

August 18, 2020

**TO: PARTIES INTERESTED IN PROPOSED ACCEPTANCE CRITERIA FOR
CO₂CONCRETE-BASED CONCRETE MASONRY UNITS**

**SUBJECT: Proposed Acceptance Criteria for CO₂Concrete-Based Concrete Masonry
Units, AC520-1020-R1 (ME/VC)**

Hearing Information:

WebEx Event Meetings

[Tuesday, October 6, 2020](#)

[Wednesday, October 7, 2020](#)

8:00 am Central Daylight Time

Click each date above to register.

Please register for *both* days

Dear Colleague:

You are invited to comment on a proposed new acceptance criteria for CO₂Concrete-Based Concrete Masonry Units, AC520, which will be discussed at the Evaluation Committee hearing noted above. The proponent of the proposed acceptance criteria is the University of California, Los Angeles (UCLA).

The criteria is being developed for the evaluation of CO₂Concrete-Based Concrete Masonry Units that are an alternative to load-bearing or non-load-bearing concrete masonry units in compliance with ASTM C90 and ASTM C129, respectively, under the 2018 IBC Section 2103.1 (Article 2.3 of TMS 602), and 2018 IRC Section R606.2.1. This criteria is applicable to hollow/solid normal weight, medium weight, and lightweight concrete blocks that are made from proprietary CO₂Concrete mixture formulations and material components.

You are invited to submit written comments on this or any other agenda item, or to attend the Evaluation Committee hearing and present your views during the Webex Event meeting. If you wish to contribute to the discussion, please note the following:

1. Regarding written comments and presentations:
 - a. You should submit these via e-mail to es@icc-es.org or by U.S. mail to the Eastern Regional (Birmingham) office to be received by the applicable due date.

- b. Comments are to be received by **September 10, 2020**. These written comments will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site shortly after the deadline for submission. Written comments that are not submitted by this deadline will not be considered at the meeting.
- c. Rebuttal comments, from the proponent noted in this letter, are to be received by **September 22, 2020**. They will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site shortly after the deadline for submission. Written rebuttal comments that are not submitted by the deadline will not be considered at the meeting.
- d. If you want to make a visual presentation at the hearing, it must be received in PowerPoint format. The presentation is to be received by **September 22, 2020**. These will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site after the deadline for submission. Presentations that are not submitted by the deadline cannot be presented at the meeting. **Note:** Videos will not be posted on the web site.

Presentations will be retained with other records of the meeting.

- e. ICC-ES will post to the web site, on **October 2, 2020**, memos by the ICC-ES staff, responding to the previously received public comments.
- f. If you miss the deadlines for submission of written comments and visual presentations, your verbal comments can be presented at the Webex Event meeting.
- g. Proposed criteria, written public comments, visual presentations, and responses by ICC-ES staff for this agenda item are all available on our website.

2. Regarding verbal comments and presentations:

Please plan to speak for not more than ten minutes. As noted above, visuals are to be in PowerPoint format and will be shown during the Webex Event meeting.

- 3. Keep in mind that all materials submitted for committee consideration are part of the public record and will not be treated as confidential. It is the presenter's responsibility to certify to ICC-ES staff that no materials infringe copyright.
- 4. Please do not communicate with committee members before the meeting about any items on the agenda.

We appreciate your interest in the work of the Evaluation Committee. If you have any questions, please contact me at (800) 423-6587, extension 3253, or Vincent Chui, P.E., S.E., at extension 3244. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,

A handwritten signature in black ink, appearing to read 'M. Ekenel', written in a cursive style.

Mahmut Ekenel, PhD., P.E.
Senior Staff Engineer

ME/VC/lis

Encl.

cc: Evaluation Committee

ICC EVALUATION SERVICE, LLC, RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE

The purpose of the Evaluation Committee is to review and approve acceptance criteria on which evaluation reports may be based.

2.0 MEMBERSHIP

2.1 The Evaluation Committee has a membership of not fewer than nine, with one of the members named by the ICC-ES president each year to serve as the chairman–moderator.

2.2 All members of the committee shall be representatives of a body enforcing regulations related to the built environment.

2.3 Persons are appointed to the committee by the ICC-ES president, from among individuals who have formally applied for membership.

2.4 The ICC-ES Board of Managers, using simple majority vote, shall ratify the nominations of the president.

2.5 Committee membership is for one year, coinciding with the calendar year. Members may be renominated and reappointed, but no person shall serve for more than five consecutive terms.

2.6 In the event that a member is unable to attend a committee meeting or complete a term on the committee, the ICC-ES president may appoint a replacement to fill in at the meeting or for the remainder of the member's term. Any replacement appointed for only one meeting must have prior experience as a member of the Evaluation Committee. Appointments under this section (Section 2.6) are subject to ratification as noted in Section 2.4.

3.0 MEETINGS

3.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1.0, subject to Section 3.0.

3.2 All scheduled meetings shall be publicly announced. There shall be three meetings per year.

3.3 More than half of the Evaluation Committee members, counting the chairman, shall constitute a quorum. A majority vote of members present is required on any action. To avoid any tie vote, the chairman may choose to exercise or not exercise, as necessary, his or her right to vote.

3.4 In the absence of the chairman–moderator, Evaluation Committee members present shall elect an alternate chairman from the committee for that meeting. The alternate chairman shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

3.5 Minutes shall be kept and shall be the official record of each meeting.

3.6 An electronic record of meetings may be made by ICC-ES if deemed necessary; no other audio, video, electronic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before the presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy.

3.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items must be delivered to ICC-ES and shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting. Such materials will be posted on the ICC-ES web site (www.icc-es.org) prior to the meeting. Comments and submissions not meeting the following deadlines will not be considered at the meeting:

- Initial comments on agenda items shall be submitted at least 28 days before the scheduled meeting.
- A rebuttal comment period shall follow, whereby rebuttal comments to the initial comments may be submitted by the proponent at least 21 days before the scheduled meeting.
- Those planning on giving a visual presentation at the meeting must submit their presentation, in PowerPoint format only, at least 10 days before the scheduled meeting.

The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section.

4.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that at the discretion of the chairman, staff counsel may be necessary. Also, matters related to clients or potential clients covered by confidentiality requirements of ICC-ES Rules of Procedure for Evaluation Reports are discussed only during closed meetings.

5.0 ACCEPTANCE CRITERIA

5.1 Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, or method of construction. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the ICC-ES President.

EXCEPTIONS: The following acceptance criteria are controlled by the ICC-ES executive staff and are not subject to committee approval:

- The Acceptance Criteria for Quality Documentation (AC10)
- The Acceptance Criteria for Test Reports (AC85)
- The Acceptance Criteria for Inspections and Inspection Agencies (AC304)

5.2 Procedure:

5.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 4.0 of these rules.

5.2.2 Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

5.2.3 The committee shall be informed of all pertinent written communications received by ICC-ES.

5.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members. In the interest of fairness, each person requesting to testify on a proposed acceptance criteria or proposed changes to an existing acceptance criteria will be given the same amount of time. The following time limits are established:

- a. For entities offering their first testimony on any item, a 10-minute limit applies. This time limit applies to both verbal testimony and/or visual presentations.
- b. Each person offering testimony may return to the microphone for one five-minute period to offer additional testimony and/or to rebut testimony given by others.
- c. Each person offering testimony on the staff recommendation, on each criteria, is allowed one, two-minute trip to the microphone.

Time limits do not include time needed to answer questions from the staff and/or committee members. The chairman–moderator shall have limited authority to modify time limitations on testimony. The chairman–moderator shall also have the authority to adjust time limits as necessary in order to get through the hearing agenda.

Keeping of time for testimony by an individual will be by an automatic timing device. The time remaining shall be evident to the person testifying. Interruptions during testimony will not be tolerated. It is the responsibility of the chairman–moderator to maintain decorum and order during all testimony.

5.3 Approval of any action on an acceptance criteria shall be as specified in Section 3.3 of these rules. Possible actions made by the Evaluation Committee include: Approval; Approval with Revisions; Disapproval; or Further Study. The Evaluation Committee must give the reason(s)

for any Disapproval or Further Study actions with specific recommendations.

5.4 Actions of the Evaluation Committee may be appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria or the ICC-ES Rules of Procedure for Appeals of Evaluation Committee Technical Decisions.

6.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

6.1 Acceptance criteria may be revised without a public hearing following a 30-day public comment period and a majority vote for approval by the Evaluation Committee, when at the discretion of the ICC-ES executive staff, the subject is a revision that requires formal action by the Evaluation Committee.

6.2 Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

- a. *Lack of clarity:* There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)
- b. *Insufficiency:* The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)
- c. *The subject of the acceptance criteria is not within the scope of the applicable codes:* A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)
- d. *The subject of the acceptance criteria needs to be discussed in public hearings.* The committee member requests additional input from other committee members, staff or industry.

6.3 An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

7.0 COMMITTEE COMMUNICATION

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report, shall take place only in a public hearing of the Evaluation Committee. Accordingly:

7.1 Committee members receiving an electronic ballot should respond only to the sender (ICC-ES staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to

ICC EVALUATION SERVICE, LLC, RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

7.2 Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-

ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members.■

Revised August 2020

PROPOSED ACCEPTANCE CRITERIA FOR CO₂ CONCRETE-BASED CONCRETE MASONRY UNITS

AC520

Proposed August 2020

PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes. (Some reports may also reference older code families such as the BOCA National Codes, the Standard Codes, and the Uniform 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.

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

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

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PROPOSED ACCEPTANCE CRITERIA FOR CO₂CONCRETE-BASED CONCRETE MASONRY UNITS

1 1.0 INTRODUCTION

2 **1.1 Purpose:** The purpose of this acceptance criteria is to establish requirements for
3 issuance of ICC Evaluation Service, LLC (ICC-ES) evaluation reports on CO₂Concrete-
4 Based Concrete Masonry Units under the 2018 *International Building Code*[®] (IBC) and
5 the 2018 *International Residential Code*[®] (IRC). The bases of this acceptance criteria and
6 resulting evaluation reports are IBC Section 104.11 and IRC Section R104.11.

7 The reason for the development of this criteria is to provide guidelines for qualifying
8 use of concrete masonry units (CMU) produced using alternative materials and curing
9 methods in masonry construction, since the IBC and IRC do not describe the use of such
10 concrete masonry units in masonry construction.

11 **1.2 Scope:** The CO₂Concrete-Based Concrete Masonry Units described in this
12 criteria are alternative to load-bearing or non-load-bearing concrete masonry units in
13 compliance with ASTM C90 and ASTM C129, respectively, under the 2018 IBC Section
14 2103.1 (Article 2.3 of TMS 602), and 2018 IRC Section R606.2.1. This criteria is
15 applicable to hollow/solid normal weight, medium weight, and lightweight concrete blocks
16 that are made from proprietary CO₂Concrete mixture formulations and material
17 components.

18 1.3 Codes and Referenced Standards:

19 **1.3.1** 2018 *International Building Code*[®] (IBC), International Code Council.

20 **1.3.2** 2018 *International Residential Code*[®] (IRC), International Code Council.

21 **1.3.3** TMS 402-16, Building Code Requirements for Masonry Structures,
22 American Concrete Institute.

23 **1.3.4** TMS 602-16, Specification for Masonry Structures, American Concrete
24 Institute.

25 **1.3.5** ASTM C90-14, Specification for Loadbearing Concrete Masonry Units,
26 ASTM International.

27 **1.3.6** ASTM C129-14a, Specification for Nonloadbearing Concrete Masonry
28 Units, ASTM International.

29 **1.3.7** ASTM C 140-15, Standard Test Methods for Sampling and Testing
30 Concrete Masonry Units and Related Units. ASTM International.

31 **1.3.8** ASTM C150/C150M-19a, Standard Specification for Portland Cement.
32 ASTM International.

33 **1.3.9** ASTM C270-14a, Standard Specification for Mortar for Unit Masonry, ASTM
34 International.

35 **1.3.10** ASTM C 426-16, Standard Test Method for Linear Drying Shrinkage of
36 Concrete Masonry Units, ASTM International.

37 **1.3.11** ASTM C494-19, Standard Specification for Chemical Admixtures for
38 Concrete, ASTM International.

39 **1.3.12** ASTM C1262-18, Standard Test Method for Evaluating the Freeze-Thaw
40 Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units,
41 ASTM International.

42 **1.3.13** ASTM C1314-18, Standard Test Method for Compressive Strength of
43 Masonry Prisms, ASTM International.

44 **1.3.14** ASTM E84-16, Standard Test Method for Surface Burning Characteristics
45 of Building Materials, ASTM International.

46 **1.3.15** ASTM E111-17, Standard Test Method for Young's Modulus, Tangent
47 Modulus, and Chord Modulus, ASTM International.

48 **1.3.16** ASTM E119-16, Standard Test Methods for Fire Tests of Building
49 Construction and Materials, ASTM International.

50 **1.3.17** ASTM E178-16a. Standard Practice for Dealing with Outlying Observations.
51 ASTM International.

52 **1.3.18** ASTM E518-15, Standard Test Methods for Flexural Bond Strength of
53 Masonry. ASTM International.

54 **1.3.19** UL263-11, Standard for Fire Tests of Building Construction and Materials,
55 Underwriters Laboratories, Inc.

56 **1.3.20** UL723-08, Standard for Test for Surface Burning Characteristics of Building
57 Materials, Underwriters Laboratories, Inc.

58 **1.4 Definitions:**

59 **1.4.1 CO₂Concrete technology:** The CO₂Concrete technology utilizes dilute
60 CO₂ streams in construction components using a proprietary CO₂Concrete formulation
61 (see Section 1.4.1.1). This technology allows for flexible and adaptable CO₂ uptake (see
62 Section 1.4.1.2) and is designed for stack-tap integration into diverse flue gas streams
63 including those associated with power generation, cement and steel production, and the

64 petrochemical industries, amongst many others. Importantly, this technology requires no
65 pre- or post-treatment (e.g., carbon capture, clean-up, etc.) of the flue gas, and
66 processing conditions can be applied at ambient pressure/temperature.

67 **1.4.1.1 CO₂Concrete Formulation:** The CO₂Concrete formulation contains
68 diverse ingredients that make-up the formulation. The formulation may be composed of
69 a ternary binder system consisting of hydrated lime (Ca(OH)₂, also known as portlandite),
70 fly ash, cement in compliance with ASTM C150 or ASTM C595 or ASTM C1157, tap water
71 and mineral aggregates. The CO₂Concrete formulation may also contain other
72 constituents such as chemical admixtures, lightweight aggregates, bottom ash, and
73 alternative fly ash types. The CO₂Concrete mixture formulation partially replaces cement
74 with other supplementary cementitious materials to contribute for CO₂ avoidance (see
75 Section 1.4.1.3).

76 **1.4.1.2 CO₂ uptake:** The CO₂ uptake associated with the “carbonation”
77 reaction that involves the formation of calcium carbonate (CaCO₃) as a reaction product
78 typically expressed as the mass of CO₂ uptake per unit mass of reactants or total solids
79 in mixture formulation. CO₂ uptake contributes towards reducing the (net) embodied
80 carbon intensity of a material (See Section 1.4.1.4). The CO₂Concrete CMUs feature a
81 total CO₂ uptake and extent of portlandite conversion (i.e., carbonation) more than 2
82 percent g_{CO₂}/g_{solid} and 50 (mass) percent, respectively, following carbonation processing.

83 **1.4.1.3 CO₂ avoidance:** The CO₂ avoidance is CO₂ reduction that is
84 associated with the use of material constituents that have a lower CO₂ intensity than

85 cement. CO₂ avoidance contributes towards reducing the (net) embodied carbon
86 intensity of a material.

87 **1.4.1.4 Embodied CO₂ intensity:** The amount of CO₂ that is emitted in the
88 production of a material typically expressed as the mass of CO₂ emitted per unit mass
89 of material produced. The embodied carbon intensity of CO₂Concrete CMUs must be at
90 least 40 percent lower than the traditional ASTM C90 complaint CMUs.

91 **2.0 BASIC INFORMATION**

92 **2.1 General:** The following information shall be submitted:

93 **2.1.1 Product Description:** Masonry units shall be described using a
94 generic or trade name, and manufacturer's catalog number (if available).

95 **2.1.2 Installation Instructions:** Manufacturer's published instructions for
96 installation and application shall be submitted.

97 **2.1.3 Packaging and Identification:** A description of the method of
98 packaging and field identification of the CO₂Concrete-Based Concrete Masonry Units
99 shall be submitted. Product identification shall comply with the product identification
100 provisions of the ICC-ES Rules of Procedure for Evaluation Reports.

101 **2.2 Testing Laboratories:** Testing laboratories shall comply with Section 2.0 of
102 the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES
103 Rules of Procedure for Evaluation Reports.

104 **2.3 Test Reports:** Test reports shall comply with AC85.

105 **2.4 Product Sampling:** Sampling of the CO₂Concrete-Based Concrete Masonry
106 Units for tests under this criteria shall comply with Section 3.1 and 3.3 of AC85.

107 **2.5 Qualification Test Plan:** A qualification test plan shall be submitted to and
108 approved by ICC-ES staff prior to any testing being conducted.

109 **3.0 TEST AND PERFORMANCE REQUIREMENTS**

110 **3.1 Material Tests:** Test shall be performed in accordance with Sections 4.1 and
111 4.2, Section 4.4 and Section 4.6 of this criteria and comply with conditions of acceptance
112 outlined in each section. Testing shall be performed for each CO₂Concrete formulation.

113 **3.2 Durability Tests:** Tests shall be performed in accordance with Sections 4.3
114 and 4.5 of this criteria and comply with conditions of acceptance outlined in each section.
115 Testing shall be performed for each CO₂Concrete formulation.

116 **3.3 Noncombustibility Tests (Optional):** Noncombustibility testing shall be
117 conducted on CO₂Concrete material for each formulation in accordance with ASTM E136
118 (mix/prism test) for evaluation for installation on exterior walls in buildings of Type I, II, III
119 and IV construction in accordance with IBC Section 703.5.1.

120 **3.4 Fire-Resistance-Rated Wall Tests (Optional):** For use as a fire resistance-
121 rated wall assembly, a specimen of CO₂Concrete masonry block assembly shall be
122 tested for each formulation in accordance with ASTM E119 or UL 263. As an alternative
123 to fire testing, a fire analysis can be submitted demonstrating that the CO₂Concrete
124 masonry blocks can be added to fire-resistance-rated assembly(s) described in IBC
125 Section 721. The analysis shall consider the provisions in IBC Section 721. Unless the
126 walls constructed using CO₂Concrete masonry unit blocks are qualified by fire-resistance
127 testing, or analyses under IBC Section 721, the scope of the evaluation report shall be
128 limited to use in non-fire-resistance-rated construction.

129 **3.5 Thermal Resistance Tests (Optional):** Thermal resistance testing of the
130 CO₂Concrete masonry blocks shall be conducted for each formulation in accordance
131 with ASTM C518 on 1 inch (25.4 mm) thick panel samples to establish an R-value per
132 inch to be reported in the evaluation report.

133 **4.0 TEST METHODS**

134 **4.1 Dimensional Accuracy:** Technical evidence for dimensional accuracy of
135 CO₂Concrete blocks shall be submitted. Dimensions and variations shall conform to
136 Table 1 of ASTM C90 and/or Section 7 of ASTM C129 for load-bearing or non-load-
137 bearing concrete masonry units, respectively. Tests shall be performed on a minimum of
138 three replicate specimens. The maximum allowable variation for all dimensions (width,
139 height, length, and thickness) shall be less than $\pm\frac{1}{8}$ in. (3.2 mm) from the specified
140 standard dimension.

141 **4.2 Compressive Strength:**

142 **4.2.1 Procedure:** The compressive strength of CO₂Concrete blocks shall
143 be tested following 28 days of curing in accordance with ASTM C140. Specimens shall
144 be stored and cured in accordance with ASTM C140 prior to testing. Tests shall be
145 performed on a minimum of three replicate specimens for each formulation.

146 **4.2.2 Conditions of Acceptance:** Minimum net area compressive
147 strength shall conform to Table 2 of ASTM C90 and/or Table 2 of ASTM C129 for load-
148 bearing or non-load-bearing concrete masonry units, respectively.

149 **4.3 Water Absorption:**

150 **4.3.1 Procedure:** The water absorption of CO₂Concrete blocks shall be
151 tested following 28 days of curing in accordance with ASTM C140. Specimens shall be
152 stored and cured in accordance with ASTM C140 prior to testing. Tests shall be
153 performed on a minimum of three replicate specimens for each formulation.

154 **4.3.2 Conditions of Acceptance:** The maximum water absorption shall
155 conform to Table 2 of ASTM C90 for load-bearing concrete masonry units.

156 **4.4 Linear Drying Shrinkage:**

157 **4.4.1 Procedure:** The purpose of this test is to evaluate the shrinkage
158 behavior of CO₂Concrete blocks. Total linear drying shrinkage shall be determined in
159 accordance with ASTM C426. Tests shall be performed on a minimum of three replicate
160 specimens for each formulation.

161 **4.4.2 Conditions of Acceptance:** The average linear drying shrinkage
162 measurements of all tests at 28-days shall be less than 0.065 percent.

163 **4.4.3 Freeze-thaw Durability:**

164 **4.4.4 Procedure:** The purpose of this test is to evaluate the freeze-thaw
165 durability of the CO₂Concrete formulation used for concrete masonry unit production.
166 Tests shall be performed in accordance with ASTM C1262 and weight loss shall be
167 determined. Tests shall be performed on a minimum of five replicate specimens for each
168 CO₂Concrete formulation. Number of cycles shall comply with Section 4.4.5 of this
169 criteria.

170 **4.4.5 Conditions of Acceptance:** Each of the five test specimens at the
171 conclusion of 20 cycles shall not exceed 1 percent of its initial weight. If this condition at

172 the end of 20 cycles is not met, then the weight loss of each of four of the five test
173 specimens at the conclusion of 30 cycles shall not exceed 1.5 percent of its initial weight.

174 **Exception:** In areas where repeated freezing and thawing under saturated
175 conditions do not occur, evidence of compliance with freeze-thaw durability requirements
176 in Section 4.4.5 is not required.

177 **4.5 Flexural Bond Strength:**

178 **4.5.1 Procedure:** The purpose of this test is to demonstrate that the bond
179 strength of CO₂Concrete blocks offers similar performance as compared to the reference
180 (control) ASTM C90 blocks. Each CO₂Concrete formulation shall be tested. Blocks shall
181 be assembled in stack bond pattern. The number of blocks used in test beams shall be
182 sufficient to comply with Method A loading conditions of ASTM E518. Control blocks shall
183 be in compliance with ASTM C90, and control block beams shall have the same
184 dimensions as CO₂Concrete block beams. Type M mortar shall be in compliance with
185 ASTM C270 and shall be used to bind the blocks into a beam.

186 **4.5.2** The flexural bond strength shall be tested in accordance with ASTM
187 E518. The value of the flexural bond strength shall be calculated using the section
188 modulus, assuming a fully bedded block area. A total of three replicate beams shall be
189 tested for each formulation.

190 **4.5.3 Conditions of Acceptance:** The average flexural bond strength of
191 the CO₂Concrete block determined in accordance with ASTM E518 shall be statistically
192 equal to the values obtained for control CMU blocks. Outliers shall be subject to further

193 evaluation in accordance with ASTM E178. Also, both CO₂Concrete block beams and
194 control beams shall display predominantly the same failure modes (limit states).

195 **4.6 Masonry Modulus of Elasticity**

196 **4.6.1** The purpose of this test is to demonstrate that the CO₂Concrete
197 blocks have equal or better modulus of elasticity value as compared to TMS 402
198 specified modulus of elasticity values (Chapter 21 of IBC).

199 **4.6.2** Determination of modulus of elasticity tests shall be conducted on
200 concrete masonry prism in accordance with ASTM C1314, and modulus of elasticity shall
201 be calculated in accordance with ASTM E111. A minimum of two replicate specimens
202 shall be tested for each formulation.

203 **4.6.3 Conditions of Acceptance:** The modulus of elasticity of each
204 specimen shall be at least equal to $E_m = 900 * f'_m$, as specified by TMS 402. The value of
205 f'_m shall be taken from Section 4.2 of this criteria.

206 **5.0 QUALITY CONTROL**

207 **5.1** The products shall be manufactured under an approved quality control
208 program with inspections by ICC-ES or by a properly accredited inspection agency that
209 has a contractual relationship with ICC-ES.

210 **5.2** Quality documentation complying with the ICC-ES Acceptance Criteria for
211 Quality Documentation (AC10) shall be submitted. A qualifying inspection shall be
212 conducted at each manufacturing facility when required by the ICC-ES Acceptance
213 Criteria for Inspections and Inspection Agencies (AC304). Ongoing follow-up

214 inspections, by ICC-ES or by a properly accredited inspection agency that has a
215 contractual relationship with ICC-ES, are required under this acceptance criteria.

216 **6.0 EVALUATION REPORT RECOGNITION**

217 The evaluation report shall include the following:

218 **6.1** General information required by Section 2.1.

219 **6.2** A statement that the CO₂Concrete blocks can be used in lieu of ASTM C90
220 load-bearing and/or ASTM C129 non-load-bearing concrete masonry units when
221 masonry structures are designed in accordance with the provisions of TMS 402 (as
222 referenced by Chapter 21 of IBC), or in accordance with IRC Section R606.2.1.

223 **6.3** A statement stating that design and details of the masonry construction using
224 CO₂Concrete blocks must comply with the provisions of TMS 402 (as referenced by
225 Chapter 21 of IBC) and this evaluation report. Design and details must be done by a
226 registered design professional and be submitted to and approved by the code official
227 having jurisdiction.

228 **6.4** Unless evidence in accordance with Section 3.4 of this acceptance criteria is
229 provided, a statement that limits the use to masonry construction for non-fire-resistance-
230 rated construction.

231 **6.5** A statement that special inspection shall be provided for installations under
232 the IBC and IRC conforming to IBC Sections 1705.1.1 and 1705.4.

233 **6.6** The evaluation report shall specify the construction types for which the
234 CO₂Concrete blocks have been evaluated.

235 **6.7** If exception under Section 4.4.5 of this criteria is used by the evaluation report
236 applicant, the evaluation report shall include the following Condition of Use: “Use of
237 CO₂Concrete blocks in masonry construction are limited to areas where the average
238 rainfall does not exceed 20 inches (508 mm) annually and the average daily low
239 temperature exceeds 30°F (-1.1°C).”

240 **6.8** Unless evidence in accordance with Section 3.3 of this acceptance criteria is
241 provided, a statement that limits the use of masonry construction for Type V construction
242 only.■