

1 **PROPOSAL 2-4C (2009)**

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3 **SCOPE: Commentary to Part 1, Section 1.4, Exception #1**

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7 **PROPOSAL FOR CHANGE:**

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9 **Add Commentary for Section 12.8.7 as follows:**

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11 Part 1 of the Provisions takes exception to portions of ASCE-7 Section 12.8.7 that allow the stability  
12 coefficient,  $\theta$ , to exceed 0.10. The SAC Steel Project has introduced recommendations in FEMA-350 for  
13 the consideration of P-Delta effects. The recommended requirements may be interpreted as requiring  
14 explicit modeling of geometric effects for steel moment-resistant frames when values of the stability  
15 coefficient,  $\theta$ , exceed approximately 0.04, and thus are more restrictive than the Provisions. The  
16 application of the FEMA-350 approach to other structural systems and materials (e.g. dual systems,  
17 braced frames, or wood buildings) has not been defined.

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19 ASCE-7 allows amplified forces to be used in a linear elastic analysis where  $\theta$  exceeds 0.10. In such  
20 cases, there is a very real possibility that the tangent stiffness of the structure may become negative,  
21 leading to the possibility of significantly increased dynamic displacement demands (Gupta and  
22 Krawinkler, 2000). Depending on the progression of plastic hinging and strain hardening, limiting  $\theta$  to  
23 0.10 will maintain a positive tangent stiffness throughout much or all of the expected response. The Part 1  
24 Exception allows structures to exceed this limit only if a positive slope is maintained in a nonlinear static  
25 analysis (as specified in ASCE 41-06 Supplement No. 1) that accounts for P-delta effects or if adequate  
26 resistance to instability is demonstrated by nonlinear dynamic analysis (as specified in Chapter 16 of  
27 ASCE-7).

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29 The occupancy importance factor,  $I$ , was inserted into Eq. 5.2-16 to ensure that the permissible axial load  
30 level does not increase as the importance factor increases.

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32 **REFERENCES**

33  
34 Gupta, A., and Krawinkler, H., (2000), "Dynamic P-delta effects for flexible inelastic steel structures,"  
35 Journal of Structural Engineering, American Society of Civil Engineers 126(1), Jan., pp 145-154.

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37 FEMA-350 (2000). Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings,  
38 prepared by the SAC Joint Venture, Report Number FEMA-350, Federal Emergency Management  
39 Agency, Washington, D.C., June.

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41 **REASON FOR PROPOSAL:**

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43 Commentary is needed to Proposal 2-4, which was passed by the PUC on April 8, 2008.

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45 **TS 2 VOTE:**

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47 YES = 6      Yes with Reservations = 1      No =      Not Voting = 2

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50 **Charney Yes with Reservations Comment:**

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My reservation is related to the last sentence of the commentary. I thought the "I " was put in the equation to make sure that the stability ratio is based on the elastic stiffness of the system (the deflection in the numerator of the equation for theta does not include I, but the force V in the denominator does). I believe we approved an ASCE 7 ballot that puts the "I" back in the formula in ASCE 7, where it was apparently left off in error.