



June 2, 2008

**TO: PARTIES INTERESTED IN EVALUATION REPORTS ON CONCRETE AND REINFORCED AND UNREINFORCED MASONRY STRENGTHENING USING EXTERNALLY BONDED FIBER-REINFORCED (FRP) COMPOSITE SYSTEMS (AC125)**

**SUBJECT: Section 7.3 (Design Criteria) of AC125**

Dear Madam or Sir:

The purpose of this letter is to solicit comments regarding Section 7.3 (Design Criteria) of AC125 (Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer Composite Systems), effective June 1, 2007. The two issues of concern are as follows:

1. Based on the information in ACI 440.2R-2002 (Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures), Equation 1 in Section 7.3.2.1 of AC125 may lead to underestimating the stress levels of the FRP reinforcement in cases where multiple layers of reinforcement are used for strengthening applications. Equation 1 in Section 7.3.2.1 of AC125 (Flexural Strength Enhancement) limits the stress level of the FRP composite to less than or equal to 0.75 times the ultimate tensile stress of the composite ( $f_{ji} = E_f \varepsilon_f \leq 0.75 f_{uj}$ ). ACI 440.2R-2002 also requires that a limitation be applied to maximum strain level. In accordance with Sections 9.2.2 and 9.2.3 of ACI 440.2R, the stress level in the FRP reinforcement must be limited to  $f_{fe} = E_f \varepsilon_{fe}$  (Equation 9-4), where  $\varepsilon_{fe} \leq \kappa_m \varepsilon_{fu}$  (Equation 9-3). The  $K_m$  factor, as defined in Equation 9-2 of ACI 440.2R, is a function of number of layers used, modulus of elasticity of composite material and thickness of composite; and the maximum value must not be greater than 0.90. Based on our observations, the  $K_m$  factor may get lower than 0.75 for multiple layer FRP applications. ICC-ES staff would like to receive public input as to whether the limitation in Equation 1 of AC125 is conservative enough for multiple layer strengthening applications.
2. Section 9.4 of ACI 440.2R suggests that, to avoid inelastic deformations of the reinforced concrete members strengthened with external FRP reinforcement, the existing internal steel reinforcement should be prevented from yielding under service load levels; hence, the stress in the steel under service load should be limited to 80

percent of the specified yield strength ( $f_{s,s} \leq 0.80 f_y$ ). This 80 percent strength reduction requirement does not exist in AC125. ICC-ES staff would like to get public input as to whether AC125 needs to be revised to address the potential for inelastic deformations, and whether the 80 percent yield strength limitation should be adopted for AC125.

You are cordially invited to submit written comments, within 30 days of the date of this letter. All comments received in the 30-day comment period may be considered as AC125 comes up for possible future revisions. An explanation of the alternate criteria process can be found on our web site at [http://www.icc-es.org/Criteria\\_Development/alternative\\_criteria\\_process.shtml](http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml). Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to ICC-ES staff.

If you have any questions, please contact the undersigned at (800) 423-6587, extension 3289, or Brian Gerber, S.E., Senior Structural Engineer, at extension 3260. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,

A handwritten signature in black ink, appearing to read 'M. Ekenel', with a long horizontal flourish extending to the right.

Mahmut Ekenel, Ph.D.  
Senior Evaluation Specialist

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