermediate framing members. Wall openings for doors or windows are permitted provided a minimum 4 foot wide wood structural braced panel with minimum height to length ratio of 2 to 1 is provided at each end of the wall line and that the wall line be sheathed for 50% of its length.

2308.12.5 Attachment of sheathing. Fastening of braced wall panel sheathing shall not be less than that prescribed in Table 2308.12.4 or Table 2304.9.1. Wall sheathing shall not be attached to framing members by adhesives.

All braced wall panels shall extend to the roof sheathing and shall be attached to parallel roof rafters or blocking above with framing clips (18 gauge minimum) spaced at maximum 24 inches (6096 mm) on center with four 8d nails per leg (total eight 8d nails per clip). Braced wall panels shall be laterally braced at each top corner and at maximum 24 inch (6096 mm) intervals along the top plate of discontinuous vertical framing.

**TABLE 2308.12.4
WALL BRACING IN SEISMIC DESIGN CATEGORIES D AND E
(Minimum Length of Wall Bracing per each 25 Linear Feet of Braced Wall Line ^a)**

CONDITION	SHEATHING TYPE ^b	$S_{DS} < 0.50$	$0.50 \leq S_{DS} < 0.75$	$0.75 \leq S_{DS} \leq 1.00$	$S_{DS} > 1.00$
One Story	G-P ^c	10 feet 8 inches	14 feet 8 inches	18 feet 8 inches	25 feet 0 inches
	S-W	5 feet 4 inches	8 feet 0 inches	9 feet 4 inches	12 feet 0 inches
Story Below top story [HCD 1]	G-P ^{e,d}	18 feet 8 inches ^d	NP	NP	NP
	S-W ^d	10 feet 8 inches ^d	13 feet 4 inches ^d	17 feet 4 inches ^d	21 feet 4 inches ^d
Bottom story of three stories [HCD 1]	G-P	Conventional construction not permitted; conformance with Section 2301.2, Item 1 or 2 is required.			
	S-W				

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Minimum length of panel bracing of one face of the wall for S-W sheathing shall be at least 4'-0" long or both faces of the wall for G-P sheathing shall be at least 8'-0" long; h/w ratio shall not exceed 2:1. For S-W panel bracing of the same material on two faces of the wall, the minimum length is permitted to be one-half the tabulated value but the h/w ratio shall not exceed 2:1 and design for uplift is required.
- b. G-P = gypsum board, ~~fiberboard, particleboard, lath and~~ portland cement plaster or gypsum sheathing boards; S-W = wood structural panels ~~and diagonal wood sheathing. NP=not permitted.~~
- c. Nailing as specified below shall occur at all panel edges at studs, at top and bottom plates and, where occurring, at blocking:
 For 1/2-inch gypsum board, 5d (0.113 inch diameter) cooler nails at 7 inches on center;
 For 5/8-inch gypsum board, No 11 gage (0.120 inch diameter) cooler nails at 7 inches on center;
 For gypsum sheathing board, 1-3/4 inches long by 7/16-inch head, diamond point galvanized nails at 4 inches on center;
 For gypsum lath, No. 13 gage (0.092 inch) by 1-1/8 inches long, 19/64-inch head, plasterboard at 5 inches on center;
 For Portland cement plaster, No. 11 gage (0.120 inch) by 1 1/2 inches long, 7/16-inch head at 6 inches on center;
~~For fiberboard and particleboard, No. 11 gage (0.120 inch) by 1 1/2 inches long, 7/16-inch head, galvanized nails at 3 inches on center.~~

~~d. [HCD 1] Applies to detached one- and two-family dwellings only.~~

~~e.d. S-W sheathing shall be 15/32" thick nailed with 8d nails, at 6:6:12.~~

REASONS FOR AMENDMENT/INTERPRETATION/CLARIFICATION:

The propose amendment continues the previous 1999 and 2002 LARUCP amendment to limit the use of conventional wood frame construction to simple one story residential buildings, limit the use of conventional framing braced wall panels to 25 feet maximum spacing, require that interior braced walls be supported by continuous foundations and limits the use of stone and masonry anchored veneer when using conventional framing design.

Larger or more complex buildings must be designed by a registered design professional. Near source earthquake conditions subject most local buildings and structures to loads in excess of base code lateral forces. Large number of multilevel wood frame buildings, especially those with split level, cantilevered floors and complex shaped wind attachments, suffered extensive damages in the Northridge Earthquake.

Additional weight attributed to the use of heavy veneer substantially increases loads to conventionally braced walls in an earthquake. Moreover, normal to wall loads that occur in an earthquake can seriously overstress wood bearing walls in combined seismic/gravity load combinations. Numerous conventionally framed veneer covered structures sustained serious damages in the Northridge Earthquake as a result of the heavy weight of the veneer.

Interior walls can easily be called upon to resist over half of the seismic loading imposed on simple structure. Without a continuous foundation, earthquake loads would be transferred through a non-structural concrete slab floor or by a wood floor. Raised wood floor diaphragms and bolting of the perimeter walls can become inadequate to resist the imposed horizontal shear.

FINDINGS:

Local Geological Conditions – The greater Los Angeles/Long Beach region is a densely populated area having buildings constructed over and near a vast array of fault systems capable of producing major earthquakes, including but not limited to the recent 1994 Northridge Earthquake. Conventional framing does not address the need for a continuous load path, critical shear transfer mechanisms, connection ties, irregular and flexible portions of complex shaped structures. Unless designed by a registered design professional, such buildings built by conventional framing requirements will be prone to serious damage in future large earthquakes. The proposed modification need to be incorporated into the code to assure

that new buildings and additions to existing buildings are designed and constructed in accordance with the scope and objectives of the International Building Code.