ICC EVALUATION SERVICE, INC.
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June 2, 2008

TO: **PARTIES INTERESTED IN EVALUATION REPORTS ON CONCRETE FLOOR, ROOF AND WALL SYSTEMS AND CONCRETE MASONRY WALL SYSTEMS**

SUBJECT: Proposed Revisions to the Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems, Subject AC15-0608-R1 (MR/BG)

Dear Madam or Sir:

The enclosed May 14, 2008, letter from Xella Aircrete North America, Inc., requests a revision to the subject acceptance criteria. Currently, Section 6, Evaluation Report Recognition, sets a limitation to Seismic Design Categories A or B for structural concrete used as lateral force–resisting systems that do not comply with the 2006 *International Building Code* (IBC) or Seismic Zone 0, 1, or 2 under the *Uniform Building Code* (UBC), unless substantiating data verifying compliance with appropriate design provision of the applicable code is submitted.

Xella Aircrete North America, Inc., is proposing to revise the acceptance criteria to reference the 2007 Supplement to the IBC. The 2007 Supplement to the IBC includes a revision to Chapter 16 that adds a new Section 1613.6.4 concerning autoclaved aerated concrete (AAC) masonry shear wall design coefficients and system limitations. The revisions set forth seismic design coefficients and factors for AAC masonry shear walls, which are not addressed in the 2006 IBC, and recognize reinforced walls for low–rise (35 feet) buildings in seismic design category C. This also differs from the 2006 IBC.

The revisions to the subject acceptance criteria, as presented in this letter, are being posted on the ICC-ES web site to allow for public comment. The revisions include adding the 2007 Supplement to the IBC as a reference code. The revisions would also add a new Section 6.4 as follows:

> *6.4 In lieu of Section 6.3, a statement that autoclaved aerated concrete masonry shear walls used in lateral force–resisting system, shall be subject to design and system limitations in accordance with Section 1613.6.4 of the 2007 Supplement to the IBC.*

You are cordially invited to submit written comments, within 30 days of the date of this letter. 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.

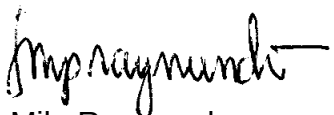
Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

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.

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

Yours very truly,



Mila Raymundo
Senior Evaluation Specialist

MR/gh:raf

Enclosure

cc: Evaluation Committee

Wednesday, May 14, 2008

Brian Gerber
ICC Evaluation Service, Inc.
Los Angeles Business/Regional Office
5360 Workman Mill Road
Whittier, California 90601

RE: 2007 Supplement to the International Codes

Dear Brian,

Please accept this letter to notify you that Xella Aircrete North America is requesting to include 2007 Supplement to the International Codes into the following acceptance criteria documents:

- ◊ (AC15) Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems.
- ◊ (AC215) Seismic Design Factors and Coefficients for Seismic-force-resisting Systems of Autoclaved Aerated Concrete (AAC).

The 2007 Supplement contains changes submitted in the 2006/2007 Code Development cycle which were approved by the membership of the International Code Council. Including the 2007 Supplement in the referenced acceptance criteria documents will provide for the latest developments in building regulations.

If you have any questions, please do not hesitate to call me.

Kind regards,

Sylvester Schmidt
President/CEO
Xella Aircrete North America, Inc.

Xella Aircrete North America Inc
2400 Hebel Boulevard
Adel GA 31620

Phone 229 896 1593
Fax 229 896 1912

Xella Aircrete North America Inc
1117 Perimeter Center West Suite W-509
Atlanta GA 30338

Phone 678 280 8570
Fax 678 280 8571

www.xella-usa.com

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR CONCRETE FLOOR, ROOF, AND WALL SYSTEMS AND CONCRETE MASONRY WALL SYSTEMS

AC15

Proposed June 2008

~~**Effective July 1, 2007**~~

Previously approved July 2007, June 2003, January 2001, October 1999, June 1987

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 CONCRETE FLOOR, ROOF AND WALL SYSTEMS AND CONCRETE MASONRY WALL SYSTEMS

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for structural concrete, floor, roof and wall systems or concrete masonry wall systems to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 *International Building Code*® (IBC) the 2006 *International Residential Code*® (IRC), and the 1997 *Uniform Building Code*® (UBC) .

The reason for the development of this criteria is to provide guidelines for the evaluation of structural concrete, floor, roof and wall systems or concrete masonry wall systems, where code compliance is unachievable and the codes do not provide requirements for testing and determination of structural capacities, reliability and serviceability of these products.

1.2 Scope: The acceptance criteria applies to concrete floors, roof, or wall systems, or concrete masonry wall systems that comply with, or are alternatives to, requirements in the IBC, IRC, or UBC. This acceptance criteria emphasizes structural characteristics. Other characteristics shall comply with the applicable code or acceptance criteria.

1.3 Reference Standards:

1.3.1 2006 *International Building Code* (IBC), International Code Council.

1.3.2 2006 *International Residential Code* (IRC), International Code Council.

1.3.3 2007 *Supplement to the International Building Code*

~~**1.3.3**~~ **1.3.4** 1997 *Uniform Building Code* (UBC).

~~**1.3.4**~~ **1.3.5** Prescriptive Method for Insulating Concrete Forms in Residential Construction (publication No. EB118), dated May 1998. The document is available from the Portland Cement Association, located at 5420 Old Orchard Road, Skokie, Illinois 60077-1083.

~~**1.3.5**~~ **1.3.6** Building Code Requirements for Structural Concrete (ACI 318-05). Referenced in Chapter 19 of the IBC.

~~**1.3.6**~~ **1.3.7** Building Code Requirements for Structural Concrete (ACI 318-95). Referenced in Chapter 19 of the UBC.

~~**1.3.7**~~ **1.3.8** ASTM E 72-02, Standard Methods of Conducting Strength Tests of Panels for Building Construction, ASTM International.

~~**1.3.8**~~ **1.3.9** ASTM C 90-03, Standard Specification for Load-bearing Concrete Masonry Units, ASTM International.

~~**1.3.9**~~ **1.3.10** ASTM C 1019-03, Standard Test Method for Sampling and Testing Grout, ASTM International.

~~**1.3.10**~~ **1.3.11** ASTM C 39-99ae1, Standard Test Method for Compressive Strength of Cylindrical Specimens, ASTM International.

~~**1.3.11**~~ **1.3.12** ASTM C 270-04, Standard Specification for Mortar for Unit Masonry, ASTM International.

~~**1.3.12**~~ **1.3.13** ASTM C 469-02, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression, ASTM International.

~~**1.3.13**~~ **1.3.14** ASTM C 496-96, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens, ASTM International.

~~**1.3.14**~~ **1.3.15** ASTM C 507-00, Standard Test Method for Determining Density of Structural Lightweight Concrete, ASTM International.

~~**1.3.15**~~ **1.3.16** ASTM C 173-01$^{\epsilon 1}$, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method, ASTM International.

~~**1.3.16**~~ **1.3.17** ASTM C 1386-98, Standard Specification for Precast Autoclaved Aerated Concrete (PAAC) Wall Construction Units, ASTM International.

~~**1.3.17**~~ **1.3.18** ASTM C 1452-00, Standard Specification for Reinforced Autoclaved Aerated Concrete Elements, ASTM International.

~~**1.3.18**~~ **1.3.19** ASTM E 455-98, Standard Test Method for Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings, ASTM International.

~~**1.3.19**~~ **1.3.20** ASTM E 564-00$^{\epsilon 1}$, Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings, ASTM International.

1.4 Definitions:

1.4.1 Flat ICF Wall Systems: A solid concrete wall of uniform thickness (solid rectangular cross section) produced by the ICF.

1.4.2 Insulating Concrete Form (ICF): Concrete-forming systems used for constructing cast-in-place concrete walls, consisting of stay-in-place formwork using foam-plastic insulation or other insulating materials.

1.4.3 Post-and-Beam ICF Wall Systems: A perforated concrete wall with widely spaced (greater than that required for screen-grid ICF walls) vertical and horizontal concrete members (cores), with voids in the concrete between cores created by the ICF form. The post-and-beam wall resembles a concrete frame rather than a monolithic concrete (i.e., flat, waffle-, or screen-grid) wall.

1.4.4 Screen-grid ICF Wall Systems: A perforated concrete wall with closely spaced vertical and horizontal concrete members (cores), with voids in the concrete between the members that have been created by the ICF.

1.4.5 Waffle-grid ICF Wall Systems: A solid-concrete wall with closely spaced vertical and horizontal concrete members (cores), with a concrete web between the members that have been created by the ICF.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning the systems, including configurations, components,

material specifications, manufacturing process, dimensions, and tolerances.

2.1.2 Installation Instructions: Installation instructions, details, and drawings, describing installation requirements and limitations.

2.1.3 Packaging and Identification: A description of the method of packaging and field identification of the concrete or concrete masonry system components. Identification shall include the ICC-ES evaluation report number and notice of any product installation limitations.

2.1.4 Field Preparation: A description of the methods of field-cutting, application and finishing.

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

2.3 Test Reports: Test reports shall comply with AC85. The test report shall be in sufficient detail to identify specimen properties that might affect performance.

Additional tests, beyond those specified, may be required for special conditions or unique components or systems.

2.4 Product Sampling: Sampling of the concrete or concrete masonry system components for tests under this criteria shall comply with Section 3.1 of AC85. Products shall be sampled from each manufacturing facility for which recognition is sought.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: Justifying data in support of the application for recognition under the IBC IRC, and UBC as an alternative method of construction, shall be provided in two phases:

1. An initial submittal as described in Section 3.2.
2. A final submittal as described in Section 3.3.

Discussions between the applicant and ICC-ES are necessary to provide a basis of mutual understanding and agreement. Information specified in Section 3.2 of this acceptance criteria should be submitted to ICC-ES at least 30 days prior to any preliminary discussions.

Justifying data in support of the application for recognition only under the IRC shall verify compliance with the applicable provisions of Section R611. If justifying data for compliance with Section R611 is not provided, the requirements noted in this criteria for compliance with the IBC shall be provided.

This acceptance criteria focuses on structural requirements. Other considerations and elements of the product or system, such as foam plastic, interior finishes, fire-resistive construction, and other code issues, are subject to requirements as set forth in the applicable code or other ICC-ES acceptance criteria.

3.2 Initial Submittal: The initial submittal shall include the items noted in Sections 3.2.1 through 3.2.4.

3.2.1 Product or System Description:

1. Basic information as described in Section 2.1.
2. Clarification as to whether the product or system is new or a modified version of a previously recognized one.
3. Description of the unique features of the product or system.
4. Description of how the product or system will be used.
5. Restrictions or limitations on use.

3.2.2 Product or System Application:

1. Description of how the product or system will be used or installed in the field.
2. Procedures establishing quality control in field installations. Section 5.0 describes related requirements.
3. Requirements for product handling and storage.
4. Details describing installation of fasteners into structural elements, along with procedures for establishing design values.

3.2.3 Extent of Recognition:

1. Complete description of details and of recognition being sought (i.e., bearing, nonbearing, etc.).
2. Clarification of recognition under either Chapter 19 or 21 of the IBC or UBC.
3. Details on how the product or system does or does not comply with Chapter 19 or 21 of the IBC or UBC, including conformities and deviations. This should include statements with language such as “complies with Chapter 19 or 21 of the IBC or UBC (whichever is applicable) in the following areas . . .” and “does not comply with Chapter 19 or 21 of the IBC or UBC (whichever is applicable) in the following areas . . .”
4. Details and examples of how the product or system is designed and analyzed, including formulas with procedures (engineering analysis), design of lintel beams, and properties needed for design and analysis. The engineering analysis shall consider failure modes or limit states, deflections and creep. If testing is required, it shall be conducted in accordance with Section 3.0 of this acceptance criteria. The intent of testing is to verify the design equations and assumptions used in the engineering analysis.
5. For the structural design of buildings that use ICF flat, waffle-grid, and screen-grid wall systems and that do not exceed a height of two stories plus a basement, where the maximum unsupported wall height is 10 feet (3048 mm), the design of the concrete walls formed by ICFs shall be in accordance with publication No. EB118, subject to all applicability limits of Table 1.1 of that document. Alternatively, the engineering analysis shall be in accordance with Chapter 19 of the IBC or UBC, whichever is applicable.
6. For buildings that use ICF wall systems and exceed a height of two stories plus a basement, or where the unsupported wall height of any story exceeds 10 feet (3048 mm), the following testing or design requirements, or both, are required:

   a. For flat ICF wall systems, walls shall be designed in accordance with Chapter 19 of the IBC or UBC, whichever is applicable. Qualification testing is not required unless the engineering analysis includes design formulae and assumptions not conforming to the applicable code.

b. For waffle-grid ICF wall systems, walls shall be designed as described in Section 1914 of the UBC or Chapter 14 of ACI-318 (IBC), whichever is applicable; the empirical design method, Section 1914.5 of the UBC or Section 14.5 of ACI 318 (IBC), may not be used. When the engineering analysis complies with the design assumptions and formulae of Section 1914 of the UBC or Chapter 14 of ACI-318 (IBC), whichever is applicable, qualification testing is not required.

c. For screen-grid and post-and-beam ICF wall systems, qualification testing shall be conducted in accordance with these criteria to substantiate the design methodology.

3.2.4 Qualification Test Plan: When testing is required, the test plan shall specify all or part of the tests described in Section 3.0, as well as any additional tests identified as applicable for special features of the product or system. The test plan shall be a complete document. In general, qualification testing shall provide data on material properties, including density, stresses, deformations and/or ductility, creep, and limit states or failure modes to support a rational analysis procedure. Tests shall simulate the anticipated loading conditions and load levels. Test specimens shall be configured to confirm reinforcement placement methods, including anchorage, development lengths and splices.

The testing details noted in Section 3.0 are intended for verification of the engineering analysis procedures, not for establishment of design stresses. Modifications to the design values described in Section 3.3.2, based on test results, may be considered.

It is the responsibility of the applicant to define additional tests necessary to qualify the design data for unique components or systems.

The test procedures for concrete masonry and for concrete products or systems are described in Sections 4.1 and 4.2, respectively.

All tests shall be conducted by an accredited testing laboratory as set forth in Section 2.2.

3.3 Final Submittal: The final submittal shall consist of testing laboratory test report(s) and a design criteria report, as described in Sections 3.3.1 and 3.3.2. The final submittal shall be combined with the data from the initial submittal, to complete the required documentation for the product or system. Contents in the final submittal shall comply with Sections 3.3.1 through 3.3.3.

3.3.1 Testing Laboratory Test Report: The testing laboratory shall report on the qualification testing performed in accordance with the approved test plan. Any deviations from the test plan shall be noted and explained.

In addition to the information requested in Sections 2.0 and 3.0, the test report shall include the following:

1. Description of test specimen.
2. Description of test setup.
3. Rate and method of loading.
4. Deformation measurements.
5. Modes of failure.

3.3.2 Design Criteria Report: A design criteria report shall be submitted and shall include a complete analysis and interpretation of the qualification test results presented in the independent laboratory test report. Design stresses for concrete masonry, or characteristic strengths for concrete systems, shall be specified, based on the analysis.

Design stresses or characteristic strengths used in the analysis and design shall be qualified by the test data. The safety factor procedure, provisions of Chapter 19 or 21 of the IBC or UBC, whichever is applicable, and an appropriate design analysis shall be used to assign design stresses or characteristic strengths that provide the degree of safety required by the applicable code. Alternatively, the safety index procedure in Section 3.3.3.2 may be used for strength design.

The submittal shall include provisions for reinforcement placement methods, including anchorage, development lengths and splices.

At the time of initial submittal, there shall be agreement between the applicant and ICC-ES on the selected procedure.

3.3.3 Design Value: The predicted design capacity, based on working stress or strength methods, shall be derived using either the Safety Factor Procedure or the Safety Index Procedure.

3.3.3.1 Safety Factor Procedure: Design Value $\leq$ (Average Maximum Strength) $\times$ ($^1/_{SF}$)

where:

SF = 5.0 (for Working Stress for Concrete Masonry).

= 2.5 (for Special Inspected Masonry).

= 1.7 (for Strength Design for Concrete).

= 1.8 (for Strength Design for Concrete Masonry).

The Average Maximum Strength is based on three identical specimens, as specified in Section 4.0.

3.3.3.2 Safety Index Procedure (Strength Design of Concrete or Concrete Masonry): Design Value $\leq$ Average Maximum Strength $\times$ exp (-0.75 B V)

where:

B = Safety index = 3.5.

V = $CV_t \geq 0.10$.

V_t = Coefficient of variation of the average maximum strength.

C = 2.0 - 0.1n.

n = Number of identical specimens. The value of n for this equation may range from 5 to 10.

The average maximum strength and coefficient of variation of the maximum strength shall be based on a minimum of five identical specimens.

The Safety Index Procedure requires independent quality control on the manufacture of the product in accordance with Section 5.1, and special inspection of installation of the system in accordance with Section 5.4 or 5.5, since design stresses are directly dependent on the variability of the product.

4.0 QUALIFICATION TESTS

4.1 Concrete Masonry Wall Systems:

4.1.1 General: The following shall be considered when specifying qualification tests for concrete masonry products or systems:

1. Qualification testing is required for structural products and systems unless proper analytical justification is presented. Existing data on concrete masonry research may be submitted for review, provided the data are from an independent source and are nonproprietary. The tests shall demonstrate the applicability of the design provisions to representative configurations, and for anticipated uses.

2. Purpose and description of tests required to show compliance with design procedures noted in Chapter 21 of the IBC or UBC.

3. Analysis and details justifying that it is not necessary to conduct the qualification tests specified in this section (Section 4.3.1).

4. Purpose and description of additional tests, not covered by this acceptance criteria, required for unique features that cannot be qualified by established testing standards or requirements.

4.1.2 Tests:

4.1.2.1 Masonry Prism Tests: For recognition under the UBC, masonry prism tests shall be conducted in accordance with UBC Standard 21-17 and Section 2105.3.2. Five prisms shall be tested. In addition to the standard reporting and certification of test results, observation of specimen response shall be reported at significant stages of the loading process. For recognition under the IBC, tests shall be conducted in accordance with Section 2105.2.2.2.

4.1.2.2 Concrete Masonry Unit Tests: For recognition under the UBC, the units shall be tested in accordance with UBC Standard 21-4. For recognition under the IBC, units shall be tested in accordance with ASTM C 90.

4.1.2.3 Grout Tests: The grout shall be tested in accordance with ASTM C 1019.

4.1.2.4 Mortar Tests: For recognition under the UBC, the mortar shall be tested in accordance with UBC Standard 21-14. For recognition under the IBC, mortar shall be tested in accordance with ASTM C 270.

4.1.2.5 Wall Compression Tests: Wall compression specimens having a minimum eccentricity of $^{t}/_{6}$ shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall compression tests, three masonry prisms shall be tested for correlation of results with those of wall tests; these are in addition to the tests required under the Masonry Prism Tests.

3. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.1.2.6 Wall Flexural Tests: Wall flexural specimens shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall flexural tests, three masonry prisms shall be tested for correlation with the wall flexural tests. These are in addition to the five tests required under the Masonry Prism Tests.

3. Loading in the out-of-plane direction may be applied by third-point loading or by using an air bag system.

4. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs must be taken and submitted, of specimen response at significant stages of the loading process.

4.1.2.7 Wall Flexural-compression Tests: Wall flexural-compression specimens shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall flexural-compression tests, three masonry prisms shall be tested for correlation of results with those of wall tests; these are in addition to the five tests required under the Masonry Prism Tests.

3. The applied axial loads shall be consistent with the submitted analysis, and acceptance will depend on the intended application. The lateral, out-of-plane, loads may be applied by third-point loading or by using an air-bag system. The wall shall be simultaneously loaded axially and transversely.

4. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.1.2.8 Wall Shear Tests (In-plane Shear): Wall shear specimens shall be tested in accordance with the procedure defined in Annex A, and testing shall comply with the following requirements:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall shear tests, three masonry prisms shall be tested for correlation of results with those of wall tests; these are in addition to the five tests required under the Masonry Prism Tests.

3. In addition to the standard reporting and certification of test results, physical observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.1.2.9 Anchors: Where considered necessary to demonstrate acceptable performance, anchors shall be evaluated in accordance with applicable ICC-ES acceptance criteria.

4.2 Concrete Wall, Floor or Roof Systems:

4.2.1 General: The following conditions shall be considered when specifying qualification tests for concrete wall systems:

1. Qualification tests are required for structural products and systems, unless proper analytical justification is presented. Existing data on concrete research may be submitted for review, provided the data are from an independent source and are nonproprietary. The tests shall demonstrate the applicability of the design provisions to representative configurations, and for anticipated uses.

2. Purpose and description of tests required to show compliance with design procedures noted in Chapter 19 of the IBC or UBC.

3. Analysis and details justifying that it is not necessary to conduct the qualification tests specified in this section (Section 4.2.1).

4. Purpose and description of additional tests, not covered by this acceptance criteria, required for unique features that cannot be qualified by established testing standards or requirements.

5. Systems in which the concrete forms are structural elements (e.g., concrete masonry units) require prism tests and cylinder tests.

4.2.2 Tests:

4.2.2.1 Concrete Properties Tests: For recognition under the IBC, compressive strength tests shall be conducted in accordance with Section 1905.6.3. For recognition under the UBC, compressive strength tests shall be conducted in accordance with Section 1905.6.2. Compressive strength and other properties as needed shall be determined in accordance with the following references:

1. Compressive strength—ASTM C 39.
2. Modulus of Elasticity—ASTM C 469.
3. Split Cylinder Tensile Strength—ASTM C 496.
4. Density—ASTM C 567.
5. Air Content—ASTM C 173.
6. Autoclaved Aerated Concrete Masonry—ASTM C 1386.
7. Autoclaved Aerated Concrete—ASTM C 1452.

4.2.2.2 Wall Compression Tests: Wall compression specimens, with a minimum eccentricity of $t/6$, shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall compression tests, three cylinders shall be tested for correlation of results with those of wall tests.

3. The mix design used by the concrete supplier shall be part of the test documentation.

4. In addition to the standard reporting and certification of tests results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.3 Wall Flexural Tests: Wall flexural specimens shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall flexural tests, three cylinders shall be tested for correlation of results with those of wall tests.

3. The mix design used by the concrete supplier shall be part of the test documentation.

4. The loading in the out-of-plane direction may be applied by third-point loading, since air-bag tests are usually not effective on concrete systems.

5. In addition to the standard reporting and certification of tests results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.4 Wall Flexural-compression Tests: Wall flexural-compression specimens shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the wall flexural-compression tests, three cylinders shall be tested for correlation of results with those of wall tests.

3. The mix design used by the concrete supplier shall be part of the test documentation.

4. The applied axial loads shall be consistent with the submitted analysis, and acceptance will depend on the intended application. The lateral, out-of-plane, loads may be applied by third-point loading, since air-bag tests are usually not effective on concrete systems. The wall shall be simultaneously loaded axially and transversely.

5. In addition to the standard reporting and certification of tests results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.5 Wall Shear Tests (In-plane Shear): Wall shear specimens shall be tested in accordance with the procedure defined in Annex A, and testing shall comply with the following requirements:

1. Six specimens shall be tested, using three identical specimens at two different configurations and/or heights.

2. Within 48 hours of the shear wall tests, three cylinders shall be tested for correlation of results with those of wall tests.

3. The mix design used by the concrete supplier shall be part of the test documentation.

4. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.6 Floor or Roof Panel Flexural Tests: Floor flexural specimens shall be tested in accordance with the general guidelines of ASTM E 72, with the following exceptions:

1. Six specimens shall generally be tested, using three identical specimens at two different concrete densities or configurations. If only one concrete mix design and configuration is anticipated, only three tests are needed.

2. Within 48 hours of the floor or roof panel flexural tests, three cylinders must be tested, for comparison of analytical and experimental results.

3. The concrete mix design(s) shall be documented.

4. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.7 Floor or Roof Panel Diaphragm Shear Tests: Panel shear specimens shall be tested in accordance with procedures defined in Annex B, and testing must comply with the following requirements:

1. Six specimens shall generally be tested, using three identical specimens at two different concrete densities. If only one concrete mix design and configuration is anticipated, only three tests are needed.

2. Within 48 hours of the floor or roof panel diaphragm shear tests, three cylinders must be tested, for comparison of analytical and experimental results.

3. The concrete mix design(s) shall be documented.

4. In addition to the standard reporting and certification of test results, observations shall be reported, and photographs shall be taken and submitted, of specimen response at significant stages of the loading process.

4.2.2.8 Anchors: Procedures are set forth in Section 4.1.2.9.

4.3 Interpretation of Tests Results: Design stresses for concrete masonry or characteristic strengths for concrete floor, roof and wall systems, used in analysis and design, shall be qualified by the test data. Procedures from the IBC or UBC, whichever is applicable, along with appropriate test data, shall be used to verify design stresses or characteristic strengths that provide the required level of safety. The Safety Factor Procedure and Safety Index Procedure described in Section 3.3 shall be used to correlate the assumed design stresses to the qualification test data.

The average maximum strength from each set of tests may be the average ultimate value, provided the ultimate value for each test is within 15 percent of the average. Otherwise, the lowest ultimate value shall be used.

5.0 QUALITY CONTROL

5.1 The products shall be manufactured under an approved quality control program. Inspections by an inspection agency accredited by the International Accreditation Service (IAS), or otherwise acceptable to ICC-ES, shall be provided when specified by the applicable code or this acceptance criteria.

5.2 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

5.3 Prefabricated Components: The manufacture of products or systems requiring quality control must comply with quality control details noted in the UBC and applicable ICC-ES acceptance criteria.

5.4 Jobsite (UBC): Installation of elements requiring special inspection in the UBC shall comply with Section 1701 and other applicable sections of that code.

Exception: When approved by the code official, special inspection is not required for special concrete wall systems involving single-story, maximum 8-foot-high walls, housing Group R-3 or Group U-1 Occupancies, provided the following conditions are met:

1. Maximum height of individual concrete lifts is 48 inches (1219 mm). Succeeding lifts must be placed in accordance with Section 1905.10.5 of the UBC.

2. The size and spacing of concrete cores shall yield a wall of at least 85 percent solid concrete.

3. Installation is by properly trained installers approved by the manufacturer.

4. The evaluation report and installation instructions indicate methods used to verify proper placement of concrete.

5. Specified compressive strength (f'_c) of concrete used in design is one-half of that specified.

5.5 Jobsite (IBC): Installation of elements requiring special inspection in the IBC shall comply with Section 1704 and other applicable sections of that code.

5.6 Jobsite (IRC): For walls complying with the specific requirements in Chapters 4 or 6 of the IRC, special inspection is not required. For other systems, Section 5.5 of this criteria applies.

6.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include the following:

~~1.~~ **6.1** Basic information required by Section 2.1, including product description, installation procedures, and packaging and identification.

~~2.~~ **6.2** Design loads and deflections for each assembly, based on analysis of data in Section 3.3.

~~3.~~ **6.3** A statement that structural concrete wall systems or concrete masonry wall systems recognized under this acceptance criteria and used as lateral force–resisting systems shall be limited to Seismic Design Categories A or B under the IBC, or Seismic Zones 0, 1, or 2 under the UBC, unless substantiating data verifying compliance with appropriate design provisions of the applicable code is submitted.

6.4 In lieu of Section 6.3, A statement that autoclaved aerated concrete masonry shear walls, used in a lateral force resisting system shall be subject to design and system limitations in accordance with Section 1613.6.4 of the 2007 Supplement to the IBC. ■

ANNEX A
METHOD OF CONDUCTING STRENGTH TESTS FOR CONCRETE AND CONCRETE MASONRY WALL SHEAR TESTING (In-plane Shear)

The method of conducting strength tests for concrete and concrete masonry wall shear testing is based on the racking procedure developed for sheathed wood frames as described in ASTM E 72. As alternatives, procedures in ASTM E 564 may be used. For these tests, the loading procedure described in ASTM E 72 shall be modified to apply the lateral racking and vertical loads through a continuous, reinforced concrete or steel member. Its attachment to the specimen shall be designed so that applied loads are uniformly distributed along the specimen length. The specimen shall be mounted on a base in a manner equivalent to the method commonly used in the field. In this regard, the attachment of the specimen to the base shall be constructed to avoid a concentrated reaction. In addition, where the superimposed vertical load is not sufficient to resist the overturning moment, hold-down devices shall be incorporated to prevent premature failure due to this action.

The procedures and details of the specific test setup will depend on the product or system being tested, and these procedures and details shall be fully described in the test plan.

ANNEX B
METHOD OF CONDUCTING STRENGTH TESTS FOR CONCRETE FLOOR AND ROOF PANEL SHEAR TESTING (Diaphragm Shear)

The method of conducting strength tests for concrete floor and roof panels to determine diaphragm shear capacity is based on the procedures in ASTM E 455. For the cantilever tests, the loading procedure described in ASTM E 455 shall apply the loads through a continuous structural member that simulates in-situ conditions including connection devices. In addition, the specimen shall be tested in a horizontal position. A fully representative portion of a panel may be tested rather than a complete panel provided that it can be demonstrated by analysis that extrapolation of the results to complete panels and panel assemblies can be justified. In addition, where assemblies of panels act together to resist diaphragm shear, portions of at least two panels shall be tested with a sufficient number of connection devices to demonstrate the shear capacity of those devices.

The procedures and details of the specific test setup will depend on the product or system being tested, and these procedures and details shall be fully described in the test plan.

APPENDIX A
(NONMANDATORY INFORMATION)
SAFETY FACTORS AND SAFETY INDEX PROCEDURE

A1. The Safety Index Equation:

The safety index equation is:

$$R_D \leq R \exp(-0.75\,BV) \qquad \text{(A-1)}$$

where:

R_D = Design value of strength.

R = Average maximum strength.

B = Safety index.

= 3.5.

V = Coefficient of variation of maximum strength.

Table A.1 provides values for the ratio [(R/R_D) or (Average Maximum Strength/Design Value of Strength)], for a range of values of V.

Consider the case in which R and V are determined, and thus R_D is calculated using Formula (A-1). This R_D is compared with the 1997 UBC calculated design strength. For example, in Section 2108.2.4.4:

$M_u \leq \phi M_n$ (A-2)

Equating Formulas (A-1) and (A-2), it follows that:

$R_D = \phi M_n$ (A-3)

and, therefore, the calculated value for R_D from Formula (A-1) must be greater than M_n. Alternately stated:

$(R_D/\phi) > M_n$ (A-4)

To illustrate this calculation, consider the case in which V = 0.20. Then, from Table A.1, (R/R_D) is equal to 1.69 and:

$R = 1.69\ R_D = 1.69\ M_n$ (A-5)

Finally, if one calculated M_n from Section 2411 of the UBC, then:

$(R/M_n) = 1.69$ (A-6)

and if $\phi = 0.8$, then the ratio must be:

$(R/M_n) \geq 1.36$ (A-7)

A2. Determination of Coefficient of Variation of Average Maximum Strength Using Test Data:

A minimum of five identical specimens shall be tested in order to use the safety index procedure. It is clear that, with only five specimens, one does not have as valid an estimate of the coefficient of variation, *V*, as one would have if a larger number of specimens (say 10) were tested. Therefore, it is reasonable to multiply the value of V calculated using n test specimens in order to incorporate this reduction in confidence. It is reasonable that:

$V = C\ V_t$ (A-8)

where:

C = 1.0 if $n \geq 10$. (A-9a)

= $[(1- b)/5]n + [2b-1]$. (A-9b)

V_t = Coefficient of variation.

The recommended value of b = 1.5, and therefore:

$C = 2.0 - .10n$ (A-9c)

A3. Interpretation of Safety Factor Procedure:

Consider first the working stress design equation:

$F_W = R_W$ (A-10)

where:

F_W = Working stress (i.e., unfactored or service) loads.

R_W = Working stress design (allowable).

The strength design loading, F_S, can be expressed using an average load factor of 1.6 as:

$F_S = 1.6\ F_W$ (A-11)

and the design strength, R_s, must be such that:

$F_S = R_D$ (A-12)

For example (from Section 2108.2.4.4 of the UBC):

$R_D = \phi M_n$ (A-13)

Therefore, from Formulas (A-12) and (A-11), it follows that:

$1.6\ F_W = R_D$ (A-14)

Then, using Formula (A-10):

$1.6\ R_W = R_D$ (A-15)

But from the basic definition of the safety factor for working stress design:

$$R_W = R/SF \quad \text{(A-16)}$$

so:

$$1.6\ (R/SF) = R_D$$

or

$$SF = 1.6\ (R/R_D)$$

with (R/R_D) given in Table A.1, it follows that one can similarly obtain the safety factor for working stress design, *SF*. Table B.1 shows that if *SF* = 2.5, which is a reasonable value, then it corresponds to an (R/R_D), or Strength Design safety factor, value of 1.56.

The result of this exercise is to indicate that an *SF* value, for working strength design, of 2.5 corresponds to an *SF* value, for strength design, of 1.6, and they both correspond to a coefficient of variation, or *V*, value of 17 percent.

An *SF* value for the strength design of concrete masonry equal to 1.6 would be a good recommendation except that, historically, 1.7 is used for concrete. For this reason, the acceptance criteria uses a value of 1.7 for concrete, and a slightly higher value of 1.8 for concrete masonry.

TABLE A.1—SAFETY FACTORS

V (%)	(R/R_D)	*SF*
0.10	1.30	2.1
0.15	1.48	2.4
0.17	1.56	2.5
0.20	1.69	2.7
0.25	1.93	3.1
0.30	2.20	3.5
0.35	2.51	4.0
0.40	2.86	4.6

R = Average maximum strength.
R_D = Design value of strength.