4. How to build and manage the *Arborloo*

The ***Arborloo*** is a nothing more or less than a simple pit latrine. But it differs in several fundamental ways in its design and the way it is used from the commonly used deep pit latrine.

A**ll the parts of the ***Arborloo, apart from the pit, are portable. This includes the “ring beam” protecting the pit head, the concrete slab and the superstructure. Each of these components moves on a *“never ending journey”* from one pit to the next at about 6 -12 monthly intervals. The latrine is literally picked up and moved, leaving the almost filled pit behind.

* ***Arborloo*** pits are shallow, - normally no more than one metre deep and they are not lined with bricks or other materials. The pit is normally protected at the head with a “ring beam” made of bricks or concrete which strengthens the pit head and reduces the effects of erosion and pit flooding from rainwater. In very sandy soils, a 200 litre drum may be used to make a pit lining. If the soil is very firm, no ring beam is required at all from a constructional viewpoint, but it helps to raise the toilet foundations on a ring beam to stop pit flooding during the rains.

***S**oil, wood ash and leaves are added regularly to the pit in addition to excreta. These aid the composting process considerably. The remarkable conversion from excreta into humus is normally complete well within 12 months of closing off the pit. The addition of soil and ash on a regular basis also reduce fly and odour nuisance.

* The ***Arborloo*** pit is NOT used as a dumping ground for rubbish like most pit latrines. The dumping of plastic, bottles and rags etc, is not recommended.

An *Arborloo* in Phalombe, Malawi

* Once the latrine has been moved to the new site, a layer of leaves and fertile topsoil between 15cm and 30cm deep is added to the contents of the pit, which are first levelled off. The pit contents can be left for a month or two or more to settle or can be planted with a young tree straight away. Some people prefer to leave the day of tree planting until after the arrival of the rains. This is a wise move if water is scarce. But it is also possible to plant the young tree directly after topping up with soil. Trees will not grow in raw excreta - they must be planted in a good layer of soil placed above the excreta. Within a few months the layers containing the excreta will have changed into humus which the tree roots can then start to invade. So in effect the old latrine site becomes a site for a tree. Most trees will grow well in these shallow

pits if planted properly and cared for. The young tree should be watered regularly, and protected from animals like goats and chickens like any other young tree. Covering the surrounding soil with “mulch” helps to retain water. With a combination of excreta, soil, ash and leaves in the pit the pit contents turn into humus which most tree roots can cope with easily and later will thrive on. Later on diluted urine can be used to provide additional nutrients.

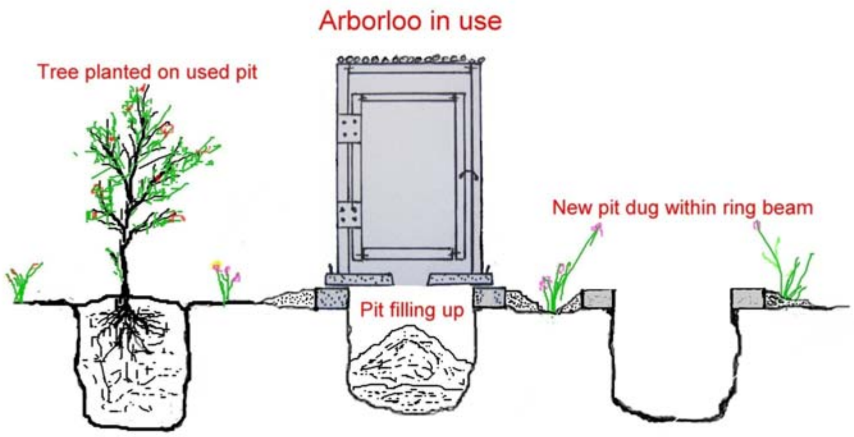
The ***Arborloo*** fulfils all the basic requirements of ecological sanitation. The recycling of human excreta is made as simple and convenient as possible. Natural processes are involved in a way that retains a simplicity of method and flexibility of design. The latrine is safe from a health point of view - the excreta is never touched by hand and contained below a layer of leaves and topsoil. Thus contamination of the environment is minimal. The pit is shallow and thus further away from ground water than any conventional pit latrine. The excreta (faeces and urine) combine with the soil and other ingredients to form a crumbly, nutrient rich humus, which becomes an ideal medium for tree growth. Thus the odorous and potentially dangerous raw excreta are converted far more quickly into a safer humus than in “deep pit” latrines. The combination of human excreta and soil, ash, leaves etc greatly enhances the nutrient levels found in the parent soil. This applies to all soils - whether they are rich or poor. The humus formed is crumbly, with much elevated levels of all the major nutrients like nitrogen, phosphorus and potassium, which the trees can use. The ability of the “new soil” to retain water is also enhanced. Urine added to the pit is either absorbed into the pit humus or leaves or soaks into the side walls and base of the pit where some of its nutrients (particularly phosphorus) become available later, when the tree roots penetrate the soil. As the tree grows it absorbs more and more of the nutrients laid down earlier. Over time some nitrogen is lost, but this can be applied later with diluted urine.

The ***Arborloo*** also provides an excellent example of how the nutrients derived from human excreta can be recycled through the production of food - in this case fruit. The concept of “closing the loop.” is well demonstrated. The fruits eaten from trees grown on older ***Arborloo*** pits, once processed by the human body, are reintroduced back into the ***Arborloo*** pit currently being filled. Over a period of time “woodlots” of gum trees or “orchards” of fruit trees will result and the general fertility of the land is improved. Trees also offer shade, leaf compost and stability to the soil.

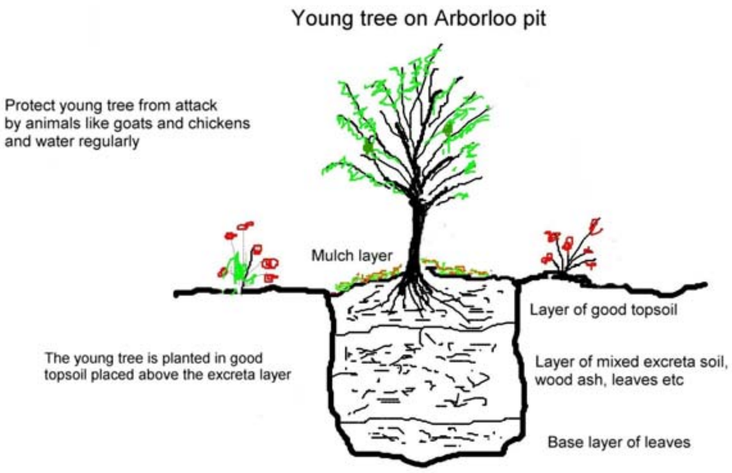
Remarkably, the mixing of barren topsoil and human excreta, results in a mix with enhanced nutrient value. If a fertile soil and leaves are also added, the resulting mix is even richer. It is into these soils that the tree roots will eventually grow. Tree growth into the pit contents represents only the first stage of root invasion - it continues into the surrounding soil which will also be nutrient enriched to a lesser extent.

Not surprisingly, a similar method of processing human excreta, has been used in the African traditional way of life for generations. In countries like Malawi, Mozambique, Kenya and Rwanda, villagers traditionally plant trees on disused latrine pits. And even nature uses the same principle - often the seeds of trees fall into disused and abandoned pits and germinate there. What better means exist to show that even human excreta, once changed into humus, can be an ideal medium for tree growth. The ***Arborloo*** is a refinement of this simple and well established principle. The physical structure of the latrine is designed to be portable, unlike more conventional latrines. Also the shallow pit is fed a mix of ingredients, deliberately, to ensure a more rapid conversion of excreta into humus and thus a better survival and growth rate of trees.

In practice the latrine is used until the pit is nearly full, which for a family should be between 6 and 12 months. Once the pit is nearly full, the structure, slab and ring beam are removed and the ring beam is placed on another suitable site nearby and a new pit dug within the beam - about one metre deep. The slab and superstructure are now placed on top of the beam and the latrine is put to use once again. The family may start off by using the toilet in any convenient place, but may then decide to place it within a specific piece of land set aside for an orchard or wood lot. Gum trees grow particularly well on these organic pits. However fruit trees are generally far more popular. In Malawi, citrus trees like orange and tangerine are the most popular trees because they have a commercial value.



The *Arborloo* moves on a never ending journey leaving behind a series of fertile pits filled with a mix of human excreta, soil, wood ash and leaves etc which provide a suitable planting medium for trees when composted. Nutrients in the excreta are used by the tree to enhance its growth.



HOW THE *ARBORLOO* WORKS

In time all human excreta or animal dung turns into soil. The rate of conversion depends on many factors such as temperature, the proximity of soil, containing the myriad of micro-fauna and micro-organisms, including bacteria and fungi that break down excreta. Also the presence of air and moisture is important. Animals like worms and insects also play their part in "breaking down" and converting the excreta. The addition of leaves and other organic vegetable matter also assists the process by increasing the proportion of air in the compost, and also improves the final fertility and nutrient level of the humus. In contrast, the process in deeper pit latrines, to which only excreta is added is quite different. Here the solid mass of excreta from top to bottom, can lead to anaerobic conditions which really slow down the process of conversion considerably. Such a conversion may take several years to complete. The rate of conversion in deeper pits will depend on several local conditions such as whether the pit is lined or not and the depth etc. Compost formation is faster in unlined pits since the area of living soil in contact with the excreta is large compared to those pits which are lined with bricks or concrete rings.

Thus a shallow, unlined pit, filled with a mix of ingredients certainly hastens the conversion process, but it also hastens the filling of the pit! Thus a balance must be struck. In fact when dry soil and ash are added much of urine and water content of the faeces are absorbed into the soil and the increase of volume is not as great as might at first be feared. In fact nearly 70 - 80% of the faeces is made up of water, leaving only about 20% solid matter. It is this 20% which is finally absorbed into the humus like material formed.

Whilst moist conditions are important within the pit, the pit should not be flooded with water, as this destroys the ideal environment of conversion and also increases the risk of spreading pathogens from the pit. Also the contents should not be so compacted as to exclude air, which leads to inefficient anaerobic conditions being encouraged. Thus it is essential for the process to take place at its best, that a good deal of soil, ash and leaves are added regularly to the pit. Under these conditions the effective aerobic conversion of excreta into a humus-like soil can take place quite efficiently. Just a few months may be all that is required. Within a year, the humus is fully formed and relatively safe. In the ***Arborloo*** it will never be touched.

Siting the *Arborloo*

It is normally recommended that standard pit latrines are built at least 30m away from water sources such as wells and boreholes to avoid potential contamination of the water source. This is an arbitrary figure as the potential of the pit latrine as a source of contamination of ground water depends on many factors such as soil type, water table depth, potential for flooding, slope, season, etc. Very often the potential of pit latrines as a source of contamination for shallow water supplies has been exaggerated, but there is still much debate about it (see bibliography). Where there is space, such as in the rural areas, pit latrines can be placed well away from wells as a matter of routine. This may not be the case in peri-urban situations where plots sizes are much smaller (see bibliography). However where shallow composting pit toilets like the ***Arborloo*** (and ***Fossa alterna***) are used, there may be more flexibility on siting in relation to water sources.

The site chosen for the latrine should fulfil several other requirements. It should be convenient for the users. It should also be placed on slightly raised ground to avoid flooding during the rains. It should also be sited some distance (about 30m) away from any well used for domestic purposes. In the case of the ***Arborloo***, the fact that a tree will be growing there in years to come should also be taken into consideration. Thus thought should be given to the possibility that in many years to come there may be a lot of trees growing on old pit sites which will form an orchard or wood lot. Trees do require space!

In siting the ***Arborloo,*** consideration must also be given to the future site of individual trees, orchards, wood lots or plantations. Thus the family must decide where the future trees may be planted in relation to their homes and the gardens. For instance trees may be planted in special places within the garden which may provide shade or fruit, or they may be planted in an orchard (for fruit trees) in a specific area. They may also be planted along a fence line. The spacing may depend on the type of tree to be planted. For trees which grow large like the mango or avocado, planting sites should be placed several metres apart to allow healthy growth of the mature trees in the future. However in the case of paw paws or gum, for instance, the pits may be closer together. Paw paw wood is soft and can easily be trimmed and the tree life is more limited. After some years, a paw paw could easily be removed and the same pit site dug out and used again. This may make the paw paw more suitable for smaller plots in peri-urban or urban areas. Also pits can be planted along fences where trees may also be grown.

Ground water protection

The reduced depth of pits used with the ***Arborloo*** increases the distance between the raw excreta introduced into the ground and the local water table. However the reduced potential for ground water pollution is not related to pit depth alone. The contents of ***Arborloo*** pits also differ from standard pits in that they contain a mix of excreta, soil, ash, leaves etc which promotes an aerobic composting process in which the raw excreta is converted into a soil like humus much more rapidly than in deeper conventional pits. This earthy humus is quite unlike the original pit contents and its potential for contaminating the ground is likely to be much reduced compared to the almost raw excreta contained for years on most deeper pits.

These conditions include the existence of soil micro-organisms and air which the additions of soil and ash/leaves etc help to form. The process is different in the standard deep pit in which the pit contents of human excreta and anal cleansing materials are much more compact, exclude air and contain very few soil micro-organisms and where the process of conversion is normally of the anaerobic type which is far less efficient than the aerobic type promoted in the ***Arborloo.*** The addition of soil, wood ash and leaves for instance, in volumes which are about equal to the excreta is vital for this process. The resulting humus, far from polluting the ground, actually enhances the fertility of the soil and allows for increased biological activity which promotes the growth of plants and trees in particular in the ***Arborloo.*** However it is best to avoid areas which are subject to flooding, as the ground water may penetrate the pit and upset this natural composting process and spread pathogens before they have been destroyed. In such cases “above the ground” methods must be sought (see later).

Ground stability

The ring beam method of protecting a shallow pit may require some experimentation in some areas at first. In firmer ground the beam will remain very stable, but in looser and sandy soils more care should be taken. If an ***Arborloo*** pit shows any signs of collapsing - the ring beam, slab and structure can be removed within a few minutes and relocated elsewhere. In some places the soil is so firm that even a ring beam may not be required, especially where the ***Arborloo*** method is chosen. But even in this case, the possibility of pit flooding should be avoided with the use of a ring beam. Currently the ring beam is being tested in a wide variety of environments in Zimbabwe, from very sandy soils to firmer red soils.

The *Arborloo* - Stages of construction

Now we shall describe how to build and manage the simplest eco-toilet – the ***Arborloo***. The basic building components of both the ***Arborloo*** and ***Fossa alterna*** are the same, but the ***Arborloo*** is built with a single shallow pit about one metre deep in a temporary location. The ***Fossa alterna*** is built with two shallow pits which are deeper (1.2 – 1.5m deep), wider and permanently located. Generally ***Arborloo*** slabs and pits are made round to suit a more traditional type of structure, and ***Fossa alterna*** slabs and pits are made rectangular. But in fact whilst the building components of both these eco-toilets are basically the same, there is much variation in the way they are built. There are four basic components:

1. The shallow pit or pits
2. The component protecting the shallow pit (concrete or brick ring beam or brick lining)
3. The concrete slab
4. The “house” (superstructure).

To this can be added additional components like pedestals, vent pipes or hand washing facilities, which are optional additions. Low cost pedestals can be made very attractive by using standard plastic toilet seats in combination with a off-the-shelf 20 litre buckets. The method is described later in this book. Vent pipes (PVC or asbestos) help to ventilate the pit, providing a throughput of fresh air as well as removing odours from the toilet. Vents also remove excess moisture and condensation from the pit and composting materials. Hand washing devices attached to the toilet are essential if personal hygiene is to be improved.

Which slab and ring beam?

The ***Arborloo*** is normally made with a small round concrete slab and matching ring beam made of bricks or concrete. But there is much variation in the size and shape. Slabs and ring beams for the ***Arborloo*** can also be made rectangular (see chapter on ***Fossa alterna***). If a rectangular portable superstructure is to be used, the rectangular shape is preferred. If traditional poles and grass are to be used, the round shape may be better. Each has its advantages and disadvantages. Round slabs can be moved by rolling them, which can be a big advantage. This means that for the one metre diameter slab (and matching ring beam) a single person is able to move the slab and ring beam to the intended toilet site. Rectangular slabs and rings beams cannot be rolled so they need at least two people, and normally four persons to lift and move them. But rectangular pits are easier to dig and excavate than round pits. The pit linked to the one metre diameter slab is about 80cm wide, and this is not so easy to dig and re-excavate compared to the rectangular pit which provides more room for using the digging tools, and in the case of excavation, also for repeated excavation.

There are advantages in using a rectangular slab together with a rectangular movable superstructure. The superstructure just sits on top of the slab. The structure need never touch the surrounding soil and this can have its advantages. If part of the structure is made of timber, the termites are less likely to eat the wood if it is sitting on a concrete slab compared to being part dug in the ground. With round slabs, the structure is normally built around and outside the slab. This means that the soil must be raised around the slab. Generally round slabs are best for simple structures made from poles and grass.

Then there is a question of economy. A high strength round slab made with cement and river sand can be made one metre in diameter using ¼ bag of cement (10 litres) and 30 litres river sand (1:3) and 3 - 4mm reinforcing wire. This is a very strong and relatively light weight slab. It can be moved after 7 days of curing. The same size slab can be made with a mix of 5 litres cement (1/8th bag) and 30 litres river sand (1:6) and 3 – 4mm reinforcing wire. But in this case the cement and sand must be of the highest quality and great care must be taken at every stage of construction. 10 days of curing is required for this "economy slab." If care is not taken the economy slab will crack. If care is taken, it is as good as the high strength slab. The larger 1.2 metre diameter round slab can also be made also with 10 litres of cement and 50 litres river sand (1:5) and 3 – 4mm reinforcing wire. A 1.2m X 0.9m rectangular slab can also be made with the same mix of ingredients (see later). 8 litres of cement is provided in the "Compost Toilet Starter Kit" and is mixed with 30 litres river sand to make a 1metre diameter slab (see later).

The concrete ring beams linked to these various concrete slabs are made with the same mix of materials (cement, river sand and wire) as the matching slabs. All these alternatives are described in this book.

The ring beam is valuable since it helps to stabilise the head of the pit. In very loose sandy soil a ring beam may be inadequate, but in most places it works well. To lower costs ring beams can be made of local bricks. These can be mortared together with weak sand and cement for the ***Arborloo*** since they will be moved every 6 – 12 months. Termite mortar or clay can also be used to mortar the bricks together. Where the ring beam is made for the ***Fossa alterna,*** it will remain in position for long periods of time. So if it is made of bricks it is best mortared together with strong cement mortar. A concrete ring beam is ideal for the ***Fossa alterna***. If the soil is very loose and a ***Fossa alterna*** is chosen, then the shallow pit (dug down 1.2 – 1.5m) should be brick lined to the base.

Upgradeability

Since this concept of making humus in shallow pits for growing trees and vegetables is still evolving, there is still room for various ways of doing things. A family may decide to start by building an ***Arborloo*** using a one metre diameter slab and bricks as a ring beam. This slab may use a quarter bag of cement (or even an eighth of a bag with care for the economy model). Then the family may decide to make a concrete ring beam later. If well made, the concrete work will last almost indefinitely – it is just moved from one location to the next – there is no need to reconstruct it every time the toilet moves – and this can be an advantage. Then, later on, the family may choose to use the pit humus for use in the vegetable garden rather than grow trees. In this case the family can make two extra ring beams of bricks or concrete and rotate the toilet around the three permanent toilet sites and excavate the humus after one year of composting. Even the toilet which uses one slab and three rings beams will use only a single 50 kg bag of cement for the high strength concrete version or half a bag for the economy model. But care is required with using economy concrete. It must be made and cured properly with quality sand and cement. Otherwise it may crack, which is not such a good idea on a toilet. The family may decide to grow trees some years and make humus in other years. The options are open and available.

Protecting the pit – ring beam and brick linings

If the soil is firm and a light superstructure is used, and particularly for the ***Arborloo,*** it may not be necessary to protect the pit at all, since it will be used for a limited period of time (up to 12 months) and the chances of collapse are minimal. However, it is always best to lay the concrete slab above ground level to avoid erosion due to surface water flowing during the rains. Composting does not work very well in very wet conditions and it is best to avoid pit flooding. So it is desirable to build a ring of bricks around the rim of pit, on which the slab is mounted. Such a ring of bricks is called a "ring beam." But not all ***Arborloos*** are built with them.

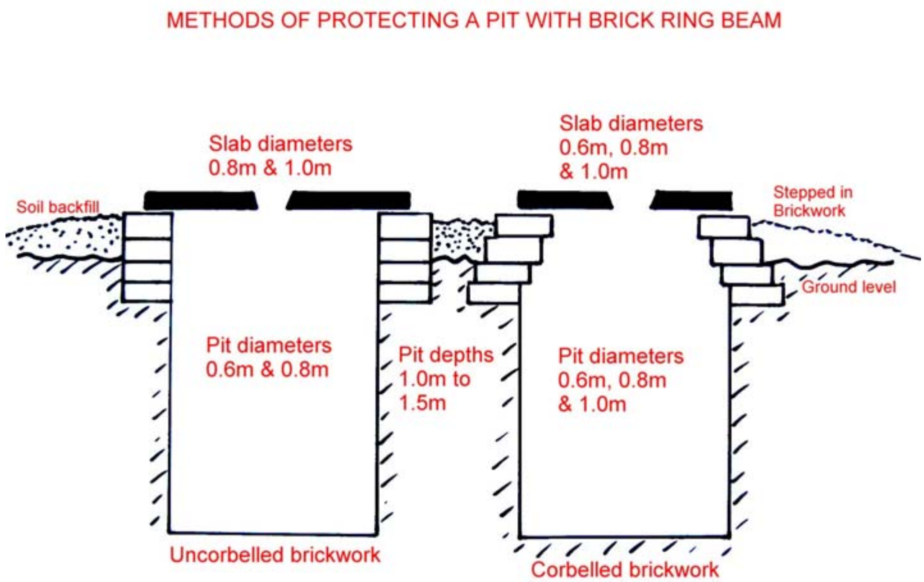
These *Arborloos* built in Embanweni, Malawi, where the soil is firm, do not have any form of pit protection. The 0.8m diameter concrete slab is laid directly over a 0.6m diameter hole and the simple superstructure built on top. The pits are dug about 1.0m deep.

In most other cases where the structures are made of light traditional materials like poles and grass, it is best to mount the concrete slab on a "ring beam." This raises the slab above ground level and helps to reduce the chances of pit flooding during the rains and also stabilises the whole unit. This is true for both the ***Arborloo*** and the ***Fossa alterna.*** In most cases where the soil is moderately firm and stable, and the superstructures are not made of bricks, the ring beam may be all that is required for pit protection.

Only when the superstructure is heavy and built with bricks, must the pit be fully lined with bricks. But since most of the toilets described here do not use bricks, they do not require fully lined pits. In any case the ***Arborloo*** will rarely be made of bricks and is relocated once or twice a year and the pit may need little protection unless the ground is soft. In most cases a "ring beam" which is constructed in a round or square shape is made up of bricks or concrete and build around the pit head. Or rather the other way round! The ring beam is made first on the site and only then is the pit dug inside it. Then the slab and structure are mounted on top. There are several ways of protecting the pit with a ring beam.

Brick ring beams

These can either be made round, square or rectangular depending on the slab shape chosen. If made of bricks, it is often best to cut down into the soil about 0.3m and dig out an area large enough to lay cement or termite mortared bricks so that the internal measurement of a round pit is at least 0.6m across. The bricks are built up from beneath ground level and then at least one course above ground level. Ring beams for the ***Arborloo*** do not need to penetrate the earth so far, because the toilet will not remain in the site for more than one year. Many ring beams made for the ***Arborloo*** in Malawi are made to support slabs which are only 0.6m in diameter, but one meter diameter slabs can be placed over slightly wider pits which last longer.



The arrangement of slabs and upper brickwork protection of circular pits. The brickwork can be constructed vertically upwards or "stepped in" a little at each course (corbelling). The corbelling method is more complicated but allows for a slab to be added which is the same diameter as the pit. This is useful, as a slab of a particular diameter can be fitted on a wider pit with greater volume.

Arrangement of brick "ring beams" for the *Arborloo*

Arborloo pits in Malawi are dug round, and using a 0.8m diameter slab the pit is about 0.6m in diameter and about 1m deep with straight sides. The ring of bricks is cement mortared around the rim of the pit, preferably cut down into the softer topsoil and built up to at least one course above ground level. If a 0.8m diameter round slab is placed on top, the ring beam will give 10cm of support all the way round. If a 0.6m diameter slab is used, the pit can be dug to the same diameter, but the layers of brickwork in the ring beam must be stepped in (corbelled) to give sufficient support for the slab. If a 1m diameter slab is used, the internal diameter of the pit and ring beam (without corbelling) can be 0.8m diameter. A 1m diameter pit can be held up by a corbelled ring beam on a pit 1.0m in diameter. With less experience avoid the use of corbelling and use a 0.8m diameter slab mounted over a 0.6m diameter pit or a one metre diameter slab mounted over a 0.8m diameter pit.

The left picture shows the arrangement of bricks in the corbelled (stepped in) method of making a ring beam to protect the pit in Malawi. In the case shown four courses of bricks have been laid. Two courses are laid end to end around the pit and two courses with the bricks laid radially. This provides extra strength. The bricks are best bonded with cement mortar or traditional mortar made of special soil cut from anthills or from other sources. The brick protection usually starts beneath the ground and rises above ground level. On the right a concrete slab is mounted over the ring beam of an *Arborloo.* In this case both the pit and the slab are 0.6m in diameter. The pit was 1.0m deep below ground level. Soil cut from the hole is then placed back around the ring beam up to slab level and the structure then built on top. This makes a stable unit.

Another case in Malawi showing corbelled brickwork protecting a shallow pit of an *Arborloo.* Once again the diameter of both the pit and slab is 0.6m. Here the poles for the structure have been mounted in the ground before soil from the pit soil is placed back around the brickwork up to slab level.

A brick ring beam being built at Kufunda training centre, Ruwa, Zimbabwe. In this case two courses of bricks are laid on top of each other without any corbelling as this is considered easier for villagers. The bricks are mortared with local ant hill soil which resists erosion. The 0.8m diameter hole is dug inside the ring beam and the soil placed around the ring beam and rammed in place. The 1m slab is then fitted.

Making concrete ring beams

Making toilet components in concrete is usually a good investment. If well made and cured, concrete lasts for decades, and its services can be relied on for generations. Thus a well made concrete ring beam (or two in the case of the ***Fossa alterna***) should last indefinitely if cared for, and will not require reconstruction. This also applies to the slab which should always be made in concrete.

The concrete ring beam can be used in both the ***Arborloo*** and the ***Fossa alterna***. The ***Arborloo*** will use one ring beam, the ***Fossa alterna,*** two ring beams. This system of construction is used in some parts of Zimbabwe and ring beams and concrete slabs are either round or rectangular in shape. Normally round ring beams are used for the ***Arborloo*** and rectangular ring beams for the ***Fossa alterna***, but these are interchangeable.

Making round concrete ring beams

In this case a concrete ring beam has been made in a circular shape with a mix of 10 litres cement and 30 litres quality river sand. The mould is made from bricks over a plastic sheet. For the inner ring of bricks a mix of full and half bricks has been used. Spaces between bricks in the inner ring have been filled with segments of stiff plastic. The inner diameter of the concrete ring beam is 85cm and the outer diameter 115cm. This provides for a ring beam width of 15cm all round. Half the mix (5 litres cement mixed with 15 litres sand) is made up first and added between the two brick rings. Then one circle of 4mm wire is placed on the cement midway between the bricks. If in sections the ends of the wire should be slightly bent.

The second half of the full mix is then made up and added to the mould and smoothed off with a wooden float. Two handles are added, one at each side of the ring beam. The beam is then covered with plastic and left overnight. The following morning it is watered down, covered and kept wet for another 10 days before being moved. The fully cured ring beam is then taken to the toilet site and placed on the ground and levelled off. A hole is dug down within the ring beam down to a depth of between 1m and 1.5m. The removed soil is placed around the ring beam and rammed in place (right photo). The matching 1 metre diameter slab can now be fitted (see later). This is followed by the construction of the superstructure.

Concrete slabs

The concrete slab is an essential part of any toilet. Once well made and well cured it should last almost for ever. So it is worth investing in the cement and good ingredients right from the start. Once a good concrete slab has been made, it can be fitted on various types of toilet including the ***Arborloo*** and ***Fossa alterna.*** The ingredients are fresh cement, clean sharp river sand and some 3 – 4mm diameter wire for reinforcing. Even better if granite chips can be found to mix with the sand, but it is not easy to find in most rural locations. The cement should be fresh, since over time its ability to make good concrete does fall off. Also the type of sand is important. Pit sand dug out of the ground will not do. Clean river sand taken from the river and washed is best. It should have a range of sizes of sand including some chips and very small stones. Also some reinforcing wire is required. It does not need to be thick steel bar. It can be wires between 3mm - 4mm in diameter. 3mm wire is fine. Concrete slabs are cast in a mould which is normally made of bricks or wooden planks depending on the shape.

It is best to lay the concrete over plastic sheet, as this retains the ingredients and helps to improve the final strength The wire is placed inside the concrete half way up, so half the mix is added to the mould first, the wire is added, then the final part of the mix is added and smoothed down with a steel float. A hole is made for squatting and a special mould is required for this. It also helps to add handles, made from lengths of 8 - 10mm steel bar. These make lifting the slab easier. A most important aspect of making concrete is the curing. Concrete sets quite quickly and within a day can be quite hard. But it takes much longer to develop strength. The concrete cannot develop strength if it is allowed to dry out. So a curing slab must be kept wet at all times. Also the longer the curing time, the stronger the slab will become. So it is best to keep the slab wet and cure for at least a week before it is moved. For the more economic slabs using a 6:1 mix, 10 days curing is recommended. It is also best kept the slab under a plastic sheet or at least under a layer of wet sand to keep it wet. If properly made, a well cured concrete slab will last indefinitely. It is a good investment in money, time and effort.

Concrete slabs are a very important part of the structure of all pit toilets. They are not difficult to make if the simple constructional details are followed. Making concrete components is a very good way of investing money for the future. If well made, concrete lasts almost for ever. Here school children make a concrete slab in Mombasa, Kenya

Making round concrete slabs

Round slabs are used a great deal in Malawi, and increasingly in Zimbabwe and suit the ***Arborloo*** and ***Fossa alterna*** principles very well. Very often round slabs are made in a dome shape in Malawi without reinforcing. But concrete slabs are easier to make flat with a little reinforcing. Reinforcing wires are generally available in most local hardware stores. Some of the new generation round slabs are also made with handles for use in eco toilets so that the movement of the slab from one location to the next is made easy.

Making a strong 1 metre diameter round concrete slab

The mould is made from bricks laid on plastic sheet. This slab is 1 metre in diameter and made with a total of 10 litres cement (quarter bag) and 30 litres quality river sand. Four pieces of wire 4mm in diameter each 90cm long are used as reinforcing. The mould for the squat hole is placed slightly to the rear of centre. The same size slab can also be made with a weaker mix of 6 litres cement and 30 litres quality river sand (5:1). In this case the construction and curing must be undertaken meticulously.

Half the mix is made first with 5 litres cement and 15 litre river sand in a wheelbarrow. The concrete slurry is added to the base of the mould and distributed evenly over the whole surface. The four wires are then added as shown at right angles to each other.

Another mix of 5 litres cement and 15 litres river sand is now made up as before and added to the mould over the wire reinforcing. The concrete is levelled with a wooden float and then finished off with a steel float. Two handles are placed on either side of the squat hole to make picking up easier and more hygienic. 10mm steel bar is best for the handle if it is available. The concrete is left overnight and the following morning watered down and then kept wet for about7 days. The slab is only 32mm thick, and relatively light to pick up or role into place. The 3:1 mix is a very strong one. This slab is made to fit over the circular concrete ring beam shown earlier or over a ring beam made of bricks. This is shown later.

Making an "economy" 1m diameter concrete slab and matching ring beam

Using great care, it is possible to make a 1m diameter concrete slab using only 5 litres of cement mixed with 30 litres of river sand (6:1). A matching ring beam can also be made with the same mix. The same technique is used as described earlier for the 1m diameter slab and ring beam made with a 3:1 mix. So it is possible, with great care, to make both a slab and a ring beam with only 10 litres (1/4 bag) of cement. But there is not much room for error. The following list of essentials are required: 1) The cement should be fresh. 2) The sand should be quality river sand. 3) The slab should be made in a mould mounted over plastic sheet. 4) The slab should be reinforced with 3 or 4mm wire (4 pieces). 5) The cement and sand should be measured carefully. 6) The dry materials of cement and sand should be thoroughly mixed before adding water. 7) Water should be added so the final mix is not too wet. 8) The concrete should be thoroughly mixed again. 9) Half the concrete mix should be added to the mould first and levelled all over with a trowel. 10) The four 90 cm long 3 - 4mm reinforcing wires are laid in a square formation around the squat hole mould. 11) The second half of the concrete mix is then added, levelled off, compacted and smoothed down with a wooden float. 12) The concrete work is finished off with a steel float, paying particular attention to the area around the squat hole and the rim of the slab. 13) Steel handles are placed on either side of the slab and the concrete smoothed off. 14) The squat hole mould is carefully removed after an hour and the edges made neat with a trowel. 15) The slab is covered with plastic sheet overnight. 16) The following morning the slab is watered down. The slab is kept wet under the plastic sheet and not moved for 10 days. 17) The slab is then lifted and taken to the ring beam (brick or concrete) and laid on a bed of clay, anthill mortar or weak cement mortar.

A measuring device can be made with a 2 litre plastic milk bottle cut in half. Measured amounts of water are added and marks made on the bottle. When full the measuring device holds one litre of material. A mark showing half a litre is also shown. For this slab 5 litres of cement is mixed with 30 litres sand (6:1).

The first half of the mix is added to the mould and levelled off and smoothed down. The 4mm reinforcing wires are added and the second half of the mix is then added. It is tamped down and levelled off with a wooden float. The slab is also steel floated. Steel handles are added. It is given 10 days to cure, being kept wet and covered throughout this period. Good ingredients, mixing and curing are essential. A well made and well cured "economy" slab is quite strong enough for the job as the photo shows.

Sequence of fitting the circular concrete ring beam and slab.

The construction of a 1 metre diameter concrete slab with matching concrete ring beam using between one quarter and half a 50kg bag of cement (depending on the mixture used) is a good investment for the family. The advantage of the concrete ring beam, as opposed to the brick one, is that it is permanent, will last almost indefinitely and can easily be moved from one location to the next. The circular slab and ring beam are easy to move because it can be rolled.

Where the concrete ring beam/concrete slab combination is used as an ***Arborloo,*** the toilet is used for as long as the pit can accept the combination of excreta, soil, ash and leaves. Once full, the entire structure (ring beam, slab, house) is moved to the next location. The ring beam is put in place, the pit excavated within it, the slab mounted and the superstructure put in place again or reconstructed. At each full pit site soil is added to the pit contents and a tree planted.

But the system can also be used to make humus (like the ***Fossa alterna***) for the vegetable garden. Using these smaller ring beams and matching 1 metre diameter slabs, 3 ring beams and one slab can be made from between half and one 50 kg bag of cement, depending on the mix. In this case the 3 ring beams are made and located on site and remain in their original locations. The matching slab and superstructure rotates around them in sequence. Since the pits are smaller than the normal ***Fossa alterna*** pit, the slab and structure may need to be relocated every 6 months. But by the time the third pit has been filled, the humus in the first pit will have had adequate time to compost. The compost can be dug out and the slab and structure relocated on its original site. In this way there will be a never ending source of humus. If for some reason the ground starts to fail, the ring beam can be moved to a new site.


The site of the toilet is first levelled off with a hoe and the rim beam placed firmly on the ground. The hole is then dug inside the ring bean down to a depth of 1 to 1.5 metres. Some of the excavated soil is placed around the ring beam and rammed in place. This will help to prevent rain water undermining the pit.


The slab is then brought close by. A layer of clay, cement or termite mortar is then laid on the ring beam, The slab laid centrally on the ring beam. Now the superstructure must be built around the slab.

Fitting the slabs

Once the slab has cured properly it is removed from the mould, washed down with water and fitted over the ring beam at the head of the pit. It is a good idea to bed the slab in some weak cement mortar laid over the beam to allow the slab to settle properly (slabs and beams are never made perfectly level). Alternatively some anthill mortar can be used. Hopefully at this stage two sacks of dry leaves will also have been deposited into the base of the pit to help the composting process. Once this has been done, the time has come to fit the superstructure.

Optional pedestal

It is possible to fit a pedestal on to any pit or eco-toilet, but the slab must be made specifically for it – with a 30cm diameter hole, rather than the 30cm X 19cm squat hole. This includes the ***Arborloo***. Commercial pedestals are available, but expensive. It is possible to make a strong home made pedestal at much lower cost. As time passes pedestals are becoming more popular in several countries where squatting was once the norm. Those who are more elderly greatly appreciate them. Constructional methods for home made pedestals are described later in this book.

Home made pedestal placed on the slab. The pedestal is smart, cheap and durable.

Superstructures

Toilet superstructures are built mainly for privacy, and protection from the weather. For the ***Arborloo***, they need to be portable or easily moved from one location to the next. A large range of materials can be used for the construction of the superstructure. These include poles and grass, frames made from poles, reeds, bamboo, wooden planks and steel etc with a variety of coverings for privacy. Coverings include grass, reeds, reed mats, plastic sheet, shade cloth, timber planks, iron sheeting, Hinged (using car tyres) or hanging doors may be fitted or the structure can be made without a door in a square spiral configuration. The type of superstructure chosen may depend on the availability of local materials. There is enormous variation in the type of structure which can be built, both for the ***Arborloo*** and the ***Fossa alterna.*** The finished superstructure for both the ***Arborloo*** and ***Fossa alterna*** can best be illustrated by showing and describing photos taken from a number of countries including Malawi, Mozambique, Kenya, South Africa and Zimbabwe

The Arborloo photo gallery


Left, the simplest superstructure – poles and grass – no door - no roof. Thanks to Jim Latham, Eco-Ed Trust. Right, slightly more advanced – pole and grass structure with door and roof. Low cost and very durable door hinges can be made with cut sections of car tyres. Photo taken an Fambidzanai – Permaculture Training Centre


Left, simple portable structure made from poles and grass in Mozambique. This one has no door but has a roof, which has just been removed. The various sections are in panels and can be taken apart. Photo taken in Niassa Province. Thanks to Ned Breslin, WaterAid. Right, *Arborloo* structure built at Kusa Village, near Kisumu. Thanks to Osienala and RELMA


Woven basket superstructure from Malawi. Thanks to Steven Sugden and WaterAid.
Woven basket structure on *Arborloo* in Northern Malawi. The door is made from sacking. A neat and effective unit. Photo: thanks to Jim McGill, Embangweni eco-san project.


Arborloo **structure with low cost vent pipe. On the left the structure is made of poles and grass with low cost vent made with sacking and cement slurry. The interior is shown on the right. Thanks to staff of Mvuramanzi Trust. Zimbabwe.**


Structure made of bamboo and reeds. The four main bamboo uprights are anchored in the ground. They can be protected to a certain extent from ants with old engine oil or wood ash. The hinge for the door is made of old car tyre, as shown on the right. This material makes an effective and durable hinge.


Structure using small gum poles and old cement packets – also with a door Photo taken at Kufunda Village Ruwa. Thanks to Marianne Knuth. Moving an *Arborloo* superstructure in Maputaland, South Africa. Note the wooden structure has legs. Thanks to Dave Still and Stephen Nash of Partners in Development.



Two portable structures at Woodhall Road, Harare. One made of gum poles in sections which are wired together (right). The structure on the left is a steel frame covered with grass walling. Note hand washing device hanging from structure. All toilets should be provided with a hand washing facility. The structure made with steel frame and grass covering is easy to move. This is an excellent system where the frame is light and very durable and will last for many years. Less durable low cost walling materials like grass can be replaced when required. Photo taken at Fambidzanai, near Harare.



Photos of the steel frame *Arborloo* structure with grass walls and door made of sacking cloth. The vent pipe is a low cost home-made type made by wrapping plastic sheeting around a PVC pipe, then applying hessian and cement slurry. The structure has a door with car tyre hinge (see close up).



Simple *Arborloo's* at the Eco-Ed Trust, Mutorashanga, Zimbabwe. The pole and grass structure is easily taken apart and reconstructed from the original materials. The grass can be replaced every year if required. This type does not have a roof, but a roof is desirable to keep out rain. Thanks to Jim Latham,

Management of the *Arborloo*

Daily management of the *Arborloo*

The ***Arborloo*** is used like a normal pit latrine in that urine, faeces, anal cleansing materials (preferably paper) are added to the pit on a daily basis. In addition and in order to build up the mix of ingredients which assist in the conversion of faeces into humus, it is important to regularly add dry soil and wood ash to the pit, preferably after every visit made for defecation. This material is best made up beforehand in the dry state, stored in sacks or bags and then added to a smaller container within the latrine. About four parts sifted dry soil and one part wood ash are mixed. Half a mug full of the soil/ash mix should be added after every visit made to deposit faeces. It also helps to add leaves to the pit – these improve the texture and nutrient value of the final humus.

It is wise to collect fertile soil in dry weather conditions and store this for future use in the latrine. It can be stored in bags or even in heaps in a part of the garden and covered with a plastic sheet during the rains. Wood ash should also be stored for future use. Although fertile soil is the best for use in the ***Arborloo*** pit (and also the ***Fossa alterna*** pit), the actual soil used will depend on what is easily available. The most obvious choice is to store the soil that was dug out of the pit during the initial excavation and re- introduce this back into the pit, every day. Sometimes wood ash may not be available or will be added separately. The most important ingredient to add is soil. Adding wood ash helps a great deal, especially in reducing odours and fly breeding and making the mix slightly more alkaline. Leaves improve the texture and also nutrient levels in the humus and also help to aerate the mass.

Experience over time, by the householder, will show that the best results are obtained when a mix of ingredients is put down the pit. This mix may include: excreta (urine and faeces), paper, topsoil, wood ash and leaves. The exact amount and mix must be judged over time. Clearly it would make no sense to add an excessive amount of soil, as the pit will fill too fast. As a rule of thumb the amount of soil added should approximately equal the volume of the excreta.

These additional materials help to improve the final texture and quality of the humus formed in the pit. It is also very desirable to add a sack full of dried leaves to the base of the pit before use and also a small sack full of leaves to the pit at 3 or 6 monthly intervals to increase the proportion of air and humus like material in the pit. The proportion of addition materials placed in the pit should be about equal to the volume of solids added. About half to a full mug full per visit after faeces have been added. In fact much of the bulk of the excreta will be absorbed into the dry soils and other dry materials (wood ash) added. It is important to add dry soil and dry wood ash to the pit, as these will help to absorb moisture from the excreta. Certainly some of the urine will be absorbed into the pit soil. Excess urine may also percolate into the soil surrounding and under the pit which will enhance it nutrient content prior to root invasion by the tree, even though some also nutrients will be lost.

No Garbage please !!!

It is also important to avoid placing non - biodegradable materials down the pit. These include rags, plastic sheets and bags, bottles, rubber objects and all manner of other objects that are often put down standard pit latrines. Whilst this part of the management is more important with the ***Fossa alterna*** where the pit contents are excavated (see next chapter) it is wise also in the case of the ***Arborloo.*** It is important that the pit is filled with good soil, not a pile of rubbish mixed with soil.

Flooding!

The conversion of excreta into humus will not take place if the pit is flooded with water. This means that only limited amounts of water should be added to the pit. Good pit drainage very much dependent on soil type and area of soil in the pit available for drainage. Where the ring beam method of pit protection is used a large surface area of soil will be available for pit drainage. Pits lined with bricks or concrete rings do not drain so well.

Distributing pit contents

For the best results, and to ensure the best possible use of the pit volume, it pays for the user to look down the pit from time to time and level the contents. Since dry soil and ash when added to the pit tend to make deposits of excreta less fluid, the pit contents tend to rise up within the pit directly under the squat or pedestal hole. A central mound is thus formed – a process called "turreting." If the most economical use of the pit volume is to be made, it is very important for this mound to be flattened off from time to time with a stick. This flattening out of the pit contents and the occasional addition of a bucket of water helps to keep the contents moist and well distributed within the pit. These procedures will lengthen the life of the pit.

Relocating the *Arborloo*

When the ***Arborloo*** pit is almost full***,*** the superstructure and slab are removed and put on one side. The ring beam is dug out and removed (or taken apart if made of bricks) from the old site and placed on a new site nearby. It does help to have handles fitted to the concrete ring beam in the case of the ***Arborloo***. This makes the movement easier and more hygienic. After the ring beam has been well placed and levelled on the new site, a new hole is dug down within the ring beam, as before, and the ring beam surrounded by soil taken out of the hole. The soil surrounding the ring beam is rammed hard in place.

The slab and superstructure are remounted on the ring beam as before. A seal is made between the ring beam and slab using a weak mix of cement and sand (1:20) or a clay like or termite soil made into mortar. The new location is chosen with care, taking note that the trees once planted will often grow large. Pits should not be closer that 3 metres apart. For trees which are known to grow large 5 metres may be a better distance. In a school setting or family homestead the ***Arborloos*** may be placed in an area which will turn into a wood lot or fruit tree orchard.

Preparations for tree planting

The contents of the used pit (filled with excreta, soil/ash/leaves etc) are now levelled off and topped up with fertile soil, at least 150mm deep. This soil can come from old compost heaps, fertile soil/leaf litter found under trees or any other place where the soil looks good. The aim is to plant the young tree in the topsoil so the roots come nowhere near the excreta layer. The more energetic can actually cover the pit contents first with soil and ram it into the mass with a pole, thus increasing the soil content of the pit. Ramming in soil actually promotes the conversion process. After ramming in extra soil into the pit contents, the final topsoil layer is added to completely cover the excreta lay and prepare it for tree planting. This final layer of topsoil should be at least 150mm thick.

Natural growth of trees in latrine pits

When a latrine pit is abandoned the contents contract in volume. Seeds of various types may fall into the depression formed and start to germinate. The kitchen wastes may also be thrown into such an abandoned pit. Pumpkin and tomato seeds will almost certainly germinate in such an environment. The same holds true for the seeds of trees that may fall into the old pit depression. The fact that this process occurs in Nature suggests that the medium found in these pits offers a suitable medium for plant growth.

A new latrine is being built to the left. On the right is the depression left from an old latrine pit. Close inspection reveals that an indigenous tree is starting to grow there. Photo a Kusa Village, Kenya.

The importance of trees

The most important aspect of the promotion of the ***Arborloo*** principle is that a link is made between the worlds of sanitation and forestry. The world lacks trees and they have such a beauty and value of their own which adds much to the world we live in. There is no part of the world that could not benefit by having more trees. This applies particularly to those barren parts of the developing world where trees may have been lost years ago and the resulting effects of erosion or reduced soil fertility are being felt. By linking the production of new trees with the reuse of human excreta we combine a problem (the disposal of human excreta) with a need for new trees and the many benefits they may bring forth. With each tree a story can be told. After ten years of use an ***Arborloo*** can leave behind a fine orchard of fruit trees or a wood lot of gums suitable for fuel or building. The tree is one of nature's marvels. It can be the provider of food, fuel, building materials, and medicine. It helps to stabilise the soil and offers shade. It provides leaf litter and thus provides additional fertility to the soil. It also provides beauty and richness to our environment. It helps to reduce erosion. The ***Arborloo*** is an elegant solution, which in the simplest possible way is able to provide an effective solution for low cost sanitation, adds greatly to the promotion of trees, and also offers an excellent example of recycling human excreta. Not surprisingly it is gaining popularity in many African countries.

Magnificent trees near Lake Victoria

The time has certainly arrived when we need to make the world of sanitation more interesting. And certainly one effective way of doing this is to make strong links between the sanitary world and that of agriculture in its many forms. Ecological sanitation has come at the right time, to offer us a practical way of doing this. That is what is good about ecological sanitation. It brings the worlds of agriculture, forestry, horticulture, food, fruit, herbs, natural medicines, fuel and many other things together.

Every means possible should be taken to grow more trees of all sorts, exotic trees and also indigenous trees. The links made between sanitation and the propagation of more trees is an important one. The value of the nutrients available in excreta, even if they exist below ground level, can be realised and witnessed with ease. Fruit trees grow very healthily on such organic pits if planted correctly, watered and protected. The fruits when tasted are delicious. What simpler and better way of demonstrating the concept of ecological sanitation and "closing the loop!"

The concept of the ***Arborloo*** is being promoted and tested in countries like Kenya, Mozambique, Malawi, Zambia, as well as Zimbabwe, where it is thought to have considerable practical application. The potential for its use throughout Africa is enormous. Because the method and concept is simple and yet retains the basic elements of ecological sanitation, it is thought of as a good first step along a route of increasing sophistication within the realm of ecological sanitation. It is, for instance, possible to upgrade the ***Arborloo*** and make a ***Fossa alterna***, moving quite simply from a series of single pits into a permanently sited alternating double pit system (***Fossa alterna***). By slight modification or replacement of the latrine slab (making a vent pipe hole), the system can be upgraded further to a VIP latrine. The ***Arborloo*** is the very best method of entering the world of ecological sanitation. The method is simple and cheap and there is no handling of processed human wastes. Many people may prefer to start off with this option. It is an excellent "entry point" for ecological sanitation.

Examples of *Arborloo* programmes

The *Arborloo* in Malawi

The **Arborloo** is very popular in Malawi perhaps because trees have been planted on old latrine pits for generations. Where the ground is hard the slab may be placed directly on the pit cut in the ground. In softer ground a ring beam or corbelled brick ring wall is built up from below ground level to above ground level and backfilled. Round slabs are very common in Malawi. As many as 8 slabs 0.8m in diameter can be made from a single bag of cement (left). Many domed slabs have no reinforcing. The one shown at left has 2 metres of 2.5mm wire placed in it. Photos taken in Phalombe district.


Most *Arborloos* in Malawi are of simple construction using poles and grass Photos taken in Embangweni (left) and Phalombe (right). Thanks to CCAP and COMWASH.

Making the 0.8m diameter round slab in Malawi


Making a round 0.8m diameter concrete slab in Malawi with sharp river sand and cement. When the river sand is of high quality, the addition of granite stones may be unnecessary. In this case a tin strip 40mm deep is formed into a circle 0.8m in diameter and supported by bricks. It is laid over a sheet of plastic. 4 wires are cut as reinforcing. In this case 2 metres of 2.5mm wire has been cut into 4 pieces (2 X 0.55m and 2 X 0.45m). 3mm or 4mm wire can also be used. The mix of sharp river sand and cement is 4 to 1(20 litres river sand and 5 litres cement). 8 slabs can be made from one 50 kg bag of cement using this method. High quality river sand and proper curing are important.

The sand and cement are thoroughly mixed and water is added to make a stiff moist concrete. The squat hole mould is added in the centre. Half the volume is added first, then the reinforcing wires, then the final part of the mix is added and trowelled flat and finished off with a steel float. The tin and squat hole moulds are removed and the slab covered with plastic sheet and left for 10 days to cure being kept wet throughout the curing process after setting. Photos taken in Phalombe. Thanks to COMWASH

The 1.0m diameter round slab in Malawi

Making a round 1.0m diameter concrete slab in Phalombe with high quality sharp river sand and cement. In this case a circle of bricks one metre in diameter is laid on the ground. Some sand is added to level off. A sheet of plastic is then laid inside the brick mould. 4 wires are cut as reinforcing. In this case 3 metres of 2.5mm wire has been cut into 4 pieces (2 X 0.7m and 2 X 0.8m). 3mm or 4mm wire can also be used. The mix of sharp river sand and cement is 3 to 1(30 litres river sand and 10 litres cement). The process is the same as for the 0.8m slab. Cure for 10 days and keep wet at all times after setting. 4 slabs can be made from one 50 kg bag of cement using this method. High quality river sand and proper curing are important. Thanks to COMWASH

A quality hand made 0.8m diameter domed circular slab made with a mix of stone chips, river sand and cement with footrests and handles. No reinforcing has been used. With this method 4 slabs can be made from a single 50 kg bag of cement. This is mounted over a circle of bricks laid as a ring beam for the *Arborloo* as shown on the right. Where the slab is used on a *Fossa* alterna it is mounted on a ring beam made of bricks (or concrete) at the top of the pit (where the soil is firm) or on the uppermost course of bricks in a fully lined pit which extends above ground level. The larger diameter one metre slab is best used on the *Fossa alterna* and the smaller 0.8m diameter slab on the *Arborloo.*


On the left a pole and grass *Arborloo* in the Phalombe plain. Thanks to COMWASH. On the right a brick *Arborloo* built in a peri urban settlement near Lilongwe, Malawi. Thanks to WaterAid, Malawi.

Sequence of building low cost *Arborloo* in Zimbabwe at Kufunda Village

Making the 1 metre diameter concrete slab


The circle for the 1 metre diameter slab mould is marked on levelled ground and bricks placed together in a circle


Plastic sheet is placed inside the mould and the concrete mix is made up in a wheel barrow (30 litres of good clean river sand and 5 litres of fresh cement. This is thoroughly mixed before and after adding water to make the concrete mix. Using this economy mix 8 slabs can be made with a single 50kg bag of cement.


A mould for the squat hole is made with a bucket or with bricks as shown here. Half the mix (about 17 litres) is added to the mould first and levelled off. The four 90cm pieces of wire (3 – 4mm thick) are added to make a wire square around the squat hole. Then the remaining concrete is added, levelled, tamped down hard and finished off with a wooden float and steel trowel.

Two thick wire handles are made up and inserted in the concrete on either side of the slab. A little extra cement can be added around the handles for extra strength. After an hour or two the mould for the squat hole is removed and the hole made neat with a trowel. The slab is covered with plastic sheet and left overnight. In the morning it is soaked in water and covered again. It is kept wet for 10 days under the plastic sheet. The longer it is kept wet under plastic sheet the stronger it will become.

Making the brick ring beam

A suitable site for the toilet is located, preferably on slightly raised ground. A circle is marked on the ground 80cm in diameter. A ring of fired bricks is laid on the chosen site around the mark to start making the ring beam. Anthill mortar is gathered, broken up and mixed with water to make a stiff mortar.

The brick ring beam is bonded together with anthill mortar, in between and above the bricks. Two courses of bricks are laid, one above the other and placed so that the upper bricks lay over the joint between the lower bricks. (note - if bricks are not available a concrete ring beam can be made instead).

The pit is dug out down to 1 – 1.5 metres and the extracted soil placed around the ring beam and rammed in place. The ring beam and surrounding soil will help to make the toilet stable.

The slab is then moved and placed over the ring beam embedded in a layer of anthill mortar to keep it steady. The superstructure is now built with locally available materials like wooden poles and grass).

Making a concrete ring beam

Two circles of bricks are laid over a plastic sheet. They are arranged so they form a mould in which the 6:1 mix of river sand (30 litres) and cement (5 litres) is placed. The open joints formed between the bricks of the inner circle of bricks can be filled with wet sand before adding the concrete mix. The mix is made in a wheel barrow and thoroughly mixed. Half the mix is added first to the mould. This is followed by a complete circle of 3 – 4mm wire. The remaining half of the mix is now added. The concrete is beaten down hard with bricks (see left photo) and smoothed down. The ring beam is then covered with plastic sheet and left over night. The following morning it is soaked in water and left to cure for 10 days. It is kept wet and under the plastic sheet throughout the curing period. After 10 days it can be lifted and placed on to the toilet site. A pit 1m – 1.5m is dug inside the ring beam. A sack of leaves is added and the concrete slab placed on top (in anthill mortar). The structure is then built around the slab. Soil, ash and leaves are added frequently to the pit contents to encourage the formation of good compost. For more detail see Appendix on low cost construction of ***Arborloo.*** Thanks to Marianne Knuth and Kufunda Village.

The Kufunda outreach programme in the villages

Trainees from Kufunda go back to their villages and show others how to caste simple concrete slabs and build the ***Arborloo.*** Whilst the cost of the cement is low (one 50 kg bag costing around USD8.50 can serve five families), most families prefer to spend their scarce resources on food or school fees. Consequently the concept of a “Compost Toilet Starter Kit” has been introduced. The Starter kit provides enough cement to make a one metre diameter concrte slab and also provides a young tree and simple instructions. The Kit contains 8 litres of cement (one fifth of a 50 kg bag), which is mixed with 30 litres of river sand to make the concrete slab. Some wire is also required. Both river sand and wire are available in most villages. Ring beams are normally made with local fired bricks bonded together with termite mortar. Structures are normally built in the simplest way at first – made from grass and poles. Often there is no roof at first. But even at this stage, a significant step forward has been made to the provision of sanitation in the village. The regular addition of soil and wood ash ensures significant reductions in both odour and fly breeding without the use of a vent pipe. Simple as it is, the construction of the ***Arborloo*** signifies a significant step forward in the provision of low cost and affordable sanitation.

Once the ***Arborloo*** has been made, the toilet can be upgraded at a later date, using the same slab with a more permanent concrete ring beam, and a more substantial house fitted with a roof. The family may choose to build a second or third pit and use the ***Fossa alterna*** (alternating pit) system in time, rotating the use of the toilet between two or three pits. This becomes a more obvious method, once the value of the humus formed in the pit has been seen by family members. The pit humus can significantly increase the production of vegetables and also maize, especially when combined with the use of urine. Such advantages become very apparent when a combination of humus and urine are used on very poor sandy soils – soils which are all too common in rural Zimbabwe and other parts of the sub-region. Once the effects of the humus on tree, vegetable or maize production have been witnessed, the popularity of the toilet system increases. Also once the method of making concrete slabs has been learned, the family may choose to make more slabs of its own.

The stage has not yet been reached when the enhanced growth of fruit trees has been experienced in this programme, which in its infancy. Programmes in Malawi and Mozambique are more advanced. One thing is certain – families are very pleased with their own efforts in finally being able to construct their own toilet at minimum cost and without the use of artisans and labourers. Women are particularly proud that they can construct the system, normally the role of the men. In programmes promoted by Kufunda in Rusape, Ruwa, Mondoro and Zvimba, women are the most active participants and also the best instructors.

The Starter Kit concept, currently being tested, provides an incentive for the family member (often a woman) to start the process off. The Starter Kit also provides small trees (currently mulberry) which are planted, first in pots, at the same time as the toilet is built. Later, the partly grown trees are transferred from the pot to a generous layer of soil placed above the filled ***Arborloo*** pit. With watering, care and attention, the tree can grow into a considerable family asset later. All the instructions are provided in the Kit. It is an interesting and low cost method of promoting the uptake of low cost sanitation. Other excellent promotional methods are also being tried by WaterAid in Malawi and Mozambique and COMWASH in Malawi.


Participants at a "compost toilet workshop" in Mondoro are busy making the concrete slab. Instructions in the local language – Shona – are available. With the cement provided in the kit, a strong one metre diameter concrete slab can be built together with local river sand and some wire. The slab is flat and easy to construct. The importance of proper curing is emphasised. Cover with plastic sheet and after hardening keep wet for at least a week. The important aspect of this programme is that local villagers who are neither artisans or builders by trade acquire the skills. By far the greatest number of participants are women. In Mondoro, it is the women who train others to make the slab and toilet.


The ring beam is an important part of the structure, as it elevates the toilet slab above ground level and helps to the protect the unlined shallow pit. Most ring beams are made with local fired bricks and termite mortar. The slab sits on top of the beam and then the structure is built around this. On the right a group of villagers attend the compost toilet workshop in Mondoro.


A sack of soil near the home made slab on an *Arborloo.* The finished *Arborloo* made in the simplest way, provides a safe way of disposing of excreta. The facility offers privacy, with almost no smell or fly nuisance. It is an important first step in the provision of sanitation for low income families. These photos were taken in the Mondoro district.

