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## Building Codes Division



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## Statewide Code Interpretation

March 6, 2007

### No: 2004 OSSC 1312.2.2 2004 Oregon Structural Specialty Code

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**Code Section:** 1312.2.2

**Code Edition:** 2004 Oregon Structural Specialty Code (OSSC)

**Date:** Original: 11/07/2001 Updated: 3/06/2007

**Subject:** Simplified Trade-Off Approach

**Question:** N/A

**Answer:** N/A

**Analysis:** 2004 Oregon Structural Specialty Code Section 1312.2.2, provides for a simplified trade-off approach to determine compliance with thermal performance standards for Other Buildings. The Oregon Structural Specialty Code (OSSC), Chapter 13, Other Building provisions regulate energy conservation requirements within buildings and structures. In general, Other Building refers to buildings and structures other than Group R Occupancies three stories or less in height. When the 1996 energy conservation requirements for Other Buildings was adopted, various performance requirements allowed the designer and builder flexibility in construction methods. Performance standards deal with end results. Performance standards do not show the designer or builder how to achieve the result. Nor do they show the plan reviewer how to determine whether the performance result was achieved. It was intended that methods for reviewing and verifying compliance would be developed later. OSSC Chapter 13, Section 1312.2.2, Simplified Trade-off Approach (STA) was one of those provisions. It allows envelope components to be substituted based on a building's overall thermal performance. *The Methodology for Compliance Using the Simplified Trade-off Approach* and the computer program Code Comp, published by Oregon Office of Energy January 31, 1997, has been proffered as a method of demonstrating and verifying that proposed trade-offs comply with the Simplified Trade-off Approach in OSSC, Section 1312.2.2. The Technical Working Group (TWG) of the energy Conservation Board (ECB) was responsible for drafting the 1996 energy conservation requirements for other buildings. The requirements were adopted December 30, 1994 and became effective on April 1, 1996. When ECB was merged into the Building Codes Structures Board (BCSB) in 1993, the TWG became affiliated with BCSB.

**Choice of means and method for demonstrating compliance.** The means and method selected must allow for compliance of envelope measures with the Simplified Trade-off Approach in OSSC 1312.2.2. As relevant it provides, "The STA is an analytical method to determine

if a proposed building has no larger annual heating load through the exterior envelope and no larger annual cooling load through the exterior envelope than a similar building meeting the Prescriptive Path Approach." The limitations placed on trade-offs are reasonable in order to keep STA simple enough to be widely applicable and still provide design flexibility. The criteria for selection of the computer program was reasonably designed to select an algorithm and appropriate computer program to demonstrate equivalent heating and cooling thermal performance for the elements of the building envelope as specified under OSSC Section 1312.2.

**Need For a New Tool to Demonstrate Compliance with OSSC, Section 1312.2.2.** The Code-Comp program was originally developed as an MS DOS based program. Since that time, computing technology has advanced significantly, making a DOS based program obsolete and no longer compatible with many of today's operating platforms. In addition, there were limitations and bugs in the software that made compliance unnecessarily complicated. To solve these problems, a new Code-Comp program has been developed utilizing a graphical user interface (GUI) compatible with all Microsoft Windows platforms post Windows 95. The new program includes an upgrade to the calculation engine from ASEAM (a modified bin method of simulation) to DOE2.1E (an hourly method of simulation.) The majority of the changes proposed for the methodology document are required for consistency with the new calculation engine. In addition, several other changes have been made to fix the flaws with the original program assumptions. The Oregon Building Codes Administrator shall approve the output reports generated by this program.

**Highlights of Proposed Changes:**

1. OSSC required outside air ventilation has been added to the loads for each space type. Equivalent ventilation load is input for both proposed and baseline buildings. This input was missing from previous versions of Code-Comp, and its addition adds accuracy to the calculation.
2. The simulation of an economizer has been added to portions of building that the user identifies as being served by a system with an economizer (at least 70% of the space.) If present, economizers are added to both proposed and baseline buildings. Previously, economizers were not considered in CodeComp. This resulted in cooling loads that were not passed on to the HVAC systems influencing allowable tradeoffs. Additional roof insulation caused a particular problem. Roof insulation added above code levels would cause annual cooling load to increase and the building would fail to comply. Annual cooling load increases, since during hours when there is a net cooling load on the building and outside air temperature is lower than inside air temperature, the added roof insulation reduces heat transfer out of the building. These are the same hours (outside air temperature less than inside air temperature) that an economizer would contribute to cooling the space. If an economizer is used in this building, cooling load will not increase during these hours since the economizer is picking up this cooling load. The updated version of CodeComp solves this problem.
3. An assumption regarding window shading for small buildings has been removed. The existing methodology assumes "exterior window shades conforming to "common practice", represented by a continuous 2-foot deep overhang beginning 1-foot above the top of the window. This common practice exterior shading assumption is limited to

windows located on the S, SE, and SW orientations. This applies to the top floor of all buildings where an overhang is proposed except Large Buildings, for which no exterior shading is assumed.” This was originally incorporated in the methodology in order to prevent tradeoff credit being granted for what was considered standard practice. A problem appears when a designer specifies the building with something less than the assumed “common practice” level of shading. For example if a building is designed to code prescriptive standards, and incorporates a continuous 2-foot deep overhang beginning 1-foot above the top of the window on only the south and southwest side of the building, the building would fail compliance. This may act to penalize the design which falls slightly beyond boundaries assumed by the current methodology.

**Selection of the Thermal Performance Calculation Algorithm and Computer Program.** The software program United States Department of Energy (DOE) 2.1E is the appropriate calculation algorithm and computer program. DOE 2.1E has credibility based on its use nationally to estimate energy impacts of energy conservation measures. DOE 2.1E accurately evaluates thermal performance of envelope components using hourly climatic data.

**Selection of Code Comp.** In order to limit the trade-offs to the approved code regulated items, it is necessary to check the building descriptions for consistency with standard engineering practice. To minimize the cost of code enforcement for buildings using this approach, it is necessary to provide standardized documentation and reporting protocols. Code Comp is established in the State as the computer tool meeting these requirements. Code Comp has been revised to incorporate DOE 2.1E calculation algorithm and details of the *Methodology for Compliance Using the Simplified Trade-off Approach*. The revised computer program Code Comp reasonably meets the criteria developed by ECB/TWG to implement OSSC Section 1312.2.2.

- (1) The STA allows design flexibility and energy efficiency by allowing trade-offs between elements of the building envelope.
- (2) Since a significant amount of energy is used for cooling in commercial buildings, the trade-off approach recognizes reduced cooling load provided by shading devices and increased building wall mass. The STA also requires equivalency with the Prescriptive Path for HVAC systems and lighting. Trading-off between heating and cooling use is too burdensome for STA because it requires analysis of the interaction of HVAC and lighting systems and the cost of fuels. Allowing trade-offs between envelope, HVAC systems and lighting are only allowed by the Whole Building Approach, Interpretive Ruling 95-7, and is beyond the intent of this simplified approach.
- (3) A computer program is the only practical means to establish compliance with the requirements in order to support the different trade-off possibilities among elements of the building envelope. Appropriate criteria for selection of a computer program to perform the trade-offs include:
  - A program simple enough to run on an IBM-PC compatible computer running Microsoft Windows operating systems.
  - A graphic user interface and reports that are easy to use and assist in uniform enforcement and inspection.
  - Algorithms in the public domain.
  - Accuracy of algorithms established in the literature.

- Algorithms that account for effect on energy use of fixed external shading devices.
- Algorithm that accounts for effect of wall mass.
- A computer program that is accurate for range of climate conditions in Oregon.
- A computer program that uses industry standard inputs as defaults for envelope thermal characteristics.

(4) The Code Comp computer program, developed and published by the Oregon Office of Energy, is widely accepted as a computer compliance program for commercial buildings. Code Comp provides an appropriate user interface for STA because Code Comp:

- Includes a library of default values for elements and a method to include non-typical elements not covered by code in order to provide consistency across buildings of similar type.
- Provides reports in a succinct and uniform format that jurisdictions are already familiar with.
- Is in the public domain.

(5) DOE 2.1E is a nationally accepted computer simulation tool that utilizes 8,760 hour climate data.

- DOE 2.1E provides a relatively accurate calculation engine for the CodeComp interface.
- DOE 2.1E computer code is in the public domain.
- DOE 2.1E is supported by US DOE and Lawrence Berkely National Laboratories.
- DOE 2.1E input structure is sufficiently detailed to allow modeling of appropriate elements of a building envelope.

(6) DOE2.1E is a computer program that was developed and supported by the US Department of Energy (USDOE) and Lawrence Berkley Laboratory:

- DOE2.1E provides a relatively straight forward link to the CodeComp interface.
- DOE2.1E computer code is in the public domain.
- DOE2.1E's input structure is sufficiently detailed to allow modeling of appropriate elements of the building envelope.
- DOE2.1E allows integration of requirements specified in (5) and (7).

(7) The *Methodology for Compliance Using the Simplified Trade-off Approach* published by Oregon Office of Energy in connection with the TWG and the Energy Committee provides a methodology for integrating DOE 2.1E as the calculation tool in CodeComp program and also incorporates the restrictions on trade-offs developed by ECB.

(8) Code Comp was revised by Oregon Office of Energy to implement the *Methodology for Compliance Using the Simplified Trade-off Approach* including the DOE2.1E computer program.

(9) 2004 Oregon Structural Specialty Code Section 104.10, Alternate Materials, Alternate Design and Methods of Construction, allows acceptance of an alternate which achieves the intent of the code and provides equivalent effectiveness and safety for occupants and property.

(10) This interpretation is authorized by ORS 455.060, Rulings on Acceptability of Materials, Designs or Methods of Construction, and Attorney General's Opinion OP- 5208, issued October 1, 1981, which advised the statute permits authoritative interpretations of code requirements.

(11) This interpretive ruling provides the equivalent energy effectiveness of thermal performance standards required in the 2004

Oregon Structural Specialty Code Section 1312.2.2 for any structure, except:

1. Group R Occupancies three stories or less in height;
2. Group SR Occupancies constructed to the requirements for Group R Occupancies three stories or less in height;
3. Detached Group U, Division I Occupancies containing habitable rooms built to the One and Two Family Dwelling Specialty Code; and
4. Group U, Division I Occupancies attached to:
  - a. Group R Occupancies three stories or less in height; or
  - b. Group SR Occupancies constructed to the requirements for Group R Occupancies three stories or less in height.

(12) The revised *Methodology for Compliance Using the Simplified Trade-off Approach* dated September 26, 2001 and the computer program CodeComp for Windows are the appropriate tools for demonstrating compliance with OSSC, Section 1312.2.2.

(13) The Methodology for Compliance Using the Simplified Trade-off Approach dated January 31, 1997 and the computer program CodeComp 3.03a are acceptable means for demonstrating compliance with OSSC, Section 1312.2.2. until June 30, 2002.

The following interpretation that establishes a methodology for the Simplified Trade-off Approach specified in 2004 Oregon Structural Specialty Code Section 1312.2.2 is adopted:

(1) The attached *Methodology for Compliance Using the Simplified Trade-off Approach*, dated September 26, 2001 and the computer program CodeComp for Windows is an approved methodology for establishing compliance with the Simplified Trade-off Approach specified in OSSC Chapter 13, Section 1312.2.2 for any structure, except:

1. Group R Occupancies three stories or less in height;
2. Group SR Occupancies constructed to the requirements for Group R Occupancies three stories or less in height;
3. Detached Group U, Division I Occupancies containing habitable rooms built to the One and Two Family Dwelling Specialty Code; and
4. Group U, Division I Occupancies attached to:
  - a. Group R Occupancies three stories or less in height; or
  - b. Group SR Occupancies constructed to the requirements for Group R Occupancies three stories or less in height.

(2) The reports generated by the program Code Comp shall be used to demonstrate compliance with the *Methodology for Compliance Using the Simplified Trade-off Approach*.

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