



TERRASYSTEM®



**S E B – Stabilized Earth-Brick
unburned – water resistant**



TERRA-SYSTEM

Bodenstabilisierung

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TERRA-3000® brick production

Helping people help themselves

Our guiding principle during the development of **TERRA 3000®**

From the basic idea for the inexpensive production of unburned bricks from loam for the “Third World”, is developed an innovation for soil stabilization of cohesive soil material. The idea was from clayey loam, which globally occurs very frequently and is generally cheap available, to turn into a useful building material for brick production without needing to burn the bricks for weather- and water resistance.

To offer, with locally occurring loam material, a low cost alternative to create better quality of life for the population.

From this developed a pioneering innovative way for soil stabilization of all types with the involvement of clayey soils and **TERRA 3000®**.

TERRA-3000® is multiple applicable, while helping people in many areas, such as infrastructure, residential construction, construction of water reservoirs and various other required applications.

TERRA-3000® is a liquid catalyst concentrate which helps when used correctly, to produce from the locally cohesive soil (clay / loam) a valuable and relatively inexpensive construction material.



Picture above: clayey laterite in Africa



Loam / clay is a proven building material for thousands of years and around 2 thirds of earth's population lives in clayey loam buildings.

Unfortunately, the burning of bricks got a high energy requirement and a high calorific technical effort, especially in developing countries, which is for the most people not affordable.

Of necessity, therefore, unfired bricks are used – which unfortunately are not water resistant - and cannot withstand very long the destruction, caused by ever-increasing vagaries of the weather and rain fronts. In many cases has to be dispensed of unfired bricks, then the clay material is applied "pure" in wooden fencing.



Picture above: loam hut in Africa

Our thought on this subject is to help people in developing countries, but not with money or finished products. We want to give them the opportunity, with the locally available soil material, with their own labor force and relatively easy to mediated "know-how" as well as the necessary equipment, to help themselves for the elemental basic need of a domicile and thereby to have a base to an perspective in a better future.

We believe that these infrastructure improvements is or may be also an important step in the direction of the current refugee situation. Because if people have an activity to help themselves for a stable, affordable and pleasant accommodation, which can be a basis for economic self-help and are not forced to leave their home by hopelessness and lack of perspectives.



Technologie - **TERRASYSTEM®**

pressed and unburned water-resistant bricks

The **TERRA- 3000®** SYSTEM replaces burned bricks and mortar by the use of **TERRA- 3000®** manufactured bricks, which are bonded to each other with the same soil material diluted with water and liquid **TERRA-3000®** catalyst.

The **TERRA- 3000®** SYSTEM is a unique technology which allows relatively easy, upcoming locally available soil, enhance in an acceptable raw material for the brick production.

The water sensitivity of such unburned bricks is brought under control and even up to the complete impermeability (by adding missing grain fractions - clay or sand).



Benefits of **TERRASYSTEM®**

- water resistant, no capillary action, remains dimensionally stable in case of moisture,
- high breaking strength of the bricks $> 12\text{N/mm}^2 = 12\text{MPA}$
- energy saving, no burning, no time-consuming and costly transportation,
- Excellent thermal features, excellent thermal capacity, almost twice as efficient as burned adobe bricks,
- Environment friendly, **TERRASYSTEM®** acts as a catalyst, very low application rate, environmentally certified,
- simple processing, also possible by unskilled staff,



Benefits of TERRA SYSTEM® in detail:

Significant cost savings

Transport cost savings : Brick Production on site.

Locally available clayey loam soil is the main raw material;

Limitations: no humus like organic content of roots, leaves, etc., (topsoil about 20 - 30 cm deep).
Minimum percentage of clay (grain size <0,002mm) higher 20%.
By means of laboratory test (combined sieve and sedimentation test) or by means of finger test detected (see description finger test).

Energy saving: no expensive and complicated burning, brick is pressed hydraulically or mechanically, no high energy costs, no energy consumption through long transports.

Equipment costs: favorable Equipment (hydraulic press, compulsory mixer, grinder), mounted onto a trailer can be brought quickly from site to site, by diesel engine or generator power independently.

Extraneous material: no mortar or cement required by means of:

1. specially formed profile bricks - engaged
2. is diluted with the same catalyst material and water for bonding.

Processing :

Easy operation: 1 trained operator and 3 - 6 untrained workers.

Quick application: bricks can be used immediately after pressing by the special brick mold (locking system), simple but precise installation, it always arise straight walls, even with inexperienced personnel. Attractive brick surfaces can be achieved through natural color of the soil, the walls may also be sealed with plaster as well deleted with paint.



TERRA-3000® – Concentrate

surface active agent in monomeric and polymeric mixture, solvents, wetting agents and catalysts, customs tariff number Nr: 38.24.90.15

1 liter **TERRA-3000®** concentrate sufficient for 5m³ loam material

Application rate: 0.2 liter **TERRA 3000®-concentrate** per m³ loam Material

Price TERRA 3000®-concentrate: see the actual pricelist

Prices are excl. VAT., Ex works EXW (or free carrier FCA on payment in advance) according to Inco-terms 2010.

Packaging: 25-liter plastic canisters

Minimum order amount 6 x 25 liter canister (150 liter)

Delivery time in larger quantities 4 - 6 weeks after written and recorded order

Payment: 50% deposit on writing only binding order - Rest before taking over the goods to the freight carrier.
In case of non acceptance the ordered goods, the deposit will be forfeited.

Soils :

Suitable soils: All soils with a clay fine fraction of <0.0063 mm grain size of at least 20%.

If the clay content is greater than 40%, the base material can easily be emaciated by adding sand in the ratio.

If there is not enough clay (<0,0063mm) in the soil, the lack of clay content should be added to achieve the necessary clay content of 20%.



SOIL SELECTION

A TERRA BRICK is produced from soil and **TERRA-3000®** - water-mixture. The soil type is classified as a sandy – loam. The soil should contain more sand than clay (> 20%) and silt (fines). If the clay content is too high, sand will need to be blended in with the soil.

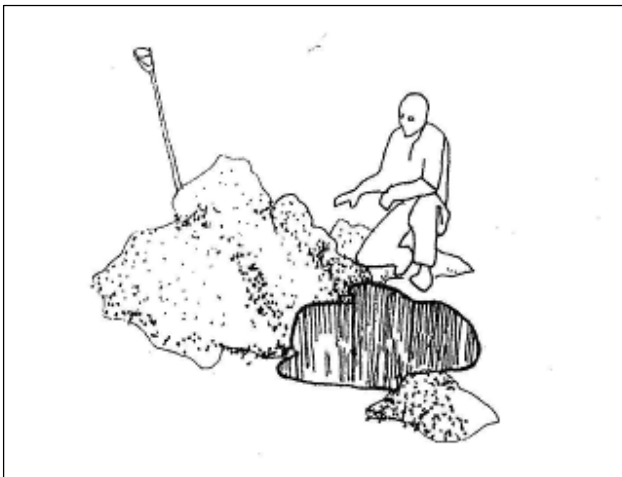
The clay keeps the brick together so it is easy to carry the brick during brick-making. The sandy portion is what binds with the solution to give the brick its ultimate strength.

Too little clay will make brick handling difficult, too much clay will make the brick shrink and crack during curing.

TERRA-BRICK are made from sub-soil (min 30cm) below ground level, never top soil, which contains organic material.

There are 3 field tests in the field to test the soil:

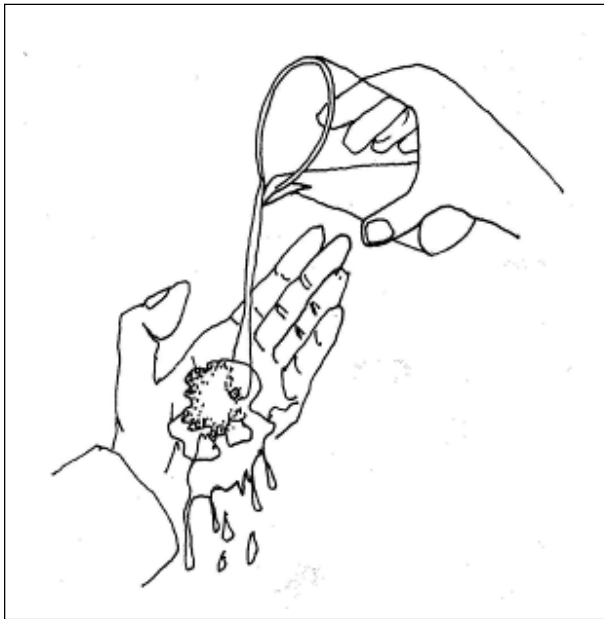
The visual test



- Dig a hole 30cm deep.
- Look at the different soil layers.
- Does the soil look sandy or does it have lumps?
 - a. If it has lumps and cracks in the soil then there is clay.
 - b. If it is very sandy then dig deeper to find a more clayey soil.
- **DO NOT USE TOPSOIL!**



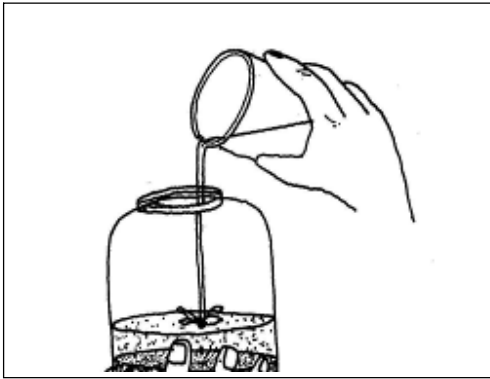
The wash test



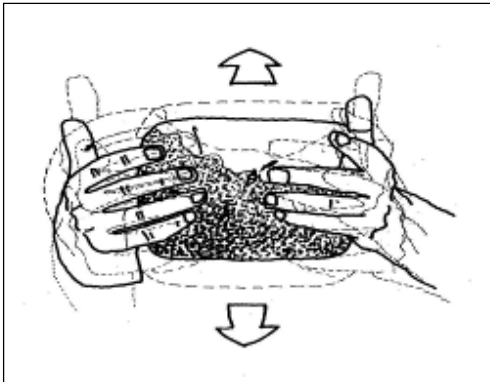
- Take some soil in the hand, pour water on it and rub and squeeze it.
- Does it feel gritty or soapy?
 - a. If it is gritty there is a lot of coarse sand.
 - b. If it is soapy then there is clay.
- Wash the hand with water. If soil washes off easily then it is mostly sand or silt. If it is difficult to wash off and leaves colour on your hand, then there is a lot of clay.



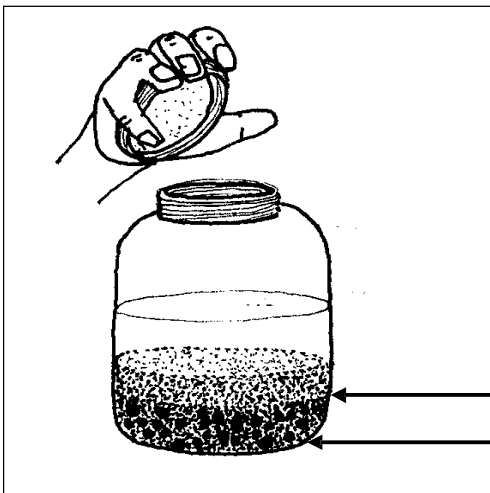
The jar test



- Fill a straight sided, flat bottomed jar $\frac{1}{3}$ with soil.
- Fill to $\frac{2}{3}$ with water



- Shake well (1 minute).



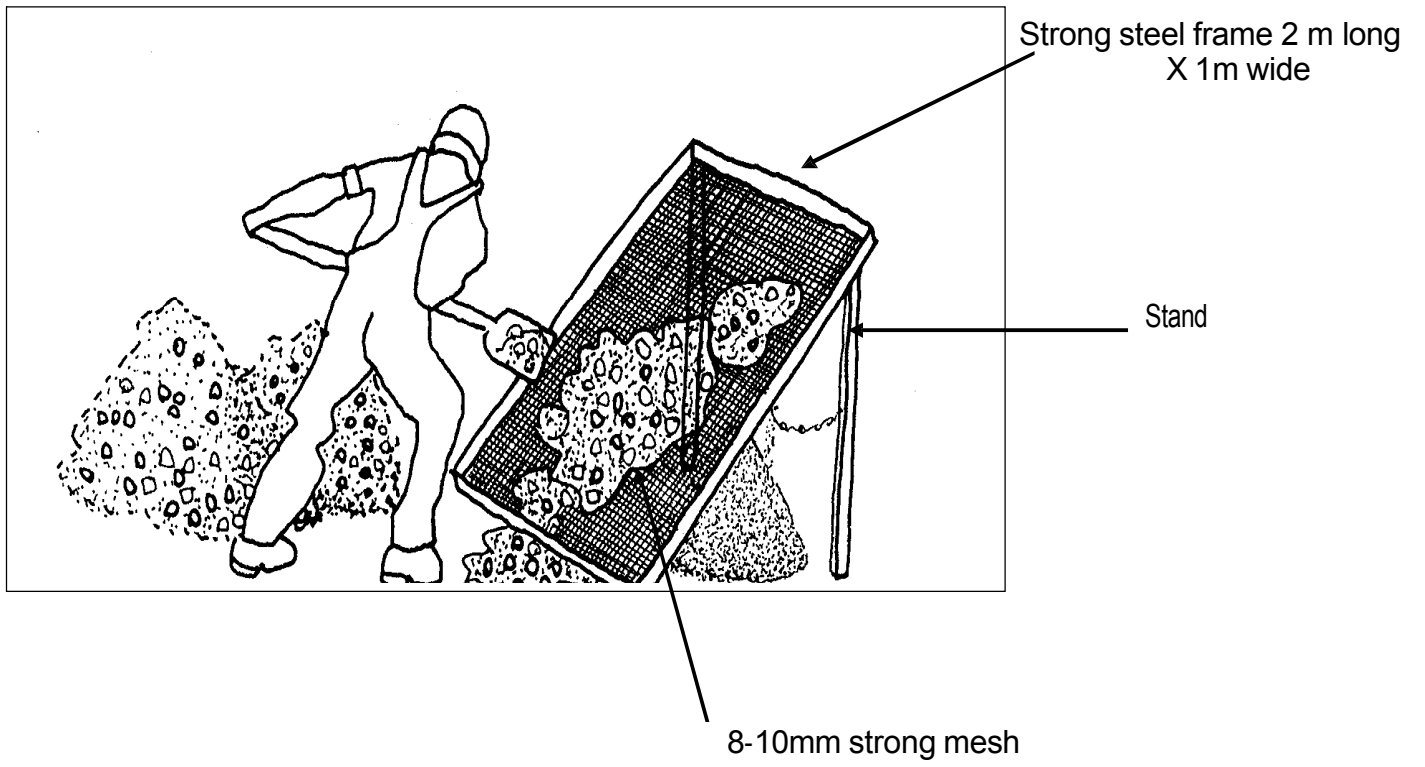
- Leave to stand for 24 hours.
- Measure the thickness of the layers of clay and sand.

Clay and silt – upper layer
Sand and gravel – lower layer

Note: There must be between 20% and 30% clay to make a brick,

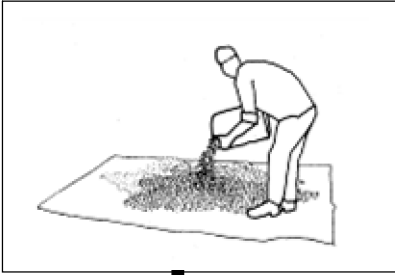


Sieving

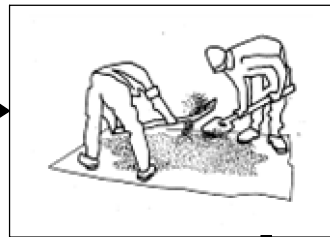
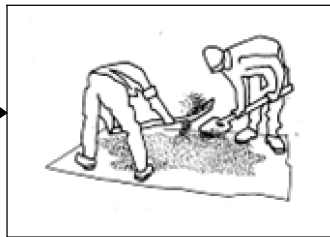
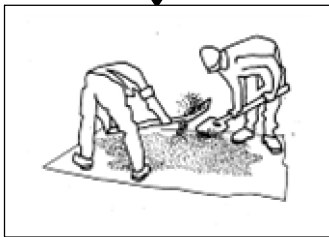




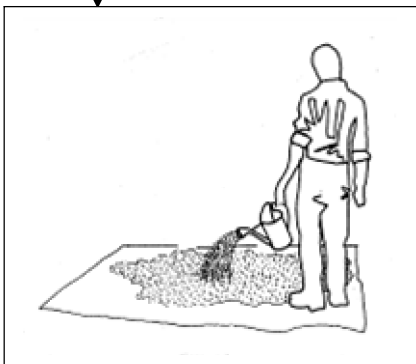
Mixing by hand



Batch the soil and TERRA-3000®-water-mix

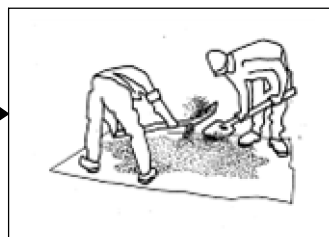
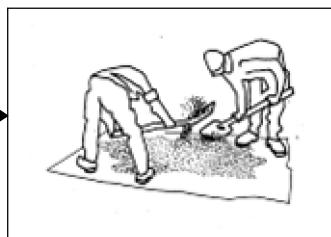
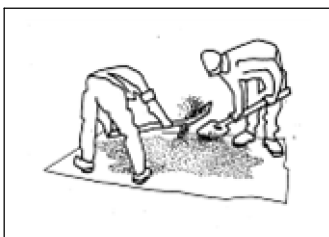


Mix three times until the TERRA-3000®-water-mix and soil are mixed thoroughly



Add water with watering can

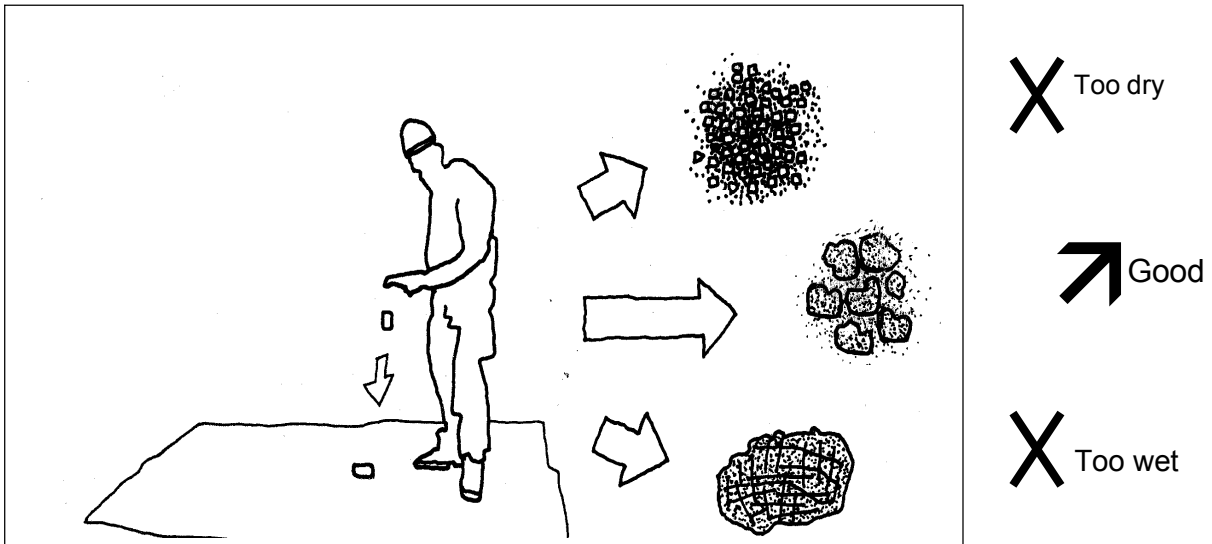
- ◆ Do not pour the water onto a single spot creating a pool of water.
- ◆ Water must be sprinkled onto the mix slowly while mixing.



Mix three times until the water is spread evenly throughout the mix

Checking the moisture in the mix

The Drop Test



1. Squeeze the soil – solution mix into a ball.
2. Drop ball from waist height.
3. - If ball shatters into many small pieces it is too dry.
 - If ball breaks into 5-6 lumps then the water content is right.
 - If ball does not break or only breaks into a few lumps it is too wet.

NOTE: A dry mix will produce a poor quality brick. The mix should be close to the optimum water content of the soil. The water content will vary brick length. When the soil – solution mix is too dry the brick length will be longer than when the water content is correct.

Necessary machinery and equipment:

1. Grain optimization of the soil:

a) manually: sieve



b) mechanical: crusher mill



2. Suitable mixers:

Compulsory mixer
with integrated sieve



b) Twin-Shaft Mixer



3. Press - important, as much pressure as possible!

a) mechanical hand press :



b) mobile hydraulic press with hydraulic compulsory mixer





c) stationary semi or fully automatic brick plant



Useful additional equipment:

1. mechanical brick cutting machine:



2. mechanical testing device for break load:



3. moisture measurement – set, according carbide method





Brick molds:

Generally a wide range of molds are possible.
Standard bricks without interlock

6 Inch (230x150x80mm) ca. 360 Stk./m³
Weight/pieces approx.. 5,4 kg

or

4 Inch (230x100x75mm) ca. 580 Stk./m³
Weight / pieces approx. 3,4 kg

or

Standard brick with interlock:
can be used without mortar in the dry method or
with liquid **TERRA 3000®**-soil mixture.

brick dimensions: width 220 mm
height 115 mm
length 50 mm to 240mm

breaking load: > 12N/ mm² = 12 MPA
about 3 times higher than
untreated loam brick



Average weight, depending on the type of soil: approx. 9 - 10 kg

These bricks are very easy to process, no previous knowledge required,
very stable, good heat and sound insulating, water-resistant.

For the floor or bottom plate, the treated TERRA-3000® soil material can also be
stamped. The result is a very good insulating and water-impermeable layer – where
you can lay directly floor coverings or tiles after good drying – for the entire house,
hardly or rather no cement is required.

Application rate: for 1 m³ of soil is 0,2 l = **TERRA-3000®** =
approx. 200 bricks (220 x 200 x 115 mm)
1 m² brick wall = 43 bricks



The quality of **TERRA- 3000®**-bricks depends on several factors:

1. From the existing soil respectively from the preparation of the soil, means: from the clay content of the grain size distribution, moisture content, the preparation (sieving, grinding, etc.)
2. From the optimal processing, means: good mixing and then well compacting.
3. An important factor is the choice of appropriate equipment. Often Various causes leads to, that non-optimal equipment is available, what then lowering the result but never leads to a failure in the result.

Some possible reasons for a lack of equipment:

lack of energy (electricity), in difficult terrain or very simple - lack of financial resources.

Due to our extensive experience, we recommend the following packages, leading in any case to an success:

1. Minimum package: 1 large sieve, some hands for hand mixing, a mechanical hand press (possibly with hydraulic) carried out all the work by hand, more staff - more bricks, 500-600 bricks / 8 hour
acquisition costs approx. € 3.000 until 5.000,--
2. Standard package: 1 large sieve, a mobile brick press on a trailer with its own diesel engine integrated with a hydraulic compulsory mixer (ca. $\frac{3}{4}$ m³) 1 or 2 hydraulic presses: 3 - 6 of unskilled helpers and 1 trained machine operator
1500-2000 bricks / 8 hour
acquisition costs approx. € 10.000 until 15.000,--
3. Optimal package : 1 mill respectively crusher for the soil material, a double shaft mixer and fully automatic press 3 man staff, important is enough energy (electricity) on site,
3000 brick / 8 hour
acquisition costs approx. € 25.000 until 30.000,--