



ICC-ES Evaluation Report

ESR-4126

Reissued March 2023

This report is subject to renewal March 2024.

DIVISION: 04 00 00—MASONRY
Section: 04 24 13—Site-cast Adobe Unit Masonry

REPORT HOLDER:

CALEARTH

EVALUATION SUBJECT:

SUPERADOBE CEMENT STABILIZED EARTH BAGS

1.0 EVALUATION SCOPE

Compliance with the following code:

2018 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Durability

2.0 USES

CalEarth SuperAdobe Cement Stabilized Earthbags are used as an alternative to adobe masonry for the construction of single-story residential structures under the IRC.

3.0 DESCRIPTION

3.1 General:

SuperAdobe Cement Stabilized Earthbags consist of woven polypropylene bags that are filled at the project site with a cement stabilized soil mixture, then closed, compacted and stacked with steel barbed wire reinforcement placed between the courses of the earthbags to form domes, buttress walls and vaults.

3.2 Material:

3.2.1 Earthbags: Continuous tubular or individual woven polypropylene bags conforming with the manufacturer's specifications with a minimum breaking strength of 605 lbf/ft (8.83 N/mm) in the longitudinal direction and a minimum breaking strength of 585 lbf/ft (8.54 N/mm) in the transverse direction.

3.2.2 Soil: Project site specific soil classified in accordance with ASTM D2487-17.

3.2.3 Cement: Portland cement complying with ASTM C150-15.

3.2.4 Steel barbed wire: Steel barbed wire complying with ASTM A121-13 (2017) with 12¹/₂ gage (0.099 in. [2.51 mm]) diameter, minimum breaking strength of 950 lbf (4.23 kN) and minimum Class 1 zinc coating of 0.28 oz/ft² (g/m²).

4.0 DESIGN AND INSTALLATION

4.1 Design:

Design of single-story residential structures with CalEarth SuperAdobe Cement Stabilized Earthbags shall be performed by a registered design professional. Allowable earthbag-to-earthbag shear strength developed by the steel barbed wire placed between the earthbag courses is provided in Table 1.

4.2 Installation:

Cement stabilized soil mixing, placement in earthbags, closing of earthbags, compaction, and stacking with steel barbed wire reinforcement placed between the earthbag courses must follow CalEarth published installation instructions and the project site construction documents.

5.0 CONDITIONS OF USE

The CalEarth SuperAdobe Cement Stabilized Earthbags described in this report comply with, or are a suitable alternative to what is specified in, the code listed in Section 1.0 of this report, subject to the following conditions:

5.1 Use of cement stabilized earthbags is limited to construction of single-story residential masonry structures designed under the IRC by a registered design professional in accordance with IRC Section R301.1.3.

5.2 The cement stabilized earthbags must be empirically designed as an alternative to empirically designed adobe masonry addressed in Section 2109 of the IBC. The design of the structure must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Use of empirical design of cement stabilized earthbags as an alternative to empirically designed adobe masonry is limited in accordance with TMS 402-2016 Section A.1.2 and Section 2109.1.1 of the IBC.

- 5.4 A site-specific soils investigation report is required in accordance with Section R401.4 of the IRC and Section 1803 of the IBC. Site-specific soils used for cement stabilized earthbags must be classified in accordance with ASTM D2487-17. A mix design using the CalEarth compaction methods, cured under expected site conditions, site specific soil, cement and water must be prepared by an approved testing laboratory and submitted to the code official. The mix design with site-specific soil must meet the requirements of Table 2 of this report.
- 5.5 For each project site, a mock-up will be constructed at an approved testing laboratory or on-site according to the CalEarth installation instructions under expected site conditions. The mock-up must consist of two stacked courses of cement stabilized earthbags measuring 5 feet (1524 mm) in length. After 28 days of cement curing, the earthbag material must be removed to expose the stabilized soil material. The cement stabilized soil mock-up surfaces must be inspected for any evidence of shrinkage cracking in accordance with Section 2109.2.1.4 of the IBC.
- 5.6 The allowable compressive stress based on the gross cross-sectional area of the cement stabilized earthbags must not exceed 30 psi (207 kPa) in accordance with Section 2109.2.3 of the IBC.
- 5.7 Structures with cement stabilized earthbag walls must be laterally braced in accordance with code-prescribed methods to the satisfaction of the code official.
- 5.8 Cement stabilized earthbags must be stacked in running bond with steel barbed wire reinforcement placed between each course.

- 5.9 Documentation must be submitted to the code official indicating that the steel barbed wire complies with the steel barbed wire specification.
- 5.10 Interior finish and roof coverings for use with the cement stabilized earthbags used as an alternative to adobe masonry have not been evaluated.
- 5.11 Exterior finishes must comply with Section 2109.2.4.8 of the IBC.
- 5.12 Single-story residential structures constructed with cement stabilized earthbags must comply with the detailed requirements of Section 2109.2.4 of the IBC.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cement Stabilized Earthbags as an Alternative to Adobe Masonry (AC506), Approved February 2019.

7.0 IDENTIFICATION

- 7.1 Product labeling shall include, the name of the report holder or listee, and the ICC-ES mark of conformity. The listing or evaluation report number (ICC-ES ESR-4126) may be used in lieu of the mark of conformity. CalEarth SuperAdobe earthbags are labeled with the company name, address, product name and ESR-4126.
- 7.2 The report holder’s contact information is the following:

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MISSION VIEJO, CALIFORNIA 92690
(760) 956-7533
www.calearth.org



FIGURE 1—CALEARTH SUPERADOBE EARTHBag WITH BARBED WIRE PLACED AT STACK INTERFACE OF COURSES

TABLE 1—ALLOWABLE SHEAR STRENGTH OF EARTHbags WITH BARBED WIRE PLACED AT STACK INTERFACE OF COURSES

Normal / Vertical Load (psf)	Allowable Lateral Shear Strength (psf)
Min. 510	530
860	565
≥1110	665

For SI: 1 psf = 4.88 kg/m²

- 1. Normal / vertical load is the weight of earthbags above.
- 2. Allowable lateral shear strength vs. sliding with a safety factor of 1.5 corresponding to the normal / vertical downward load above.

TABLE 2—CEMENT STABILIZED SOIL MIX DESIGN REQUIREMENTS

Performance Characteristic	2018 IBC	ASTM Standard	Conditions of Acceptance
Compressive Strength	Section 2109.2.1.1	ASTM C67 Section 7; Modified for a cement stabilized soil sample	Average compressive strength of 300 psi (2068 kPa) with none less than 250 psi (1724 kPa)
Modulus of Rupture (MOR) ¹	Section 2109.2.1.2	ASTM C67 Section 6	Average MOR of 50 psi (345 kPa) with none less than 35 psi (241 kPa)
Moisture Content	Section 2109.2.1.3	ASTM D2216	Less than or equal to 4%
Absorption	Section 2109.2.2.2	ASTM C67 Section 8 or equivalent	Less than or equal to 2-1/2% when placed on a constantly water saturated porous surface for 7 days ²
Shrinkage Cracking, Freezing and Thawing	Section 2109.2.1.4	ASTM C67 Section 9 and 9.4.3.1	No breakage or separation of test specimens and no more than 3 shrinkage cracks per linear foot and any shrinkage cracks shall not exceed 3 in. (76 mm) in length or 1/8 in. (3.2 mm) in width

1. An ASTM C67 tested soil-cement mixture consisting of poorly graded sand (SP) with approximately 10 percent by dry weight of soil provides an average modulus of rupture of 107 psi (738 kPa).
2. If absorption exceeds 2 1/2 percent for the site-specific mix design and all other requirements of Table 2 are satisfied, the SuperAdobe Cement Stabilized Earthbags may be used as an alternative to unstabilized adobe masonry in accordance with Section 2109.2.1 of the IBC when documentation demonstrating compliance with the foundation requirements in accordance with IBC Section 2109.2.4.5.2 is submitted to the code official for approval.

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the CalEarth SuperAdobe Cement Stabilized Earthbags described in ICC-ES evaluation report ESR-4126, have also been evaluated for compliance with the code noted below.

Applicable code edition:

2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

The CalEarth SuperAdobe Cement Stabilized Earthbags, described in Sections 2.0 through 7.0 of the ICC-ES evaluation report ESR-4126, comply with CBC Chapter 21, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) and 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report and the additional requirements of the CRC Chapters 16 and 17, as applicable.

2.1 OSHPD: The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

2.2 DSA: The applicable DSA Sections of the CBC are beyond the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued March 2023.