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Toilet technologies used in urban and peri-urban areas may be subject to some constraints. These may include:

- High water table in localities thereby making dug pits more susceptible to (or likely harmed by) infiltration. In such cases, dug pits are normally made shallow.
- Certain areas are rocky thereby making the digging of pits difficult and/or impossible.
- Unavailability of good quality wood planks for slabs fabrication. Wood often used get rotten or attacked by termites.
- Lack of knowledge on how to treat wood to prevent termite infestation.
- Lack of knowledge on sludge disposal options and mechanisms.
- Inadequacy of artisans to provide technical support during construction.

This therefore presents some challenges during the selection and construction of a toilet.

A major challenge to the sustainability of community-level sanitation interventions is in insufficient capacity to construct, manage, and maintain infrastructure (GWP, 2012). A report by the Ghana WASH project identified the lack of technical capacity to construct toilet facilities as one of the main challenges that hinder households from owning and sustaining a toilet. This means that training people and building their capacity will sustain sanitation interventions thereby increasing household sanitation coverage. Also, latrine artisans when equipped with the needed skills have the opportunity to improve their incomes and livelihoods, to better support themselves and their families (GWP, 2012).

This training manual provides basic steps and techniques to guide the Latrine Artisan during the construction of a latrine.

### Training Objectives

The overall goal of the training manual is to present to latrine artisans basic steps and techniques required to construct a sustainable toilet.

At the end of the training, latrine artisans will be able to:

- understand the need for a latrine
- identify and select appropriate toilet technologies
- construct some common toilet technologies
**Training Workshop Organization**

This training manual is divided into six (6) sections:

**Section 1: Introduction**

This section contains background to the manual. It also presents the overall objective of the latrine artisan manual.

**Section 2: Module 1: Sanitation and need for latrine**

Section 2 presents module 1 which focuses on sanitation and need for latrine. This module presents the basic understanding of sanitation and why it is important to build a latrine. It further describes the transmission cycle of sanitation related diseases and also some factors that are considered when planning to build a latrine.

**Section 3: Module 2: Toilet Technologies**

The third section presents the different types of toilet technologies. The description and how these toilet technologies function are however referred to in the Latrine Technology manual. A guide for household latrine selection is also referred to in that same manual.

**Section 4: Module 3: Guide for constructing selected toilet technologies**

Module 3 presents a guide for constructing some selected toilet technologies. This section focuses on the tools required and stages involved when constructing a latrine. Preparation of reinforcement and mortar, plumbing works and building the toilet house are all considered in this manual.

**Section 5: Module 4: Installation of prefabricated toilets**

The fifth section focuses on the installation of selected prefabricated toilets. The assembly and installation instructions of the Enviro Loo waterless toilet are presented in this manual.

**Section 6: Evaluation of Training workshop**

The last section contains feedback form for evaluating the training workshop. This makes provision for assessment of achieved goals and impacts, potential weaknesses and opportunities for improvement in subsequent trainings.
SECTION 2: MODULE 1-SANITATION AND NEED FOR LATRINE

Objectives

By the end of this session, the training participants should be:

- familiar with the definition of sanitation
- able to tell the benefits derived from using a latrine
- able to explain the transmission cycle of sanitation related diseases
- able to show the factors to consider when planning to build a latrine

Target Trainees

- Latrine Artisans
- Interested persons

Methodology(ies)

- Introduction
- Power Point presentation
- Questions and discussions
- Group activity

Equipment and Materials

- Training workshop room
- Flip chart stand and flip chart paper
- Markers
- Pens/Pencils
- Writing pads
What is Sanitation?
Sanitation refers to the hygienic and proper management, collection, disposal and/or reuse of human excreta (faeces and urine) and community liquid wastes to safeguard the health of individuals and communities. It is concerned with preventing diseases by hindering pathogens, or disease-causing organisms, found in excreta and wastewater from entering the environment and coming into contact with people and communities. This usually involves the construction of adequate collection and disposal or reuse facilities and the promotion of proper hygiene behaviour so that facilities are effectively used at all times.

Why Build a Latrine?
Unsanitary conditions threatens the health of the human population and the sustainability of the environment. Approximately 85% of the Ghanaian population does not have access to improved sanitation. In addition to the indignity suffered by those lacking sanitation facilities, majority of the people are susceptible to diseases contracted through direct and/or indirect contact with pathogenic bacteria found in human excreta. Inadequate sanitation is one of the key indicators of rural and urban poverty, and overcrowded and unhealthy living conditions of the poor in developing countries.

A latrine is a safe and private place to be used for defecation. Wide ranges of latrines are used in households, schools and other agencies (settings). Using an improved latrine provides the following impacts:
- Improves health conditions
- Promotes dignity of living or enhanced quality of life
- Improves productivity
- Poverty alleviation
- Improves water quality
- Protects the environment
What Benefits are Derived from a Latrine?

Building and using a latrine gives the following benefits:

- Provide dignity and privacy
- Safety
- A cleaner environment
- Reduced smell and improved sanitation and hygiene
- Improved safety (no need to go out into the fields at night)
- Saves time and money,
- Provides opportunity to produce compost and biogas for energy
- Breaks the transmission cycle of sanitation related diseases.

Transmission Cycle of Sanitation Related Diseases

Diarrhoea kills many people every year especially children below 5 years old. We get diarrhoea mainly because we have ‘eaten’ faeces. Faeces, can get into our mouth through a number of ways. Our Fingers, the Food we eat, and the Water we drink can all carry faeces to our mouth. The transmission cycle of sanitation related diseases referred to as the F-Diagram (below) also shows how we can carry faeces to our mouth.

![Diagram of transmission cycle of sanitation related diseases](image)


Safe water, using a hygienic latrine, adequate excreta disposal and handwashing are key ways of blocking the faecal transmission route. Also covering Food, Boiling water, Washing all fruits and vegetables, wider environmental sanitation measures and improved general health (e.g. quality nutrition or eating balanced diet) are all key ways of blocking the faecal transmission route.
Planning to Build a Latrine

Before the decision to build a latrine is made, there are many things to consider. The key things to consider include the following:

1. Type of latrine or toilet technology you prefer to build
2. Where (location/site) to build your latrine
3. Preparing the place or site/location to build your latrine
4. Digging and lining the pit
5. The covering slab (sanitation platform)
6. Size of squat hole
7. Including a handwashing station
8. Method of emptying/desludging
9. Possible reuse of faecal sludge
SECTION 3: MODULE 2-TOILET TECHNOLOGIES

Objectives

By the end of this session, the training participants should become more familiar with:
- various types of toilet technologies
- description and function of different toilet technologies
- how to select a household toilet using the household latrine selection guide

Target Trainees

- Latrine Artisans
- Interested persons

Methodology(ies)

- Introduction
- Power Point presentation
- Questions and discussions
- Group activity
- Video documentary

Equipment and Materials

- Training workshop room
- Flip chart stand and flip chart paper
- Markers
- Pens/Pencils
- Writing pads
- Projector/Screen
- Computer/Laptop
- Handouts of Module

**Time Required**

- 60 minutes

**Types of Toilets**

There are many types of toilets. Some need water to operate, some don’t need water. Toilet types can be broadly categorised as:

- **On-site systems**: they are isolated and provide some level of treatment and/or containment at the toilet location and may avoid the need for further treatment. However, a number of on-site systems need regular emptying. Examples of on-site systems include simple pit latrine, Kumasi-Ventilated Improved Pit (K-VIP) latrine, Enviro Loo toilet, Ecological Sanitation toilet (Composting and Urine Diverting Dry Toilet), Pour flush toilets, water closet with septic tanks, biofil toilet, biogas digester, aqua privy etc.

- **off-site systems**: they are more common in the developed world, cities and high density areas, and often take on the form of sewerage systems which require a reliable water supply and the provision of wastewater treatment systems. Off-site sanitation systems generally involve the construction of long lengths of permanent infrastructure. Examples of off-site systems include conventional, simplified, condominial and settled sewerage systems.

**Description of Technologies**

Refer to the Latrine Technology Manual for a detailed description of toilet technologies.

**Household Latrine Selection Guide**

It is important to choose the right toilet technology to suit people’s needs and the conditions of each location. A toilet can be a dry system that uses no water for carrying excreta or wet system which uses water. KNUST together with GOG (Government of Ghana), UNICEF and other partners have developed a guide to assist in the selection of the most appropriate household toilet technology for different conditions in urban and peri-urban areas of Ghana. Refer to the
Household Latrine Selection Guide for details.
SECTION 4: MODULE 3-GUIDE FOR CONSTRUCTING SELECTED TOILET TECHNOLOGIES

Objectives

By the end of this session, the training participants should be familiar with:

- basic steps for constructing a latrine
- tools required to construct different types of toilet technologies
- preparing reinforcement for constructing toilet
- preparing concrete using the right mixing ratios
- setting u-trap for flush water seal
- setting the vent pipe
- building the toilet house (superstructure)

Target Trainees

- Latrine Artisans
- Interested persons

Methodology(ies)

- Introduction
- Power Point presentation
- Questions and discussions
- Group activity
- Video documentary
- Practical demonstration (in the field)

Equipment and Materials

- Training workshop room
- Flip chart stand and flip chart paper
- Markers
- Pens/Pencils
- Writing pads
- Projector/Screen
- Computer/Laptop
- Handouts of Module
- Toilet construction materials
- Demonstration site

**Time Required**

- 540 minutes

**General Construction Process of Onsite Latrines**
Preliminary Works

As all other construction works, it is important to secure the site for construction from the rest of the household or community. Major accidents that have been reported during construction of latrines are children falling into pits that were not properly secured. For this reason it is a requirement that all latrine construction sites must be secured by simply driving pegs into the ground and hoarding of with red bands (usually old red cloths can be cut into bands for this purpose).

Various Components

Selecting a suitable location

- A toilet must not be located close to a water body (well, river, stream) and should be at least 100 feet (30 metres) from the edge of the flood plain of a surface water body.
- Pit should be at least 6 metres (almost 20 feet) away from kitchen and 30 metres (100 feet) from source of water.
- Latrines shall be sited away from trees to prevent obstruction of vent pipes.
- Latrines shall be constructed at convenient location accessible to users at all times.
- Avoid (if possible) sites with the following soil conditions: rocky outcrops, unstable ground conditions and depressions with high water table.
- Latrines shall be constructed at sites or locations with adequate drainage to ensure that rainwater runoffs do not flood the pit.
1: Setting out/Marking out

Tools and equipment required:
- Cutlass
- Measuring tape
- Balls of string
- Wooden stakes
- 2” x 4” nails
- A level
- Carpentry square

Activity Objectives:
- To mark out the exact location of the pit.
- To clearly mark out 90° corners in case of rectangular pits, and for circular pits a well-defined circumference.

Activities:
- Clear the site for construction of latrine to begin
- Set out the edges of pit ensuring corners are 90° (using the 3:4:5 method)

Precautions:
- Avoid moving the string that serves as the initial reference mark.
- Be careful not to leave nails on the ground or poking out of stakes, as people could step on them and get hurt.
- Ensure appropriate safety at the construction site
2: Digging of pit

Tools and equipment required:
- Measuring tape
- Shovel
- Pick axe
- Gloves

Activity Objectives:
- To excavate pit for storage and/or partial treatment of excreta.

Activities:
- Carefully dig pit within the set out range.
- Ensure that dug out soil is kept at a considerable distance from the pit to prevent them from falling back into the pit.
- Excavate to the required depth (e.g. 1.5 – 2.5 metres)

Precautions:
- Avoid standing on the edges of the ditches as they might collapse.
- Protect the areas already excavated to prevent accidents.
- Do not increase or decrease the dimensions of the ditch.
3: Steel Reinforcement

Tools and equipment required:
- Table or flat surface for bending the rebar
- Pliers

Activity Objective:
- To create the rebar structures and ties that will be used to reinforce the foundation and the concrete walls.

Activities:
- CUTTING AND BENDING THE REBAR - Cut and bend the rebar for various components of the steel framework in the foundation and the walls, always following the mason’s instructions. You may bend the rebar pieces into “staples” in the shape of a square, the letter U, and the letter L.
- TYING THE STAPLES - Place and tie the staples on the rebar rods, always alternating them so that every other one or every other four staples (depending on the type of staple) faces a different direction, according to the mason’s directions.

Precautions:
- Use gloves when handling the steel and the pliers.
- Bend the rebar properly to avoid the staples being more “closed” or more “open”.

4: Erecting Walls

Masonry walls can be done out of bricks, stones, or concrete bricks joined by mortar made out of sand, cement and water. As a general rule bricks must be of good quality without visible cracks, be of true size and shape and with straight edges and even surfaces to improve workmanship and reduce mortar wastage during laying. Good building stones on the other hand must be hard, tough and compact grained and uniform in texture and colour. In the case of concrete blocks, its use will determine its size and quality.

Tools and equipment required:
- Trowels
- Buckets
- Shovels
- Scaffolding
- S-shaped rebar tool
- Plumb-line
- Level
- Gloves

Activity objective
- To construct walls for the structure that will provide security and privacy for the users
Activities

- TRANSPORTING MATERIALS - Move blocks, sand, and cement closer to the house. Hand up buckets full of the concrete mixtures when the masons request them, but be careful not to overload the scaffolding.
- PREPARING CEMENT MIXTURES - Make mortar for laying blocks, cement mixture for filling the U-shaped blocks and cement mixture for filling the holes in the blocks where vertical rebar has been placed. The cement mixture should be runny.
- FILLING HOLES IN THE BLOCKS - Fill the holes in the blocks where vertical rebar has been placed, pushing the cement mixture down into the crack with a small piece of rebar as you proceed to make sure that no air bubbles or empty spaces are created.
- CLEANING THE MORTAR JOINTS - Use the S-shaped rebar tool to clean the mortar joints of excess cement before the mortar dries.

Precautions

- Do not spread the mortar across long sections of that wall. Otherwise, the mortar will dry before the blocks are laid.
- Build the four walls simultaneously, row by row.
- The blocks must be clean and completely dry.
- Make sure that the vertical rebar stays correctly placed in the center of the blocks as they are filled with cement.
- Wear gloves when carrying the blocks.

5: Roofing

The main function of the roof is to keep away water from entering the privy room and the pit during rainfall and provide shade during periods of sunshine. In this regard one key principle in roof design and construction is to get water off the roof as quickly as possible without allowing it any opportunity to stand on the roof. As such pitched roofs are preferred to flat roofs in this country (Ghana) by norm/practice.

Tools and Equipment required:

- Hummer
- Plumb-line
- Level
- Gloves
- Activities
• Determine the pitch/slope of the roof
• Layout the trusses on the ground
• Hoist the trusses into pace and align them using the level and plumb-line
• Fix the purlins on the trusses depending on the roofing material
• Fix the roofing sheets using roofing nails and the hammer
• For other roofing materials, secure them in place using the appropriate fixings & fasteners.

Precautions:
• Be careful when hoisting the trusses into place to avoid accidents
• Wear gloves when transporting the roofing sheets to reduce the possibility of cuts
• Do not drive the nails in the roof valleys

**Constructing a Ventilated Improved Pit (VIP) toilet**

![Diagram of a Ventilated Improved Pit (VIP) toilet]

**Tools Required**

<table>
<thead>
<tr>
<th>Tools List</th>
<th>Construction Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammers</td>
<td>Nailing wood &amp; using chisel</td>
</tr>
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<td>Handsaws</td>
<td>Cutting wood</td>
</tr>
<tr>
<td>Trowels &amp; wooden floats</td>
<td>Working concrete</td>
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<tr>
<td>Shovels</td>
<td>Preparing site, mixing concrete</td>
</tr>
<tr>
<td>Spirit Level</td>
<td>Levelling blocks and concrete</td>
</tr>
</tbody>
</table>
Plumb Bob and String Line | Levelling blocks and concrete
---|---
String Line | Marking out dimensions
Measuring Tape | Measuring dimensions
Large bucket or wheelbarrow | Mixing concrete
Carpenter’s square | Accurate measurements

**Stages Involved**

There are four (4) key stages to building a VIP toilet.

1. Selecting and preparing a suitable location
2. Digging the pit
3. Building the toilet slab
4. Building the toilet house (Superstructure)

**Digging the pit**
1. Dig a pit in the ground
2. The size of the pit mouth should be 2.35m x 1.2m for rectangular and diameter of 1.35m for circular pits with depth not less than 2.5m. However the depth should be dependent on the type of soil but should not exceed 3m deep.
3. For circular pits, the diameter must be uniform throughout and the walls must be vertical
4. Add small concrete foundation (sub foundation) at the top edge (50cm) of pit to support the toilet slab
5. The sub foundation at the top 50cm of the pit must be lined with concrete bricks/ blocks or stones
6. Line pit above ground level to at least one line of concrete bricks/blocks. About 24 bricks are needed for the top 50cm and the above ground level part.
7. If the soil is unstable, line the whole pit and this can be done with any timber, rubble stones, concrete bricks/blocks or old drums to support walls of the pit.
8. Vertical joints between the concrete bricks/blocks or stones of the walls below the top 50cm must not be filled.

Building the toilet slab

Description of slab

1. Toilet slab must be made of reinforced concrete to give it more strength and safe to use.
2. For rectangular slabs, a dimension of 2.45m x 1.5m with thickness of 75 mm with reinforcement is adequate.
3. The circular concrete slab has a dome form to give it more strength.

The dimensions of a circular concrete slab are:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>1.35m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness:</td>
<td>60mm</td>
</tr>
<tr>
<td>Height of the dome</td>
<td>80mm</td>
</tr>
<tr>
<td>Squatting hole</td>
<td>400x120/200mm</td>
</tr>
</tbody>
</table>
Preparing the form

Rectangular slab

1. Cut long pieces of purlin
2. Make a wooden formwork by nailing together 4 pieces of purlin so that inner dimensions of wooden formwork are 2.45m x 1.5m x 75mm. Use 10cm nails, two on each side to fasten the wooden formwork.
3. Carefully place squat hole mould in position.

Circular slabs

1. This requires 3-4 moulds to be made: gap mould, slope mould, triangular mould, any mould for footrests.
2. Make a wooden gap mould for the squatting hole. The wooden gap mould dimensions are: thickness of 6cm, bottom side should be all around 1cm smaller than the topside in order to get a conical section.
3. Put two big nails (say 6” sizes) in the bottom side in order to keep the gap mould in-situ
4. Make a slope mould out of a board
5. Make a triangle mould fitting from 27 x 40 x 2 cm between the footrests.
6. Coat all the moulds with (old) oil in order to prevent sticking them onto the concrete.

Circular Dome Slab
1. Look for a nice level place to work on.
2. Put a small pole in the middle and let it stand out 8 cm above the ground and sign around the pole a circle with a beam in the ground (use the slope mould).
3. Make outside the circle a ring of bricks.
4. Make a dome of soil in the circle from the outside towards the pole. The top of the pyramid has to be flat in a diameter from 40 cm. Use the slope mould.
5. Put a strip of strong plastic against the inward side of the bricks in order to prevent seaming the mortar and the bricks together.
6. Moisten the soil inside the bricks to avoid leaking away later on the cement water out of your mortar.
7. Place the gap mould in the centre on the flat part of the soil.

Preparing the reinforcement for rectangular slabs
Cut pieces of 12mm diameter steel bars to the following dimensions for reinforcing each slab.
- 118 cm  8 pieces
- 83cm  6 pieces

Preparing the reinforcement for Circular slabs
Cut 12mm diameter steel bars into the following pieces
- 2 x 35 = 70 cm.
- 2 x 115 = 230 cm.
- 2 x 87.5 = 175 cm.
- 2 x 67.5 = 135 cm.
- 2 x 105 = 210 cm.
- 4 x 40 = 160 cm.
Tie the bars together with iron wire.
Preparing mortar with gravel (Concrete)

1. Make a concrete mixture of ratio 1:2:3 which means: 1 part cement to 2 parts sand to 3 parts gravel. Thus, the ratio 1:2:3 is explained as:
   - One head pan of cement (half a bag of cement)
   - Two head pans of sand
   - Three head pans of gravel

2. Add as much clean water as necessary to get a uniform and workable mix.

Note: Water should not be saline or contain organic materials. Don’t add too much water, because it will leak out of your slab into the soil before the mortar is hardened and it will take with it a part of the expensive cement.

Making the rectangular slab

1. Place a template mould for the seat slab and a vent pipe ring for the vent-pipe hole in the appropriate place within the wooden frame.

2. Lay concrete in the frame to a depth of about 37.5mm and compact well.

3. Place steel bars on the layer of concrete. Make sure that the bars do not touch any side of the wooden frame (allowance should be at least 10mm). If any bars overlap holes, trim accordingly.

4. Tie the steel handles to the bars with wire (only for cover and vent pipe slabs).

5. Place wood inserts in seat slab to enable installation of seat cover.

6. Cover steel bars with the rest of the concrete to level with wooden frame.

7. Make the slab surfaces smooth by throwing some handful of pure cement powder on the surface of the slab and polish with a steel trowel.

8. Allow the slab to cure by covering with wet paper or wet sand or wet jute sack after one day.

9. Remove wooden frame after one day but allow slab to stay on the ground for at least 7 days where slab could be ready for use or installation on the pit.

10. Sprinkle water on the slab two or three times each day for at least 14 days and leave concrete to cure
Making the circular slab

1. Put the concrete on the slope of soil, divide it equal in a layer of 37.5mm thickness.

2. Place the iron bars on the concrete. Make sure using the correct distance between the bars themselves and between the bars and the outside surface of the concrete. The bars need at least 2 cm concrete all around them in order to protect them against aggressive moisture (urine and cleaning water).

3. Put the rest of the concrete on the bars. Knock gently with a wood float on the surface to drive away all the air bubbles out of the concrete.

4. Throw some hands full of pure cement powder on the surface of the slab and polish it carefully into the surface with a steel trowel until you get a nice smooth surface.

5. After some hours, when the concrete has hardened a little bit, release the gap mould from the concrete but let it in situ.

6. Make two footrests near the squatting hole. The height of the steps is 2 cm above the centre plate.

7. Finally cover the slab with a sheet of plastic in order to avoid drying out the fresh concrete. To prevent blowing away the sheet by the wind put some stones on the sheet. If there is no sheet available, use paper, grass or something else.

8. The next day you can remove carefully the gap mould, the surrounding bricks and the plastic strip.

9. Clean the three moulds very thorough and coat them again with oil for the next slab you are going to make.
10. Now you have to wait 4 weeks until the slab has totally hardened.

11. Don’t move it sooner! The first two weeks you have to sprinkle the slab at least 3 times a day with sufficient water to keep the concrete wet. The concrete will harden sooner and better in wet circumstances! After sprinkling replace the plastic cover all the time.

Test Vent Pipe and Cover Slabs for Strength

1. Test vent pipe and cover slabs for strength after 14 days.
   - Place slab on 4 pieces of bricks (or wood) at the corners.
   - Allow 4 men to stand on the slab.
   - Check that the slab is not broken.
Placing the slab

1. After 4 weeks the slab can be removed carefully. Put it upwards and roll it to its destination
2. Handle the slab with enough strong people.
3. Put the slab carefully over the pit.
4. Slab must be well centred and well seated on the sub foundation
5. Earth up soil around the sub foundation to avoid stagnant water accumulating around the toilet

Building the toilet house (Superstructure)

The toilet house can be any design that meets the local conditions and there could be use of locally available materials. Internal dimensions of latrine superstructure could be:

Length - 1.4m
Width - 1.2cm
Height - 2.4m at front and 1.8m at rear

- Assemble doorframe and place in the entrance of the superstructure. Ensure that it is straight and vertically plumb.
- Erect 10cm thick wall from floor to flush with proposed front bottom edge of seat slab.
• Continue laying blocks/bricks for superstructure walls.
• When rear wall reaches height of about 1.6m, insert pieces of wire (4 mm diameter) into this wall and install rear rafter. Secure rafter with wires.
• Construct roof and install door.
• Tie fly-screen on vent-pipe and install vent pipe in hole as follows:
  • Check whether vent-pipe hole is clear
    ✓ Carefully drive a 15 cm nail into vent pipe about 15 cm from the bottom end.
    ✓ Place vent pipe firmly in hole
    ✓ Top of vent pipe should extend a minimum of 300mm above the roof and covered with fly screen/mesh
• Build toilet wall so pipe is exposed to the sun
• Ensure that the vent-pipe:
  ✓ is truly vertical
  ✓ is fastened securely with wire to the rear rafter at the back of the roof.
  ✓ Seal vent-pipe hole edges with cement.

![Fixing Pipe with the Mesh at the Top](image-url)
## Tools Required

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Steps to Construct KVIP

1. Mark layout and dig the pit to a depth of between one and two metres.

**Note:** These are internal dimensions. So it is necessary to dig a slightly bigger pit. The actual size will be determined by the materials to be used for the sub foundation.

2. Cast three slabs (2 cover slabs and one seat slab).
   - Remember that the seat slab has 2 seat holes.
   - Remember also that each of the two cover slabs has a vent-pipe hole

3. Line the pit walls from top to bottom

4. Pit dividing wall and pit lining should be constructed at the same time so that they could bond properly. Dividing wall must be well sealed with cement plaster to ensure that it is watertight. Allow the pit lining to project at least 20cm above ground level. Pit dividing wall should be 15 to 23cm thick.

5. Install the cover slabs and construct foundation for the superstructure.

6. Place a lintel across edge of the slabs and start constructing the superstructure.

7. Install seat slab when superstructure walls reach height of about 35cm.

8. Complete superstructure construction.

9. Tie fly-screen on vent-pipe and install in one of the vent-pipe holes after checking that the hole is clear. Ensure that the vent-pipe is straight and then fasten securely with wire to the rear rafter at the back of the roof.

10. Seal vent-pipe edges with mortar.

11. Place covers on other vent-pipe hole and corresponding seat hole.
Compost Toilet
### Tools List

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### Construction steps

1. Select and prepare the site
2. Construct footings and base slabs
3. Construct chamber walls
4. Prepare the inside of chamber
5. Cast the chamber roof (which is the toilet room floor)
6. Prepare the false chamber
7. Prepare the rear door and baffle boards
8. Construct riser
9. Construct the toilet house walls and roof
Constructing footings and base slabs
- Layout and level the base sides using pegs and string lines.
- Use the 150 x 25mm rough sawn timber to build formwork for the concrete base slab. The formwork should be sized to match the size of the chamber.
- Dig a 200mm deep footing under the position of each block wall.
- Square and level the formwork.
- Use 12mm mesh reinforcing steel in the floor and set vertical 10mm reinforcing bars at correct spacing for concrete block walls.
- Prepare concrete, pour and trowel the base slab and footings smooth.

Construct Chamber walls
- Lay four (4) courses of sandcrete blocks or five (5) for larger chamber to form the two (2) compost chambers.
- Fill the hollow cores in the sandcrete blocks with mortar.

Prepare the inside of chamber
- Cast a 100mm high and 100mm wide concrete step along the floor against the back wall and cast a 50mm high by 150mm wide step across the front of the step.
- Use mortar to plaster and seal the inside of the walls and floor.

Chamber roof (Toilet room floor)
- Using plywood or local materials prepare formwork to cast the top floor 75mm thick.
- Use polythene to prevent concrete sticking to formwork.
- Make round formwork for an opening to match the toilet pedestal.
- Place 100mm/150mm PVC insert for vent at the back edge of the floor over each chamber.
- Use 12mm mesh reinforcing steel in the floor and set vertical 10mm reinforcing bars at correct spacing for concrete block walls.
- Prepare concrete, pour and trowel the chamber roof smooth.
Prepare the false chamber floor

- Make a 50mm x 50mm hardwood slat floor using galvanised nails. The floor will sit inside the chamber to support solid waste and allow urine drain. An alternate to hardwood is using bamboo. This will reduce the cost but the bamboo will need a replacing each time a chamber is emptied. Make this floor in two pieces for ease of installation.

Prepare the rear door and baffle boards

- Fix 100mm x 50mm hardwood or treated pine around the door opening with masonry nails to support a rear door cover and baffle boards.
- Fit 50mm x 25mm hardwood to make a guide for the superflex plank baffle boards.
- Cut marine ply to match the door opening, place against the frame and drill four holes for the rear door bolts.

Construct the seat riser

- Use either a fibreglass or PVC seat riser or construct your own cement seat riser.
- Inside the toilet house, provide a place to store biodegradable material that is added each time the toilet is used.

Construct the toilet house walls and roof

- Concrete blocks, sawn timber framing, iron wall cladding or other local materials can be used for the house.
- Gutters can be made from PVC pipe or locally available bamboo.

Note: If adding a seat insert bolts into the floor before the cement set to attach the seat riser and wall base plate.

Mixing the Concrete

1. Make a concrete mixture of ratio 1:2:3 which means: 1 part cement to 2 parts sand to 3 parts gravel.
2. Prepare about 240 litre wet mortar. In order to get this;
   - Put the quantities on a hard even surface and mix them very well (first mix the sand and the gravel than add cement)
   ✓ Three head pans of cement (one and half bags of cement)
✓ Six head pans of sand
✓ Nine head pans of gravel

3. Add as much clean water as necessary to get a uniform and workable mix.

**Note:** Water should not be saline or contain organic materials. Don’t add too much water, because it will leaking out of your slab into the soil before the mortar is hardened and it will take with it a part of the expensive cement.
Constructing Double Vault UDDT

Tools required

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Bolt cutters or hacksaw | Cutting rebar to size
Pliers | Cutting and fastening tie wire
Carpenter’s square | Accurate measurements
Drill | Drilling holes in wood for bolts

**Construction steps**

**General requirements**

The basic design rules for constructing UDDTs:

**IMPORTANT**
- The interior walls of the vaults MUST be plastered to minimize infiltration of moisture.
- The vault doors must close well to keep the faecal matter safely contained and prevent water from entering the vault.
- The vaults must have good air circulation via vertical ventilation pipes that remove moisture and odour above the level of the roof.

**Site selection and preparation**
- Site selection for UDDT toilet is one of the easy but important steps.
- In-situ toilets require foundations.
- Clear and level the ground where the toilet is to be located and remove the top soil and debris. The depth depends on the type of soil and will be given by the site engineer.
- Make sure all of the materials and tools are at the site before each construction step is started.
- There should be a space of 1.5m between the vault door and the nearest wall to allow for easy emptying.
- Consider the position of emptying hole, urine container and effective use of space.
- Orient the emptying hole at the backside of entrance and allow adequate space for emptying.
- Layout of toilet is done as per the drawing.
Construction of foundation slab

- Set the profiles at the four corners of the toilet.
- Using a string set at a parallel line to an existing facility or fence (make sure you leave >1.5m between vault door and obstruction) and mark on the profiles with a nail.
- Set the other dimensions with above profiles being the baseline.
- Check the diagonals and make sure the structure corners are perfectly square.
- Transfer the dimensions to the ground using a plumb bob.
- Construct a wooden shuttering box with inner design dimensions with a depth of 10cm for casting the foundation slab.
- Mark the foundation area for excavation. The marks are excavated at 15mm deep and 25mm wide.
- Excavate 600mm wide foundation trench within the marks until hard surface is reached (usually 1.5 – 2 metres depth). This may vary from place to place depending on the type of soils.
- Place a blinding layer of concrete mix 1:3:6 at the bottom of the excavated trench.
- Build foundation using quarry stones/concrete blocks using 1:3 mortar.
- Backfill the slab formation.
- Hand compact the foundation area.
- Place the dump proof membrane (DPM).
- Place concrete mix of 1:2:4 and 8mm reinforcement steel bar mesh where necessary (e.g. black cotton soil).
- Backfill the area around foundation with excavated soil.

Construction of vaults

**Note:** The foundation slab should dry and cure for at least 2 days.

- Build the vault using bricks/concrete blocks/stones/concrete panel. For other prefabricated options see the specific manufacturer’s user instructions.
- Build the vault walls using mortar of mix 1:3 (cement: sand).
- Set the height, length and width of the vault.
- Plaster the inside of the vault with a thin coat (2-3mm) mortar of mix 1:1.
- Cast the top slab and fix the squatting pan and anal cleansing pan where necessary.

**Note:** The top slab should dry and cure for at least 3 days.
Construction of superstructure

- Select the preferred material for the superstructure (concrete panels/bricks/concrete blocks/stones/prefabricated panels).
- Select the appropriate tools to construct the superstructure.
- For in-situ options, build the walls with 1:3 mortar, reinforcing alternate layers with hoop iron.
- For prefabricated options assemble as per the manufacturer’s manual.
- Build the roof as per specification in the technical drawings provided.
- Fix the main doors and vault doors as per provided technical drawings. Make sure the vault doors are watertight.
- Fix the ventilation pipe(s), PVC/steel/concrete minimum diameter 100mm. The pipe should rise 50cm above the roof. Avoid bends in pipe and cover the end with a cap to prevent rainwater from entering. Make sure that the joints of the pipe and the vaults are watertight to avoid water from entering.
- Fix the urine diverting pipes with diameter of at least 50mm. Use rigid piping or semi-rigid hoses (plasticized PE/ polypropylene PP/PVC/uPVC). Do NOT use metal pipes due to corrosive properties of urine. Use appropriate glue for joining the pipes.
- Construct the urine soak pit where necessary or collect and store/sanitize urine for use as fertilizer in agriculture. For detailed connection to soak pits see the provided technical drawings manual.
- Beautify where necessary (e.g. internal plastering, painting and external keying).
- Test and adjust all fixtures and fittings for ease of operation and use.

Plumbing work

Final work of toilet is plumbing i.e. urine container, vent pipe, black water pipe, and other fitting works. Plumber must be careful to control leakage.
Construction Procedure for Flush Toilets (cistern or pour flush)

Construction steps

General requirements

The basic design rules for Cistern Flush

- Ensure that there is a sewer network or septic tank and soak pit.
- Ensure that there is proper gradient to allow waste water flow by gravity to a sewer or septic tank via manholes.
- The manhole chambers must be built to the technical standards to avoid stagnation and blockage.
- Use a qualified plumber to install appropriate piping for waste water.
- All replaceable valves and fittings should be fitted in a way that allow for easy repairs and maintenance. NEVER cover them with wall tiles or plaster.

Site selection and preparation

- The location of the cistern flush toilet should allow for easy piping and plumbing works.
- The floor should have a drain in case of water overflow.
- Connect the overflow pipe of the cistern to the outside of the toilet cubicle.
Construction of foundation slab

- In case built separately, excavate the foundation area,
- Place concrete mix of 1:2:4 and 8mm reinforcement steel bar or BRC A98 mesh where necessary (e.g. black cotton soil).
- Fit the necessary piping, low level pans or leave holes.

![Diagram of foundation slab]

Construction of cistern and toilet pans

**Note:** The foundation slab should dry and cure for at least 3 days to be strong enough for the installation of either sitting or squatting pan.

- Fix the low level squatting pan before plastering the floor and sitting pan after plastering.
  - Use mortar of mix 1:3 (cement: sand).
  - Fix the sitting pan after plastering the floor according to the type and specification of the supplier. This has to be done by a qualified plumber. Fix the pan tightly with screws on the floor.
  - Plaster the walls with a thin coat (2-3mm) mortar of mix 1:1 before fixing the cisterns/relevant pipes.
Note: Ensure that the plaster works do not hinder the plumbing/fitting works.

Construction of superstructure

- Select the preferred material for the super structure (concrete panels/bricks/ concrete blocks/stones/prefabricated panels).
- Select the appropriate tools to construct the superstructure.
- Build the walls and beautify where necessary (e.g. keying).
- Build the roof according to the provided technical drawings.
- Fix the main doors. Fix the door frames first and then the door shutters. The door should be level and open freely.
- Fix the ventilation pipes, PVC/steel/concrete with minimum diameter of 100mm, class B. The pipe should rise 50cm above the roof. Avoid bends in the pipe and cover the end with a cap to prevent rainwater from entering. Make sure that the connection of the pipe and the vaults construction are watertight to avoid water from entering.
- Fix the necessary sewage pipes/fittings leading to manhole chambers.

Construction Procedure for Septic Tanks

Construction steps

General requirements

The basic design rules for Septic tanks:

- A septic tank must have at least two compartments, with T-shaped inlet baffle (100mm) and outlet baffle (100mm). Each compartment must have an access manhole that is airtight.
- All septic tanks shall discharge to a soak away.
• There must be adequate and reliable water supply at all times
• The septic tank should be watertight.
• A septic tank should have a minimum size (about 1,700 litres) to be capable of receiving one day’s maximum sewerage flow from a dwelling.
• A septic tank shall have a means of access for the purpose of emptying and cleaning.
• The depth in such a tank should be below the outlet invert level, not less than 1m and there is an air space of not less than 200mm between the surface of the liquid contained therein and the underside of the top cover.
• Inspection chambers must be installed at all bends and junctions of the drains.

Site selection and preparation
• The soil and subsoil must be suitable and the size of the plot adequate.
• The water table must be low.
• Nothing else may be built on top of a septic tank.
• Locate in an optimal place to allow flow by gravity.

Construction of foundation slab
• The slab is made from concrete 150mm thick.

Construction of walls
• Walls should be constructed from materials like concrete, bricks and mortar/ durable materials that are not subject to excessive corrosion.
• The interior of bricks tanks should be plastered with waterproof mortar.
• Use mortar of mix 1:3 (cement: sand).
• Ensure that the plaster works do not hinder the plumbing/fitting works.
• Fix the T-pieces for inlets and outlets and seal properly with mortar.

Construction of top slab
• Prepare the form work for the top slab with the necessary steel reinforcement.
• Cast the concrete slab with the frames for the manholes.
• Use concrete mix of 1:2:4.
• Cure for at least 3 days.
• Fix the manhole covers.
Construction Procedures for Soak Away Pits

Construction steps

General requirements

The basic design rules for soak pits.
- Soak away pits are built circular from cement blocks, two meters in diameter and to such depth as circumstances dictate. Reinforced slab over the top to contain a 600mm x 450mm inspection cover.
- They should be constructed in such a way not to cause any kind of pollution.
- They should be more than 3m from any building.
- They should not be constructed where the water table is high.

Site selection and preparation
- The soil and subsoil must be suitable and the size of the plot adequate.
- A simple percolation test should be done for the infiltration soils. Soils with percolation test rate above 30 minutes are not allowed.

Construction of circular soak away
- Top slab is made of reinforced concrete with manhole.
- Is made from 450mm rubble fill (outer core).
- Inner side: honeycomb blocks.
- Inner bed of rubble (about half of depth of pit) and the above blocks.
• Covered with a standard manhole cover.
• Inlet pipe 100mm (from septic tank).

**Some Key Toilet Components**

**Setting and fixing the U-trap and the drain**

• The pan and the U-trap should be fixed in place and set in lean concrete 1:3:5 mix and the floor around the pan carefully screeded and smoothed with 1:3 cement mortar.
• Lay the drain pipe connecting the U-trap to the pit. The fall or slope on the pipe should be at least 1 in 25.
• Cement the pipe through the pit walls and backfill around the pipe

[Diagram of toilet components]

**Setting and fixing a Vent pipe**

• The vent pipe should be fixed in place vertically and made to go above the roof of the latrine superstructure.
• The lower end of the vent pipe should be fixed directly on top of the pit to allow for the gases to easily escape through the pipe.
• Set the lower end of the vent pipe in the vent slab and fit it in place with lean concrete 1:3:5 mix and carefully smooth the floor around the pipe with 1:3 cement mortar.
SECTION 5: MODULE 4-Installation of Prefabricated Toilets

By the end of this session, the training participants should be familiar with
• Assembly and installation of selected prefabricated toilet technologies.

Target Trainees

• Latrine Artisans
• Interested persons

Methodology(ies)

• Introduction
• Power Point presentation
• Questions and discussions
• Video documentary
• Practical demonstration

Equipment and Materials

• Training workshop room
• Flip chart stand and flip chart paper
• Markers
• Pens/Pencils
• Writing pads
• Projector/Screen
• Computer/Laptop
• Handouts of Module
• Toilet construction materials
• Prefabricated toilet technology installation manuals

Time Required

• 240 minutes
Installations procedure

There will be the main procedures of site selection and the installation of the latrine.

- The selection of the site for the latrine will follow the same criteria presented already (see previous sections on latrine site selection).
- The installation of the latrine will follow the manufacturers guide or manual that came with it.
WORKSHOP EVALUATION FORM

Date
Location of Training
Facilitator(s)

Please respond to the following statements by using the 4 point scale to indicate the extent to which you agree or disagree with each statement. Tick the number that applies

**4- Strongly Agree 3- Agree 2- Disagree 1-Strongly Disagree**

| Q1. The training objectives were clearly defined and met | 4 | 3 | 2 | 1 |
| Q2. The training was well organized | 4 | 3 | 2 | 1 |
| Q3. Participation and interaction were encouraged | 4 | 3 | 2 | 1 |
| Q4. The information presented were relevant and useful | 4 | 3 | 2 | 1 |
| Q5. The training materials were presented in an organized manner | 4 | 3 | 2 | 1 |
| Q6. The training materials provided were useful | 4 | 3 | 2 | 1 |
| Q7. The training experience will be useful in my job | 4 | 3 | 2 | 1 |
| Q8. The facilitator(s) was knowledgeable about the training topics | 4 | 3 | 2 | 1 |
| Q9. The facilitator(s) was well prepared | 4 | 3 | 2 | 1 |
| Q10. The facilitator(s) was a good communicator | 4 | 3 | 2 | 1 |
| Q11. The facilitator(s) responded to questions effectively | 4 | 3 | 2 | 1 |
| Q12. Given the topics treated, the training was well paced within the allotted time | 4 | 3 | 2 | 1 |
| Q13. The meeting room and facilities were adequate and comfortable | 4 | 3 | 2 | 1 |
| Q14. The training has made a big difference in the way you used to do your job | 4 | 3 | 2 | 1 |
| Q15. Overall assessment of the training workshop is Excellent | 4 | 3 | 2 | 1 |

Thank you for your feedback
REFERENCE


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Percy Quansah &
Nehemiah Addae Samwini