THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH AND SOCIAL WELFARE

NATIONAL SANITATION OPTIONS AND CONSTRUCTION GUIDELINES

MARCH, 2012

Ministry of Health and Social Welfare,
Department of Preventive Services,
P.O Box 9083,
Dar es Salaam.
PREFACE

Since 1961 when Tanzania mainland got independence to date, still there is a critical problem of unimproved sanitation at household level. Currently, about 90% of households own sanitation facilities (any form) for disposal of human excreta. In addition, only 23% and 27% of the households have access to improved sanitation in rural and urban areas respectively. The existence of unimproved sanitation facilities significantly contributes to increased prevalence of sanitation related diseases such as diarrhoea, typhoid, dysentery and cholera. In most districts diarrhoea (one of indicators of poor sanitation) is ranked third among the top ten diseases. Use of improved sanitation on the other hand could save thousands of lives every year, and it can reduce diarrheal diseases one of the leading causes of child mortality in Tanzania, by about 36 per cent.

Despite various efforts undertaken by the government and different stakeholders in promoting sanitation and hygiene there is still inadequate knowledge and skills on construction and proper use of toilets/latrines coupled with unhygienic practices. Furthermore, different groups in the community, such as people with disabilities, the elderly, children and victims of disaster are not given significant consideration during design and use of sanitation facilities.

These challenges have prompted the Ministry of Health and Social Welfare (MoHSW) to develop the guidelines which will be used as reference material to Local Government Authorities (LGAs) and other stakeholders in the construction and use of improved sanitation facilities. Sustained use of improved sanitation facilities has a direct impact on school attendances, people’s dignity, social welfare and better economic opportunities. Moreover, it helps to accelerate the achievement of the Millennium Development Goals (MDGs) as translated in National Strategy for Growth and Reduction of Poverty (NSGRP) abbreviated in Kiswahili as MKUKUTA.

The guidelines are therefore the standard working tool for different stakeholders in the field of environmental sanitation dealing with planning; designing; implementing; and monitoring and evaluation of sanitation programmes in the country. It is expected that the guidelines will assist artisans, communities, Local Government Authorities, policy makers and other stakeholders in implementing sanitation activities to improve public health in the country.

Regina L. Kikuli  
Ag. Permanent Secretary  
Ministry of Health and Social Welfare
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# ACRONYMS

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<thead>
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<th>Full Form</th>
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<tbody>
<tr>
<td>BCC</td>
<td>Behavior Change Communication</td>
</tr>
<tr>
<td>HMIS</td>
<td>Health Management Information System</td>
</tr>
<tr>
<td>HWB</td>
<td>Hand Wash Basin</td>
</tr>
<tr>
<td>IEC</td>
<td>Information Education Communication</td>
</tr>
<tr>
<td>IPLs</td>
<td>Improved Pit latrines</td>
</tr>
<tr>
<td>MDGs</td>
<td>Millenium Development Goals</td>
</tr>
<tr>
<td>MKUKUTA</td>
<td>Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania</td>
</tr>
<tr>
<td>MUHAS</td>
<td>Muhimbili University of Health and Allied Sciences</td>
</tr>
<tr>
<td>NSGRP</td>
<td>National Strategy for Growth and Reduction of Poverty</td>
</tr>
<tr>
<td>OPD</td>
<td>Out Patient Department</td>
</tr>
<tr>
<td>PPP</td>
<td>Public-Private Partnership</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children Fund</td>
</tr>
<tr>
<td>VIP</td>
<td>Ventilated Improved Pit</td>
</tr>
<tr>
<td>WC</td>
<td>Water Closet</td>
</tr>
<tr>
<td>WSS</td>
<td>Water Supply and Sanitation</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>JMP</td>
<td>WHO/UNICEF Joint Monitoring Programme</td>
</tr>
<tr>
<td>HESAWA</td>
<td>Health Sanitation and Water Programme</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENT

The development of these guidelines on sanitation options has been of paramount importance towards improving sanitation and hygiene status in Tanzania. The preparation and accomplishment of the guidelines has been done in a participatory manner involving various stakeholders. In this respect, the Ministry of Health and Social Welfare would like to appreciate efforts of all experts and partners who participated in developing these guidelines.

Special thanks are directed to Dr. Donan W. Mmbando (Director of Preventive Services), Mr. Elias B. M. Chinamo (Assistant Director of Environmental Health and Sanitation Services), Mr. Hussein Mohamed (Assistant Lecturer - MUHAS), Mr. Amour Seleman (Environmental Health Officer) and Mr. A. Mwakitalima (Environmental Health Officer) who worked tirelessly in coordinating the development and production of these important guidelines.

I would like to express the deepest appreciation to Regional and District Health Officers who shared their field experiences on sanitation and hygiene issues which in turn provided valuable inputs to the development of these guidelines.

Furthermore, the government would like to thank the secretariat for their tireless efforts in designing and finalizing this document, their names are attached in Appendix I.

Finally the Ministry would like to express its sincere gratitude to UNICEF for financing the development of these guidelines.

Dr. Donan W. Mmbando
Ag. Chief Medical Officer
Ministry of Health and Social Welfare
DAR ES SALAAM
### GLOSSARY

<table>
<thead>
<tr>
<th><strong>Design</strong></th>
<th>For the purpose of this document, design refers to basic design aspects of sanitation facilities.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecological sanitation</strong></td>
<td>Is a form of sanitation technology that usually involve urine diversion and recycling of nutrients contained within human excreta back into the local environment for soil conditioning.</td>
</tr>
<tr>
<td><strong>Household</strong></td>
<td>It is a smallest socio-economic unit that consists of one or more persons with common living and catering arrangements. Such persons are usually not always related to each other by blood or by marriage</td>
</tr>
<tr>
<td><strong>Hygiene</strong></td>
<td>Personal cleanliness by using water and soap to improve health and enhance person’s dignity</td>
</tr>
<tr>
<td><strong>Hygiene facilities</strong></td>
<td>These are facilities for hand, body and utensil washing amenities. It also includes sanitary receptacles and cleansing facilities</td>
</tr>
</tbody>
</table>
| **Improved Pit Latrine** | Consists of a pit excavated into the ground, covered with a washable floor, and a drop-hole through which excreta falls into. The following provisions are some of the improvements made to differentiate it from traditional pit latrine:  
  - Provision of an impervious and washable floor e.g. Sanplat  
  - Provision of superstructure with roof and lockable door  
  - Stability of both substructure and superstructure  
  - Hand washing facilities  
  - Fly proofing  
  - Lined pit hole |
| **Improved sanitation/latrine** | Include the following sanitation options;  
  - Pour-flush/flush latrine |
- Improved Pit Latrine
- Ventilated Improved Pit latrine
- Composting latrine
- Ecological sanitation

**Learning Institution**  
In this document it refers any learning institution except pre-primary, primary and secondary schools

**Open defecation or urination**  
Defecation/urination in the open area (e.g. in the bush, open pit, or on the street)

**Pour Flush Latrine**  
Means a latrine which uses water to flush or convey faecal matter from a pedestal or squatting pan to a pit. A pit can be located directly below the pan or can be offsite

**Raised or mound**  
It is a type of latrine constructed in the rocky and/or high water table areas where the recommended pit Depths (4 meters) cannot be attained

**Sanitation**  
It refers to means of preventing human contact from the waste to promote health. It is generally used to refer to the provision of facilities and services for the safe disposal of human faeces and urine. It also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal

**Sanplat**  
Is a specific design of a *floor slab* for any type of latrine, except for WC. It is branded as “Sungura” which can be used to improve floor of any type of pit latrine with light – tight fitting lid to overcome problems of odour and flies.

**Sullage**  
Is a waste water resulting from washing clothes and kitchen utensils, shower or bath water and other domestic water not containing excreta
| **Tippy tap** | In Kiswahili known as ‘Kibuyu chirizi’ is a simple technology for hand washing made of container perforated on one side and tied by a rope which when tilted allows a flow of water. Tilting is done by pressing a wood tied to a rope to allow running water for hand washing. It can be made using locally available materials such as jerry cans, tin cans, gourd, and plastic containers of different sizes or pottery depending on the culture and preference of the community. |
| **Ventilated Improved Pit latrine** | Is a pit latrine where odours and flies are effectively controlled by the action of a vent pipe. The wind blows across the top of the vent pipe creating a flow of air that sucks out the foul smelling gases from the pit. The top of the vent pipe must be covered with a fly proof mesh. |
| **Water Closet** | Is the commonest type of flush latrines, which provides hygienic method of excreta disposal when used properly. |
CHAPTER ONE
BACKGROUND

1.1 Introduction to sanitation

Sanitation is generally used to refer to the provision of facilities and services for the safe disposal of human faeces and urine. It also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal. UN Habitat reports that over a billion of the world’s population remain without access to safe drinking water and over twice that number are denied access to adequate sanitation. In Africa alone about 589 million people have no access to any form of toilet facilities\(^1\). Though Tanzania has high coverage of latrines of approximately 90% in rural areas and 95% in urban areas, yet 76% have no access to improved sanitation facilities\(^2\).

Sanitation has been a challenge especially in developing countries, as it is a major cause of diarrhoea and other excreta related diseases. Improved sanitation contributes to a significant beneficial impact on health as it reduces diarrhoea morbidity by 37.5 percent\(^3\).

As sanitation coverage stands high in Tanzania one would expect to experience little sanitation related diseases but the situation is opposite. Some of the factors contributing to this situation are the use of unimproved sanitation options coupled with poor hygiene practices. This means that the reported high sanitation coverage does not consider suitability of the latrine, appropriate use, cleanliness and other hygienic factors. In addition vulnerable groups e.g. children, people with disability, victims of disasters are not given adequate attention to access suitable sanitation facilities. Certainly, when people do not find guidance on improved sanitation options, they will always tend to develop their own solutions which can compromise public health and the environment at large.

1.2 Status of Sanitation at Households

The latrine coverage at household level in Tanzania is high, but most of them are of poor quality and do not provide effective barriers against sanitation related diseases. The ‘MTU NI AFYA’ (Man is Health) campaign, HESAWA, PHAST, and the National Health and Sanitation Competitions are some of the efforts taken to address the sanitation challenges. Together they have resulted into rapid

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\(^1\) WHO/UNICEF JMP (2008): Joint monitoring programme for water supply and sanitation
\(^2\) WHO/UNICEF JMP (2010): Joint monitoring programme for water supply and sanitation
construction of large number of latrines and the culture of latrine use became well entrenched across the country (nomadic communities and coastal area dwellers were the exceptions). However, such efforts have largely contributed to increased coverage of any form of sanitation but not the quality.

1.3 Sanitation at Learning Institutions

Sanitation and hygiene situation in learning institutions also need to be improved. Many of them do not have adequate number of sanitation facilities that meet the standards. Moreover, facilities for people with disabilities in these institutions are inadequately provided. Most of the facilities are usually waterborne; however managerial and operational problems are encountered. In addition, facilities for disposal of sanitary pads are inadequate resulting into haphazard disposal and consequently blocking of drainage systems. Water intermittency is another challenge contributing to poor hygiene and operation of toilets. Lack of regular maintenance of sanitation facilities contributes significantly to the malfunctioning of the system.

1.4 Sanitation in Public Places

Provision of sanitation facilities in public places is quite important towards ensuring that the open defecation and urination are kept under control. However, some public places such as beaches, recreational grounds, swimming pools, bathing places, bus/railway stands, and markets usually do not have toilets. Existing facilities lack operation and maintenance resulting into unhygienic conditions. Moreover, there are inadequate provisions of sanitation facilities for special groups especially people with disability and children. At earmarked bus stopovers along highways, there are no sanitation facilities provided for travelers. This encourages haphazard defecation, the practice commonly known as ‘KUCHIMBA DAWA’. Such practices lead into serious land and water sources contamination.

1.5 Sanitation in disaster and emergency

Disasters and emergency in general may lead to displacement of people. Displaced population usually lack adequate sanitation and if not provided timely, victims tend to defecate haphazardly. Consequently, sources of water become contaminated resulting into outbreak of waterborne diseases. Based on the experiences during emergency situation, it is deemed necessary to consider the inclusion of sanitation options to guide various implementers and stakeholders. A range of sanitation options have been recommended to be used during disasters and emergency situations.
1.6 Objective of the guidelines

The objective of these guidelines is to provide essential guidance on the selection and construction of various sanitation options in the country. The aim is to streamline the achievement of the MDGs targets on sanitation as translated into the National Strategy for Growth and Reduction of Poverty (NSGRP II).

The provision of these guidelines will therefore facilitate the selection, designs and construction of improved sanitation options for households; public places; health facilities, learning institutions\(^4\), special groups and during emergency and/or disastrous situations. Furthermore, it will provide guidance for monitoring and evaluating sanitation intervention at various levels and facilitate the operational and maintenance of the facilities.

\(^4\) The school sanitation has been covered in the SWASH guidelines
CHAPTER TWO
HOUSEHOLD SANITATION OPTIONS

2.1 Introduction

Provision of sanitation facilities is one of the important issues to be considered at household level. In Tanzania, majority of households do not have improved sanitation facilities in comparison to their residential houses. In some instances a household possesses an elegant dwelling house while the toilet is in queer situation implying that toilet/latrine is not considered as part of a dwelling house. The dominancy of unimproved sanitation facilities has been contributed by several factors including inadequate skills of local artisans and the community on latrine design and construction, priority, poverty, increased population (overcrowding), inadequate knowledge on hygiene practice and lack of space in squatter.

The following are sanitation options recommended at household level and should be widely promoted for use with special attention on their operation and maintenance:

i. Improved Pit Latrine (with washable slab e.g. sanplat)
ii. Ventilated Improved Pit Latrine (VIP latrine)
iii. Pour Flush Latrine
iv. Water borne systems i.e. Water Closets (WCs) connected to septic tanks or sewers
v. Raised/Mound pit latrine

The following are typical examples of improved and unimproved pit latrines

Figure 2.1: Example of unimproved pit latrine
2.2 Factors influencing the selection of sanitation option

The following are criteria used for selection of sanitation options:

i. Soil permeability
   • This determines the depth of pit to be excavated and the possibility of contamination of ground water source.
   • Helps to determine the type of pit lining materials and tools to use

ii. Availability of water
   • Easy access to water is important factor for selection of sanitation option e.g. if water is available, flush latrine/WC is recommended

iii. Level of water table
   • It is one of the factor used to determine the type of sanitation option e.g. in case of high water table Raised/Mound pit latrines are the best option.

iv. Culture
   • Cultural norms and traditional practices have influence in selection of site in relation to users

v. Costs
   • Costs of any option to be selected will depend on the affordability of the household; cost will influence the choice of building materials and the operation and maintenance of the facility
2.3 Selection of Construction Materials

The choice of construction materials for different parts of the latrine depends on soil conditions, type of superstructure required, affordability and availability of materials. Table 1 specifies the recommended type of construction materials.

**Note:** It is advisable that building materials used for construction of latrines be of the same quality as the ones used for residential houses.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Substructure</th>
<th>Slab</th>
<th>Superstructure</th>
<th>Type of latrine recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable Soil</td>
<td>Unlined round pit.</td>
<td>Concrete slab circular shaped with provision of vent pipe.</td>
<td>Should provide privacy. Should be impervious.</td>
<td>- VIP - Pour Flush - Raised/mound pit latrine</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Materials:</strong> Mobi slabs (plastic), 12mm reinforcement bars, wire mesh, cement, sand, timber, logs, aggregates, Mozambique/dome slab, wood woven raft, sanplat.</td>
<td><strong>Materials:</strong> Cement, Sand, Cement Bricks, Wood poles, Burnt bricks, Chicken wire, Mats and Bamboo sticks.</td>
<td>- WCs connected to: Septic tank and Sewer.</td>
</tr>
<tr>
<td>Loose soil</td>
<td>Lined round pit.</td>
<td>Wider than the pit.</td>
<td>Should provide privacy and it should be wider than the pit.</td>
<td>- Should protect the user from all weather conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Materials:</strong> Soft water, Stones, Burnt or cement bricks, Cement, Wood, poles.</td>
<td><strong>Materials:</strong> Mobi - slabs (plastic), 12mm wire mesh, cement, sand, timber, logs, aggregates, Mozambique/dome slab,</td>
<td>- VIP - Pour flush - Raised/mound pit latrine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Materials:</strong> Cement, Sand, Bricks, Wood poles, Chicken wire, Mats</td>
<td>- Septic system - Double vault</td>
</tr>
<tr>
<td>Soil Type</td>
<td>Substructure</td>
<td>Slab</td>
<td>Superstructure</td>
<td>Type of latrine recommended</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>------</td>
<td>----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Hard rock</td>
<td>Purlins, Timber, concrete rings and any other suitable local materials</td>
<td>wooden woven raft SanPlat.</td>
<td></td>
<td>- VIP -Raised/mound pit latrine</td>
</tr>
<tr>
<td></td>
<td>-Unlined round pit is recommended -Depth not less than 1m.</td>
<td>Each slab should have an aperture for the vent pipe.</td>
<td>- Should provide privacy and each pit should have its door way. - May have one building but with separation wall for each pit.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Materials:</strong> Cement, Sand, Bricks, Wood poles, Chicken wire and Mats/Sacks</td>
<td></td>
</tr>
<tr>
<td>Water Logged</td>
<td>-Raised substructure about 1.5m - Full lining from the ground water table.</td>
<td>Each slab should have an aperture for the vent pipe.</td>
<td>Should provide privacy and each pit should have it door way.</td>
<td>- Protect the user from all weather conditions. -Raised/mound pit latrine -Sewerage system</td>
</tr>
<tr>
<td></td>
<td><strong>Materials:</strong> -Block bricks -Burnt bricks -Stones</td>
<td></td>
<td><strong>Materials:</strong> -Cement -Sand -Bricks, Wood poles, -Chicken wire -Mats/Sacks</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Materials:</strong> Mobi - slabs (plastic), 12mm wire mesh, cement, sand, timber, logs, aggregates, Mozambique/dome slab, wooden woven raft sanplat.</td>
<td></td>
<td><strong>Materials:</strong> -Iron sheets -Gum Poles -Wood Purlins - Local grass available</td>
<td></td>
</tr>
</tbody>
</table>
2.4 Designs and Construction Details of Various Latrine Options

2.4.1 Improved Pit Latrines (IPLs)

Improved Pit Latrine consists of a pit excavated into the ground, covered with a floor with a drop-hole through which excreta fall into. Improvements made to differentiate from traditional pit latrine include the following:

- Provision an impervious washable floor e.g. Sanplat
- Provision of adequate privacy
- Stable substructure and superstructure
- Presence of hygiene facilities e.g. Kibuyu Chirizi

a) Construction materials and equipment

- **Tools/equipment needed**
  Spade, hoe, pick axe, machete, tape measure, string, bucket, shovel, trowel, flat wood, spirit level and pegs.

- **Construction materials**
  Sand, aggregate, blocks or bricks, water, wire mesh, and cement. Similarly, latrines can be constructed using locally available materials to meet the above named criteria.

b) Construction steps

Site selection
- Construct a toilet at a distance of 5 - 6 m from the residential house
- Distances from water sources (ground and surface water) should not be less than 100m if the toilet is uphill and 50 m if the toilet is downhill, depending on soil condition
- Generally the latrine should be located at a minimum distance of 30m from water source

Site clearance
- Uproot tree stamps if any
- Remove top soil and level the surface

c) Setting
- Peg and tie string to position walls and extent of excavation
- Check diagonals
• Check setting – measure at least 30 cm from the back wall then leave a squatting hole
• Measure plan area for latrine room $L \times W = 1.5 \times 1.3 = 1.95 \text{ m}^2$

d) Pit excavation
• Excavate a circular pit (3 – 4m deep, 1.5m internal diameter)
• It should be noted that a circular pit is more preferred than a rectangular pit because it is stable

e) Pit lining
• Use available local materials e.g. stones, blocks, wattles or metal for pit lining where unstable soil exist (Figure 2.3 to figure 2.8)

![Figure 2.3(a): Typical Pit lining with burnt bricks (without mortar)](image1)

![Figure 2.3 (b): Pit lining with burnt bricks and cement sand mortar](image2)
Figure 2.4: Round pit with basket lining

Figure 2.5: Rectangular pit with partial brick lining

Figure 2.6: Rectangular pit with full lining

Figure 2.7: Rectangular pit lined with logs
**Figure 2.8:** A drum pit lining

**f) Concrete slab casting**

**In-situ slab casting**

(i) Choose hardwood poles with not less than 100 mm diameter
(ii) Place the hard wood poles on top of the pit in parallel
(iii) Leave a distance of 200 – 250 mm between poles
(iv) Set wall plan
(v) Place on top of steel reinforcement some form of formwork using locally available materials such as tins, iron sheets, tree barks and grasses, try as much as possible to maintain a levelled surface. In a place where hard wood can be found use a minimum number of woods (Total number of 3 are proposed).
(vi) Place wire mesh 2 mm above the formwork using spacing blocks or stones at reasonable spaces so that the wire mesh does not directly rest on the formwork. Remember to locate and cut a hollow in the wire mesh for the drop hole
(vii) Prepare and cast floor slab as follows;
   - Mixing ratio is 1 part cement, 3 parts clean sand, 6 parts aggregates (1:3:6)
   - First mix cement and sand until a uniform colour is formed. Then add aggregates and mix together until a uniform mixture is achieved.
   - Add water progressively while mixing until a workable concrete is obtained
- Place the concrete on top of the wire mesh until the concrete slab is 100 mm thick. Make sure the drop hole is not covered with concrete by providing some form of a mould or formwork for a drop hole.
- Finish slab casting with gentle slope towards the drop hole. Allow curing of the slab for at least 7 days, by pouring water every morning and late in the evening.
- Finish the slab with smooth sand cement screed.

**Precast slabs**

(i) Prepare a formwork for the slab according to the size of the pit and allow 100 mm of overhang to allow the slab to rest over the pit.
(ii) Locate the position of the squatting hole. A formwork or mould can be used to secure the drop hole from being filled in with concrete.
(iii) Place wire mesh 2 mm above the poles using spacing blocks or stones at reasonable distances so that the wire meshes are uniformly laid.
(iv) **Remember** to locate and cut a hollow in the wire mesh for the drop hole.
(v) Prepare and cast floor slab as follows:

- Mixing ratio is 1 part cement, 3 parts clean sand, 6 parts aggregates (1:3:6).
- Mix cement and sand until a uniform colour is formed. Then add aggregates and mix together until a uniform mixture is achieved. Add water progressively while mixing until a workable concrete is obtained.
- Place the concrete on top of the wire mesh until the concrete slab is 100 mm thick. Make sure the drop hole is not covered with concrete.
- Finish slab casting with gentle slope towards the drop hole.
- Finish the surface with cement sand screed. Allow curing of the slab for at least 7 days, by pouring water early in the morning and late in the evening.
- Place the cured slab on the pit according to the required orientation.

**g) Super structure**

**Walls**

- Set either rectangular or circular super structure according to the required measurement.
- Erect walls not less than 2.5m high with bricks or blocks using cement sand mortar or mud.
• Select windward side and provide door space 0.75 m wide and 1.8 -2.1 m height.
• On the back wall at a height of 1.8 m leave air holes of 300mm wide and 300mm high.

**Note:** Other local walling materials such as those used to construct dwelling house are recommended

**Roofing**
• Roof the structure using locally available and durable roofing materials provided that the roofing does not leak

**Door**
• Place a door frame
• Fix door shutter leaving 50 mm free space from the floor level. Make sure that the shutter is lockable in both sides but opens inside.

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**Figure 2.9:** Typical example of a superstructure of IPL with ‘Kibuyu Chirizi’
h) Sullage management
Sullage is the water resulting from washing clothes and kitchen utensils, shower or bath water and other domestic water not containing excreta. Sullage can have a lot of germs in it and so is dangerous for children who may play in it or even drink it. The quantity of sullage varies with the quantity of water supplied and certain local practices such as whether personal and clothes washing is done at home or at the source. Where water borne sanitation does not exist, domestic sullage should be disposed of separately from excreta. Any pools or areas where sullage collects should be kept dry by building permanent drainage and filling in any holes with earth or sand.

Sullage from house can be disposed of in several ways:
- It can be used for watering garden provided a suitable sized plot is available and the soil is sufficiently permeable. The method is particularly important in dry areas where sullage may be the only water available for small scale irrigation.
- Allow the sullage to flow into a septic tank if this is already built
- Construct soak pit which allows sullage to soak into the ground. This type of pit only works in absorbent soils such as sandy soil.
- Where the soil contains a lot of clay, sullage from a single household can be allowed to flow over the soil around crops, which helps to absorb the water.
- In urban areas where many people live close together, it may be best to lay a piped drainage system such as small bore or conventional sewerage.

Note: To avoid excessive odour, sullage should not be directed into the toilet. Separate stance should be provided, with a drain pipe of 100 mm or 150 mm diameter to drain sullage to the soak pit.

Soak pit construction
- Excavate pit (approximately 1m diameter, and 1 – 2 m deep) at least 5 m away from latrine pit
- Fill in the pit with rubbles of about 200 mm thick
- Cover the rubbles with a well compacted clay soil of 200mm thick if the area is relatively dry, but if the area is water logged the clay soil will not provide a good cover therefore concrete can be used
- Depending on the type of soil and if the area is water lodged, plaster all interior walls with cement-sand mortar of 1:2 ratios to attain a smooth surface easy to clean.
i) Hand washing with soap

Contaminated hands transmit disease pathogens from person to person either directly or indirectly across surfaces. Hands that have been in contact with faeces, nasal discharge and other bodily fluid, and not washed thoroughly with water and soap, can carry disease causing organisms like bacteria, viruses and protozoa. Thorough hand washing involves washing with soap for at least 30 seconds. Special attention need to be paid to nails because germs can lodge underneath and becomes hard to get removed by ordinary process. Therefore, it is advisable to use special brushes to clean the nail bed.

Qualities of hand washing facility
(i) It should allow water to run/ drop direct on hands and contain soap
(ii) Easily openable mouth/ tap (elbow tap are preferable)
(iii) Be located at convenient place for easy reach
(iv) Does not allow sullage spill over
(v) Located outside toilet facility

Options for hand washing facilities
(i) Water direct from a tap
(ii) Running water from container with a tap
(iii) Leaking container hanged at the toilet wall or polls e.g. Kibuyu Chirizi

How to make a simple hand washing facility
Requirements/materials
(i) A plastic or metal container with a hole and lid (capacity 3 or 5 litres), however, any locally available container can be used e.g. calabash/ kibuyu
(ii) Nail (not less than 6 inches)
(iii) String (nylon string is suitable)
(iv) Wood of about of 20 mm diameter, 3 meters long with “Y” shaped end
(v) Wood (40 mm diameter, 100 -120 cm long)
(vi) Candle
(vii) Small piece of wood (25-30 mm diameter) x 30 – 40 cm long
(viii) Soap
(ix) Fine aggregates

Steps for making a simple hand washing facility
(i) Take a plastic container
(ii) Mark 2 imaginary lines from bottom of the container to divide container into three equal parts
(iii) Pierce the container lid with a hot nail to make a hole, insert a string tied to a wood
(iv) At the first imaginary line (from top) same side where mouth/ the opening of the container is, make a hole using a hot nail.
(v) At the first line from top, opposite the hole made by piercing the container, make two holes at each opposite side, and insert a string from one hole to the other.

(vi) Excavate two holes of about 20 cm deep with a spacing of at least 75cm, place a piece of wood/timber (20mm) upright firmly, place a 1 metre wood horizontally between the two poles (the height of poles should not be less than 1.5 metres)

(vii) Hang the container by joining two strings at the horizontal wood
(viii) Pour water in the container up to the drop hole
(ix) Cover the stringed lid tightly
(x) Place gravels at the ground direct to a place where water from the hand washing facility will be dropping

j) Sanitation Platform (Sanplat)

Sanplat is a specific design of floor slab for any type of latrine, except for WC. It is branded as “Sungura” which can be used to improve floor of any type of pit latrine with light – tight fitting lid to overcome problems of odour and flies. The slab has safe drop hole, smooth surface, elevated foot rests and slope towards drop hole for easy use and cleaning (Figure 2.10.a). Note: the sanplat is made from plastic mould (figure 2.10. b)

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Limitations
- Casting sanplat slab requires a special mould

2.4.2 Ventilated Improved Pit Latrine (VIP latrine)
Ventilated Improved Pit latrine is a pit latrine where odours and flies are effectively controlled by the action of a vent pipe. The wind blows across the top of the vent pipe creating a flow of air that sucks out the foul gases from the pit (Figure 2.11). The inside of the super structure is kept semi-dark so that emerging flies would be attracted by the sun light that comes through the vent pipe and not the drop hole. The whole system is engineered as a permanent latrine by designing the pit either as a single pit or as an alternative twin pit.

**Latrine Components**
- Lined pit, Washable Squatting slab, Roofed shelter, Vent pipe with fly screen at the top, Door which should be facing wind direction

Construction processes, site selection, Tools/equipments, construction materials, excavation, pit lining and super structure is similar to Improved Pit latrine (section 2.3.1). However, VIP has extra provisional requirements of the hole for installing the vent pipe.

**Note:** During setting for the pit measure at least 30 cm from the back pit wall to provide a space for vent pipe then leave a squatting hole

**Pit covering**
Place cover/squatting slab over the pit in relation to planned orientation if people prefer to sit while defecating, rather than to squat, a pedestal seat can be built on the slab

**Super structure of VIP latrines**

The VIP latrine superstructure is similar to that of Improved Pit Latrine except that it is slightly off set from the pit wall to allow a space for a vent pipe (Figure 2.11)

**Position of the vent pipe**
The internal diameter of the vent pipe should be 100-150 mm for PVC and 230 mm square for brick and cement rendered reed or hessian 230mm diameter. The vent pipe should be straight (i.e. no bends in the pipe) and at least 0.5 m above the highest point of the roof with fly screen at the top. To prevent PVC breaking use appropriate quality of the PVC, Use of alternative technology such as brick vents is also advisable.
Figure 2.11: Typical VIP Latrine

**Note:** It is advisable to excavate a circular pit

**Hand washing facility**
Provision of hand washing facility is as explained in section 2.3.1(i)

**2.4.3 Raised/Mound Ventilated Pit Latrines**
These are type of latrines constructed in the rocky areas and high water table where the recommended pit depths cannot be attained (Figure 2.12). In such circumstances the pit depths are increased by raising pit walls. The pit is excavated as deep as possible working at the end of dry season in areas of high
ground water, provided that the water table of the particular area is known. The recommended height above ground level should be not more than 300 centimetres. The lining may be extended above ground level until the desired pit height (volume) of 4 m is achieved relatively to hydro-geophysical characteristics.

**Latrine components**
Lined pit, Cover and washable squatting slab, roofed shelter, vent pipe with fly screen at the top, door - facing wind direction, mound

**Construction process:**
**Site selection:**
Site selection criteria are as described in section 2.3.1 (b)

**Stairs**
Rough caste with a height of the riser of 150mm and a landing of 250-300mm. All parts of the pit are raised above should be plastered with cement to avoid leakage.

**Construction materials**
Sand, aggregate, cement, soft water, bricks/blocks. wire-mesh, timber, nails, flies screen, pipe, and roof-cover.

**Construction steps**
Construction procedures are similar to the VIP latrine described in section 2.3.1 (b)

**Limitations of raised pit latrine**
- Not user friendly to some groups like sick, the elderly, children and people with disability, Provision for such people are found in chapter five
- Needs lining and plastering on both sides
- Can easily collapse if not well constructed

Note: The accessibility for people with disability is explained in chapter five
2.4.4 Pour Flush Latrine

A Pour Flush latrine uses water to flush or convey faecal matter from a pedestal or squatting pan to a pit (Figure 2.13). About 1-3 litres of water is enough to flush the contents. A pit can be located directly below the pan or can be offsite. In case

**Note:** Vent pipe must contain wire mesh/screening and should contain PVC vent cap at the outlet
of an offsite pit, a pipe is required to convey contents to a pit. The pan is connected to a trap to provide a water seal. A vent pipe is provided to keep away odour. The pour flush latrine can have a single or twin pit.

**Advantages of Pour Flush Latrine include:**
- Safer if pit is offsite
- Odourless
- Need little water
- They are relatively cheaper than water closet
- They are durable (and appropriate)

**Latrine Components**
- Lined pit, Cover and squatting slab
- Roofed shelter
- Vent pipe with fly screen at the top
- Door
- Drain and squatting or pedestal pan

**Tools/equipment**
Spade, hoe, pic axe, tape measure, bucket, trowel, spirit level, tie string

**Construction materials**
Sand, aggregate, water, wire mesh, cement, PVC (diameter 100-150 mm) pipe, water closet pan (vitreous pan or modified pan) and a trap

**Construction processes**

**Site selection and clearance**
- Locate on leeward side
- The soil should not be water lodged
- Remove tree stamps if any
- Remove top soil and level the area.

**Setting and measurements**
- Plan area for soakage pit \( L \times W = 1.2 \times 1.2 = 1.44 \text{ m}^2 \)
- Peg and lay string
- Check diagonals

**Pit excavation**
- Excavate a circular, rectangular or square pit. However, for stability of the pit walls, a circular pit is recommended.
- Recommended pit dimensions are: depth 3 m and width 1.5 m
Construction Off site pit

Pit lining
- Use locally available materials e.g. stones, burnt bricks, cement or wattles.
- Provide holes between the lining to facilitate seepage
- Use cement mortar on the last three courses which will provide a base for the superstructure
- Establish a slope of 1:30 - 40 for the drain from the squatting/pedestal pan to the pit. In this case provide an opening in the pit wall lining to fix the drain pipe.

Installation of the water trap, drain and vent pipe
- Place the trap underneath the pan.
- Connect water trap to a 100 or 150 mm drain which discharges into the offsite pit which should be located not more than 10 m
- Bury the drain pipe at a slope of 1:30-40
- Provide inspection chamber between the offsite pit and pan
- Provide a vent pipe of 100 mm diameter just after the trap but outside shelter
- Cover the offsite pit with tight fitting lid

**Note:** The typical water traps are shown in Figure 2.14 and 2.15

On-site pit

Casting of pit cover slab (*in-situ*)
- Place hard wood poles of not less than 100 mm diameter on top of the pit
- Keep a distance between logs of 200 – 250 mm
- Place wire mesh 20 mm above the poles using spacing blocks or stones at reasonable distance so that the wire mesh is uniformly laid.
- Prepare concrete with a ratio of 1:2:4 (cement, sand and course aggregates)
- First mix cement and sand until a uniform colour is formed. Then add aggregates and mix together until a uniform mixture is achieved. Add water progressively while mixing until a workable concrete is obtained.
- Place the concrete on top of the wire mesh until the concrete slab is 100 mm thick. Make sure the drop hole and vent pipe are not covered with concrete. Allow curing of the slab for at least 7 days, by pouring water early in the morning and late in the evening.
- Use cement mortar to fix the squatting or pedestal pan with water seal right at the drop hole
- The overall size is about 450 mm by 200 mm wide and it should be installed so that the rear edge is at least 200 mm from the wall of the toilet compartment.

Super structure
Materials
- Set a super structure according to the required measurement.
- Erect walls with bricks or blocks using cement – sand mortar or mud up to 2.3 – 2.5m height. Alternatively mud can be used to make walls.
- Provide door space of 750 mm wide and 1.8 – 2.1m height
- Place the vent pipe making sure it exceeds the highest point of the roof (at least 300 mm above the roof). Make sure that a rust proof fly screen is fixed at the top of the vent pipe

Roofing
- Roof the structure using locally available durable materials

Door
- Fix door shutter leaving 50 mm free space from the floor level. The shutter should be lockable in both sides but opens inside. In some cases construct the modest wall to save the purpose of a door.

Finishing of various parts
- All interior walls should be plastered with cement-sand mortar with a ratio of 1:2 to have smooth surface which is easier to cleaning. For in situ slabs, finish with smooth sand cement screed.

Limitations:
- Intermittency of water
- Soil conditions
- Anal cleansing materials
Figure 2.13: Pour flush latrine

Figure 2.14 shows how combined pan and water seal for direct pour-flush latrine depends on the design of the pan of pedestal, the depth and volume of water seal, and the minimum passage size through the seal. For a water seal directly above the pit about 1 litre of water is normally sufficient for flushing. Two
litres may be required and for an offset pit and a minimum of 3litres for an improved pedestal pan and offset.

Figure 2.14: Combined pan and water seal for direct pour-flush

Figure 2.15: Pan and Seal for offset pour-flush

2.4.5 Ecological Sanitation (Ecosan)
Ecosan is a type of latrine constructed with parts that separate faecal matter, urine and ablution water or sullage and have twins compartments (Figure 2.15). After being collected in a specified container urine can be used directly as manure while the faecal matter needs to be kept in its compartment for not less than 9 months before being removed and used as manure.

**Components of Ecosan latrine**
- Ecosan pedestal pan or squatting slab (provided with urine hole).
- A superstructure with two compartments of faecal matter beneath, with two rear doors painted black which is fixed in the receptor vaults to trap light and convert into heat energy to facilitate drying of faeces and killing of pathogens.
- Urine container (at least 40 litres)
- Vent pipe (on the faecal compartments)

**Tools/equipment**
Spade, hoe, and pick axe, tape measure, bucket, wood flat, trowel, spirit level, shovel, karai, pliers, gloves, oil and spirit level.

**Construction Materials**
Sand, aggregate, blocks, burnt bricks, PVC pipes, screen gauze, PVC pipe cap, 40 litre container, 1” pipe, Elbow 1”, cement, water, wire mesh, Sanplat, timber 12ft 1”x10”, and nails. Others include ecosan mould (pedestal), 40 litres urine container, container for faecal matter and water

**Construction process**

**Site selection**
- Position the toilet as an in-house or as an outside facility (detached)
- Locate faecal compartments in such a way that receives direct sun light

**Size**
L=2.5 m, W= 1.3 m.

**Construction Steps for the Ecosan latrine**

**Steps**

**Site clearance**
- uproot tree stumps if any
- remove top soil and level the ground

**Setting**
- Peg and position the walls.
- Check diagonals

**Construction of faecal matter compartment**
• Mix concrete at a ratio of 1:3:6, 100mm thick for the base of the latrine. Make two separate compartments to collect feacal matter for a period of at least 5 year each.

Formula for pit volume

\[ v = rPn \]

Where

- \( v \) = volume of the pit
- \( r \) = solid accumulation rate (constant 0.003m\(^3\)/capita/year)
- \( P \) = number of users of the latrine both adults and children;
- \( n \) = interval between succession (years)

• Example, for six (6) people family size, the volume (v) = 1.2m\(^3\) for a period of 5 years, proposed dimensions of each compartment: area 1m x 1m; height 1.2m
• Plaster the internal walls of the compartment with cement mortar of 1:2
• Provide small doors of 450mm x 300mm for each compartment for removal of manure, see figure 2.16.

**Slab construction**

- Make a pre-cast slab
- Prepare framework for pouring 50mm (2") concrete; provide a hole for a drop hole and vent pipe
- Pour 50 mm thick concrete of ratio 1:2:4 in two layers of 25mm separated at the middle by 6 mm wire mesh.
- Leave it to cure for at least 7 days then remove formwork.
- After curing place the slab on top of the compartments (use at least 6 adult people to carry the slab)

**Superstructure and fixing of pans**

- Construct superstructure walls and stairs as shown from the plan, the front and rear walls should be 2500mm and 2300mm high respectively.
- Fix the following: appropriate pan (Pedestal, specified Ecosan slab), urine pipe, foul water pipe and vent pipe.

**Moulding of Ecosan pedestal pan and slab**

Pedestal pan and squatting slabs for Ecosan toilet are made by using special moulds. After being cured the pedestal or squatting slab is fixed at the drop hole of the floor.
Lubricate the inner surface of the mould using oil, make cement mortar of 1:2, insert the urine drain pipe of 25 mm diameter in the mould before pouring the mortar. Pour the mortar in the mould; knock the external surface to vibrate the mould in order to remove air. After one day dismantle the mould and allow the pan to cure. Apply the same procedure for moulding the Ecosan squatting pan.

Advantages
- Preserve water pollution
- Minimize land contamination
- Urine and decomposed faecal matter can be used direct as a manure

Disadvantages
- Construction needs high technology
- Not user friendly
- Difficult in maintaining hygiene
- Needs separation of urine and feaces
- Expensive to low income communities
- Odours and smell inevitable
- Nuisance in handling of faeces
- Not suitable in urban setting

**Note:** Experience indicates that Ecosan is not commonly used in Tanzania due to its difficulties in operations and has many disadvantages in comparison to other types of latrines.
2.4.6 Flush Toilets
There are two types of flush toilets commonly used; water closet connected to septic tank and the one connected to sewer

a) Water Closet (WC) connected to septic tank
Water closet is the commonest type of flush toilet. It provides the most permanent and hygienic method of excreta disposal when properly used. It is a reliable sanitary convenience for permanent buildings, both public and private. It uses water to convey faecal or urine from a pan to the drainage system which discharges into septic tank.
Latrine components of the WC

- Squat or pedestal pan, flushing system, drainage system, superstructure, Vent pipe, door, water supply system and cleansing appliances

Construction process

Site selection
- Site septic tank relative to surroundings usually near toilet to avoid excessive piping
- Locate soak away pit to be accessible by cesspit emptier

Size of septic tank
The right size of the septic tank depends upon the number of users (See table 2.1). The size of the soak away pit should be big enough to accommodate all percolating water from septic tank. Alternatively, cesspit can also be used.

Tools/equipments
Spade, hoe, and pick axe, tape measure, bucket, shovel and spirit level

Construction Materials
Sand, aggregate, blocks, bricks, reinforcement bars, vent pipe, T- inlet and outlet pipes, cement, water, wire mesh, timber and nails, pan.

Construction steps for septic tank and soak-away pit

Main steps
- Site clearance
- Setting
- Pit excavation
- Tank construction

Steps
Site clearance
- uproots tree stumps if any
- remove top soil and level the floor

Setting
- Peg and position the walls
- Check diagonals and radius in case of a soak away
- Allow a free working space of 30 cm around the pit

Capacity of septic tank
The capacity of a septic tank should be sufficient for the settlement / floatation on the rate of flow of liquid through the tank and this is related to the retention time. Storage space required for the sludge and scum is largely a function of the time interval between desludging. The tank size must be large enough for the incoming liquid to be retained in the tank for at least one day. Because tanks
are desludged when the volume of sludge and scum occupies 2/3 of the tank volume, the capacity of the tank is designed to be three times the daily wastewater flow. This is represented by the formula:

\[ C = 3 \times P \times r \times Q \]

Where:
- \( P \) = number of people using the tank
- \( r \) = retention time in the tank (minimum 1 day)
- \( Q \) = volume of wastewater used/person/day
- \( C \) = capacity

**Note:** The formula above is not commonly used in Tanzania, and instead the data in Table 2.1 has widely been used for several years in Tanzania.

### Table 2.1: Septic tank Size (Depth is from top water level)

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LENGTH (cm)</td>
</tr>
<tr>
<td>1</td>
<td>1 to 6</td>
<td>210</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>260</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>350</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>400</td>
</tr>
</tbody>
</table>

Effluent disposal by infiltration is not applicable where soils are non-porous (e.g. clay or black cotton soil) or standard percolation rates are in excess of 60 min/25 m\(^2\) (refer MLHUD).

**Other conditions to consider**
- Allow at least three days curing before erecting walls
- Construct walls and cast a separation wall as baffle walls according to specified dimensions
- Prepare shattering for the roof slab leaving provision for manholes.
- Fix slab reinforcements
- Also cast manhole covers separately
- Leave slab to cure for at least 14 days then remove shattering.
- Plaster the walls to make them water tight
- Backfill
Soak away pit construction

- Excavate pit according to specification preferably when the floor slab for septic tank is curing
- Cast blinding concrete strip around the base to act as foundation for the wall
- Construct walls of the soak-away pit leaving perforated holes according to stated dimensions
- Prepare shuttering for the roof slab leaving provision for manholes.
- Fix slab reinforcements
- Pour concrete slab of 15 cm. (at a ratio of 1:2:4)
- Cast the cover for the manhole
- Leave it to cure for at least 14 days then remove shuttering.
- Backfill the pit in such away that water (runoffs) flows away from the soak away.

Figure 2.17: Septic tank
Figure 2.18: Lined soak pit

Figure 2.19: Unlined soak pit
b) Water Closet Connected to Sewer

It is a type of flush toilet connected to sewer network which drains to a wastewater treatment facility. Toilet flushed contents together with domestic wastewater is drained into the sewer system for transportation to a treatment facility. There are several types of treatment facilities for treating effluent to the required disposal standards. It requires a reliable water supply. Specific design criteria must be applied throughout the sewerage network. Skilled, organized and effective operation and maintenance capability is required for sewers and the full functioning of wastewater treatment facilities.
CHAPTER THREE
SANITATION OPTIONS IN PUBLIC PLACES

3.1 Introduction

Availability of toilets in public places is one of the important services in promoting sanitation. However, there is inadequacy of toilet services in public places such as bus stands, recreational areas, railway stations, check points, weigh bridge, beaches, ferries and travelers stops. Furthermore, the existing public toilets receive minimal operation and maintenance services. Inadequacy of the sanitation facilities coupled with unhygienic conditions of the available facilities precipitate haphazard urination and or defecation in various places.

The latrine options recommended in public places are Ventilated Improved Pit (VIP) latrine and Flush latrine. However, due to difficulties in maintaining hygiene of the pedestal type of WC pan in public places with exception of hotels/guest house, it is recommended to use squatting type. In the case of VIP latrines, experience has shown that it is usually difficult to maintain air extraction through vent pipe if the multiple stances are built “back to back”. In this regard back to back multiple stances of VIP for public places are discouraged.

Responsibility for the provision of sanitation facilities in public places is not always obvious, especially where there are informal gathering places. Basically, this should be part of the role of the health departments in local authorities. However, to enhance effective management of sanitation facility in public areas, it is advisable to involve private sectors. Special attention should be paid to the adequacy of facilities, cleanliness and provision of regular maintenance.

3.2 Basic rules for sanitation in public places

(i) There should be sufficient toilet facilities based on maximum number of people using the area during the day. This normally means one toilet compartment for every 25 users. The total number of urinals plus compartments in the men’s block should be equal to the total number of compartments in the women’s block. It is recommended that the urinal be of stall type.

(ii) The toilet facilities should be arranged in separate blocks for men and women. The men’s toilet block should have urinals and toilet compartments; the women’s block should have a provision of toilet and sanitary compartment and provided with hangers and lined waste bin.

(iii) All doors should be lockable inside

(iv) There must be a hand washing facilities with running water and liquid soap close to the toilet facilities.
(v) There must be a clean and reliable water supply for hand washing, personal hygiene and flushing of toilet facilities
(vi) There must be a provision for refuse collection
(vii) There must be a provision of sanitation facilities for people with disabilities, the elderly and other special groups as presented in Figures 5.1-5.8

3.3 General Public toilet design principles

(i) Public toilets should be designed to provide maximum visibility while maintaining privacy and control vandalism.
(ii) Public toilets should be located in places that are easily accessible by general public
(iii) They should be located on a continuous accessible path of travel from other accessible facilities in the area such as car parks, picnic areas and shops
(iv) Toilets should provide for the needs of people with disabilities and other special needs. Access for the disabled and wheelchairs needs to be considered
(v) To improve ease of access, toilet units (one or two stances) should be dispersed throughout an area rather than concentrated into a centralized toilet facility
(vi) There should be adequate lighting and ventilation
(vii) There should be hand washing facility

Safety considerations

The following design features are intended to create a safe environment in and around public toilets to make users feel comfortable

(i) Single stance unisex toilets
(ii) Self-contained stances with hand washing facilities
(iii) Stances accessible directly from public space
(iv) Clear sightlines to toilet entry
(v) Toilets visible from public space (not shielded from public view)
(vi) Adequate lighting in and around the toilet stances (corridors and pathways)
(vii) Gentle slope surfaces on floors
(viii) Disposal containers are to be provided in all public facilities
(ix) Avoid slippery floor finish

3.3 Operation and Maintenance of Public Toilets

Public toilets present a challenge in operation, care and maintenance. They are often built and left to the public to use without a clear allocation of responsibilities
for the cleaning and repair, with the result of extreme filthiness, smell and fly problems. Public-private partnership (PPP) is advisable to ensure quality services. The community needs to be sensitized to pay for the service. Further, the local authority should ensure affordable user charges are put in place so as to motivate the public to make use of the facilities.

3.3.1 Elements for effective running of public toilets

Community involvement: Communities and stakeholders should be involved from the beginning and at all stages of planning, building and operation.

Note: Management and Hygiene practices of public toilets should be emphasized since they can be easily soiled. It is recommended that this type of toilet should be privatized

3.3.2 Awareness

Public health practitioners and other potential stakeholders should promote utilization of public toilets as well as maintaining cleanliness

(i) Hygiene education: Hygiene education has to be provided to users through Behavioral Change Communication (BCC) and other means. There should be authority responsible for availability of IEC materials.

(ii) Service: There should be a permanent caretaker of the toilet responsible for general cleanliness

(iii) Supervision: Local authorities should ensure regular supervision of sanitation facilities meant for the public.

(iv) Bus operators: To be supplied with IEC materials for distribution to each vehicle and sensitized on proper hygiene practice. Operators should collaborate with Local Government Authority to ensure that hygiene is practiced.

3.4 Layout and dimensions of public toilets

The layout and dimensions depend principally on the number of people that need to use it at the same time. Other factors to be taken into consideration are the dimensions of the pits (which may depend on soil conditions), the number of entrances, and the location of the urinal as indicated in Figure 3.1.

NB: If shower is provided, it can be used as a changing room
Figure 3.1: Public Toilet Layout

Note: The ramps must be less than 5% slope hence its dimensions can be increased
**Entrances**

Entrances for men and women as a rule should be separate and labeled. Depending on cultural factors they may even need to be located in different directions and at a good distance from each other. Separate entrances to the separate compartment may be convenient but in general only two entrances are required: one for men and the other for women. It may be practical to have a separate entrance for the urinal. To allow people to pass freely a minimum of 100 cm is required and a corridor of about 150 cm wide. The minimum room size of the toilet is 100 cm x 150 cm.

**Hygiene facilities**

A hand washing facility should be provided at the entrances of the latrine. Running water and liquid soap should be provided. Disposable tissue and a drier (if possible) are important as well. Running water for hand washing is recommended. It may be achieved through either piped water system (elbow or floor operated taps) or local made alternative like a, ‘kibuyu chirizi’ if piped water is not available (section 2.3.1(i)). The hand-washing facility needs to be filled up regularly throughout the day to ensure it is functional.

| Note: Hand washing facility should be provided inside the toilet compartment for people with disability (refer chapter five) |

**Urinals**

The space required for urinal is 50-60 cm for each user with addition of another 50-60 cm for each corner if the gutter is built in an angle (as two people cannot use the same corner at the same time). The space required for other places may need to be estimated from place to place. To allow free movement, a space of 120 cm is recommended for the person urinating and for people passing. For hygienic and privacy reasons pot urinals with stall wall between users are recommended to be used in public toilets. Urinals for women are not recommended due to hygienic reasons and privacy.

**Ventilation**

There should be adequate ventilation inside the toilet. To get adequate ventilation in the toilet, provide openings (doors, windows) on opposite sides of the building to allow wind to pass through it. There should also be an opening above the door to allow air to pass through even when the door is closed. For pit ventilation, a vent-pipe is required for each drop hole. If the same pit is used for many drop holes, the pit must be partitioned with air tight walls to prevent the draught with bad smells passing from one hole to the other.

| Remember the rule: one pit - one drop hole - one vent pipe |
3.5 Construction Details

The substructure: The procedure for pit excavation, setting, lining technique and slab construction is similar to other toilet options except that pit for public toilets must be lined.

The Superstructure

Principles rules of walls construction, slab casting/fitting, vent fitting, roofing and material required are similar to other types of toilets. However, there must be provisions of sanitation facilities for people with disability, elderly. Changing rooms should be provided. Where changing rooms are not provided shower room can also be used as a changing room as long as necessary provisions such as a bin for disposal of sanitary pads are provided in female compartments.
CHAPTER FOUR
SANITATION OPTIONS FOR LEARNING INSTITUTIONS AND HEALTH FACILITIES

4.1 Introduction

Provision of latrines in learning institutions is a challenge. Many learning institutions do not have adequate number of sanitation facilities that meet the standards. Moreover, facilities for people with disabilities in these institutions are inadequately provided. Most of the facilities are usually waterborne; however managerial and operational problems are encountered. In addition, facilities for disposal of sanitary pads are inadequate resulting into haphazard disposal and consequently blocking of drainage systems. Water intermittency is another challenge contributing to poor hygiene and operation of toilets. Lack of regular maintenance of sanitation facilities contributes significantly to the malfunctioning of the system.

Regarding sanitation in Health Care Facilities (HCFs) in the country, experience indicates that, the challenge is on the adequacy and poor operational and maintenance. Majority of them do not function well and cleanliness is questionable. Further, the sanitation facilities in HCFs require proper disinfection to kill the germs that are mostly found in excreta of sick individuals.

The inadequate provision of sanitation facilities in these institutions leads into limited accessibility, poor working condition, discomfort, loss of work time and increased risk of disease transmission. To address these challenges, provision of proper sanitation facilities in these institutions is inevitable.

This chapter describes the improved sanitation facilities for learning institutions like colleges, universities and health facilities in general. Details for primary and secondary school sanitation options are discussed in National SWASH guidelines. The specific details required for sanitation improvement in respective institutions are described in subsequent sections.

4.2 Selection criteria of sanitation options

The selection of types of sanitation options in institutions depends on;

- Availability of water supply
- Number of users by gender
- Time spent at the institution (e.g. boarding/non-boarding scholars, in and out patients)
- Convenience for users
- Soil stability
The recommended toilet options in these institutions are:

- **Ventilated improved pit latrine (VIP)** – This is a minimum standard for institutions in rural settings.
- **Water borne system** - flush toilets connected either to septic tank or to sewers as a minimum standard for urban setting.
- **Mound pit latrines** as a minimum standard where either water table is high or the ground is impermeable.

### 4.3 Construction of toilets in learning institutions

Criteria for site selection, procedures for construction of substructure and superstructure are the same as other public toilets. In addition, latrine location in these institutions should highly consider wind direction especially in rural areas where VIP latrines are the minimum requirements. The following are issues to consider during designing of toilets for learning institutions:

- **Entrance**
  
  Entrances for male and female should be separated and in opposite direction. It is ideal to provide separate toilet block for each sex. For comfortable passage, it is recommended that the minimum width should be 120 cm.

- **Suitability of sanitation option**
  
  The most suitable sanitation option is the one that is technically feasible, socio-culturally acceptable and environmental friendly.

- **Water supply**
  
  Each learning institution should ensure to have adequate supply of water both for drinking, sanitation and hygiene purposes.

- **Hand washing facility**:
  
  Running water and liquid soap should be provided for hand washing. Water for hand washing should pour from leaking container or tank e.g. ‘*kibuyu chirizi*’ with foot operated mechanism fitted with a strong ropes or chain to avoid re-contamination (section 2.3.1 (i)). For other types of hand washing facility a tap should be elbow, knee or automatic operated. The size of water container should be big enough to cater for the need of all users for the whole day.

- **Layout and design dimensions**
  
  The layout and dimension depend principally on the estimated maximum number of students that will use it at the same time. Other factors to be
considered are the dimension of the pit (which may depend on soil conditions), and number of entrance and the provision of urinal(s)

4.3.1 Non–Boarding Universities or Colleges

The recommended ratio of stances per number of students for non-boarding institutions are; in case of females, the ratio is 1 stance: 20 students (1:20), and 1 stance: 25 students (1:25) for males, for the first 100 students. Thereafter, additional number of students for females the ratio is 1 stance: 30 students (1:30). For males, the additional number of stances required is 1 stance: 25 students (1:25) and then it is reduced by half to incorporate urinals. In this case, urinals should be provided for males whether the toilet is WC or VIP latrine. If the urinal is of gutter type, 50-60 cm is required for each user with addition of another 50-60 cm for each (Bowl type).

4.3.2 Boarding Universities/ Colleges

The recommended ratio for the first 100 students is 1 hole: 20 students (1:20). For males, the additional number of stances should be divided by half to have urinal as stated above in non – boarding universities or colleges. If the urinal is of gutter type, 50-60 cm is required for each user with addition of another 50-60 cm for each Bowl type.

4.3.3 Toilet compartment

Space for each compartment should be 120 cm x 150 cm, but for the people with disability it is recommended to have a minimum size of 120 cm x 210 cm for easy turning with their wheel chairs. Figure 4.1, shows a layout of VIP latrine special for males in universities and colleges. In VIP toilets hand washing facilities are provided outside the toilet building for easy control of sullage.
Figure 4.1: VIP latrine for learning institutions (Male/Female)
Figure 4.2: Pour flush latrine for females in learning institutions

The ramp ramp kerb should be of H:6 cm X W 6 cm and, Flat platform 134 cm X 100 cm.

**Note:** The slope for ramps must be less than 5% Also hand washing facilities for compartments of people with disability should be inside the same room.

**Flush latrine**

If water is available it is ideal to opt for a flush latrine in which hand washing facilities are provided inside. Figure 4.2 shows a layout and a picture of a typical pour flush toilet for females

The ramp slope should be 120cm wide, ramp kerb of H:6 cm X W 6 cm and, Flat platform 134 cm X 100 cm
4.4 Specifications for Latrine Construction in Learning Institutions

Construction
Construction of pit, pit lining, concrete slab, superstructure, vent pipe are similar to other types of public toilets

4.5 Sanitation Options for Health Care Facilities

In HCFs, waterborne systems elevated to septic tanks are best options. For inpatients, there must be enough stances (1:20 for men and 1:25 for female) as well as designated toilet for staff, bathrooms and provision for people with disability and elderly. There should be staff toilets at each department in Hospital and in Health Centres.

At the Out Patient Department (OPD), the type of toilet options recommended is Pour Flush and VIP. Pour Flush toilet is recommended where water supply is reliable, whereas VIP latrine is ideal where water supply is a problem. The provision of smooth surfaced pans is important as it facilitates taking of stool samples (specimens) and ease cleaning, however, water should be provided in these rooms for flushing. Toilet facilities should be provided at patients’ relatives waiting place.

**Note:** Waste bins with liner should be provided at OPD and pediatrics units for disposal of baby diapers and sanitary pads

Water Supply and Hand Washing Facilities: Hand washing facilities with running water and liquid soap should be provided just near the entrance (section 2.3.1 (i)). Ablution materials will depend on type of toilet provided but in most cases soft tissue paper and preferably water are suitable and should be provided.

4.6 Sanitation Options for Other Institutions/Offices

Provision of adequate sanitation facilities in institutions such as offices, courts, prisons, army barracks, mining centers, police post, factories, and estates presents a challenge. In some of these institutions, toilet facilities are rarely provided. Where toilet facilities are present their hygienic status is poor due to lack of proper operation and maintenance. It is recommended that these institutions should have VIP latrines as a minimum standard. Where water supply is reliable flush toilets should be given a priority.
CHAPTER FIVE
LATRINE OPTIONS FOR SPECIAL GROUPS

5.1 Introduction

For many years special groups have not been given adequate attention with regard to provision of adequate sanitation facilities. Special groups in this case include people with disability, mountain climbers, travelers, elderly and people in plantations.

5.2 Latrine Design for People With Disability

Currently, people with disability face problems with use of toilet facilities at home and at public places due to lack of suitable facilities to accommodate them. When considering provision of toilets in households, institutions or any other public places for people with disability there are some generalization for good practice, which can be considered for an easy access and user friendly facilities. These may include additional space within the unit, appropriate seat, handrail, sloped floor and use of bed pans/potties.

The following factors should be considered when designing and constructing toilets for people with disability.

- **Distance from the house to the latrine**: Distance to latrines for people with disability should be reasonable for easy access. It is recommended that toilet facility be located not more than 6 meters from the house or public place.

- **Ramp floor**: for easy access to the latrine, a ramp with a slope of 1:20 is recommended (Table 5.1)
### Table 5.1: Minimum standards for construction of a sloped floor

<table>
<thead>
<tr>
<th>Description</th>
<th>Concrete, wooden/earth with kerb both sides; level platform midway and at top in front of the toilet door</th>
</tr>
</thead>
</table>
| Dimensions                                                                 | Ramp W:120cm  
Ramp kerb H:6 cm X W 6 cm  
Flat platform 134 cm X 100 cm |
| Gradient                                                                   | 1 :20 level platform midway                                                                           |
| User                                                                       | User with a wheelchair independently  
Alternatively those who do not have a wheelchair will have to be assisted by relatives |
| Key features                                                                | Smooth but not slippery, firm, durable surface  
Gradient should be gentle enough to enable people with disability to propel themselves up slope. Kerb on side prevents wheelchair falling off.  
Platform in front of toilet door enables users to open door without risk of rolling backwards. |
| Costs                                                                      | Locally available materials with affordable cost are best options.                                      |

- The entrance area to the latrine should not be less than ninety centimeter (>90 cm) to enable people with disability to move around by using a wheelchair. For example, figure 5.1, shows a person with disability maneuvering with a wheelchair in the entrance area.

### Table 5.2: Minimum standard for entrance area

<table>
<thead>
<tr>
<th>Description</th>
<th>Smooth concrete floor and threshold, with toilet floor only 1 – 2 cm above the surrounding yard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Entrance width 90 cm</td>
</tr>
</tbody>
</table>
| Key features             | A level area of packed earth/concrete/wooden in front of the latrine for wheelchair stability while the user opens the door.  
The earth in front of the toilet is level with the floor inside making wheelchair access easily |
5.2.1 Supporting People With Disability to Use Toilet

a) Provide a latrine door with a handle

A hand rail across the width of the door can be easier to hold on than single handle (Figure 5.1). Ensure that the latrine door can be opened and closed easily in and out. Addition of rope tied near the squatting plate will enable to shut the door.

![Figure 5.1: Door rail extending the full width of the door to help person with disability maneuvering with a wheelchair in the entrance area (SWASH, 2010)](image)

b) Provide adequate space within the toilet, the width should not be less than 120 cm

![Figure 5.2: Spacious toilet with handrails and easily cleanable seat](image)

c) Provide a seat or squat plate – (fixed or movable)

---

6 SWASH Guidelines (2010):
People with disability can find seats helpful. Seats can either be fixed or movable and can be designed in a range of sizes and shapes depending on such factors as age, sex and type of disability.

Things to be considered when designing a seat:
- It should not be porous and should be easy to clean
- It should be strong enough to support the weight of the user.
- It should not be slippery, use locating holes for the legs or bracing to support the seat.
- The inside space should be enough to allow people with disability to maneuver from either standing position or from a seated position from a wheelchair onto the seat.
- Fix splash back guards on sideways of the seat to prevent splash back between the squat hole and the user’s legs.

d) A model of commode chair
A model of 'commode chair' is a chair with a frame made out of wood, metal or plastic which has a seat with a hole in it and with a pot supported underneath the seat which can be removed for emptying and cleaning (Figures 5.3). Commode chairs can be improved by providing privacy, wheels, handles, deep pot, and additional strength and not slippery.

e) Pit latrine for People With Disability
Pit latrine can be provided with supporting rails as shown in figure 5.4 (a)

Figure 5.4 (a): Pit latrine with support rails  Figure 5.4 (b): Flush latrine with chair

f) Small stool to be placed over the latrine hole
Provide a small stool placed over the latrine hole modified with a splash back guard on both sides. In additional hand rail, poles/rope may be incorporated in this toilet structure for support. Small stool can be used by children to place over the latrine hole.

Figure 5.5: Wooden stool which can be placed over the latrine hole

g) Mounded seating plate
This is a raised concrete or wooden seating block. It is an in situ pedestal type (Figure 5.6). It also helps people who cannot squat. Mounded seating should be designed to suit the user.

![Figure 5.6: A mounded seating plate](image)

**h) Rope for support when moving to and from seat**
A supporting rope can be provided for people with disability who find it easier to use (Figure 5.7).

![Figure 5.7: A rope suspended from roof beam for support while squatting](image)

**i) Bed pans and potties**
A bed pan is a bowl-like vessel made up of iron, plastic, or clay to serve the purpose of bedridden people (Figure 5.8). Use bed pans for people with disability who are bed bound to the extent that they cannot use toilets of any kind. Bed pans should be easily cleanable and designed to suit type of disability, sex, and age.

![Figure 5.8: Bed pans and a male urine container](image)

### 5.2.2 Latrine layout for people with disability in public places

Any acceptable latrine may be modified in such a way that it accommodates the qualities for people with disabilities. Consideration should be based on single latrine i.e. it is easy to provide in households and latrine block i.e. in public places such as camps, bus travel stations and other institutions.

### 5.2.3 Cleansing and hand washing facilities

People with disability require special devices for hand washing, depending on type and degree of disability. These devices may range from locally made to more advanced technology like water hose pipes with pressure and locally made devices such as raised water tanks with pipes and ‘*kibuyu chirizi*’. The importance is for taps that do not need a grip or have a large area for gripping. Those that can be pushed are often the easiest to use.

Provide a hand washing basin located less than 100 cm high from the floor. Water tap cork should be of elbow or knee operated or automated type to avoid contamination.

### 5.2.4 Issues for blind and visually impaired

Blind and visually impaired people need to find their way using their remaining vision or judgment; signalling the edge of a step or entrance is helpful. This can be done by using bright colour paint or a change of floor texture as a blind person can feel the difference with their feet or with a cane; another way is the use of
permanent structures as “land-mark” (e.g.; lamp post; gates etc). Safety rail is recommended on paths.

5.3 Sanitation Options for Travellers

People travelling long journeys would need sanitation services. However, the majority of highways have not been provided with sanitation facilities at reasonable distances (an interval of two hours travel). In places where such provisions are lacking travellers have no choice except to use sanitary services available in hotels. Lack or inadequate provision of toilet facilities along the major highways and within the vehicles cause the passengers to find alternatives of short calls and defecation locally known as ‘kuchimba dawa’ along the highways.

It is recommended that public toilet be provided along the highways at convenient places. Toilet options include VIP latrine, Pour flush and WC, of which standard criteria and construction technique are as provided in Chapter 2 of these Guidelines. However, it is more convenient to provide toilet facility inside the buses which will be emptied at predetermined stations. The situation is equally worse in trains. Toilets in trains are not provided with receptacles to keep excreta. In this case, the excreta spread along the railways leading into massive land and water contamination. For hygienic and public health reasons it is proper to provide toilets with receptacles that will contain urine, faeces and other wastes. Transport authorities should ensure that the public health requirements are adhered to.

Drivers of town shuttles (commonly known as daladala, vifodi, mzunguko, bajaji, tax, express buses, etc.), urinate inside empty water bottles and throw them alongside the road. It is recommended that appropriate measure should be taken to ensure that they use existing public sanitation facilities.

Marine transport has similar challenges especially domestic vessels whereby the emptying system is direct to water. The risk is more when emptying is done near the shores i.e. when the vessel is anchored. It is recommended that vessels should be equipped with receptacles which can contain all wastes and should be emptied and disposed at predetermined stations. In most cases hand washing facilities are lacking neither are they equipped with enough clean water.

5.4 Sanitation Options for Fishermen and Coastal dwellers

Some communities including fishing camps live along water bodies such as rivers, lakes and ocean. These communities in most cases use these water bodies as domestic water sources and for fishing. Some of these communities do not have toilet facilities as a result they defecate, wash clothes and bath in the
same water bodies. Yet, they use the same water for drinking without any treatment. These practices present a risk of spread of waterborne diseases.

In these areas, health education and promotion on sanitation should use participatory approaches such as CLTS to influence behaviour changes. The enforcement of law is also recommended to individuals who do not want to change. Toilet designs and construction to these communities will base on whether the toilets are for household or public use.

5.5 Latrine Options in Plantations and small scale mining

Plantation workers/labourers spend several hours and will need sanitation services. However, majority of plantations and small scale mining areas have inadequate sanitation facilities. As a result, they defecate into the open air resulting into contamination of water bodies. Major public health risks include spread of diseases such as schistosomiasis, typhoid, dysentery and cholera.

It is therefore recommended that:
- Owners of plantations should provide latrines at reasonable area within the plantation with consideration of accessibility, gender and number of workers/ labourers
- Public toilets be provided in small scale mining areas

5.6 Latrine Options for people climbing mountains

Mountain climbing is a rapidly growing field which involves tourists both domestic and foreign. With this increasing number of visitors there is increased risk of environmental contamination if toilet facilities are not provided. Water sources which most of them are located on the mountain areas are more affected. Toilet facilities should be provided at reasonable places for mountain climbers. Local health department should guide on designing, construction techniques and operation of toilets for mountain climbers. However, mobile latrines should be provided during peak seasons to supplement the demand
CHAPTER SIX
SANITATION OPTIONS IN EMERGENCIES AND DISASTERS

6.1 Introduction

Emergencies occur after a disaster has taken place which is defined as “a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources” (UNISDR 2009 Terminology on disaster risk reduction). Emergencies and disasters can occur anywhere in the world, affecting human health, people’s lives and the infrastructure built (including water and sanitation) to support them. This is often exacerbated by some key elements related to development and environmental conditions that include poverty, insufficient management and sanitation. Disasters and emergency are inevitable as can happen anytime. During these situations many people are displaced and therefore need timely provision of sanitation services to avoid eruption of diarrhoeal diseases as well as safeguarding respect and dignity particularly children and women.

Along with food and shelter, safe water and sanitation are the highest priority interventions in emergency situations. Unless adequate water and sanitation services are quickly provided to emergency-affected children and their families, disease and death will follow. And unless good hygiene is consistently practiced by affected people, the danger of diarrhoea, cholera and other disease outbreaks will persist. This is true in all types of emergencies, from rapid onset natural disasters to long-term crises caused by a range of complex factors.

6.2 Sanitation options in emergencies and disasters

The choice of sanitation option depends solely on the magnitude, duration and complexity of the emergencies and disasters. For instance, the defecation fields, shallow trench latrines, and deep trench latrines have mostly been used in emergencies that lead into displacement. However, they may be useful in any situation where temporary toilets are needed rapidly. The other techniques are widely used in stable situations, but can be adapted to any long-term emergency settlement. Whatever the technical option chosen, consideration should be given to hand-washing facilities and night lighting. The needs of small children should be given special attention.
6.2.1 Defaecation fields

A defaecation field is illustrated in Figure 6.1. The area set aside should be of sufficient size to accommodate 0.25 m² per person per day excluding access paths. Separate areas for men and women are usually desirable. The field should be in a convenient place, but no nearer than 30 m to other camp facilities. Ideally, it would be on land that slopes away from the camp and any surface water sources. The soil should be soft enough to dig easily in order to cover excreta. Users should be directed to strips of land in the defecation field roughly 1.5 m wide. They should use one strip until it is filled, usually entering by one access path and leaving by another. When a strip is filled, excreta are then covered with at least 10 cm of soil and another strip is opened some away. The field is used systematically in this way, beginning with the strips furthest from camp. An improvement on this basic system is to dig shallow trenches (15 cm deep) in the strips, so that the excreta can be completely buried.

**Note:** Defaecation field is a short term (2-3 days) option applied during initial stage of mass displacement. Later on other advanced options should be adopted.

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7 WHO (2005); Technical Notes for Emergencies -Technical Note No. 14
6.2.2 Shallow trench latrines

Shallow trench latrines (Figure 6.2) allow feces to be buried and far better contained than in a defecation field. Approximately 3–5 m length of shallow trench is needed for every 100 people, and it is preferable to have a number of shorter, shallow trenches. Trenches should never be used for more than a week before they are completely filled, compacted and replaced by new trenches. Shallow trench latrines should be sited in the same way as defecation fields.

Figure 6.2: Shallow trench latrine

6.2.3 Deep trench latrines

A further improvement is the deep trench latrine, which is deeper, longer and wider than the shallow trench latrine. It can last 1–3 months and is constructed as shown in Figure 6.2 It can be constructed from a variety of materials, including wooden planks and plastic squatting plates for the floor and plastic sheeting, and wooden planks.
6.2.4 Simple pit latrines

Individual simple pit latrines, either hand-dug or drilled, may be an option in lower-density, longer-term emergency settlements. Family latrines are normally preferred as they are more hygienic than public facilities, and there are long-term benefits in terms of maintenance.

Normally the pit should be designed to last at least a year, and its volume should be calculated on the basis of about 0.07 m$^3$ per user per year. In unstable soils, the top 50 cm of the pit, or the whole depth of the pit, may need to be lined to prevent collapse. Pit linings may be made of many different materials, including brick, concrete, old oil drums or bamboo. Pit linings should normally not be watertight below 50 cm deep.
6.2.5 Portable toilets for emergency sanitation response

A Portable Toilet is a technology for Safe Excreta Disposal that can be easily transported and quickly constructed to provide culturally appropriate sanitation facilities in an emergency situation.

The importance of portable or mobile toilets for emergency includes the need for rapid response (24 to 72 hours) to provide sanitation to large numbers of people. It can be installed in a day and fully decommissioned in hours. They are easy to use at temporary welfare centers when sanitation facilities are needed immediately. Figures 6.4 to 6.7 show steps for construction of a portable latrine.

Figure 6.4: Pit excavation & lining

Figure 6.5: Superstructure construction

Figure 6.6: Privacy fitting

Figure 6.7: Completed portable latrine
Note: During emergency situation mobile toilets is an option at initial stages where temporary excavated trench have not yet prepared.

6.3 Site selection for latrines

Latrines should be sited at least 30m from any water source. If the abstraction point is upstream of the latrine, the distance can be reduced provided that the groundwater is not abstracted at such a rate that its flow direction is turned towards the abstraction point. In heavily-fissured rock this distance may have to be increased substantially. Because pollution (faecal and chemical) tends to disperse downslope from its source, latrines should be sited downhill from any groundwater source, particularly if the bottom of the latrine is less than 2 m above the water-table (see Figure 8.7).

6.4 Management sanitation facilities in emergencies

One of the main reasons that sanitation facilities fail in emergencies is insufficient management\(^8\). There are several reasons for this, including insufficient consultation with users at the design stage, leading to facilities that are not used as intended; insufficient resources provided for maintaining and cleaning public facilities; and inadequate supervision of self-build sanitation programmes, leading to incorrect siting and construction of latrines. Excreta disposal programmes in emergencies demand substantial resources and management support, from the assessment stage to decommissioning facilities or handing them over.

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\(^8\) WHO, (2002); Environmental Health in Emergencies and disasters: A practical guide, chp 7, pg 35
CHAPTER SEVEN
OPERATION AND MAINTENANCE

7.1 Introduction

The routine and periodic operation and maintenance is designed to keep a toilet functional and in a condition that makes people comfortable to use it. Challenges with the operation and maintenance of sanitation facilities have long been recognized as key constraints to the sustainability of these services/facilities. In order to address these challenges in both urban and rural areas of Tanzania, this chapter proposes a framework for operation and maintenance (O&M) by outlining procedures and activities involved in delivery of service (operation) as well as keeping the sanitation facilities in a serviceable condition (Maintenance). The O & M framework has been developed based on practical experiences documented from different sources.

7.2 Operation and Maintenance of sanitation options

The operation and maintenance of sanitation facilities used at different levels are categorized into three groups namely; household level; public areas and emergency/disastrous areas. The following sub-sections describe main aspects of O & M of these facilities.

7.2.1 Operation and maintenance of household level sanitation facilities

As outlined in chapter two of these guidelines, the sanitation options suitable for household level are improved pit latrine, raised/mound latrine, ventilated improved pit latrine, pour flush latrines and flush latrines. The recommended routine operations include;

- Daily cleaning by using water and detergents (morning and evening);
- Provision of soap (preferably liquid soap running water for hand washing facility
- Keeping toilet doors closed when not in use
- Ensuring availability of ablution materials (water or paper) all round
- Provision of sanitary bins

The maintenance of household sanitation facilities are presented in Table 7.1
Table 7.1: Maintenance of household sanitation facilities

<table>
<thead>
<tr>
<th>Problem</th>
<th>Repair needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door broken or does not give privacy; hinges loose</td>
<td>Repair panels of door; put new hinges; grease them</td>
</tr>
<tr>
<td>Door cannot be locked from inside or outside</td>
<td>In side: Make simple lock mechanisms using a metal staple/eye and catch/hook. Outside: Attach 2 staples/eyes (one door and wall) and buy padlock</td>
</tr>
<tr>
<td>Cement plaster comes off the walls</td>
<td>Remove loose parts, clean and re-plaster with good cement mortar.</td>
</tr>
<tr>
<td>Roof is leaking</td>
<td>Repair/remove damaged ceiling boards. Clean and replace the roof with strong cement mortar (3 cm) or repair or replace damaged iron sheets on existing roof</td>
</tr>
<tr>
<td>Pit latrine: Cover slabs are broken or missing or has holes</td>
<td>Put new cement mortar or replace the entire slab</td>
</tr>
<tr>
<td>Pour flush or WC: pan is broken</td>
<td>Replace the pan</td>
</tr>
<tr>
<td>VIP latrine: Ventilation pipe is broken</td>
<td>Install new PVC vent pipe</td>
</tr>
<tr>
<td>For direct pit latrines: Pits are full</td>
<td>Cover the old pit and dig a new one, or if appropriate empty the pit (sec. 7.3)</td>
</tr>
</tbody>
</table>

Figure 7.1: Operation and Maintenance of household toilet
7.2.2 Operation and maintenance of public toilets

The operation and maintenance of public sanitation facilities are the same as for household level. However, special consideration has to be given to daily operation of the public toilets. It is suggested that a public toilet to have at least two attendants working in shift bases if the toilets operate for 24 hours. Toilets should be cleaned regularly (preferably in hourly basis). The toilet attendants must be provided with protective equipment i.e. heavy gloves, overall-coat, gumboot and mask. It is emphasized that toilets be cleaned with disinfectants. To minimize smell in the urinal, clean at least twice a day with water and detergent powder using a soft brush with a long handle. The detergent powder can be sprinkled in the evening to be washed in the next day. Furthermore, air refresher pellets should also be placed in the urinal to prevent excessive smell. The suggested cleanliness facilities include hard brooms, soft and hard brush with long handles, mopping set, squeegee, scoopers, tongs and draining rod set.

7.2.3 Operation and Maintenance of sanitation facilities in emergency and disaster areas

The sanitation options that can be used in emergency and disaster areas have already been explained in details in chapter 6. The O & M of these facilities are similar to those at the public and household level. However, the exceptional is on the management and disposal of excreta. In case of open defection field, it needs the availability of permanent attendant to direct users where to ease. It is recommended that when the strip section is full, it must be covered and shift into a new strip. Similarly, trench toilets must be covered with soil after they have been used and filled-up. For mobile toilets, the excreta should be disposed of safely in approved areas. Mobile toilet containers should be cleaned and disinfected before reuse.

7.3 Pit emptying and sludge management

The pit latrine when is about 0.5m from the floor slab is considered full. At such instance there are two options to do;

i) Stop using the latrine, cover it and use the newly constructed facility or;
ii) Emptying the contents and continue using it

Often, the lack of available space and related cost of constructing a new latrine imply that pit emptying is the most practical alternative. The continued use of a latrine when it is full will lead to spread of feacal matters on the floor slab hence creating un-aesthetic condition and increased risk of feacal-oral disease transmission. In this case the overall benefits of improved sanitation will be compromised substantially.
Several pit emptying technology are in use worldwide and the selection depends on various factors including; cost, availability of the equipment, skilled labour, pit lining, type of latrine, settlement pattern, disposal method etc. Two categories of pit emptying methods exist depending on the nature of the facility. The methods are; single pit and alternating pit emptying. Details for each method are as follows;

7.3.1 Single pit emptying

The single pit emptying method employs the removal of excreta from the pit so that the same pit can continue to be used after the emptying. It is advisable where the pit has been strongly lined and there's no space to erect a new structure. Several technologies exist under this category as follows;

(a) Vacuum Tanker

This is the conventional method for pit and septic tank emptying. This is truck-mounted tank between 1 and 10m$^3$ in capacity with a vacuum pump connected to the tank to suck out the sludge. The technology can be used to empty pit latrines and septic tanks only in accessible areas. Mechanical emptying systems exist that are both technically and financially viable, but these are typically the services provided by local sewage operators in the more formal areas of towns and cities, using large conventional vacuum tankers to empty both pits and septic tanks.

To address the challenge of providing mechanized pit emptying services in informal areas and slums, a low cost technical solution has had to be developed. The solution is portable vacuum tankers, specifically designed for use in slums and other areas that are difficult to reach with a conventional vacuum tanker (Figure 7.2)

![Figure 7.2: Features of a portable vacuum tanker](image)
Note: The use of vacuum tankers requires good management and a market for the service, if reliable pit emptying services are to respond to user demand, willingness and ability to pay for the service.

(b) Vacutug
Vacutug has a trailer-mounted 1,000 litter tank used in conjunction with a vacuum pump. The technology can be used successfully to empty pits in slums and unplanned settlements where there narrow path which can not be accessible for a large vacuum tank. The vacutug removes waste safely for both workers and public health. One of the disadvantages of the technology is on its commercial viability.

![Vacutug](image)

Figure 7.3: Motorived 500 litres Vacutug

The Vacutug is probably the most widely used small vacuum tanker operating in informal settlements. The excreta to be removed may be too solid for the pump to lift, so water may need to be added and the contents mixed to liquefy them first. Any stones, sticks, plastic bags and other solid items thrown into the pit will block the suction hose. Users need to be educated into what can and can’t be put into the pit, if this emptying option is to be used.

(c) Manual Desludging Hand Pump (MDHP)

Manual Desludging Hand Pump (MDHP) was developed by the London School of Hygiene and Tropical Medicine (Fig.7.4). The method can be used together with a bucket and fibre bags. The technology can be used to empty pit in both urban and rural areas. The operators of the technology need to put on protective devices during pit emptying.
7.3.2 Emptying alternating pits

Alternating pit latrines make use of the same pits on a rotational basis. This means that a permanent superstructure can be used. Two pits are dug, each sized to store about two years’ worth of excreta. Each pit has a removable cover slab, providing access to the pit. One pit is on use at a time while the other undergoes decomposition. Once the pit is full, it is closed off for storage, while the second pit is used. As the second pit fills, the first pit is emptied and put back into use. Given the right conditions of temperature, moisture content and pH, after 2 years storage the excreta will have decomposed and the pathogens died off sufficiently that the excreta to be manually handled. To accelerate the decomposition of excreta, it is advisable to put ash and animal dung on the top of the full pit. The decomposed excreta may look like soil, but it should still be handled carefully to minimize health risks associated with any incorrect use of the latrine. Manual emptying often involves someone entering into the pit, so they should be equipped with ladders, ropes, protective clothing, mask, gloves, shovel and buckets.
Pit closed for storage

Pit in use

Figure 7.5: A twin-pit VIP latrine
### 7.3.3 Disposal of sludge

Once the sludge is collected it has to be safely disposed. Therefore, disposal must be considered in parallel with pit emptying technologies. Final disposal of sludge is one of the most neglected items. The provision of inadequate facilities may result in indiscriminate or illegal disposal of sludge to rivers, open drains, the sea or any open space, particularly if the emptying technology does not possess appropriate haulage capacity for long distances and government systems are not supportive. Time spent transporting the sludge to the disposal site consumes time that an expensive vacuum pump could be emptying a pit.

Disposal of sludge close to the latrine is considered the most economic method. This involves digging a latrine, filling it up with sludge, letting the liquid leach out of the sludge for one or two days, then covering it with at least 30 cm of dry, excavated soil. This can be applied in low- to medium-density areas, but is increasingly limited by the space available and the depth of the groundwater table, as groundwater may be contaminated. Other options include transporting it directly to the sewerage network or an intermediate point to be transported further. Once faecal sludge has been removed from the pit, it should be transported and disposed of safely. There are several options for sludge disposal. These options, and others, are briefly outlined in Pickford and Shaw (1999) and explained in more detail in Cairncross and Feachem (1993), pages 143-146 or from SANDEC (2012).

**a) Discharge into a sewer**

If the sludge is fairly liquid and there is a sewerage system nearby, it can be emptied into a trunk sewer, or at the start of a wastewater treatment works, with the permission of the local sewage authority. Sludge should not be emptied into storm water drains.

**b) Composting and applying to land**

Faecal sludge can be composted, mixing it first with volume of vegetable waste to enhance an aerobic composting process. As the compost is likely to contain plastic bags, stones and faeces that are not fully decomposed, it should be buried with a soil covering at least 0.5 m deep. Burying excreta in a shallow trench with a large surface area, is better than a deep pit, as a trench is easier to dig and provides better protection to any groundwater resources.

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(c) Direct burying

Smaller volumes of sludge can be buried directly in a trench. The sludge is placed in layers (e.g. 100 mm thick) that are then covered with 200 mm of soil before the next layer of sludge is added. The final layer should always be soil. After a couple of years, the contents can be dug out and used as a soil conditioner. Crops grown in the area should not come into direct contact with the soil where faecal sludge is applied (so growing trees on the land is best, and growing beans or corn is better than salad crops). The disposal site should be away from any water source and areas that are liable to flooding. As a possible route for faecal contamination is through rainfall runoff, surface water must be directed away from any disposal site, using ditches or low soil embankments.

(d) Drying beds and ponds

Large quantities of faecal sludge may require more formal treatment, for example by drying it in a sludge drying bed. This shallow basin must be sited away from houses and designed to ensure the contents cannot be washed away by rainfall. A further method of sludge treatment is using waste stabilization ponds. This can be done in combination with municipal wastewater, or separately.

Figure 7.6: Cross-section through a sludge drying bed
CHAPTER EIGHT
MONITORING AND EVALUATION GUIDE

8.1 Monitoring and Evaluation

During implementation of environmental health and sanitation interventions with reference to these guidelines, monitoring activities will be done using existing Health Information and Management system (HMIS) based on targets that will be set and activities planned. The HMIS incorporates data on water and sanitation including latrine coverage on annual basis. Nevertheless, the monthly and weekly reports provided under Integrated Disease Surveillance and Response (IDS R) also provide data on sanitation related diseases. In this case, it helps to correlate disease trend and latrines use. Other monitoring systems that can also assist monitoring and evaluation include National Census, MKUKUTA Evaluation, National Household Budgets Surveys, Joint WHO/UNICEF Monitoring and Evaluation and Research and Surveys conducted by Government and non-Government institutions. Evaluation will be done to measure actual impacts against the predetermined strategic interventions. Important indicators to be considered during monitoring and evaluation are elaborated in table 8.1.

Table 8.1: Generic Monitoring and Evaluation Tool
This tool is designed as a generic with a simple set of indicators that should be taken into consideration while preparing a tool for monitoring.

<table>
<thead>
<tr>
<th>S/N.</th>
<th>Sanitation and Hygiene issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td><strong>Household level</strong></td>
</tr>
<tr>
<td>1</td>
<td>Number of households with <em>improved toilets</em></td>
</tr>
<tr>
<td>2</td>
<td>Number of latrines with hand washing facilities nearby</td>
</tr>
<tr>
<td>3</td>
<td>Location of latrines in accordance to standards</td>
</tr>
<tr>
<td>4</td>
<td>Type of toilet facility</td>
</tr>
<tr>
<td>5</td>
<td>Qualities of floor cover</td>
</tr>
<tr>
<td>6</td>
<td>Siting of the toilet</td>
</tr>
<tr>
<td>7</td>
<td>Soil characteristics</td>
</tr>
<tr>
<td>8</td>
<td>Provisions of facilities in a toilet for people with disability and elderly if there is any</td>
</tr>
<tr>
<td>9</td>
<td>When was the toilet constructed?</td>
</tr>
<tr>
<td>10</td>
<td>Frequency of latrine emptying</td>
</tr>
<tr>
<td>11</td>
<td>Model of emptying</td>
</tr>
</tbody>
</table>

<p>| <strong>B</strong> | <strong>Learning Institutions and health care facilities</strong> |
| 1    | Number of institutions with proper toilet facilities |
| 2    | Provision of toilets separate for male and female |
| 3    | Provision of urinals in male block |
| 4    | Ratio of stances against number of users |
| 5    | Location (for convenience) |</p>
<table>
<thead>
<tr>
<th></th>
<th>Provision of changing rooms for female</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Provision of sanitary pads disposal facility</td>
</tr>
<tr>
<td>8</td>
<td>Provision of suitable sanitation facility to people with disability</td>
</tr>
<tr>
<td>9</td>
<td>Provision of hand washing facility</td>
</tr>
<tr>
<td>10</td>
<td>Pit lining of the toilet</td>
</tr>
<tr>
<td>11</td>
<td>Provision of running water for hand washing and liquid soap</td>
</tr>
<tr>
<td>12</td>
<td>Availability of reliable water supply</td>
</tr>
<tr>
<td>13</td>
<td>Separate toilets for female and male staff</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Public Places</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Availability of reliable water supply</td>
</tr>
<tr>
<td>2</td>
<td>Separate provisions for male and female</td>
</tr>
<tr>
<td>3</td>
<td>Type of toilet</td>
</tr>
<tr>
<td>4</td>
<td>Provision of changing room in female block</td>
</tr>
<tr>
<td>5</td>
<td>Provision for disposal of sanitary pads</td>
</tr>
<tr>
<td>6</td>
<td>Provision of suitable sanitation facility to people with disability</td>
</tr>
<tr>
<td>7</td>
<td>Urinals in male block</td>
</tr>
<tr>
<td>8</td>
<td>Provision of store</td>
</tr>
<tr>
<td>9</td>
<td>Clear responsibility of operation and maintenance</td>
</tr>
<tr>
<td>10</td>
<td>Inclusion of public private partnership</td>
</tr>
<tr>
<td>11</td>
<td>Presence of IEC/BCC materials</td>
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<table>
<thead>
<tr>
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<th>Special Groups</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Distance from house to latrine</td>
</tr>
<tr>
<td>2</td>
<td>Provision of ramp</td>
</tr>
<tr>
<td>3</td>
<td>Provision of adequate room space</td>
</tr>
<tr>
<td>4</td>
<td>Provision of seat or squat plate</td>
</tr>
<tr>
<td>5</td>
<td>Provision of support mechanisms (rope/hand rail)</td>
</tr>
<tr>
<td>6</td>
<td>Provision of hand washing facility and liquid soap</td>
</tr>
<tr>
<td>7</td>
<td>List of special groups and their sanitation facilities recommended</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inclusion of sanitation issues in the emergency and preparedness package</td>
</tr>
<tr>
<td>2</td>
<td>Provision of safe and adequate water supply</td>
</tr>
<tr>
<td>3</td>
<td>Provision of disinfectants</td>
</tr>
<tr>
<td>4</td>
<td>Provision of sanitation excreta disposal facilities</td>
</tr>
<tr>
<td>5</td>
<td>Solid waste management services</td>
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</tbody>
</table>