ICC EVALUATION SERVICE, INC.
Evaluate ▪ Inform ▪ Protect

Los Angeles Business/Regional Office ▪ 5360 Workman Mill Road ▪ Whittier, CA 90601
(562) 699-0543 phone ▪ (562) 695-4694 fax

January 7, 2006

To: **PARTIES INTERESTED IN EVALUATION REPORTS FOR PREFABRICATED LATERAL-FORCE-RESISTING ASSEMBLIES**

Subject: Application of a "one-third" stress increase when designing pre-fabricated shear panels using the 1997 UBC and 2000 IBC allowable stress design provisions

ICC-ES has issued several evaluation reports to recognize prefabricated shear panels used in light-frame construction. The shear panels are primarily constructed using wood or steel components. Questions continue to be raised on the applicability and use of the one-third stress increase that is permitted in allowable stress design (ASD) "Alternate Basic Load Combinations" (1997 UBC Section 1612.3.2, 2000 IBC Section 1605.3.2 and 2003 IBC Section 1605.3.2). Design values published in some of the prefabricated shear panel evaluation reports include the one-third stress increase in anticipation that the panel will be designed using these provisions. Understanding the basis of the published design values shown in the evaluation reports as well as their associated footnotes is essential to assure appropriate design and the proper application of this adjustment.

The following questions and answers were developed to clarify the use of these adjustments in conjunction with ICC-ES recognized prefabricated shear panels.

Q1. What is the intent of the one-third stress increase referenced for use with the ASD "Alternate basic load combinations" in the 1997 UBC and 2000 IBC?

A. Both the 1997 UBC and the 2000 IBC state that allowable stresses are permitted to be increased for "Alternate" Basic Load Combinations that include wind or seismic loads. Section 1612 of the Handbook to the 1997 Uniform Building Code, An Illustrative Commentary, states that the bases of this stress increase is on the low probability of all transient loads occurring simultaneous at design load levels.

It should be noted that in ASCE 7-02 this probability effect is being applied to the load side of the equation rather than increasing allowable stresses. ASCE 7-02 also states that the effects of one or more loads not acting shall be considered, whichever produces the most unfavorable effect in the building. See **Q7** for additional information.

Q2. Can the one-third stress increase for simultaneous transient loads be used for pre-fabricated shear panels?

A. The one-third stress increase is applicable when designing a steel-based shear panel using the 1997 UBC and 2000 IBC for allowable stress design with the "Alternate Basic Load Combinations". This increase is currently included in the recognized design capacities for prefabricated steel-based shear panels in anticipation that the designer will use these provisions.

It is not allowed when designing with wood-based shear panels. The wood design provisions of each building code prohibit the use of this one-third increase. The load duration factor (C_D) applied to wood stresses is a completely different adjustment. See **Q5** and **Q6** for additional information.

Q3. What if I am designing using the "Alternate" load combinations of the 1997 UBC and 2000 IBC and the combined transient loads do not come into play when selecting a prefabricated shear panel? Should I still use the one-third increase included in the Evaluation reports for a steel-based panel?

A. This question highlights a shortcoming of the historical one-third increase for simultaneous "transient" loads. It is also one of the reasons why the one-third increase has been phased out in the references of the 2003 IBC. When using the 1997 UBC or 2000 IBC "Alternate" load combinations, the designer needs to evaluate whether the one-third stress increase for "transient" loading included in the recognized steel panel design capacities is appropriate.

In some cases, the design may be governed by one of the "alternate" load combinations that does not include a concurrent transient load (i.e. 0.9D + E/1.4), thus negating the rational for the one-third increase. For other cases, even if a load combination includes a concurrent transient load, the sizing of the lateral load-resisting elements in a typical bearing wall system is based only on the lateral (wind/seismic) portion of the combination (i.e. wood sheathing or steel membranes plus connections will resist the lateral portion of the load while live loads are carried by other structural elements such as studs). Although the one-third increase has historically been allowed in these cases by interpretation of the UBC and IBC, these inconsistencies have caused some designers to question the appropriateness of a one-third increase when sizing a prefabricated steel-based shear panel. Should the designer determine that the one-third increase is not appropriate when designing a steel-based shear panel because there is no concurrent transient load in the controlling load combination, the recognized design capacities for the pre-fabricated steel panels should be reduced by a factor of 1.33.

Q4. Do code-recognized design values in evaluation reports for pre-fabricated shear panels typically include the one-third stress increase?

A. At the report holder's request, code-recognized design values for steel-based prefabricated shear panels under the 1997 UBC and the 2000 IBC have typically included the one-third

increase to reflect applications with simultaneous transient loads designed under the ASD "Alternate Basic Load Combinations". When designing using the Basic load combinations, ASCE 07-02 or other conditions where the designer judges that the simultaneous transient load increase is not appropriate, the recognized design capacity of a steel-based shear panel should be reduced by a factor of 1.33. To avoid confusion, evaluation reports in the future will not include this increase.

Recognized design capacities for prefabricated wood-base shear panels have not included an increase for simultaneous transient loading.

Q5. Is the one-third stress increase stated in the ASD "Alternate basic load combinations" the same as the duration of load (C_D) increase utilized for wood?

A. No. These adjustment factors are distinct and independent concepts that are intended to adjust for different phenomena. The one-third stress increase is used in specific load combinations to account for simultaneous transient loads. The "duration of load" (DOL) adjustment is intended to account for a material property unique to wood as a structural material. Timber design codes have long recognized the duration-dependent strength of wood construction. Wood can support higher stresses if the loads are applied for a short period of time and the DOL adjustment is used to account for this phenomenon.

Q6. Should design values tabulated in ICC-ES reports for pre-fabricated shear panels be adjusted for "duration of load" (DOL)?

A. No. For steel-based pre-fabricated shear panels, a duration of load adjustment is not applicable. Tabulated values for wood-based pre-fabricated shear panels already include an adjustment for duration of load (similar to diaphragm tables published in the UBC or IBC) and do not require further adjustment.

Q7. How are current codes addressing the one-third stress increase?

A. ASCE 7-02 eliminates the "Alternative basic load combinations". As a result, the one-third increase for simultaneous transient loads is no longer applicable. The 2003 IBC, Section 1605.3.2 still permits a "stress increase" where permitted by the material section of the code, but the provisions for a stress increase have been eliminated for both wood and steel in the material sections (i.e. the 2003 IBC reference standard - AISC 335-89s1 Supplement No.1 to the Specification for Structural Steel Buildings 2001 - Chapter A) and AISI/COS/NASPEC 2001 Appendix A. Therefore the 2003 IBC does not permit a one-third stress increase for wood or steel pre-fabricated shear panels.