GUIDE ON LOW COST SANITATION CONSTRUCTION TECHNIQUES FOR MASONs
ABOUT RAJIV GANDHI DRINKING WATER MISSION

Accelerated Rural Water Supply Programme is being implemented rigorously to supplement the efforts of the States/Union Territories. The Rajiv Gandhi National Drinking Water Mission was launched in August 1986 to accelerate the progress of drinking water supply in rural areas and to provide cost effective science and technology inputs to improve the programme implementation in active collaboration and cooperation with the states, local people and institutions.

The Missions' objective is to provide safe drinking water free from chemical and biological contamination as also ensure provision of 40 litres of safe drinking water per person per day (LPCD) in all areas for all human beings and additional 30 LPCD in Desert Development Programme areas for drinking water requirement of cattle. Habitations which are not getting full supply of 40 LPCD are treated as partially covered requiring augmentation facilities to bring them to the level of 40 LPCD.

The Mission’s major activities include improvements in the quality of drinking water through the Sub Missions on Eradication of Guineaworm, control of Fluorosis, Removal of Excess Iron and Brackishness, Removal of Arsenic, Water Conservation and Recharge of Aquifers. In addition, other programmes on water quality surveillance, training of villagers and officers/staff involved in the programme, research and development, and information, education and communication for health awareness are being implemented in cooperation with the State/UT Governments. Panchayats and non-Governmental Organisations, with special provisions for SCs and STs.

The Mission has a specialist role to play and has been created by the Ministry of Rural Areas and Employment, Government of India.

ABOUT NIRD

Integrated Rural Development through holistic approach is a national commitment. The goal is to enrich the quality of life of poor by meeting the basic needs and generating employment opportunities on a wider scale through decentralized planning. The Mission of NIRD is to facilitate rural development efforts by improving the knowledge, skills and attitudes of rural development officials and non-officials through training courses, workshops and seminars. Further, improvement of economic and social well-being of people in rural areas with focus on disadvantaged groups through research, action research and consultancy efforts is sought. NIRD is the country's apex body for undertaking training, research, action research and consultancy functions in the rural development sector. It is an autonomous body registered under Societies Act, funded by the Ministry of Rural Areas and Employment, Government of India.

NIRD is given the mandate to (i) conduct and assist in the organisation of training programmes, conferences, seminars and workshops for senior level development managers; (ii) undertake, aid, promote and coordinate research on its own or through other agencies; (iii) analyse and propose solutions to problems encountered in planning and implementation of the programmes for rural development, panchayati raj and similar institutions, and (iv) disseminate information through periodicals, papers and books in furtherance of the basic objectives of the Institute.

The Institute serves as a forum for discussions and debate about issues of common concern, and through its training and research activities, attracts academics and development practitioners from all over the country and abroad.

The Institute disseminates the results of its research studies and recommendations of its various seminars and workshops through a number of publications like the Journal of Rural Development, Panchayat Unnati and NIRD Newsletter.
GUIDE ON LOW COST SANITATION CONSTRUCTION TECHNIQUES FOR MASONs
Guide on Low Cost Sanitation Construction Techniques for Masons

About the Booklet

This booklet is one of the ten such booklets meant for a variety of Grassroot functionaries, School teachers, Panchayats, Motivators and Masons engaged in the implementation of the Drinking Water and Sanitation Programmes in rural areas.

The booklet is addressed to the rural masons. It specifically seeks to enable them to: (i) Comprehend the implementation of low-cost rural sanitation, (ii) Identify the structural components of on-site and cost-effective excreta disposal systems, (iii) Identify location specific technologies for the local users, (iv) Understand the construction methods for household and community sanitation systems and their upgradation over time, (v) Estimate the quantity of the materials required, their costs and labour components and (vi) Set up small sanitary production centres.
# CONTENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>OBJECTIVES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Various types of low cost excreta disposal systems for households</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Design Considerations and Constructional Features</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>On-site designs of substructures and superstructures</td>
<td>27</td>
</tr>
<tr>
<td>5.</td>
<td>Optimization of cost</td>
<td>29</td>
</tr>
<tr>
<td>6.</td>
<td>Advantages of pre-fabrication. Three dimensional views of various tools and equipment for prefabrication</td>
<td>30</td>
</tr>
</tbody>
</table>

# ANNEXURES

- Annexure 1.1: 34
- Annexure 2: 38
- Annexure 3: 46
- Annexure 4: 54
OBJECTIVES

After the use of the booklet, the target group of masons should be able to:

i) comprehend the importance of low-cost rural sanitation;

ii) identifying the various structural components of on-site, cost-effective excreta disposal systems;

iii) identify location-specific technologies for the user;

iv) understanding the various construction methods for household and community sanitation systems and their gradual upgradation;

v) estimate the quantity of materials required, their costing and labour involved;

vi) initiate setting up of small production centres.
Introduction

More than 50 kinds of diseases and 80 per cent of sickness are due to lack of potable water supply and good sanitation facilities for the disposal of human wastes. Indiscriminate open air defecation is the cause for transmission of diseases like cholera, dysentery, typhoid and worm infections. Sanitary disposal of human excreta prevents the transmission of these diseases. This is best done through a sanitary latrine. (Refer booklet on low cost latrines).

To control the transmission of diseases it is necessary to provide a sanitary barrier between the source of infection, i.e., the disease producing organisms in infected excreta and the hosts, the human population. The barrier will prevent faecal matter from coming into contact with man or with his food or drinking water. The function of the sanitary barrier is to prevent contamination from one agent to another like water and soil. The sanitary barrier is nothing but a sanitary latrine.

1.1 Basic Requirements

The following are the basic criteria for safe excreta disposal systems:

a) The excreta should not contaminate drinking water source.

b) The excreta should not be accessible to animals or flies or other insects.

c) There should be no handling of fresh excreta.

d) There should be freedom from odours or unsightly conditions.

e) The method used should be simple and inexpensive in construction and operation.

f) It should ensure privacy and protection against weather.

g) It should suit the habits of the local people. It should be user-friendly: particularly women, children and the aged should be able to use it.
Various Types of Low Cost Excreta Disposal Systems for Households

2.1 Types

1. Conventional pit latrine
2. Pour-flush latrine, direct pit latrine, offset pit latrine, 2-pit latrine
3. VIP latrine
4. Septic Tank

2.2 Conventional Pit Latrine

The pit latrine consist of a pit dug on the ground. A platform with a squat hole or seat is directly placed above the pit. Then a superstructure is created around the platform. Excreta is deposited in the pit. When this pit is full the superstructure and squatting place are removed and the pit is covered with a soil then a new pit is dug nearby.

2.3 Pour-flush toilets

The Pour-flush toilet is a low cost sanitation technology that needs much less water than a conventional flush toilet. The pour-flush consist of a squatting pan connected to a 20 mm water seal trap set on a cement concrete floor. This unit is then connected to the pits lined by brick work (honey comb construction). The pour flush toilet is as hygienic as a conventional cistern flush toilet. The pour-flush type can be a single or double pit design. The pour-flush toilet can be direct pit where squatting slab with pan is placed above the pit. It can also be indirect pit where the pan is connected to a single or a double pit located a little away from the pan by means of a pipe via an inspection chamber.

2.4 VIP Latrine

VIP Latrines are hygienic, low cost and useful form of sanitation with minimal fly nuisance: they need only minimal requirements for user care. The pit is slightly offset to make room for external vent pipe. The vent pipe should be painted black and located on the sunny side of the latrine superstructure. The air inside the vent pipe will thus heat up and create
an updraft with a corresponding down draft through the squatting plate. This, any odour emanating from the pit contents are expelled through the vent pipe, leaving the superstructure odour free. The pit may be provided with removable cover section to allow desludging.

The pit ventilators have an important role in reducing fly breeding. The draft discourages adult flies from entering and laying eggs. The fly screen at the top of ventilators cuts down access of flies to the pit content. Nevertheless, some eggs will be laid and eventually adults will emerge. If the vent pipe is large enough to let light into the pit and if the superstructure is sufficiently dark, the adults will try to escape up the vent pipe. The vent pipe, however, is covered by a gauge screen so that the flies are prevented from escaping and they eventually fall back to die in the pit.

2.4.1 Ventilated Improved Double Pit Latrine (VIDP)

i) To eliminate the need to construct very deep pits.

ii) To preclude the necessity of constructing another latrine once the pit is full.

A double pit latrine may be recommended. Each pit should be designed to have an operating life of at least one year.

Operation and maintenance of the VIDP is the same as that of VIP. One pit would be used at a time until full and then sealed while the second pit is in use. When the latter is almost full, the first pit would be emptied and put back into use once more. By alteration the two pits can be used indefinitely because of the long residence time (a minimum of one year) of the decompositing excreta in the pit not in use at the time. Pathogenic organism will have been destroyed by the time the pit needs to be emptied. As a consequence, there is no danger of spreading pathogens and excavated humus-like material can be used as soil conditioner or disposed of without fear of contamination.

2.5 Septic Tank Latrines

This kind is too much expensive for use in rural households. Even if it is affordable by some rich family the effluent disposal is often neglected creating gross pollution of surface/ground water. It also poses logistic as well as health problems in disposal of sludge. Therefore, this is highly discouraged and hence not discussed in this booklet.
Design Considerations and Constructional Features

From the point of view of suitability, acceptability and applicability pour-flush toilets are adopted in most parts of the country. A few regions or pockets social habits such as wiping in place of washing or acute scarcity of water has led to the adoption of VIP latrine. Therefore details of these two are highlighted in this chapter.

3.1 VIP Toilet Construction Details

3.1.1 Constructional details

The Ventilated Improved Pit latrine was developed specially for areas where water is scarce. This is an improved type of pit latrine. The main components are the following.

1. Pit
2. Pit slab
3. Superstructure
4. Vent pipe

The top two layers and the bottom two layers of brickwork should however have cement mortar brickwork (1:6).

The pit is circular in shape 1.5 m in diameter and about 3 m, and preferably 4 m, deep. The sides of the pit are lined with brick work. A ring of brick 75 mm, thick above ground level in C.M. 1:6 and levelled on top smoothly to accept the cover slab is provided. The cover slab is 1.5 m. dia, 75 mm. thick pre-cast in RCC 1:2:4. While casting the slab, two holes-one for fixing the vent pipe and another of size 300 mm long and 150 mm wide for the squat hole should be left.

The superstructure is offset from the pit and part of it rests on the pit itself. The rest of the superstructure rests on the ground on a solid foundation. The shape of the superstructure can be either spiral or rectangular. The brick work is in cement mortar 1:6 and 225 mm, thick for foundation and upto basement. The floor level of the superstructure is to be in level with the floor slab. Therefore, the basement in between the cover slab and brick foundation is to be filled with brick jelly and levelled and then the entire latrine floor is provided with flooring concrete. The top of floor is finished with sloping for entrance towards the squat hole. Foot rest is not generally required but if it is desired it can be fixed. The height of the superstructure is 2.00 m.
The vent pipe is part of the superstructure but provided along the outer surface of the enclosure. It can be either PVC or AC or brick cement improved materials for AC/PVC pipes and 200 mm. For improvised pipes constructed by means of split bamboo wrapped with minimum of 100 mm dia. Brick vent pipe of inner size 225 x 225 mm, can also be built. The top of the vent pipe is fitted with fly screen preferably of stainless steel and in the case of brick vent pipe it is placed on the top surface and embedded in cement mortar. No layer of brick is placed over the screen to hold it as it would interfere with air movement around screen. The height of the even pipe is atleast 50 cm. above the roof level. A completed VIP latrine is shown in Fig.1.

(a) Fly Control

In the superstructure, semi-dark condition is to be maintained. Window and ventilation are not provided. Enough care is taken to see that no direct sun light falls into the latrine. As semi-darkness is maintained inside the latrine, the flies present in the pit will be attracted towards the source of light and odour at the top of the ventilation pipe. The flies that pass through the vent pipe are trapped by the screen and pass up and down and finally die. Also the flies that approach the latrine externally are attracted to the top of the vent pipe due to the presence of odour and are prevented by the screen from entering the latrine. However, some will try to pass through the squat hole if the latrine floor is not kept clean.

(b) Odour Control

Because of flow of wind a draught is created at the top of the vent pipe. Therefore, the foul gas present in the pit rises through the vent pipe and escapes into the atmosphere and it will not pass through the squat hole. Also this facilitates the flow of fresh air into the pit through the squat hole. Under sun light, the vent pipe gets heated up and the hot air present at the top passes up the pipe and the cooler air from the pit is drawn up into the pipe. This mechanism works well in thin walled pipes made of asbestos, PVC and steel, coloured gray or black. It is less effective in thick walled brick vent pipes.

3.1.2 Operation and Maintenance

The VIP latrines can be used as bathrooms as well. When it is used thus, the squat hole needs to be covered so that soap and other bathing materials do not fall into the pit. While covering, care should be taken to ensure that the squat hole is not covered air tight as this would prevent the circulation of air. Also, if used as a washroom the floor should be thoroughly washed and made clean. When water is added to the pit, this will increase the rate of digestion of contents of the pit. Care should be taken to ensure that the amount of water does not overburden the pit.

A VIP latrine will take about 20 years to fill if used by a family of six persons. Under ideal conditions, the loading is 0.025 m³/year / person. Sometimes, garbage is also disposed
Figure 1: A Completed VIP Latrine
into the pit and in such cases, loading will be 0.04 m²/year/person, and then the same latrine used by a family of six persons will take 12 years to fill.

The internal wall of latrines should be plastered. The screen should be inspected periodically.

The best place for a latrine is downhill and 30 m away from a well. It should be located somewhere near the house and preferably down wind, with the opening facing the house. The operation of the latrine should be done in such a way that morning and afternoon sunlight does not reflect from the walls into the interior of the latrine. The cost of constructing one VIP latrine with pucca superstructure with RCC roof slab works out about Rs.5000/- (1996 rate).

3.2.1. Direct Pit Waterseal Latrine

This unit consists of a squatting slab cast with a steep cement pan. The pan of a direct pit latrine has an in-built waterseal either with a front discharge (Fig.2) or rear discharge (Fig.3). The slab can be of either a circular (Fig.4) or a rectangular shape (Fig.5). Both reinforced cement concrete (RCC) and ferro-cement (FC) constructions are common. The squatting slab is placed over a pit dug in the ground. If the soil is loose, the pit is lined to prevent the sides from collapsing (Fig.6) The size of the pit should be such that it takes two years to get filled up. A temporary superstructure is built for privacy and protection.

After defecation, 2-3 litres of water is poured to flush the excreta out of the pan. The excreta accumulates in the pit where decomposition takes place. The gas formed during decomposition escapes through the joints/openings of the pit lining and is absorbed by the surrounding soil. The effluent is leached out and absorbed by the soil while the solid part (sludge) accumulates in the pit. Thus, on prolonged use the pit gets filled up with sludge. When this happens, a new pit is constructed and the squatting slab and superstructure are shifted over it. The filled up pit is covered with a thick layer of soil and allowed to be stabilized for about two years. During this time the contents of the filled pit will have become organic humus and safe for handling. When the new pit gets filled up, after another two years or so, the first pit is cleaned and the squatting slab and superstructure shifted over it. Since the superstructure has to be shifted over and over again, only a temporary construction is recommended for this type of latrine.

To construct this type of latrine, the squatting slab fitted with a cement concrete pan is manufactured at the production centre. At the construction site, a pit is dug and the squatting slab is placed over its. The details of the steps are given below.
Fig. 2  
Pour-flush latrine-front discharge

Fig. 3  
Pour-flush latrine rear discharge

Fig. 4  
Pit with RCC rings

Fig. 5  
Rectangular squatting slab

Fig. 6  
Collapsing
3.2.1.1 Constructional Features

i) Cement Concrete Pan (fig.7)

For casting the cement concrete pan, a mould is used. The outer surface of the mould is painted with liquid paraffin to facilitate removal of the pan after setting. Cement-sand mortar (1:3) is poured around the mould to make a pan of 12 mm thickness. The mortar is shaped and finished with handwork using trowel. Time is given for setting after which the pan is carefully detached from the mould and cured properly. The pan is used for constructing the squatting slab.

ii) Rectangular RCC Squatting Slab (Fig.8)

The finished dimensions of a rectangular slab are 1.2 x 1 m x 0.04m. For construction, the outline of the slab is drawn and the position of pan marked. A hole is made in the ground at the place of pan just enough to accommodate it. Some sand is poured if the hole for the pan to rest on. The pan is placed and slowly manipulated so that the top of the pan is brought to the level of the desired finished surface of the slab. Once the pan is levelled, the gap in the hole is filled with sand and compacted properly.

A waterproof sheet (tin or polyethylene sheet) is laid on the levelled ground. A hole is cut in the shape of the pan to bring the pan edge cut. The casting frame (iron bar/angle or wooden frame) is placed over the sheet. The reinforcement is placed as per drawing and cast with concrete mixture (1.2.4). Proper setting and curing time is given.

iii) Pit (Fig.9)

A suitable site is selected. The outline of the squatting slab is drawn on the ground. A pit is dug at the centre of the outline (0.9m internal dia and 1m clear depth). Stable and hard soil conditions do not require pit lining. For loose sandy and black cotton soil pit lining is provided to prevent the sides from collapsing 75mm and 110mm thick honeycomb brick lining is commonly used. Alternatively, RCC rings or burnt clay rings can also be used. Local materials like bamboo matting, old drum, rubble masonry work, etc. can also be used to reduce cost, if they are available. Once the pit is ready, the squatting slab is placed over the pit. A spirit level is used to check the horizontal level of the slab. If the horizontal level is not achieved, the required water seal will not be caused and the latrine will not function properly.

Circular RCC Squatting slab (1m dia x 0.04m thickness) can also be used. In this case, similar procedure is followed for constructing the pit, except the diameter of the pit should be 0.75m instead of 9m as in the case of rectangular slab (Fig.10).

iv) Superstructure

It is ideal to provide a temporary superstructure suitable for subsequent shifting. Bamboo, wood, thatch, hedge, hay, CI sheet, etc. are the common construction material suitable for this kind of latrine superstructure. The ultimate choice of the superstructure will depend on the houseowner.
Figure 7: Casting of a cement pan

Figure 8: Rectangular squatting slab
Figure 9: A pit with RCC rings

Figure 10: Colour Squatting Slab
3.2.2. Waterseal Latrine with Single offset pit (Fig. 11)

Description

The pour-flush latrine with a single offset pit comprises the waterseal pan and trap assemble, squatting platform, junction chamber and the superstructure similar to the two-pit waterseal latrine. However, it has a single offset pit (instead of two pits as described above under II) constructed away from the squatting platform. A pipe is used to connect the squatting platform to the pit through a junction chamber. A temporary or permanent superstructure is constructed for privacy and protection.

Functioning (Fig. 12)

A single offset pit latrine functions exactly in the same way as a two-pit latrine. Once the single offset pit fills up, another pit is dug and connected with the junction chamber with a pipe. The flow of excreta is diverted to the new pit by blocking the outlet at the junction chamber. The contents of the filled pit are left undisturbed for two years after which they will have become organic humus and safe for manual clearing.

When the second pit also fills up, in another 2-3 years, the first pit is cleaned manually and the outlet is opened at the junction chamber to divert the flow of excreta from the second pit to the first pit.

3.2.3. Two-pit pour-flush latrine (Fig 13 & 14)

3.2.3. 1 Function

In this type two offset pits are used. One of the outlets of the Y-junction is blocked while the other is kept open to make the corresponding pit to the pit latrine functional. After defecation, 2-3 liters of water is poured to flush the excreta out of the pan. The excreta accumulates in the first pit, where decomposition takes place. The gas formed during decomposition escapes through the joints/openings of the pit lining and is absorbed by the surrounding soil. The effluent is leached out and absorbed by the soil while the solid part (sludge) accumulates in the pit. It takes 2-3 years for the first pit to fill up. Once it fills up the flow of excreta has to be diverted to the stand by second pit. The outlet connected to the first filled up pit is blocked and the junction chamber cover replaced. The contents of the filled pit will become organic humus and safe for manual cleaning in two years. When the second pit also fills up, in another 2-3 years, the first pit is cleaned manually and the same operation is repeated to divert the flow of excreta from the second pit to the first pit. Thus the two pit pour flush waterseal latrine facilitates continuous operation.

3.2.3.2 Constructional Features

a. Standard drawing showing various components is given in fig. 14. The depth of the foundation varies to suit the soil characteristics and other local conditions. For example, the top of the platform should be raised in areas prone to flooding.
Figure 11: Waterseal Latrine with single offset pit

Figure 12: Functioning
**Figure 13:** Components of a two pit latrine

- Top 2 layers full lining brick down in cement mortar 1:6
- 4th and 6th layers full lining
- Honeycomb brick lining in cement mortar 1:6
- Bottom layer full lining brick work in C.M. 1:6

**Figure 14:** Components of a two pit latrine

- 4 Nos. 6 mm DIA, BARS at 125 c/c
- 6 Nos. 6mm Dia, BARS at 200 c/c
- Junction of two halves
b. The plan showing the outer perimeter of squatting platform, junction chamber, connecting drain and the pits, is drawn on the ground, as in fig. 14.

c. The level of various units (squatting platform, junction chamber and pits) is determined keeping in view the slope as in fig. 14.

d. Foundation trenches are made and masonry construction carried out.

e. The P-trap is placed in position and a spirit level is used to ensure water seal.

f. The pan is fixed with the ‘P’-trap and tested for proper levelling and ensuring water seal by pouring water into the pan.

g. The empty gap between the pan and the platform wall is packed firmly with soil and rubble to ensure that the pan, P-trap and water seal remain in position.

h. The construction of platform is completed with masonry work as shown in the drawing.

i. The outer sides of the platform are plastered with 20mm thick cement mortar.

j. The Y-shaped brick drain (75mm wide) is laid at a slope of 1.10 to ensure easy flow of excreta. A 75mm dia pipe maintaining the slope can also be used. This Y-junction should have a provision of flow diversion by blocking either of the outlets which could be altered when a pit is filled up due to prolonged use.

k. Foot rests are constructed on the platform to facilitate use.

l. Two leach pits are dug, each of 1mm dia and 1mm depth. For loose, sandy and black cotton soil, 75mm or 110mm, brick lining is constructed. Alternative local materials can also be used for the lining. For stable soil, lining is provided only upto 0.3m.

m. The pit cover can be made of bamboo with mud cover, stone slabs, etc. Alternatively, a 50mm thick RCC slab (6mm dia steel rod as reinforcement) can be used. Ferro cement slab can also be used.

n. The choice of the superstructure should be left to the house owner. Different types in use are bamboo reinforced mud wall with thatch roof, bamboo matting side walls, thatch walls, brick walls, etc. Roof can be made of tiles, AC sheets, stone slabs, or 50mm reinforced concrete slabs.

3.2.3.2.1 Squatting pan

The squatting pan should conform to ISS: 2556 (Part III) 1981 as amended by the UNDP Global Project. The horizontal length of the pan should be at least 425 mm. The pan can be of ceramic, fibre glass (FRP), PVC, HDPE mosaic or cement concrete. Ceramic or fibre glass pans have many advantages over the concrete ones. They are smooth, require less water for
flushing and are more aesthetic. Fibre glass pan is cheaper, lighter and easier to transport than the ceramic one. Concrete pan is heavy, difficult to transport and get roughened and unattractive after sometime due to the action or uric acid, but are less expensive initially. ISS for a new design of the pan developed by the UNDP Global Project is under consideration by the Indian Standards Institution.

3.2.3.2.2 Trap

The trap should conform to ISS:2556 (Part XIII)-1973 as amended by the UNDP Global Project. It should be of 70 mm water-seal. Ceramic or fibre glass or HDPE or PVC traps are smooth and need less water for flushing than concrete ones, but initially costs more. Specifications for the new design of the pan developed by the UNDP Global Project are under consideration of the Indian Standards Institution.

3.2.3.2.3. Foot-Rest\s

Foot-rests should conform to ISS: 2556 (Part X)- 1967. Foot-rests can be of ceramic, concrete with mosaic finish, brick or stone. The size of foot-rest should be 250mm X 125mm with 15 to 20 mm height.

3.2.3.2.4 Flooring

The Central Building Research Institute have suggested that the latrine cubicle of size 80 cm X 100cm is sufficient for comfortable sitting. Impervious flooring should be provided to prevent moist condition. The surface of the floor should be smooth and sloped slightly towards the pan to facilitate draining of wash water.

3.2.3.2.5 Supersstructure

- The local materials used for building houses will probably be the most suitable and cheapest for building the superstructure.
- Traditional building materials such as mud or thatch can also be used but they require repair and replacement.
- Sufficient ventilation is essential inside the cubicles.

3.2.3.2.6 Connecting Drain or pipe to pits

The trap should be connected to the pits either by pipe or covered drain. If pipe is used, a junction chamber of minimum size 250 mm X 250mm internal should be provided at the junction point (Drawing No.2). The pressure AC pipe should be used as it is cheaper and its size should not be less than 75mm. In case of drain, it could be made of bricks or stones with a minimum size of 75mm X 75mm with semi-circular bottom. The slope provided should be 1 in 5 to 1 in 15. In the drain bends and curves should be avoided. The inlet pipe or drain into the pits should project a minimum of 100 mm into the pits.
3.2.3.2.7 Leach Pits

Size and Shape

The size of the leach pits depends upon a number of factors such as: number of users, cleaning interval, soil composition including its permeability, weather conditions and the quantity of water used for flushing and anal cleaning. The effective volume (Ve) is the volume in between bottom of inlet piper to the bottom of pit and arrived by the formula. 

\[ Ve = ARNT \]

where 
\[ AR = \text{Sludge accumulation rate} \]
\[ N = \text{No. of users} \]
\[ T = \text{Time for filling} \]

A study on sludge accumulation rate carried out by various research institutes in India and UNDP Global reveals that an effective capacity 0.045 cu.m to 0.05 cu.m per capita per year has to be provided under dry conditions. Under wet conditions, i.e., where the ground water level is above the bottom of the pit at any time during the year, the capacity of the pit has to be increased.

The pit capacities (effective volume) for 5, 6, 10 and 15 users with three years pit service, under dry and wet conditions are as follows:

**Table No. 1**

<table>
<thead>
<tr>
<th>Number of Users</th>
<th>Effective Volume In CU. Meter For 3 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pit Under DRY Condition</td>
</tr>
<tr>
<td>5</td>
<td>0.68</td>
</tr>
<tr>
<td>6</td>
<td>0.81</td>
</tr>
<tr>
<td>10</td>
<td>1.36</td>
</tr>
<tr>
<td>15</td>
<td>2.04</td>
</tr>
</tbody>
</table>

It has been observed that all the pathogens will be killed in a period of about two years and thereafter the cleaning operations can be organised depending upon the weather conditions and manure requirement. A minimum storage capacity for three years has been suggested for the leach pits to facilitate cleaning operations for, the household strengths of 5 or 6, 10 and 15 over practically all the Indian households. Based on the recommendations of the National Building Code GOI, one seat is to be provided upto 10 users, and two for 15 users and more.
Each of the twin pits is designed for the required number of users. Based on three years cleaning interval, the recommended effective depth (distance between the invert level of pipe or drain and bottom of the pit) is 1.1 m and the diameter 0.9 m for 5 users.

The shape of the pit can be circular, rectangular or a combination of the two. However, circular pits should be constructed wherever feasible as these are more stable and cost less. Where circular pits of standard sizes cannot be constructed due to space constraints, very small diameter (not less than 0.8 m) but deeper pits or oval pits may be adopted.

More than one latrine seat can be connected to a pair of pits provide the total number of users is not more than the capacity of the pits. Providing a free board of 200 to 250 mm the economical sizes of the circular pits in dry and average soil conditions for different users are given in Table No. 2 (as worked out at 1980 prices for Lucknow, U.P.).

<table>
<thead>
<tr>
<th>Number of User</th>
<th>Pit inside the Premises</th>
<th>Pit outside the Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diameter (Effective)</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Depth</td>
<td>1.1</td>
</tr>
<tr>
<td>5</td>
<td>0.90</td>
<td>1.1</td>
</tr>
<tr>
<td>10</td>
<td>1.10</td>
<td>1.4</td>
</tr>
<tr>
<td>15</td>
<td>1.25</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Diameter (Effective)</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Depth</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

The economical pit sizes at any particular place would, however depend upon the local rates of labour and materials.

Siting of Pits

Pits at the back side of latrine pan is ideal. If there is no space it can be located either in the side or in the front of the pan. In such cases water requirement will be more.

Location of Pits

The leaching pits should preferably be located within the premises of the house, and, as far as possible, in the open space or the courtyard. If open space is not available it can be located either in the varandah or in a room. If space is not available within the house premises they may be constructed under the footpath, narrow lane or roads with the consent of the competent authority. The design also requires changes to suit such conditions.
Distance between two Pits

The minimum space between the two pits should be equivalent to at least the effective depth of the pit. Spacing between the two pits can be reduced by providing an impervious barrier like cut off screen or puddle wall.

Distance of leaching pits from existing structure

The digging of pits and subsequent seepage may disturb the soil around the pits. The distance of the leach pits from foundations of existing building depends upon the soil characteristics, depth as well as type of foundation of the building and the depth of the leaching pits. The safe distances in different types of soil and depth of leach pits for a two storey building as recommended by the Central Building Research Institute, Roorkee, are given in Table No. 3

<table>
<thead>
<tr>
<th>Type of soil</th>
<th>For pits inside premises</th>
<th>For pits outside premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total depth of pit</td>
<td>Distance of pit from the existing</td>
</tr>
<tr>
<td>Clayey sand</td>
<td>1.30</td>
<td>0.22</td>
</tr>
<tr>
<td>(Sand 50%)</td>
<td>1.73</td>
<td>0.43</td>
</tr>
<tr>
<td>Sandy clay</td>
<td>2.05</td>
<td>0.60</td>
</tr>
<tr>
<td>(Clay and silt 50%)</td>
<td>1.73</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>2.05</td>
<td>0.88</td>
</tr>
</tbody>
</table>

However, in cases where the leaching pits are quite close to the foundation of the existing building, the openings in the brick work lining of the leaching pits may be reduced to 12-15mm. Experience shows that the leach pits could be located even 15 metres away from the latrine cubicle provided the connecting pipe is laid at a slope of 1:5 to 1:15. Table No. 4 shows the safe distances of separation under different soil conditions.
### Table No. 4 SAFETY DISTANCES

<table>
<thead>
<tr>
<th>Case</th>
<th>Effective size of the formation soil</th>
<th>Minimum horizontal distance of separation</th>
<th>Modification needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. greater than 2m</td>
<td>less than 0.2 mm (fine sand, clay and silt)</td>
<td>3m</td>
<td>None</td>
</tr>
<tr>
<td>2. greater than 2m</td>
<td>greater than 0.2 mm (coarse sand)</td>
<td>3m</td>
<td>Provide envelope of sand and impermeable pit bottom</td>
</tr>
<tr>
<td>3. less than 2m</td>
<td>greater than 0.2mm (coarse sand)</td>
<td>10m</td>
<td>Provide envelope of sand and impermeable pit bottom</td>
</tr>
<tr>
<td>4. less than 2m</td>
<td>less than 0.2mm (fine sand, clay and silt)</td>
<td>10m</td>
<td>None</td>
</tr>
</tbody>
</table>

#### 3.2.3.2.8 In depressions and water logged areas

The pits should be located in depression where waste water or rain water is likely to remain collected all around the pits. The depressions should be got filled up. If they are too big to be filled up (like a pond) or if the pits are to be constructed in water logged areas or adjacent to ponds or tanks, the top of the pits should be raised by 0.6 to 0.8 m above the ground level and earth filling done all around the pits upto a distance of 1.5 metres right upto the top. The raising of the pit may necessitate raising of the latrine floor also.

#### 3.2.3.2.9 Water pollution aspects

Proper information and investigations of the hydrogeological conditions of the sites where the leaching pits to be located are pre-requisites for the implementation of the programme in order that the pollution risk to ground water and water distribution pipes is minimal.

In dry pits or unsaturated soil conditions i.e., where the distance between the bottom of the pit and the maximum ground water level throughout the year is 2 m and more.

#### 3.2.3.2.10 Lining of pits

The pit should be lined with honeycomb brick work of stone in cement or lime mortar or random stone masonry without any mortar. These can also be lined with burnt clay or
concrete rings. Under special circumstances, lining can be done with bitumen coated bamboo matting also, but the life of such lining is limited.

**Brick or stone masonry lining**

In brick lining, the thickness should be 75 mm for pits within premises and 115 mm or 125 mm (depending upon the brick size) in pits outside the premises. The thickness of stone masonry lining should be minimum possible keeping structural and cost considerations in view.

**Use of ring for lining**

Cement concrete rings if used should have perforations. The use of cement concrete rings may not be economical. Moreover, the availability of cement is also not easy. In some cases burnt classy rings are used.

3.2.3.2.11 **pit covers**

For covering the pits, concrete dome with or without reinforcement suited to the site conditions, reinforced concrete slab, stone slab or wooden planks of appropriate quality can be used. The selection would depend upon the cost, availability and site conditions. The covers should be designed for the expected load. For pits located within the premises, the load taken should be the same as for roofs of residential buildings. For pits located under footpath and road, covers may be designed for light and heavy traffic respectively.

3.2.3.2.12 **Designing of inspection chamber and connecting device**

Inspection (Junction) chamber of size 250 mm X 250 mm should be constructed at bifurcation point of pipe.

Base concrete 1:6:12 (one cement, 6 sand and 12 brick ballast) or 1:3:6 lime mortar (one lime, 3 sand and 6 brick ballast) 75 mm thick.

Side wall 115 mm thick using bricks in C.M.1:6 (one cement and 6 sand) or L.M. 1:3 (one lime and 3 sand)

Pipe should be embedded in masonry.

25 mm thick cement concrete 1:2:4 (one cement, 2 sand and 4 broken jelly (10 mm) should be laid sloping towards the pit at the bottom of chamber.

Inner side of the chamber plastered with CM 1:4 (one cement and four sand)
The bottom should be rounded smooth and sides rounded off with neat cement.

Curing should start next day for a week.

After curing, the mouth of one of the two pits should be closed with flat brick with weak cement mortar.

The top of the chamber should be closed with precast RCC slab of size 325 mm x 325 mm.
Pipe Connection

Non-pressure AC pipe of 75mm may be used
Should be laid at a slope 1 in 5 to 1 in 15
Jointing of AC pipe with cement mortar 1:1
(one cement and one sand)
The joint should be made water tight
The pipe should extend 10cm from the wall of the pit
Detailed drawings are shown in Annexure -II.

3.2.3.2.13 Designing the floor (squat slab)

Design considerations for the floor include provision of:

(a) An opening of about 1'4" long (to prevent soiling of squatting hold) and less than 8' wide, (to prevent children falling into the pit). A keyhole shape is suitable;

(b) A slanting footrest, located in the squatting slab, so that excreta fall into the pit and not onto the squatting slab itself;

(c) A free distance between 4" and 8" from the back wall of the superstructure to the opening in the squatting slab. Less space will be insufficient while more will make the rear part of the squatting slab will be soiled. Generally, the preferred distance is 6".

(d) Smooth edges in the squatting slab. Sharp edges could make its cleaning difficult and unpleasant.

3.2.3.2.14 Designing the superstructure

Size

The superstructure must not be too large but should fit the dimensions of the floor slab to discourage people from defecating on the floor if the opening has been soiled by previous users. Provision should be made for:

(a) a plan area of at least 8 square feet but not more than 15 square feet;

(b) a roof of at least 6.5'-0" above the slab near the entrance door;

(c) other parts should be a minimum of 6'-0".

Doors and ventilation

The door should open outwardly to minimise the need for additional internal floor area. If this is not culturally acceptable, an open entrance with a privacy wall may replace a door. If the door option is adopted, it should be possible to fasten it from inside.

To provide for the draft required for functioning of the vent pipe, a 4" and 2 1/2" space should be provide on top and bottom of the door respectively. The space should be covered by flyscreen to minimise flies.
**The Walls and Roof**

They must be weather proof, provide adequate privacy, exclude vermin, and be architecturally compatible with the main house. An L-shaped wall in front of the door may be regarded by the community as desirable or essential for privacy in urban areas.

### 3.2.3.3 Materials required for latrine construction

Conventional construction materials such as cement, roofing sheets, paint and planks are expensive. The selection of material to build a latrine is important since it influences the cost and consequently affordability of the facility by the community. It is therefore necessary to maximize the use of locally available building materials to maintain latrine as a low cost option of excreta disposal. The choice of material will depend on socio cultural acceptability and financial capability of the community or individual.

### 3.2.3.2.3 Estimated material cost

Material required for construction of latrines up to plinth level having RCC pit covers, and honeycomb lining of the pit is shown in the following table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit Cost*</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(Rs.)</td>
<td>(Rs.)</td>
</tr>
<tr>
<td>Bricks</td>
<td>410 Units</td>
<td>1 per unit</td>
<td>410</td>
</tr>
<tr>
<td>Cement</td>
<td>2 bags</td>
<td>100 per bag</td>
<td>200</td>
</tr>
<tr>
<td>Brick ballast</td>
<td>0.15 cu.m</td>
<td>250 per cu.m</td>
<td>38</td>
</tr>
<tr>
<td>Aggregate</td>
<td>0.1 cu.m</td>
<td>400 per cu.m</td>
<td>40</td>
</tr>
<tr>
<td>Sand</td>
<td>0.5 cu.m</td>
<td>100 per cu.m</td>
<td>50</td>
</tr>
<tr>
<td>Steel (6mm dia)</td>
<td>6 kg</td>
<td>8 per kg</td>
<td>48</td>
</tr>
<tr>
<td>Pan &amp; Trap</td>
<td>1 set</td>
<td>250 per set</td>
<td>250</td>
</tr>
<tr>
<td>Trained Mason</td>
<td>2 mandays</td>
<td>60 per manday</td>
<td>120</td>
</tr>
<tr>
<td>Unskilled labour</td>
<td>2 mandays</td>
<td>40 per manday</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>1236</strong></td>
</tr>
</tbody>
</table>

* All dimensions in mm

**Note:**
1. This estimate is tentative. Real price may vary from place to place.
2. ISI marking FRP pan with HDPE P-trap have been considered for estimating purpose. Other pans like ceramic, burnt clay, mosaic etc., also could be used, at varied costs.
3. The cost of superstructure not included in the above estimate.
### Estimated cost superstructure

For 110mm brick wall superstructure, the following materials are needed for the design shown in the following table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit Cost* (Rs.)</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricks</td>
<td>250 units</td>
<td>1 per unit</td>
<td>250</td>
</tr>
<tr>
<td>Cement</td>
<td>1 bag</td>
<td>100 per bag</td>
<td>100</td>
</tr>
<tr>
<td>Sand</td>
<td>0.3 m</td>
<td>100 per m</td>
<td>30</td>
</tr>
<tr>
<td>Roof (stone slab)</td>
<td>1 set</td>
<td>100 per set</td>
<td>100</td>
</tr>
<tr>
<td>Door (sheet metal)</td>
<td>1 No</td>
<td>300 per door</td>
<td>300</td>
</tr>
<tr>
<td>Mason</td>
<td>1 manday</td>
<td>60 per manday</td>
<td>60</td>
</tr>
<tr>
<td>Unskilled</td>
<td>1 manday</td>
<td>40 per manday</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>880</strong></td>
</tr>
</tbody>
</table>

* Year 1995

**NOTE:** 1. This estimate is tentative. Real price may vary from place to place.
Figure 15: Side View Section
CROSS SECTION - PIT LINING

Reinforcement details of pit cover

4 Nos. 6 mm DIA, BARS at 125 c/c

6mm Dia, BARS 125 c/c

6 Nos. 6mm Dia. BARS at 200 c/c

6mm Dia, BARS at 200 c/c

Junction of two halves

Notes:
1. Not to Scale
2. All Dimensions in mm.

Figure 16: SECTIONS A-B
### 4.1 Introduction

The pour-flush water-seal latrine consists of a squatting pan with steep bottom slope (25 to 30) and a trap of 20 mm water-seal set in a cement concrete floor. After use, it is flushed by hand using a small container holding about 1.5 to 2 litres of water. The excreta is carried through a pipe of drain into two honeycomb leach pits, which are used, alternatively. The liquid in the pits percolates and gases are absorbed by the soil, leaving the solids behind. The pits are used alternatively, each designed to last for about three years (before it gets filled). When one is filled, it is taken out of use and the excreta is then diverted to the second pit. When the filled pit is left for about two years, the contents become rich organic humus which is safe for handling. When convenient it is emptied and the contents are used as manure. The pit is then, ready to be put back in to use when the second pit is full. The pour-flush water-seal latrine is a very satisfactory and hygienic sanitation system. It can be located inside the house, since the water-seal prevents odour and insect nuisance.

### 4.2 Pit Lining

The common materials that can be used for pit lining include:

(a) bricks, concrete blocks, stones, laterite blocks or adobe materials;

(b) lumber, rough-hewn logs, split cane, and bamboo. Rough-hewn logs normally last longer than bamboo. These may be tarred to increase their life.

### 4.3 Floor or Slabs

The materials commonly used include:

(a) reinforced concrete, reinforced concrete with brick filler or ferro cement;

(b) wood, built-up floor of small-diameter wooden branches.

### 4.4 Super Structure

The possible materials include:

(a) materials (laterite) dug out of the pit;

(b) laterite blocks/bricks or concrete blocks;

(c) split cane/bamboo or palm fronds;

(d) lumber.
4.5 Use and Maintenance

4.5.1 Using the Latrine

The health of the family will not improve just by building a latrine. The members, including the children must use it always. Very young infants should make use of potties and have their faeces disposed of in the latrine. The following guidelines will ensure the proper use of the latrine:

(a) Clean your latrine at least twice a week.
(b) If disinfectant is used, do not pour it into the pit. It prevents bacteriological action
(c) Do not wipe hands or bottom on walls.
(d) Use the pan/hole provided. Do not pass excreta on the floor.
(e) Throw paper or any other anal cleaning materials into latrine after use.
(f) Do not throw refuse such as grass and leaves from gardening or rubbish bin into the pit. These will fill it up quickly and cost money for replacing.
(g) Pour a little water before using a dry pan in order to ensure that excrements do not stick on the surface of the pan.
(h) Close the door properly after use. This is to keep the interior of the superstructure shaded.
(i) Wash hands with soap/detergent after using latrine.
(j) Keep the surroundings clean.

4.5.2 Maintaining the latrines

A poorly maintained or malfunctioning latrine may be more dangerous to health than not using one at all. It can also negate all efforts to convince the community of the value of latrines. The community will, by inference, believe that all latrines are smelly, dirty, and full of flies. The maintenance requirements of latrines include:

(a) Ensuring that proper drainage is maintained around the latrine.
(b) Ensuring that the pit is completely sealed at the base; and in case of indirect pits the pit cover must be in proper position and must not leak.
(c) Checking for broken slabs and joints.
(d) Ensuring that the door closes properly and does not fall off.
(e) Checking for collapsed soil around the pit.
(f) Checking that the cover of the inspection chamber/junction box is in position securely.

4.6 Tools and Equipment

Sketches and drawings of various tools required for cast in-site and prefabricated construction (the sketches of tools are given in Annexure I)
Optimization of cost

With the use of appropriate technology, locally available material and their optimal use, the cost of construction of latrines can be optimized in a given locality.
6. Advantages of pre-fabrication, Three dimensional views of various tools and equipment for prefabrication

6.1. Various methods of pre-fabrication

6.1.1 Ferro cement / RCC

It is recommended that precast centre be used to produce the different slabs to ensure good quality and to provide easy access for household to purchase slabs.

6.1.2 Site preparation

The site for a precast centre should:

(a) Use a central and accessible site of about 30’x15’ (i.e. 450 square feet) which is large enough to produce about 30 large slabs or 60 small slabs per day.

(b) Level the site properly and treat with 2 to 3” thick concrete base with smooth screened surface.

6.1.3 Form works

Figure (Annexure II) shows the sizes of wood and the dimensions required for the form work. While the precast centre is being prepared, wood for the fabrication of form works should be purchased, smoothly planned and neatly fabricated to the correct dimension.

6.1.4 Concrete Reinforcement (Iron Rods)

Figure (Annexure II) shows the dimensions of reinforcement required for vent, cover, squat and sitting slabs. Another important material required at the precast base is reinforcing bars and binding wire.

6.1.5 Concrete reinforcement (Iron Rods)

Good quality precast concrete slabs require clean and well graded aggregates. It is therefore necessary to ensure the quality of the cement, sand, stones and water to be used for precast works. The normal proportion for the mixture is one part of cement, two parts of sand and four parts of stones (1:2:4) by volume mixed with a quantity of water enough to assist the casting process.

6.1.6 Costing Procedure

(a) Make sure the casting platform is cleared of all debris.

(b) Before arranging form works, spread thin plastic sheet or a clean large sheet of paper (cement bags could be used) on the platform.
(c) Oil or grease the internal parts of the form work.

(d) Place formworks properly fixed with provision for easy dismantling on the sheeted platform.

(e) Place steel in position (i.e. steel already tied).

(f) Mix concrete, using the proportion stated earlier on i.e. 1:2:4, then place in form works making provision for at least half inch cover for steel both at bottom and top of the slab and compact gently making sure that the steel reinforcement remains at its correct position.

(g) When concrete begins to set, spread a smooth 1:1 cement-sand mixture on the surface, using wood float, and steel trowel to leave the surface of the concrete smooth.

(h) Make sure that the form work for squatting and vent holes in squat and vent slabs are removed when the concrete is half set and apply trowel to smoothen the surface. For squat slab the surface around the hole should slope towards the hole.

(i) Leave concrete covered and damp for twenty four hours and carefully remove form works.

(j) Cure concrete slabs (properly watered every day) for at least seven days before installation.

6.2 Essential components of production centres

6.2.1 Production Centres

These centres will produce selected items required for construction of various sanitary facilities using the local skill and available materials and use the RSMs as an outlet for their products. Based on the number of RSMs existing in a district, there could be one production centre manufacturing all items or each centre specializing in a few items so as to take advantage of the economies of scale. Initially there could be one production centre per district. These could be established through NGOs, DWCRA groups, etc. The District Collector/ Superintending Engineer (PR) will send the proposals to establish the production centres in the District. The support will be around Rs. 2.00 lakhs for establishing one production centre towards the following components. UNICEF will extend assistance fully for this purpose.

6.2.2 Establishment of production centres

1. Work shed (size 30'x15'=450 sft) brick work up to plinth level, pucca colour, concrete pillars, AC sheet roofing with facility of one small storeroom.

2. Moulds for ring, square, squatting plate, round squatting plate, pit cover, pan/traps etc.
3. Curing vat of size 8' x 6' x 4' brick wall with concrete flooring.
4. Open space for brick soiling (25' x 20' size)
5. Show room publicity and marketing support.
6. Revolving fund for production and procurement of sanitation materials

6.2.3 Management of production centre and marketing

It is recommended that precast centre be used to produce the different slabs to ensure good quality and to provide easy access for household to purchase slabs.

6.3 Precautions required during production and transportation of prefabricated items

1. Place form works properly fixed with provision for easy dismantling on the sheeted platform.
2. Make sure that the formwork for squatting and vent holes in squat and vent slabs are removed when the concrete is half set and apply trowel to smoothen the surface. For squat slab the surface around the hold should slope towards the hole;
3. Leave concrete covered and damp for twenty-four hours and carefully remove form works;
4. Cure concrete slabs (properly watered every day) for at least seven days.
ANNEXURES
ANNEXURE 1.1

Wheel Barrow
(0.1 CU.M. capacity)

Gauging Trowel
178 mm

CEMENT - Finishing
Trowel 120-280 MM

Brick Masons Trowel
110*200 mm

Purdy Chisel
Knife edge blade
40*100 mm

Carpenter's plumb
level and Sprit
300 mm
ANNEXURE 1.1

Nail head hammer of 450 G

Nail head hammer of 280 G

Measure Tape - 7.6 m

Engineering Try square - 100 mm

Measure Tape - 3 m

Carpenter's Try / Metre
Square 200 mm * 200
MODEL A

Two pit water flush latrine with super structure (All Brick Level)
DETAILS OF BRICK LINED PIT

Notes:
1. Not to Scale
2. All Dimensions in mm.
DETAILS OF LATRINE UPTO PLINTH LEVEL

FLOOR PLAN OF WC

- 65 THK. ARTIFICIAL STONE FLOORING
- 20 THK. P.C.C. (1:2:4) WITH 6mm STONE CHIPS
- 5mm THK. NEAT CEMENT FINISH

G.L

75 THK. B.F.G

Notes:
1. Not to Scale
2. All Dimensions in mm.

PIT COVER

6φ M.S. ROUNDS @ 150 C/C 7 NOS.
6φ M.S. ROUNDS @ 150 C/C 7 NOS.

REINFORCEMENT ARRANGEMENT OF PIT COVER

6φ M.S. ROUNDS @ 150 C/C (BOTH WAYS)

Notes:
1. Not to Scale
2. All Dimensions in mm.
JUNCTION CHAMBER (CONCRETE)

ANNEXURE II

Notes:
1. Not to Scale
2. All Dimensions in mm.

JUNCTION CHAMBER (BRICK LEVEL)

ANNEXURE II

Notes:
1. Not to Scale
2. All Dimensions in mm.
DETAILS OF BRICK SUPER STRUCTURE

ANNEXURE II

THREE DIMENSIONAL VIEW

PLAN FOR 75 T NK BRICK WORK
STEP 1

PLAN FOR 250 T NK BRICK WORK
STEP 1

PLAN FOR 125 T NK BRICK WORK
STEP 2

SECTION - AA
FINAL STEP

Notes:
1. Not to Scale
2. All Dimensions in mm.

FINAL STEP
Notes:
1. Not to Scale
2. All Dimensions in mm.
Notes:
1. Not to Scale
2. All Dimensions in mm.
LOW COST OPTIONS FOR SANITARY LATRINES

Model - A

Model - B

Model - C

Model - D

Model - E

Model - F
LOW COST OPTIONS FOR SANITARY LATRINES
Formwork for Vent and Cover Slabs; Squat & Vent Holes
Training Aids

1. The latrine shown in the picture on page 28 is a pour-flush waterseal latrine, i.e. water is poured from a container into the pan to flush the excreta into the pit. To facilitate flushing, the pan should be wet before use. About 2 litres of water is required for flushing the stool down into the pit. Some of the water always remains in the pan. This water forms a "waterseal" which prevents flies entering the pit and bad smell coming out of it. It is also very easy to maintain. The water for cleaning can be stored in a big pot placed by the latrine.
2. The latrine has two pits. For a family of 5 or 6 members, each pit of 1 metre depth and 1 metre deep. Only one pit is used at a time by blocking the inlet of the Y-shaped drain leading to the second pit. One pit will fill up to the drain outlet level in about three years. The excreta should remain in the covered pit undisturbed for at least two years to decompose. After that time, contents which are odourless can be handled safely and used as organic manure.
3. Material and labour required to build a waterseal latrine are:

1. Bricks 410 Nos
2. Sand 12 bags
3. Cement 2 bags
4. Aggregates 3 bags
5. Pan & Waterseal 1 set
6. Iron rod for pit cover reinforcement 6 kg
7. Local material such as bamboo and tharch for superstructure, estimated at Rs. 75/-

However, the cost of a latrine in a given area may vary depending on the price of materials, and the place of their availability.
4. If one can use freely available stones or scrap construction material near the house in place of bricks, the cost can be further reduced.

- 410 BRICKS
- SAND 0.5 M³
- 2 BAGS CEMENT
- STEEL 6 MM DAI 6 KGS
- PAN AND WATERSEAL
- 2 DAYS LABOUR
5. One important factor that should be borne in mind is the location of the pit with respect to a ground water source, such as a well. When the pit bottom does not reach the water table, the pit can be located 10 metres away from the water source; Where the pit touches the water table, the distance should be increased to 15 metres. (For fissured rocky formation, please get advice from the engineer).
Fig. CASTING OF A CEMENT PAN
<table>
<thead>
<tr>
<th>SL.#</th>
<th>ITEMS</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Bricks</td>
<td>580 PCs</td>
</tr>
<tr>
<td>02</td>
<td>Sand</td>
<td>23 Cft</td>
</tr>
<tr>
<td>03</td>
<td>Cement</td>
<td>3 Bags</td>
</tr>
<tr>
<td>04</td>
<td>1/2&quot; Stone Chips</td>
<td>0.65 Cft</td>
</tr>
<tr>
<td>05</td>
<td>Pit Cover</td>
<td>2 PCs</td>
</tr>
<tr>
<td>06</td>
<td>Pan &amp; Trap</td>
<td>1 Set</td>
</tr>
<tr>
<td>07</td>
<td>Door</td>
<td>1 PC</td>
</tr>
<tr>
<td>08</td>
<td>Bamboo</td>
<td>1.5 PC</td>
</tr>
<tr>
<td>09</td>
<td>Tiles</td>
<td>30 PCs</td>
</tr>
<tr>
<td>10</td>
<td>Nails, Bolts, Rod, Wire Etc</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Asbestos Roof (3.5' x 3.5')</td>
<td>1 PC</td>
</tr>
</tbody>
</table>
### B. LABOUR:

<table>
<thead>
<tr>
<th>SL.#</th>
<th>ITEMS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>MASON</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>LABOUR</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>CARPENTER (NOT REQUIRED FOR ASBESTOS ROOF)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### C. CARRYING COST

<table>
<thead>
<tr>
<th>SL.#</th>
<th>ITEMS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>LOCAL CARRYING COST &amp; WASTAGE @ 12% ON MATERIAL COST</td>
<td></td>
</tr>
<tr>
<td>IEC 01</td>
<td>Guide on Community Participation For Village Level Functionaries</td>
<td>S. Ponnuraj</td>
</tr>
<tr>
<td>IEC 02</td>
<td>Guide on Drinking Water and Sanitation For School Teachers</td>
<td>B.B. Samata, Anu Dixit</td>
</tr>
<tr>
<td>IEC 03</td>
<td>Guide on Quality of Drinking Water For Grassroot Functionaries</td>
<td>A.K. Adhya</td>
</tr>
<tr>
<td>IEC 04</td>
<td>Guide on Water and Excreta Related Diseases For Grassroot Functionaries</td>
<td>A.K. Susheela, K. Majumdar</td>
</tr>
<tr>
<td>IEC 05</td>
<td>Guide on Motivation For Village Motivators</td>
<td>S.C. Saxena</td>
</tr>
<tr>
<td>IEC 06</td>
<td>Guide on Technology Options for Low Cost Sanitation For Implementing Agencies</td>
<td>P.K. Chakraborty, M. Narayana Rao</td>
</tr>
<tr>
<td>IEC 07</td>
<td>Guide on Low Cost Sanitation Construction Techniques For Masons</td>
<td>M. Narayana Rao</td>
</tr>
<tr>
<td>IEC 08</td>
<td>Guide on Sustainability of Drinking Water Sources For Implementers and Users</td>
<td>K. Majumdar</td>
</tr>
<tr>
<td>IEC 09</td>
<td>Guide on Role of Panchayati Raj Institutions For Panchayat Members</td>
<td>S. Ponnuraj, P. Durga Prasad, S. Srinivasan</td>
</tr>
<tr>
<td>IEC 10</td>
<td>Guide on Sanitation Upgradation For Implementing Agencies and Users</td>
<td>B.B. Samata, Anu Dixit</td>
</tr>
</tbody>
</table>