SEAOSC Seminar —

# 2010 California Building Code Topics

## Saturday, Jan. 29, 2011
## 8 am - Noon

## The Grand Event Center,
## Long Beach California

- Overview and application of 2010 CBC Chapters 16 and 17
- Determination of multi-directional ground motion
- Design for orthogonal effects and multi-directional ground motion
- Special issues related to steel design
- Changes in Chapter 23 and SPDWS-08
- Application of 2010 CBC Chapters 19 and ACI 318-08

**Speakers include**
**Casey Hemmatyar, Marty Hudson, Baris Erkus, Ashi Dhalwala, Doug Thompson and James Lai**

*See reverse side for registration form and register today!*

***Sponsored by the SEAOSC Seismology Committee***

*SEAOSC Seismology Committee sponsored seminar*

# Application of 2010 California Building Code

Saturday, January 29, 2011, 8:00 a.m. to 12 noon
Breakfast and registration: 7:30 – 8:00 a.m.
Grand Event Center Auditorium
4101 E. Willow Street, Long Beach, CA 90815

## PROGRAM

| Time | Topic |
|---|---|
| 7:55 | **Introduction** |
| 8:00 | **Overview and Application of 2010 CBC Chapter 16, 16A, 17 and 17A**<br>- Presentation captures major amendments to CBC in Chapter 16, 16A, 17 and 17A<br>Speaker: Casey K. Hemmatyar, S.E., Pacific Structural & Forensic Engineers Group Inc. (PSFEG), Ventura |
| 8:45 | **Special Issues Related to Steel Design**<br>- Historical perspective to-date and design considerations<br>Speakers: Ashwani Dhalwala, M.S., S.E., CEG, Santa Monica;<br>Peter Maranian, PhD, S.E., Brandow and Johnston, Los Angeles |
| 9:25 | **Determination of Multi-directional Ground Motion**<br>- DSA and OSPOH require the use of maximum direction of ground motion. This presentation helps to remove the myth<br>Speaker: Martin Hudson, PhD, G.E., MACTEC Engineering, Los Angeles |
| 9:55 | **Break** |
| 10:10 | **Design for Orthogonal Effects and Multi-directional Ground Motion**<br>- Application of multi-directional ground motion design spectra in design of structures for orthogonal effects using simple guidelines<br>Speaker: Baris Erkus, PhD, P.E., Ove Arup Partners, Los Angeles |
| 10:40 | **Changes in Chapter 23 and SPDWS-08**<br>- Many wind and seismic provision have been deleted from the 2010 CBC/2009 IBC and are now only in the 2008 SDPWS. Specific detailing issues will be discussed.<br>Speaker: Douglas Thompson, S.E., STB Structural Engineers, Lake Forest |
| 11:30 | **Application of 2010 CBC Chapters 19 and ACI 318-08**<br>- Overview changes in 2010 CBC Chapter 19 and ACI 318-08<br>Speaker: James S. Lai, S.E., La Canada Flintridge |

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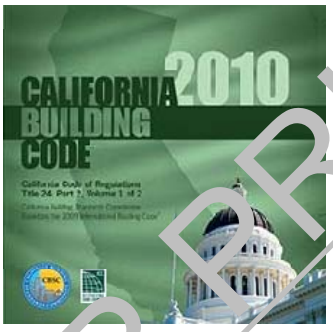
Pacific Structural & Forensic Engineers Group Inc.

psfeg.com

# Overview & Application 2010 CBC
# Chapter 16, 16A, 17 &17A

Presented by:
Casey Hemmatyar, S.E.




Structural Engineers Association of Southern California

## Presentation Outline

- Chapter 16 & 16A - Structural Design
- Chapter 17 & 17A - Structural Tests and Special Inspections

- Note: topics/changes discussed in this presentation will not pertain to minor editorial issues presented in the code.

## Symbols Used In IBC

**Italicized Terms**: Definitions in Chapter 2. Except for Chapter 19 with respect to difference in ACI 318.

*Italicized Terms*

**Marginal Arrows**: Deletion from Model Code (IBC 2006)

**Thick Single Vertical Lines**: Change from previous model code (IBC 2006)



## Symbols Used In CBC

**Thin Vertical Line**: Change pertaining to the previous California Building Code (CBC)

**Thin Double Vertical Lines**: Changes or additions to the previous California Building Code (CBC)

**Greater-Than Symbol**: Indicates California deletion of California Language

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## Chapter 16 - Structural Design

- *1601 – General*
- *1602 – Definitions and Notations*
- *1603 – Construction Documents*
- *1604 – General Design Requirements*
- *1605 – Load Combinations*
- 1606 – Dead Loads
- *1607 – Live Loads*
- 1608 – Snow Loads
- *1609 – Wind Loads*
- *1610 – Soil Lateral Loads*



## Chapter 16 - Structural Design

- *1611 – Rain Loads*
- *1612 – Flood Loads*
- *1613 – Earthquake Loads*
- *1614 – Structural Integrity*
- *1615 – Additional Requirements [DSA-SS/CC]*

## Section 1601 – General & Section 1602 – Definitions & Notations

- Sections 1601.1.1: Application for community college buildings based on division of the state architects.
- Modification to 1602:
  - Live load for deck and balcony has been changed to the same live load as the occupancy served.



## Section 1603 – Construction Documents

- Deletion to sections:
  - Section1603.2
  - Section1603.3
  - Section 1603.4

## Section1604 – General Design Requirements

- Modification to section 1604.8.2:
  - Wall anchorage requirements has been changed by eliminating the minimum horizontal force of 280 plf and the new minimum anchorage force is based on ASCE 7 section 11.7.3 which requires a minimum of 5% of the wall portion's weight



## Section 1605 – Load Combinations

- Deletion of section:
  - 1605.4 of the 2006 IBC
- Addition of Section:
  - 1605.1.1 Overall structural stability to be verified (i.e. buoyancy, sliding)
- Exception to 1605.3.1 Basic load combination:
  - Roof live loads of 30 psf or less need not be combined with seismic loads is added.

## Section 1607 – Live Loads

- Modification of terms:
  - Live loads for balconies has been changed to the same as occupancy served and there is no more distinction between balconies and decks.
  - 2nd load condition for vehicle barrier systems in section 1607.7.3.
- Addition to 1607.9 & 1607.9.1.1 One-way slabs:
  - Live load reduction related to one-way slabs to reconcile with ASCE 7.



## Section 1609 – Wind Loads

- Additions:
  - Exception 3 under section 1609.1.1. Allow the use of AISI S230 for residential buildings
  - Exception 6 under section 1609.1.1. Allows wind tunnel tests in accordance with section 6.6 of ASCE 7, subject to the limitations in section 1609.1.1.2.
  - Section 1609.6. This is a simplification of the ASCE 7 method 2-analytical procedure.

## Section 1609 – Wind Loads (Cont.)

- Modification to 1609.1.1.1 Applicability:
  - Reference to SBCCI SSTD 10 has been changed to ICC 600 for group R-2 and R-3 buildings
- New Section:
  - 1609.1.1.2 Wind Tunnel Test Limitations. Imposes a lower limit on wind loads obtained from wind tunnel tests. Base overturning moments and wind pressure for components and cladding on walls and roofs are typically limited to 80% of force level determined by section 6.5 of ASCE 7.



## Section 1610 – Soil Lateral Loads

- Modification to section 1610.1:
  - If soil lateral load from table 1610.1 is not used, the minimum design lateral soil loads shall be determined by a geotechnical investigation in accordance with section 1803.

## Section 1611 – Rain Loads & Section 1612 – Flood Loads

- Addition to 1611.1:
  - The design rain load based on 100-year hourly rainfall rate and figure 1611.1 which shows the 1-hour rainfall rate has been added to determine the rain load.
- Sections added to 1612:
  - 1612.3.1 Design flood elevation
  - 1612.3.2 Determination of impacts



## Section 1613 – Earthquake Loads

- Modification:
  - Section 1613.6.1 Assumption of flexible diaphragm: Subsection 4 discussing the portions of wood structural panel diaphragms that cantilever beyond the vertical elements of the lateral-force-resisting system. Based on section 4.2.5.2 of AF&PA SDPWS.

## Section 1613 – Earthquake Loads (Cont.)

- Added Sections:
  - Section 1613.6.3: Automatic sprinkler systems
  - Section 1613.6.4: Autoclaved Aerated Concrete (ACC) Masonry Shear Wall Design Coefficients and System Limitations
  - Section 1613.6.5: Seismic Controls for Elevators
  - Section 1613.6.6: Steel Plate Shear Wall Height Limits



## Section 1613 – Earthquake Loads (Cont.)

- Added Sections (Cont.):
  - Section 1613.6.7: Minimum Distance for Building Separation
  - Section 1613.6.8: HVAC Ductwork with $I_p = 1.5$
  - Section 1613.7 ASCE 7, Section 11.7.5

## Section 1614 – Structural Integrity

- Section added:
  - Section 1614: Added to the 2009 IBC.
  - Section 1614.3: Frame structures shall comply with the requirements of this section.
  - Section 1614.4 Bearing wall structures: Requires high-rise buildings in occupancy category III or IV to be tied together in the transverse, longitudinal and vertical direction with elements of certain minimum strength. It's modeled after ACI 318 for concrete structures.



## Section 1615 – Additional Requirements

- Modification:
  - Lighter version of 1614A of 2007 CBC which applied to all DSA-SS/CC (Community Colleges).

## Section 1603A – Construction Documents

- Additions:
  - 1603.3A.1.5 Earthquake Design Data
    - Applicable horizontal structural irregularities.
    - Applicable vertical structural irregularities.
- Modification:
  - 1603A.1.10 Construction Procedures



## Section 1604A – General Design Requirements

- Modification:
  - 1604A.3.7 Horizontal Diaphragms
- Addition:
  - Table 1604A.3 Deflection Limits (veneered walls)
  - Table 1604A.5 Occupancy Category of Buildings and Other Structures
  - Addition to Occupancy Category IV.

## Section 1605A – Load Combination

- Modification:
  - 1605A.1.1 Stability
    - When using allowable stress design, factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported.



## Section 1607A – Live Loads

- Addition:
  - Table 1607A.1 Minimum Uniformly Distributed Live Loads. Note "q" added.
- Sections Added:
  - 1607A.7: Loads on handrails, guards, grab bars, shower seats, dressing room bench seats and vehicle barrier systems
  - 1607A.11.5: Uncovered open-frame roof structures
  - 1607A.13: Interior walls and partitions

## Section 1608A – Snow Loads & Section 1609A – Wind Loads

- Partial Deletions:
  - 1608A.2 Ground Snow Loads
- Modification:
  - 1609A.6.2 Symbols and Notations
    - Importance Factor included in list



## Section 1613A – Earthquake Loads & Section 1614A – Structural Integrity

- Addition:
  - 1613A.1 Earthquake Loads definition
    - Active Earthquake Fault
    - Next Generation Attenuation (NGA)
  - Section 1613A.6.3 Automatic Sprinkler Systems
  - Other changes based on updates on chapter 1613 as noted
- Changes based on updates on chapter 1614 as noted

## Section 1615A – Modification to ASCE 7

- Modification:
  - 1615A.1.9 ASCE 7, section 12.10.2.1
    - $\Omega_0 Q_E$ for section 12.4.3.2, collector splice and their connections are defined. Largest of:
      - $\Omega_0 F_x$
      - $\Omega_0 F_{px}$
      - $0.2 S_{DS} I_{wpx}$
      - ASCE 7, section 12.13.1.1 Foundation and superstructure-to-foundation connections



## Section 1615A – Modification to ASCE 7 (Cont.)

- Modification:
  - 1615A.1.12 ASCE 7, section 13.1.4
    - Non-structural component exemption
    - Furniture
    - Temporary or moveable equipment
    - Architectural, Mechanical and Electrical components in seismic design category E and higher.

## Section 1615A – Modification to ASCE 7 (Cont.)

- Modification:
  - 1615A.1.14 ASCE 7, section 13.4
    - Design force attachment
    - Anchorage in concrete
    - Anchorage in masonry
    - Post installed in concrete and masonry
  - 1615A.1.15 ASCE 7, section 13.4.5
    - Power actuated fastener



## Section 1615A – Modification to ASCE 7 (Cont.)

- Modification:
  - 1615A.1.16 ASCE 7, section 13.5.6
    - Suspended ceiling and seismic forces (Fp)
    - Minimum of 4 psf Wp
- 1615A.1.20 ASCE 7, section 13.6.5
    - Conduit, cable tray, and other electrical distribution systems
- 1615A.1.21 ASCE 7, section 13.6.7
    - Duct work

## Section 1615A – Modification to ASCE 7 (Cont.)

- Modification:
  - 1615A.1.22 ASCE 7, section 13.6.8
    - Piping system
    - ASME pressure piping system
    - Fire protection sprinkler piping system
    - Other piping systems.
  - 1615A.1.23 Elevator guide rail support
  - 1615A.1.25 ASCE 7, chapter 16: Seismic Response History Procedure



## Section 1615A – Modification to ASCE 7 (Cont.)

- Modification:
  - 1615A.1.29 ASCE 7, Chapter 17: Seismic Design Requirements for Seismically Isolated Structures
  - 1615A.1.35 ASCE 7, Chapter 18: Damping Systems
  - 1615A.1.36 ASCE 7, Chapter 21: Site-Specific Ground Motion Procedure for Seismic Design
  - 1615A.1.37 ASCE 7 Table 12.2.1: Earthquake motion measuring instrumentation

## Chapter 17 & 17A

- 1701 - General
- *1702 - Definitions*
- 1703 - Approvals
- *1704 - Special Inspections*
- *1705 - Statement of Special Inspections*
- *1706 - Special Inspections for Wind Requirements*
- *1707 - Special Inspections for Seismic Resistance*
- *1708 - Structural Testing for Seismic Resistance*



## Chapter 17 & 17A (cont.)

- 1709 - Contractor Responsibility
- 1710 - Structural Observations
- 1711 – Design Strengths of Materials
- 1712 – Alternative Test Procedure
- 1713 – Test Safe Load
- 1714 – In-Situ Load Tests
- *1715 – Preconstruction Load Tests*
- *1716 – Material And Test Standards*

## Section 1702 - Definitions

- Modifications to the terms:
  - Fabricated Item
    - Items are now in accordance with a standard that is listed in Ch 35
  - Structural Observation
    - Updated to coordinate with the current (re-numbered) sections



## Section 1702 – Definitions (cont)

- Deletion of the terms:
  - Label
  - Manufacturer's Designation
  - Mark
- Addition of the terms:
  - Intumescent Fire-Resistant Coatings
  - Mastic Fire Resistant Coating

## Section 1704 – Special Inspection

- Section 1704.3 – Steel Construction
  - Modification to Table 1704.3, Required Verification and Inspection of Steel Construction
    - Further specifies certain types of materials



## Section 1704 - Special Inspections (cont)

- Addition of sub-section in 1704.3.1 Welding
  - 1704.3.1.1 – Structural Steel
  - 1704.3.1.2 – Cold-Formed Steel
  - 1704.3.1.3 – Reinforced Steel
- Addition of Sections for:
  - Cold-Formed Steel Trusses Spanning 60 feet or greater, 1704.3.4

## Section 1704.4 – Concrete Construction

- Addition of note #4 was placed in Table 1704.4, Required Verification and Inspection of Concrete Construction
  - Inspection of anchors installed in hardened concrete per ACI 3.8.6, 8.1.3, 21.2.8



## Section 1704.5.2 Masonry Construction

- Modification of Table 1704.5.1, Level I Inspection
  - For occupancy category I, II, or III
  - Three new sections were added at the beginning of Table
    - The first section was the previous #6 section of previous code
    - The second section was the verification of $f'_m$ and $f'_{AAC}$
    - Verification of slump flow and VSI (For Self-Consolidating)

## Section 1704.5.3 Masonry Construction

- Modification of Table 1704.5.2, Level II Inspection
  - For occupancy category IV
  - Three new sections were added at the beginning of Table
    - The first section was #4 section of previous code
    - The second section was the verification of $f'_m$ and $f'_{AAC}$ (for every 5,000 sqft)
    - Verification of pre-mixed mortar and grout
    - Verification of slump flow and VSI (For Self-Consolidating)



## Section 1704.6 Wood Construction
## Section 1704.9 Deep Foundation

- Addition of Section 1704.6.2 Metal-Plate-Connected Wood Trusses Spanning 60 feet or Greater
- Section of Masonry Piers relocated to Section 1704.11 – Vertical Masonry Foundation Elements
- Approved Geotechnical Report required

## Section 1704.10 Helical Pile Foundations

- Require continuous special inspection during installation
- Torque and other installation data must be recorded as required by design professional
- Geotechnical Reports are used for compliance



## Section 1704.12 Sprayed Fire Resistant Material

- Modification and Addition of Sections
- Structural members include Beams, Joists, and Columns

## Section 1705 – Statement of Special Inspections

- Re-organization of Section 1705.3-Seismic Resistance
- Addition of:
  - 1705.3.1 Seismic-Force-Resisting Systems
  - 1705.3.2 Designated Seismic Systems
  - 1705.3.3-1705.3.5 Seismic Design Category C-F



## Section 1706 – Special Inspections for Wind Requirements

- New Section, Previously know as Section 1706 Contractor Responsibility
  - 1706.1 Discusses all Exposure Categories, B,C & D
  - 1706.2 Covers all of the structure of wood, except for shear panels or diaphragms with fastening spacing more than 4" O.C.
  - 1706.3 Cold-Formed Steel Light Weight Construction, with a similar exception and when sheathing is gypsum or fiberboard
  - 1706.4 Periodic Inspection for Roof/Wall Cladding

## Section 1707 – Special Inspections for Seismic Resistance

- Expanded the Exceptions section in 1707.2 Structural Steel.
- 1707.4 Cold-Formed Steel Light Weight Construction, with a similar exception and when sheathing is gypsum or fiberboard

**Exceptions:**

1. *Special inspections* of structural steel in structures assigned to *Seismic Design Category* C that are not specifically detailed for seismic resistance, with a response modification coefficient, *R*, of 3 or less, excluding cantilever column systems.
2. For ordinary moment frames, ultrasonic and magnetic particle testing of complete joint penetration groove welds are only required for demand critical welds.



## Section 1707 – Special Inspections for Seismic Resistance (cont)

- Section 1707.6 – Architectural Components – Exceptions
  - Includes non-bearing walls and cladding in SDC D and higher

**Exceptions:**

1. *Special inspection* is not required for exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface.
2. *Special inspection* is not required for exterior cladding and interior and exterior veneer weighing 5 psf (24.5 N/m$^2$) or less.
3. *Special inspection* is not required for interior nonbearing walls weighing 15 psf (73.5 N/m$^2$) or less.

## Section 1708 – Structural Testing for Seismic Resistance

- 1708.1 Testing and Qualification or Seismic Resistance
  - Section expanded and now includes a 4th qualification for seismically isolated structures.
- Architectural components assigned to SDC C and higher with Ip = 1.0 require testing



## Section 1708 – Structural Testing for Seismic Resistance (cont)

- 1708.2 Concrete Reinforcement.
  - All reinforcing for earthquake resisting elements shall be according to ACI 21.1.5.2 (ASTM A 705)
- 1708.3 Structural Steel – quality assurance Exceptions
  - Structures with R < or = 3 in moment frame in SDC C (excluding cantilever column system)
  - Ordinary moment frames required only for demand critical welds

## Section 1708 – Structural Testing for Seismic Resistance (cont)

- 1708.4 Seismic Certification of Non-Structural Components
  - Several requirements are needed for certification based on actual tests, 3D shock test, analytical method using dynamic characteristics forces by the use of historical data.



## Section 1715 - Preconstruction Load Tests

- Section 1715.5.2
  - Exterior windows and door assemblies
- ASTM E330 or ANSI/DASMA 108 acceptance criteria

# Chapter 17A Structural Test and Special Inspections

- Table 1704A.5.1 & Table 1704A.5.2 – Change in Title and Sections
- Addition of 1708A.4 Seismic Certification of Nonstructural Components
  - Addition of section [OSHPD 1&4] and 2 "Exception" sections



# Section 1708A.4

*[OSHPD 1 & 4] Active or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with ASCE 7 Section 13.2.5 or experience data in accordance with ASCE 7 Section 13.2.6 unless it can be shown that the component is inherently rugged by comparison with similar seismically certified components.*

*Unless specified otherwise in the test standard, a minimum of two tests are required. Where a range of products are tested the two tests can be on different size products as required by design changes in the internal structures.*

***Exception:** When a single product (and not a product line with more than one product with variations) is certified and manufacturing process is ISO 9001 certified, one dynamic test shall be permitted.*

*For a multicomponent system, where active or energized components are certified by tests or experience data, connecting elements, attachments and supports can be justified by supporting analysis.*

*Special seismic certification in accordance with ASCE 7 Section 13.2.2 shall be required for the following systems, equipment, and components, unless specified otherwise by the enforcement agency:*

1. *Emergency and standby power systems including generators, turbines, fuel tanks and automatic transfer switches*
2. *Elevator equipment (excluding elevator cabs)*
3. *Components with hazardous contents (excluding pipes, ducts, and underground tanks)*
4. *Smoke control fans*
5. *Exhaust fans*
6. *Switchgear*
7. *Motor control centers*
8. *X-Ray machines in fluoroscopy rooms*
9. *CT (computerized tomography) Scanners*
10. *Air conditioning units*
11. *Air handling units*
12. *Chillers*
13. *Cooling towers (excluding cooling towers designed as nonbuilding structures)*
14. *Transformers*
15. *Electrical substations*
16. *UPS (Inverters) and associated batteries*
17. *Distribution panels including electrical panel boards*
18. *Control panels including fire alarm, fire suppression, preaction, and auxiliary or remote power supplies*

***Exceptions:***

1. *Equipment and components installed in nonconforming buildings, unless the equipment or component provides a service/system or utility to conforming buildings, or building is designated as SPC 3 or higher.*
2. *Equipment and components weighing not more than 20 lbs supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with ASCE 7 Chapter 13 as modified by Section 1615A.*