S-18020/75/2018-SBM
Government of India
Ministry of Drinking Water and Sanitation
Swachh Bharat Mission (Gramin)
4th floor, Pt. Deendayal Antyodaya Bhawan
CGO Complex, Lodhi Road
New Delhi-110003
Dated: 04.02.2019

To,

ACS/ Principal Secretary/Secretary
in-charge of Rural Sanitation,
All States/UTs

Subject: Technical training to Masons on ODF (S), ODF + Technology reg.

Madam/ Sir,

As you are aware, one of the important components of SBM is the construction of IHHL in all the HH of the villages to achieve open defecation free status contributing to improved well-being and health status of the families in the project area. The technology employed for the toilet construction not only ensures its proper functioning but also ensures its sustainable usage. Thus, the role of the technical manpower (masons) involved in the construction of the toilets becomes critical. In the current context, when the coverage of rural sanitation has increased to more than 98%, it becomes imperative to re-train/ conduct refresher training for Masons to address the issues related to ODF sustainability and ODF+. To ensure the quality of the toilets constructed, retrofitting of unsafe toilets, making the dysfunctional toilets functional and constructing assets (compost pits, drains, water stabilization tanks etc.) for ODF+, quality refresher training needs to imparted to masons on scale and in a short time.

2. For the purpose, the Ministry has developed an SBM (G) training module and manual with the support of Ministry of Skill Development & Entrepreneurship (MSDE), National Skill Development Corporation (NSDC) and Construction Skill Development Council of India (CSDCI). This initiative aims at providing technical training to Masons on key issues pertaining to **ODF, ODF (S) and ODF +** and also getting certification for the same. Other features of the training are as follows:

- Training will be imparted on the Qualification Packs (QP viz. Job Roles) of Rural Mason with an emphasis on sustainable rural sanitation viz. twin pit technology, retrofitting of existing rural toilets, solid-liquid waste management etc.
- Training duration: 32 hours (8 hours per day)
- This will be followed by an 8 hours evaluation by CSDCI.
- On successful completion of the above, CSDCI will also award a certificate and incentive of INR 500.

3. It is hoped that these modules/ manual (enclosed- may be modified as per the State's requirement) will help the States rollout ODF (S) and ODF+ trainings as per their training calendar. The NSDC empaneled training agencies/ partners across the country have been advised to help the States with the same*(list available on NSDC's website)*.

4. Towards this initiative, the agencies may need support through mason mobilisation, wage compensation (during the training days), availability of training infrastructure, which may be provided as per SBM (G) guidelines and funded as per the State's policy on capacity building.

Yours faithfully,

Encl: A/a

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Copy to:

Mission Director/State Coordinator, SBM-G, All States/UTs

पेयजल और स्वच्छता मंत्रालय
MINISTRY OF
DRINKING WATER AND SANITATION

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Technical Training Manual for Masons

Contents

Preface

This book is designed to enable training for one NOS of Rural Mason QP i.e. **CON/N3608: Install Sanitary Fittings and Fixtures for Rural Toilets** along with orientation on Swacch Bharat Mission, Open Defecation and its implications, Waste Management (Solid and Liquid) in Rural Areas.

For the rural mason to be able to fulfill this expectation in a context that is wanting as far as technical guidance, affordable and appropriate products and local hand holding support is concerned, it is imperative that the capacity of the mason or the building artisan be developed. Given the limited development of rural markets for provision of specialized services, the rural mason invariably ends up shouldering the responsibility of undertaking multiple (specialized) tasks at each stage of construction.

The present exercise is an attempt by the Government of India at bolstering the capacity of existing masons in rural India. It is critical that these masons who are at the cutting edge of delivery of state sponsored constructions, are supported to develop their expected role as a 'total solution provider'.

The current initiative of the Government attempts to overcome each of these barriers for learning in the following ways

1. Training is designed as a decentralized programme at village & district level wherein the trainee mason will be trained to perform needs of rural sanitation.

2. Trainee Mason will be oriented on implications of Open Defecation and promotion of safe technology option for rural sanitation.

3. This book itself summarizes all Dos and Don'ts along with ready reference details relevant to rural toilet constructions, waste management, retrofitting of existing sanitation in rural areas in an illustrated format.

Chapter – 1: Introduction to Swachh Bharat Mission (Gramin)

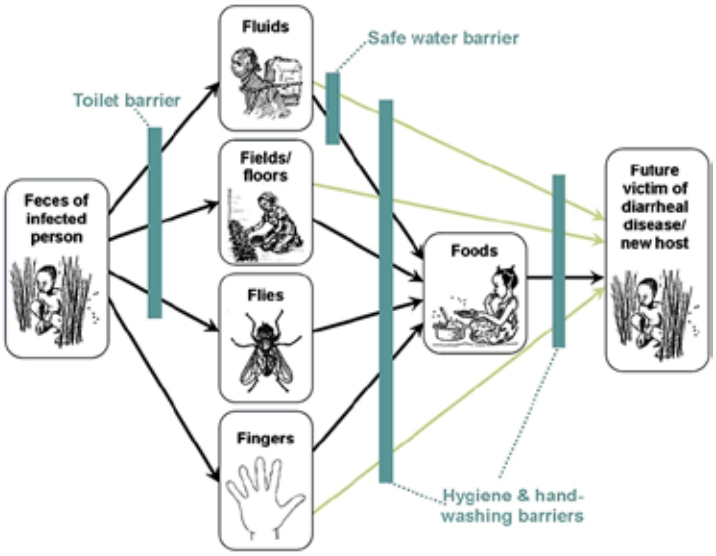
1.1 Open Defecation & its Implications

Open Defecation:-

Open defecation refers to the practice whereby people go out in fields, bushes, forests, open bodies of water, or other open spaces rather than using the toilet to defecate.

Evils of Open Defecation:-

- It causes breeding and transmission of pathogens, which carry diseases and infections.
- Children, women and young girls are most vulnerable.
- Children under the age of five are most prone to diarrhea and sometimes even lose their lives.
- Women are often forced to restrict themselves by reducing/ controlling their diet.
- Women face higher risks of sexual assault.



Open Defecation Free (ODF):-

- No visible faeces found in the environment/ village.
- Every household as well as public/ community institutions using SAFE TECHNOLOGY for disposal of faeces.

The Safe Technology Options mean:-

i. No contamination of soil surface, ground water or surface water.
ii. Excreta inaccessible to flies or animals.
iii. No handling of fresh excreta.
iv. Freedom from odour and unsightly conditions.

How to become Open Defecation Free:-

We should promote sanitation and toilet construction in rural areas. In this direction, Govt. of India has also taken an initiative to make it happen by launching Swacch Bharat Mission (SBM).

1.2 Swachh Bharat Mission & ODF Sustainability

To accelerate the efforts to achieve universal sanitation coverage, the Prime Minister of India launched the Swachh Bharat Mission on 2nd October, 2014, which aims to achieve an Open Defecation Free (ODF) and Swachh Bharat by 2nd October 2019 - marking the 150th birth anniversary of Mahatma Gandhi. Swachh Bharat Mission, a massive mass movement, has captured the imagination of a large section of the population and is being implemented as a mass movement that seeks to engage everyone in a collective quest for cleaning & making Villages, Districts, States and eventually India Open defecation Free (ODF) by 2nd October, 2019. Inspiring results have been achieved to date.

The effectiveness of the programme is predicated upon generating demand of toilets, leading to their construction and sustained use by all the household members. This is to be bolstered with adequate implementation capacities in terms of trained personnel, financial incentive systems and procedures for planning and monitoring. The emphasis is on stronger focus on behavior change intervention including interpersonal communication, strengthening implementation and delivery mechanisms down to the GP level and giving States flexibility to design delivery mechanisms that take into account local cultures, practices, sensibilities and demands.

ODF communities are sustainable provided there are clear post-ODF interventions which offer persistent engagement with ODF communities consolidate management of solid & liquid waste, augmenting water supply, operation & maintenance, retrofit defective toilet technologies and financing provisions for implementing these interventions.

MDWS has emphasized sustainability of interventions and benefits adequately in all its interventions and engagements with States and stakeholders. Several advisories, guidelines etc. have been issued from time to time to support States and Districts achieve sustainability of interventions. This manual is an extension of ministry's effort for supporting the States in ensuring ODF sustainability.

Chapter – 2: Toilets in Rural India

2.1 Introduction to Toilet

The Purpose and Importance of the Toilet

Open defecation has been the root cause of many health hazards and nutritional deficiencies among rural population especially children. Lack of awareness about toilets and lack of resources for construction of toilets are resulting in Open Defecation. The Rural Mason should know how to construct the Toilet.

The General Types and Lay-out of Toilets in Rural Areas

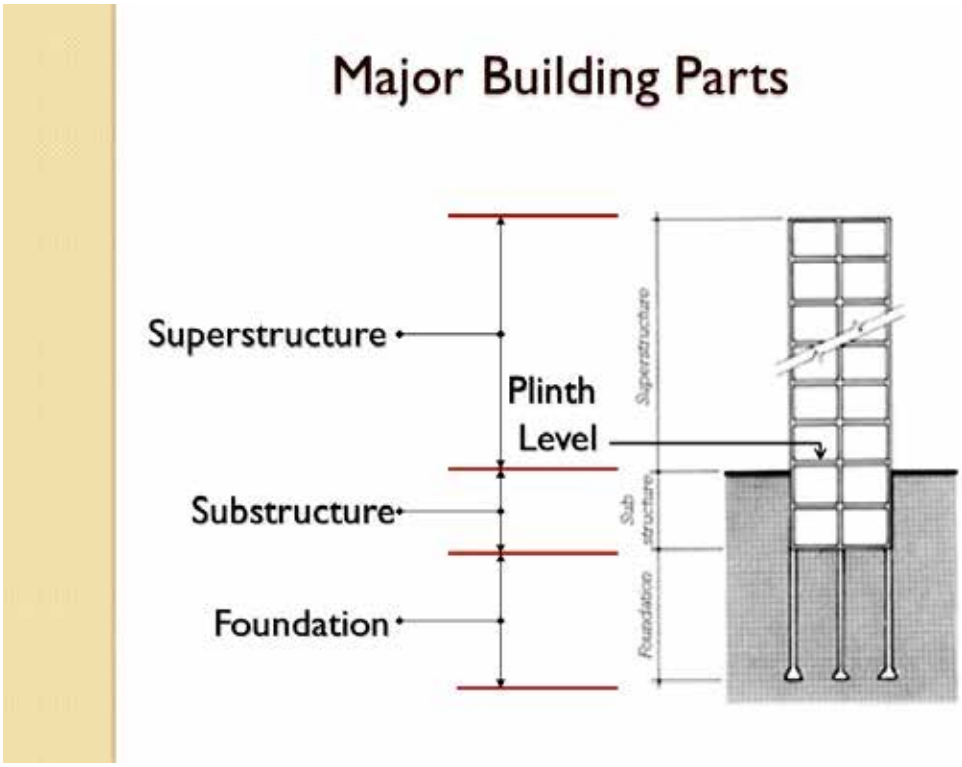
The following types of toilet are commonly used in Rural India.

i. Twin Pit Toilets
ii. Septic Tank Toilets
iii. Temporary Toilets
iv. Single Pit Toilets
v. Toilets with Attached Bathroom

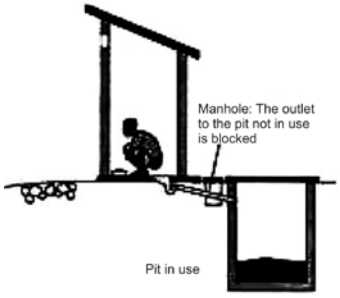
2.2 Components of Toilet

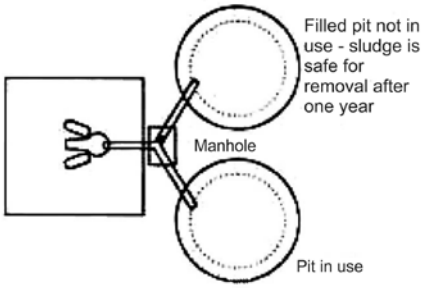
Every Toilet has

- **Substructure :** Substructure is technically important as it provides safe disposal or reuse of human waste. All technical options are meant for substructures only.
- **Superstructure :** The superstructure basically provides privacy. There may be a wide range of types of superstructures for the same type of sub structure, depending on the economic status of the beneficiaries.



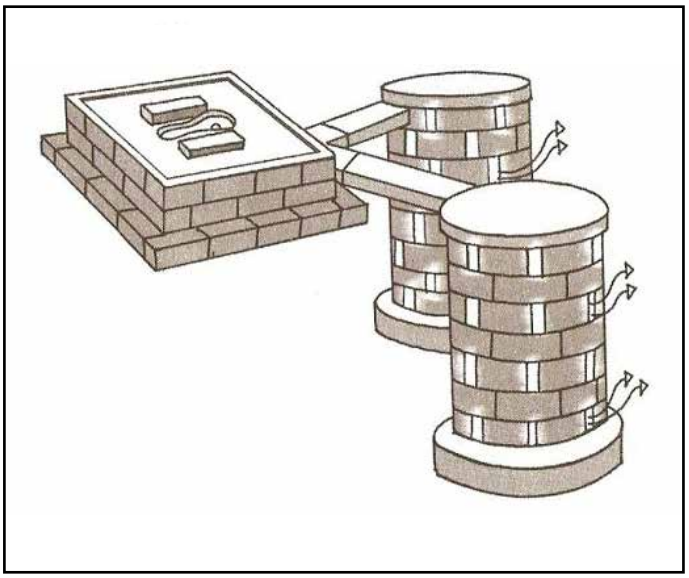
2.3 Different Types of Toilet

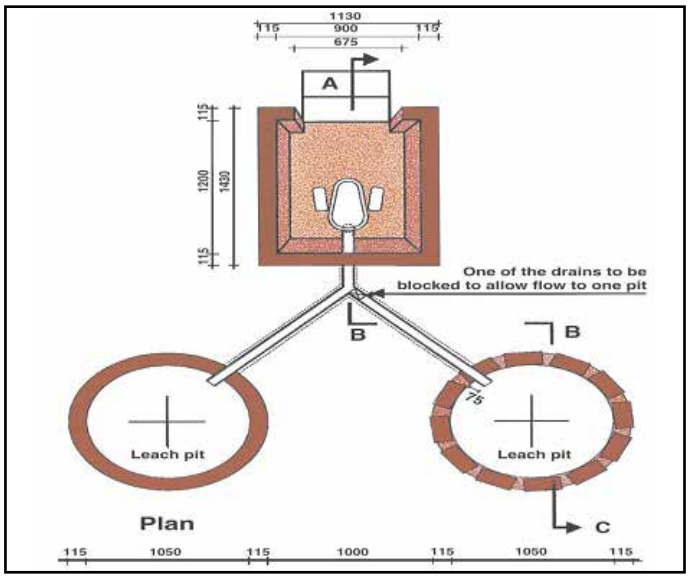


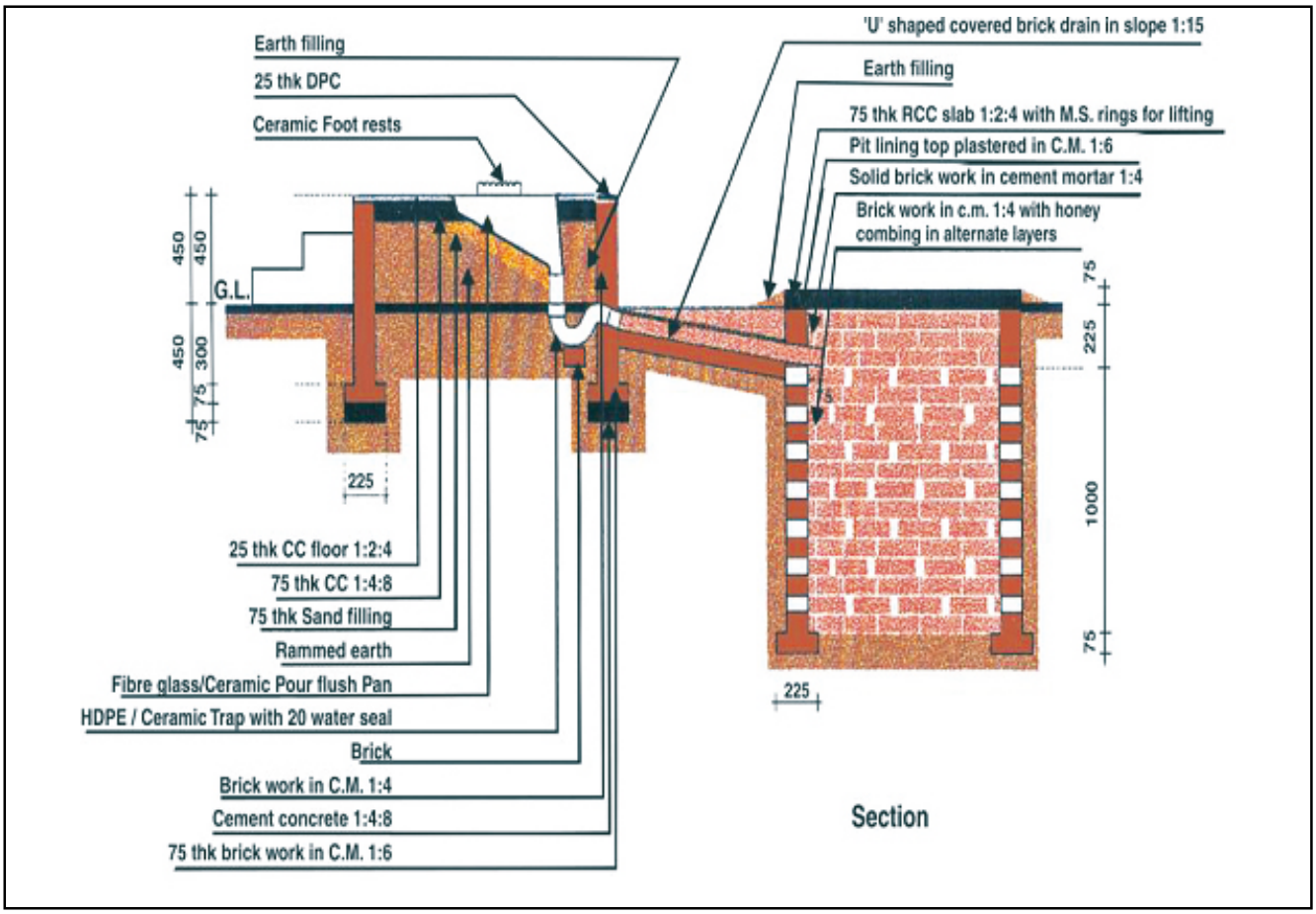


2.3.1 Twin Pit Toilets

In this design, two leach pits are connected to one single pour-flush toilet. At any given point of time only one pit would be in use. Once the pit is filled, the other pit will be put in action to receive the excreta along with water. The toilet will have permanent superstructure like a room for privacy purpose. The same can be used as bathroom also if the size is slightly increased. The toilet can also be constructed inside the house, while the pits are constructed outside the house. The Government is promoting this type of toilet in the country under rural sanitation programs.



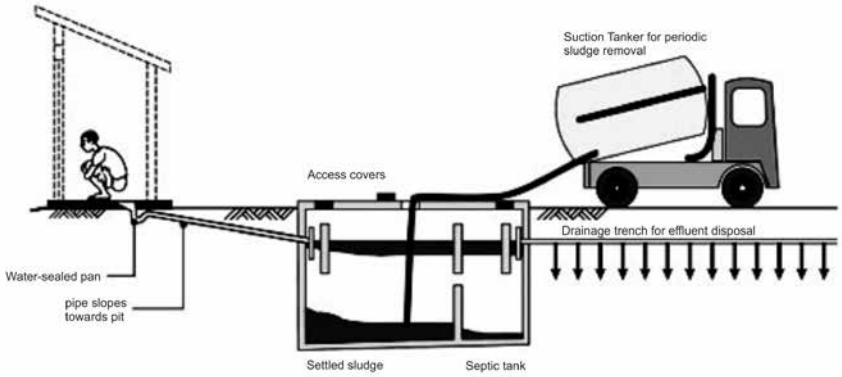




2.3.2 Septic Tank Toilets

A septic tank comprises a sealed tank having both an inlet and an outlet into which excreta are flushed from a conventional cistern flush toilet using typically between 10-20 litres of water for each flush. The tank is connected to the toilet by a sewer pipe. Partially treated effluent flows out of the tank. This marks an important difference from the pit latrine, in which any water entering the pit leaves by percolation into the surrounding ground.

Septic tanks may receive either toilet waste alone, or both toilet waste and sullage from sinks and water from baths.

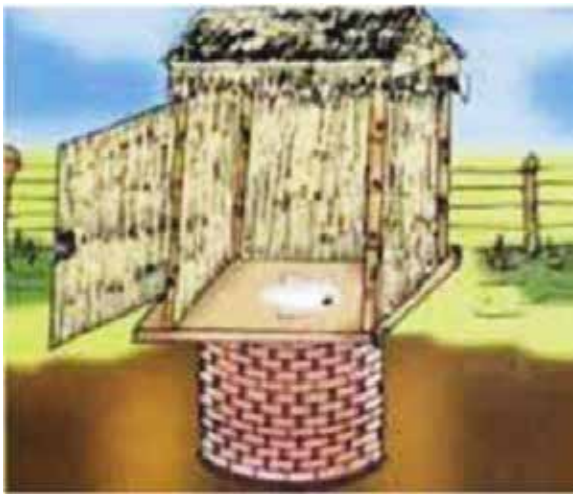


The septic tank acts as a settlement unit in which solids settle out by gravity, the solids undergo a process of anaerobic decomposition.

The effluent, which flows out of the septic tank, constitutes a potential health hazard. A common disposal method is, absorption into the ground using a soakage pit or trench. The settled sludge should be periodically removed by a suction tanker. Septic tanks may be built to combine several households or plots. Regular maintenance (removal of sludge) is essential and relatively expensive.

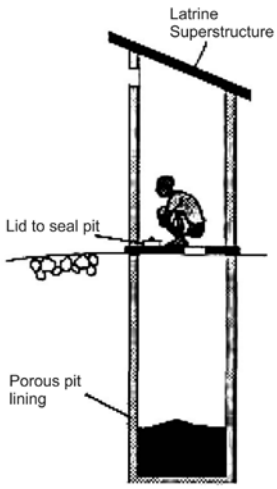
2.3.3 Temporary Toilets

It can be a simple solution for sanitation in places of mass gathering and during emergencies. This is relatively simple in design and most cost effective. This toilet is constructed only up to plinth level. Temporary material like gunny bag material or bamboo mats or thatched roof can be used for privacy. A single pit may be dug and used for few months. Once the pit is filled another pit may be dug in the vicinity.



2.3.4 Single Pit Toilets

The principle of all types of pit latrine is that the excreta and anal cleaning water to be deposited in a pit hole in the ground. In its simplest form the pit latrine consists of a superstructure, which affords privacy to the user, a hole (or seat) set into a slab, which covers the pit beneath the slab into which excreta are deposited. Alternatively the single pit is dug little away from the toilet room and connected through pipes.



2.3.5 Toilets with Attached Bathroom

This multi-functional toilet cum bathroom accommodates provision for water storage, bathing and washing facilities inside the toilet. Most importantly it provides privacy for the user members not only for defecation but also for bathing. This is little expensive as it consists of concrete structures and brick masonry for various components. This toilet may have septic tank or two pits.

Chapter – 3: Construction & Maintenance of Twin-pit Toilets

3.1 Components of Twin Pit Toilets

The following are the components of toilets to be taken up under the housing programme.

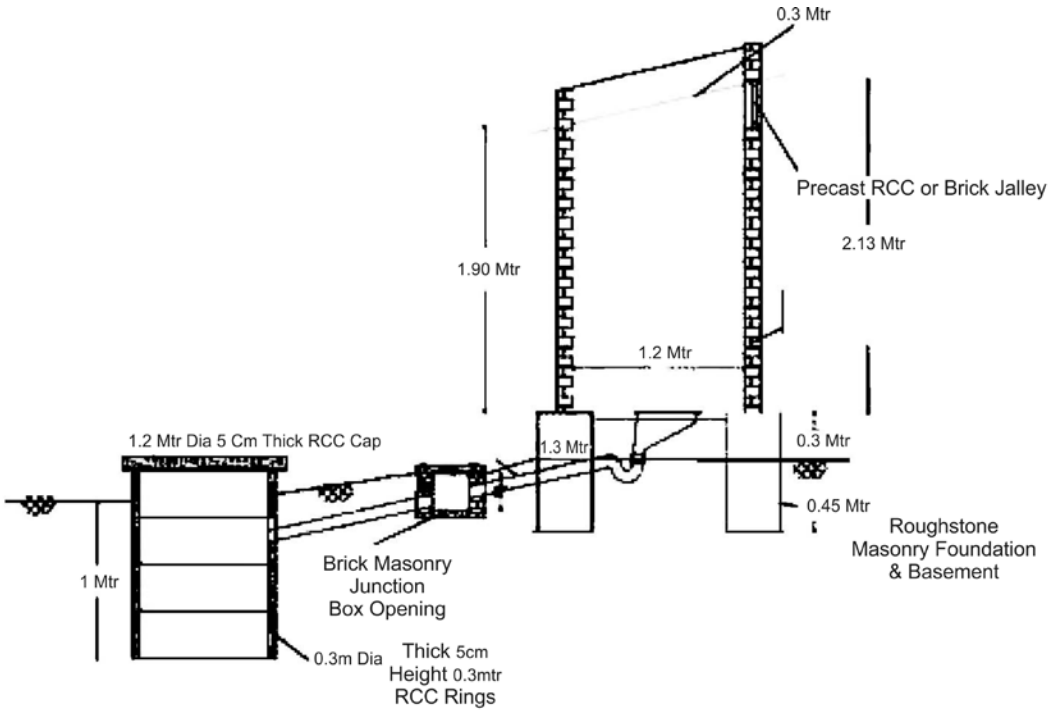
1. Twin Pits
2. Junction Box
3. Toilet Pan and Water Seal
4. Toilet Room

3.2 Sequence of construction of Twin Pit Toilets

The various activities for toilet construction should be planned in the following sequence so that the construction may be smoother without any dismantling work and also to the desired slopes.

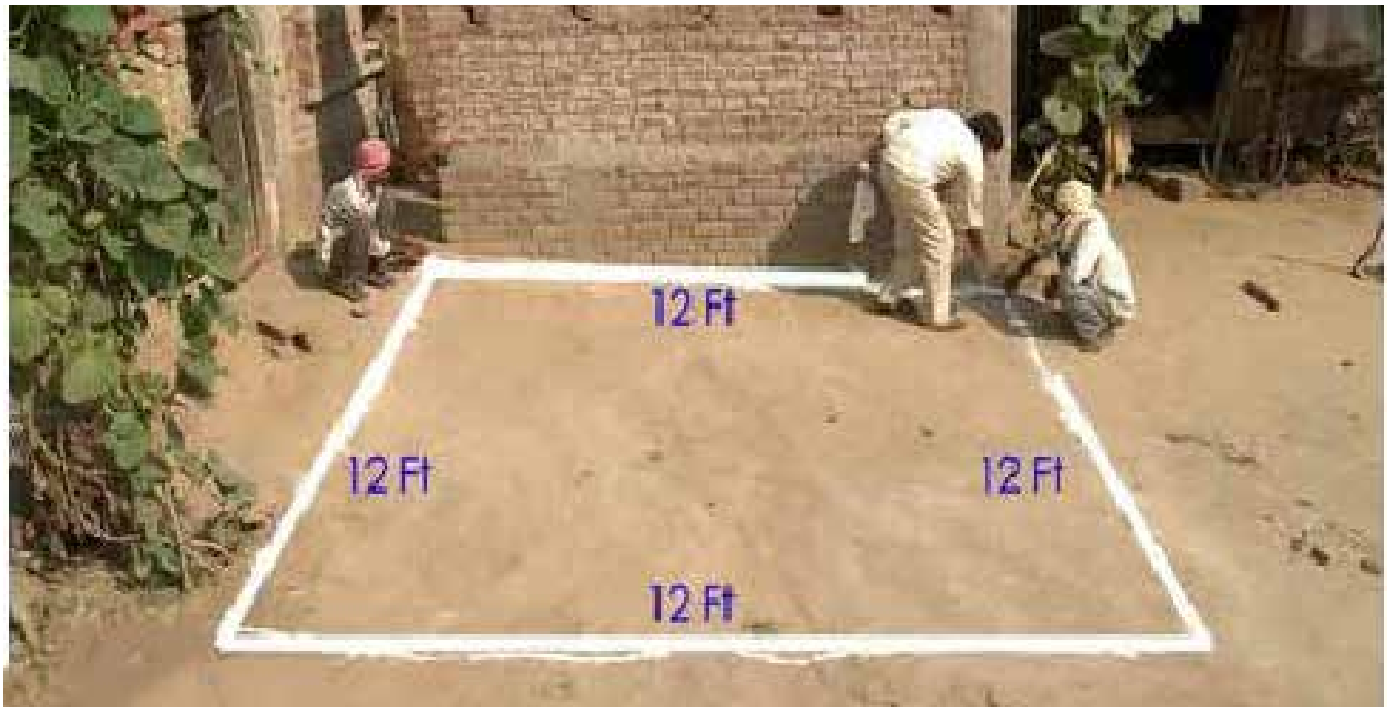
1. Layout
2. Pit Construction
3. Foundations up to Plinth of the Main Room
4. Positioning of Toilet Pan
5. Construction of Junction Chamber
6. Fixing of Pipes
7. Superstructure of Toilet Main Room

Dimension commonly followed in rural houses are shown in the following illustration.

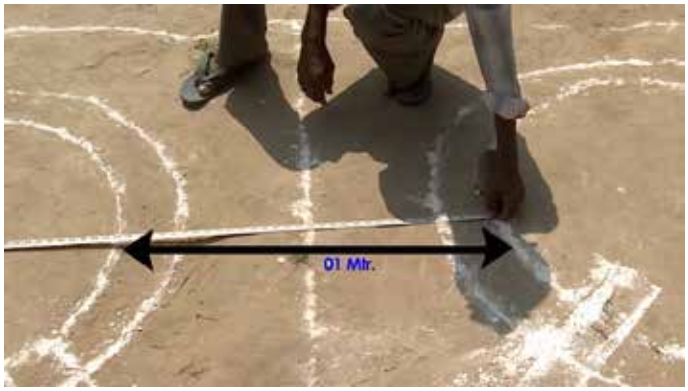


3.2.1 Layout

Finding adequate space for construction of toilet:- There should be a proper and sufficient space of at least 12ft*12ft in area for construction of twin pit.



Layout of toilet:- Proper layout should be done on the acquired area for toilet room, junction chamber, twin pits etc.



3.2.2 Construction of Two Pits for Toilets

Work method:

1. Select the place for the toilet in consultation with the house owner.
2. Using thread, lay out the pit with 0.9 m dia. Leaving the distance of 1 m from the edge of the first pit, give mark out to another pit of same dia. The Distance of these pits should be 1.6 m away from the main room of the toilet to be constructed.
3. Dig the trench up to 0.9 m depth using crowbars and shovel. Place the excavated earth away from the pit. The soil excavated from the pits will not be refilled, hence it may be disposed off.
4. Construct a foundation footing with 22.5 cm width and 100 mm thick using the brick or stone in cement mortar 1:3.
5. Start brick masonry of 10 cm (one brick width) thickness inside the pit. Leave seep holes of half brick size. These holes will allow water absorbed into natural soil. Substitute the brick masonry with cement concrete rings it the case if the case may be.
6. Curing of Brick Masonry should be done for minimum 14 days.
7. Construct the wall height up to ground level. The masonry wall above ground may be required to construct after the fixing of the pipe from junction chambers. Ensure that the pipes from the Junction Box can easily discharge by gravity into the pits.
8. The RCC cover with a thickness of 50 mm for the pit shall be constructed separately to seal the pit. The cover may be done in two segments so that it is easily lifted and fixed on the pit
9. Follow the same construction process as above for the second pit.

Labour:	**Tools+ Equipment:**	**Material:**
• Rural Mason • Labourers to assist	• Tape measure • Rural Mason • Complete masonry tool set • Crow bars and shovel/spade • Mortar pan • Plumb bob • Water tube and spirit level	• Bricks or CC rings • Cement and Sand • Steel bars for reinforcement • Clean water for cement mortar

Quality Control:

- Check correct positioning of all elements and their levels.
- Water should be able to flow into the pit.
- Correct depth of the pits and their diameter during excavation.

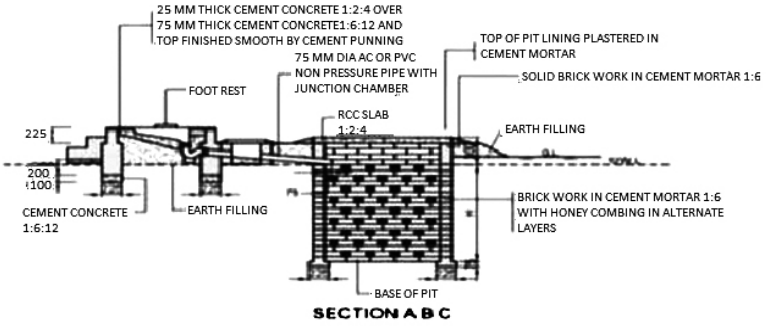
Size of the Pit:

Honey combing: Honey combing should be provided in twin pits. There are total 14 layers of bricks to be constructed in the pit where first layer should be of 9 inches having 1/4th of its section inside the dug lined in the lowest circumference of the pit to provide support to the pit soil. Rest layers of brick should be of 4inches having honey comb at 3rd, 5th, 7th, 9th, and 11th layer. Top two layers should be at above ground level and should be plastered from both sides.

3.2.3 Pits Under Different Soil Conditions

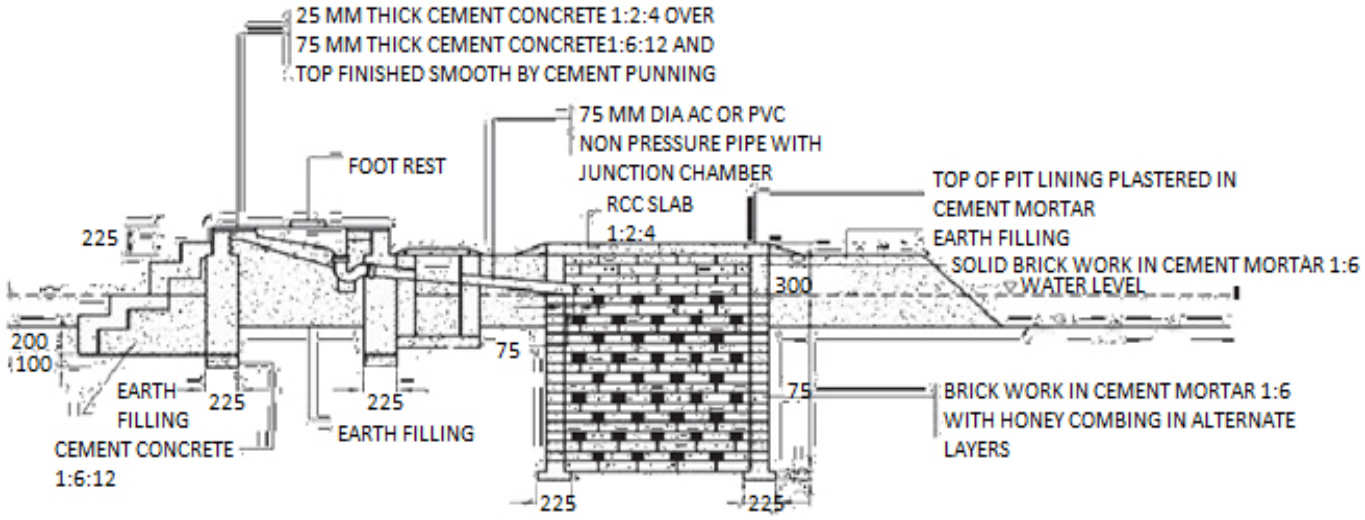
In High Subsoil Water Level:

Where the subsoil water level rises to less than 300 mm below ground level, the top of the pits should be raised by 300 mm above the likely subsoil water level and earth should be filled all-round the pits and latrine floor raised as stated above.



In Water Logged Area:

The pit top should be raised by 300 mm above the likely level of water over ground level if there is water logging. Earth should then be filled well-compacted around the pits up to 1.0 m distance from the pit and up to its top. The raising of the pit will necessitate raising of latrine floor also.



Pits under Water Logged Area

In Black Cotton Soil:

Pits in black cotton soil should be designed taking infiltrative rate of 10 l/m2/d. However a vertical fill (envelope) 300 mm in width with sand, gravel or ballast of small sizes should be provided all-round the pit outside the pit lining.

Bottom of pit is below maximum ground water level:

- The top of the pits should be raised above the ground level, so that the pipe into the pit is at least 0.75 m above the maximum ground water level.

- The sand envelope is taken up to 0.3 m above the top of the inlet pipe and confined suitably to exclude any surface drainage including rain water directly entering the sand envelope.

In Rocky Areas:

- As chances of percolation are very low, so the leach pit toilets are not suitable for rocky areas.
- Availability of mechanical devices to clean the toilet is very low, due to which pits get filled frequently.
- Also, disposal of sludge is very difficult in rocky areas.
- Hence, it is not acceptable by the beneficiaries in rocky areas.

3.2.4 Junction Box

The Junction Box is constructed to direct the flow of excreta and water from the toilet pan to the pit. The Junction Box is constructed in 'Y' shape allowing the excreta and water in one pit at a time. The Y junction chamber is constructed using cement mortar, brick and clay/PVC/Asbestos pipes. Size of junction chamber is 1 ft*1ft.

3.2.5 Toilet Pans and Water Seal

The efficiency of the entire toilet depends on the positioning of toilet pan and creating water seal. The toilet pan is connected to junction chamber through a pipe. The 'P' shaped trap, which is part of the toilet pan contains the water seal. The presence of water in the curve of the pipe inside the toilet pan works as a seal to prevent foul smell to travel from the pit to the toilet room through the junction chamber. The positioning of the pan makes the presence of the water seal, hence the Mason has to know how to position the toilet pan in a perfect horizontal position.

Toilet Pan should have a steep slope of 250-290. Greater slope is desirable for flushing with least water. Water seal in pan should be of 20 mm for proper functioning. The top of the footrest should be about 20 mm above floor level and inclined slightly outwards in the front.

Water Seal and its Purposes:

Water Seal is an important thing that a Rural Mason should understand to build effective toilets in rural areas. The purpose of the water seal has already been explained above. Toilet Pans with built-in water seals are also available in the market. These may prove to be cost effective. The trainer shall demonstrate the trainees the working of a water seal by showing the actual water seal in the toilet pan by pouring water in the pan before it is fixed in the toilet.

Setting of P trap and Water Seal: P-trap should be fixed as per its actual and should not be deviated from its original position in any condition. P-trap of 20mm water seal should be preferred as it requires less quantity of water for flushing.

Setting up Toilet Pan: Toilet Pan should be leveled well from several points and should be in line and as per the level of floor of toilet room. It should be equidistant from side walls of toilet room & 9 inches from back wall.




Positioning of the Toilet Pan:

Positioning the toilet pan exactly horizontal is the skill that Rural Mason should acquire. If the pan is not positioned exactly horizontal to the center bubble of the spirit level, the water will not be retained in the neck portion and water seal will not be formed. This will allow foul smell and insects to enter the toilet and make it unusable. So it is very very important to position the toilet pan in a perfect horizontal position. The trainer shall facilitate the positioning of the toilet pan in the toilet using the steps given.

Work method:

1. Ensure that the Masonry up to plinth is constructed.
2. Fix the toilet pan temporarily on loose bricks/blocks. Ensure that the top of the pan is in line with the plinth level.
3. Check whether the top of the pan is leveled by setting the spirit level on the surface of the pan. It is to be checked in all directions.
4. Once it is perfectly leveled, fix the toilet pan at plinth level using gravel and sand underneath.
5. Connect the pipe extending it to the outside of the plinth so that it may reach the Junction Box.
6. Once the toilet pan is fixed, lean concrete may be laid underneath the pan to fix it.
7. Seal all the joints using natural fiber (like Jute) and cement putty.

Labour:	Tools+ Equipment:	Material:
• Rural Mason • Labourers to assist	• Complete masonry tool set • Mortar pan • Plumb bob • Water tube and spirit level	• Bricks or CC rings • Toilet pan/pan • Bricks • 75 mm AC/ HDPE/clay pipe • Foot rests • Cement • Sand 20/40mm stone

Quality Control:

- Check correct positioning of the pan, location and levels.
- Ensure properly sealed connection of pan with P trap and outflow pipe to Junction Box.

3.2.6 Construction of the Toilet Room

The main toilet room has the following sub-components

1. Foundations
2. Plinth construction
3. Superstructure - masonry wall
4. Roofing
5. Flooring

Foundation for Toilet Rooms

Foundation for a toilet as part of rural house may be taken up using either bricks or stone or cement concrete blocks. Depending upon the type of the soil, the depth of foundation should be decided.

Generally the depth shall be 45 cm to 90 cm. The foundation width shall be 45 cm to 60 cm. Leveling course with 10 cm thickness using cement concrete should be done over which random rubble masonry shall be done.

Plinth Construction:

The plinth is the masonry wall above ground up to 30 cm height. The width of the plinth wall may be 30 cm. Generally, stone masonry is recommended for plinth walls. In case stone is not available brick or cement concrete blocks may also be used.

Superstructure - Masonry Wall:

Once the plinth wall is constructed, brick/stone/CC brick masonry with thickness of 20/22 cm should be taken up. The height of the wall should be 1.9 m at one side and 2.15 m at the other side. The difference of 25 cm between two walls is to allow the water to drain off in case a sloping roof using GI sheets is used. A finishing course of 30 cm height masonry will be added after laying the roofing sheets.

Roofing:

To keep the cost lower, GI/Tin sheet roofing is preferred for the roof. Wooden rafters, in country wood, may be used to support the roof. Iron angles or tubular steel members may also be used as rafters.

Roof of toilet room should have a slope and should not allow water logging at its top.

Plastering and Colourwash/ Whitewash

Plastering in cement mortar 1:6 with 12 mm thickness should be done to the toilet walls if the masonry is constructed with clay bricks. The plastering shall be done properly. Sometimes the plastering is done externally and left without plastering inside the room for cost cutting.

Flooring:

Flooring around the toilet pan may be done in the room either with IPS (CC) flooring or with stone slabs. The flooring should be done only after compacting the gravel/hard soils in the plinth portion using Rammer and laying 75/100 mm lean mix concrete.

Floor of toilet room should be leveled so as to provide the slope from all the corners of toilet towards the pan.

Work Method:

1. Give mark out for the toilet room (internal dimensions 1m x 1.2m), Junction chamber (0.3 m x 0.3 m), twin pits (as per dimensions above).
2. **Foundations of toilet room up to plinth**
   - a) Earth shall be excavated for foundations with a width of 0.6 m and to a depth of 0.7 m unless otherwise required due to site conditions. The trench should be dug 0.3 m on either side of the center-line. After the foundation trench is dug, ensure that there is no loose soil in the foundation trench.
   - b) Prepare cement concrete 1:5:10 using stone of size 25-40 mm on a firm ground.
   - c) Lay and compact cement concrete with the thickness of 100 mm.
   - d) Prepare cement mortar 1:6 ready for stone masonry.
   - e) Construct the 1st footing RR stone masonry with a width of 0.6 m and to a depth of 0.3 m.
   - f) Construct 2nd footing 0.45 m to a depth of 0.3 m below ground and 0.3 m above ground. The masonry above ground would work as plinth.

3. Superstructure - Masonry Wall

a) Keep the brick ready for construction of brick masonry.

b) Prepare cement mortar 1:6 on firm ground for masonry wall.

c) Brick/stone/CC brick masonry with thickness of 20 cm/ 22 cm should be taken up over plinth. The front side of the wall should have height of 1.90 m and rear side of the wall should have 2.13 m. The sidewalls should have slopes accordingly.

d) The height of the wall should be 1.9 m on one side and 2.15 m on other side. 25 cm slope is to be provided to allow the water to drain off on the roof. Another 30 cm height masonry will be added after laying the AC sheets.

e) Plastering of brick masonry is optional. Depending on the financial capacity of the house owner the plastering may be taken up. For stone masonry or CC masonry the plastering is not required.

4. Roofing

a) Insert three wooden rafters/steel tubular rafters/Steel angular rafters as support to the roof.

b) Keep adequate number of GI/Tin sheets ready for roof.

c) Fix three rafters in parallel on wall so that the roofing sheets are laid on them.

d) Fix the roofing sheets on rafters using 'J' bolts.

e) Once the roofing sheets are fixed, construct 22 cm masonry over sheets. This wall holds the sheets firm against winds.

f) The ends of the rafters are properly anchored in the walls.

5. Plastering and colourwash/white wash

a) Clean the walls by removing protruded cement mortar if any.

b) Wet the wall with water before plastering is started.

c) Prepare the cement mortar 1:6 for plastering.

d) Take up plastering of 12 mm thickness.

e) After one day, curing will be taken up for minimum 14 days "For plastering details refer to Worksheets M16.

6. Flooring

a) Keep the plinth filled with gravel and compact in layers of 150 mm thickness. Sprinkle water on each layer for good compaction.

b) Prepare the lean concrete of 1:5:10 mix using 65-75 mm thickness stone.

c) Put the concrete up to a thickness of 100 mm. Compact the concrete with Rammer. Ensure that the concrete is laid 50 mm below the top of the plinth.

d) Prepare cement concrete in 1:2:4 proportion.

e) Lay the cement concrete with 50 mm thickness. It should be compacted with Rammer. The cement concrete should be laid flushing with top of the toilet pan.

f) Finish using cement slurry on cement concrete when the cement concrete is still green.

g) Red oxide may be used over slurry to improve the aesthetics of flooring.

Labour:	Tools+ Equipment:	Material:
• Rural Mason • Labourers to assist	• Complete masonry tool set • Mortar pan • Plumb bob • Water tube and spirit level • Hammer • Saw	• Bricks • 75 mm AC/ HOPE/ clay pipe • Foot rests • Cement • Sand • Course aggregate of 20 mm, 65/75 mm • Clean water for cement mortar and concrete • Nails, various sizes

Quality Control:

- The level of the top concrete level should be flushed with top of toilet pan and top of the plinth level so that whenever the flooring is washed the water should easily flow to toilet pan.
- Ensure that while constructing masonry and plastering, the cement mortar should not spill over the toilet pan. The toilet pan should be covered with used cloths or gunny bags so that the cement mortar or concrete should not enter into toilet Pan/P-trap.
- Curing should be carried out for minimum 14 days for all cement work in this task.

3.3 Advantages of Two Pit Pour Flush Toilets:-

- It is a permanent solution for on- site household human waste disposal.
- It requires only 1.5 to 2 liters of water per use of toilet.
- Digested human waste, when taken out of the pit after two years is semi solid, free from odour and pathogens, that can be easily dug out by beneficiaries.
- Degraded sludge has good percentage of plant nutrients and can be used for agriculture and horticulture purposes.
- It does not require scavenger to clean the pits.
- It can be easily upgraded and connected to sewer whenever such facility is available in future.
- It has easy maintenance.

3.4 Maintenance, Safe-handling & Cleaning of Twin Pit Toilets

Maintenance of Twin Pit Toilets:

- Toilet pan should be cleaned well. Human excreta contains a full spectrum of pathogens that transfer from diseased to healthy individuals through several direct and indirect routes, causing infections and superimposed infections. Sanitation has a direct impact on health. Transmission of infection can be avoided through proper cleanliness.
- Little amount of water should be spread on the pan to keep it wet so that the excreta cannot stick to the pan.
- We should not use high quantity of water to flush the excreta to give long life to the pits as using high amount of water will lead the pit to reach its saturation position in shorter duration. For low flush of water, pan should be of higher slope (28°-30°) and water seal of 20 mm only. It requires only 1.5 to 2 liters of water per use of toilet.

- However, it has been observed that in many cases people do not use such pan and the 20 mm trap. Instead, they use ceramic pan with a trap of 60 mm or even higher, that requires more water to flush out excreta.
- Absorbing capacity of any soil is finite. High hydraulic load causes accumulation of water in pit which makes the pit filled up frequently.
- Volume of pit should be sufficient enough to store sludge for the intended period of minimum of 2 years.
- There should be sufficient pit wall areas available for leaching of liquid from pit to soil. It can be determined through the infiltration rate of the soil.
- Rate of infiltration of pits varies and depends on soil type.
- Clay soil in wet condition has least infiltration rate, it becomes almost impermeable.
- Sand and silt have more permeability and high infiltration rates due to large soil porosity.
- The rate of infiltration also depends on ground water table.
- In case of unsaturated soil, infiltration is induced by gravity and presence of air and water in the soil pores.
- In the saturated soil all pores are filled with water and infiltration depends on the size of the pores. However, pore size of surrounding soil of a leach pit is never constant.
- We should not allow any solid substance to enter the pan opening as it blocks the P-trap making toilet non-functional. In case of blockage of pan due to such objects, it should be taken out manually from the pan; it may cause more problems, if stuck in the P-trap.
- Blocking of unused pit should be proper to stop flow of excreta and water through it as the simultaneous use of both the pits will dilute the purpose of making twin pit toilets.
- Junction chamber should not resist the flow of excreta and should be smooth enough to allow the passage of excreta through it. Blockage and resistance in junction chamber will itself cause an overflow of water and exit of excreta out of the junction chamber. Surface finish from inside the junction chamber should be very smooth and water tight and the same should be plastered in the direction of fulfilling the objective of it.
- Door of toilet may be greased and painted well for increasing its durability. Unpainted gates will face harmful environmental effects on it as the same may cause rusting, rough surface, tough movement etc.
- Roof of toilet should not allow water logging and the same should be designed to provide slope for drainage of rain water. Water logging at the top of toilet will cause seepage of water in toilet walls as well as the logged water will contribute in population of harmful mosquitoes causes diseases like malaria, dengue etc.
- Water tank construction should also be done to avoid transportation of water from distant and the same should be constructed at appropriate height so that it can allow proper flow and pressure of water at outlet through its potential. Capacity of water tank should be as per the usage of toilet.

Safe-handling & Cleaning:-

- Sustainability of any toilet depends upon its design, technical function, ease of operation and maintenance. Any expenditure on maintenance of toilet may not normally be feasible for majority of the population.
- Cleaning of toilet is also a major factor which motivates one to use the toilet and discourage about Open Defecation.
- Maintaining cleanliness will always be favorable for the toilet and the same should be performed by cleaning with normal and clean water.
- It should not be cleaned with acid or any other chemical as it causes killing of microbes and the same results in less degradation of excreta.
- In case of double pit toilet, proper junction chamber is essential. It is required to change over pit when one pit is filled. Junction chamber should be suitable enough to block the pit after it is filled.
- Such blocking is done normally by putting a piece of brick at the opening of the pipe connecting to the pit. Junction chamber and twin pits may be covered with cap and sealed with soil around so that the gas and foul smell can be consumed by the soil.
- A pit toilet does not require a vent pipe as it allows oxygen in the pit and the same affects the decomposition.
- Gases produced in the pit are diffused in soil through honey comb structures. The gases are mainly Carbon dioxide and Methane.
- Toilet should not be used for washing of clothes as the detergent water kills the microbes present in the pit. Waste of kitchen should also not be put in the toilet.
- Pit should be at least 4 to 8 inches above the ground level, to avoid rain water entering into pit. However, it is observed that, in some cases pit cover is made at the level of ground. In such cases during rainfall, water flows in to the pit causing inconvenience in use of toilet.

Disposal After One Pit is Full:-

- Immediate disposal/transportation of sludge is not required in case one pit is full.
- Overflow from the currently used pit is the sign of its saturation. Junction chamber may be opened to observe the condition. Outlet of currently used pit is to be covered and the alternative outlet to be opened.
- The water in the pit will be discharged through the soil and the sludge in the pit will be transformed in manure over the period of about one year.
- Digested human waste, when taken out of the pit after drying is semi solid, free from odour and pathogens, that can be easily dug out.
- Degraded sludge has good percentage of plant nutrients and can be used for agriculture and horticulture purposes. It does not require scavenger to clean the pits.
- Manure can be extracted with the help of spade or bucket. Digested human waste should be handled with care- hand contact should be avoided/minimized.

Chapter – 4: Retrofitting of Rural Toilets

4.1 Retrofitting Existing Toilets

Retrofitting means to modify existing equipment or structure with additional or new components or members.

Following is an illustrative list of toilets that may require Retrofitting/Repair /Substitution:

- Dry bucket type that needs manual cleaning
- Toilets with single leach pit
- Single pit with no junction
- Incorrect pits beneath a structure
- No space for second pit
- Poor angle of toilet pan trap
- Poor Junction chamber
- Septic tanks without soak pit
- Septic tanks without side walls or cemented floor
- Pit is cemented at the bottom and in use
- Leach pits without holes
- Single chambered septic tank of insufficient length
- Absence of vent pipe for septic tank
- Septic tank of inadequate size
- Septic tanks or pits constructed under the seat/ floor
- Shared toilet to IHHL (Less Space)
- Twin pits built too close to each other
- Twin pits too close to drinking water source
- Twin pit in high water table areas
- Pit toilets with vent pipes

Dry Bucket Type Latrine:

- The Swachh Bharat Mission has resulted in elimination of dry latrines from rural India, as reported by State governments. However, if any dry latrine is still found to have been constructed in a village household, it will have to be immediately retrofitted.
- All existing dry latrines should be converted into water-flushed one with twin leach pits.
- The superstructure, if usable, may be retained.
- The substructure should be totally dismantled, (protecting the wall foundations) and re-constructed, as per site conditions.

Toilets with Single Leach Pit:

- This involves a single leach pit with a squatting pan placed directly over it. When the pit in use is filled, another pit is dug and the same squatting slab is transferred to the new pit. The first pit is covered with earth and the excreta is allowed to be converted to manure.

- A new pour flush toilet may be constructed along-with the construction of another pit next to the existing pit, both connected to the junction chamber.
- The pit presently in use may be continued for disposal through junction chamber, while newly constructed to be kept closed.

Single Pit with No Junction:

Option I - If the pit is in use?

- Household should flush the toilet thoroughly with water to ensure no excreta is left in the pan and pipe.
- Meanwhile, household should use neighbour's toilet for 02 days.
- A second leach pit may be constructed 01m away from the first pit.
- The existing pipe leading to the first pit may be cut (leaving 05inches from the rear wall of the toilet) till 01ft ensuring Y-junction is of 01ft x 1ft size from inside. Both the pits should be connected with Y-junction through pipes (4inches) maintaining a slope of 1:10.

Option II – If the pit is not in use?

- Second leach pit (1m x 1m) should be constructed at a distance of 01m from the first pit.
- Y-junction should be constructed and both the pits should be connected with it through pipes maintaining a slope of 1:10.

Improperly Constructed Pits Beneath a Structure:

- The incorrect pits should be abandoned.
- Two new pits (1mX1m) should be dug outside the house at least 1.5 m away from the superstructure.
- Both pits should be connected with a Y-Junction (1ftX1ft) installed outside the toilet room.

No Space for Second Pit:

- Single pit (circular or rectangular) may be dug, breadth may be increased but depth should be 01m.
- A brick wall to be constructed in middle of the pit for separation. The same wall should be plastered well from both sides.
- The foundation of the wall should be 01ft below earth to resist water seepage from one pit to another.
- If adequate space is not available, location of the pits can be altered depending on the space availability.
- Such alternatives are presented in the diagram below.

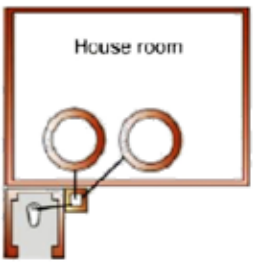


Fig 15 Leach pit inside house

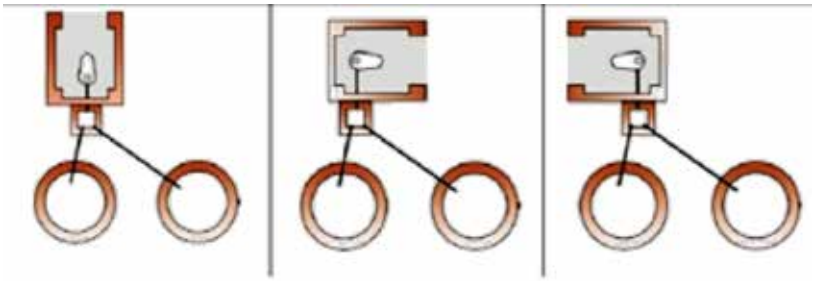


Fig 13 : Leach Pits at right angle to squatting place

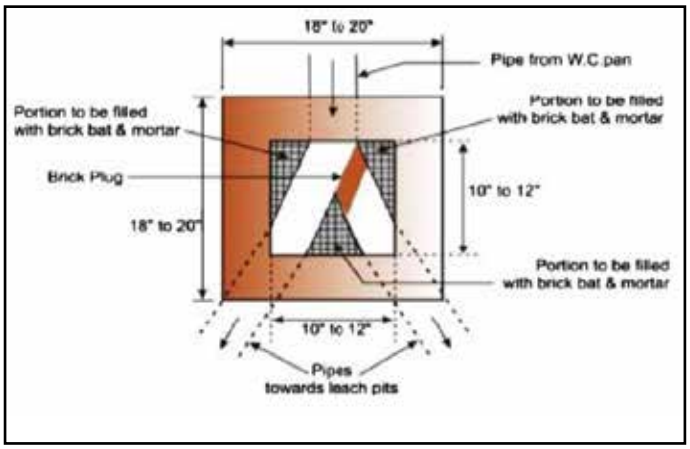
Fig 14 : Leach Pits in one straight line

Poor Angle of Toilet Pan Trap:

- Pan trap should have a water seal of 20mm (for rural pan) & 50 mm (for commercial pan).
- Pan trap should be repaired and proper water seal should be checked.

Poor Junction chamber:

- It is the lifeline connecting pan & pit together.
- Junction chamber should be repaired and strengthened.

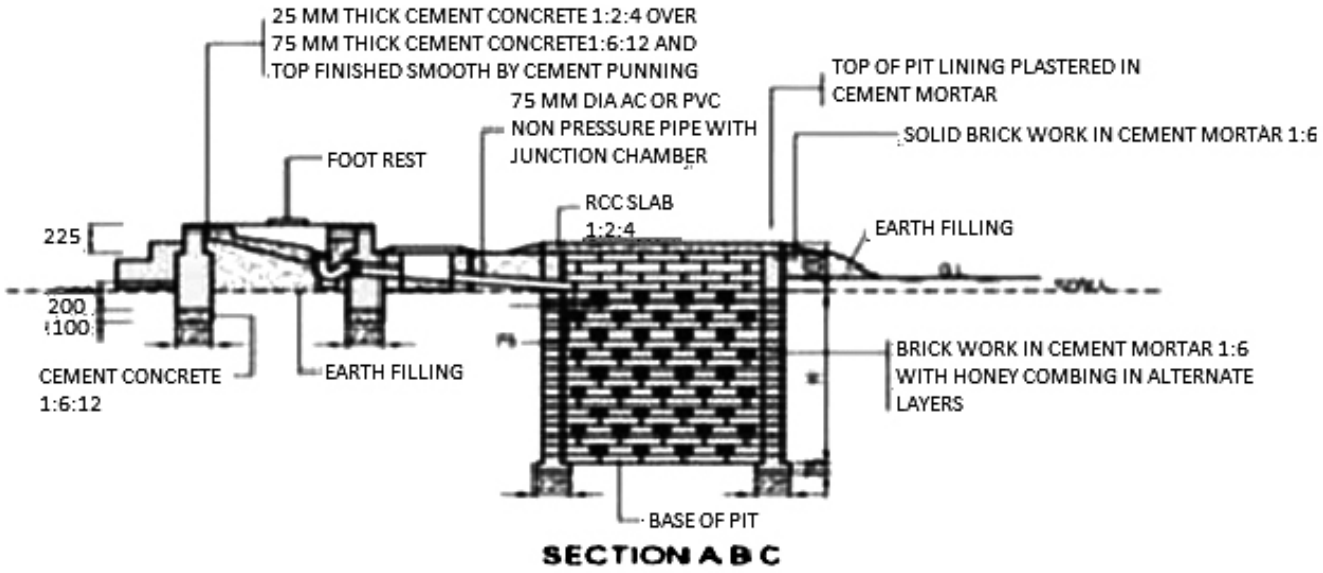


Septic Tanks without Soak Pit and Cemented Entirely:

- These hold the water inside the tank leading to a faster filling of the tank. Therefore fecal sludge removal will have to be frequent leading to recurring cost.
- In this case, soak pit should be constructed and connected to septic tank.

Septic Tanks without Soak Pit and Wastewater Opened to the Drainage Nearby:

- In such cases, the freshwater sources will be polluted.
- In this case, soak pit should be constructed and connected to septic tank.



Septic Tanks without Side Walls or Cemented Floor:

- This is actually a soak pit termed as septic tank.
- The side facing of drinking water source should be walled and cemented.
- A second proper leach pit and a junction chamber may be constructed.
- If the site conditions require, the existing septic tank may be dismantled and new twin pits with chamber may be constructed.

Pit is Cemented at the Bottom and in Use:

- If the side walls have holes then it can be used. Once filled & waste removed, holes may be made at the bottom too.
- If it is completely sealed –holes should be made both at the bottom & side walls.

Leach Pits without Holes:

Option I: In case pits are not having holes & are not in use.

- Holes should be made in both the pits, in alternate layers (except two layers at the bottom & the top) and bottom should be unsealed (if cemented).

Option II: If a pit is in use.

- In case both the pits are without hole and one is in use. Second pit may be modified and holes may be made and can be used leaving waste of the first pit to dry. After a year, it should be emptied and holes should be made as mentioned above.

Single Chambered Septic Tank of Insufficient Length/Septic Tank of Inadequate Size:

- Such tanks would generally be without soak pits.
- A soak pit may be constructed and connected.
- The fecal sludge needs frequent removal and scientific disposal.

Absence of Vent Pipe for Septic Tank:

- Provide a vent pipe to evacuate the obnoxious gases from the septic tank.
- The vent pipe should have 3" diameter, should be raised above the nearest building structure.
- Vent pipe should have a cowl on the top for proper ventilation & a mosquito screen wrapped around, to avoid access to mosquitoes and flies.

Septic Tanks or Pits Constructed Under the Seat/Floor:

- Such constructions are made due to lack of space.
- It should be ensured that the toilet is pour flush with water seal.
- The pits can be located on the verandah or even in a room.
- They may also be constructed under a footpath or under narrow lanes.

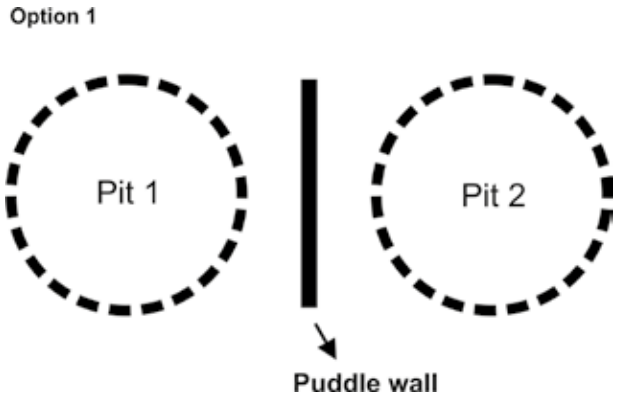
Shared Toilet to IHHL (Less Space):

- In case of less space, 01 or more households can be connected to twin pits through Y junction which should have enough room to accommodate 01 or more pipes.
- It may be ensured that all the households use one pit at a time using less water for flushing & cleaning. No acids or products should not be used for cleaning instead ash/lime/salt may be used.

Twin pits built too close to each other:

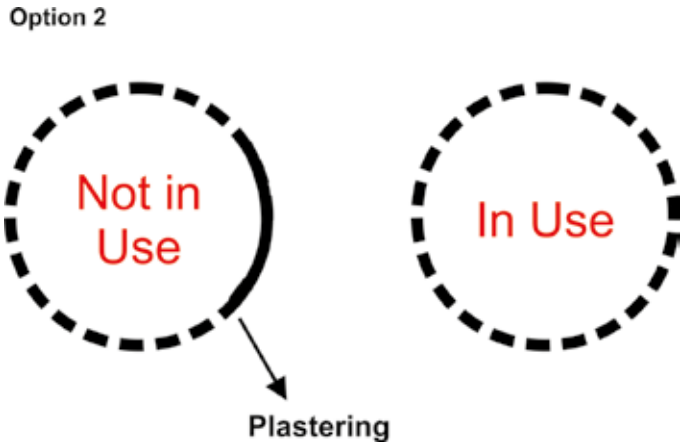
Option 1 –

- Construct a puddle wall between the two pits (Wall length = pit diameter, Wall depth = pit depth).



Option 2 –

- Plaster the inner surface of the pit wall of the 'not in use' (empty) pit.
- Stop using the first pit and divert the flow of faeces to the renovated pit.
- Leave the faecal matter in the first pit to decompose.
- After decomposition, empty the first pit.
- Plaster the inner wall adjacent to the other pit.



Twin Pits Too Close to Drinking Water Source:

- Distance less than 10-15 meters– dismantle the water source.
- Saturated (wet) or unsaturated soil –relocate the water source at safe distance.
- Soil type is either fine sand or coarser soil - should not use the water for any purpose.
- The pit wall towards the water source may be completely cemented from inside & outside using cement mortar.

Pits Too Deep:

- Growth and functioning of pathogens (bacteria) decomposing excreta being affected beyond 1m.
- Deep pits contaminate ground water.
- Abandon the deep pit. Separate leach pit (01 m x 01m) should be constructed beside the existing pit with a junction chamber connecting the superstructure. The new pit may be used with immediate effect.
- The abandoned deep pits may be filled up with earth till 01m and be connected with the junction chamber with a pipe (4 inch) or a second leach can be constructed with a minimum distance of 01m from the first pit.

Twin Pit in High Water Table Areas:

- In water logged areas, the pit top should be raised by 300 mm above the ground. Earth should then be filled well-compacted around the pits up to 1 m distance from the pit and up to its top. The raising of the pit will necessitate raising of latrine floor also.
- Other alternative technologies are Bio-Toilet & Eco San Toilet.

Bio-toilet	Eco San Toilet
Bio-toilet is a decomposition mechanized toilet system which decomposes human excretory waste in the digester tank using specific high graded bacteria (aerobic or anaerobic) further converting it into Methane gas, Carbon dioxide gas and Water.	ECOSAN Type of toilet separates human excreta, urine and wash water and allows dry decomposition of excreta. ECOSAN toilet envisages use of specially designed toilet pan for segregation of all types of waste material. Maintaining dry excreta and allowing decomposition of dry excreta is an important part of this technology.

Twin Pit at high water table:

Pit Toilets with Vent Pipes:

- The gases produced during decomposition in the pit are absorbed by the earth around the pit through the holes and leave the toilet odourless. Vent pipes are not required.
- Vent pipes provide a safe space for breeding of mosquitos and flies.
- Vent pipes need to be removed/cut and sealed to ensure oro-faecal safety.

On the Pit Toilet:

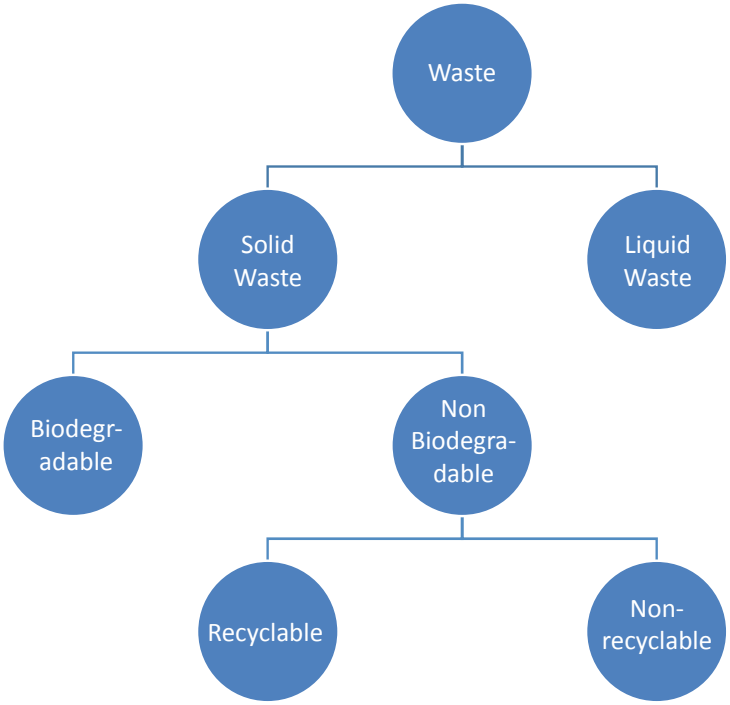
- Conversion of on pit toilet to off- pit toilet by digging two pits off-site and connecting them with Y Junction (junction chamber).

Chapter – 5: Waste Management in Rural Areas

5.1 Waste:

Waste is any material/liquid that is thrown away as unwanted and which doesn't have any commercial value. Waste may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

5.2 Classification of Waste:



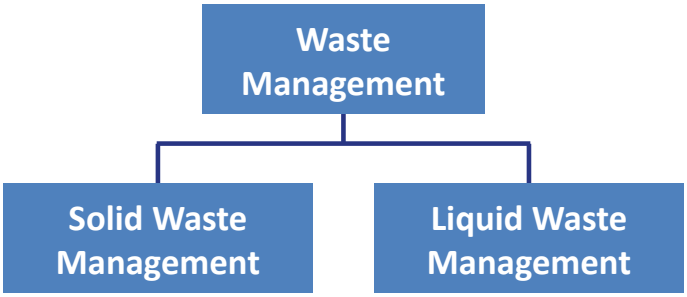
5.3 Impacts of Waste on Environment:

There are potential risks to environment and health from improper handling of solid waste.

i. Chemical poisoning through chemical inhalation
ii. Uncollected waste can obstruct the storm water runoff resulting in flood
iii. Cancer, congenital malformations and neurological disease
iv. Mercury toxicity from eating fish with high levels of mercury
v. Degrades water and soil quality
vi. Methane gas from the landfill enhances the greenhouse gas effect and climate change.
vii. Leachate poses a threat to local surface and ground water systems.

5.4 Introduction to Waste Management:

- Proper management of solid and liquid waste is an important determinant of improved sanitation in any community.
- In rural areas, most of the waste can be safely reused for beneficial purposes with limited resources.
- A number of waste prevention techniques for solid and liquid waste management are available, and they are commonly summarized as the so-called 4Rs: Reduction, Reuse, Recycling and Recovery.
- Selection of technology by community should be based on the availability of space requirement, one-time cost and operation and maintenance costs of the system.



5.5 Solid Waste Management:

- Solid waste (as different from liquid effluents) are those undesirable, useless and unwanted materials and substances that arise from human and animal activities.
- Any waste other than human excreta, urine & waste water, is called solid waste.
- Solid waste in rural areas generally includes-house sweeping, kitchen waste, garden waste, cattle dung & waste from cattle sheds, agro waste, broken glass, metal, waste paper, plastic, cloths, rubber, waste from markets & shopping areas, hotels, etc.
- Solid waste can also be defined as the organic and inorganic waste materials produced by households, commercial & industrial establishments that have no economic value to the owner.

Composting:

- Composting is a form of waste disposal, where organic waste decomposes naturally under oxygen-rich conditions.
- Composting is the most suitable, sustainable and environment friendly method of recycling and reuse of solid waste in rural areas as in rural areas most of the household contains organic waste, with little quantity of inorganic waste and it is completely free from toxic waste.

Advantages of Composting

- Compost reduces greenhouse gases.
- Compost improves soil quality.
- Compost helps clean up contaminated soil.
- Compost helps control erosion.
- Compost makes and saves money.

Different Methods of Composting

- Over ground compost tank (NADEP Method)
- Underground brick lined Manure Pit or Garbage Pit
- Vermicomposting in shed
- Household Vermitank

5.5.1 Over-Ground Compost Tank (NADEP Method):

This method of making compost involves the construction of a simple, rectangular brick tank with enough spaces maintained between the bricks for necessary aeration.

Selecting and Preparing the Site for the NADEP Tank

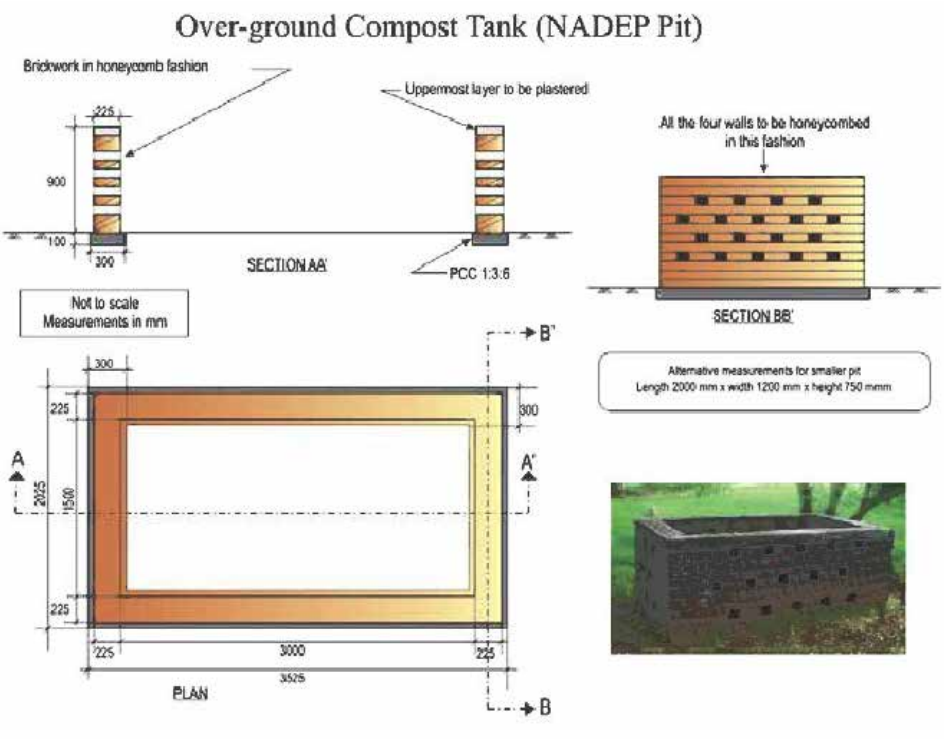
The NADEP method uses a permanently built tank of mud or clay bricks, or cement blockettes. It is, therefore, important to choose the permanent site for the tank with care.

1. Select a site where there is enough space to collect the materials together before filling the tank, and where mature compost can be stored until it is needed.
2. The site needs to be near a source of water.
3. The site should be sheltered from rain, floods and wind. The best is in the shade of a tree, or on the north or west side of a building or wall. However, air should be able to circulate all round the tank.

Building the NADEP Tank:

1. The inside dimensions of the tank are as follows:
   Length: 3 metres
   Width: 2 metres
   Height: 1 metre
2. This size of tank requires 120–150 blockettes or mud bricks, four 50-kg bags of cement, and two boxes of sand.
3. The building should be done by a properly qualified mason, i.e. someone who knows how to build such a structure.
4. The floor of the tank is made of bricks or blockettes laid on the ground and covered with a layer of cement.
5. Each of the four walls has three rows of holes or gaps between the bricks or blockettes

6. After the tank is built, the walls and floor are covered with a light plaster of fresh cow dung mixed with water, and then the plaster is left to dry.



Filling the Tank:

A standard NADEP tank can be filled in one or two days. It requires a team of 2 to 4 people and an effort of approximately 32man hours. Before filling the tank, the following materials should be collected together:

- Dry and green plant materials, 1400–1500 kg is needed. Grass, hay or straw that has left over from feeding animals, or that has been damaged by rain, is very suitable.
- Cow dung or partly dried Bio-slurry (the discharge from a Bio-gas digester), 90–100 kg or 10 sacks.
- Dried soil that has been collected from cattle pens, cleaning drains, paths, etc.: 1750 kg are needed. The soil should be sieved to remove old tins, plastic, glass, stones, etc.
- Water: amount varies with the season and the proportion of dry to green plant materials available.
- However, usually an equivalent amount to plant materials is needed, i.e. 140–150 liters.
- If urine from cattle and/or people is available, it should be diluted in the proportion of 1 part urine for 10 parts water (1 jug of urine put into 10 jugs of water in a bucket).
- Before starting to fill the tank, sides and floor of the tank are thoroughly wetted with slurry made from fresh cow dung mixed into water.

- The three layers used to fill the tank are as follows:
  First layer: use 100–150 kg of dry or mixed dry and green plant materials to make a layer 15-25 cm thick at the sides, and slightly thicker in the middle.
  Second layer: mix 4 kg of cow dung or 10 kg of fresh biogas slurry in 25–50 litres of water and sprinkle or scatter it over the plant materials so they get completely moistened.

Third layer: cover the wet plant waste and cow dung or slurry layer with 50–60 kg of clean, sieved top soil.

- Continue to fill the tank like a sandwich with these three layers put in sequence. Put more materials in the middle of the tank than around the sides. This will give a dome shape to the filled tank with the center 30 to 50 cm higher than the sides.
- Cover the last layer of plant materials with a layer of soil 7 to 8 cm thick. Make a cow dung plaster and cover the soil so that there are no cracks showing. The top of the filled tank can also be covered with plastic, particularly to protect the compost making process during rainy seasons.
- After the tank is filled, the progress of compost making can be tested by pushing a stick into the tank through the gaps in the wall. In a school or agricultural college, the students can monitor the changes in temperature by inserting a long thermometer, e.g. a soil thermometer.
- As the materials decompose in the compost making process, the top of the filled tank will shrink down below the sides of the tank.

Following up on the NADEP Compost Making Process :

It is important to keep the contents of the tank moist, i.e. with a moisture content of 15–20%.

- Check the mud plaster seal on the top of the tank and fill any cracks that appear with cow dung plaster.
- Pull out any weeds if they start to grow on the surface, as their root systems can damage the cover and take water out of the compost.
- If the atmosphere gets very dry and hot, such as in the dry season, water can be sprayed through the gaps in the walls of the tank.

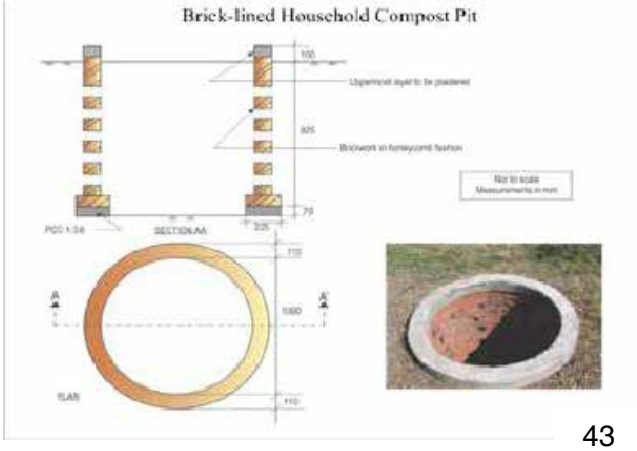
The decomposition process for compost to be made takes about three to four months in a warm climate. When it is mature, it is dark brown, moist, and with a pleasant earthy smell, little can be seen of the original materials that were put into the tank. This mature compost should not be allowed to dry out or it will lose a lot of its nitrogen. However, before the compost is mixed to make nursery soil, it should be sieved. The sieved compost is used in making the soil for the nursery beds, and the remainder is kept and added to a new compost-making process. One NADEP tank of the size described here can produce about 300 tonnes of high-quality compost.

Following up on Conditions in the Compost Making Process When the compost pit has been filled or the piling of materials is complete, it should be checked regularly to make sure that there is enough but not too much moisture, and that it is getting hot, at least in the first two to three weeks.

5.5.2 Underground Brick Lined Manure Pit or Garbage Pit:

Applicability of the Method:

- Rural areas with low rainfall.
- Houses with an open space of about 7 square meter.
- Houses with no cattle or with a single cattle.
- Loose soil structure.
- House owner can make this pit with little technical.



Description of the Method:

- Dig two pits of 1.1m diameter & 1m depth.
- Construct circular pits having inner diameter of 1m, in honey comb 100mm thick brick masonry.
- The height of the circular pits should be 100mm above ground.
- Plaster the top layer of the pit.
- The bottom of the pit should not be cemented.

Use and Maintenance of the Pit:

- Go on adding garbage from the house over the layer of bricks (only biodegradable type).
- When the garbage attains a height of about 150mm, add dung slurry, mix it with garbage & level it.
- Spread a very thin layer of soil over it (once a week) to avoid odour & fly nuisance.
- Continue to add garbage every day.
- Follow the above procedure & repeat the layers till the pit is full. It is recommended to fill the pit up to about 300mm above ground level.
- After 3-4 days, the garbage above ground settles down.
- Plaster it with soil only.
- Leave the pit as it is for 3-6 months for maturation.
- After 3-6 months take out the compost & use it in the fields.
- Till the manure in the pit matures, use another pit of the same dimensions, dug at a minimum distance of 1m from the first pit.

Limitations of Underground Brick Lined Manure Pit or Garbage Pit:

- Not suitable for heavy rainfall areas and rocky terrain.

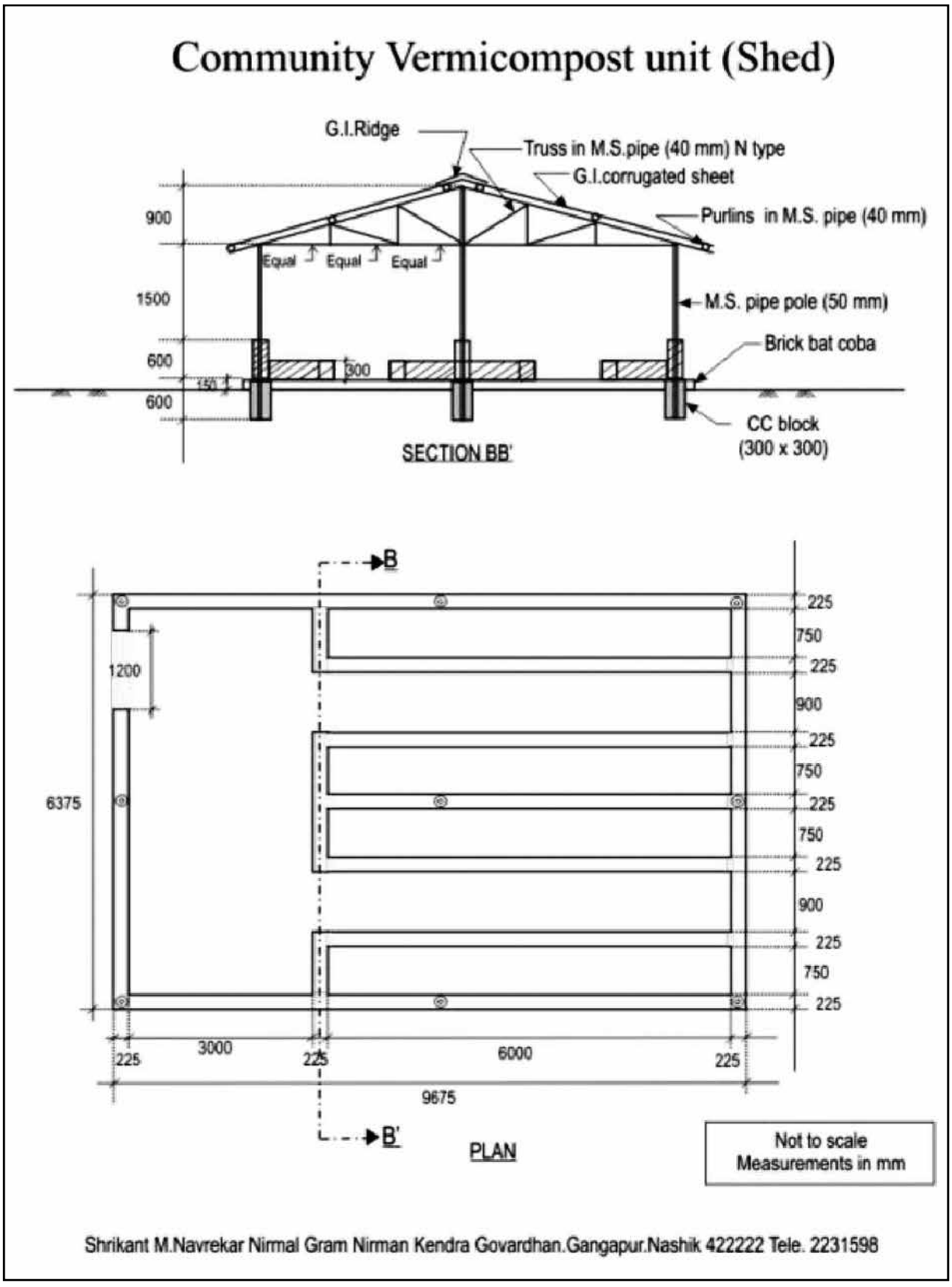
5.5.3 Vermi-composting in Shed:

- Appropriate site should be selected and the site should be protected from direct sunlight and should not be in low lying areas.
- Preparation of site is required by proper ramming of soil before preparation of vermi-composting beds.
- **Construction of appropriate shed:** thatched roof/tin sheds on bamboo/metal poles with proper slope to drain rain water, and proper ventilation.
- The biodegradable waste should be pre-digested in a separate bed before transferring to the treatment beds.

Vermiculture bed preparation steps

- Make a basic bed of size 24 cft (L=8ft,B=3ft, Ht =1ft) with one brick (9 inch x 4 inch x 3 inch) size containment all-round the bed.
- Alternatively, brick tanks of same dimensions having 2 feet height may be constructed. With this worms will not escape to the surroundings.
- The worms are also protected from natural enemies. The tank may be easily covered with a wire mesh.
- Apply a layer of cow dung slurry on the base.

- Put one inch sand on the cow dung slurry plastered bed.
- Followed by putting 2 inch thick organic waste.
- Put 9 inch thick feeding material (cow dung/ biodegradable organic matter such as leaves, kitchen waste) for earthworms in the ratio of raw cow dung: organic waste = 1:5.



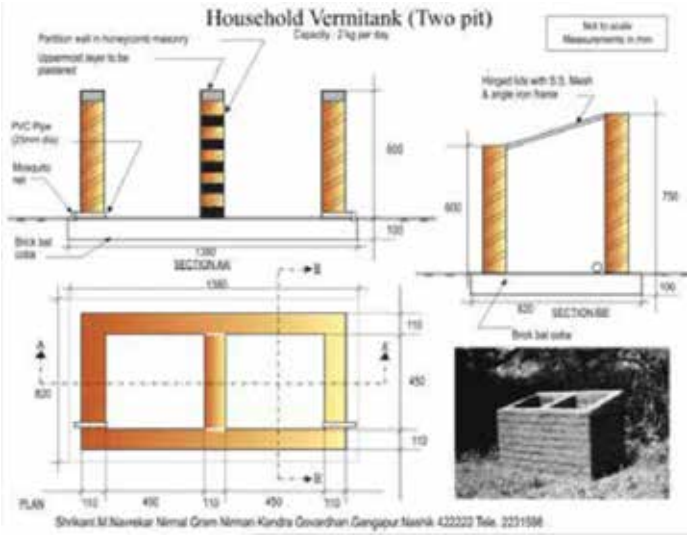



Operation & Maintenance Protocols

- Chop the waste to size less than 5cm before placing in the Basin/ pot/ tank.
- Thickness of waste layer should not exceed 15 cm.
- Use one basin/ pot/ tank for the first 15 days and then use the second basin/ pot/ tank after filling the first.
- Sprinkle cow-dung powder along with waste.
- Protect the vermi basins/ pots/ tanks from mouse, ants and other pests.
- Keep the waste covered with wet sack or cloth piece.
- Sprinkle water over the cover sack/cloth to maintain moisture of 50-55%.
- Avoid over sprinkling of water and stagnation of liquid at the bottom of the basin.
- Vermi-Basin/pot/tank should not be exposed to direct sun light or rainfall.
- Prevent introduction of excessive hot, sour and oily substances and also bones, meat & fiber materials.
- For removing the vermi-compost, expose the basin/pot/tank with contents in shaded sunlight for 2-4 hours and remove the compost from the top and use the basin/pot/tank with earthworms for further composting of bio-waste.
- Compost taken out should not be dried under sunlight.
- Renew the base layer annually.
- Collection of wash out from the basin in the final stages of composting for vermi-wash.

5.5.4 Household Vermitank:

- Vermitank is a specialized unit constructed in brick masonry, capable of converting biodegradable solid waste into high quality organic manure in a short period. It is very easy to operate & maintain.



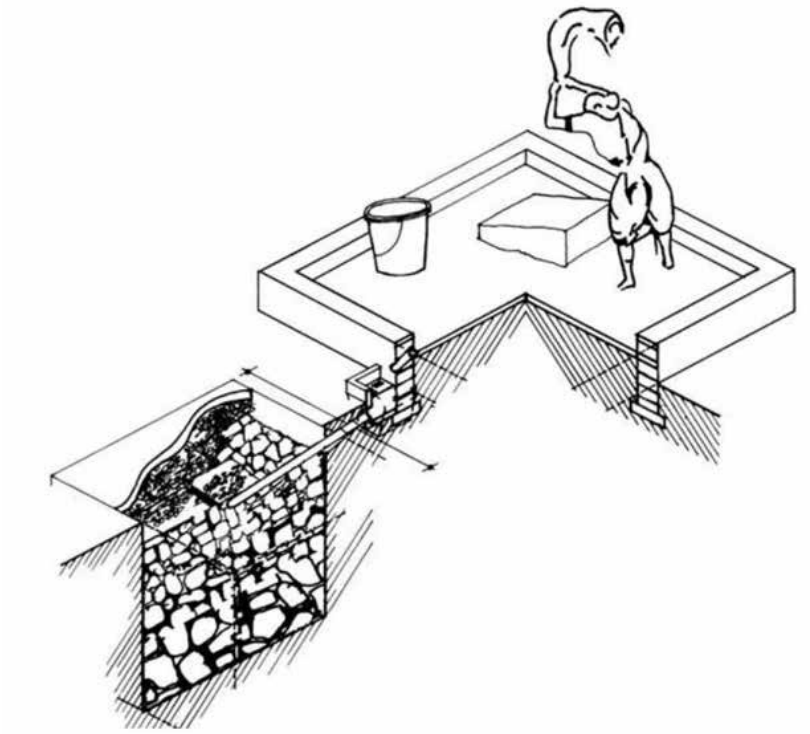
Materials required:

- The vermicompost pit is usually earthwork oriented below the ground. Vermicompost tank will require some masonry construction.
- The basic raw material required for the system are brick bats, core sand and fine sieved soil for preparation of basic layer.
- Material requirements are to be arrived based on detail estimate for a particular size of the system.
- This can be worked out with the help of a mason who will be engaged to construct the system.

5.6 Liquid Waste Management:

5.6.1 Individual & Community Soakage pits:

It has been observed that easy availability of water {particularly in piped form} leads to increased wastewater from kitchen, scullery and laundry. In the rural areas there is lack of proper drainage system to carry away this waste to safe disposal yards and hence this waste water accumulates and results in water stagnation, breeding of mosquitoes and flies which results in many diseases.



Household waste water from cooking, cleaning, laundering & bathing that forms muddy pools & slushy lanes can be drained in the soak pits. The pit loosely filled with boulders and pebbles percolates about 200-300 liters of water per day,deep into the soil, keeping the surroundings clean & dry. As water is absorbed by the ground, which helps to increase the ground water table. The movable sieve filters at the mouth
of the pit helps frequent removal of the solid waste. Improved model of soak pit may be installed. Household soak pit may be constructed for disposal of wastewater (low cost, no chance of any contamination of water, waters stagnation).

Periodical Maintenance

This soak pit will keep working for 3-5 year depending upon the texture of the soil underneath etc.

- The limiting factor for application of this solution is high water table.
- Soak pits should be at least 3 m away from nearest source of drinking water.

5.6.2 Stabilization Pond System for Wastewater Treatment

- Waste stabilization ponds (WSPs) are a low-cost, low-energy, low-maintenance and, above all, a sustainable method of wastewater treatment.
- Waste stabilization ponds are an extremely appropriate method of wastewater treatment in India particularly in rural areas.
- WSPs are simple to construct. Earthwork is the main aspect of work.
- It contains construction of different ponds of desired depth and capacity with proper lined or protected embankments, inlet and outlet chambers and interconnecting pipes.
- It is simple to maintain. Observations to blockage of pipes, scum removal, repair of embankments whenever required, are only routine management aspects of the system.
- Ponds should be located at least 200 m (preferably 500 m) away from habitation.

5.6.3 Brick lining/Embankment Protection for Water Bodies/Ponds in Villages

- Plastering should be done to minimize seepage through it.
- Dimensions should be as per the requirement in terms of quantity to be served.
- Proper compaction should be done for soil before brick laying.
- Proper slope of 1:40 to 1:20 be maintained for proper drainage.
- Brick lining with good quality of bricks, over burned bricks, stones can also be used.
- Pointing should be done in the brick work if plastering can not be done due to financial reasons.
- Size of water body can be decided based on requirements. However it is advisable to take the opinion of Engineer before the work is planned or started.
- Boulder soling may also be done for embankment protection.

5.7 Construction of Open Drains in Villages

- Drains should be as per ground level and in line with the ground level.
- Drains should follow a slope of 1:20.
- Drains should also be symmetrical to the alignment of the road.
- Size of drains should be kept according to the volume of drainage to be done.
- Drains should be constructed as per properly designed depth and width to carry appropriate volume through it.
- Drains should be strong enough to hold itself and the same may be ensured through proper use of material and plastering from inside and outside layer of drain to resist seepage of water through any surface.
- Finishing of drains should be as effective as it should not resist the solid particles flowing through it.
- A well compaction of sub layer should be done before construction of drain over it.
- Cleaning of drains should be done at set interval of time such as weekly, monthly etc.
- There may be spraying of DDT or similar pesticides to stop breeding of mosquitoes in drains.

Chapter – 6: Conclusion

6.1 Rural Sanitation Campaign

The Rural Sanitation Campaign has the following as its objectives:

- Accelerate sanitation coverage in rural areas.
- Focus on intensive education and awareness campaigns to ensure that people understand the need for safe sanitation.
- Promote cost-effective and appropriate technologies.
- Through all the above, improve the health and quality of life in rural areas.

6.2 Eliminating Open Defecation

Open Defecation in Rural India remains a problem that perplexes policy makers and civil society alike. Under the Swachh Bharat Mission, India has been made an Open Defecation Free country by October 2019. There is a need to sustain these outcomes through constant focus on quality of sanitation technology being adopted by households, communities and institutions in rural areas.

The following factors are to be taken into account for toilets to become household and community-friendly:

- Affordability
- Space in the home
- Geographical conditions – soil/water table etc
- Cultural habits
- Availability of water/scarcity of water
- Availability of skilled or semi skilled manpower

Suitable technology for construction of toilets should to be selected and implemented accordingly.

6.3 Waste Management

- Solid and liquid waste management (SLWM) is the collection, transport, processing, recycling or disposal of waste materials, usually ones produced by human activity, in an effort to reduce their effect on human health or local aesthetics or amenity.
- Management of solid waste should to be taken up at two levels:
  i) Household level
  ii) Community level
- Both levels involve segregation and adoption of appropriate technology for treatment and disposal.
- Composting is one of the options for treatment of solid waste.
- Stagnant waste water smells bad and also acts as breeding place for mosquitoes resulting in spread of diseases like dengue, malaria, filaria etc. Proper disposal and also reuse of waste water wherever possible will help in combating diseases as well as meeting water scarcity.
- The village level water management system should be as simple as possible for a village level person to understand and implement.
- It should be decentralized.
- Technological options are based on:

i) Domestic (Household) level management

ii) Community level management.

- The knowledge and skill requirement of masons must include dimensions of various kinds of chambers, earth work, brickwork, plastering, concreting, construction of sheds, tanks etc.

सत्यमेव जयते

पेयजल और स्वच्छता मंत्रालय
MINISTRY OF
DRINKING WATER AND SANITATION

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Swachh Bharat Mission is a public movement. This is the need of the hour and a change in our behaviour is a must.

Shri Narendra Modi
Prime Minister of India