

**Agenda  
Item  
IV-A**

**State of Oregon**

**Board memo**

**Building Codes Division**

**August 6, 2008**

**To:** Building Code Structures Board

**From:** Richard Rogers  
Structural Program Chief

**Subject:** SUPPLEMENT: Statewide Alternate Method No. OSSC 08-05  
Adopting the 2006 International Building Code (IEBC)  
*Summary of proposed Structural Provision changes*

**Discussion:**

Based upon research by the Vintage Building Committee of the Structural Engineers Association of Oregon (SEAO) and code changes submitted to the 2009 IEBC by the Existing Building Committee of the National Council of Structural Engineering Associations (NCSEA-EBC), the Building Codes Division is proposing that the following structural modifications be included in the consideration of the 2006 IEBC alternate method proposal.

The division's long term goal is to pursue the adoption of the 2009 IEBC (in place of OSSC chapter 34) as part of the regular adoption cycle of the 2010 OSSC, effective April 1st, 2010.

As indicated by the number of successful proposed model code changes to the 2009 IEBC, the 2006 IEBC contains errors, omissions and associated difficulties. The proposed changes are seeking to remedy numerous conflicts and unintended loopholes which inadvertently leave many buildings with no structural requirements.

***Available IEBC Compliance Options:***

- The ***Prescriptive Compliance Method*** of Chapter 3 mirrors the requirements of Chapter 34 of the 2007 OSSC. There are no significant structural concerns with this method.
- ***The Work Area Compliance Method of Chapters 4 through 12 constitutes the entirety of the proposed structural revisions.***
- The ***Performance Compliance Method*** of Chapter 13 requires all structures to meet the 2007 OSSC. There are no significant structural concerns with this method.

In assessing the structural Change of Occupancy provisions of the 2006 IEBC, the SEAO review compared the 2006 IEBC provisions to the City of Portland (COP) Title 24.85 *Seismic Design Requirements for Existing Buildings*. COP Title 24.85 is a local amendment that governs mandatory seismic rehabilitation and repair of existing structures within the

City of Portland. Both the IEBC and COP Title 24.85 require mandatory seismic upgrades to existing buildings undergoing changes of occupancy to a higher relative hazard class. COP Title 24.85 has been in place for over 10 years and has a successful track record of balancing the diverse needs of building owners, historic preservations, and public seismic safety policy. Conversely, the IEBC has yet to be adopted widely in jurisdictions in high seismic risk regions. Research has shown that the standards of the 2006 IEBC would allow significant changes in the seismic hazard of a structure (as measured by occupant load) without requiring any seismic retrofiting. In as much, some of the proposed modifications are modeled after the requirements of Title 24.85 with adjustments to fit within the standard of the 2006 IEBC. The 2009 IEBC will be consistent with these changes.

***Vague code language and loopholes that hinder code effectiveness.*** The Existing Building Committee of the National Council of Structural Engineering Associations (NCSEA-EBC) has submitted numerous code revision proposals as part of the 2009 IEBC adoption process. All of the NCSEA-EBC proposals have been balloted and approved (1<sup>st</sup> round) for inclusion in the 2009 IEBC and fix the most notable problems of the code. In order to avoid duplication of work and to provide consistency with the next generation of the IEBC, the NCSEA-EBC proposed revisions were the basis for most of the proposed structural revisions.

***Seismic Regions (west coast):*** Many states have adopted the IEBC but research has found that few states or municipalities in high-seismic regions have fully adopted the IEBC 2006. Several cities such as Seattle, are receptive to the use of the IEBC for minor tenant improvements but do not allow the use of the IEBC for structural alterations or changes of occupancy because of the concerns noted previously.

***2006 IEBC Appendix A (Seismic upgrades).*** The division concurs with SEA0 and others that many of the provisions of Appendix A are out-of-date and as such should be deleted in favor of ASCE 41 and ASCE 31.

- ***ASCE 31 provides guidelines for the “evaluation of existing buildings”***
- ***ASCE 41 specifies “technical requirements for the seismic rehabilitation.”***

These two documents provide state-of-the-art guidance for rehabilitation of existing structures.

***Reference standards of the IEBC.*** In some instances the referenced standards are obsolete, redundant, or not applicable in the manner referenced. For example, references to FEMA 356 should be changed in that it is no longer available and has been incorporated into ASCE 41.

### ***Section-by-section summary of the proposed changes:***

***The attached documents detail the proposed changes by chapter.***

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Chapter 1*

**Section 101.5**

Chapter 1 describes the administration information of the 2006 IEBC. Section 101.5 defines the three methods that designers can use to demonstrate compliance. The obvious expectation that all new structural elements must meet the current IBC was clarified in Section 101.5.

NCSEA's revision at the model code level removed a loophole found in Section 101.5, which allowed the use of the original code in effect at the time the building was built.

**SUMMARY OF PROPOSED REVISIONS:**

1. Clarify that all new structural members must meet the current IBC.
2. Remove loophole that allows structural design to previous editions of code.

**PROPOSED CHANGE:**

**101.5 Compliance Methods.** The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 101.5.1 through 101.5.3 as selected by the applicant. Application of a method shall be the sole basis for assessing the compliance of work performed under a single permit unless otherwise approved by the code official. Sections 101.5.1 through 101.5.3 shall not be applied in combination with each other.

New structural members added to a building or structure as part of the addition, rehabilitation, repair or alteration shall comply with the *International Building Code*. Repairs and alterations of existing buildings in flood hazard areas shall comply with Sections 501.4 and 601.3, respectively.

**Exception:** Nonstructural Aalterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building has sustained substantial nonstructural damage, as defined in Section 506.2 or the building is undergoing more

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~~than a limited structural alteration as defined in Section 807.5.3. New structural members added as part of the repair or alteration shall comply with the International Building Code. Repairs and alterations of existing buildings in flood hazard areas shall comply with Sections 501.4 and 601.3, respectively.~~

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Chapter 5*

**Section 506.1**

Section 506.1 describes the Work Area Method requirements for structural repairs. Repairs follow the work area method, with the amount of repair work commiserative with the damage. The highlights of the revisions in this section include revising references to FEMA 356 to the replacement national standard ASCE 41. The correct usage of companion IBC, ASCE 31 and ASCE 41 was clarified.

**SUMMARY OF PROPOSED REVISIONS:**

1. Changing reference to ASCE 41 (from FEMA 356)
2. Clarify the evaluation and design procedures (i.e. IBC, ASCE 41 and ASCE 31)
3. Removal of reference to the Appendices to meet reduced IBC forces
4. Clarifying that ASCE 31 can only be used for evaluation to meet reduced IBC forces
5. Clarifying what is required for repair.

**PROPOSED CHANGE:**

**506.1 General.** ~~Repairs of structural elements shall comply with this section.~~ Structural repairs shall be in compliance with this section and Section 506.2. Regardless of the extent of structural or nonstructural damage, dangerous conditions shall be eliminated. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the International Building Code for new buildings of similar structure, purpose and location.

**506.1.1 Seismic evaluation and design.** Seismic evaluation and design of an existing building and its components shall be based on the following criteria.

**506.1.1.1 Evaluation and design procedures.** The seismic evaluation and design shall be based on the procedures specified in the *International Building Code*, ~~ASCE 31~~ or ASCE 41. ~~FEMA 356. The procedures contained in Appendix A of this code~~

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~~shall be permitted to be used as specified in Section 506.1.1.3.~~ When allowed, seismic evaluation can be based on ASCE 31.

**506.1.1.2 Compliance with IBC level seismic forces.** Where compliance with the seismic design provisions of the ~~When seismic forces are required to meet the~~ *International Building Code* is required, the procedures shall be in accordance with level, they shall be one of the following:

1. ~~One hundred percent of t~~The values in the *International Building Code* using one-hundred percent of the prescribed forces. The  $C_d$ ,  $\Omega$  and R-factor used for analysis in accordance with ASCE 7~~Chapter 16 of the~~ *International Building Code* shall be the R-factors specified for structural systems classified as “Ordinary” in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as “Intermediate” or “Special.”
2. ~~Those associated with~~ Compliance with ASCE 41 using both the BSE-1 and BSE-2 Earthquake Hazard Levels and the ~~defined in FEMA 356.~~ Where FEMA 356 is used, the corresponding performance levels shall be those shown in Table 506.1.1.2.

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**TABLE 506.1.1.2**

**ASCE 41~~FEMA 356~~ AND ASCE 31 PERFORMANCE LEVELS**

OCCUPANCY CATEGORY (BASED ON IBC TABLE 1604.5)	PERFORMANCE LEVEL FOR USE WITH ASCE 31 AND WITH <u>ASCE 41</u> <del>FEMA</del> <del>356</del> BSE-1 EARTHQUAKE HAZARD LEVEL	PERFORMANCE LEVEL FOR USE WITH <u>ASCE 41</u> <del>FEMA</del> <del>356</del> BSE-2 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Collapse Prevention (CP)
II	Life Safety (LS)	Collapse Prevention (CP)
III	Note a, <u>Note b</u>	Note a
IV	Immediate Occupancy (IO)	Life Safety (LS)

- a. ~~Performance levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV. Acceptance criteria for Occupancy Category III shall be taken as 80 percent of the acceptance criteria specified for Occupancy Category II performance levels, but need not be less than the acceptance criteria specified for Occupancy Category IV performance levels.~~
- b. For Occupancy Category III, the ASCE 31 Screening Phase checklists shall be based on the Life Safety performance level.

**506.1.1.3 Compliance with Reduced IBC level seismic forces.** ~~When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following: Where seismic evaluation and design is permitted to meet reduced *International Building Code* seismic force levels, the procedures used shall be in accordance with one of the following:~~

1. ~~Seventy-five percent of the forces prescribed in ~~the~~ *International Building Code* using seventy-five percent of the prescribed forces.~~ The  $C_d$ ,  $\Omega$  and R-factor used for analysis in accordance with ASCE 7~~Chapter 16 of the *International Building Code*~~ shall be the R-factor~~s~~ as specified in Section 506.1.1.2 of this code.

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~~2. In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A shall be deemed to comply with the requirements for reduced International Building Code force levels.~~

~~2.1 The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.~~

~~2.2 Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.~~

~~2.3 Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light framed construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.~~

~~2.4 Seismic evaluation and design of soft, weak or open front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.~~

~~Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.~~

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~~3. In accordance with ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2.~~

~~4.2. Compliance with ASCE 41 using Those associated with the BSE-1 Earthquake Hazard Level defined in FEMA 356 and the performance level as shown in Table 506.1.1.2. Where FEMA 356 is used, the design spectral response acceleration parameters  $S_{XS}$  and  $S_{X1}$  specified in ASCE 41 shall not be taken less than 75 percent of the respective design spectral response acceleration parameters  $S_{DS}$  and  $S_{D1}$  defined by the *International Building Code* and its reference standards.~~

A building that is evaluated and determined to meet ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2 is considered to be compliant with reduced IBC level forces.

**506.2 Repairs to damaged buildings.** Repairs to damaged buildings shall comply with this section.

~~**506.2.1 Dangerous conditions.** Regardless of the extent of structural damage, dangerous conditions shall be eliminated.~~

**506.2.1 Repairs for less than substantial structural damage.** For damage less than substantial structural damage, the damaged elements shall comply with the *International Building Code*.

**506.2.2 Repairs for S**ubstantial structural damage to vertical elements of the lateral-force-resisting system. A building that has sustained substantial structural

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damage to the vertical elements of the lateral-force-resisting system shall be evaluated ~~and repaired~~ in accordance with ~~the applicable provisions of~~ Sections 506.2.2.1, and either repaired in accordance with Section 506.2.2.2 or repaired and rehabilitated in accordance with Section 506.2.2.3 depending on the results of the evaluation. ~~through 506.2.2.3.~~

**506.2.2.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluations shall establish whether the damaged building, if repaired to its predamaged state, would comply with the provisions of the *International Building Code*, ~~except that the seismic design criteria shall be the .~~ ~~Wind forces for this evaluation shall be those prescribed in the International Building Code.~~ ~~Seismic forces for this evaluation are permitted to be the~~ reduced level seismic forces specified in Section 506.1.1.3.

**506.2.2.2 Extent of repair for compliant buildings.** If the evaluation establishes that the building in its pre-damage condition complies with the provisions of compliance of the predamaged building in accordance with Section 506.2.2.1, then the damaged elements shall repaired such that they comply with the International Building Code. ~~the repairs shall be permitted that restore the building to its predamaged state using materials and strengths that existed prior to the damage.~~

**506.2.2.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish that the building in its pre-damage condition complies with the

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~~provisions of compliance of the predamaged building in accordance with~~ Section 506.2.2.1, then the building shall be rehabilitated to comply with the provisions of this section. The wind loads for the repair and rehabilitation shall be those required by the building code in effect at the time of the original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the *International Building Code*. The seismic loads for this rehabilitation shall be those in effect at the time of original construction, but not less than IBC level forces specified in Section 506.1.1.2, applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces. The wind design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the design level shall be as required by the code in effect at the time of original construction or as required by the *International Building Code*, whichever is greater. Seismic forces for this rehabilitation design shall be those required for the design of the predamaged building, but not less than the reduced level seismic forces specified in Section 506.1.1.3. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

~~506.2.4 Less than substantial structural damage.~~

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Chapter 6*

**Section 606.1**

Section 606.1 describes the Work Area Method requirements of a Level 1 Building Alteration. Level 1 is the lowest level of alteration work on an existing building with Levels 2 and 3 building on the requirements contained herein. Unfortunately, this section is disorganized and has subsequently been nearly re-written. The proposal is to re-organize section 606 by creating 3 sub-sections including: General, Support of new loads and additional requirements for re-roof of certain concrete and masonry buildings.

**SUMMARY OF PROPOSED REVISIONS:**

1. Deleting redundant text in section 606.1 and 606.2 regarding structural work and the applicability of this section.
2. Section 606.2 is revised to ensure that new equipment is anchored/braced in accordance with current code.
3. Clarifying in 606.3.1 and 606.3.2 that bracing and anchorage for walls and parapets is required only where construction does not meet reduced level code forces. Where the existing bracing/anchorage system does not meet the reduced level forces then installation of new anchors must be to current code. Allowing installation of new anchorage that does not meet current code is in direct violation of several code sections. All new work must meet current code.
4. Revising the language of the parapet bracing provisions in 606.3.1 to ensure that all URM parapets are braced, not just the URM parapets that are components of URM bearing wall buildings. Many concrete frame buildings, for example, contain URM parapets that pose equal life-safety risk.
5. Revising scope of section 606.3.2 regarding wall anchorage requirements. New language includes anchorage of flexible roof diaphragms for reinforced masonry and concrete buildings, not just URM bearing wall construction. This mitigates the substantial risk demonstrated in past earthquakes, posed by older concrete tilt-up and other heavy wall construction that rely upon inadequate anchorage to flexible roof diaphragms. Requiring installation of anchorage during re-roofing is a cost-effective way of updating these buildings to provide enhanced performance for seismic loads.
6. Revise scope of roof diaphragm upgrades to only include buildings in high wind regions.

**PROPOSED CHANGE:**

**606.1 General** Where alteration work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the ~~structural~~ provisions of this section shall apply.

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~~606.2 Design criteria. Existing structural components supporting alteration work shall comply with this section.~~

**606.2.1 Addition or replacement of roofing or replacement of equipment.** Where addition or replacement of roofing or replacement of equipment results in additional dead loads, structural components supporting such reroofing or equipment shall comply with the ~~vertical-gravity~~ loading requirements of the *International Building Code*. Replacement equipment shall be anchored and braced in accordance with the requirements of the *International Building Code*.

**Exceptions:**

1. Structural elements where the additional dead load from the roofing or equipment ~~is not increased~~ does not increase the force in the element by more than 5%.
2. Buildings constructed in accordance with the *International Residential Code* or the conventional light-frame construction methods of the *International Building Code* and where the additional dead load from the roofing or equipment is not increased by more than 5 percent.
3. Addition of a second layer of roof covering weighing 3 pounds per square footing (0.1437 kN/m<sup>2</sup>) or less over an existing, single layer of roof covering ~~shall be permitted~~.

606.3 Additional requirements for re-roof permits. The requirements of this section shall apply to alteration work requiring re-roof permits.

~~606.2.2 Parapet bracing and wall anchors for reroof permits.~~ 606.3.1 Bracing for unreinforced masonry parapets. ~~Unreinforced masonry bearing wall buildings~~

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~~classified as~~ Where a permit is issued for re-roofing where roofing materials on more than 25% of the roof area of a building assigned to Seismic Design Category D, E or F are removed and which has parapets constructed of unreinforced masonry, the work shall include installation of ~~shall have~~ parapet bracing ~~and wall anchors installed at the roof line whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with~~ to resist the ~~reduced~~ *International Building Code level* seismic forces as specified in Section 506.1.1.3-2 ~~and design procedures of Section 506.1.1.1.~~ unless an evaluation demonstrates compliance of such items using the reduced *International Building Code* seismic forces as specified in Section 506.1.1.3.

**606.3.2 Wall anchors for concrete and masonry buildings.** Where a permit is issued for re-roofing where roofing materials on more than 25% of the roof area of a building assigned to Seismic Design Category D, E or F are removed from a building with a structural system consisting of concrete or reinforced masonry walls with a flexible roof diaphragm or unreinforced masonry walls with any type of roof diaphragm, the work shall include installation of wall anchors at the roof line to resist the *International Building Code* seismic forces as specified in Section 506.1.1.2, unless an evaluation demonstrates compliance of the existing wall anchorage to resist the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3..

**606.3.3 Roof diaphragms resisting wind loads in high wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or

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section of a building located where the basic wind speed is greater than 90 mph or in a special wind region, as defined in Section 1609 of the *International Building Code* ~~where the roof diaphragm is a part of the main windforce resisting system the integrity of the roof diaphragm shall be evaluated and if found deficient because of insufficient or deteriorated connections, such connections shall be provided or replaced.~~ roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition do not comply with those wind provisions, they shall be replaced or strengthened.

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**Section 707**

Section 707 describes the Work Area Method requirements of a Level 2 building alteration. Level 2 is limited to reconfiguration of space and new equipment. These revisions significantly rewrite the structural alteration provisions of the IEBC and are necessary to fix many gaps, errors and omissions of the current edition and provide needed clarity and consistency in application of the code.

**SUMMARY OF PROPOSED REVISIONS:**

1. Clarify the applicability of structural provision sections. The current language of section 707.1 does not invoke the structural requirements unless the live loading (per IBC table 1607.1) is changed. This error would allow all types of structural revisions that do not meet code as long as the live-load is not increased. This revision ensures that the structural provisions are applicable to all alterations of structural members.
2. Reinforcing those requirements for Alteration Levels 1, 2 and 3 are cumulative. This change is not mandatory as it is included generally in section 404.2, but does improve usability of the code.
3. Removing section 707.2 which is in direct conflict with other sections that do allow limited strength reduction of lateral system. Reduction in strength of gravity framing is covered under the gravity framing section.
4. Adding section 707.3 minimum design loads to provide consistency with the provisions for Level 3 alterations.
5. Revising section 707.4 to clarify the applicability of structural provisions to all alterations, similar to item 1 above.
6. Merging 707.4.1 into section 707.4 to improve presentation. Rename section to clarify applicability to gravity framing system.
7. Separating previous lateral loads section 707.4.2 into new section 707.5 to better clarify lateral and gravity requirements.
8. Clarifying lateral revision checks of existing elements by changing the alteration trigger to a D/C ratio change versus changes in load and capacity. This approach better satisfies the intent of the code to allow minor changes to structural elements of the lateral system without triggering upgrade of the lateral system as it allows some limited increase in force and/or decrease in capacity. The D/C ratio approach provides more flexibility than currently provided in OSSC chapter 34, which does not allow any strength reduction. It improves current IEBC language by closing the loophole that inadvertently allowed simultaneous 10% increases in load and decreases in capacity.
9. Deleting the snow drift section 707.4.3 and including this section within the gravity loads requirements for enhanced clarity.
10. Adding section 707.6 for voluntary seismic upgrades similar to requirements for Level 3 alterations.

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**PROPOSED CHANGES:**

**707.1 General.** ~~Where alteration work includes installation of additional equipment that is structurally supported by the building or reconfiguration of space such that portions of the building become subjected to higher gravity loads as required by Tables 1607.1 and 1607.6 of the *International Building Code*, the provisions of this section shall apply. Structural elements and systems within buildings undergoing Level 2 Alterations shall comply with the requirements of this section and section 606.~~

**707.2 Reduction of strength.** ~~Alterations shall not reduce the structural strength or stability of the building, structure or any individual member thereof.~~

~~**Exception:** Such reduction shall be allowed as long as the strength and the stability of the building are not reduced below the *International Building Code* levels.~~

**707.3 ~~707.2~~ New structural ~~members, elements.~~** New structural ~~members, elements~~ in alterations, including connections and anchorage shall comply with the *International Building Code*.

**707.3 Minimum design loads.** The minimum design loads on existing elements of a structure that do not support additional loads as a result of an alteration shall be the loads applicable at the time the building was constructed.

**707.4 Existing structural ~~members, elements carrying gravity loads.~~** ~~Existing structural components supporting additional equipment or subjected to additional loads based on *International Building Code* Tables 1607.1 and 1607.6 as a result of a reconfiguration of space shall comply with Sections 707.4.1 through 707.4.3~~Alterations shall not reduce the capacity of existing gravity load-carrying structural elements unless it is demonstrated that the elements have

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the capacity to resist the applicable design gravity loads required by the *International Building*

~~Code.~~**707.4.1 Gravity loads.** Existing structural elements supporting any additional gravity loads as a result of the alterations, including the effects of snow drift, ~~additional equipment or space reconfiguration~~ shall comply with the *International Building Code*.

**Exceptions:**

1. Structural elements whose stress is not increased by more than 5 percent.
2. Buildings of Group R occupancy with not more than five dwelling units or sleeping units used solely for residential purposes where the existing building and its alteration comply with the conventional light-framed construction methods of the *International Building Code* or the provisions of the *International Residential Code*.

**707.4.2 Lateral loads.****707.5 Existing structural elements resisting lateral loads.**

~~Buildings in which Level 2 alterations increase the seismic base shear by more than 10 percent or decrease the seismic base shear capacity by more than 10 percent. Any existing lateral load-resisting structural element whose demand-capacity ratio with the alteration considered is more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall comply with the structural requirements specified in Sections 807.5 and 807.7.~~**Section 807.5. –Changes in base shear and base shear capacity shall be calculated relative to conditions at the time of the original construction. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and**

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1613 of the International Building Code. For purposes of this section, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.

~~**Exception:** If the building's seismic base shear capacity has been increased since the original construction, the percentage changes shall be permitted to be calculated relative to the increased value.~~

~~**707.4.3 Snow drift loads.** Any structural element of an existing building subjected to additional loads from the effects of snow drift as a result of additional equipment shall comply with the *International Building Code*.~~

~~— **Exceptions:**~~

- ~~1. Structural elements whose stress is not increased by more than 5%.~~
- ~~2. Buildings of Group R occupancy with no more than five dwelling units or sleeping units used solely for residential purposes where the existing building and its alteration comply with the conventional light frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.~~

**707.6 Voluntary lateral-force resisting system alterations.** Alterations of existing structural elements and additions of new structural elements that are initiated for the purpose of increasing the lateral-force resisting strength or stiffness of an existing structure and that are not required by other sections of this code shall not be required to be designed for forces conforming to the *International Building Code*, provided that an engineering analysis is submitted to show that:

1. The capacity of existing structural elements required to resist forces is not reduced;

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2. Either the lateral loading to existing structural elements is not increased beyond their capacity or the lateral loading to existing structural elements is not increased by more than 10 percent;
3. New structural elements are detailed and connected to the existing structural elements as required by the *International Building Code*;
4. New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required by the *International Building Code*; and
5. A dangerous condition as defined in this code is not created.

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**Section 807**

Section 807 describes the Work Area Method requirements of a Level 3 building alteration. Level 3 work area will exceed 50% of the building area. The proposed revisions update the structural provisions section for Level 3 alterations to align with the nomenclature, formatting and requirements of Level 2 (section 707) and Level 1 (section 606) alterations. The proposed modifications to section 807.1 reinforce that provisions of Level 3 alterations are cumulative with level 1 and 2. Although not mandatory, as this language is included in 405.2, it does improve usability of the code.

**SUMMARY OF PROPOSED REVISIONS:**

1. Removing section 807.2 which is in direct conflict with the lateral load provisions which allow limited reduction in strength of lateral system. Reduction in strength of gravity framing is covered under gravity framing section.
2. Revising 807.3 to re-name the section and to reference Level 2 alteration requirements. This removes duplicate information and reinforces the intent that provisions are cumulative (i.e. Level 3 must satisfy requirements of Level 1 and Level 2) and consistent for all alteration levels.
3. Revising 807.4 to re-name section.
4. Adding section 807.4 regarding gravity load carrying elements to follow similar format as section Level 2 alterations section 707. Referencing the requirements of section 707 reinforces the intent that the Level 3 provisions are cumulative with other alteration levels and consistent for all alteration levels.
5. Clarifying section 807.5 requirements are for all Level 3 alterations and Level 2 alterations where referred to from section 707.
6. Removing exception 3 from 807.5 as base shear capacity is no longer a trigger. Also, changes in capacity are specifically referenced from the revised section 707.4.
7. Changing code from reduced IBC to full IBC forces for altered elements of the lateral system for substantial and limited alterations. This brings the code in line with current design practice and OSSC chapter 34 and COP title 24.85. This ensures that modified portions of structures conform to the current best practices regarding structural loads and design.
8. Revise 807.5.3 to clarify that all modified structural elements must meet current code forces.

**PROPOSED CHANGES:**

**807.1 General.** Where buildings are undergoing Level 3 alterations including structural alterations, the provisions of this section and sections 707 and 606 shall apply.

~~**807.2 Reduction of strength.** Alterations shall not reduce the structural strength or stability of the building, structure, or any individual member thereof.~~

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~~**Exception:** Such reduction shall be allowed provided that the structural strength and the stability of the building are not reduced to below the *International Building Code* levels.~~

~~**807.3 New structural members.**~~ **807.2 New structural elements.** New structural members in alterations, including connections and anchorage, shall comply with the *International Building Code*. elements shall comply with Section 707.2.

**807.4.3 Minimum design loads.** The minimum design loads on existing elements of a structure that do not support additional loads as a result of an alteration shall be the loads applicable at the time the building was constructed.

**807.4 Existing structural elements carrying gravity loads.** Existing structural elements carrying gravity loads shall comply with Section 707.4.

~~**807.5 Structural alterations.** Buildings and structures undergoing Level 3 structural alterations or buildings in which the seismic base shear is increased by more than 10 percent or in which the seismic base shear capacity is decreased by more than 10 percent because of alterations shall comply with this section. Changes in base shear and base shear capacity shall be calculated relative to conditions at the time of original construction.~~

**807.5 Existing structural members resisting lateral loads.** All structural elements of the lateral-force resisting system in buildings undergoing Level 3 structural alterations or buildings undergoing Level 2 alterations as triggered by Section 707.5 shall comply with this section

**Exceptions:**

1. Buildings of Group R occupancy with no more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *International Building*

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Code or in compliance with the provisions of the *International Residential Code*.

2. Where such alterations involve only the lowest story of a building and the change of occupancy provisions of Chapter 9 do not apply, only the lateral-force-resisting components in and below that story need comply with this section.

~~3.If the building's seismic base shear capacity has been increased since the original construction, the percentage changes shall be permitted to be calculated relative to the increased value.~~

**807.5.1 Evaluation and analysis.** An engineering evaluation and analysis that establishes the structural adequacy of the altered structure shall be prepared by a registered design professional and submitted to the code official.

**807.5.2 Substantial structural alteration.** Where more than 30 percent of the total floor and roof areas of the building or structure have been or are proposed to be involved in structural alteration within a 12-month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the *International Building Code* for wind loading and ~~with the reduced *International Building Code* level seismic forces, as specified in Section 507.1.1.3 for seismic loading.~~ For seismic considerations, the analysis shall be based on one of the procedures specified in Section ~~507~~506.1.1.1. The areas to be counted toward the 30 percent shall be those areas tributary to the vertical load-carrying components, such as joists, beams, columns, walls and other structural components that have been or will be removed, added or

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altered, as well as areas such as mezzanines, penthouses, roof structures and in-filled courts and shafts.

**807.5.3 Limited structural alteration.** Where not more than 30 percent of the total floor and roof areas of the building are involved in the structural alteration within a 12-month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads applicable at the time of the original construction or of the most recent substantial structural alteration as defined by Section 807.5.2. Any existing structural element whose seismic demand-capacity ratios with the alteration considered are more than 10 percent greater than their demand-capacity ratio with the alteration ignored shall comply with the *International Building Code* level seismic forces as specified in 506.1.1.3.

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**Section 907**

Section 907 deals with the Work Area Compliance method regarding changes of occupancy. A change of occupancy can change the floor and roof live loads, snow and lateral loads (through changes in importance factor due to a change in the building occupancy category) and the seismic hazard category. Section 907 requires that all structural framing supporting increased gravity loads meet current code. Under the 2006 IEBC a change of occupancy requires a mandatory seismic upgrade when the occupancy classification is moved to a higher relative hazard level (per IEBC Table 912.4) or the building occupancy category moves to a higher level (per IBC Table 1604.5).

Using the Means of Egress Hazard Category table of the 2006 IEBC (Table 912) as the standard for requiring mandatory seismic upgrades to existing buildings results in far fewer buildings requiring mandatory seismic strengthening than the application of COP Title 24.85 or the 2009 IEBC. Adoption of the unammended 2006 IEBC will allow for substantial increase in the seismic hazard of an existing structure (as measured by total building occupant load) without mandatory seismic strengthening. The case studies performed by the members of SEAO determined that occupancy changes that required seismic upgrades under COP Title 24.85 were often not required under the 2006 IEBC. Modification of the IEBC hazard category table to be consistent with the current standards of COP Title 24.85 will have a considerable impact on improving the seismic safety of the state’s existing building inventory. As stated above, the IEBC has not yet been adopted in any region of significant seismic hazard whereas the COP Title 24.85 has a significant track record of balancing the diverse needs of historic preservationists, building owners, and the safety of the general public.

In case studies conducted by SEAO, 5 of 20 buildings studied would require a seismic upgrade under the provisions of COP Title 24.85 but would not if the existing building was to comply with the Work Area Method of the 2006 IEBC Chapter 9. For example, a 16 story landmark, downtown Portland structure, which changed more than a third of the floor area from occupancy category M to R, adding more than 150 occupants required an IBC or ASCE 41 upgrade under COP 24.85. Under the 2006 IEBC, the building only needed to meet the “code at the time of construction.”

**SUMMARY OF PROPOSED REVISIONS:** These revisions incorporated the 2009 IEBC committee hearing results and SEAO’s revision to relative hazard level based on occupancy classification. Table footnotes gave exceptions that do not require structural improvements when there is only a minimal area or number of occupants changed. This combination of triggers with exceptions have worked well in the past to balance development and improvement requirements. Items modified include:

1. Incorporation of IEBC committee hearing results that are mainly editorial to make the section consistent with current IBC terminology.
2. Substantially change the occupancy classification relative hazard table. The revised table more accurately reflects changes to higher more hazardous occupancies. The additional required structural improvements are balanced by more exceptions that do not require

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structural improvements. Past experience has shown these rules to be a good balance between development and required improvements.

**PROPOSED CHANGES:**

**901.3.1 Partial change of occupancy classification.** Where a portion of an existing building is changed to a new occupancy classification, Sections 907 and 912 shall apply.

**907.3 Seismic loads.** Existing buildings with a change of occupancy shall comply with the seismic provisions of Sections 907.3.1 and 907.3.2.

**907.3.1 Compliance with the *International Building Code* level seismic forces.** ~~When~~  
Where a building or portion thereof is subject to a change of occupancy ~~such that a~~  
~~change in the nature of the occupancy results in the building being assigned to a higher~~  
~~seismic occupancy factor~~ occupancy category based on Table 1604.5 of the International  
Building Code; or where such change of occupancy results in a reclassification of a  
building to a higher hazard category as shown in Table 907.3 ~~Table 912.4~~; or when the  
total building occupancy load is increased by more than 150 occupants, ~~where a change~~  
~~of a Group M occupancy to a Group A, E, I-1, R-1, R-2 or R-4 occupancy with two thirds~~  
~~or more of the floors involved in Level 3 alteration work~~ the building shall ~~conform~~  
comply with the seismic improvement standards of Table 907.3 and as defined in  
Section 506 requirements of the International Building Code for the new seismic use  
group for the new occupancy category.

**Exceptions:**

1. ~~Group M occupancies being changed to a Group A, E, I-1, R-1, R-2 or R-4~~  
~~occupancies for buildings less than six stories in height and in Seismic Design~~  
~~Category A, B or C.~~

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2. Where approved by the code official, specific detailing provisions required for a new structure are not required to be met where it can be shown that an ~~applicable~~ equivalent level of performance and seismic safety is obtained for the applicable ~~seismic use group~~ using occupancy category based on the provision for reduced International Building Code level seismic forces as specified in Section ~~507~~ 506.1.1.3. ~~The rehabilitation procedures shall be approved by the code official and shall consider the regularity, over strength, redundancy and ductility of the lateral load resisting system within the context of the existing detailing of the system.~~
3. *Editorial Note: Item 3 is deleted in its entirety*
4. *Editorial Note: Item 4 is deleted in its entirety*

*Editorial Note: Table 907.3 and notes are proposed amendments in their entirety*

**Seismic Hazard Categories and Structural Improvement Standard**

<b>TABLE 907.3</b>		
<b>Relative Hazard</b>	<b>OSSC Occupancy Classification</b>	<b>Seismic Improvement Standard</b>
1 (Highest Hazard)	A, E, I-2, I-3, H	506.1.1.2
2	R-1, R-2, R-4, SR, I-1, I-4	506.1.1.3
3	B, M	
4	F-1, F-2, S-1, S-2	
5 (Lowest Hazard)	R-3, U	

Notes:

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- 1) Required improvements shall be made such that the entire building conforms to the indicated standard.
- 2) Where the area of the new occupancy with a higher hazard category is less than or equal to 33 percent of the total building area, and the total occupant load for the building is not increased by more than 150 occupants, the building does not have to be structurally improved unless required by other provisions of this code.
- 3) Where a change in occupancy results in the addition of more than 150 occupants to the building, the building is required to be structurally improved based on the seismic improvement standard for the occupancy classification of the majority of the added occupants.
- 4) Buildings with a total occupant load greater than 1,500 may use 10% of the occupant load in place of the 150 noted in notes 2) and 3).
- 5) The cumulative effects of the building area occupancy changes and occupant load changes shall be considered on [DATE] for the purposes of this section.