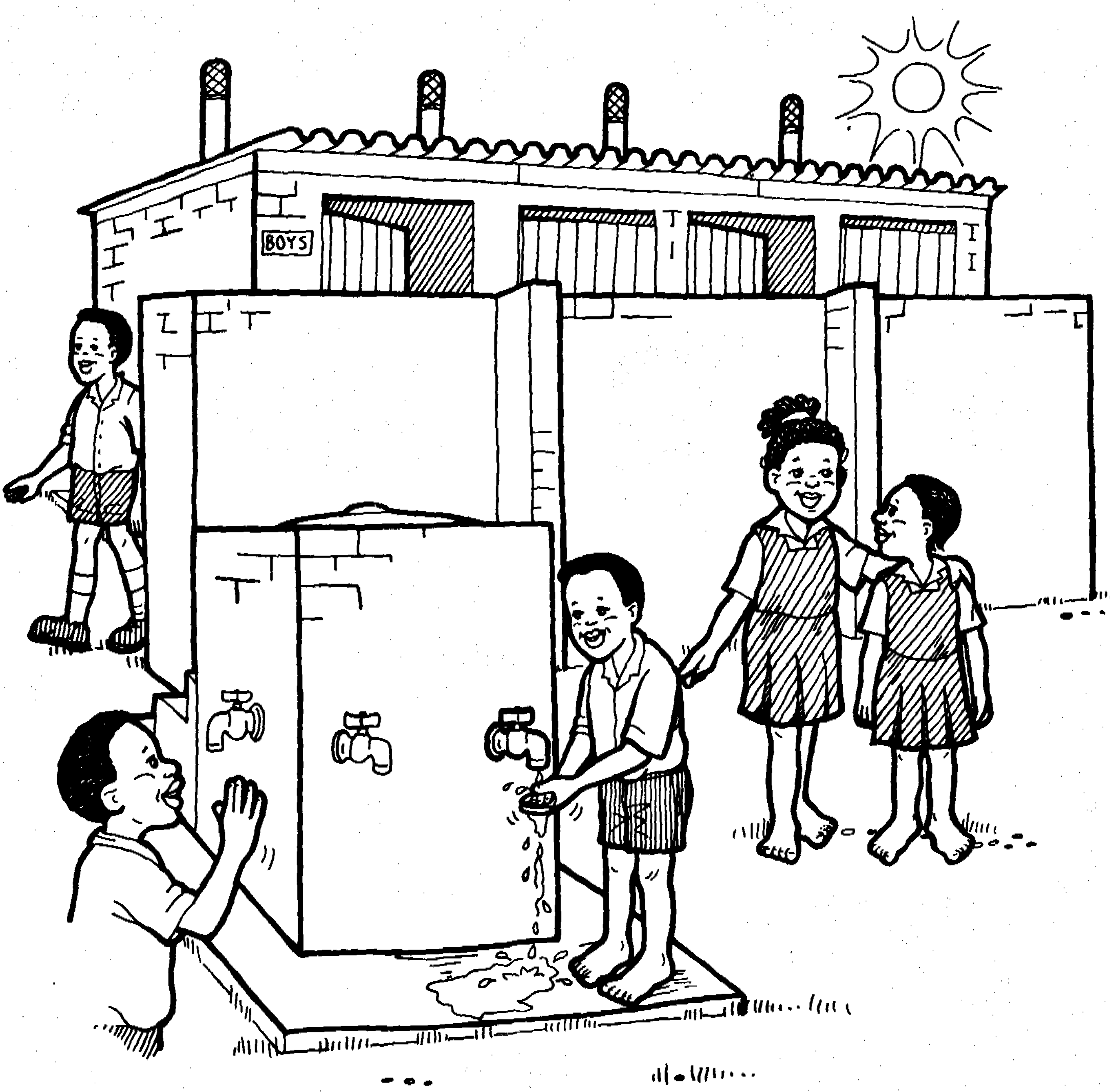
Building School VIPs

Guidelines for the design and construction of
Ventilated Improved Pit toilets
and associated facilities for schools



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Partners in Development cc

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A healthier learning environment

The need to provide a quality education to all the children of South Africa is an enormous challenge. Much attention is rightly given to teacher training, to curriculum development and to the construction of classrooms. Meanwhile the quality of the school environment, and in particular the state of school sanitation, is too often forgotten. Particularly in our rural areas, there is a drastic shortage of school sanitation facilities. Those that do exist are too often badly designed, badly built or badly maintained. Poorer health and poorer learning are the results.

The National Sanitation Co-ordination Office, or NaSCO, was formed to promote joint sanitation initiatives across the sectors of health, housing, water supply, education, local government and the environment. NaSCO recently commissioned a study of the state of school sanitation. Amongst other things, this identified that there was no simple guideline available to planners, consultants and school governing bodies to assist them to provide sound sanitation facilities at schools. This publication is intended to fill that gap.

As far as the choice of toilet is concerned, these guidelines discuss only Ventilated Improved Pit toilets (VIPs). VIPs are not the only option available for school sanitation; but they are affordable, robust, simple to build, easy to maintain and do not need a reliable water supply. This makes them particularly appropriate for most rural and many peri-urban situations. There is, however, a very evident lack of understanding in many quarters of what constitutes a proper VIP. This has too often caused a mistaken and wholly unnecessary prejudice against VIPs.

These guidelines also include sections on the provision of hand washing facilities and urinals; both important items that are often neglected.

Better school sanitation is, however, not just about facilities. The practice of appropriate hygiene behaviour by users is essential to derive the full health benefits from the facilities. Active management is required to keep facilities in a healthy state. Thus a clean and healthy learning environment can only be achieved and maintained when learners, teachers, governing bodies and local authorities all see this as a major priority. There is much work to be done.

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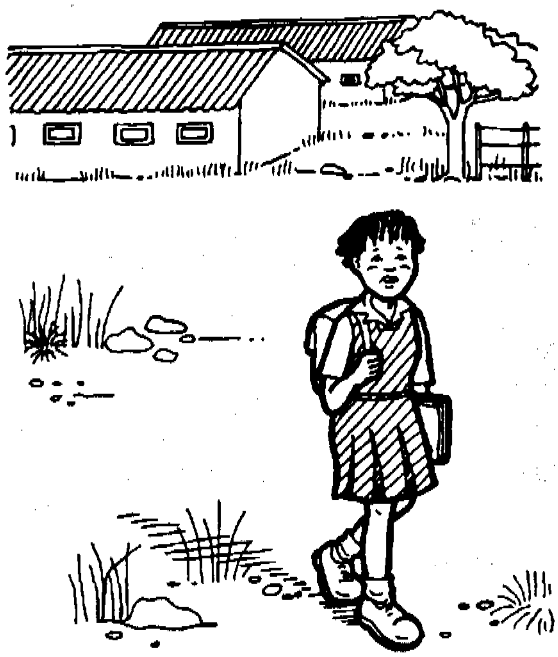


Why is she leaving school?

In many parts of South Africa, school sanitation is non-existent or inadequate. Many learners choose to leave the school rather than face a badly soiled, blocked or broken toilet that lacks toilet paper and water to wash their hands.

Having to use such toilets is a health risk, whilst the result of learners responding to the call of nature by leaving the school is hardly conducive to their education.

Often the toilets provided are too complex, too fragile and their upkeep too expensive for poorly resourced schools. In particular this is often the case where flushing toilets are installed.

Even when a more simple technology is used, the design or construction is often incorrect. Such facilities often turn out to be no better than pits in the ground.

If the layout, orientation and school maintenance of school toilets is not carefully considered, they can become the site of illegal activity, intimidation and other undesirable behaviour, because they are avoided by teachers, a problem frequently associated with their physical condition.

There is a drastic shortage of school sanitation facilities, and those that exist are too often badly designed, badly built or badly maintained. Poorer health and poorer learning is the result.

School sanitation does not start and end with building toilets. Hand-washing facilities, urinals and water drainage systems must also be considered. All facilities must be planned with the school environment and the needs of the users in mind. Training must include personal hygiene and the use and upkeep of the facilities provided. The implementation of systems to manage and maintain school sanitation facilities is also crucial.

The information presented in this booklet is primarily technical but relates to these largely non technical issues. These guidelines will assist planners, engineers and others involved in the provision of school sanitation.

The toilet designs included in these guidelines are all forms of Ventilated Improved Pit toilet (VIP). They have been selected because they are proven, effective, robust, affordable, simple to use and relatively simple to maintain.

Note - These guidelines are complemented by the blue volume "Building VIPs", which describes the design and building of household VIP toilets. Other sources covering school sanitation are listed on the inside of the back cover of these guidelines.

2............................... Where Are VIPs Appropriate?

The toilets described in these guidelines are all forms of Ventilated Improved Pit toilet, or VIP for short. VIP toilets have been used successfully in schools throughout southern Africa and beyond. When carefully planned and well built, VIPs are particularly appropriate in rural schools and many peri urban schools because:

- VIPs are hygienic.
- VIPs are simple to plan and affordable to build.
- VIPs are robust.
- VIPs need no water to operate and only a little water to clean.
- VIP maintenance is simple and inexpensive, without the need for expensive spare parts.

There are other options available for school sanitation, but these are often too expensive, insufficiently robust or too difficult to maintain. Even when piped water is available, VIPs may be a better option than flush toilets as they do not need expensive maintenance. However, it is wise to remember the following:

- Just because VIPs are simple to build does not mean that key details of their design and construction can be overlooked.
- School VIPs are permanent and must be emptied when full. This has to be done either with a pump or manually.
- In certain conditions, VIP effluent could contaminate ground water. However, these situations are rare and the toilet design can usually be modified to ensure groundwater is protected.

Note - *A description of how to assess the risk of groundwater contamination is described in the booklet "A Protocol to Manage the Potential of Ground Water Contamination from Onsite Sanitation"*, published by DWAF.

Summary

Well built school VIPs are hygienic, affordable, robust, simple to build and easy to maintain with local resources. If carefully planned and built, they are the most sustainable option for school sanitation.

School latrines are permanent structures and must be designed to allow for emptying.

3.................................. What Makes a VIP Work?

Quite a number of School VIPs do not work. Other toilets are thought to be VIPs but in reality are pit toilets. Problems arise whenever one of the basic principles of VIP operation has been overlooked.

The First VIP Principle: Eliminate Smell.

This is achieved by ventilating the **pit** and **cubicle**. Wind passing over the **vent pipe** sucks air from the pit and causes a draft in the cubicle. This effect is helped if the vent pipe warms up in the sun, and any ventilation gaps in the cubicle **superstructure** face the prevailing wind. The toilet block should be positioned taking these factors into account.

If the **drop hole** is sealed by a close fitting lid with no air gap, any urine splashes in the cubicle will start to smell. The same effect will occur if there are no air inlets into the cubicle, eg, an opening above or below the door. It is also important that the vent pipe is large enough and sticks up above the superstructure by at least 0.5 m.

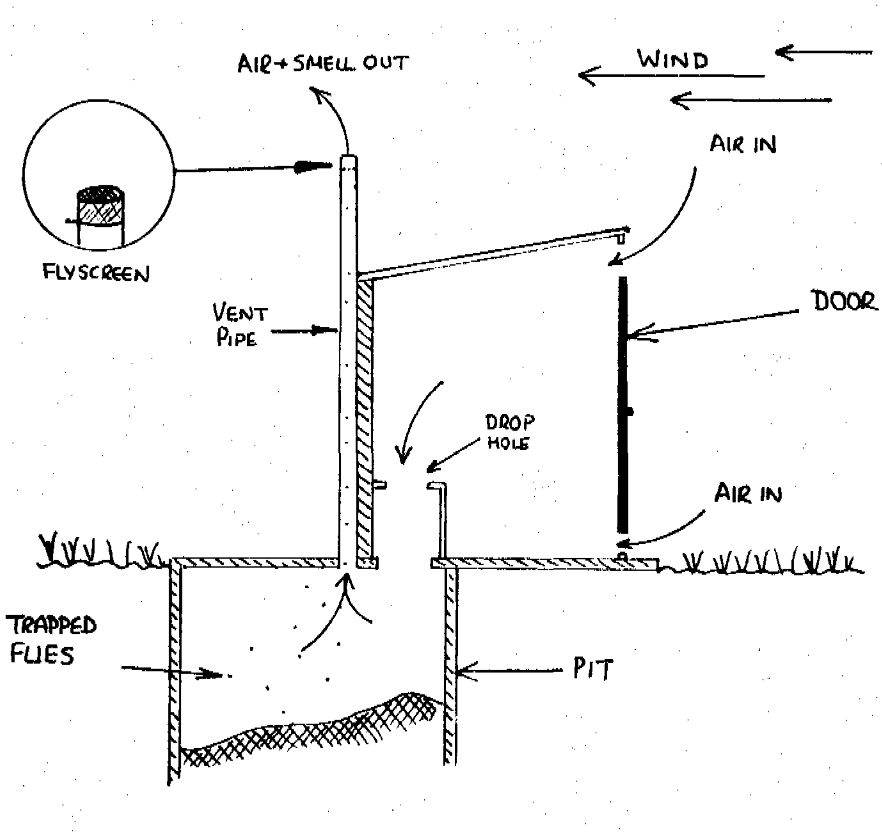
The Second VIP Principle: Eliminate Flies.

Flies are attracted to smell and carry disease. To eliminate this health risk, the VIP minimises the chance of flies getting into and out of the toilet.

Flies are attracted by the smell of the air leaving the vent pipe. A **fly screen**, with a 1 mm^2 gap size stops them getting in.

Some flies will still get into the pit through the seat. As the cubicle is relatively dark inside, *flies are attracted* to the light at the top of the vent pipe and are trapped by the fly screen.

It is thus very important that the pit is completely sealed apart from the drop hole and the vent pipe, that no direct sunlight enters the cubicle and that the vent pipe is fitted with an effective fly screen. Wet pits can provide a breeding space for mosquitos. If this becomes a problem, periodically pouring a small quantity of diesel down the drop hole should solve the problem.



Fundamentals of VIP Operation

Summary

School VIPs can help eliminate smell if:
- the toilet is correctly orientated
- the vent pipe is large enough and high enough,
- the seat is not sealed, and
- there is adequate ventilation into the cubicle.

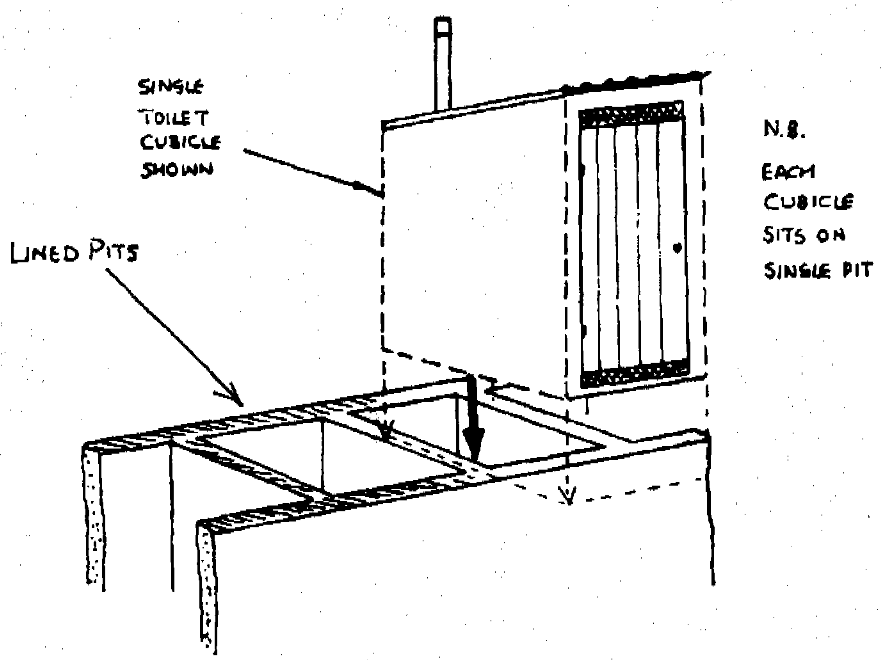
School VIPs can help to eliminate flies if:
- the pit is properly sealed
- a durable fly screen is fitted to the top of the vent pipe, and
- the cubicle is relatively dark (no direct sunlight can enter).

4..Types of School VIP

There are two main types of school VIP. Their layout can be adapted to suit almost any situation. Both types are permanent structures which, if properly built and maintained, can last for many years.

4.1 Single Pit VIP

The first type is called the **Single Pit VIP**, so called because each cubicle sits over its own fully lined pit. Each pit has a vent pipe. Individual pits are formed by first excavating a trench which is then fully lined and sub-divided by building brick or block work partition walls. The trench is normally dug 3 metres wide and 2,5 metres deep *(note: shoring of deep trenches is essential to protect workers)*. Its length depends on how many toilets are needed in the block. Typically each pit is 1 m wide.



Single Pit School VIP

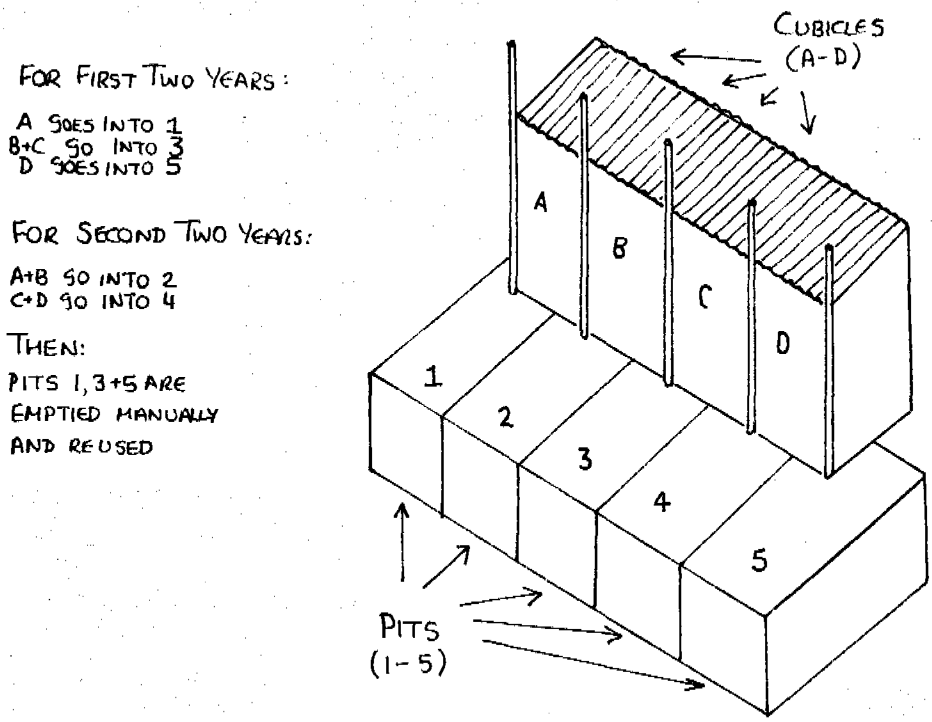
Single Pit VIPs can be used by up to **50** learners. Each pit is sized to fill up in five to ten years, after which it must be pumped out mechanically with sludge pumps (these can be hired) or a truck mounted vacuum pump. For easier emptying by pump the pit contents should be kept in a moist form; this has the benefit of reducing the volume of the contents and extending pit life by promoting anaerobic digestion.

A single pit design is thus suited for any location where the excavation of a large pit does not present a problem, and where pit emptying by either sludge pump or vacuum tanker is both possible and likely to happen.

4.2 Ventilated Improved Double Pit Toilet.

The second type of school toilet is the **Ventilated Improved Double Pit (VIDP**) toilet. Each cubicle is placed over two pits which it shares with the cubicles to the left and right. **Only one of these pits is used at any one time.** When it is full, the pedestal or seat is moved over to the other pit. The contents of the first pit are left to decompose for several years before being manually removed.

*VIDPs can be 25 to 40% more expensive to build than single pit VIPs because of the additional block work associated with the double pit design and the need for slightly wider cubicles. Each VIDP can only be used by a maximum of **40** people; this is because the depth of the pits is limited to 1.6 m to facilitate manual emptying.*



Ventilated Improved Double Pit Arrangement

The main advantage of this type of toilet is that the decomposed pit contents are safe to handle and inoffensive, and can thus be removed manually without the need for a vacuum truck or sludge pumps, neither of which may be available. After being left for two years or longer, the pit contents will have decomposed into a useful soil like humus which can be emptied and used as a soil conditioner or simply buried.

The VIDP's shallow pit is not only easier to excavate than the deeper single pit option. It is also less likely to contaminate shallow ground water if this is a possibility.

Where soils are particularly shallow and underlain by hard rock, it may be preferable to raise the VIDP pit by up to one metre above the ground level. In impermeable soils, water used for cleaning the cubicle floor should not be channelled into the pit.

The VIDP is therefore more suitable where excavation is difficult due to very hard or very wet ground conditions, or where pit emptying by vacuum tanker or sludge pump is either impossible or simply unaffordable.

Summary

Single Pit School VIP

- Larger capacity (up to 50 learners).
- Pit designed to be pumped out every 5 - 10 years (pit contents should be moist to wet).
- Use only where emptying by vacuum tanker or sludge pump can be arranged.

School VIDP

- Slightly smaller capacity (up to 40 learners).
- Shallow pit easier to dig in very hard or wet ground conditions.
- Use of alternating pits, which are designed to be emptied manually two years after filling.
- Appropriate where ground water contamination possible.

5 .... Numbers, Layout and Orientation

The number of toilet seats, urinal spaces and hand washing points to be provided is a major factor in determining the capital cost of a school sanitation project.

Boys and girls facilities must be separated. The number of seats for boys can and should be reduced by building urinals. Table 1 below give the *minimum* recommended provision. They are based on international and national experience on usage rates as well as limitations imposed by pit volume and filling time.

TABLE 1: Minimum Recommended Provision of Toilets *(for disabled users, see pg 9)*

Grouping	Females	Males
Nursery School Children Age: 3 - 5 yrs	1 seat per 20 users rounded up, + 1.	
Primary School Learners Age: 5 - 12	1 seat per 30 users, rounded up, + 1	1 seat per 40 users, rounded up. 1 urinal space per 40 users, rounded up.
High School Learners Age 12 - 18 yrs	1 seat per 30 learners, rounded up, + 1.	1 seat per 50 users, rounded up. If VIDP, 1 seat per 40 users. Urinal space - as above.
Teaching Staff	1 seat per 10, rounded up, with a minimum of 2	1 seat per 10, rounded up.

The number of toilets needed could be adjusted to suit a limited budget, but to avoid queuing problems, a management regime would be required that includes staggered break times or 5 minute gaps between lessons. The pit fill up time would also need checking to ensure this was acceptable, especially in the case of a VIDP.

Within any provision of toilets, in what ever configuration they are being provided there should be at least one unisex Special Access Toilet for the use of disabled students, parents and teachers. Should the combined student population exceed 300 students, one additional Special Access Toilet should be provided for every 300 students thereafter. The facility should comply with the technical requirements set out in Appendix B.

The following guidelines are recommended for the provision of hand washing facilities:

TABLE 2: Minimum Recommended Provision of Handwashing Facilities

Nursery Schools Boys and Girls	Boys	Girls	Teachers
One tap per four seats (rounded up)	One tap per four seats (rounded up)	One tap per four seats (rounded up), but not less than two, screened for privacy	One tap per two seats. Facilities separate for male and female.

Worked Example 1: Estimating the Number of Seats and Taps Required

A High School has 256 girls and 345 boys, 7 male and 8 female teachers. What sanitation facilities are needed assuming single pit VIPs are to be built?

Boys: Toilets: The guideline is one seat per 50 users, rounded up. 50 goes into 345 six times, remainder 45. That means seven (6 +1) toilets are needed.
Urinals: The guideline is one space per 40 users, rounded up. 40 goes into 345 eight times, remainder 25. That means nine (8 + 1) urinal spaces are needed.
Taps: The guideline recommends one tap per four seats, rounded up. Four goes into seven once, remainder three. Two (1 + 1) taps should be provided.

Girls: Toilets: The guideline calls for one seat per 30 girls, rounded up, plus one extra. 30 goes into 256 eight times, remainder 16 i.e. 8 + 1 + 1 = 10 toilets should be provided.
Taps: There should be one tap for every four seats. Four goes into ten twice, remainder two, so three taps are recommended.

Male teachers: 1 toilet and a hand washing space.
Female teachers: 2 toilets and a hand washing space.
Disabled users: The guideline is one toilet for every three hundred students, rounded up. Thus two special access toilets should be provided, each with its own built in hand washing facility.

Having worked out seat numbers, the orientation and layout of the toilets, urinals and hand washing stands should be planned. The toilets can be built individually (maybe for staff), in pairs, or indeed in groups of any number. They can also be arranged in row or block form. Urinals and hand washing stands can be planned as part of a block or at the end of a row, or as a separate structure altogether. The most important factors that need to be considered are summarised in the following pages.

5.1 Social Issues Affecting Layout and Orientation

Segregation

Toilets for boys and girls should be fully segregated (preferably in different parts of the grounds) to provide a sense of security for girls. This should extend to hand washing stands.

Convenience

The facilities should be sited for convenience, i.e. not so far from the school rooms that use is discouraged.

Privacy

Many girls have to wash their sanitary cloths whilst at school. Thus tap stands for girls should if possible be enclosed by a privacy wall.

Security

Avoid building right next to a fence where the user may be afraid of intimidation or abuse. This also reduces the ease in which a student leaves the school on the pretext of going to the toilet.

Limit social space

Avoid "building in" closed off passages within a block that can be dominated by a particular group of students.

Disabled Users

A Special Access Toilet for disabled and elderly users should be provided in a position which allows both sexes, parents and staff to make use of it. It should be located as close as is feasible to the hardened access corridors of the school and have a hardened surface from the corridor to the toilet (see Appendix B for further details).

Pre-primary

Pre-primary children are best catered for with open plan shared cubicles where the teacher can supervise and train all the children together.

5.2 Management Issues Affecting Layout and Orientation

Care of toilets

Depending on the management regime adopted, choose a layout in which classes or groups can readily identify the toilet which they are to use and are to be responsible for.

Expansion

Plan for future expansion by earmarking an area for future school sanitation.

Emptying

Toilets are more easily emptied from the outside. There must thus be good access to the rear of the toilets. If the sludge or humus is to be buried in trenches within the school grounds, an area close to the rear of the latrines should be set aside for this.

Space

A group of single pit latrines is sometimes favoured instead of a block of latrines. This layout option may not necessarily cost more, but it will use significantly more space. If space is constrained, the toilet block option is preferable.

5.3 Technical Issues Affecting Layout and Orientation

Excavation

Avoid areas in which pit excavation is going to be difficult (use trial pits or augur holes to check).

Wind direction

If possible site VIPs so that any doors face the prevailing wind direction and not into the sun. This helps ventilation. Avoid building VIPs upwind of the school.

Water table

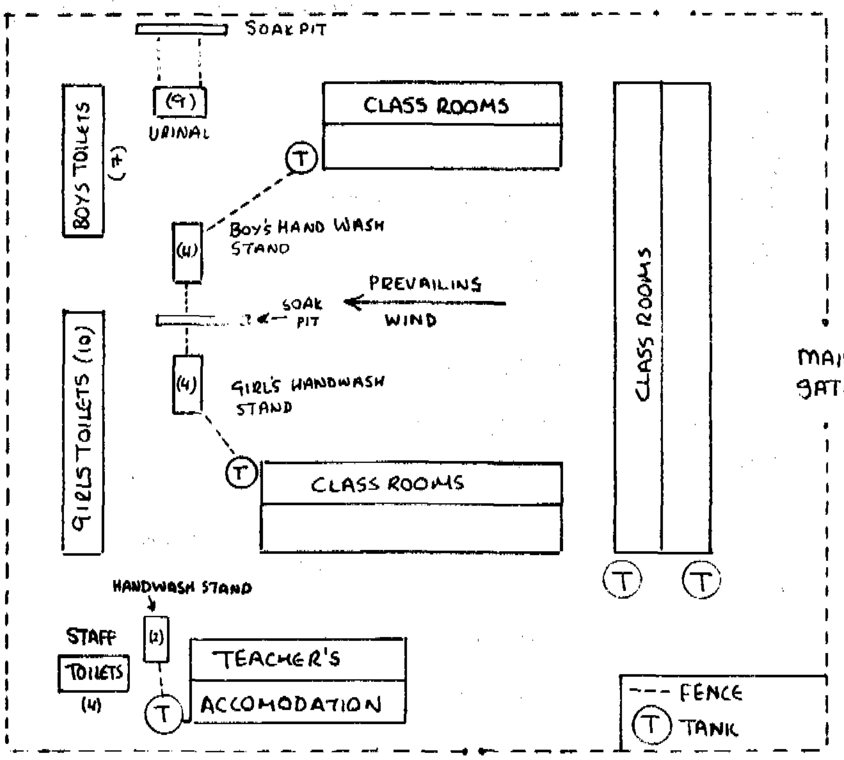
Avoid building VIPs in depressions that can be flooded, where draining excess water from the tap stands will be difficult, or where there is a risk that a high water table will flood the pit.

Contamination Risk

The pits should be at least 75 metres away from the nearest borehole or well. ***Refer to the DWAF <u>Groundwater Protocol</u> for details.***

5.4 Example of Layout and Orientation

The following diagram illustrates how these issues can be combined to decide the layout of school toilets and other facilities, using the number of seats calculated earlier in this section.



Example of Layout and Orientation of School Sanitation

Summary

Having decided on the technology, calculate numbers of toilets, urinals and hand washing facilities needed for girls, boys and members of staff.

Then decide how to arrange, orientate and place these facilities considering SOCIAL, MANAGEMENT and TECHNICAL issues.

6 .... Pit Capacity

Establishing the dimensions of a pit, whether this be for a single pit VIP or a VIDP, is fundamental to the design of any VIP. The pit volume required depends on:

- the solids accumulation rate.
- the number of learners using the pit.
- the desired life span of the pit.

When designing a VIP toilet, provision must be made for free space at the top of the pit, usually **0.5 m.** A simple formula is used to calculate pit volume.

For a VIP toilet, effective pit volume (V_e) is calculated as follows

$$V_e = C_a \times N \times P$$

Where:

V_e	=	**Effective pit volume in cubic metres**
C_a	=	**Applicable solids accumulation rate in cubic metres**
N	=	**Desired filling time in years (10 for a Single VIP, 2 years for a VIDP)**
P	=	**Number of users per pit**

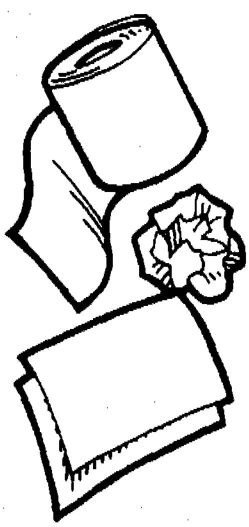


TABLE 3: Guideline Figures for the normal Solids Accumulation rate, C

Note: These figures apply to domestic sanitation, and must be reduced when planning for schools (see page 13).

Anal cleansing materials	Wet Pits C (m^3 / person / year)	Dry Pits C (m^3 / person / year)
Soft Toilet Paper	0.03	0.04
Other Paper	0.04	0.06

These basic figures have been averaged from a number of sources, and apply to adults. The use of other materials for anal cleansing (such as mealie cobs) must be discouraged by the school, simply to prolong pit life.

To get the applicable solids accumulation rate for a school , C_a, the normal solids accumulation rate, C, given in Table 3 must be modified by three factors:

- Reduction Factor r_1: Schools are typically open only 200 days or approximately 55% of the year. ***If this factor is applied it is important that school facilities are not used by outsiders during holiday or term time. This means that either the toilets must be lockable, or the school must be securely fenced.***

- Reduction Factor r_2: The figures in the table above can be reduced as the solids accumulation rate is less for children than it is for adults. In high schools, they can be reduced by 25%(i.e. multiply by 0,75), in primary schools, 50% (i.e. multiply by 0,50) and in nursery schools by 75% (i.e. multiply by 0,25).

- Reduction Factor r_3: The accumulation rate must be reduced by a further 50% (i.e. multiply by 0,50) to allow for the fact that many learners do use the bush or toilets at home outside of school hours.

Worked Example 2: Pit Volume, School VIDPs

It has been decided to design a VIDP toilet block in a high school. Calculate the effective pit volume (V_e) and the total pit depth.

$$V_e = C_a \times N \times P$$

First calculate *the applicable solids accumulation rate*, C_a, using Table 3 and the appropriate reduction factors for schools, r_1, r_2 and r_3. From Table 3, select the "Dry Pits"column, which should be the case for a properly functioning VIDP. Select the "Other Paper" row. Thus the figure to use for C, before applying any reduction, is 0,06. This figure must be multiplied by:

1) 200/365 (reduction factor r_1) to allow for the days the school is closed;
2) 0,75 (reduction r_2) the factor applicable for high school users; and
3) 0,50 (reduction r_3) to allow for the fact that learners are only at school for half the day.

So we have $C_a = 0.06 \times 200/365 \times 0.75 \times 0.50 = 0.012m^3$

For a VIDP, the *desired filling time*, **N**, is usually set at **2** years.

The number of users per seat is taken as 40 which will give spare capacity in pits used by girls. As it is a VIDP, at any one time 2 seats will share one pit. *The number of users per pit*, **P**, is thus 2 x 40 = **80.**

So now we can calculate the effective pit volume

$$V_e = 0.012 \times 2 \times 80 = 1.9m^3$$

The cross sectional area of a school VIDP pit is typically 2.5m x 1.2m or $3m^2$. The resulting effective depth would in this case be 1.9/3 = 0.64m, plus an additional 0.5m freeboard.

The total pit depth would therefore be equal to 0,64 + 0,5 or 1.14m, which one will round up to 1,2m (to fit in with the blockwork). This is shallow enough to be emptied manually.

Now applying the same example to a Single Pit VIP:

Worked Example 3: Pit Volume, Single Pit School VIPs

Using the same school as that in Example 2, estimate the effective pit volume and total pit depth that will apply if single pits rather than double pits are specified.

as before $V_e = C_a \times N \times P$

First calculate the *applicable solids accumulation rate* C_a:

Table 3 gives the normal solids accumulation rate of $0.04m^3$ for adults for wet pits.

The reduction factors applicable for schools r_1, r_2 and r_3 are the same as for the previous example. So

$$C_a = 0.04 \times 200/365 \times 0.75 \times 0.50 = 0.008m^3$$

For a Single Pit Design, the *desired filling time*, **N = 10** years.

The number of users per seat is taken as 50 which will give spare capacity in pits used by girls. As it is a Single Pit Toilet the *number of users per pit*, **P = 50.**

Thus the effective pit volume required, V_e, is

$$V_e = 0.008 \times 10 \times 50 = 4m^3$$

The cross sectional area of a single pit would typically be 2.6m x 1m or $2.6m^2$, in this case resulting in an *effective pit depth* of 4/2.6 = 1.54m. To this an additional 0.5m would have to be added giving a total pit depth of 2.04m, say 2,0m.

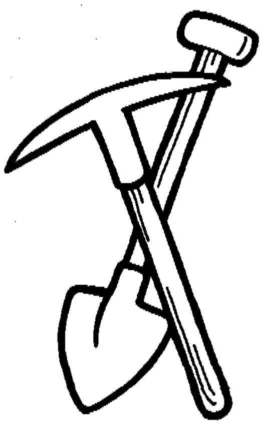
Summary

To calculate pit volume, use the formula: $V_e = C_a \times N \times P$, where C_a is the applicable solids accumulation rate. C_a is based on the normal solids accumulation rate for adults (see Table 3), which is reduced by three factors relevant to school sanitation.

To get the total pit depth remember to add 0.5 m free board.

The maximum recommended pit depth for a VIDP is 1.5 m, and for a Single pit VIP, 2.5 m. Shoring MUST be used if the trench is liable to collapse.

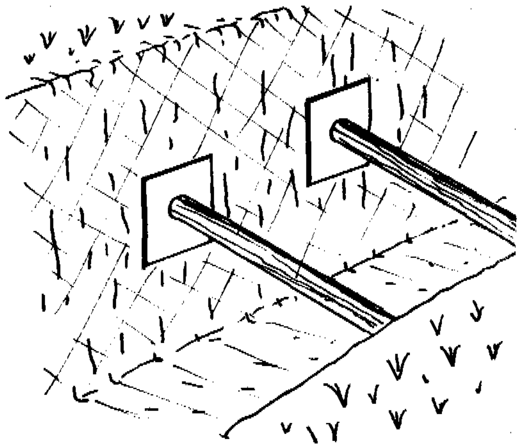
7 ....Sub-Structure and Slabs



7.1 Setting Out and Excavation

Excavating a trench 3 m deep, 3 m wide and 8 metres long is a task which must be undertaken with care. First **trial pits** should be dug to test the soil stability and check for rock etc. The site should be cleared and levelled before being **set out** with pegs and string. Soil should be dumped well away from the side of the trench (so as not to fall back into the excavation). The trench should be progressively cut over its full width

A combination of angling the sides of the excavation (more or less steeply according to the stability of the soil)and shoring of deep trenches (over 1,5 metres deep) must be used to prevent a soil collapse. The trench can be shored with 75mm gumpoles, each with a 200mm by 300mm piece of scaffold plank nailed to each end. These poles should be set just over a metre below the surface and a metre and a half apart.



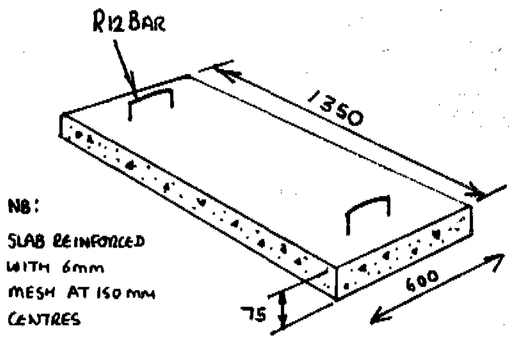
The sides of the trench should be shored with timber for safety

7.2 Foundations & Pre-casting

The trench must be fully lined and sub-divided into individual pits with cross walls. The lining and cross walls should be laid on a 200 mm thick concrete foundation. The setting out must be transferred to the trench bottom and the pegs set using a spirit level to ensure that the top of the foundation is level. A 1 *cement*: 3 *stone*: 6 *sand mix* is recommended for the foundation with just enough water to make the concrete workable. The concrete must not be thrown into the pit, but rather poured down a chute or slide.

Both the VIDP and Single Pit designs recommended include a number of moveable precast concrete slabs that cover the pit outside the toilet. Work to make these can start during excavation. Precast slabs should be cast using a 1 : 2 : 4 mix. The casting area should also be level and screeded with a thin layer of concrete. Form work should be laid on plastic sheeting or cement bags.

The form work should be carefully fabricated so that it can be easily dismantled to release the slabs after 24 hours, cleaned up and reused. All the slabs are 75mm thick and reinforced with 6mm mesh at 150mm centres or a weldmesh equivalent. Pit cover slabs include cast- in steel handles made from R12 bar. After the form work is removed the slabs should be cured and protected from frost for a further six days before use.



Typical Precast Slab

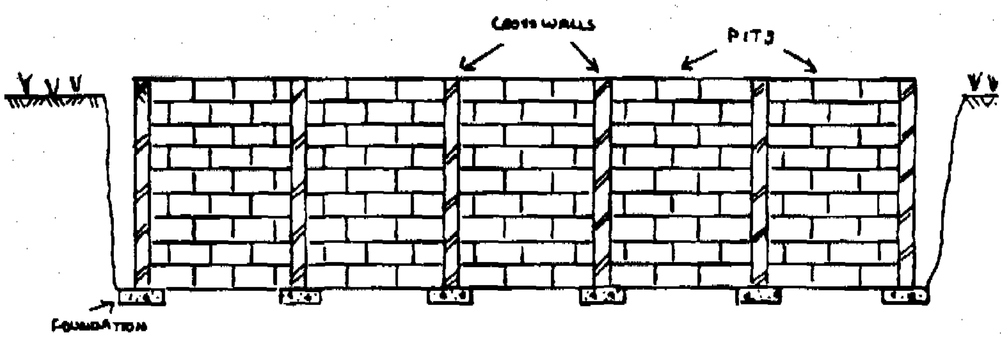
7.3 Lining and Cross Walls

Lining the trench and building cross walls is essential:

- so that the pits are robust enough to withstand repeated emptying;
- so that the weight of the superstructure is well supported;
- so that burrowing animals and roots do not penetrate into the pit, weakening it and allowing flies to enter and leave;
- so that there is no cross ventilation between adjacent pits that will disrupt air flow.

Only well cured cement blocks and fired bricks should be used to line pits.

The lining and cross walls must extend from the foundation to the cover slabs. The vertical joints in alternate courses of pit lining block work are left open in a VIDP (but not the cross walls) to allow for seepage. However, the top two courses of block work and the lowest course are fully sealed.



Pit Lining and Cross Walls

If a raised VIDP is being built, the lining should not extend more than 1 m above ground level.

Removable **pit cover slabs** are then mortared in place and sealed with a weak 1: 10 cement mortar. It is important these are fully sealed to prevent flies getting in and out.

Summary

Excavated trenches must be fully lined with mortared blocks or bricks built on level concrete foundations. Individual pits are formed by keyed-in cross walls, also built on foundations, that extend right up to the floor slab.

Precast slabs must be cured and protected from frost for 7 days before use.

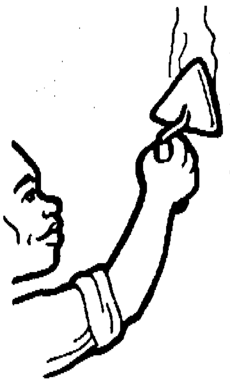
8. Superstructure

8.1 General

The function of the **superstructure** is to provide the user with privacy, comfort and protection, and to prevent vermin from entering the toilet. It also may accommodate hand washing stands, urinals, and in some designs a small utility room for cleaning materials.

The relatively dark interior discourages flies from leaving the pit via the pedestal. All that is necessary is to ensure direct sunlight cannot enter (although if it is too dark children may be afraid to use the toilet).

The **cubicle** or **compartment** should not be too big as too much extra space can encourage soiling and the use of the toilet for activities other than those intended. Typically 1 to 1.5 m^2 of floor space (including the pedestal or bench) is sufficient, the latter for a VIDP. This may have to be increased if the door is to open into the cubicle. *An allowance of 2,75 m^2 should be provided for the Special Access Toilet for disabled and elderly users which should be configured strictly in accordance with the minimum dimensions indicated in Appendix B.*



8.2 Walls

The superstructure can be built of fired bricks, cement blocks or specially treated timber. Stabilised soil blocks may be used if they are plastered to provide protection from rain. **All wall corners must be directly supported by concrete foundations, rather than being placed on a slab suspended over the pit.**

If the vent pipe is to be built of blocks, they must be keyed into the rear wall. If a PVC pipe is planned, galvanised 8 gauge wire ties should be built in at the top and bottom of the wall instead.

If needed, door frames should be treated or painted before being placed in position. A ventilation gap of about 100mm should be left at the top and the bottom of the door. *The Special Access Toilet for disabled or elderly users should have a structural opening for the door at least 900mm wide excluding the door frame and the walls should be capable of supporting grab rails on the side and back walls of the cubicle (refer to Appendix B).*

Any privacy (screen) wall must be built on prepared foundations and tied in to the structure or buttressed at least every 3 metres or less to prevent it toppling over.

Wall interiors should be carefully finished and, if the budget allows, plastered and painted with a washable acrylic paint (not too dark but not white either). Joints between the walls and the floor should ideally be rounded with a mortar coving to facilitate cleaning. Tiling is expensive, easily damaged and not recommended for schools. A shelf for toilet paper can be keyed into a side wall using blocks which are then plastered. This should not interfere with access and should be within reaching distance from the seat.

Summary

Superstructure walls can be cement block, brick or treated timber.
Stabilised soil blocks can be used if externally rendered.
Wall corners should not rest on bridging slabs.
Wall interiors should be finished by plastering and if possible painting with a washable paint.

8.3 Roof

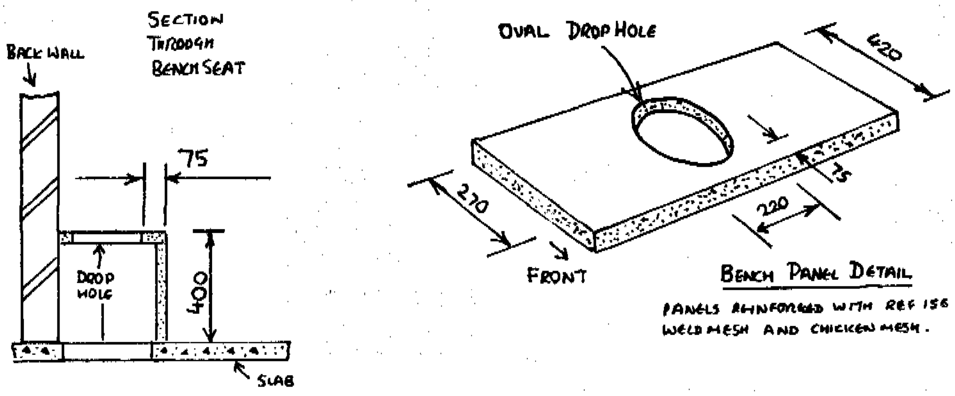
Rafters are not required for the small spans over toilet cubicles. Timber purlins should be built directly into the front and back of the side walls and tied down securely with 8 gauge wire. The roof sheets (corrugated iron, IBR or asbestos cement) are nailed to the purlins.

Funds permitting the roof can be extended over the screen wall (which is accordingly raised), which provides a sheltered space and protects the doors.

8.4 Seats and Pedestals

Getting the design of the seat right is very important. Moulded plastic pedestals, if kept clean, are attractive and easy to install. Benches fitted with plastic seats and liners (see below) are preferable though as cleaning is easier and they are more robust. If possible, any liner should diverge rather than converge towards the pit (ie: be larger at the bottom than at the top) to reduce the need for frequent cleaning. *A pedestal is required in the Special Access Toilet. The type, height and positioning of the pedestal are critical for wheelchair users and it is essential that the pedestal be of a highly robust construction. Refer to Appendix B for technical details, which should be strictly adhered to.*

The bench is best formed by precast ferrocement panels 40mm thick. Galvanised steel, wood and other materials may rot and are unsuitable. The drop hole (two in the case of a VIDP, one of which is temporarily sealed) should be formed in the bench panel with a suitable mould. ***The critical dimension is that from the front of the bench to the front of the hole. This should be no more than 75mm*** **or the hole will be set too far back for user comfort.**



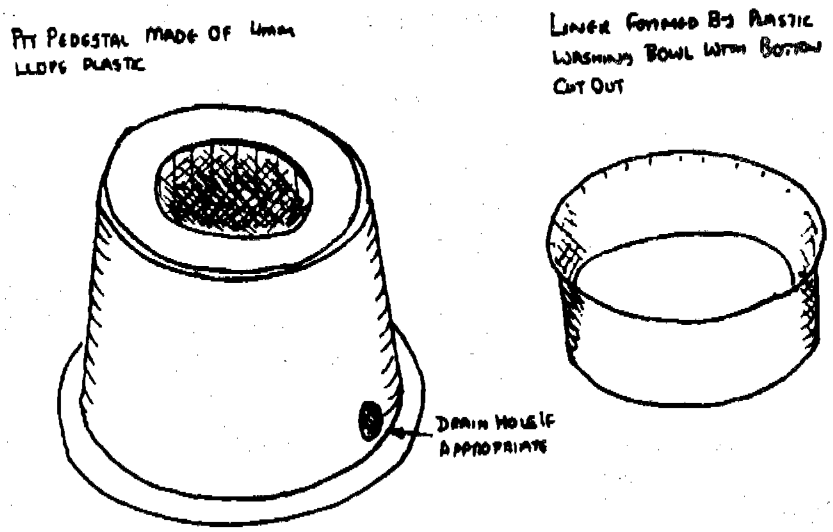
Details of Bench Design

In high schools the top of the bench or pedestal should be 400mm above the floor. A standard toilet seat (available from plumbing supply stores) can be cemented into place for comfort and to facilitate cleaning. It is also a good idea to paint the bench panels with a washable acrylic paint.

If a the toilet seat used includes a lid, this may have to be modified to ensure a minimum air gap of 15mm, without which the cubicle will not be adequately ventilated. The cheaper plastic lids are not very robust and it may be simpler to remove them altogether.

The drop hole cast in the bench panel should either be circular with a diameter of 220 - 250mm, or an oval shape 220 by 270 mm (and suit any plastic seat used). Larger drop holes may discourage younger learners from using the toilet for fear of falling in. In primary and nursery schools the seat height should be reduced to 300mm and the drop hole reduced to 200mm diameter.

To help keep the drop hole clean and reduce flies and odours, a ***diverging*** pedestal liner is recommended, and these are commercially available. Alternatively, a plastic washing bowl with the base cut away can be cast in the bench panel. This can be first slightly deformed into an oval shape to suit a plastic seat. A 200mm bowl thus formed into an oval 150 by 220 mm is suggested for primary schools learners and older members of nursery schools. A larger diameter bowl should be used to form the drop hole for older users.



Examples of Pedestal Liners

Summary

The seat is a very important part of the toilet. Bench type seats are recommended because they are strong and easy to build.

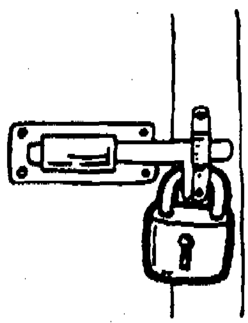
The bench seat can be made from ferrocement panels. The height of the seat should be carefully considered. 400 mm is recommended for high schools, in primary schools this can be reduced to 300 mm.

To keep the drop hole clean, a plastic washing bowl with its bottom cut out can be used as a liner.

8.5 Floor

The compartment floor should be plastered with a strong 1:4 mix and steel floated after the seat is completed. The floor should slope gently towards the a 40 mm drain hole cast in the bench panel or pedestal ***unless the soil is very impermeable when it should drain out of the door.*** Any gaps between the panel and walls should be filled with cement mortar. Corners should be finished with a slight radius to help cleaning. The ideal floor finish is stoep paint, which can be renewed from time to time.

8.6 Doors and Locks



In the case of senior primary and high schools, it is recommended that each compartment should have a door both for privacy and security. ***Toilets intended for nursery and junior primary school children should however not have doors as they are not easy for young children to use.*** In this case a screen or privacy wall is needed for privacy and to cut out some (but not all) light.

Doors that open inwards are generally recommended as they are much less vulnerable to wind damage. *However, due to the space constraints related to the Special Access Toilets for disabled or elderly users, their doors must always be outward opening (see further details regarding doors for these toilets in Appendix B.)* Outward opening doors ***must*** be secured after use, or they will be easily damaged.

The door itself should be between 650 and 850 mm wide, depending on the size of blocks used in the superstructure.

Getting the design of a timber door right is very important to prevent it sagging or warping. If timber is going to be used, 22 mm treated softwood, tongued and grooved, and battened with 22 mm x 110 mm softwood is suggested. The battens must take account which way the door is to be hung. Hinges and fixtures should be screwed rather than nailed. A gap of 100 mm above and below the door should be provided for ventilation, allowing air into the compartment to replace that sucked from the pit via the vent pipe.

Doors should have a simple catch fitted on the inside. Doors should also have a catch on the outside so that the door can be closed after use and a lock to enable the toilet to be secured after school hours.

Doors should be varnished with a polyurethane exterior grade varnish, or painted with a coat of primer and gloss paint. Different colours could be used by learners to identify their own toilet which they are responsible for cleaning.

In many areas there is a strong tendency for school toilet doors to be stolen. It is thus recommended that screen walls are constructed to provide a minimum degree of privacy, whether the doors are in place or not.

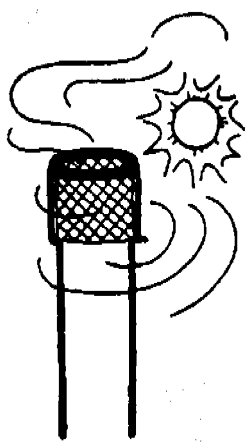
Summary

Doors should have an inside catch for the users privacy and an outside lock for security.

Doors can open inwards or outwards. If they open inwards, more space is needed in the cubicle. If they open outwards, users **MUST** secure them to prevent wind damage.

Screen walls are strongly recommended. They provide for a minimum degree of privacy - essential if the doors do not remain in place.

9 .... Vent Pipe & Fly Screen



Getting the vent pipe and fly screen right is essential if the VIP is to work properly. The rule is that every pit in use needs a vent pipe. The vent pipe ***must not*** have any bends or right angles in it and ***must not*** have a cowl at the top.

Minimum **internal** vent pipe diameters are shown in Table 4 below. ***Under-sizing vent pipes will lead to problems with smell that could cause the toilets to be abandoned.*** The vent pipe must extend 500 mm above the highest point of the roof and be perfectly straight. It should also not extend into the pit.

TABLE 4: Minimum Recommended Internal Vent Pipe Diameters

Wind Prevalence	Type: Fibrecement or uPVC	Type: Brick or Block
Windy (av. wind speed > 3 m/s)	100 mm	180 mm square
Other areas	150 mm	230 mm square

The fly screen should be made of 1 mm^2 aluminium or stainless steel mesh. Plastic coated glass fibre quickly becomes brittle and tears. Galvanised mesh soon corrodes. The fly screen condition should be checked every three months, and it should be replaced if need be. Further details are included in the blue "Building VIPs" guidelines.

10 ....Urinals

Urinals must be seen as part and parcel of school sanitation because:

- they prevent the accidental fouling of the boy's toilets, which is in many cases the prime cause of unpleasant odours;
- they reduce the number of toilet seats needed, and as urinal spaces are cheaper than toilet seats this reduces the overall cost; and
- they help keep VIDP pits dry, which can stop them overflowing and facilitate manual emptying.

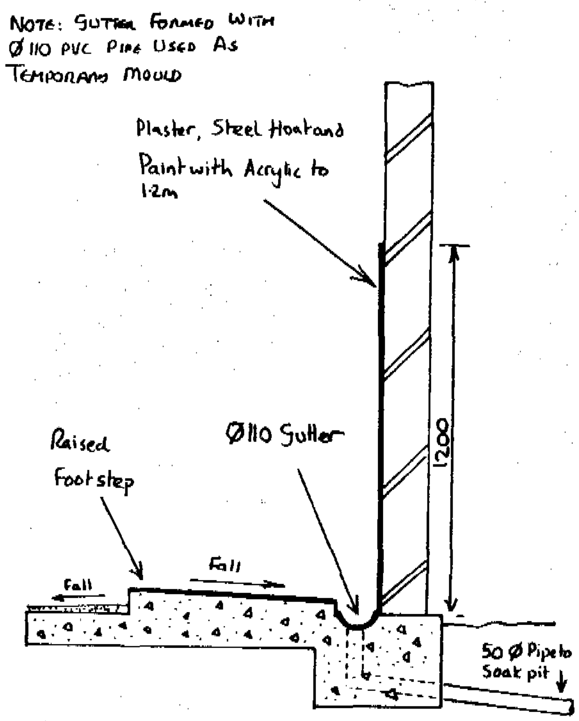
Note - *A urinal space is 600mm of urinal channel. One urinal (the room or building) may thus include a large number of urinal spaces).*

Urinals can be built as separate buildings or as part of a toilet block. It is not necessary for the urinal to be roofed.

The design detailed in the Appendix has ten urinal spaces, enough for 500 male learners. It consists of a 110 mm floor level channel running around three sides of the urinal compartment, and leading to two drain pipes that feed a soak pit. Details of the soak pit are contained in Section 12.

A raised foot kerb separates the urine channel from the screeded concrete floor. It is very important that a tough plastic or stainless steel trap is incorporated in the drain to prevent debris blocking the pipes. This is especially so if the urinal building is not roofed.

The compartment walls should be plastered and steel floated up to 1.2 m above the floor. This should then be painted with a "urine" resistant washable epoxy or acrylic paint.



Detail of Urinal Design

11 .... Hand Washing Stands

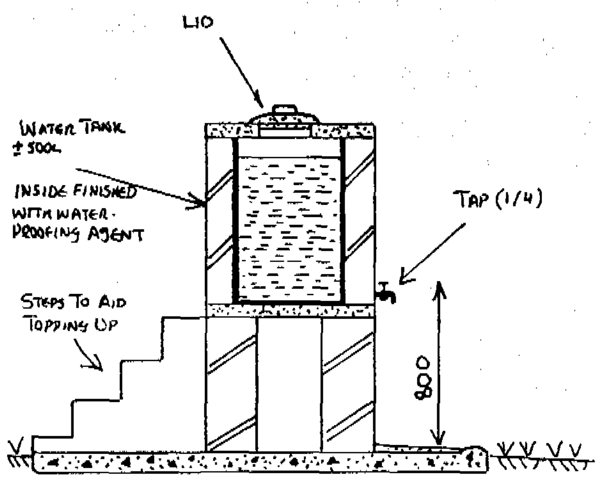
The importance of ensuring that learners wash their hands after using the toilet, preferably using soap, cannot be stressed enough. Neither can be the importance of having water to clean the toilets and urinals on a daily basis. ***If hand washing is not being practised, and the toilets are not cleaned (preferable daily) then any investment in school sanitation will have only a negligible health impact.***

One litre of water per student per day should suffice for both hand washing and cleaning. A prerequisite is that the school must have an adequate drinking water supply, or water intended for hand washing will not last. Any system relying in part or fully on learners bringing in water for hand washing and cleaning can only work if their drinking water needs are adequately catered for at school and if they have fairly convenient access to a water source near their homes.

A school tap stand designed to supply water for hand washing typically consists of a small water tank that can be topped up manually or is connected to a school water supply , a number of taps, and a drain leading to a soak pit.

The stand should be located in or near the toilet block. Separate facilities are needed for boys and girls. It is recommended that the girl's tap stand is built with a surrounding privacy wall.

Taps for hand washing should be self closing and have a restricted flow of 2 - 3 litres a minute. A separate, lockable maintenance tap should also be provided for cleaning water. As in the case of urinals, it is recommended that a separate soak pit is used. Details of soak pits are included in the next section.



Typical Details of a Hand Washing Stand

One idea to help with the collection of water for hand washing is to divert rainwater from the roof of the toilet block into a collection tank. This would have to be supplemented during the dry season from another source. The tap stand could be adjacent to the toilet block.

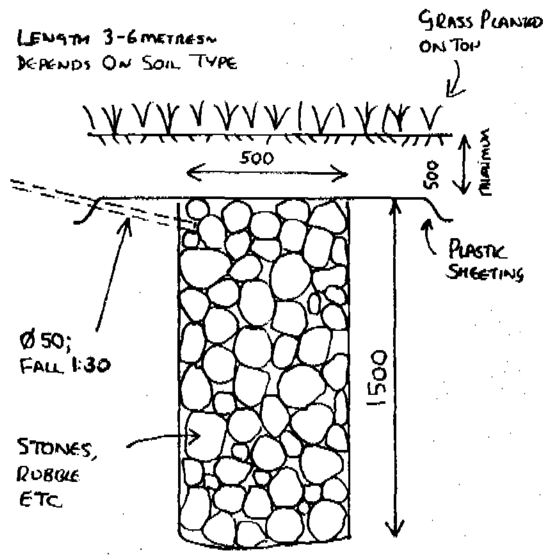
12 .... Soak Pits

Having already discussed the design of urinals and hand washing facilities, it is important to consider how to deal with significant quantities of urine and waste water. Stagnant pools of water provide breeding places for mosquitoes and disease.

It is recommended that in general, waste water from hand washing stands and urine (from urinals) is diverted into a one or more soak pits. The limited volume of water used for cleaning toilet floors (approximately 10 litres a day) can normally be diverted into the toilet pit without any risk of flooding it unless the ground is almost impermeable.

Soak pits should be sized according to the volume of liquid they are expected to cope with and the permeability of the soil. In most cases, a pit 6 m long, 1.25 m deep and 0.5 m wide is sufficient for 10 urinal spaces (500 learners) or a hand washing stand. The pit should be filled with stone or rubble, the top 500 mm being backfilled with the excavated soil placed over a polythene or similar barrier.

If there is any doubt about the capacity of the ground to drain water, a simple percolation test can be carried out. Dig or augur a small pit to the required depth and fill it with water to a mark. Refill it to that mark several times until the ground around the pit is fairly saturated. The volume of water needed to maintain this level is then measured over a number of hours. If the daily volume of urine and waste water is known or can be reasonably estimated, the results of this test can be used to size the soak pit.



Detail of Soak Pit Design

13 ....Management and Maintenance

The effective management of school sanitation, together with regular maintenance and cleaning, is vital if the facilities provided are going to be used as intended and have long term benefits to the learners. Fundamentally, the key responsibility for both management and maintenance lies within the school itself.

It is the principal's responsibility, assisted by his or her staff and the school board, to manage and maintain the school's sanitation facilities. He or she can call on learners themselves to play a role, although for this to be sustainable, they must realise the importance of sanitation and how they stand to benefit.

The following factors are among those that need to be considered.

13.1 Management of School Sanitation

A management regime

A management regime may be needed to reduce queues at school toilets at critical times during the school day. Options may include time-tabled 5 minute gaps between lessons and staggered break times.

Defined responsibilities for cleaning and inspecting toilets and other facilities

Responsibilities must be discussed, agreed and clearly defined. These must include school learners if they are to be responsible for cleaning toilets on a daily basis, and how this is to be monitored. **Note: It is unwise to ask a learner to clean one or more toilets as a punishment for some misdemeanour.** *If it is not possible to get the learners themselves to keep the toilets clean, the school governing body has no option but to* *employ a cleaner from the local community.* For a typical school with, say, seven hundred pupils this cleaning should not require more than two hours of work per day, which for 200 days will cost about R2 000 per year, or R3 per child per year.

If the cleaning of the toilets and their surrounds is neglected there may as well not be any toilets.

Provision of cleaning materials

Cleaning materials will need to be provided, including brushes and disinfectant for the walls, floors and seats (not for the pit). Not only will the materials have to be paid for, but there must also be a system to monitor the use of cleaning materials and reorder when stocks are low. A store needs to be set aside for cleaning materials.

Note: Jik and other disinfectants must not be poured into the pits as they will kill microorganisms responsible for reducing the volume of its contents. At some schools Jik or similar products are regularly poured into the pits ("to make them smell nice"), but this practice will in fact drastically shorten the time before the pit fills up. *Where the pit contents are fairly wet it may be useful to add proprietary enzyme products from time to time. Some users report that this practice slows the filling of their pits.*

Provision of water and toilet paper

Systems need to be established to ensure that there is sufficient water for hand washing and cleaning, and that learners have toilet paper (not necessarily in roll form). Although learners could bring a limited quantity of water in themselves to supplement a limited school supply, this is unlikely to be sustainable. A better option is to sort out the school's own water source with the authorities responsible before embarking on a sanitation project. It may be necessary to pay for water used every month. School learners can and do bring in paper however.

Hygiene and user education

For the facilities provided to result in long term benefits, learners must receive training in how to use them properly and how to modify their personal hygiene behaviour, for example, in terms of hand washing after using the toilet. How this is to be done must be included in the school's sanitation management plan.

Security of toilets

Toilets should be locked outside of school hours to prevent them being used by outsiders and to ensure that they are not vandalised (doors are often stolen if they are not left locked after hours). This policy and the reasoning behind it will need to be discussed with the surrounding community.

13.2 Maintenance of School Sanitation

Emptying and disposal of pit contents

Depending on toilet type, design and the number of users, the pits will eventually need to be emptied. In the case of VIDPs, this is done manually every two to four years. A pit emptying contractor will have to be paid to do this. The VIDP's toilet seats must be moved across to their alternate positions as well. Emptying should take place during school holidays. The humus excavated can be buried locally in trenches, and in time it will be found that trees grow particularly well on the disposal site.

Single pit latrines will need to be pumped out mechanically every 10 or so years. This will need the use of a truck mounted vacuum pump, or, if the contents are very wet, a sludge pump. Although the vacuum tanker can dispose of the waste elsewhere, a trench will be needed if a sludge pump is to be used.

General maintenance

Like any other building, school sanitation facilities will need regular inspection and maintenance. Cracks must be repaired, and surfaces replastered and painted whenever necessary. Fly screens in particular need to be checked every year and replaced if necessary. A bucket of water poured down the chimney is a good way of clearing any cobwebs that may be obstructing air flow. Blocked soak pits may need to be rested to regain their usefulness. All this work will require planning and funding by the school's governing body. A maintenance budget should be prepared during the planning phase, to ensure that the facilities provided can be sustained.

Old toilets

Rural school yards are too often littered with old school toilets which are not only dangerous, unsightly and unhealthy, but they also waste valuable space. Old toilets, if they are not to be emptied and put back into service, should be broken down and covered up. The school's governing body is responsible for seeing that this happens.

13 ....Bibliography

The following books, papers and guidelines provide further useful information on the provision of school sanitation:

Bester J.W. and Austin, L.M., *Building VIPs: Guidelines for the Design and Construction of Domestic Ventilated Improved Pit Toilets*, CSIR, August 1997

Corbett, Bruce, *Perceptions Practices and Dynamics of School Water, Sanitation and Health Issues in Gauteng Province*, report prepared for the Gauteng Integrated Schools Sanitation Improvement Programme (GISSIP), September 1997

Directorate of Geohydrology, *A Protocol to Manage the Potential for Groundwater Contamination from On-site Sanitation, Department of Water affairs and Forestry*, 1997

Morgan, Peter, *Rural Water Supplies and Sanitation*, Ministry of Health, Zimbabwe, Macmillan, 1990

Mvula Trust, *Specific Policies for Water and Sanitation Development*, Version 7.0, November 1997

National Sanitation Co-ordination Office, *A Guide to Including Schools in CWSS Sanitation Projects*, June 1998

Appendix A: Sample Drawings for Basic School VIP Toilet Blocks

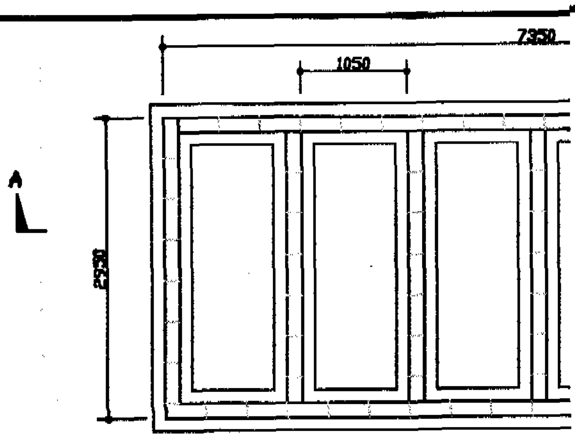
Drawing 1: Typical VIP School Toilet Block (single pit)

Drawing 2: Typical VIDP School Toilet Block

Drawing 3: Typical School Urinal

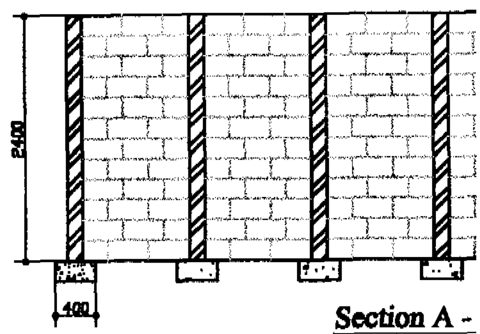
Drawing 4: Typical Hand Washing Facility

Bills of Quantities for Drawings 1 to 4



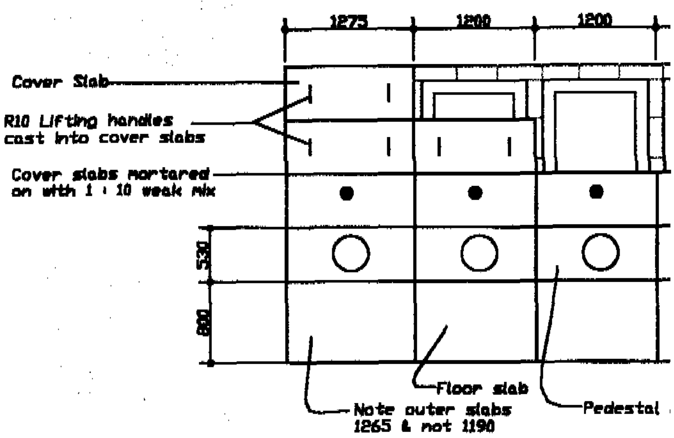
Plan Of Pit

Scale 1 : 50



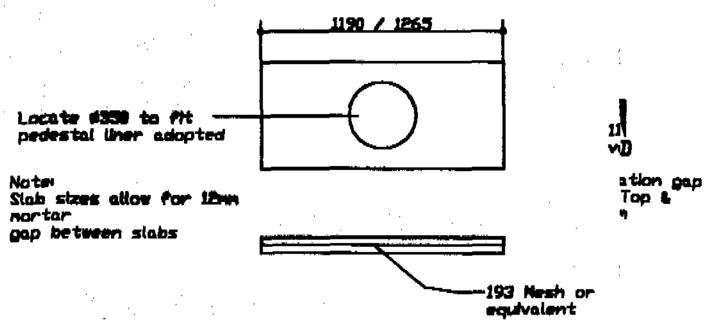
Section A -

Scale 1 : 50



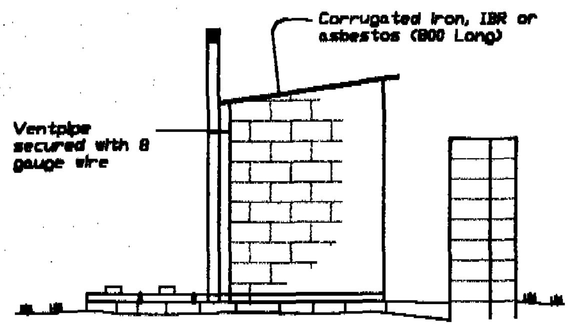
Plan of Ninth Course of Blockw

Scale 1 : 5(



Detail : Pedestal Slab

Scale 1 : 25



Side Elevation

Scale 1 : 50

Notes

1. Detail shows section B-B with completed cubicle and pedestal arrangement. In this case a propriety polyethylene pedestal liner has been used with a bench type seat. The floor has been screeded to fall - draining into the pit through the ø40 drain hole shown.

2. All dimensions are in mm.

3. Mix for all slabs to be 1 cement : 2 sand : stone and reinforced with a grid of 6mm bars at 150mm spacing. The seperate panels are sealed together with a weak mortar mix. Mix for strip footings to be 1 cement : 4 sand : 4 stone, Max stone size to be 19mm.

4. Dimensions for blocks : (This drawing) 400x200x150

5. Mix for blocks to be 1 cement : 8 sand by volume.

6. Mix for mortar to be 1 cement : 5 sand. Mortar joints to be nominally 10mm thick.

7. Place brickforce every second course for the pit lining and every third course for the superstructure

8. Conventional doors & door frames are not required. The doors can be hung on 25x50mm treated timbers wired in place. The doors must be primed & then painted with at least 2 coats of exterior enamel paint or alternately painted with exterior polyurethane varnish (min 2 coats)

9. The roof is supported with 2 50x75mm purlins, each securely wired in place. No rafters are required.

10. Completed blockwork above ground to be bagwashed with 1 cement : 3 sand mix.

Drawing 1 : Single Pit Type School Toilet Block

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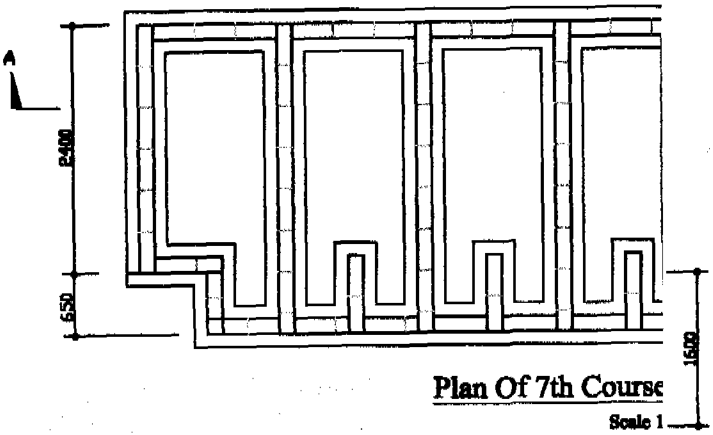
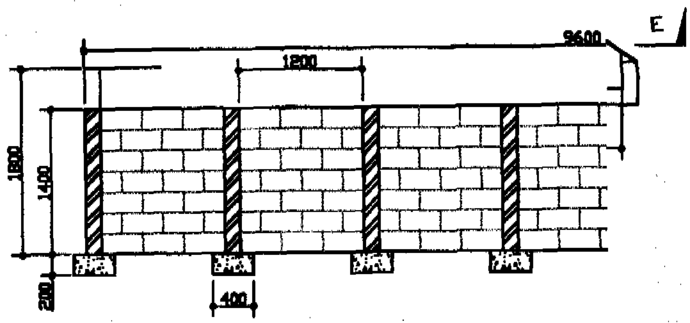


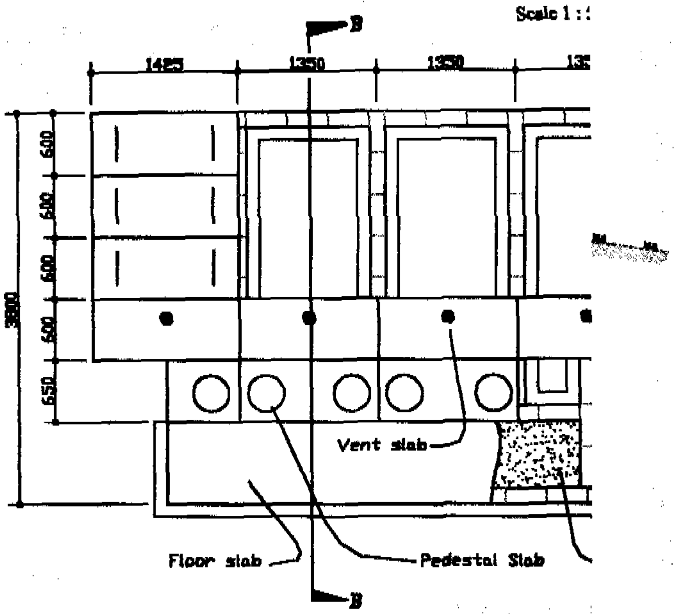
Plan Of 7th Course

Scale 1



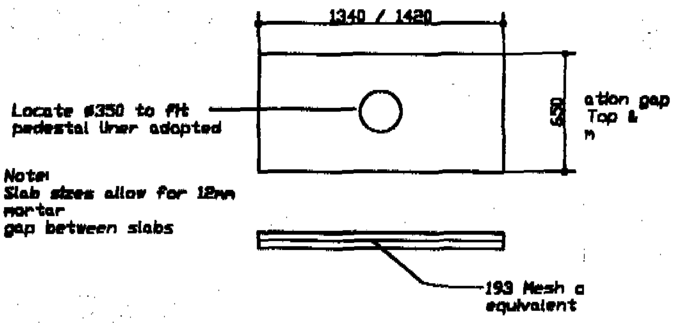
Section A

Scale 1 :



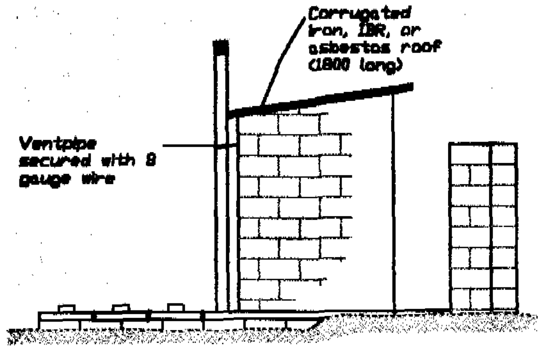
Plan Of Ninth Course of Blockw

Scal



Detail : Pedestal Slab

Scale 1 : 25



Side Elevation

Scale 1 : 50

Notes :

1. Detail shows section B-B with completed cubicle and pedestal arrangement. In this case a propriety polyethylene pedestal liner is shown with a bench type seat. The floor has been screeded to fall - draining away from the pit out the door.

2. All dimensions are in mm.

3. If the pit is raised above the ground, the raised part of the pit lining should be plastered and painted with a bitumastic paint on the inside.

4. Mix for all slabs to be 1 cement : 2 sand : 2 stone and reinforced with a grid of 6mm bars at 150mm spacing. The seperate panels are sealed together with a weak mortar mix. Mix for strip footings to be 1 cement : 4 sand : 4 stone. Max stone size to be 19mm.

5. Dimensions for blocks : (This drawing) 400x200x150

6. Mix for blocks to be 1 cement : 8 sand by volume. (crushing strength to be 2.0 MPa or better)

7. Mix for mortar to be 1 cement : 5 sand. Mortar joints to be nominally 10mm thick.

8. Place brickforce every second course for the pit lining and every third course for the superstructure

9. Conventional doors & doorframes are not required. The doors can be hung on 50x50mm treated timbers wired in place. The doors must be primed & then painted with at least 2 coats of exterior enamel paint or alternately painted with exterior polyurethane varnish (min 2 coats)

10. The roof is supported with 2 50x75 purlins, each securely wired in place. No rafters are required.

11. Completed blockwork above ground to be bagwashed with 1 cement : 3 sand mix.

Drawing 2 : Ventilated Improved Double Pit School Toilet Block

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Bill of Quantities: Single Pit VIP School Toilet: 6 Cubicle Design
Drawing No 1

Component	Applies to: A: Whole Block B: Individual toilet space (m3)	Concrete or Plaster W = 10%	Mix	Cement W = 10% (l)	Sand W = 10% (l)	Stone W = 10% (l)	Blocks (400 x 200 x 150 mm)			6mm ReBar W = 10% (m)	Corrugated Steel Width = 600m Length = 1.5m	Chicken Mesh 50mm sqr W = 10% (m2)	Brick-force 6 inch (m)
							No W = 10%	Cement W = 25% (l)	Sand W = 25% (l)				
Pit Foundation	A	2.56	1:4:4	493	1971	1971							
	B	0.64	Lean	123	493	493							
Pit Lining	A		1:5.3				1097	249	1372				200
including Cross Walls	B		1:5.3				264	60	330				48
Precast Slabs	A	1.70	1:2:2	655	1309	1309				275			
	B	0.30	Rich	115	230	230				53			
Superstructure Walls	A		1:5.3				526	119	657				60
	B		1:5.3				120	27	151				14
Bench Seat	A	0.31	1:3	137	412							6.2	
	B	0.05	Rich	23	69							1.0	
Floor Screed	A	0.13	1:3	55	166								
	B	0.02	Rich	9	28								
Internal Plaster	A	20.1	1:5.3	90	477								
	B	3.34	1:5.3	15	79								
Galvanised Steel Roof	A										19		
	B										3		
Drainage Apron	A	0.55	1:3:3	141	424	424							
	B	0.1	Medium	23	70	70							
Screen wall	A	0.88	1:4:4	169	678	678							
foundation	B	0.35	Lean	67	270	270							
Screen wall	A		1:5:5				810	184	1013				24
	B		1:5:5				405	92	507				9
TOTALS	A			1740	5436	4381	2433	553	3042	275	19	6.2	284
	B			376	1238	1062	790	179	987	53	3	1.0	71

Notes:

W = Wastage factor
Roof timbers, doors,tie wire, lifting handle bar and other minor materials not included in Bill of Quantities.
Mix proportions based on materials being batched loose.
1 Pocket cement = 50 kg = 38 l.
Standard vent pipe 100mm internal diameter, minimum length 2640mm.
Internal plaster to a height of 1.2m

Bill of Quantities: Double Pit VIP School Toilet: 6 Cubicle Design
Drawing No 2

Component	Applies to: A: Whole Block B: Individual toilet space (m3)	Concrete or Plaster W = 10%	Mix	Cement W = 10% (l)	Sand W = 10% (l)	Stone W = 10% (l)	Blocks (400 x 200 x 150 mm) No W = 10%	Blocks Cement W = 25% (l)	Blocks Sand W = 25% (l)	6mm ReBar W = 10% (m)	Corrugated Steel Width = 600mm Length = 1.5m	Chicken Mesh 50mm sqr W = 10% (m2)	Brick-force 6 inch (m)
Pit Foundation	A	3.38	1:4:4	651	2606	2606							
	B	1.08	Lean	209	835	835							
Pit Lining	A		1:5.5				1050	262	1443				224
including Cross Walls	B		1:5.5				325	81	446				69
Precast Slabs	A	2.10	1:2:2	808	1616	1616				411			
	B	0.58	Rich	223	447	447				106			
Superstructure Walls	A		1:5.5				311	78	428				60
	B		1:5.5				114	29	157				14
Bench Seat	A	0.36	1:3	144	432							21.6	
	B	0.06	Rich	24	72							3.6	
Floor Screed	A	0.16	1:3	71	212								
	B	0.03	Rich	12	35								
Ferrocement Roof	A	0.70	1:3	307	921								
	B	0.12	Rich	51	153								
Galvanised Steel Roof	A										14		
	B										2.4		
Drainage Apron &	A	5.57	1:3:3	1429	4288	4288							
Floor slab	B	0.93	Medium	238	715	715							
Screen wall foundation	A	0.88	1:4:4	169	678	678							
	B	0.35	Lean	67	269	269							
Screen wall	A		1:5:5				238	59	327				24
	B		1:5:5				91	23	125				9
TOTALS	A			3580	10753	9188	1598	400	2205	411	14	21.6	308
	B			825	2527	2266	530	132	728	106	2.4	3.6	92

Notes:
W = Wastage Factor
Roof timbers, doors,tie wire, lifting handle bar and other minor materials not included in Bill of Quantities.
Mix proportions based on materials being batched loose.
1 Pocket cement = 50 kg = 38 l.
Standard vent pipe 100mm internal diameter; minimum length 2640m.
Note: 7 not 6 vent pipes needed.

Bill of Quantities: School Urinal: 10 Stand Design
Drawing No 3

Component	Concrete or Plaster W = 10% (m3)	Mix	Cement W = 10% (l)	Sand W = 10% (l)	Stone W = 10% (l)	Blocks (400 x 200 x 150 mm) No W = 10%	Blocks Cement W = 25% (l)	Blocks Sand W = 25% (l)	6mm Bar W = 10% (m)	Brick-force 6 inch (m)
Concrete Foundation	1.72	1:4:4	330	1322	1322				82	
Blockwork Walls		1:5.5				245	56	307		22
Rendering Interior	0.15	1:3.5	63	221						
Floor Screed	0.10	1:3	43	128						
TOTAL			436	1671	1322	245	56	307	82	22

Notes:

W is wastage factor.
Mix proportions based on materials being batched loose.
1 Pocket cement = 50 kg = 38 l.
For Rendering, a wastage factor of 25% has been allowed for.
The drainage pipe, drain grids and paint have not been included in BoQ.

Bill of Quantities: School Hand Washing Stand: 4 Tap Design
Drawing No 4

Component	Concrete or Plaster	Mix	Cement	Sand	Stone	Blocks (400 x 200 x 150mm)			6mm ReBar	Chicken Mesh	Brick-force
	W = 10% (m3)		W = 10% (l)	W = 10% (l)	W = 10% (l)	No W = 10%	Cement W = 25% (l)	Sand W = 25% (l)	W = 10% (m)	50mm sqr W = 10% (m2)	6 inch m
Concrete Foundation	0.45	1:4:4	87	348	348				59		
Tank Support Columns		1:3.5				24	9	33			
Water Tank:											
Concrete Base	0.13	1:2:2	50	100	100				24		
Blockwork Walls		1:3.5				48	16	55			18
Ferrocement Lid	0.07	1:3	29	86						4.5	
Access Steps	0.06		23	69		16	4	20			
Rendering: Tank Interior		1:3.5	11	40							
Rendering: Columns		1:5.3	17	91							
Rendering: Steps		1:5.3	9	48							
TOTALS			226	782	448	88	29	108	82	4.5	18.0

Notes:
W = Wastage Factor
Taps, drain pipes and paint not included in BoQ
Mix proportions based on materials being batched loose
1 Pocket cement = 50 kg = 38 l

Appendix B: Special Access VIPs for Disabled Users

by Phillip Thompson of Integrated Design Consultants

1 ....VIPs for Special Needs Users Including Disabled People

With the introduction of inclusive education in South Africa, the special needs of disabled students and teachers, as well as the needs of elderly parents and other special needs users, need to be taken into account when providing any configuration of toilets. These toilet facilities have very specific sizes, fittings and configurations which have been tested to meet the broadest range of special needs. While at best they are a compromise, it is essential that these facilities are constructed and fitted in strict accordance with the technical requirements noted in this Appendix.

2 ....Locality and Access

As noted in Section 5.1 these toilet facilities should be located as close as possible to the main circulation ways to facilitate easy access. The topography on which the school is built will determine how far away they can be located, as access is very gradient specific. The toilets should be accessed by a hardened pathway at least 1m wide. The gradient along the pathway should not exceed 1:12, with the exception of short sections less than 2 m long which may have a gradient of 1:10. Ideally the pathway should be covered where possible. All transitions at doorways should not have a threshold exceeding 15mm in height. The unisex nature of a Special Access Toilet demands that it is sited away from the girls' and boys' toilets, but it could be located adjacent to the teachers' toilet facilities depending on their locality.

3 ....Design Details

The are no special requirements for the substructure and the superstructure can be constructed in the standard manner provided that block work cavities are filled wherever grab bars and other fittings are to be secured. Timber structures should be provided with substructure (reinforcing panels) to carry these fittings. The secure fixing of these fittings is essential for the safety of the user.

The minimum cubicle size is 1600mm x 1700mm with an outward opening door located in one of the 1700mm walls.

Floor: The floor should be constructed of a durable slip resistant material such as a grano screed with suitable stone chip base, which can easily be cleaned. The fall on the floor should be limited to 1:75 and should drain from one or more even falls without channels.

Walls: Depending on the construction of the superstructure the walls should provide a surface adjacent to the grab bars which should be smooth with an acrylic paint (or better) finish. As noted above the walls should be capable of supporting the grab bars which carry the full weight of the disabled person. The grab rails should be constructed of 50mm diameter stainless steel tubing in accordance with Drawing B1. These should be fixed to the wall with masonry anchors or bolted in the case of timber construction. The cranked grab bar should be located adjacent to the pedestal wc, while the straight bar should be located across the rear wall behind the pedestal wc as set out in Drawing B2. The heights and configuration are critical and should be strictly adhered to.

Doors: The door should open outwards as it is necessary to utilise the minimum cubicle size. Inward opening doors may only be used in cubicles which are at least 30% larger and then the configuration requires careful design. The clear opening of the doorway, from the face of the open door to the face of the frame on the opposite side of the door should be 760mm. This is normally provided by an 813mm door frame with a 44mm thick door. The door should be fitted with an internal grab handle as indicated on Drawing B2 as well as standard lever type "D" handles and locks. All door handles should be fitted to permit knock down opening, to allow disabled users with limited hand function to open the latch or lock. There should also be a slotted emergency opening mechanism which is accessible from the outside face of the door. This door furniture is essential to ensure independent use by the disabled person and ensure that the user is able to operate the door with limited grasp function. A stainless steel sheet metal kick plate 300mm high should be fitted to both sides of the door if possible This will protect the door from damage generated by the footrests of the wheelchairs.

WC Pedestal: The wc should be of a pedestal type which is located specifically in the location indicated on Drawing B2. The height of the seat should be 500mm above the finished floor level. The wc pedestal should be robust in design. If the wc is fitted with a separate seat, the seat should be constructed of solid hardwood or high density composite wood, fitted of corrosion resistant metal fittings and fixings. The wc pedestal and the seat should be securely fixed to the floor slab with masonry anchors. It is essential that this is not compromised in any way as it will generate accidents which may have serious consequences. The pedestal and seat should have a smooth durable finish to facilitate cleaning.

Handwashing Where ever possible hand wash facilities should be provided within the cubicle. While this is not provided in the standard VIP, it is almost essential for a broad range of disabled persons to have direct access to a handwash facility when seated on the wc. It is recommended that a small wash basin be provided located as indicated on Drawing B2. As the amount of water for hand washing has to be conserved a low level tank should be provided to gravity feed a lever arm basin tap. The waste water from the basin should be diverted into a soakpit or (where the soil permeability permits) into the toilet pits.

General: It should be stressed that the configuration of fittings and the dimensions indicated in Drawing B2 are critical and should be adhered to in all respects. The relative position of fittings within the minimum size constraints just permits the disabled user to enter, close the door and transfer onto the pedestal. The critical interrelationship of elements has been designed to take into account a broad range of special needs. In this respect certain compromises have been adopted and only specialists in the field of universal design are capable of generating variations which may be functional for all user groups. It is strongly recommended that wherever possible these approved standard layouts and configurations should be utilised as indicated in Drawing B2 without any variation.

Procurement The special grab bars can be custom manufactured by any suitable engineering works, however it should be noted that they are stock items from the larger plumbing suppliers. The ironmongery and other plumbing fittings are standard stock items and can be procured from most building suppliers.

Key Points To Remember

Managing School Sanitation

- The responsibility for managing school sanitation lies with the school principal, teachers, the school governing body and the students themselves.
- The health benefits associated with school sanitation will not be realised if the toilets are not cleaned and if hand washing is not practised.
- All learners must be trained in the correct use of the facilities as well as personal hygiene.

Maintaining School Sanitation

- VIP toilets are appropriate to most schools in rural and peri-urban locations, but must be well designed and built.
- Learners with physical disabilities must have access to sanitation.
- Hand washing stands and urinals must be included as vital elements in school sanitation.
- All school VIPs must be emptied when full.