CATEGORY

BUILDING SYSTEMS

PRODUCT / TECHNOLOGY

COMPRESSED STABILISED EARTH BLOCKS (CSEB)

Alternate of burnt clay bricks / cement concrete blocks for load bearing and non-load bearing walls

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CONTACT DETAILS

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BRIEF

Compressed stabilized earth blocks (CSEB) are manufactured from local soil mixed/ stabilised with small amount of cement (upto 5%), sand and water. Being produced from local soil, it offers a sustainable alternate to burnt clay bricks/cement concrete blocks. These blocks are compressed in a Press (manual or motorised) and cured for 28 days to get desired compressive strength. The Auroville has also developed a special machine “Auram Press 3000” for production of these blocks and offers 70 types of blocks with 18 moulds.

Depending upon application, the blocks can be solid, hollow, round or customized. These blocks can also be used for construction of columns, floors and roofs.

The top soil being fertile is removed and deeper soils are extracted as main raw material for production of these blocks. Depending upon the characteristic of local soil, a design mix comprising of local soil, cement, sand and water is prepared and is cast in moulds through a press to produce blocks of desired strength as per application.

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SALIENT FEATURES

- The dry compressive strength of these blocks after 28 days of curing varies from 5 to 9 MPa whereas wet compressive strength varies from 3 to 4 MPa (after 24 h. immersion)
- The dry bending and shear strength after 28 days curing varies from 0.5 to 1 MPa and 0.4 to 0.6 MPa respectively.
- The water absorption is 8 to 12% after 24 h. immersion whereas the bulk density of these blocks varies from 1800 to 2000 kg/m^3.
- The quality of blocks is greatly influenced by the soil quality, compression force, curing and percentage of stabilizer and quality of manufacturing.
- These blocks offer sustainable solution for wall construction replacing burnt clay bricks and cement concrete blocks.
- The blocks can be manufactured at the site itself leading to cutting down transportation cost saving fossil fuel and generating local employment.
- Green house gas emissions are significantly reduced as these blocks are not fired in kilns as done in the case of burnt clay bricks.
- Being made from local soil, these blocks are resource efficient, cost-effective, climate resilient, energy efficient and eco friendly.
- These blocks are particularly suited for rehabilitation purpose after disaster and have been used worldwide including after Bhuj earthquake of 2001, 2003 Bam earthquake of Iran, 2004 Tsunami relief and rehabilitation at Tamil Nadu.

ECONOMIC ASPECTS

- CSEB are cost effective and help local economy.
- CSEB wall is 16 % cheaper per m^2 of wall as compared to burnt clay bricks
- CSEB wall is 26 % cheaper per m^3 of finished wall as compared to burnt clay bricks
- Much less mortar is required (50 to 60% less)
- Stabilised earth mortar is 30% cheaper than cement sand mortar
- No plaster is required for CSEB walls
- Savings in shuttering and construction time.

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SUSTAINABILITY ASPECTS

- THERMAL LAG - An earth wall of 50 cm thickness has a thermal lag of 12 hours.
- HYDRO-THERMAL BEHAVIOUR
  - As clay is only stabilised and not burnt, it can still absorb and release some moisture through evaporation and condensation. This phenomenon is called “latent heat”:
  - The outside temperature is higher: the wall will evaporate moisture. This will cool down the wall and thus the building inside.
  - The temperature is lower outside: the wall will condense moisture. This will create heat in the wall and thus the building inside.
  - Exposed CSEB walls regulate indoor humidity, helping achieve thermal comfort throughout the year.
  - With proper planning and design, less energy is needed to achieve a comfortable indoor environment.
- Embodied energy per m^3 of raw material - 548.52 MJ/m^3 (~11.2 times less than burnt clay bricks)
- Carbon emission (CO_2) - 49.37 Kg/m^3 (~13 times less than country fired bricks)
- The earthen construction has ~4 times less embodied energy than a conventional building of RCC frame, RCC slab, infill with fired bricks.
- The earthen construction has low emissions for the operation and use (~3 times less than a conventional building).



SUITABILITY & AVAILABILITY

- These blocks can be used in all climates, from temperate to very hot, tropical and mountains climates and can be used in Pan world in all continents.
- Depending upon the design mix, geo-climatic conditions, the blocks can be used for load bearing application for upto 4 floors.
- Sold by Auroville Pan India. CSEB can be produced using Auram press 3000 anywhere in India.
- Not all type of soil can be used for CSEB. It is required to conduct testing of soil before manufacturing Bricks/Blocks.
- Currently being used in 38 countries world wide and 13000+ human resource from 92 countries have been trained by Auroville for earth construction.


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LIMITATIONS, IF ANY

- Not suitable for high rise structures. However, can be used for non-load bearing applications or filler walls.
- In order to have quality production of blocks, the soil need to be tested characterized and design mix need to be prepared.
- Training of masons and artisans are required.

MARKET LINKAGES

- The precast components can be locally cast near construction site.
- It can also be produced by small entrepreneurs and supplied to consumers at State/ Block/ village level

MAJOR PROJECTS

- 2,698 earthquake resistant houses, after the 2001 Bhuj earthquake in Gujarat.
- Auroville Kindergarten, Solar kitchen Prarthna apartments, Tibetan pavilion, etc.
- Primary School at Jantanagar, Nepal - Built in 20 days with the community (Precasting was done in 3 months)
- Al Medy Mosque at Riyadh, 420 m^2, 18.05 m high minaret - Built in 7 weeks with ~ 75 unskilled masons and ~ 150 workers
- Kaza Community Centre, Spiti valley, India – Rammed earth - First prize (Low Carbon Award) from Green Building & City Solutions Awards 2016
- Sharanam at Pondicherry - Double storey lodges

CERTIFICATION/INDIAN STANDARD/ ENDORSEMENT

- IS 1725-2013 Stabilized Soil Blocks for General Building Construction
- GSDMA India, adopted CSEB for the rehabilitation of the regions affected by the January 2001 Gujarat earthquake in Kutch district
- Government of Iran (Housing Foundation) adopted CSEB for the rehabilitation of the regions affected by the December 2003 earthquake in Bam.
- The government of Tamil Nadu (Tsunami Relief and Rehabilitation), India, for the reconstruction of the zones affected by the December 2004 Indonesian tsunami.