

**Standard for Compressed Stabilized Earth blocks:  
AS-1:2007**

**March, 2007**

**Standard for Compressed Stabilized Earth blocks:****AS-1:2007****1. General**

In creation of this document, numerous standards have been consulted and referred to from leading national institutions focused on compressed earth block technology. These include: GTZ in Germany; a series of institutions in India, including the Aureville Earth Institute; the Uniform Building Code in the United States and the various modified renditions of Colorado, New Mexico, Arizona and California; and, Australia. Amongst these standards there is a common theme amongst them that outlines specific minimum values for various stabilized soil block performance criteria. In particular, the standard created through a joint effort between the Center for the Development of Industry (CDI), Belgium and CRATerre, France entitled ‘Compressed Earth Blocks’ has been a valuable reference and has formed the basis for the following outlined standard.

**1.1 Object**

The aim of the present standard is to define compressed stabilized earth blocks (CSEB’s), to classify them according to their appearance, their conditions of use, and to determine the categories into which they fall as well as their designation.

**1.2 Field of application**

The standard applies exclusively to CSEB’s stabilized with AnyWay’s Soil Block™ that are intended for the realization of simple built structures in common masonry with mortar joints and of a similar built structure.

The standard does not apply to CSEB’s used for flooring or tiling, nor to CSEB’s designed to be assembled dry, interlocking, using glue, or used in reinforced masonry.

**1.3 Definitions**

To designate the specific product which is the object of this standard, the term “compressed stabilized earth blocks” (CSEB’s) has been adopted. It should be noted, however, that the literature abounds with other designations, all referring to the same product: stabilized soil blocks (SSB’s), pressed soil bricks/blocks, etc.

Compressed stabilized earth blocks are masonry elements, which are small in size, which have regular and verified characteristics obtained by the static or dynamic compression of earth in a humid state followed by immediate de-moulding.

Compressed stabilized earth blocks generally have a rectangular format and are full or perforated with vertical and/or horizontal indentations.

Compressed stabilized earth blocks are principally made from earth and owe their cohesion in a humid or dry state to the interaction of AnyWay's Soil Block™ with the various soil fractions, principally clay.

The final characteristics of the CSEB's depend on the quality of the raw material (natural soil) used and on the quality of the execution of the various manufacturing stages (preparation, mixing, compression, curing).

## **2. Classification depending on field of use**

### **2.1 Mechanical constraints**

Mechanical constraints are defined according to three (3) categories of resistance:

- Category 1: Structural elements which are not load-bearing and structural elements capable of withstanding limited external loads. Example: boundary wall; single storey building.
- Category 2: Structural elements capable of withstanding important external loads. Example: a two-storey building.
- Category 3: Structural elements capable of withstanding high external loads. Example: a three storey building.

### **2.2 Environmental constraints**

These are defined according to four (4) categories of environment

- Category DR: Structural elements located in a dry environment with no danger of being wet. Example: internal partitions; external walls which are not exposed or which are protected from water damage.
- Category WL: Structural elements capable of withstanding water damage by lateral spraying. Example: lateral walls exposed to rain; bathroom walls being splashed.
- Category Wv: Structural elements capable of withstanding water damage by vertical penetration (capillary rise, suction, penetration by gravity). Example: external walls unprotected from capillary rise; external walls unprotected from water leaking through the roof).

Category A: Structural elements capable of withstanding mechanical abrasion (impact, rubbing or wind). Example: corner or walls subject to impact; areas subject to sandstorms).

### **3. Specifications**

#### **3.1 Textural characteristics**

The soil should not contain any particle with a diameter greater than 10 mm.

#### **3.2 Geometric characteristics**

##### ***3.2.1 Surface smoothness***

The sweep, defined as the topographic features of a surface, must not exceed 2 mm for the sides and 3 mm for the compression surfaces.

##### ***3.2.2 Edge smoothness***

The sweep must not exceed 3 mm. Some roughness on the edges can be tolerated, whether it is due to de-moulding or caused by mishandling.

#### **3.3. Appearance characteristics**

##### ***3.3.1 Damage***

A distinction is made between mechanical damage caused by impact when handling CSEB's and cracks or other defects which result from an imperfect production process.

For mechanical damage, the following rule is to be respected: damage which has no effect on the appearance of the masonry (such as chips on the side of the CSEB which is visible) will not be taken into account.

The following are regarded as damaged:

- Any broken CSEB
- Any CSEB displaying chipped edges or corners, the volume of which exceed 5% of the volume of the block.

##### ***3.3.2 General appearance***

The CSEB should display no systematic affects such as cracks and significant ships of a kind likely to jeopardize correct execution and the stability of the masonry.

### ***3.3.3 Holes, punctures and scratches***

For exposed faces, these must affect no more than 20% of the surface and not exceed 5 mm in depth.

### ***3.3.4 Roughness***

The exposed faces can have a grainy or rough appearance.

### ***3.3.5 Chipped corners***

Chipped corners and edges which do not extend over more than 10 mm and which do not exceed 10 mm in depth are tolerated on all surfaces.

### ***3.3.6 Flaking, splitting***

These are tolerated provided mechanical performance is not affected.

### ***3.3.7 Cracks, crazing and fissures***

a) micro cracks: are tolerated on all faces

b) macro cracks: conditions of acceptability for all faces:

- They must not exceed 1 mm in width
- They must not exceed 40 mm in length
- They must not exceed 10 mm in depth
- They must not exceed 3 in number on any one surface

## **3.4 Physico-chemical characteristics**

### ***3.4.1 Efflorescence***

Compressed stabilized earth blocks must not display any significant and lasting efflorescence covering more than 1/3 of the total surface of the block. A thin whitish film or a thin band are not taken into account.

### ***3.4.2 Mechanical and physical characteristics***

Mechanical and physical characteristics are determined by the values shown in the Table AW-1.

## **4.0 Methods of testing**

Each of the tests prescribed in this section shall be applied to sample units selected at random of five (5) units per 500 blocks prior to construction.

## 4.1 Dry compressive strength

The units shall be tested according to the following procedure:

- The compressed earth block shall be tested in the position in which the earthen masonry unit is designed to be used. and bed on and cap with a felt pad not less than 3.2 mm or more than 6.4 mm in thickness. The surfaces must be smooth.
- The specimens may be suitably capped with calcined gypsum mortar or the bearing surfaces of the tile may be planed or rubbed smooth and true. When calcined gypsum is used for capping, conduct the test after the capping has set. A true platen should be used in the testing machine, along with swivel head to accommodate nonparallel bearing surfaces.
- The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 1.27 mm per minute.
- Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. The compressive strength is defined as  $P/A$ , where  $P$ =load and  $A$ =area of compression surface.

## 4.2 Wet compressive strength

The units for wet compressive strength shall follow the procedure outlined in section 4.1, with the addition of a 24 hour soaking period prior to loading.

**Table AW-1:** Mechanical and physical characteristics required for CSEB's

Code	Environmental category	Mechanical category	Dry compressive strength (MPa) <sup>a</sup>	Wet compressive strength (MPa)	Water absorption (%)
CSEB 1 D	Dry environment (D)	1	≥ 2	N/A	N/A
CSEB 2 D		2	≥ 4	N/A	N/A
CSEB 3 D		3	≥ 6	N/A	N/A
CSEB 1 W <sub>L</sub>	Effect of water, lateral (W <sub>L</sub> )	1	≥ 2	≥ 1	N/A
CSEB 2 W <sub>L</sub>		2	≥ 4	≥ 2	N/A
CSEB 3 W <sub>L</sub>		3	≥ 6	≥ 3	N/A
CSEB 1 W <sub>v</sub>	Effect of water, vertical (W <sub>v</sub> )	1	≥ 2	≥ 1	≤ 15
CSEB 2 W <sub>v</sub>		2	≥ 4	≥ 2	≤ 10
CSEB 3 W <sub>v</sub>		3	≥ 6	≥ 3	≤ 5

<sup>a</sup> = Compressive strength should be tested as outlined in Section 4.0