Toilet construction activity at Muteesa Primary School, Uganda

NETWAS Uganda with assistance from Aquamor, Zimbabwe. 20.10.2010

The pupils at Muteesa primary school have taken an active part in toilet construction together with support from Ecosanres, NETWAS, Uganda and Aquamor, Zimbabwe

During October 2010 they helped construct a spiral VIP toilet which can also be used as a Fossa alterna.

The VIP toilet normally uses a single pit, but it can be designed to use two pits alternately. It thus becomes a type of Fossa alterna (alternating pit system)

In this case the pits are dug shallower (1.5m deep) and materials which assist composting are added (leaves, ash, soil green cuttings from kitchen etc)

Also in this case the alternating pits are dug larger than normal Fossa alterna pits, so they have more volume and the period of alternating is increased from one year to up to 5 years.

A special technique known as corbelling is used in the pit brickwork, where the base of the pit has a larger diameter than the top

The Pupils are involved in several stages of construction:

**Concrete slab making*

**Pit lining*

**Superstructure construction*

**Roof making*
Etc

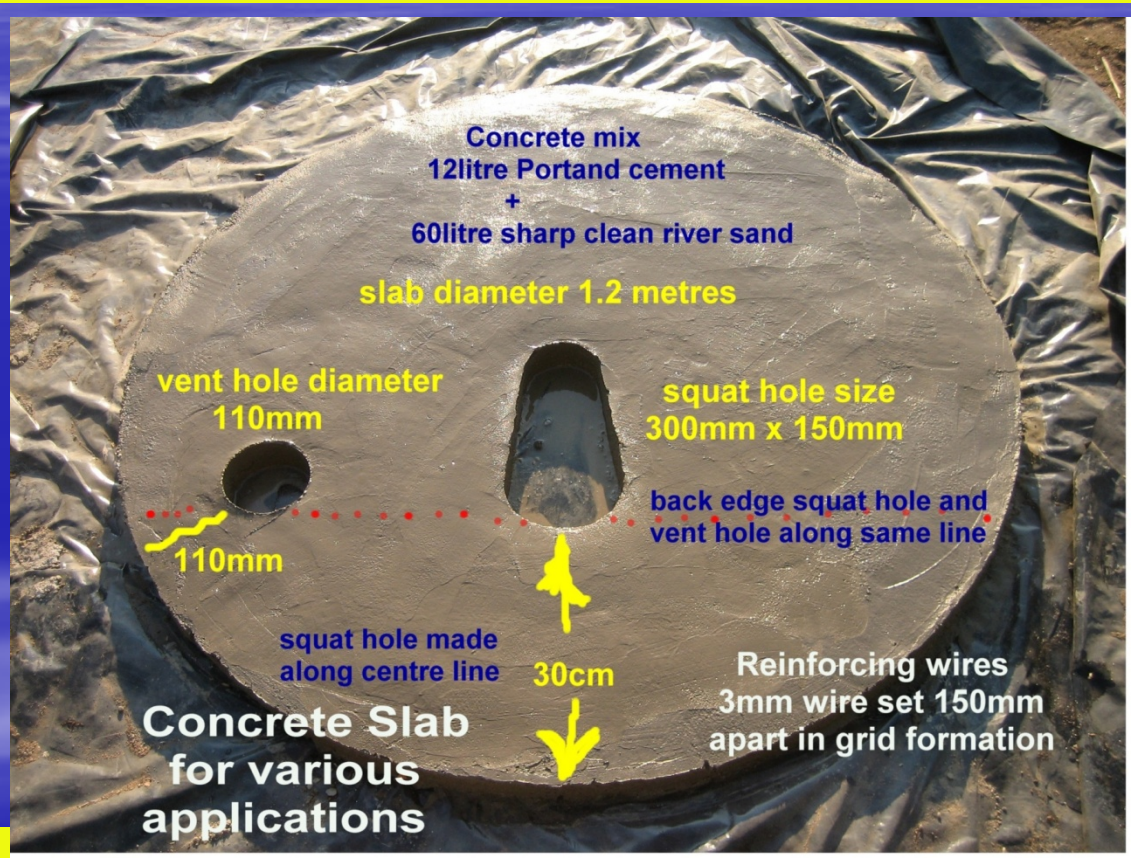
There are several methods of making the superstructure (house). These include the spiral brick, the doored brick, the grass and pole method and also a variety of portable toilet house designs.

In this case a brick spiral design was chosen

By building in brick, the pupils gain valuable experience in brick laying.

Making the concrete slab.

The concrete slab is an important part of the structure and should be made several days before being moved.



The slab is 1.2m in diameter and has a squat hole (30cm X 15cm) and also a hole for a vent pipe (110mm diameter).

The slab is made within a circle of bricks on a plastic sheet. The 1.2m diameter is marked on the plastic sheet. Bricks are laid around. Lengths of 4mm wire are also cut as reinforcing and laid as shown in the photo.

The concrete mix is then made, normally using 12 litres of Portland cement and 60 litres of clean sharp river sand. In this exercise to hasten curing, 20 litres of Portland cement was mixed with 70 litres of river sand

Once the moulds for the squat hole and vent hole have been placed in position carefully, half the concrete mix is added into the area within the brick mould and levelled off. The wires are then added.

The remainder of the concrete mix is then added and levelled off.

After a few hours the moulds for the squat and vent holes are removed. The slab is covered with plastic sheet. This is left overnight and then watered the following morning. It is kept wet for a week before moving.

Making the spiral superstructure.
This is only one of a series of "toilet houses" which can be made. This type was chosen at the school for this project.

In this design there is no door and privacy is ensured because of the shape of the structure

Making the superstructure

A practice slab was built on which the pupils could practice the method of laying bricks. The structure made over the pit was built later.

For the "practice unit" an extension was made to the slab on which the walling outside the slab could be built.

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Practice unit

An extension was made to the slab and filled with a weak concrete mix. This was built up to the level of the slab

It is a good idea to have a place for practicing the brick laying technique.

Making the superstructure

The teacher or instructor then shows the pupils the correct method of laying the bricks and bonding them together with cement mortar.

In this case the mortar for the brickwork was made with 20 parts of pit sand to one part of Portland cement,

The method of laying bricks can only be taught on site and by hand. A builder is also present to help the pupils to build the brickwork properly. Some pupils will be better than others. Everyone should be encouraged to have a go.

Making the superstructure

The method of laying bricks and bonding them together should be studied carefully. To gain strength for the wall the bricks are offset as shown in this photo. Half bricks are also used.

Making the superstructure
Course by course the structure rises

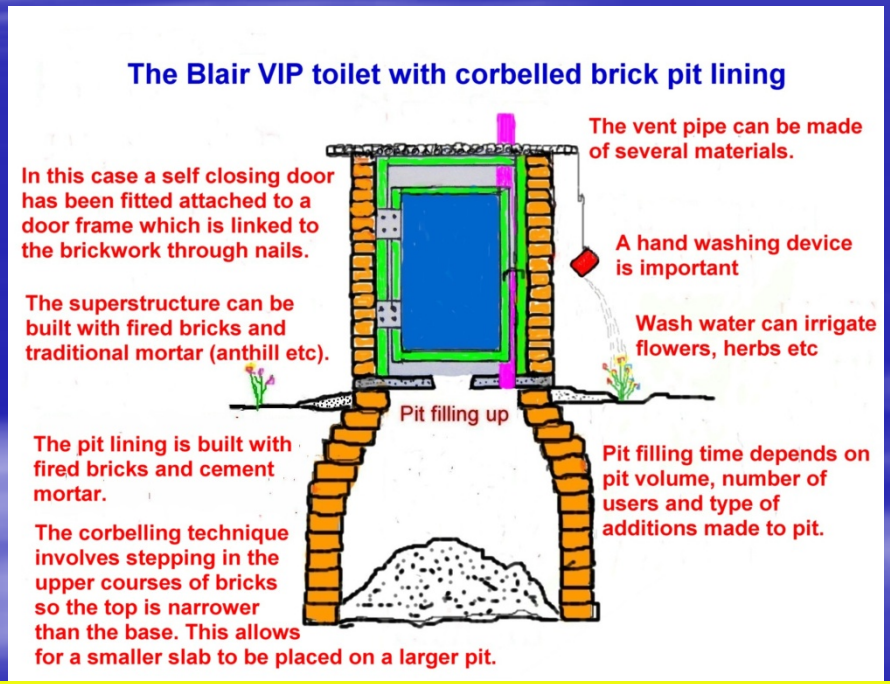
Digging and lining the pit with bricks

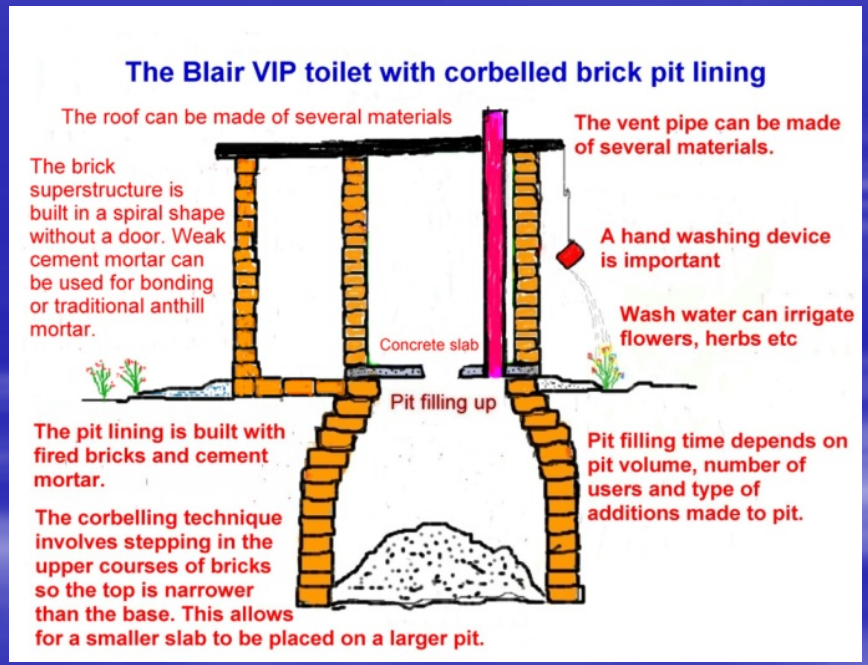
The pit is dug 1.5m deep with a diameter of 1.7m. This means that once the pit has been lined the internal diameter will be 1.4m or close

The walls are dug vertical and the base flat.

Lining the pit with bricks

In this case the pit is lined using the "corbelling" technique. The base of the pit is wider than the top. In this way a large capacity pit can be built which can be "capped" by a much smaller and lighter slab





Corbelled pits beneath doored and door-less spiral structures

Lining the pit

The bricks are laid around the rim of the pit next to the pit wall. They are laid close together in the shape of a ring. The mortar used is a mix of 20 parts pit sand and 1 part Portland cement. The internal diameter should be about 1.4m.

The cement mortar for bonding the bricks is prepared. Builder and pupils work together in lining the pit.

Lining the pit

Bricks are laid around the pit to aid the builders and pupils. The diameter of the pit brickwork is maintained at 1.4m for about 0.8m from the bottom of the pit. Then the brickwork is stepped in about 25mm for each course.

This method also takes practice

Lining the pit

As the brickwork is stepped in, the gap between the bricks and the original pit wall increases. This gap (annular space) is filled with soil.

Lining the pit

The brickwork is extended upwards above ground level until the external diameter of the brickwork is a little more than 1.2m – the diameter of the slab.

The brickwork must give the 1.2m diameter slab support

Lining the pit

Backfilling the space between brickwork and pit. Soil is added to the space up to ground level. The top of the brickwork is covered with mortar and levelled

At this stage the pit is lined and ready for the cured slab to be mounted.

Preparing for spiral structure.

In the case of the spiral superstructure, an extension must be made outside the slab This forms a foundation on which the brick wall outside the slab will be built. The distance between the walls of the entrance is about 50cm

Making the roof.

The roof is made from a wooden frame nailed together on which thin corrugated iron sheets are nailed. In this case iron sheets 3m long were purchased and were cut in half, making the length of each piece 1.5m. Three of these were used for the roof. The timbers were cut as shown in the photo, so they can cover the future structure with an overlap all round

The timbers were laid on the ground, and the three roofing sheets were laid on top. These were then nailed in position.

Continuing with building the superstructure

Fitting the concrete slab

The concrete slab is allowed to cure for several days and preferably a week. It is kept wet and under plastic sheet all the time. It is now carefully lifted and moved to cover the pit. The slab is mounted in a bed of weak mortar laid over the brickwork . The slab is made level.

Fitting the concrete slab

The concrete slab is lowered gently on to the pit brickwork

Continuing with building the superstructure

In this case a spiral superstructure was built. An extension to the toilet floor outside the slab area is required. This has been built up with bricks to provide an entrance about 50cm wide This extension is then filled with stones and cement.

Filling the extension with stones and concrete

The extension is built up to the level of the slab. The construction of the brick spiral superstructure can now begin

Building the superstructure

The bricks are gathered around the structure. A line of bricks is placed on the slab and extension to identify where the bricks will be laid. The entrance and opening to the toilet cubicle are about 50cm wide

The bricks are then laid. The camera time at the start of laying bricks was about 8am. The actual time was 10am.

Laying bricks
About half way after about 1.5 hours

Laying bricks

And further up after 2 hours 45 minutes!

Laying bricks

The final brick course is laid at about 1pm (camera time), 5 hours after start (including lunch break!)

Fitting the roof

The roof timbers are supported by the brickwork. A half brick is laid at the front to raise the roof slightly to allow rainwater run off. The timbers are wired to the brickwork to secure.

The structure with roof fitted

The roof is secured to the brick structure with wires.

Fitting a vent pipe

A vent pipe was fitted to this toilet to reduce odours. The pipe will also help to control flies if a fly screen is fitted at the top of the vent. In this case a 110mm PVC pipe is fitted. Half a full length has been fitted (3m). Normally VIP vents are 2.5m long

A hole is made in the roof directly above the vent hole in the slab. The pipe is fitted from above. A corrosion resistant fly screen should be fitted (e.g aluminium)

Fitting the vent pipe

A weak mix of cement mortar is laid around the pipe on the roof.

At this stage a hard concrete toilet floor still needs to be made so the toilet can be washed down thoroughly and kept clean

Adding a sloped floor

A cement mix of river sand, pit sand and cement (2:1:1) is made up and applied to the floor of the toilet. This has a hard surface and is sloped down towards the squat hole from the entrance.

The floor is made with a slope towards the squat hole

Adding a sloped floor

The entrance step and slope

A line of bricks cut to half the thickness is laid at the entrance and the floor slopes downwards from these to the squat hole. A bucket of water can then be thrown on the floor and washes the slab down. Note the sloped cement behind the entrance step.

Making other parts of the toilet system at Muteesa Primary.

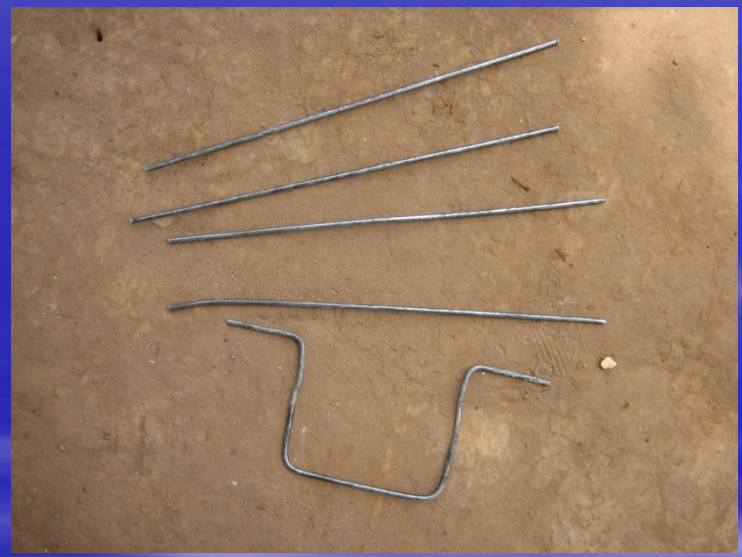
The toilet shown in this presentation is a hybrid between a VIP and a Fossa alterna. In this case a second pit has been dug just as the first. 1.5m deep with an internal diameter of 1.4m. The pits will be alternated, but at a period much longer than a year.

Covering the second pit.

The second pit is built up with corbelled brick work the same as the first. It is capped by a 1.2m concrete slab with a central hole. The hole can be made with a plastic basin. The mix of cement is the same as the toilet slab (about 12 litres cement and 60 litres river sand)

The second pit

The second pit will be filled with compostable materials like, leaves, grass, green vegetable cuttings, soil, ash and even some animal manure. This will form useful compost for the garden, whilst the first pit is filling up.



The central hole in the second pit cover slab is closed with a concrete lid. This can be made by using part of the plastic basin as a mould. The basin is cut in half, the lower half is used to make the hole in the slab and the upper half to make the cover. Part of the same concrete mix is used and a little extra cement is added for strength. A wire handle and 4 reinforcing wires are cut to strengthen the lid.

The second pit cover lid.

The lid must be made very strong as it will be moved a lot as compostable materials are added to the pit

The wire handle is placed centrally within the mould and half of the concrete mix added. Then the 4 reinforcing wires are added and the remaining concrete mix added and smoothed off with a trowel. This is covered and left to cure.. Once hard it is watered for several days without moving.

Use of the toilet.

This "ecological VIP toilet", made with a shallow (1.5m deep pit) will be used like a Fossa alterna. That is two pits will be used alternately. There are two 1.5m deep pits rather than one 3m deep pit.

Extra materials will be placed down the used pit in addition to excreta. These will be mainly leaves with some soil and ash. These should be added once a week. Several sacks of leaves are added to the pit before it is used. This will help to start the composting process off. The pit should take a few years to fill up.

The only other maintenance requirement is that the toilet is kept clean by washing down with water.

Alternating pits

It is not yet known how long this trial pit will take to fill up in the environment in which it has been fitted.

Once the used pit is nearly full. The second pit is emptied of all its compost. Some of this can be stored to be placed down the new used pit. Some used on the garden .

An extension must be built next to the second pit, so the spiral structure can be built on top.

The roof and pipe of the VIP toilet are removed, the brickwork structure dismantled, the bricks cleaned, the slab removed and refitted on the new pit The new structure, using the same bricks is built on the second pit and roof and pipe refitted.

Demonstration of doored structure

This power point describes how the spiral version of the ecological VIP was built at the school. A demonstration of the doored ("horseshoe") version was also made in the school grounds.

A 1.2m diameter slab was made without reinforcing wire (since it will remain a static demonstration). This was allowed to cure. Two gum poles were purchased (preferably treated) and placed in two holes dug in front of the slab and 0.5m apart (for insertion of the door).

The doored structure

An concrete extension of the slab was made in front of the slab and around the poles to act as a floor on which the bricks could be built.

Bricks were then gathered around the site for the demonstration

The doored structure

Using a 20:1 mix of pit sand and Portland cement as mortar, the bricks were built up on the slab and floor extension to make a structure which is horseshoe shaped.

The construction is easy and even less experienced people are able to built this structure. The structure derives its strength from the shape. In this demonstration the poles were short. In the working toilet the treated gum poles are 2.4m or longer and held firmly in the ground,

The doored structure

The construction of bricks in this shape is res easy to build and even less experienced people are able to construct the brickwork. The structure derives its strength from the shape. The primary school pupils also helped to build.

The involvement of pupils is important and exciting
The pupils can be totally involved

The demonstration unit can be built up and taken apart many times to practice the skill of laying bricks. The horseshoe shaped structure is much easier for the pupils to build, but the wood should be treated against termite attack and the hinges and doors made strong so they will last.