THE TIMBER DECK VIP LATRINE
AN APPROPRIATE DESIGN FOR SUSTAINABLE SANITATION DELIVERY

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SUMMARY

Seven years into the RDP, the backlog in rural sanitation has been reduced by only two percent. One of the reasons is that practitioners and communities are still mostly locked into the idea that to build a pit latrine you need a lined pit, a concrete slab and a concrete block superstructure. Such a latrine is far more expensive than the R600 government subsidy. A further problem with lined pits and concrete superstructures, is that the pit must be emptied every seven to ten years, or else the latrine must be abandoned.

One response has been to opt for mass produced, small, corrugated iron top structures. However, once the slab and other costs are factored in, even these are more expensive than the subsidy, and their aesthetic value is debatable.

This dilemma has led to the development of the Timber Deck VIP latrine, which requires little or no cement, uses traditional building materials for the superstructure, is spacious and inexpensive. The Timber Deck latrine is based on the idea that most pits do not need to be lined if the top structure can be moved when the pit is full. If the top structure is to be moved then all materials of value must be movable. For the walls of the structure the traditional building materials of the area are used, whether these are wattle and daub, mud bricks, reeds or stone. The subsidy is used to pay for a 1.5 metre by 1.8 metre CCA treated, sealed and painted timber deck (which doubles as a pit cover and latrine floor), a vent pipe, a fly screen, roofing, a moulded VIP pedestal, and some assistance with construction.

This paper describes and illustrates this technology and examines the experience from three pilot projects where it has been used.

1. A BACKGROUND TO RURAL SANITATION IN SOUTH AFRICA

The backlog in rural sanitation in South Africa is estimated at 18 million (DWAF, 2001). Seven years into the RDP, and after expenditure of over R167 million, this backlog had been reduced by only 2%.

One of the reasons for the slow rate of sanitation delivery is that practitioners and communities are still mostly locked into the idea that to build a pit latrine you need a lined pit, a concrete slab and a concrete block superstructure. Such a latrine is far more expensive than the R600 subsidy (now R900) which is made available for materials and labour. A further problem with lined pits and concrete superstructures, is that the pit must be emptied every seven to ten years, or else the latrine must be abandoned.

What cost-effective sanitation options are currently being pursued in South Africa?

2. COST EFFECTIVE SANITATION OPTIONS

The basis of rural sanitation in South Africa and elsewhere is the Ventilated Improved Pit Latrine or VIP. A properly designed and functioning VIP minimizes odours and breeding of flies through three key design features:

1) *Odour Control*: The latrine incorporates a vent pipe, 100 mm in diameter or larger and unobstructed except for a fly screen fixed at the top. To work effectively this vent pipe must not extend below the latrine slab, and it must extend at least 0.5 metres above the latrine roof. The latrine superstructure should also be designed in a way that air flow is always down through the pedestal, and up out of the vent pipe.

2) *Fly Control*: The interior of the latrine should not be brightly lit - ideally it should be dimly lit. Flies

breeding in the pit should be drawn primarily to the natural light at the top of the vent pipe, where they will be trapped by the fly screen. Flies outside the pit should be drawn primarily to the odours emanating from the top of the vent pipe (not the top of the pedestal!) where the fly screen prevents them from accessing the pit. In this way, the VIP reduces rather than promotes the breeding of flies. A properly designed and functioning VIP is not dependent on the use of a seat and flap to limit the breeding of flies in the pit.

3) *A smooth, non porous, non-soiling pedestal, or no pedestal at all (i.e. a squat hole only)*. In South Africa the custom is to use a pedestal, whereas in many other countries pedestals are not used. A poorly designed and constructed pedestal, with jagged plaster, timber or steel edges permanently soiled, will negate most of the aesthetic and hygiene improvements rendered by any latrine.

Ventilated Improved Pit Latrines (VIPs), which are currently being built in South Africa at or close to the R900 sanitation subsidy include the following options:

2.1 Prefabricated Steel Superstructure

The steel superstructure is a light, easily transportable and easily erected steel frame with corrugated iron walls and roof (see Figure 1). This is set on a concrete slab, with a pedestal and a vent pipe. With a light and movable superstructure, lining (full or partial) of the pit is only required where the pit is located in collapsible soils. The advantages of this option are its relatively low cost, and that it can be easily mass-produced. This is the most common superstructure seen in Lesotho, which is known for its very successful urban and rural VIP sanitation programmes. In Lesotho there has been no materials and labour sanitation subsidy.

Figure 2: The VIP with a steel frame superstructure is a common solution to the problem of low cost and fast sanitation delivery. However, due to cost considerations these structures tend to be cramped. Also the fly control and odour control design features of a true VIP are not observed.

The disadvantages of the steel superstructure are:

- Due to cost considerations it is generally made only just big enough to accommodate a person sitting on a toilet seat i.e. these toilets are small!
- These toilets are not at all insulated from extremes of weather - on a hot day they are very hot, and on a cold day very cold.
- Due to cost considerations they are made from light steel and thin corrugated iron. The design life of these components will not much exceed the filling time of the pit.
- The structures tend to be open between the walls and the roof (for temperature control), which means that venting of the pit is primarily via the superstructure, and not via the vent pipe.
- With walls made of highly reflective corrugated iron, the interior of these structures tends to be bright. Thus fly control will only be achieved then if the pedestal is provided with a seat and flap, and this flap should be kept closed when not in use.
- The superstructures are light and must be properly secured, otherwise they blow over in the wind.
- Without a door, there is no privacy. Door latches and hinges require maintenance.

2.2 The Archloo

The Archloo is a very cost effective latrine design developed in South Africa in the late 1990s by Dr Peter Glover (see Figure 2). The superstructure is shaped in the form of an inverted catenary arch, which is a naturally strong shape. This allows for the walls to be made thin (25 to 50 mm). The superstructure thus costs less and weighs less than a comparative structure made using concrete blocks.

The materials and labour cost of a complete Archloo, including the pit lining and the door, falls within the available R900 subsidy. Many thousands of these have been constructed in KwaZulu-Natal during the last eighteen months, particularly as part of government=s rapid intervention strategies to deal with cholera affected areas.

Unlike the steel frame toilet, the Archloo does function like a true VIP. However, it does have the following disadvantages:

- Unless it is extended in size to a double arch with a side entrance, a door is essential for privacy.
- It is a permanent structure. Thus when the pit is full, either the pit must be emptied or the structure must be abandoned.
- Cost constraints tend to make the structure somewhat cramped (e.g. see Figure 2).

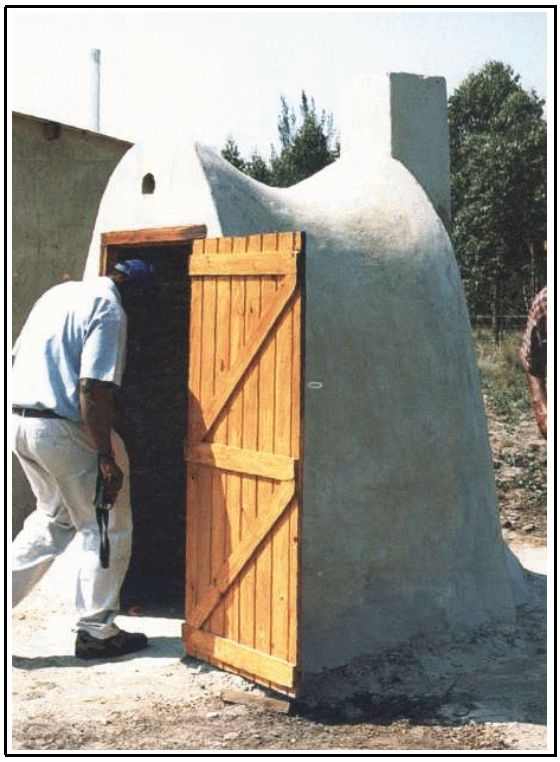


Figure 2: The Archloo is a cost effective VIP option which is now being built in large numbers in KwaZulu-Natal.

2.3 The Sanplat

The Sanplat (which is an abbreviation of Sanitary Platform) was developed with the support of SIDA in the 1980s by Bjorn Brandberg and others in Mozambique=s then National Directorate of Housing.

The Sanplat is basically just a very cost-effective latrine slab. The slab is domed, is only 40 to 50 mm thick, and reinforcement is not essential (Figure 3). In very poor countries it is often not easy to find steel reinforcing, and thus the use of the domed shape rather than steel to provide strength was considered a critical design feature. The diameter of the slab varies between 1.2 metres and 1.5 metres. In reality Sanplat makers do often place either chicken mesh or alternately a single strand of 8 gauge fencing wire in the slab to give it some resistance to cracking when being handled and transported. A well made Sanplat can support the weight of more than six adults without cracking, and this is the recommended quality control test before the slab is released for

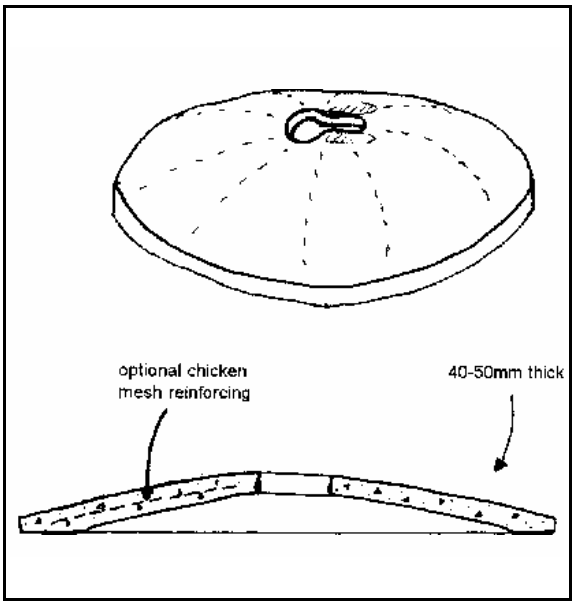


Figure 4: (Solsona, 1998) A Sanplat is a very cost effective latrine slab. Due to its domed shape, reinforcement is not compulsory. Outside of South Africa, the Sanplat is plugged when not in use, and thus no vent pipe is required. In South Africa, pedestals are used, and thus a vent pipe is required.

use.

In Mozambique the Sanplat was not introduced as an alternative slab for a VIP. Rather, users were instructed to keep the slab plugged and sealed when not in use. The vent pipe and other requirements of the standard VIP philosophy thus fall away, and the user can build any superstructure which fulfills their requirements for privacy and comfort. In South Africa, users are generally insistent on pedestals, which has led to the Sanplat being modified to include a vent pipe. The Sanplat has been very widely used in Mozambique and other countries of Southern Africa.

The Sanplat is too small in diameter to be placed over an unlined pit. The minimum requirement is that a thin strip footing (approx. 80 mm thick) and two courses of concrete blocks (or the brick equivalent) are used to support the Sanplat. This arrangement will allow for a collar approximately 400 mm deep, and a floor elevated 100 mm off the surrounding soil.

The only disadvantage of the Sanplat slab, is that it is awkward to transport over long distances or uneven terrain.

3. THE TIMBER DECK VIP ALTERNATIVE

The high cost of conventional concrete block latrines, the disadvantages of prefabricated steel superstructures, and the problem of what to do about VIPs after five to ten years when the pits fill up, led to the conception of the Timber Deck VIP latrine. The Timber Deck VIP is based on the idea that it should be possible to buy all the materials required for a VIP from a sanitation market, and transported in less than one pickup load - even on a sturdy roofrack! There should be plenty of scope for self-help, with the wall construction based on the building method and materials typical of the area. If the soil of the area has enough clay it should be possible to build without any cement at all. The resulting latrine should be spacious, inexpensive, and it should be possible to knock the latrine down and move it when the pit is full, without the loss of expensive materials.

3.1 Description of Building Method

The site is levelled and cleared 1.7 m by 2.0 m. A pit measuring 0.9 m by 1.2 m is dug to a depth of 2.5m. The pit is unlined in firm soil. In collapsing soil, the pit should be lined or partially lined with fowl mesh reinforced mortar. The pit should be well drained, ie not completely sealed. Contact between pit contents and soil is recommended for an extended pit filling time (to give maximum opportunity to organisms which live in the soil and feed off the waste).

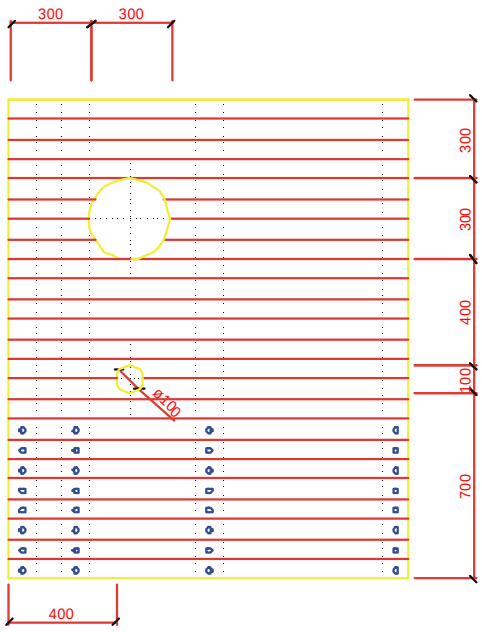


Figure 4: The arrangement of CCA treated poles and planks used to make a timber latrine deck. The gaps between the planks are sealed with an acrylic sealer, and then the deck is painted with wood primer and enamel paint. The size and shape of the pedestal hole must match the pedestal to be used.

The 1.5 metre by 1.8 metre VIP platform is made from Copper Chrome Arsenic (CCA) treated timber poles and planks (see Figure 4). After the deck is nailed together, it is sealed with a flexible acrylic sealant and painted. Deck assembly should take place at the sanitation market, where all materials required for latrine construction can be sold to the public (with or without subsidies!). Decks are relatively light, robust, and are easily transported. CCA treatment is a well established method which is used to preserve timber used for telephone poles, electricity supply poles, fencing and playground equipment. CCA preserved timber will last for more than 20 years.

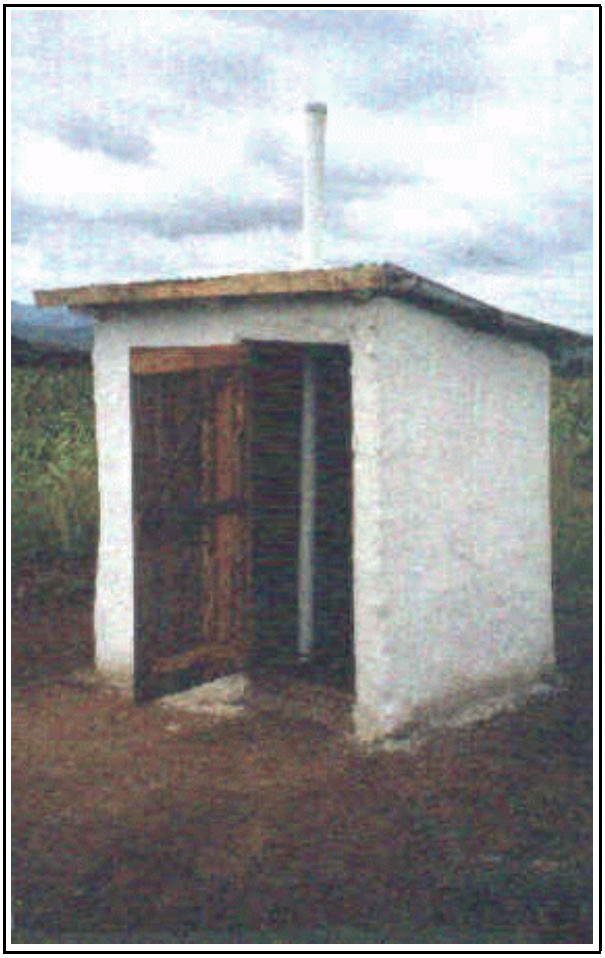
The timber deck is placed over the dug pit (set on bricks or stones to lift it above ground) and the walls are then constructed around the deck. The walls are constructed from whatever materials are freely available and common to home building in the area e.g. mud blocks (shown here), wattle and daub, soil cement, or

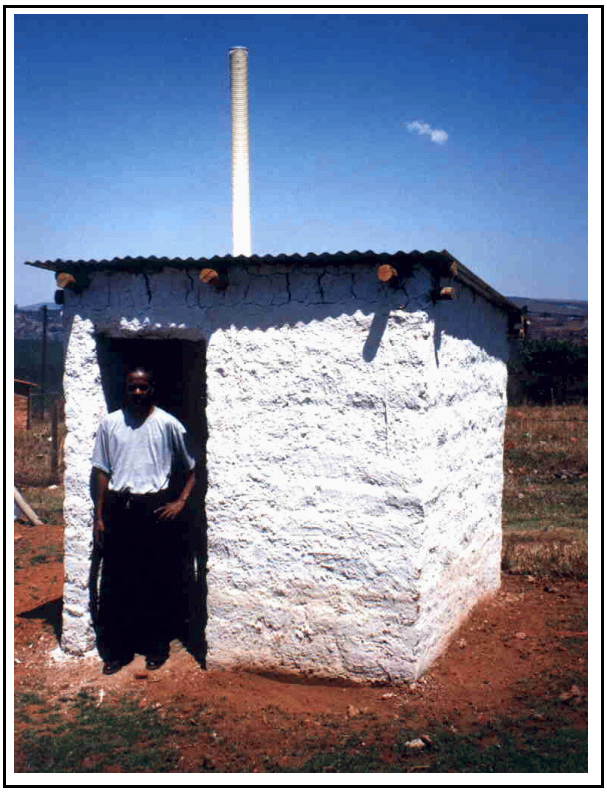
reeds. Concrete blocks are discouraged, as they are very heavy, expensive, and hard to move once mortared together.

The VIP is finished off with a corrugated iron roof, a pedestal, a vent pipe (with flyscreen!) and whitewash. The whitewash can be coloured with PVA or oxide according to the owner's preference. The VIP includes a screen wall, but some owners prefer to leave that out and to fit a door, giving them more space inside. Others construct an external screen wall.

The pedestals can be either of moulded plastic or of moulded mortar, in either case fitted with a plastic seat and flap. Where moulded mortar is used, this should be painted with two coats of acrylic paint, followed by two coats of enamel paint. This seals the pedestal and prevents it from absorbing smells and odours. The mortar option maximizes local labour contribution, but the plastic pedestal is more practical if only small numbers of latrines are to be built in an area.

Part of the design philosophy of the Timber Deck VIP is that it can be moved and re-built when the pit fills up. If any cement has been used, this will be sacrificed when the pit is abandoned and the walls are knocked down. Apart from the cement, all the other items of value, including the timber deck itself, are easily moved to a new location. In this way the timber deck does allow for sustainable sanitation without the need for anyone to empty the contents of the pit latrine (which is the only alternative if the pit latrine is of a monolithic concrete block construction).





Figures 5 and 6: Two completed Timber Deck Latrines. The example below has an internal screen wall ("a walk around") and thus no door is required. In the example above, the home owner has elected to provide a door, leaving the interior more open and spacious.

3.2 Labour and Materials Requirements and Costs

The labour and materials requirements and costs for a Timber Deck VIP are set out in Table 1 below.

Table 1: Labour and Materials requirements and Costs for a Timber Deck VIP (February 2002)

Item	Description	Cost (exclusive of VAT)
Deck	Four 1.8 m CCA treated poles and 24 1.5 m long 75x25 CCA treated planks, with sealant, nails and paint	R190
Walls	Two pockets of cement - optional for areas with little clay in soil	R60
	Whitewash, nails	R37
Roof	Four sheets 2.4 m long corrugated iron, roof screws	R132
Additional Items	Vent pipe, fly screen, socket	R50
	Pedestal and seat - excluding labour	R50
Labour	To dig pit	R100
	To make deck	R35
	To make pedestal	R35
	To build walls	R200
	To fit roof, vent pipe and fly screen	R35
TOTAL		**R924**

The cement is used either to form a collar to stabilize the top section of the pit excavation, or to stabilize the superstructure walls. The pit collar is not required if the soil is cohesive (i.e. fairly high clay content). Also the walls can be built without cement if the soil has enough clay, or if there is an alternative building material in the area such as reeds.

In South Africa, the current government policy is to apply a labour and materials subsidy of between R540 and R900 per site (excluding VAT - the exact amount depends partly on when the project was initiated, and partly on how the VAT is dealt with). Therefore, depending on how the project finances are structured, it is generally expected that the labour cost of building the walls is borne by the homeowner. In addition, part of the cost of the pit excavation may also be borne by the home owner. With these contributions, the Timber Deck VIP latrine can be built within the available subsidy. It is also relatively affordable to those who wish to help themselves without a subsidy.

3.3 Field Experience

Timber Deck VIPs have to date been built on three projects. Two were land reform projects in northern Natal, where groups of families had received assistance from the Department of Land Affairs to purchase farms, and had some funds left over with which to provide basic infrastructure. The third is a Department of Water Affairs and Forestry funded sanitation project situated in the upper Mvoti valley, 80 kilometres north east of Pietermaritzburg.

Parys and Belvue Land Reform Projects

Land Reform projects are funded using a government grant valued at between R15 000 and R16 000, excluding VAT. Typically, the split between the cost of the land and the funds left over for civil and agricultural infrastructure is approximately 60:40, although no two land reform projects are exactly alike in this regard. Unlike DWAF funded sanitation projects, there are no rules limiting how much project funding can be dedicated to the provision of toilets, or for that matter to any other item of the infrastructure. There is a tendency among some who work on land reform projects to think in an urban mode and thus it happens quite commonly that all the available funds get used up just on the water supply and sanitation provision, with nothing left over for the purchase of agricultural inputs, roads or fencing.

In the case of the Belvue and Parys Land Reform projects it was decided to allocate only R800 per site for sanitation, excluding VAT (year 2000 rands). This provided a materials and labour subsidy of R600, and R200 for builder training, project management and health and hygiene education. Fortunately the farms were adjacent, so that management resources could be pooled. The total number of families to be catered for was 108. A trainer spent two weeks on the farms initially, working with pre-selected sanitation building teams to build one demonstration latrine on each farm. Thereafter materials were provided to each farm, and the builders continued with the latrine construction. Ongoing management of the latrine construction as well as other aspects of the projects was provided by means of a student engineering technician, who was resident on the farms for the eight month duration of the projects. An engineer visited the projects for two days every second week. Due to the small number of latrines to be built, no attempt was made to set up the capacity to mould pedestals. Instead, moulded plastic VIP pedestals were bought in.

The farms both had extensive areas under wattle trees, and thus there was no shortage of materials for the superstructure construction. In fact, most of the families were also engaged in the construction of their new homes, which were of a wattle and daub construction. The VIPs were simply an extension of this building operation. The pits were stable and no linings or collars were required and no pit collapses have to date occurred. The builders learned quickly and performed adequately, although on the Parys farm the speed of the work was significantly faster.

The homeowners have in general finished off their latrines neatly. The internal dividing wall (see Figures 5 and 6), which is provided so that a door is not necessary, has not been adopted by all. Some have done away with the dividing wall and have made their own door. This provides for a spacious latrine 2.7 m^2 in area. Others have built on a screen wall outside the latrine entrance, again enabling them to do away with the dividing wall.

Relative to many other land reform projects (and even DWAF sanitation projects), the sanitation provision at Belvue and Parys was thus done in a very cost effective manner, and the end results were large and comfortable VIPs, which the homeowners clearly take pride in.

The greatest difficulty in implementing these projects was in securing the CCA treated poles and planks. The part of the timber industry which produces these items does not appear to have much spare capacity, and delivery of the order (which also included poles for fencing) was delayed for some two months. At the time it was thought that the chosen supplier was just poorly organised, but since that time experience with a larger supplier on the Mvoti sanitation project in the Natal midlands has not been much better.

Mvoti (Greater Efaye) Sanitation Project

This project is located in the upper Mvoti Valley, some 80 kilometres north east of Pietermaritzburg. VIP latrines are being constructed for some 2500 families, which are distributed over 10 distinct tribal/geographical areas. In terms of management, the project is really a cluster of ten small projects, rather than one large project.

In 1998 and 1999 there had been a preliminary sanitation project in the area - known as a Phase A project in South African sanitation terms. This entailed sanitation awareness, capacity building, builder training, and limited latrine construction. Unfortunately during the long delay between the end of the Phase A project and the commencement of the Phase B project, the project agent (the organisation providing technical and financial management support) went into liquidation. Partners in Development were then asked to take over the Phase B project.

During Phase A the latrine option which had been developed was: un unlined pit, a large (2 by 2 metre) concrete slab, and a superstructure made of either scrap timber or concrete blocks. The former were of poor qulaity and tended to get blown over. The latter were too heavy for the unlined pits and there had been several instances of pit collapses. The large concrete slab was, moreover, quite immovable, which meant that once full these latrines would either have to be emptied or abandoned.

Re-training of the builders who were still to be found was done, and this included the construction of a Blair type latrine using a round slab over a shallow pit collar and a timber superstructure, as well as Timber Deck latrine. The soil was too sandy for ordinary wattle and daub construction, but it was found that after the mixing in of two pockets of cement a very neat structure and finish was obtained. Training was also done in Sanplat construction.

After a period of time to consider the options, the Timber Deck latrine was chosen for further implementation., and during the year 2001 approximately 500 latrines have been constructed. Progress has been much slower than expected, and this has been attributable to three factors:

- the disbursement of project finance is at times delayed;
- there have been delays with the delivery of building materials; and
- there have been problems with local management and quality control.

All of the above problems were, however, essentially management problems. As the project has progressed solutions have been found to improve efficiency. These have included the employment of a member of the local community by the project agent (as opposed to the committee) to inspect all latrines, as well as to see that all materials are delivered in the correct quantities to the correct depots. In addition a closer supplier has been located for the CCA planks, and a local transport contractor has been employed to collect these planks and deliver them to the right areas at the right time. In the current financial year it is hoped to get the construction rate up to 100 per month, or a little more than one per builder per week. Some of the better builders can in fact manage two latrines per week, but logistical delays tend to limit them to a slower rate.

Initially none of the pits were stabilized, the philosophy being to avoid cement and permanent construction as far as possible. In most cases this has worked, but eight pit collapses have been reported from one area. It must still be established if these were due to incorrect pit dimensions, or to collapsing soil. If the latter, the latrines will be moved and re-built with a reinforced ferrocement collar to stabilize the upper metre of the excavation.

At the time of the project commencement the DWAF sanitation subsidy for labour and materials was limited to R600 including VAT (approx R540 excluding VAT). This meant that the cost of the pedestal could not be included in the subsidy. Builders were trained and equipped to make pedestals, and owners were encouraged to buy them at cost. However it was found that most latrine owners failed to understand that they were expected to buy their own pedestals, or alternately could not afford them. Latrine owners made their own pedestals, which were very poor and negated much of the value of the improved VIP. In the absence of perceived demand, the builders did not get around to making any pedestals. In October 2001, however, the sanitation subsidy was raised to R900 (the subsidy was first set at R600 in 1996, and has lost approximately 40% of its purchasing power since then). With the raising of the subsidy, it has been decided to include a pedestal in all the latrines as standard.

4. CONCLUSIONS

In urban and peri-urban areas pit latrines tend to be built with concrete block lined pits and concrete block superstructures. Such latrines are expensive to build (R2000 to R4000, depending on contractual arrangements) and cannot be moved. When the pits fill up after eight or so years, then either the pits must be emptied, or the latrine must be abandoned. Pit emptying is possible, but it is an unpleasant task and pit emptying services are still very poorly established. In rural areas there is enough space to relocate a latrine when the pit is full, and thus it makes sense to use a design which can be moved.

Some movable structures, such as the steel toilet, are not proper VIPs and are cramped and smelly. The Timber Deck VIP incorporates a CCA treated timber deck, which will last through three or more pit filling cycles and which can be easily picked up and moved to a new site. Other materials of value in the latrine, such as the vent pipe, flyscreen, the roofing and the pedestal, can be moved with the latrine. The walls are constructed from traditional building materials by the latrine owner. Because the latrine superstructure is

relatively light and is also two and a half times larger than the pit in area, the lining of the pit is only required if the pit is in very sandy soils.

It has been found that the Timber Deck latrine is relatively cost-effective to build, and that builders have learned the techniques easily. The logistics of materials supply is, however, challenging. The timber industry does not appear to have much spare capacity to produce the large numbers of CCA treated poles and planks that would be required if this design were adopted on a large scale. This constraint could, however, be gradually reduced with time if there was a proven and sustained demand.

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