MANUAL FOR
BUILDER OF
TRASHY HOUSING
PROJECT
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Part of graduation project by

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Explore Lab 15
watering can

pencil

small tapeline (5 metres)

large tapeline (30 metres)

rope

sailcloth

safety helmet

welder

drill

concrete-mixer

safety glove

drill

concrete-mixer

safety helmet

welder

pencil

small tapeline (5 metres)

large tapeline (30 metres)

rope

sailcloth
URBAN
the sanitair compartments contain a **toilet**, **shower** and **kitchen** for each dwelling

there are four types of dwellings:
- **2 ground floor dwellings** (small and large)
- **2 upper dwellings** (small and large)
COMMON FACILITIES PER UNIT

- **biogas system** extract gas from excrements
- each compound has it's own animal shed for small cattle
- the water well provides potable water

Water well place at least **10 metres** from the place where liquid excrements enter the ground to provide pollution of the water.

These functions together create a meeting place for the four combined units.

- Older children can meet each other
- Young children can not leave the safe compound
- Small animals can go to the sheds

**PIPES**

- The toilet is flushed with rain water
- The drain of the toilet is connected to the biogas system
- Extracted gas from biogas system goes back to the kitchen
- Grey water of shower and kitchen goes to the public gutter
the shape of the compounds create openings between multiple units

use the large openings for public functions such as schools or hospitals

use the small openings for public functions such as take-away restaurant or animal sheds

for every 2325 inhabitants you need 1 general practicer
for every 2040 inhabitants you need 1 dentist
for every 1667 inhabitants you need 1 obstetrician
for every 1360 inhabitants you need 1 pharmacy
for every 24128 inhabitants you need 1 hospital
for every 1050 inhabitants you need 1 primary school
for every 9589 inhabitants you need 1 secondary school
for every 2957 inhabitants you need 1 church
for every 12500 inhabitants you need 1 mosque
for every 2439 inhabitants you need 1 sport facility
for every 1050 inhabitants you need 1 ATM

Based on numbers of STIP0 van mensen naar meters
STREETS

the roads between the compounds connect different areas with each other

two-direction road + 1 side-walk
maintain a distance of 8 metres between the buildings

one-direction road + 1 side-walk
maintain a distance of 5 metres between the buildings

SIDEWALK

at least 1 sidewalk per street
with a sidewalk of 1.2 metres, two people can easily pass each other
most shadow exist on the north side of trees or buildings

sun rises in the east
here is shadow in the evening

the sun sets in the west
here is shadow in the morning

on the south side of trees and buildings is no shadow

use trees to create shadow for outside eating places and car parking
PREPARATION
MATERIALS
SOIL SELECTION FOR EARTH BRICKS

**WASH TEST**

**Needed Tools** Glass

- take some soil in the hand and pour some water on it
- If the soil feels gritty: the soil contains no clay
- If the soil feels soapy: the soil contains clay

wash the hand with water

- If it washes off easily: the soil exists mainly out of sand or silt
- If it washes off difficult and leaves a colour on your hand: the soil contains a lot of clay

**JAR TEST**

**Needed Tools** Jar

- fill jar for 1/3 with soil and with 2/3 with water
- shake the jar well for at least one minute

let the jar rest for 24 hours

measure the thickness of the layers
- clay = upper layer
- soil = lower layer

To make a good block the soils needs to contain 10-50% of clay. Ideally is 15-35%
**PREPARE SOIL MIXTURE**

**CEMENT: SOIL PROPORTION**

**Needed Tools** bucket

1 X cement

12 X soil

**MIX**

**Needed Tools** bucket, sailcloth, shovel

**Number of People** 2

**Time** depends on amount of bricks

- Pour 1 bucket cement and 12 buckets of soil on a sailcloth
- Mix three times with shovels
- Sprinkle slowly water with a watering can
- Repeat 3 times

**DROP TEST**

**Needed Tools** sailcloth

**Number of People** 1

**Time** 15 minutes

- Squeeze soil-cement mixture into a ball and drop from waist line on a sailcloth
- If the ball shatters into small pieces, the soil is too dry
- If the ball breaks into 5-6 lumps then the water content is right
- If the ball does not break of only into a few lumps, the soil it too wet
MAKE BRICKS

Needed Tools: blockmaking machine, shovel

PRESS BRICKS

1. Fill the soil hopper with soil
2. Close the soil hopper
3. Open the soil hopper
4. Press the brick by handling the top arm cylinder and the bottom arm cylinder
5. Open the top arm cylinder and remove the brick
**DIMENSIONS BRICK**

strek = the length of the brick  
295 mm

tkop = the width of the brick (1/2 * (strek - joint))  
140 mm

joint = size between bricks  
15 mm

klezoor = 1/4 * (strek - joint)  
70 mm

3-klezoor = 3/4 * (strek - joint)  
210 mm

**DRYING AND WATERING**

**Needed Tools** 2 sailclothes, watering can

stack maximal 7 bricks on a sailcloth

cover with another sailcloth

let the bricks dry for 7 till 14 days, while you water the bricks every morning and every evening with a watering can
PREPARE TROPICAL ROOF

WELD FRAME

Needed Tools: welder, safety helmet, safety gloves

weld the steal frameworks on the ground together

start with the T-profile

fix the transverse triangles

attach the corners of triangles together with transverse beams
SEW CANVAS

**Needed Tools** sewing machine, hammer

Sew billboards together in a canvas of 12750 x 300 mm

Hammer grommets in the canvas

Seam
CONSTRUCTION
Foundations

Dig Foundation

**Needed Tools** shovel, rake, horizontal

dig a slot of 400 mm wide and 300 mm deep

replace the ground to the place where the building will be

**Prep Concrete Formwork**

**Needed Tools** hammer, roper, horizontal

timber the framework in the groove

place the sail on the ground and place the ventilation tubing in the framework

smooth the ground 100 mm above ground level

the ventilation tubes keep the floor cool in hot-season

the sailcloth keeps the floor cool in wet-season
CONCRETING

Needed Tools concrete-mixer, boots, lath, horizontal

The concrete should be 150 mm thick

Let the concrete dry for three days

Remove the framework and fill the open space with soil
WALLS

BRICK-LAYING

Needed Tools: trowel, bucker, rope, horizontal

SIZE BRICKS

- strek = the length of the brick
- kop = the width of the brick \( (1/2 \times (\text{strek} - \text{joint})) \)
- joint = size between bricks
- klezoor = \( 1/4 \times (\text{strek} - \text{joint}) \)
- 3-klezoor = \( 3/4 \times (\text{strek} - \text{joint}) \)

Each wall is 25 bricks high.

Lay the brick walls on top of the concrete floor.

Smear between each bricks mortar with the trowel.

To make sure the wall will be horizontal you can use a horizontal line along the bricks during the brick-laying.

Start with a layer of mortar on the concrete floor.
strek = the length of the brick
kop = the width of the brick (1/2 * (strek - joint))
joint = size between bricks
klezoor = 1/4 * (strek - joint)
3-klezoor = 3/4 * (strek - joint)

OPENINGS
replace randomly whole bricks by half ones
do not place two half bricks on top or next to each other, nor in the first or last layer

stairs use 11 half bricks for each dwelling from floor till ceiling
kitchen use 7 half bricks for each dwelling from 500 mm above the floor
shower and toilet use 4 half bricks for each dwelling from 1600 mm above the floor

this will create openings which generate natural ventilation
FLOORS

SCAFFOLDING

Needed Tools: bamboo scaffolding, rope, ladder

to construct the concrete floor, it is necessary to place scaffolding

the concrete-framework is placed on the scaffolding
place on the bottom of the framework
wooden bars to create grooves in the ceiling

for the stiffness of the floor it is necessary to place steel reinforcement before pouring the concrete

pour the concrete 250 mm high

remove the framework
you will see grooves in the ceiling where the residents can easily place the self-built walls

FOR THE OTHER FLOORS REPEAT THE BRICK-LAYING AND FLOORING TWICE
THE ROOF IS SIMILAR AS THE FLOOR
TROPICAL ROOF

PLACING WELDED FRAMEWORK

Needed Tools lifter, example T-profile, pencil, drill, brush, wrench, screwdriver

lift the welded frameworks on the concrete roof

mark the places of the holes with a example T-profile

clean the holes with a brush and by blowing

drill the holes

place anchors in the holes

because of the working of the anchors, the frame is firmly attached
WATER PILLOW TANKS

Needed Tools: bamboo scaffolding, rope, ladder

- Fix a framework on the anchors with molds
- Place one water pillow tank
- Repeat this for the whole roof
- Weld the frameworks together with beams
ATTACH SAIL

Needed Tools bamboo scaffolding, ladder

attach the sailcloth to the framework with elastic robe

thread elastic through the holes if two clothes overlap one and each other