



October 1, 2008

**TO: PARTIES INTERESTED IN SPECIAL MOMENT FRAMES
CONSTRUCTED USING PRECAST CONCRETE**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Special Moment Frames
Constructed Using Precast Concrete, Subject AC41-1008-R1 (BG/IY).**

Dear Madam or Sir:

The revisions proposed to the subject acceptance criteria, as presented in the enclosed criteria draft, are being posted on the ICC-ES (alternative agenda) web site to allow for public comment. The revisions include:

1. Reorganization of the criteria to more closely follow the ICC-ES acceptance criteria format.
2. Revisions to address 2006 IBC and ACI 318-05 requirements for special moment frames constructed using precast concrete.
3. Title change to be consistent with treatment of the systems by the codes.
4. Additional details concerning quality control, as shown in Section 4.0 of the enclosed criteria draft.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. 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.

All comments received in the 30-day comment period will be considered. During this same 30-day period, however, the draft criteria will be balloted to the Evaluation Committee. If the public comments raise major issues, generate controversy, or require the criteria to be substantially rewritten, then ICC-ES staff may decide to reballot the criteria; or place a revised draft on the web site for further public comment; or put the criteria on the agenda for a future Evaluation Committee meeting.

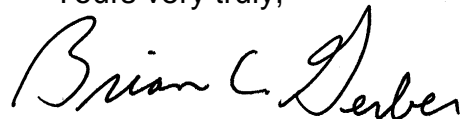
Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 3260, or Irni Yani, Evaluation Specialist, at extension 3257. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Brian Gerber
Principal Structural Engineer

BG/raf

Enclosure

cc: Evaluation Committee



**PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR
DUCTILE CONNECTORS IN PRECAST CONCRETE
SPECIAL MOMENT RESISTING FRAMES CONSTRUCTED
USING PRECAST CONCRETE**

AC41

Proposed October 2008

Previously approved January 1995

PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the International Building Code® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

Acceptance criteria are developed for use solely for purposes of issuing ICC-ES evaluation reports.

**PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR DUCTILE
CONNECTORS IN PRECAST CONCRETE SPECIAL MOMENT RESISTING
FRAMES CONSTRUCTED USING PRECAST CONCRETE**

1 **1.0 INTRODUCTION**

2 **1.1 Purpose:** The purpose of this acceptance criteria is to establish
3 requirements for special moment frames constructed using precast concrete to be
4 recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the
5 2006 International Building Code® (IBC).

6 The reason for the development of the criteria is to establish test
7 procedures, material properties, design, quality control requirements and installation
8 procedures for special moment frames constructed using precast concrete to show
9 compliance with Section 21.6.3 of ACI 318.

10 **1.2 Scope:** This criteria is applicable to special moment frames
11 constructed using precast concrete for Seismic Design Categories C, D, E, and F
12 under the IBC. ~~The Acceptance Criteria for Ductile Connectors in Precast Concrete~~
13 ~~Special Moment Resisting Frames (PC-SMRF) criteria~~ criteria shall encompass
14 both strength and deformation capacity in order to qualify as a special moment
15 frames with Response Modification Coefficient (R) = 8, System Overstrength Factor
16 (Ω_o) = 3 and Deflection Amplification Factor (C_d)= 5½ and no building height limit.
17 ~~$R_w=12$ as required by Table 12.2-1 of ASCE 7. Zones 3 and 4 by Section 1631.2.7~~
18 ~~of the 1994 Uniform Building Code™ (UBC).~~ This criteria applies to the connections
19 ~~between the beams and columns in the frame.~~ The design and construction of these
20 beams and column elements of the moment frames ~~must~~ shall comply with

21 applicable portions of the IBC. For special moment frames not satisfying the
22 requirements of Section 21.6.1 or 21.6.2 of ACI 318, compliance with Section 21.6.3
23 of ACI 318 shall be required, including tests in accordance with Section 3.2 of this
24 criteria.

25 **1.3 Code and Referenced Standards:**

26 **1.3.1 2006 International Building Code[®] (IBC), International Code**
27 **Council.**

28 **1.3.2 ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other**
29 **Structures, American Society of Civil Engineers.**

30 **1.3.3 ACI 318-2005, Building Code Requirements for Structural**
31 **Concrete (ACI 318-05), American Concrete Institute.**

32 **1.3.4 ACI T1.1-01, Acceptance Criteria for Moment Frames Based on**
33 **Structural Testing, American Concrete Institute.**

34 **1.3.5 ASTM C 39-03, Standard Test Method for Compressive**
35 **Strength of Cylindrical Concrete Specimens, ASTM International.**

36 **2.0 BASIC INFORMATION REQUIRED**

37 **2.1 General:** The following information shall be submitted:

38 **2.1.1 Product Description:** ~~A detailed description of the ductile~~
39 ~~connectors, including dimensions, materials, and drawings, and evidence of~~
40 ~~compliance with physical properties.~~ Complete information concerning special
41 moment frame components such as beams, columns and connections to be
42 recognized in the ICC-ES evaluation report shall include shapes, dimensions and

43 manufacturing tolerances, material specifications, manufacturing processes and
44 drawings with sufficient details illustrating each component. In addition, restrictions
45 or limitations on use shall be disclosed.

46 **2.1.2 Installation Instructions:** ~~Instructions describing placement~~
47 ~~and inspection.~~ Installation instructions shall include moment frame assembly and
48 placement, including details and limitations, procedures establishing quality control
49 at the project site, and product handling and storage. Detailing shall comply with
50 applicable codes or ICC-ES acceptance criteria requirements.

51 **2.1.3 Design:** Structural design and analysis procedures shall
52 include the following:

53 **2.1.3.1** Clarification of recognition under Chapter 19 of the IBC.
54 For resistance to seismic forces, the design shall conform to specific seismic design
55 requirements in Chapter 21 of ACI 318.

56 **2.1.3.2** A complete description of the structural design process.
57 The design procedures shall be based on requirements described in the IBC and
58 ACI 318. For seismic resistance, the design shall apply supplemental requirements
59 in Section 21.6 of ACI 318 and Section 4.0 of ACI T1.1 as influenced by the results
60 of tests described in Section 3.2 of this criteria.

61 **2.1.3.3** Details and examples of how the product or system is
62 designed and analyzed, including equations, with procedures and properties for
63 design analysis.

64 **2.1.4 Packaging and Identification:** A description of the method of
65 packaging and identification of the special moment frames, connections and
66 connector components. Identification provisions shall include the report holder's
67 name, the product name, the component name, a means of traceability of the
68 product, the evaluation report number (ICC-ES ESR-XXXX) and the name or logo of
69 the inspection agency.

70 **2.2 Testing Laboratories:** Testing laboratories shall comply with Section
71 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of
72 the ICC-ES Rules of Procedure for Evaluation Report.

73 **2.3 Test Reports:** Test reports shall comply with AC85.
74 In addition, the test reports shall be in sufficient details to identify the specimen
75 properties that might affect performance, such as the following:

76 1. Concrete mix design and reports of concrete compressive
77 strength at the time of load tests.

78 2. Reports of coupon tests that include the actual mechanical
79 properties (e.g., tensile and yield strength) of the reinforcement.

80 For tests performed in accordance with Section 3.2 of this criteria, the test reports
81 shall comply with Section 8.0 of ACI T1.1 in addition to AC85.

82 **2.4 Product Sampling:** Sampling of the test specimens under this criteria
83 shall comply with Section 3.1 of AC85. The construction of the test assembly shall
84 comply with Section 3.3 of AC85. Products from multiple manufacturing facilities
85 shall comply with Section 3.4 of AC85.

86 **3.0 TESTING TEST AND PERFORMANCE REQUIREMENTS**

87 **3.1** ~~Testing laboratories shall comply with the ICG-ES Acceptance Criteria~~
88 ~~for Laboratory Accreditation (AC89).~~ **Material Properties: Reports of material**
89 **properties shall be provided and generated by the testing laboratory, and shall verify**
90 **compliance with the appropriate referenced standard and/or manufacturer's**
91 **specifications.**

92 **3.1.1 Concrete: Reports of concrete compressive strength at 28 days**
93 **and at the time of load tests of each mixture used for cyclic tests noted in this**
94 **criteria, shall be submitted. The compressive strength tests shall be performed in**
95 **accordance with ASTM C 39.**

96 **3.1.2 Steel: Reports of material properties for the reinforcement and**
97 **connection components used in the load tests shall be included as a part of test**
98 **documentation. Reports of material properties shall be generated by a testing**
99 **laboratory, and shall verify compliance of the steel reinforcement material with the**
100 **appropriate referenced standard. Where the actual steel strength exceeds the**
101 **specified strength, test results shall be adjusted, by the ratio $F_u(\text{specified})/F_u(\text{actual})$.**

102 **3.2** ~~Test reports and test specimen sampling shall comply with the ICG-ES~~
103 ~~Acceptance Criteria for Test Reports and Product Sampling (AC85).~~ **Qualification**
104 **Tests: Tests shall be performed in accordance with ACI T1.1. The design**
105 **procedure shall be developed before testing in accordance with Section 4.0 of ACI**
106 **T1.1. A qualification test plan shall be submitted correlating test modules as**
107 **described in Section 5.0 of ACI T1.1 with the restrictions and limitations on use**

108 required in Section 2.1.1 of this criteria. Extremes of dimensional, reinforcing and
109 compressive strength parameters shall be considered.

110 ~~A subassembly, at least one-third scale, shall be subjected to increasing pseudo-~~
111 ~~cyclic displacements. Loads may be applied by means of hydraulic or mechanical~~
112 ~~actuators or other acceptable means. The rate of loading may be slow and the~~
113 ~~loading and unloading phases must be continuous, without intermittent stops and~~
114 ~~pauses. Starting at an estimated drift less than first yield, at least three cycles at~~
115 ~~each displacement level shall be used to evaluate strength and stiffness~~
116 ~~degradation. The load displacement readings shall be continuously recorded using~~
117 ~~digital or analog recorders. Each cycle shall be to a displacement no more than 50~~
118 ~~percent greater than the previous cycle. The subassembly configuration shall be~~
119 ~~representative of the expected behavior of the frame. As a minimum, a beam~~
120 ~~column assembly (cruciform) extending to the anticipated inflection points of the~~
121 ~~beam and column will be tested.~~

122 **4.0 — CONDITIONS OF ACCEPTANCE**

123 **4.1 — Strength:** ~~The maximum strength of the system shall be at least as~~
124 ~~great as the calculated nominal axial load, moment and shear strength (P_n , M_n and~~
125 ~~V_n , respectively) calculated in accordance with Chapter 19 of the code. The~~
126 ~~maximum strength of the system shall be no greater than the overstrength factor (λ_G)~~
127 ~~times the calculated nominal strength. The overstrength factor is dependent on the~~
128 ~~system and considers overstrength characteristics of the yielding material, with a~~
129 ~~minimum value of 1.25.~~

130 ~~———— **4.2 Deformation:** The system shall have the ability to deform to a story~~
131 ~~drift of at least 4 percent (three cycles) while retaining at least 80 percent of the~~
132 ~~maximum strength achieved during the preceding cycles.~~

133 ~~———— **4.3 Energy Dissipation:** The energy dissipated per cycle shall be at least~~
134 ~~three eighths that of an equivalent elastoplastic system.~~

135 **3.3 Conditions of Acceptance:** Conditions of acceptance for each test
136 assembly shall be in accordance with Section 21.6.3 of ACI 318 and Section 9.0 of
137 ACI T1.1.

138 **4.0 QUALITY CONTROL**

139 ~~Ductile Connectors in Precast Concrete Special Moment Resisting Frames~~
140 ~~must be manufactured under a quality control program with inspections by a quality~~
141 ~~control agency accredited by the International Accreditation Service (IAS). A quality~~
142 ~~control manual, jointly developed by the applicant and the agency, complying with~~
143 ~~the ICC-ES Acceptance Criteria for Quality Control Manuals (AC10), must be~~
144 ~~submitted.~~

145 **4.1** The connection components shall be manufactured under an approved
146 quality control program with inspections by an inspection agency accredited by the
147 International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.

148 **4.2** Quality documentation for the connection components, complying with
149 the ICC-ES Acceptance Criteria for Quality Documentation (AC10), shall be
150 submitted.

151 **4.3** Special inspection and testing shall be provided in accordance with
152 Sections 1704.4, 1707, and 1708.3 of the IBC.

153 **4.4** Fabrication and assembly work requiring special inspection is
154 permitted to be done on the premises of approved fabricators. The quality assurance
155 program for fabrication practices shall be documented and comply with the IAS
156 Accreditation Criteria for Fabricator Inspection Programs for Reinforced Concrete
157 (AC157).

159 **5.0** EVALUATION REPORT RECOGNITION

160 The evaluation report shall include:

161 **5.1** Basic information described in Sections 2.1 of this criteria.

162 **5.2** Provisions for special inspection as described in Section 4.3 of this
163 criteria.

164 **5.3** A description of the fabrication program as indicated in Section 4.4 of
165 this criteria.

166