WATER AND SANITATION FOR HEALTH PROJECT

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Community Sanitation Improvement and Latrine Construction Program

A Training Guide

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E. Dimensions of Latrine Pit

- VIP and basic latrine with cover: square pit—1 m long, 1 m wide, 2.5 m deep.
- Pour flush/waterseal: square pit—1 m long, 1 m wide, 1.5 m deep.
- Raised platform latrine pit dimensions:
    - 1.2 m depth below ground
    - 1 m above ground (total pit depth = 2.2 m)
    - 1 m by 1 m square pit.

F. Labor Requirement and Labor Cost for Excavation

- Excavation rate: 2 m^3 soil/day for 1 unskilled laborer.

  An unskilled laborer can excavate 2 m^3 of soil per day.
- The total number of days needed for the excavation is the volume of the pit divided by the excavation rate.
- The labor cost is the number of days multiplied by the unskilled labor rate.
- The volume of the pit = width x length x depth.
- For the raised platform latrine, excavation is needed only for the portion of the pit below ground level.

G. Pit Lining

- All waterseal latrines need a lining; lining material to be built of concrete block; assume no mortar needed.
- VIP and basic latrines are built in stable soil, so they do not need a lining.
- Lining and walls of raised platform latrine are to be made of brick; 1/3 bag of cement required per square meter of surface area of wall above ground, 1/6 bag per square meter of lining below ground surface.

H. Estimating Material for Lining

- To calculate the material needed for the latrine lining, first calculate the area of the pit walls. That number is then multiplied by the amount of lining material that will fit into each square meter.
- For the example of the concrete block:
  - The area of 1 concrete block face with the mortar joint = 0.072 m^2.
  - The number of the blocks in a square meter is

    1 m^2/0.072 m^2 = 13.9 blocks/m^2.
  - If a pit has a wall area of 16 m^2, the number of blocks required would be 13.9 x 16 = 222 blocks.
- For an example of the calculation for a brick lining, see Handouts 11-5 and 11-7.

I. Labor Requirement and Labor Cost for Pit Lining

- For concrete block lining--4 m^2/day by 1 skilled, 1 unskilled laborer.
- For brick lining--3 m^2/day by 1 skilled, 1 unskilled laborer.
- The above lining areas can be built in 1 day by 1 skilled builder and 1 unskilled laborer. The total labor required would be
  - the area of the pit walls divided by the labor requirement.

  This calculation would give the number of days required to build the lining. There is no difference between the time required for constructing the lining below the ground surface and the walls extending above the surface, as in a raised platform latrine.
- To find the labor cost, multiply the number of days by the rates for skilled labor and unskilled labor separately; then add the costs to obtain the total cost for constructing the pit lining.

J. Slab Construction

- VIP, waterseal, and raised platform latrine: use ferrocement slabs (dimensions: 1.2 m by 1.2 m by 0.025 m) with two layers of reinforcing screen.
- Basic latrine with cover: use reinforced concrete slabs (dimensions: 1.2 m by 1.2 m by 0.075 m) with reinforcement of rebar every 15 cm along width and length of slab.

K. Materials Estimate for Slabs

- To calculate the amount of materials in a slab, first calculate the volume.
- Example 1: Reinforced Concrete

  What are the material requirements of a reinforced concrete slab with dimensions of 1.3 m by 1.4 m by 0.1 m, with rebar spaced every 15 cm along both axes of the slab?

  Volume of slab= 1.3 x 1.4 x 0.1 = 0.182 m^3

  Volume of gravel = 0.182 m^3

  Volume of sand = 1/2 x 0.182 = 0.091 m^3

  Volume of cement = 1/4 x 0.182 = 0.046 m^3

  Bags of cement = 0.046 m^3/0.0332 m^3 = 1.4 bags, or almost 1 1/2 bags.

  - To calculate the rebar, divide the width and the length of the slab by the spacing between the rebar and subtract 1. This calculation will give the number of rebar pieces. Then multiply the number of pieces by the length and width to find the total length.
  - Number of rebar pieces along the length = 1.3/0.15 - 1 = 7.7
  - Number of rebar pieces along the width = 1.4/0.15 - 1 = 8.3
  - Total length of rebar = (7.7 x 1.3) + (8.3 x 1.4) = 22 m.
- Example 2: Ferrocement

  What are the material requirements in a ferrocement slab that is 1.5 by 1.4 by 0.03 and has two layers of reinforcing screen?

  - The volume of the slab is calculated in the same way as above; however, the material components are different.
  - Volume of slab = 1.5 x 1.4 x 0.03 = 0.063
  - The volume of sand required is two-thirds of the total slab volume of 2/3 x 0.063 = 0.042 m^3
  - Volume of cement = 1/2 x 0.042 = 0.021 m^3
  - Number of bags = 0.021/0.0332 = 0.63 bags
  - The reinforcement required is the area of the slab multiplied by 2 = 2 x (1.5 x 1.4) = 4.2 m^2
  - The calculation of poured concrete walls is determined in the same manner.

L. Slab Labor Requirement and Labor Cost

- For reinforced concrete slabs and ferrocement slabs:
  - 1 skilled builder and 2 unskilled laborers can build 3 slabs/day.
  - To calculate the number of days required for the construction of latrine slabs, divide the number of slabs needed by 3. Multiply that amount by the daily rate of 1 skilled builder and 2 unskilled laborers separately to find the labor cost of each. Add the two amounts to obtain the total labor cost.

M. Superstructure

In a typical situation, a picture of the shelter would be given to a master builder for an estimate of the material requirements and labor requirements and costs, as he or she is familiar with local construction practices and material estimates. He or she would then make up a list of requirements and costs for submission to the program implementer for approval. Listed below are materials, labor, and transport costs to be used for each type of superstructure in the scenarios:

- Wood
  - material cost: $60
  - labor cost: $30
  - transport cost: $10 (wood is locally available in each scenario)
- Concrete Block
  - material cost: $110
  - labor cost: $60
  - transport cost: $20 for each traveling day from urban center
- Brick
  - material cost: $150
  - labor: $80
  - transport cost: $20 for each traveling day from urban center

This cost does not include

- vent pipes (each vent also requires 0.04 m^2 screen)

- screening material for windows (1 m^2 required for each superstructure)

For example, if 5 VIP latrines are to be made of concrete blocks in a town that is located 3 days travel from an urban center, the following calculations would be made to determine the costs for the 5 superstructures (excluding cost of fly screen and vent pipe).

- material cost = 5 x $110 = $550
- labor cost = 5 x $80 = $400
- transport cost = 5 x 3 days x $20 = $300

Cost = $550 + $400 + $300 = $1,250

For the total cost, the cost of 5 vent pipes and screening material would be added.

Solutions to Handout 11-8

Material and labor requirements for the construction of each latrine type are calculated below. The quantities are then multiplied by the number of the types in each scenario.

If upgrades are being made, only the new materials necessary for the upgrade (plus 1 skilled builder, 1 unskilled laborer, 1/2 bag of cement) need to be determined. The old latrine components can be salvaged.

From this information, the transport cost can be calculated for each scenario.

Note: The only real choice involved is the type of shelter. Since different shelter types can be used, a solution for the superstructure is not included here.

A. Material and Labor Requirements for Each Latrine Type

1. *Basic Latrine with Cover*

Base

Materials: concrete block, mortar (sand, cement)

No. of blocks =	2.5 blocks/m x 4 m = 10 blocks
Volume of sand =	0.0035 m^3/m x 4 m = 0.014 m^3
Bags of cement =	0.05 bags/m x 4 m = 0.2 bags

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 2.5 m = 2.5 m^3
Unskilled labor required =	2.5 days/2 = 1.25 days

Slab

Materials: gravel, sand, cement, rebar

Volume of slab =	1.2 m x 1.2 m x 0.075 m = 0.11 m^3
Volume of gravel =	0.11 m^3
Volume of sand =	1/2 x 0.11 m^3 = 0.055 m^3
Volume of cement =	1/4 x 0.11 m^3 = 0.022 m^3
Bags of cement =	0.022 m/0.0332 m^3 = 0.7 bags
Length of rebar =	2 x [(1.2 m/0.15 m) -1] = 14 m

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2

Total Materials Required

Gravel	0.11 m^3
Sand	0.069 m^3
Cement	0.9 bag
Concrete blocks	10 blocks
Rebar	14 m
Superstructure	1
Screen (2 mm)	1 m^2

Total Labor Required

Skilled	0.7 day
Unskilled	2.25 days

2. *VIP Latrine*

Base

Materials: bricks, sand, cement

No. of bricks =	2 (layers) x 8.3 bricks/m x 4 m = 67
Volume of sand =	2 x 0.004 m^3/m x 4 m = 0.032 m^3
Bags of cement =	2 x 0.06 bags/m x 4 m = 0.5 bags

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 2.5 m = 2.5 m^3
Unskilled labor required =	2.5 days/2 = 1.25 days

Slab

Materials: sand, cement, screen (1 cm)

Volume of slab =	1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand =	2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement =	1/2 x 0.024 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) =	2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows and vent (2 mm) = 1 m^2
Vent pipe (3 m) = 1

Total Materials Required

Sand	0.056 m^3
Cement	0.9 bag
Brick	67 bricks
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2
Vent pipe (3 m)	1

Total Labor Required

Skilled builder	0.7 day
Unskilled laborer	2.25 days

3. *Pour Flush/Waterseal Latrine*

Base

Materials: gravel, sand, cement, rebar

Area of base =	(1.3 m x 1.3 m) - 1 m^2 = 0.69 m^2
Volume of base =	0.07 m x 0.69 m^2 = 0.048 m^3
Volume of gravel =	0.048 m^3
Volume of sand =	1/2 x 0.048 m^3 = 0.024 m^3
Volume of cement =	1/4 x 0.048 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Length of rebar =	2 x (4 x 1.3 m) = 10.4 m

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 1.5 m = 1.5 m^3
Unskilled labor required =	1.5/2 = 0.75 day

Lining

Materials: concrete block

Area of walls =	4 x (1 m x 1.5 m) = 6 m^2
No. of blocks =	6 m^2 x 13.9 blocks/m^2 = 84

Labor required:

Time =	$6(m^2)/4(m^2/day)$ = 1.5 days
Skilled =	1 x 1.5 days = 1.5 days
Unskilled =	1 x 1.5 days = 1.5 days

Slab

Materials: ferrocement of sand, cement, screen (1 cm)

Volume of slab =	1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand =	2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement =	1/2 x 0.024 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) =	2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2
Waterseal trap

Total Materials Required

Gravel	0.048 m
Sand	0.048 m
Cement	0.8 bags
Concrete block	84
Rebar	10.4 m
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2
Waterseal trap	1

Total Labor Required

Skilled builder	2.2 days
Unskilled laborer	2.5 days

4. *Raised Platform Latrine*

Base

No base required.

Pit Excavation

Volume of pit below ground = 1 m x 1 m x 1.2 m = 1.2 m^3
Unskilled labor required = 1.2/2 = 0.6 days

Lining

Materials: brick and cement

Area of lining wall below ground = 4 x (1 m x 1.2 m) = 4.8 m^2
Area of walls extending above ground = 4 (1 m x 1 m) = 4 m^2
Total wall surface area = 8.8 m^2
No. of bricks = 8.8 m^2x 65 bricks/m^2 = 572 bricks
Cement required = 1/6 bag x 4.8 m^2 + 1/3 bag x 4 m^2= 0.8 + 1.3 = 2.1 bags

Labor required:

Time = 8.8 m^2/3 m^2/day = 2.9 days
Skilled = 1 x 2.9 days = 2.9 days
Unskilled = 1 x 2.9 days = 2.9 days

Slab

Materials: ferrocement of sand, cement, screen (1 cm)

Volume of slab = 1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand = 2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement = 1/2 x 0.024 m^3= 0.012 m^3
Bags of cement = 0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) = 2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled = 1 x 1/3 day = 1/3 day
Unskilled = 2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2

Total Materials Required

Sand	---
Cement	2.5 bags
Brick	572
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2

Total Labor Required

Skilled builder	3.2 days
Unskilled laborer	4.2 days

B. End Solution to Each Scenario

The material quantities can be put onto a cost sheet and multiplied by the unit cost to find the cost associated with each program (excluding the shelter).

Scenario I

New latrine construction:

- 2 basic latrines with cover
- 2 VIP latrines
- 1 pour flush (or waterseal) latrine

For the total materials required in Scenario I,

multiply

2 x materials in 1 basic latrine

2 x materials in 1 VIP latrine

1 x materials in 1 pour flush latrine.

These materials added together will be the total material requirements.

The amount of labor is calculated in the same manner.

Total Materials Required

Gravel (m^3)	2 x 0.11 + 1 x 0.048 = 0.27 m^3
Sand (m^3)	2 x 0.069 + 2 x 0.056 + 1 x 0.048 = 0.3 m^3
Cement (bags)	2 x 0.9 + 2 x 0.9 + 1 x 0.8 = 4.4 (5 bags)
Concrete block	2 x 10 + 1 x 84 = 94 blocks
Bricks	2 x 67 = 134 bricks
Rebar (m)	2 x 14 + 1 x 10.4 = 38.4 m (or 7 lengths of 6 m rebar)
Screen (1 cm) (m^2)	2 x 2.9 + 1 x 2.9 = 8.7 (9 m^2)
Superstructure	2 x 1 + 2 x 1 + 1 x 1 = 5 superstructures
Screen (2 mm) (m^2)	2 x 1 + 2 x 1 + 1 x 1 = 5 m^2
Vent pipe (3 m)	2 x 1 = 2 vent pipes
Waterseal trap	1 x 1 = 1 trap

Total Labor Required

Skilled builder (days)	2 x 0.7 + 2 x 0.7 + 1 x 2.2 = 5 days
Unskilled laborer (days)	2 x 2.25 + 2 x 2.25 + 1 x 2.5 = 11.5 days

Scenario II

New latrine construction:

- 1 raised platform latrine

Upgrades:

- 5 basic pit latrines upgraded to 5 VIP latrines
- 5 VIP latrines upgraded to 5 pour flush latrines

In this scenario, the materials for one complete raised platform latrine are needed. For the upgrades, new slabs will only be needed for the 5 pour flush latrines, because the slabs for the 5 VIP latrines that are being converted to pour flush latrines can be used for the basic pit latrines that are to be upgraded to VIPs. The vent pipes from the VIPs being converted can also be used, assuming that they are not built as part of the superstructure. It is assumed that the superstructures for the upgraded latrines can be reused.

Recall that each upgrade requires one-half bag of cement and a day's work from a skilled builder and an unskilled laborer. For the total cement and labor required for the upgrade (aside from the new slabs for the pour flush latrines), multiply the number of upgrades by the above values.

Total Materials Required

Sand (m^3)	5 x 0.024 = 0.44 m^3
Cement (bags)	1 x 2.5 + 5 x 0.4 + 10 x 0.5 = 9.5 (10 bags)
Screen (1 cm) (m^2)	1 x 2.9 + 5 x 2.9 = 17.4 (18 m^2)
Superstructure	1 x 1 = 1
Screen (2 mm) (m^2)	1 x 1 = 1 m^2
Waterseal trap	5 x 1 = 5 traps

Total Labor Required

Skilled builder (days)	1 x 3.2 + 5 x 1/3 + 10 x 1 = 14.9 days
Unskilled laborer (days)	1 x 4.2 + 5 x 2/3 + 10 x 1 = 17.5 days

Scenario III

New latrine construction:

- 2 VIP latrines
- 2 basic latrines with cover

Upgrade:

- 2 basic pit latrines ---> 2 VIP latrines

In this scenario the materials needed for the new construction would be

2 x materials for 1 VIP latrine

2 x materials for 1 basic latrine.

The inputs needed for the upgrade would be vent pipes, cement, and labor, as noted above. As above, it is assumed that the superstructures and slabs can be reused for the upgrades.

Total Materials Required

Gravel (m^3)	2 x 0.11 = 0.22 m^3
Sand (m^3)	2 x 0.069 + 2 x 0.056 = 0.25 m^3
Cement (bags)	2 x 0.9 + 2 x 0.9 + 2 x 0.5 = 4.6 (5 bags)
Concrete block	2 x 10 = 20 blocks
Bricks	2 x 67 = 134 bricks
Rebar (m)	2 x 14 = 14 m (or 3 lengths of 6 m rebar)
Screen (1 cm) (m^2)	2 x 2.9 = 5.8 (6 m^2)

Superstructure	2 x 1 + 2 x 1 = 4 superstructures
Screen (2 mm) (m^2)	2 x 1 + 2 x 1 = 4 m^2
Vent pipe (3 m)	2 x 1 = 2 vent pipes

Total Labor Required

Skilled builder (days)	2 x 0.7 + 2 x 0.7 + 1 x 2 = 4.8 days
Unskilled laborer (days)	2 x 2.25 + 2 x 2.25 + 1 x 2 = 11 days

Scenario IV

New latrine construction:

- 20 VIP latrines, with agency assistance
- 5 raised platform latrines with vent pipes

In this scenario the slabs and fly screens are provided (transport is not), so the material calculations will include the following components:

- pit excavation
- construction of bases for VIP latrines
- superstructure
- construction of raised lining for raised platform latrines

Total Materials Required

Sand (m^3)	20 x 0.032 = 0.64 m^3
Cement (bags)	5 x 7.1 + 20 x 0.5 = 20.5 (21 bags)
Bricks	5 x 572 + 20 x 67 = 4,200 bricks
Superstructure	5 x 1 + 20 x 1 = 25 superstructures
Screen (2 mm) (m^2)	5 x 1 + 20 x 1 = 25 m^2
Vent pipe (3 m)	5 x 1 + 20 x 1 = 25 vent pipes

Total Labor Required

Skilled builder (days)	5 x 2.9 + 20 x 1/3 = 21.1 days
Unskilled laborer (days)	5 x 3.5 + 20 x 1/3 + 20 x 1.25 = 49.2 days

Notes: Materials and labor for slab construction are not necessary in this scenario. This scenario provides the only example of integrating the VIP and raised platform latrine types.

Session **12**

SUPERVISION OF CONSTRUCTION *2 hours*

Objectives

By the end of this session, the participants will be able to

- describe their role as supervisors of latrine construction,
- identify quality control points in latrine construction, and
- develop strategies for addressing common supervisory problems.

Overview

The main focus of this session is on supervision of construction. It is intended to clarify further participants' role in an excreta disposal management program.

In particular, the session examines work progress issues and quality control points. A series of critical incidents provides participants with an opportunity to explore possible responses to some common construction situations that they might face.

Procedures

1. Introduction ***5 minutes***

Present the session objectives on Flipchart A: "Session 12 Objectives" and the rationale for this session.

2. Lecturette: Role of the Supervisor of Construction ***15 minutes***

Start the lecturette with a short brainstorming exercise by asking the following question (on a flipchart):

- What comes to mind when you think of an effective supervisor?

In doing the brainstorming, suggest to participants that they think of a person they think is an especially good supervisor. Some examples can come from the group activities.

Add the following key points if not mentioned by participants:

- monitors progress of work
- anticipates needs of program
- ensures quality of the work (quality control)
- manages the contracts with labor (skilled/unskilled)
- troubleshoots
- facilitates the interaction between key parties (for example, the builder and community members)

Emphasize the following points:

- *Progress of Work*

  A delay can be encountered on a construction site for a variety of reasons, such as late arrival of materials. This problem can lead to a program-wide stoppage, which wastes money and time. The supervisor's responsibility is to conduct an ongoing assessment in order to apply corrective measures before much time is lost.

- *Quality of Work*

  A supervisor evaluates the quality of work and enforces the contract with the builder. A community member can also play a role in quality control. If good rapport is developed between the community member and the builder, the program's success and community satisfaction are enhanced.

3. Large Group Discussion: Identifying Quality Control Points ***25 minutes***

Expand the discussion of quality control with the following question:

- What do you think are the important quality control points in constructing a latrine?

List the responses on a flipchart and be sure the following are included:

- slab construction
- pit lining construction
- base construction
- superstructure construction

Tell the participants that high-quality construction of all of these latrine components is vital to the overall success of the program. To ensure high quality, the supervisor should make frequent visits to the project site during the construction of these components.

Tell the participants that of these components, the slab is the most crucial and is most frequently constructed incorrectly. It must be structurally sound, easy to clean (smooth and without undue indentation to inhibit cleaning), and easily used by *each* member of the family.

Ask participants if they can identify some common slab construction problems. Include the problems below if not mentioned by participants:

- It is not made to fit onto the base with sufficient overlap. At times it is made to the exact dimensions of the pit, which makes it impossible to mount it safely.
- No sealant is applied between the slab and the base.
- The hole in the slab is too big, so it is frightening to children.
- The upper surface of the slab is not sloped downward, toward the hole in the slab, which causes water to pool on the latrine floor.
- It does not have a smooth surface.
- It is not cured correctly and so it is weak.
- It is not made to suit the user; if the user is accustomed to using a pedestal seat during defecation, one should be provided.

Point out that the pit lining can also be a crucial component. It is often omitted because of cost and the fact that it is not a visible component of the finished latrine. In unstable soil, however, this omission creates a real hazard for use and will eventually cost additional money to correct.

Next, ask about the demonstration latrine:

- What are some of the quality control points?
- What were some of the problems of supervision with our own latrine?
- What was the impact of some of these problems?
- What suggestions do you have to fix our supervisory problems?

4. Large Group Discussion: Critical Incidents *1 hour*

Explain to participants that they're now going to be presented with some problem situations. Tell them that they will be given a few minutes to discuss the situation in their table group and decide on a group response.

Present the following task:

Flipchart B: Critical Incident Task

- Discuss the situation at your table.

- Agree on the best response.

Trainer Note: Go through the critical incidents fairly quickly with the full group. Allow 3 or 4 minutes for the small group discussion, then in the full group get a quick verbal response from each group. Spend no more than 10 minutes on each incident.

Present the following situations (on flipcharts) one at a time:

- You visit one of your latrine construction sites and find that very little work has been done in the few days since your previous visit. When you ask the master builder why progress has been slow, he says, "I'm working as fast as I can."

  What would you do?

  Trainer Note: Some possible responses are included below.

  - Remind him of his contractual obligations.
  - Write a new contract based on a set payment for a finished product as opposed to paying a daily rate (e.g., $5 for every well-made slab).
  - Find out if there is a problem. If it is something that you can help with, offer assistance.
  - Explain the situation to the community, and ask for their suggestions.

- You visit your construction site and find the unskilled workers beginning the slab construction without supervision from the master builder. The master builder, you discover, has gone off to locate some materials for the superstructure.

  What would you do?

  Trainer Note: Some possible responses are included below.

  - Have all necessary building materials on site.
  - Meet with the builder to discuss his reason for leaving the site. Possible response: Work was left in hands of qualified apprentice.
  - Remind the master builder of his contractual obligations.
  - Offer your assistance in a supervisory capacity.
  - Encourage community leaders to talk with the builder.

- The master builder comes to you and says that two 50 kg bags of cement are missing from the storage shed.

  What would you do?

Trainer Note: Some possible responses are included below.

- Encourage community leaders and the builder to work together to discover what is going on and try to stop it.

■ You go to the construction site and find that a serious altercation is taking place between the son of the senior neighborhood elder and the master builder. People have started to gather around the scene.

What would you do?

Trainer Note: Some possible responses are included below.

- Ask community leaders to try to solve the problem.
- If your help is requested, try to clarify what the dispute is about, and avoid apportioning blame.

■ You learn that the altercation is taking place between the son of the senior neighborhood elder and the master builder because the master builder is a member of a minority ethnic group and is not well liked.

What would you do?

Trainer Note: Some possible responses are included below.

- Ask community leaders to find out the problem and solve it. Give assistance if asked.
- Let community leaders make the decision about whether to stop work on the latrine.

■ Despite providing regular feedback, you continue to find the construction is substandard. Each time you give the master builder feedback, he responds: "I'll do better." He's the only master builder in town. He's worked for you before and you remember that he did a reasonable job.

What would you do?

Trainer Note: Some possible responses are included below.

- Inform the community of the problem, and try to come to an agreement with the community to cancel the building contract and find a new builder.

■ What if you are half way through the construction—the pit is lined and you have a slab—and discover that you can't get additional supplies?

■ What if midway in your program the cost of cement doubles?

Trainer Note: Some possible responses are included below.

- ☐ Every effort should be made to avoid both these situations by buying enough material at the beginning of the program.
- ☐ If the situation can't be avoided, talk to community leaders, explain the situation, and ask for suggestions.

5. Conclusions *15 minutes*

Briefly touch on major session points. Ask,

- What were the most important lessons for you that came out of this session?

Record lessons on a flipchart.

Then ask,

- How will you apply some of these lessons in your own programs?

Review the session objectives, and say a few words about the next session.

Materials

Flipchart A: Session 12 Objectives

Flipchart B: Critical Incident Task

Flipcharts of Critical Incidents

Session **13**

SANITATION EDUCATION METHODS *4 hours, 15 minutes*

Objectives

By the end of this session, the participants will be able to

- describe techniques for making effective sanitation education presentations,
- identify skills for group facilitation and one-on-one advising, and
- develop presentation plans for sessions on excreta disposal management, latrine maintenance, and the disease cycle.

Overview

One of the most challenging aspects of a sanitation program is influencing people to adopt good excreta disposal practices. The intention of this session is twofold: to assist participants in (1) determining how best to link their education messages to a problem and chosen solutions and (2) preparing and delivering effective presentations.

In this session, participants work again with the facilitative skills they learned in Session 4 as a mean of making their presentations more interactive. They are then given the opportunity to prepare presentations, which they will deliver in Session 16 to community members.

Procedures

1. **Introduction** ***10 minutes***

Make a transition into this session by recalling Part 2 of the three-part model. Say that sanitation education is one intervention that plays a central role in most excreta disposal management programs. The important question in sanitation education is how best to link the education messages to the problem—for example, the high-risk behavior(s)—and the chosen solutions. Another important question is how to deliver the presentation in a way that's most appropriate for the target audiences, both in content and delivery. This session will focus primarily on delivery, but will tap into the subject matter learned in this course.

Ask participants to recall what was the impact of using the facilitative skills in their information collection field exercise. Say that effective two-way communication skills—and facilitative skills, in particular—are essential for convincing people to adopt good sanitation practices and that they will be relying on those skills again in this session.

Briefly present the overview in your own words and the objectives on Flipchart A: "Session 13 Objectives."

2. Lecturette: Sanitation Education *15 minutes*

Say that in this session sanitation education is defined as specifically referring to excreta disposal practices—how individuals can be educated to modify their high-risk behaviors.

State that sanitation education is important at various stages in the development of a sanitation program. Present Flipchart B.

Flipchart B: Sanitation Education at Various Stages

- Awareness building
  - clarifying the problem
  - identifying needs and interests
  - providing information
  - creating a demand
- Facilitating choice
  - helping to determine appropriate interventions
  - assisting the community and individuals to make an informed choice
- Implementing the choice
  - organizing the community and individuals to carry out their decisions
- Monitoring and evaluation
  - assisting the community in building on lessons learned

Stress that sanitation education sessions and meetings are important at each of the various stages of program development. Also, the content of their sanitation education activities will vary somewhat depending on the stage of program development.

3. **Large Group Discussion: Making Sanitation Education Effective** ***50 minutes***

Ask,

- What are ways that this course has made sanitation education presentations interactive?

Add the following points if not volunteered:

- small group activities
- the use of leading questions (like the question just asked)
- role plays and case examples to encourage discussion
- visual aids that increase clarity of understanding
- the trainer's facilitative skills

Emphasize the following initial preparation steps when developing a sanitation education presentation:

Flipchart C: Initial Preparation Steps

- Clarify who the audience will be.
- Identify the specific high-risk behaviors associated with excreta disposal practices for that audience, and identify the specific low-risk behaviors that you wish the audience to adopt.
- Determine some fun and interesting ways to deliver your sanitation messages to different audiences:
  - children
  - illiterates
  - women/men
  - farmers

Ask,

- What are some fun and interesting ways to get messages across to these various groups?

Examples from the group might include songs, theater, role plays, and visuals.

Add additional points on getting the message across by using as a guide Handout 13-1: "Effective Presentations—A Planning Checklist." To summarize your discussion, and add remaining points, cover the following key points on Flipchart D.

Flipchart D: Effective Presentations—Key Points

- Clear, simple objectives
- Short, with a few key messages (20 to 30 minutes maximum)
- Facilitative skills—paraphrasing, asking questions, summarizing, and using encouragers
- Examples to reinforce key messages
- Visual aids to illustrate key messages

Distribute Handout 13-1.

Ask participants to note what techniques you used to deliver this interactive presentation. Ask them how they felt about participating. Their responses should be positive. You can then use their reactions to reinforce the importance of interactive presentations.

Ask how such a presentation could be made in a one-on-one advisory session, such as in a person's home. Explain that the steps are identical, but the delivery would be more informal.

Note the use of facilitative skills. Ask what are some of the similarities between using them for interviews and for leading a discussion. Reinforce the following points on Flipchart E:

Flipchart E: Skills for Facilitating and Advising

- Open-ended questions encourage people to reflect more and to participate actively.
- Paraphrasing helps to
  - clarify meaning
  - move the discussion along
  - encourage more people to participate in a group by keeping talkative people from dominating
  - provide a tool for gently interrupting someone who has been talking too long
  - provide a basis for summarizing points
- Summarizing makes it possible to
  - reinforce key points
  - check for progress
  - verify comprehension
  - review agreements
- Using encouragers reinforces all the other communication skills.

4. Preparing for Presentations *3 hours*

Explain that in Session 16 on Day 10 participants will practice making presentations with a real audience—members of a community. First, they must prepare a presentation plan.

To help guide their preparation, lead a discussion about possible topics based on the information they collected in the community about excreta disposal practices. Divide participants into two groups, one per trainer. When in these groups, choose topics and identify objectives for two presentations.

Then, divide each group into three teams of three or four people each and give them the task on Flipchart F.

Flipchart F: Presentation Preparation

- Prepare a 15- to 20-minute presentation.
- Follow the preparation steps in Handout 13-1.
- Prepare visual aids as needed.
- Decide who will deliver which part of the presentation to community members (it may be that not everyone has a part in the delivery).
- Take 3 hours.

Explain that they will be delivering their presentations on the last day of the course—Session 16.

Say that in the next session (the following day) they will be going back to the topic of latrines, looking specifically at operation and maintenance.

Trainer Notes:

1. Because Day 8 ends here, participants have the option of taking more time in the evenings to prepare for the Day 10 delivery.
2. If possible, invite members of the community where the information collection was done to participate in the presentations that the workshop participants will give on Day 10. You probably want to invite the community counterparts who assisted the participants in the community visits, as well as other members of the community, including leaders of various community groups. Another possible audience would be schoolchildren. Their involvement will make the sessions very realistic, help workshop participants to think seriously about preparing their presentations, and reinforce education messages in the community.
3. You may need to predetermine the "audience" for participant presentations based on the availability of the various options for the Day 10 delivery (see Session 16).

Materials

Handout 13-1: Effective Presentations—A Planning Checklist

Flipchart A: Session 13 Objectives

Flipchart B: Sanitation Education at Various Stages

Flipchart C: Initial Preparation Steps

Flipchart D: Effective Presentations—Key Points

Flipchart E: Skills for Facilitating and Advising

Flipchart F: Presentation Preparation

Effective Presentations—A Planning Checklist

A. Key Points

- Develop clear, simple objectives. Identify key messages and write them down for yourself. Orient the key messages to what the participants will be able to do or say by the end of your session with them.

  In your planning, think about the following questions:

  - ☐ What do I want the participants to learn/remember? What's really important?
  - ☐ What are the principal points I want to make? How will I sequence them?
  - ☐ What visual aids will I use? How do I want them to look?
  - ☐ What fun activities could I use to get my messages across—songs, theater, or role plays?
  - ☐ What examples will I use to illustrate what I mean?

- Keep the presentation short, with a few key points (20 to 30 minutes maximum for the entire presentation).
- Use all the facilitative skills (asking questions, paraphrasing, summarizing, using encouragers). Ask open-ended questions to encourage discussion of people's own experience and their reactions to the subject matter.
- Give examples and anecdotes to reinforce key points. Make sure they are familiar to participants and that you understand them well.
- Show simple visual aids to illustrate key points, such as pictures, clear drawings, and written material where appropriate.

B. Proceed Using Three Steps

1. *Introduction*

- Greetings.
- Describe what you want to discuss (objectives).
- Ask related questions drawing on the participants' experiences.

2. *Discuss Key Points*
   - Explain key points.
   - Use illustrations or other visual aids if possible.
   - Ask questions to relate points to participants' experiences.
3. *Conclusion*
   - Review and summarize key points.
   - Ask questions to verify comprehension and draw conclusions.
   - Discuss how the participants can apply the key points.
   - Thank them for participating.

Session **14**

O&M CONCERNS AND UPGRADING EXISTING LATRINES

5 hours, 30 minutes

Objectives

By the end of the session, the participants will be able to

- identify operation and maintenance (O&M) concerns relevant to latrines,
- identify the repair needs of existing latrines, and
- determine possibilities for upgrading existing latrines.

Overview

This is a two-part session involving the same skill areas. The first part consists of the relatively minor upkeep of a latrine, and the second part involves decision-making in renovating or upgrading latrines.

Nearly all communities have had some experience with latrines. Thus, any sanitation program should take into account existing facilities and their condition. This session enables the participants to gain firsthand practice at assessing existing facilities in a nearby community. It will give them additional experience in better determining program parameters—how much new construction is necessary versus how much upgrading can be done, what are the problems with existing facilities, and how those problems can be overcome with a sanitation program.

As part of this session, participants, in two teams, will visit four existing latrines to assess their current state of repair and the possibilities for upgrading them. They will also visit the demonstration latrine to assess the quality of its construction.

Procedures

1. Introduction ***5 minutes***

Present Flipchart A: "Session 14 Objectives." Explain the rationale for doing the session.

2. Team Discussion: O&M Concerns *30 minutes*

Open the discussion by asking the participants about the possible problems during the life of a latrine—that is, from when it is built to when it is filled to capacity. Write their responses on a flipchart and ask them to rate their importance and explain why.

Responses should include the following:

- Operation
  - capacity
  - ventilation
  - waterseal trap
- Maintenance
  - cleanliness
  - repairs

Make key points from Handout 14-1: "Operation and Maintenance Concerns." Distribute the handout.

3. Team Field Activity: Assessing Existing Latrines *3 hours, 30 minutes*

Tell participants that they will be going out into the community to assess existing latrines—their current state of repair and the possibilities for upgrading them. Say that they will also be assessing the quality of construction of the demonstration latrine.

Trainer Note: Prior to this exercise it will be necessary to prepare the community for the visit. Permission should be gained from the owners of each latrine to be assessed. The latrines to be assessed should include one or more latrines at schools, medical centers, or markets. The timing of this session allows for 30-minute visits to four latrines, plus the demonstration latrine. Approximately 50 minutes is allowed for transport to and from the community, and transport or walking between latrine sites. If this is insufficient time given the distances involved, one option would be to reduce the number of latrine visits from four to three.

Explain that they will be working in two teams to complete this activity. Say that,

- They will be looking at four existing latrines in the community, in addition to the demonstration latrine.
- Each team will be accompanied by a trainer and will start at different points.

Pass out Handout 14-2: "Team Task: Assessing Existing Latrines," and present the task on a flipchart.

Flipchart B: Team Task

- The team will be given 30 minutes at each latrine:
  - 20 minutes to inspect the latrine and make notes
  - 10 minutes for discussion

Existing Latrines

At each site, address the following questions:

- How would you assess the original construction?
  - What is the age of the latrine?
  - What building materials were used?
  - What was the level of quality of construction?
- How would you assess siting?
  - What is the proximity to water sources?
  - What is the water table?
  - What is the likelihood of flooding during heavy rains?
  - Is the soil of a suitable type to allow percolation of wastewater?
- To what extent is the latrine being used properly?
- What is the current state of repair?
  - superstructure
  - slab
  - pit (look for cracks in cement, signs of subsidence)
- What are the possibilities for upgrading the latrine? (For example, to convert a pit latrine to a VIP latrine, do you need a new slab? Can the superstructure be reused?)
- How would you assess the state of maintenance?

Demonstration Latrine

- How would you assess the quality of construction?
- What might you have done differently?

Divide the group into two teams and have each trainer take a team to the first latrine site.

Trainer Note: It would be best to choose different kinds of latrines if possible. Choose some that are in good condition and others that are in various stages of disuse and disrepair.

4. Large Group Discussion: Assessing Existing Latrines *1 hour*

Once participants are back in the classroom, go over the questions in the task, asking participants for examples of what they saw.

Ask the following questions as part of the general discussion:

- What were the different upgrade possibilities?
- What were the major design or construction flaws that you saw?
- How could these flaws have been avoided?
- What were common maintenance problems?
- Why do you think these problems existed?
- How could some of these maintenance problems be addressed?

Trainer Note: This last question should be given the most discussion time.

Then ask,

- How did you assess the quality of construction of the demonstration latrine?
- What might you have done differently?

5. Conclusions *15 minutes*

Summarize some of the session highlights.

Ask,

- What for you were the key lessons of this session?

Record the lessons on a flipchart, and read through the completed list.

6. Wrap-Up *10 minutes*

Ask,

- What do you especially want to remember to do in your own program?

Review the session objectives, and make a link to the next session.

Materials

Handout 14-1: Operation and Maintenance Concerns

Handout 14-2: Team Task: Assessing Existing Latrines

Flipchart A: Session 14 Objectives

Flipchart B: Team Task

Operation and Maintenance Concerns

Operation

- capacity
- ventilation
- waterseal trap

Capacity

The most evident operational concern common to all latrine technologies deals with the capacity of the latrine. Eventually, all latrines fill, so an effort must be made to plan for a transition.

Depending on the resources involved, this transition presents an opportunity for upgrading the latrine. Whether this option is utilized or not, all salvageable materials are taken from the old latrine site for use in constructing the new latrine or for some other purpose. Doing so can substantially reduce the cost of the new latrine.

It is generally accepted that the transition should occur when the excrement in the latrine reaches a level of 1 to 0.5 m below the slab. The latrine is then filled with earth or a combination of earth and organic waste. This distance (1 to 0.5 m) prevents pathogens from making their way to the surface where users will be exposed.

Ventilation

Blocked ventilation will lessen the air currents flowing through the latrine, which could cause the interior of the latrine superstructure to become or to remain damp. Good air circulation will also result in lessening smells in the latrine.

Occasionally, the vent pipe of the VIP becomes partially blocked, thus reducing the effectiveness of the technology. Typically the problem is caused by spider webs. Eliminating this problem is a relatively easy procedure but the vent should be checked periodically.

Waterseal Trap

As mentioned previously, utilization of the pour flush technology requires an excess of water for its proper and continued functioning. A minimum of 10 liters/person/day is recommended in excess water. For example, an eight-member family using the latrine would require an excess 80 liters of water per day.

At times, the waterseal can become clogged by waste material or wiping material that is thrown into the latrine. Another cause is the use of insufficient water in flushing the latrine.

Maintenance

- cleanliness
- repairs

Cleanliness

Perhaps the most simple, yet the most important, maintenance for a latrine is keeping it clean. This will limit contact with excreta, reduce flies in the latrine, reduce smells, increase latrine use, and improve the appearance of latrines.

Repairs

The repairs needed by a latrine will, in most cases, be obvious, as maintenance problems are commonly manifested in the superstructure or latrine slab.

Cracks in the slab or slabs with broken masonry constitute the most serious problems. The resulting weakness of the slab could cause it to fall into the pit along with whoever is on it, not to mention allowing the access of vectors to the fecal material. These problems should be rectified immediately. Whether the slabs need to be replaced or can be repaired should be decided by an experienced builder.

Cracks or breakage can also occur in the waterseal trap. This can result in higher water requirement for flushing; access of vectors to excreta; increase in smell; leakage of water onto latrine floor; or total nonfunctioning. Most waterseal traps are difficult to repair so will probably need to be replaced.

Common problems in the superstructure usually consist of small repairs such as rips in the fly screen, repairing the door hinges, etc. While the repairs needed for these items are minor, they are often neglected, which allows access to insect vectors and could lead to reduced use. A well-maintained latrine encourages use.

Team Task: Assessing Existing Latrines

- The team will be given 30 minutes at each latrine:
    - 20 minutes to inspect the latrine, and complete their notes
    - 10 minutes for discussion

At each site, address the following questions:

- How would you assess the original construction?
    - What is the age of the latrine?
    - What building materials were used?
    - What was the level of quality of construction?
- How would you assess siting?
    - What is the proximity to water sources?
    - What is the water table?
    - What is the likelihood of flooding during heavy rains?
    - Is the soil of a suitable type to allow percolation of wastewater?
    - To what extent is the latrine being used properly?
- What is the current state of repair?
    - superstructure
    - slab
    - pit (look for cracks in cement, signs of subsidence)
- What are the possibilities for upgrading the latrine? (For example, to convert a pit latrine to a VIP, do you need a new slab? Can the superstructure be reused?)
- How would you assess the state of maintenance?

Demonstration Latrine

- How would you assess the quality of construction?
- What might you have done differently?

Session 15

MONITORING AND EVALUATION *3 hours, 40 minutes*

Objectives

By the end of the session, participants will be able to

- define monitoring and evaluation,
- identify key indicators and questions for the monitoring of behavioral change and interventions, and
- identify key indicators and questions for evaluating program outcomes.

Overview

The successful installation of interventions (e.g., latrines) is no guarantee of either their continued use or the practicing of appropriate sanitation behaviors. This session involves discussions on the reasons why monitoring and evaluation exercises contribute to an effective ongoing sanitation program involving both interventions and modifications of behavior. The session builds on the knowledge and skills related to high-risk behaviors that participants gained in Session 5, and it explores key elements of monitoring and evaluation, in part through two small group activities.

Procedures

1. Introduction ***10 minutes***

Begin by reminding participants of the three-part model for excreta disposal management.

Ask the group,

- Why do we need to monitor activities once they've been initiated?

Take a few responses, then ask,

- Why is it important to evaluate the effectiveness of the activities?

Emphasize that in Part 3 of the model, monitoring and evaluation, lessons learned—and problems—in the ongoing program are identified. Say that if Part 1 of the model, problem clarification, was not well done, there will not be a good baseline of information against which to monitor and evaluate. Remind them of the baseline information on high-risk behaviors that they gathered in Session 5.

Stress that monitoring and evaluation are not useful unless they are followed by problem clarification and a subsequent intervention. Say that in this session participants will be examining how monitoring and evaluation of latrine operations and maintenance and other sanitation program activities contribute to long-term sustainability.

Go over the session objectives on Flipchart A: "Session 15 Objectives," and briefly describe the session procedures.

2. Lecturette: Monitoring ***30 minutes***

Say that *monitoring* has two key components (Flipchart B).

Flipchart B: Monitoring

- Continued observation of the prevalence of high-risk behavior, both the frequency and the degree of exposure to excreta.
- Continued observation of ongoing interventions.

Ask,

- What does *continued* mean to you? How often should one monitor an ongoing sanitation program?

Emphasize that participants should plan to monitor each time they visit the community, or at least once a month. Say that monitoring helps one adjust his or her expectations.

Focusing on the first component of monitoring:

- Let's remind ourselves, what high-risk behaviors are we monitoring?

Remind participants that high-risk behaviors are defined as behaviors that allow (or even promote) exposure to excreta. Give once again some examples, such as:

- defecation in areas where excreta may come into contact with the individual or others or contaminate a water supply,
- nonwashing of hands (with soap) after defecation,
- allowing domestic animals to defecate in areas where their excreta may come into direct contact with people or a water supply,
- handling of properly isolated excrement before it has decomposed to the extent that all pathogens are inviable,
- not maintaining the cleanliness of the latrine, and

- not properly disposing of wiping material.

Focus on the second component of monitoring and ask,

- What should you be monitoring?

Possible responses and associated questions are listed below:

- Sanitation education activities
  - ☐ How well are people understanding the message?
  - ☐ To what extent are appropriate groups (groups exhibiting high-risk behaviors) being targeted?
- Newly completed latrines
  - ☐ How would you rate user satisfaction?
  - ☐ How well does the facility satisfy the main purpose of latrines, that is, isolation of excreta?
  - ☐ Are acceptance and use of the facility achieved by all members of the family?

Then ask,

- How does one carry out monitoring?

Emphasize that observation during site visits is the best way to monitor (as opposed to written letters and reports or secondhand accounts). Stress again that observation during site visits requires sensitivity.

3. Small Group Activity: Monitoring Modified Behaviors — *40 minutes*

Split the group into their Session 5 behavioral survey teams and assign the following task for each group on Flipchart C.

Flipchart C: Group Task—Monitoring Modified Behaviors

- **Review your survey results, especially the high-risk behaviors your team saw as most important to modify.**
- **For the two most serious high-risk behaviors identified by your team, how would you monitor the extent of modified behavior?**

  For example,

  - ☐ **What questions might you ask, and of whom?**
  - ☐ **What "indicators of change" might you look/listen for?**

- Record your answers on a flipchart.
- Take 35 minutes for the task.

4. Group Reports: Monitoring of Modified Behaviors — *30 minutes*

Have each group post its flipcharts. Ask participants to get up and review the flipcharts at the front of the room.

Note any indicators of change that may not have been evident in the survey:

- cleanliness of a latrine
- signs of latrine use
- absence of improperly discarded wiping material
- absence of excreta around the latrine or house
- basic pit latrines are covered when not in use
- small children know how to use the latrine properly
- observance of hand washing after latrine use

5. Lecturette: Evaluation — *25 minutes*

Present on a flipchart the following definition of evaluation:

> *Flipchart D: Evaluation*
>
> Planned review of program successes and failures, cost to benefit ratio, and recommendations for future programs.

Ask,

- How often do you think one should evaluate?

Reinforce that, in general, programs should be evaluated once a year.

Ask,

- In an evaluation, what would be the important questions to answer in looking back over the past year?

Record their responses and add the following questions if not mentioned:

- To what extent are latrines being used, and used properly?
- What is the remaining life of each latrine?

- What have been the major problems?
- How strong is community interest?
- What does the community view as the benefits of the program?
- What are benefits of the program? (In terms of improved health status, reduced diarrhea, and sickness and death among small children.)
- How have the interventions affected the high-risk behaviors?
- Which high-risk behaviors are still evident? To what degree?

Then ask,

- How would you rate the success of interventions based on the indicators you identified in Session 6?

Say that one important outcome of an evaluation is clarification of the key questions that should be considered over the coming year. Ask,

- What would be the important questions to ask in looking ahead to the coming year?

Record their responses and add the following questions if not mentioned:

- To what extent is there interest in upgrading latrines? In constructing new latrines?
- How has the situation changed in the community? (For example, does it have an increased or reduced water supply that would make other latrine options feasible?)
- In what ways would the community benefit from a refresher course in sanitation education?
- How could the gap between current high-risk behaviors and improved behaviors be bridged? (problem clarification)
- Have new high-risk behaviors been identified? How could they be addressed?

Ask,

- What questions might you ask in considering overall program recommendations?
  - What's going well? What could be improved?
  - What lessons have been learned from the past year?
  - How should these lessons be applied to other communities?

Ask,

- How should the evaluation be carried out?

Emphasize that—as in monitoring—the best evaluation method is observation during site visits.

6. Small Group Activity: Evaluation of Program Achievements *30 minutes*

Tell participants that in this small group activity they will consider evaluations that could indicate the success or failure of the sanitation program's interventions.

Separate the group into four table groups. Assign two of the groups the topic of sanitation education for latrines and the other two groups the topic of new/upgraded latrine construction intervention.

Assign the groups the following task on Flipchart E:

Flipchart E: Small Group Evaluation Task

For the evaluation topic assigned to your table group,

- Identify specifically what you would be looking for in an evaluation of program effectiveness.

  For example,

  - What observable results would you want to look for?
  - What questions would be key in gathering information?
- Take 20 minutes for this task.

7. Large Group Discussion: Evaluation of Program Achievements *35 minutes*

Start with the topic, latrine construction intervention, and get three or four responses from each group.

Possible responses:

Latrine Construction Intervention

- number of latrines built compared with the number planned
- percentage of households that have latrines; number of households that want latrines
- percentage of latrines that are well constructed
- percentage of latrines that have doors
- percentage of latrines that have a roof
- latrine appearance: Have any cosmetic improvements been made? For example,
  - Have the walls been painted?
  - Are the surroundings clean?
  - Have owners set up hand-washing facilities by the latrine?

- Do owners express pride in the latrine?

Then take the next topic, sanitation education for latrines, and get three or four responses from each group.

Possible responses:

Sanitation Education for Latrines

- Latrine use: To what extent is the entire family using the latrine?
- Latrine maintenance: How clean is it? Does it smell?
- For a pit latrine: Is the cover in place? Does the cover make a good seal?
- For the VIP latrine: Is the fly screen in place?
- Can members of the community list three reasons why latrines are used?
- Do members of the community know they should wash their hands after using the latrine?
- Is there evidence that people have not been using the latrines in the community?

Distribute "Handout 15-1: Monitoring and Evaluation."

8. Conclusions — *10 minutes*

Refer back to the definitions of monitoring and evaluation and emphasize key points made in the session about participants' role in monitoring and evaluation.

Ask,

- What for you was most meaningful about this session?

After a few moments of reflection, take responses and record them on a flipchart. Review the completed list.

9. Wrap-Up — *10 minutes*

Ask,

- In thinking about your own potential program, what are some steps you'll want to be sure to take?

Go back over the session objectives and ask if they were met. Say a few words about the next session, "Sanitation Education Presentations"

Materials

Handout 15-1: Monitoring and Evaluation

Flipchart A: Session 15 Objectives

Flipchart B: Monitoring

Flipchart C: Group Task—Monitoring Modified Behaviors

Flipchart D: Evaluation

Flipchart E: Small Group Evaluation Task

Monitoring and Evaluation

A. Monitoring

Monitoring has two key components:

- Continued observation of the prevalence of high-risk behavior, both the frequency and the degree of exposure to excreta.
- Continued observation of ongoing interventions.

Prevalence of High-Risk Behaviors

High-risk behaviors are defined as behaviors that allow (or even promote) exposure to excreta. Examples include

- defecation in areas where excreta may come into contact with the individual or others or contaminate a water supply,
- nonwashing of hands (with soap) after defecation,
- allowing domestic animals to defecate in areas where their excreta may come into direct contact with people or a water supply,
- handling of properly isolated excrement before it has decomposed to the extent that all pathogens are inviable,
- not maintaining the cleanliness of the latrine, and
- not properly disposing of wiping material.

Ongoing Interventions

Examples of key questions for monitoring ongoing interventions include

- Sanitation education activities
  - How well are people understanding the message?
  - To what extent are appropriate groups (groups exhibiting high-risk behaviors) being targeted?
- Newly completed latrines
  - How would you rate user satisfaction?
  - How well does the facility satisfy the main purpose of latrines, that is, isolation of excreta?

- Are acceptance and use of the facility achieved by all members of the family?

Observation during site visits is the best way to monitor, as opposed to written letters and reports or secondhand accounts. Observation during site visits requires sensitivity.

Observable indicators of change may include

- cleanliness of a latrine
- signs of latrine use
- absence of improperly discarded wiping material
- absence of excreta around the latrine or house
- basic pit latrines are covered when not in use
- small children know how to use the latrine properly
- observance of hand washing after latrine use

B. Evaluation

Evaluation is defined as follows:

Planned review of program successes and failures, cost to benefit ratio, and recommendations for future programs.

Looking Back over the Year

In general, programs should be evaluated once a year. Important questions to ask in looking back over the year might include the following:

- To what extent are the latrines functioning properly?
- To what extent are they being used?
- What is the remaining life of each latrine?
- What have been the major problems?
- How strong is community interest?
- What does the community view as the benefits of the program?
- What are benefits of the program? (In terms of improved health status, reduced diarrhea, and sickness and death among small children.)

- How have the interventions affected the high-risk behaviors?
- Which high-risk behaviors are still evident? To what degree?

Looking Ahead to the Coming Year

One important outcome of an evaluation is clarification of the key questions that should be considered over the coming year. Important questions to ask in looking ahead to the coming year might include the following:

- To what extent is there interest in upgrading latrines? In constructing new latrines?
- How has the situation changed in the community? (For example, does it have an increased or reduced water supply that would make other latrine options feasible?)
- In what ways would the community benefit from a refresher course in sanitation education?
- How could the gap between current high-risk behaviors and improved behaviors be bridged? (problem clarification)
- Have new high-risk behaviors been identified? How could they be addressed?

Considering Overall Recommendations

Important questions in considering overall program recommendations would include

- What's going well? What could be improved?
- What lessons have been learned from the past year?
- How should these lessons be applied to other communities?

Emphasize that—as in monitoring—the best evaluation method is observation during site visits.

Session 16

SANITATION EDUCATION PRESENTATIONS *3 hours, 55 minutes*

Objectives

By the end of this session, the participants will be able to

- deliver a sanitation education presentation.

Overview

In this session, participants deliver the presentations on sanitation topics that they prepared in Session 13. The audience for these presentations is selected by the trainers. Following the presentations, participants receive feedback from the trainers as well as their peers.

Procedures

1. Introduction *10 minutes*

Brief participants on how the logistics for the presentations will work.

2. Practice Session *3 hours, 15 minutes*

Remain in the two subgroups that were established in Session 13. Schedule each of the presenters in the following manner:

Round 1: 20-minute presentation

10-minute feedback (from trainer and observers)

Then take a short break to allow the second presentation group to set up. Proceed with Round 2 and Round 3 in the same way.

Set up the room so that the participants who are observers are discreetly sitting in the back.

Trainer Note: If these sessions are held for "real participants" in other settings—for example, primary school students in a school classroom—you may have to adjust the practice schedule to fit within the schedule of the recipient group.

Lead each feedback session by asking observers what was effective, focusing on the presentation steps and use of facilitative skills. Then, ask for suggestions for improvement. Keep the feedback session brief, limiting your comments to two or three key points so as not to overwhelm the practice presenters. At appropriate points, especially at the end of all sessions, ask the community members who were participants for their feedback.

3. Conclusions — *20 minutes*

Reconvene all participants in one room. Then ask them what insights they gained about

- preparing presentations
- delivering presentations

Write their answers on a flipchart.

4. Wrap-Up — *10 minutes*

Ask participants to write down what they will focus on in their next presentations with their communities. When they have finished, ask for a few examples from the group.

Session **17**

ACTION PLANNING *2 hours, 15 minutes*

Objectives

By the end of this session, participants will be able to

- state and clarify unresolved questions that have surfaced on the basis of the workshop experience, and
- develop a three-month action plan for developing or improving an excreta disposal management program back home.

Overview

This session is designed as a workshop wrap-up. It should allow the participants to review critically the work they have done to date, answer any lingering questions, and plan the next steps for their own program back home.

Procedures

1. Introduction *5 minutes*

Introduce Flipchart A: "Session 17 Objectives." Briefly review the content in the overview and add any appropriate comments.

2. Unresolved Questions *40 minutes*

Ask the participants individual to think through all of the things they have done during the two-week program. Have them look through their notes and the course handouts. As they do this they should write down all of the questions that still remain about the development of an excreta disposal management program.

After 15 minutes, review briefly the entire course, referring to key course flipcharts that have been posted around the classroom.

Then, list all their unresolved questions on a flipchart (this enables you to see if most people have the same questions and gives you time to think about them).

Select the most important questions and hold a general discussion, answering the generated questions.

3. **Individual Action Planning** ***45 minutes***

Say that the easy part—the course—is almost over. The hard part is the application of the ideas and skills developed during the course.

Say that in this last phase of the course—in some ways the most important phase—you want to give them an opportunity to plan how they will put to use the ideas and skills learned in this course. Present the individual task on Flipchart B.

Flipchart B: Individual Action Planning

- Identify the steps you will take in the next three months to begin applying the cours

e ideas and skills, including the following:

  - people to contact
  - when
  - resources needed
  - activities you will undertake, and how

- Take 40 minutes.

Distribute Handout 17-1: "3-Month Action Plan."

4. **Pair Task: Sharing Action Plans** ***25 minutes***

After the individual task is completed, give the following pair task on Flipchart C:

Flipchart C: Pair Task

- After you have completed an "action plan" for three months, pair up with another person to exchange ideas and advice.
- Take 20 minutes.

Say that each person will have 10 minutes to talk about his or her plan.

5. **Large Group Discussion: Action Plans** ***15 minutes***

Bring the participants back together and ask them to share with the full group a sample of their action planning so that others may get ideas.

6. Closure **5 minutes**

Review the objectives of the session. Ask if any questions have been left unanswered.

Materials

Handout 17-1: 3-Month Action Plan

Flipchart A: Session 17 Objectives

Flipchart B: Individual Action Planning

Flipchart C: Pair Task

Three-Month Action Plan

Activities to Undertake	Resources Needed	People to Contact	By When

Session 18

TRAINING PROGRAM EVALUATION *1 hour and 10 minutes*

Objectives

By the end of the session, participants will have

- completed the training program evaluation form, and
- provided oral feedback to the trainers.

Overview

It is assumed that the trainers will be able to evaluate the workshop in a variety of ways, formally and informally. Each session contains objectives that are generally verifiable by observation. Skills can be either demonstrated or not. It is also assumed that the recipients of this training are well-motivated adults who will seek help if they don't understand something. The ultimate evaluation measure, however, will be demonstrated long after the course, when the participant is implementing excreta disposal management programs. If the training has been successful, the participant will be able to use the learning from the course to promote a program that is technically and socially sound.

This evaluation session provides one additional source of data. It is based on participants' feelings and observations about the course. The information gained from this session can be used to improve future courses and to help the trainer do a better job next time in conducting this course. This session uses two tools, a written evaluation form and an informal oral feedback session. The written form should be administered to provide a record for the trainer and the sponsoring agency. It is intended to be done anonymously to ensure more open feedback. The oral portion is designed to gather information about the workshop that will help explain and interpret the written data and provide an opportunity for give and take between the trainers and the participants.

Procedures

1. Introduction [illegible] minutes

Introduce the evaluation session by explaining that the evaluation is important to the trainers as a way of learning how the training has been received and for future training purposes. Describe the two parts of the evaluation (written and oral) and the time constraints.

2. Review of Training Program Goals *5 minutes*

Go back over the goals for the training program, reminding participants of some of the activities they did to achieve the goal.

3. Written Evaluation *30 minutes*

Distribute Handout 18-1: "Evaluation Form" and answer any questions about the instructions on the form. Then give the group time to fill it out.

4. Oral Feedback *20 minutes*

Write on the top of a flipchart the following headings that follow:

Course Strengths *Suggestions for Improvement*

Ask the group to volunteer comments on both sides of the question. Record comments as they are given. At each comment, it is good to verify the comment with others in the group to see if the comment is shared by others or is only one person's opinion. It is particularly important that the trainer not act defensively and spend a lot of time explaining weaknesses. This will only serve to discourage constructive feedback.

5. Closure *10 minutes*

Close the session in the locally appropriate manner and express appreciation for the group's participation in the training program.

Materials

Handout 18-1: Evaluation Form

Evaluation Form

1. Goal Attainment

Please circle the appropriate number to indicate the degree to which the workshop goals have been achieved. On the scale of 1 to 5, 1 equals "not achieved" and 5 equals "very much achieved."

A. Describe appropriate approaches for developing an excreta management program in the community.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

B. Identify the excreta disposal behaviors of a community and the impact of those behaviors on health.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

C. Collect information to assist in the development of an excreta management strategy.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

D. Analyze critical factors in determining appropriate latrine selection.

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

E. Describe the design requirements for four types of latrine.

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

F. Develop a latrine construction program plan, supervise construction, and assess and upgrade existing latrines.

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

G. Apply interactive techniques to sanitation education.

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

H. Monitor and evaluate sanitation interventions.

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

I. Develop an action plan to implement a sanitation improvement program "back home."

Not Achieved		Somewhat Achieved		Very Much Achieved
|	|	|	|	|
1	2	3	4	5

Comments:

2. Course Feedback and Learning

Please answer the following questions as fully as possible so that the trainers can learn how effective the training course methodology was.

A. What have been the most positive things about this course? Comments:

B. What have been the most negative things about this course? Comments:

C. What one thing stands out as important to you in this workshop? Comments:

D. What things have you learned that you did not know before? Comments:

3. Course Organization and Training

A. What comments do you have about the way the course was planned and organized?

B. What can be done in the future to improve a course like this?

C. What specific steps in developing a community sanitation and latrine improvement program do you feel you will need to learn more about in order to promote and develop a program successfully in the future?

D. What feedback do you have for the trainers?

Appendix

VIP LATRINE DESIGN AND MATERIALS CHECKLIST

Ideally, the construction of the demonstration latrine will involve materials readily available in the parts of the country where the workshop participants will be working. The list of materials given here provides an example. It will have to be customized to each workshop area to take into account the differences in the dimensions of building materials from place to place and he cost of building materials. The design for the VIP latrine is shown in the figure on the next page.

The design should also be customized to the place where it will be utilized. For examples, for a school a multiple vault system may be desired.

For this example, the following standard building units and construction practices are used:

cement bag: 50 kg or 33.2 liter (0.0332 m^3)

cinder block: 10 by 15 by 20 cm

concrete mix:

slab 1:2:4 (cement:sand:gravel)

mortar 1:3 (cement:sand)

mortar joint: 1 cm

A. Materials List

The materials list is provided in two forms: the first part is a list of the building materials needed to construct each component of the latrine; the second is a collated list of building materials.

<u>Materials Required for Latrine Components:</u>

Latrine slab (reinforced concrete: 1:2:4), 1 by 1 by 0.07 m

gravel	0.07 m^3
sand	0.04 m^3
cement	0.5 bags
rebar (3/8")	8 m
tie wire	1 m
pedestal seat	

forms for slab	
wood (2" by 4" by 3.5'N)	4
Pit lining (cinder block of dimension 10 by 15 by 20 cm)	
cinder block	300
sand	0.08 m^3
cement	0.75 bags
Superstructure (cinder block of dimension 10 by 15 by 20 cm: mortar of 1:3) by 1.2 by 1.8 m	
cinder block	260
sand	0.09 m^3
cement	1 bag
Roof	
corrugated tin (4' by 8')	1
roofing nails (1.5")	16
wood (2" by 4" by 4')	4
tar for sealant	1/2 liter
Door	
corrugated tim (4' by 8')	1
wood (2" by 4" by 6')	2
(2" by 4" by 2.5')	3
(2" by 4" by 2.5')	2
roofing nails (1.5")	25
wood nails (3")	20
hinges	2
Door frame	
wood (2" by 4" by 6')	2
(2" by 4" by 2.5')	2
concrete nails (3")	10

wood nails (3")	8
Ventilation	
vent pipe (PVC pipe 6")	3m
sleeve (6")	1
fly screen (1m by 1m)	1
wood (window frame)	
(1" by 3" by 2.5')	4
(1" by 3" by 6")	4
wood nails (2")	16

Total Materials

Gravel	0.07m^3
Sand	0.22m^3
Cement	2.5 bags
Rebar	8 m
Tie wire	1 m
Cinder blocks	580
Corrugated Int (4' by 8')	2
Roofing nails (1.5")	42
Concrete nails (3")	20
Wood nails (3")	28
Wood nails (2")	16
Door hinges	2
Fly screen (m^2)	1
PVC pipe (6")	3m
PVC pipe sleeve (6")	1
Tar	0.5 lit.

Wood:

(2" by 4" by 8')	4
(2" by 4" by 6')	7
(1" by 3" by 12')	1

B. Construction Schedule

To ensure that the construction timetable is met, a master builder should be "on call" during the entire course of the workshop, including the preliminary latrine excavation. This will necessitate an increased labor expense because the construction would take considerably less time for a master builder to complete without the participants' interruptions and course scheduling.

Before start of workshop

- Excavate Pit

Days 1 to 3

- Construct Base and Pit Lining

  In the afternoon of Day 3, the mason should prepare for the construction of the slab. This would entail building the forms, cutting and tying the regar, and having ready the appropriate amount of sand, gravel, cement, and water.

Day 4

- Construct Slab

  In the morning, the mason should construct the slab after the arrival of the participants. They should be able to see the process involved in slab construction.

Days 4 to 6

- Curing of Slab
- Construct Pedestal Seat (if one is desired)
- Initiate Construction of Foundation Superstructure

  The foundation and half of the superstructure should be build. The visit scheduled for the afternoon would allow participants to observe construction.

Days 6 to 9

- Placement of Slab and Vent Pipe
- Construction of Roof

- Use Cement and/or Tar to Seal Structure Against Vectors

  The mason should finish the superstructure with plaster and roof by the time of the visit in the afternoon of Day 9. During the visit, he should install the slab.

Day 10

- Placement of Fly Screen in Windows and Vent Pipe
- Door
- Loose ends

  Install the pipe, screen, and door and finish all loose ends. Participants should also see latrine in finished form.

C. Notes on Construction

Excavate a pit of dimensions $1m^2$ by 2.5m deep. If soil is too unstable for the pit to be self-supporting, the cinder block lining should be constructed as the pit is excavated. The first three courses of cinder blocks should be built with a two cinder block thickness to form a base upon which the slab and superstructure will rest (in some cases in independent foundation should be built). Below the third course (from the top) the vertical joints between the cinder blocks should not be mortared so as to provide an avenue for the escape of liquids in the pit. The pit walls should extend above the ground level to inhibit rainwater runoff from entering the pit. With the pit walls in place, the pit opening should be narrowed to $0.8m^2$.

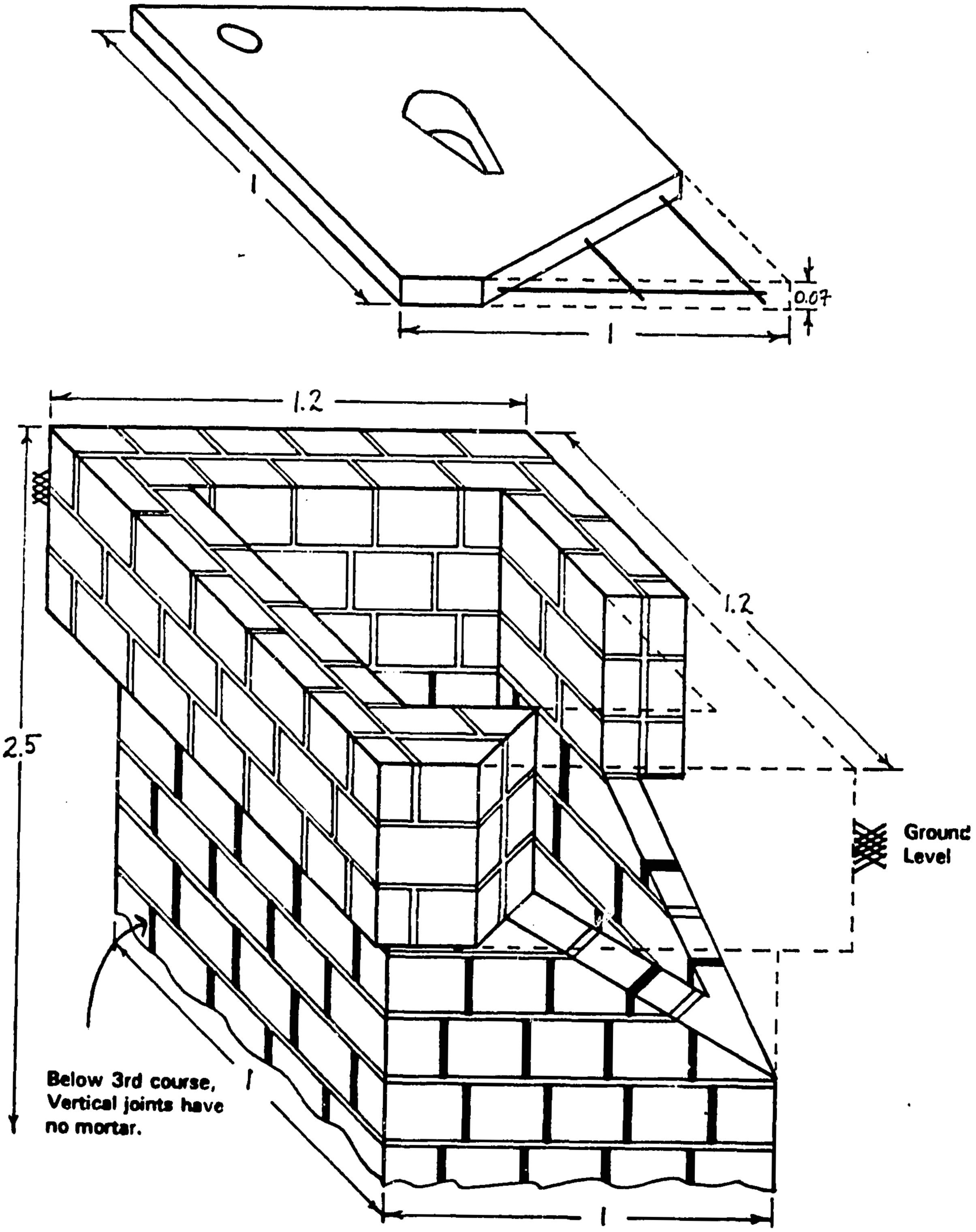
The slab should be constructed as pictured in Figure 6 of Handout 10-3. The placement of rebar is shown. The rebar should also be tied with thin malleable wire to form a rigid skeleton. Transport of the slab is facilitated by forming handles of rebar and tying it to the rebar frame. Threading a stout pole enables three or four persons to transport the slab. The slab should extend 10 cm over the base on each side: It is not necessary to make the slab integral with the base as its weight will keep it from moving. This also allows the slab to be used over again when the pit fills. The edge between the slab and the base should be sealed with mortar, however, to restrict the access of vectors and rescue smells around the latrine.

To form a hole in the slab for the vent pipe, a PVC pipe sleeve of the same dimensions can be used; it is put in place as the concrete is being poured and becomes an integral part of the slab. (Pouring concrete with the PVC pipe itself as an integral part makes the slab difficult to transport.) When the slab is placed over the pit, the pipe can be installed. The installation of the slab and vent pipe should take place before the construction of the roof, because in this design the pipe extends through the roof. The tin roofing material should be cut just larger than the vent pipe; the space between the vent pipe and the roof should be sealed with tar. The vent pipe should extend at least 1m above the roof, and the opening should be covered with fly screen.

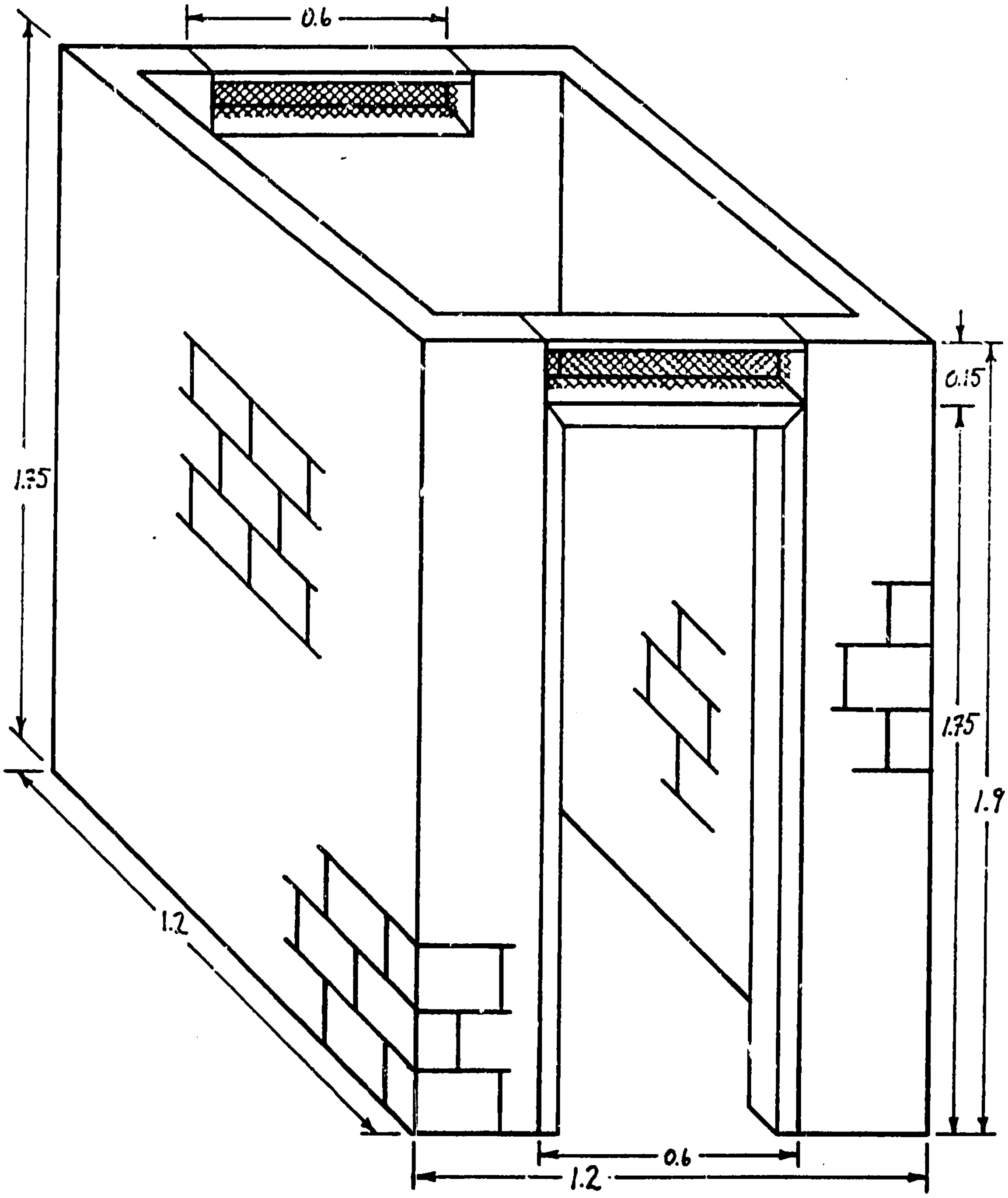
Note 1: It is sometimes argued that the vent pipe should stand on the outside of the superstructure because the thermal heating by the sun increases the air circulation efficiency of the vent pipe. However, the difference in effectiveness has proven to be minimal. On the other hand, by concealing the pipe on the inside of the superstructure the pipe is protected from the elements and children are kept from climbing on it.

Note 2: Although a 15 cm (6") vent pipe is recommended, vent pipes of lesser diameter have proven to be effective and much less costly.

An exact replication of the hole and footpad dimensions is not necessary. In cases where a pedestal and seat are required, they can be constructed form the leftover cinder blocks with a wooden frame as a seat. The hole in the seat should be smaller than, and directly over, the hole in the slab to avoid the soiling of the slab.



Pit Lining and Slab



Latrine Superstructure

Workshop Goals

- Describe appropriate approaches for developing a sanitation improvement program in the community.
- Identify the excreta disposal behaviors in a community and their impact on health.
- Collect information to assist in the development of a sanitation improvement strategy.
- Analyze critical factors in determining appropriate latrine selection.
- Describe the design requirements for four types of latrines.
- Develop a material, labor, and transport plan for a latrine program; supervise construction; and assess existing latrines for possible upgrading.
- Apply appropriate preparation and delivery techniques to sanitation education.
- Monitor and evaluate sanitation interventions.
- Develop an action plan to implement a sanitation improvement program "back home."

Workshop Schedule

DAY	1	2	3	4	5
WEEK 1	1. Introduction to the Training Course (1 hr., 50 min.) 2. Approaches to Improved Excreta Disposal Mgmt. (1 hr., 45 min.) 3. Problem Clarification (3 hr., 25 min.)	4. Skills for Conducting Behavioral Surveys (3 hr.) 5. Conducting a Survey of Excreta Disposal Practices (4 hr.)	5. Conducting a Survey —continued (2 hr.) 6. Determining Appropriate Interventions (4 hr., 20 min.) 7. Latrine Concepts (1 hr., 10 min.)	7. Latrine Concepts —continued (4 hr., 5 min.) 8. Factors in Latrine Choices (2 hr., 50 min.)	9. Information Collection Field Exercise (7 hr., 10 min.)

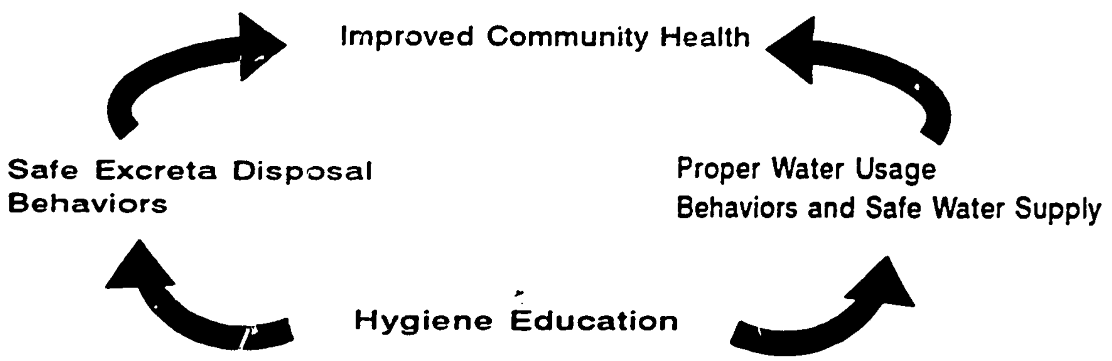
DAY	6	7	8	9	10
WEEK 2	1. Details of Latrine Design (7 hr.)	11. Planning a Latrine Construction Program (7 hr.)	12. Supervision of Construction (2 hr.) 13. Sanitation Education Methods (4 hr., 15 min.)	14. Sustained O&M and Upgrading Existing Latrines (5 hr., 30 min.) 15. Monitoring and Evaluation (3 hr., 40 min.)	16. Sanitation Education Presentations (3 hr., 55 min.) 17. Action Planning (2 hr., 15 min.) 18. Training Program Evaluation (1 hr., 10 min.)

A Program Framework for Improved Community Health

A. Equal Consideration to Safe Excreta Disposal

Although the 1980s saw the provision of safe water to thousands of communities worldwide, health benefits have not lived up to expectations. It is now widely recognized that potable water alone cannot bring about the health benefits anticipated from the Water Decade (1980-1990).

Recent findings provide convincing evidence that safe excreta disposal is equally as important as proper water usage and safe water supply in achieving long-term health benefits—one without the others will likely not result in an improved health status for the community. These findings suggest that much more attention should be given to developing or improving community-level excreta management programs. They also suggest that such programs should be carried out in conjunction with water usage and water supply programs, and not at their expense.



Note: This handout is based on WASH Technical Report No. 72, *Rethinking Sanitation: Adding Behavioral Change to the Project Mix.* Prepared by May Yacoob, Barri Braddy, and Lynda Edwards. July 1992.

B. Understanding the Problem in Light of Excreta Disposal Behaviors

Failures in past sanitation programs have been blamed on many reasons. In some cases, blame has gone to the excessive emphasis that was placed on technological improvements—constructing new latrines, for example—at the expense of behavioral considerations, such as latrine usage and upkeep and general hygienic practices. In other cases, blame has gone to the lack of understanding by program planners of the religious and cultural context within which the latrine or other sanitation promotional activities took place.

Regardless of the reasons, many inappropriate latrines were constructed—inappropriate in terms of the type constructed, where they were constructed, or for whom they were constructed. Consequently, there is ample evidence that the provision of new latrines does not guarantee usage or improved health.

Most experts agree that understanding excreta disposal behaviors is a prerequisite to determining the appropriate intervention. The progression of understanding could be viewed as follows:

Influence of Environment on Behavior	*Health Conditions Relevant to Sanitation*	*Indicators of Behavioral Change*	*Interventions*
■ free-roaming domestic animals	■ pathogen-related illness (e.g., diarrhea)	■ application for latrine	■ sanitation education
■ children defecating indiscriminately		■ attending sanitation sessions	■ latrines
		■ teaching children to use latrines	■ policy changes

In this progression, solutions to health problems are linked to specific behaviors. What are the individual behaviors that are contributing to the problem? What steps should be taken to help change those behaviors? If children are defecating indiscriminately—behavior that causes pathogen-related illness—how can that behavior be changed? One part of the solution might be to teach children how to use latrines. Another part of the solution might be to have older children accompany younger children to the latrine, especially if they are frightened by it. Building more latrines may or may not be part of the solution. The important point is that until the excreta disposal behaviors of children and adults are clearly understood, and thus the behavioral changes required to improve health conditions, one can never be certain that the best, most appropriate solution has been identified.

C. Definition of Proper Management of Excreta Disposal

Taking the lessons learned from the past into account, the following definition is proposed for the proper management of excreta disposal:

> The isolation of human excreta in ways that prevent excreta from becoming a threat to health, that are acceptable to all members of the local population, and that are sustainable.

The key terms in understanding this definition are:

Isolation

Human excreta must be isolated to prevent oral-fecal contamination. There are many ways to isolate human excreta effectively, including low- and high-technology options.

Acceptable

If a percentage of the community's population is not isolating its excreta, oral-fecal contamination can occur and can adversely affect everybody in the community, including those who are isolating their feces. Therefore, ways must be found for safe excreta disposal that all members of a community—men, women, children—are willing to adopt.

Sustainable

If lasting improvements in community health are to be achieved, the ways selected for feces isolation must not only be appropriate and acceptable to all members of a given community, but they must also be readily affordable and maintained by the local users.

This definition is intended to take into consideration the technology introduced, the individual behavior of users, and the religious and cultural context within which the promotion of an excreta disposal management program is to take place.

D. Three-Part Model—An Effective Excreta Disposal Management Program

To achieve effective excreta management, as defined above, the following three-part model is recommended:

1. Problem Clarification

2. Appropriate Interventions

3. Monitoring and Evaluation

In general this model signifies the following:

- Effective excreta management is an *ongoing process* of clarifying the problem, introducing appropriate interventions, and then monitoring and evaluating those interventions and the resulting behavioral changes, if any, to clarify additional problems.
- Planners should first *clarify the problem* in order to determine what changes in excreta disposal can reasonably be introduced within the community, and only then choose the technologies and supporting interventions to be implemented.
- If Part 1 was not well executed, Part 2 of the model will likely not result in the best interventions for the right problems.

Specifically, the three parts of this model are delineated as follows:

Problem Clarification

- What is the prevailing oral-fecal contamination route?
- What are the contributing environmental conditions?
- What are current excreta disposal behaviors?
- What are barriers to modifying behaviors?

Appropriate Interventions

- What is the problem(s)?
- What do people say they need? What are they interested in?
- What has been done before?
- What local or national policies impinge on sanitation practices or latrine choices?

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- What interventions would help reduce or eliminate high-risk behaviors associated with excreta disposal?
    - ☐ latrines
    - ☐ sanitation education, referring specifically to isolation of human excreta
    - ☐ local and national policy changes
- What are the technological options?
- What interventions would help overcome religious or other barriers to changing behavior?
- What human and organizational resources are available to ensure program sustainability?

Monitoring and Evaluation

- To what extent are the interventions resolving the excreta disposal problems?
    - ☐ current versus desired excreta disposal behaviors
    - ☐ contributing environmental conditions
- Which interventions are working well? Why?
    - ☐ indicators of success exhibited
- Which are not working well? Why?
    - ☐ indicators of success not exhibited
- What additional problems have been uncovered?

With this model, the basis for future problem solving in the management of excreta disposal is based on

- knowing what the existing hygiene behaviors and practices are, and
- knowing what behavioral changes the community must undertake to achieve better health.

This three-part model presents development and change as a process of modification that solves problems relating to what people currently do, rather than as a means by which "newer" and "better" technologies replace existing practices and arrangements. If this process is adhered to in planning new or improved excreta disposal management programs, the chances for program success and better community health will be improved.

Key Steps in Problem Clarification

1. **Understand the extent of oral-fecal contamination in a community.**

2. **Identify current high-risk behaviors associated with excreta disposal in the community.**

   High-risk behaviors are actions by men, women, and children that allow exposure to human excreta.

3. **Identify indicators of modified behavior.**

   An indicator is an observation or a verbal response that would prove or suggest that a high-risk behavior has been modified or eliminated. Examples are observing that lids cover latrine holes, and seeing a soap dish with soap and a bucket of water next to the family latrine and observing family members use the soap to wash their hands after defecating.

4. **Identify the barriers to changing high-risk behaviors.**

   A *barrier* is a belief, a norm, an attitude, or a condition that either reinforces the high-risk behavior or limits the modified behavior. Barriers can be religious, cultural, social, economic, or technological in nature; and they may not be readily observable.

   For example, a crumbling slab or a dark latrine are conditions that may cause people to fear using the latrine; or religious beliefs may dictate that women and men cannot use the same latrine; or it may be a community norm that a certain abandoned field or lot is an acceptable place for children to defecate. These are all examples of barriers to changing behaviors.

Case Study — Cause and Effect of Oral-Fecal Contamination

Hawa lives in a community of about 100 families. The government installed two wells many years ago. Both wells were well constructed and provided with hand pumps. One pump broke down a while back and the people in the village took it out and now get water from it by dropping a bucket on a rope down the well. The area around this well is always wet, and the animals in the village often come to drink from the puddles.

Hawa understands about hygiene and tries very hard to keep her family clean and healthy. She dug a latrine near her house sometime ago and trains her children to use it as soon as they are big enough. Hawa has had eight children, two of whom died very young after severe bouts with diarrhea. She has been very careful with her most recent child, who is now two years old.

For the first year, the youngest child did very well, only suffering minor bouts of diarrhea that cleared up very quickly. However, the child now seems to be sick more and more, and nearly always with diarrhea. Hawa works hard at keeping the child clean and is doing well in training her to always use a chamber pot for defecation.

Hawa is very upset about her daughter, because it seems to her that no matter what she does the child still gets sick. In fact, it seems that the more mobile the child gets, the more often she gets sick.

If this wasn't enough, Hawa has noticed that her husband and eldest son, both fishermen at the nearby lake, seem to have less energy and interest in things than they used to have. The son also seems to be getting a swollen belly, almost like a lopsided pregnancy. Hawa talks to her husband, who confirms that he is indeed feeling tired a lot.

Not everyone in Hawa's community is as enlightened as she. In fact, the majority of the people use the surrounding bush and lakeside for defecation, and small children are allowed to go almost anywhere. As Hawa's daughter gets older, she comes into greater contact with other children and animals, and possibly their feces. Both Hawa's husband and son are suffering from cholera, a common disease when infected people defecate near fresh water.

Case Exampies

1. The people of Dombashawa traditionally defecate in the bush. They are aware of the dangers of fecal contamination and always bury their feces. They use a small hoe-like implement for this purpose and always carry it with them when going to relieve themselves.

   - Is this an appropriate means of waste disposal?

2. Bambung is a village close to a river. The people have built defecation platforms over the river. Mothers throw their children's feces into the river. Health workers have tried to convince the people to start using latrines, but the people are not interested and say that their current method is much better. They talk of the smell from latrines and point out that they cannot come into contact with fecal matter by using their current method. The incidence of typhoid and dysentery infection is very high in the community.

   - Is this an appropriate means of excreta disposal?

3. At Bhaktapur in Nepal, community members thought themselves to be healthy. A deworming campaign was carried out, which included a competition to produce the greatest number of ascarides—roundworm that are large and easily seen in feces. Mothers were shocked to discover that their children produced the greatest number of worms. The health workers explained that the worms were caused by improper defecation habits.

   - Why were the children the most infected?

Cause-and-Effect Relationships in Oral-Fecal Contamination

- Interaction between a practice and its effects:
  - It is important to remember that the effect of a practice may not be "seen" for a very long time, if at all. It can be very difficult for people to understand the link between things—for example, defecating in lakes today and a swollen abdomen from schistosomiasis five years later.
- Feces and water contamination:
  - It is important to understand that water is an ideal medium for the transmission of most pathogens. Once pathogens enter a water source, they have a greater chance of infecting a large number of people.
- Feces and direct transmission of disease:
  - The above point refers to this issue: Harmful organisms will cause disease once ingested by a new host. Disease organisms cannot be seen on hands, and even if hands do not appear to be dirty, they may well be contaminated.
- Feces and indirect transmission through animals:
  - Disease organisms are tiny and can live a long time in the mouth of a dog that has been touching feces. Many disease organisms, for example, schistosomes, spend part of their life in another animal (intermediate host), then leave that animal and enter a new, human host.
- Contamination of food by poor personal hygiene behavior:
  - Otherwise clean hands may well harbor disease organisms if not washed after defecation. Food is also an excellent medium for the growth and reproduction of most disease organisms.

Problems of Sanitation

A. Isolation of Fecal Matter

- Throwing waste in rivers or lakes does not guarantee isolation.
- Many diseases are perpetuated by animals—pigs, snails, fish, for example—coming into contact with excrement.
- The need to isolate the feces of small children often goes unaddressed. *It is a misconception that children's feces are not dangerous.*
- Latrines are not the only method of isolation.

B. Personal Cleanliness

- The crucial times for handwashing are
  - after defecation,
  - before preparing food,
  - before offering food,
  - before eating, and
  - before and after attending to babies.
- It is important to use soap.
- Small children should be bathed daily, and their hands should be washed with soap before they eat.

C. Contact with Excreta

- Direct contact:
  - touching or treading in your own or other people's feces.

- Indirect contact:
  - feces on food,
  - flies on food,
  - dogs licking people,
  - animals eating feces, then being eaten by people—pigs, cows, fish, and
  - coming into contact with parasites that came from feces, for example, guinea worm.

D. Consequences of Sanitation Problems

- death,
- pathogen-related diseases,
- economic loss—cost of treatment, loss of productivity, and
- constant illness among children: they will put almost anything in their mouths.

Disease Transmission

A disease-causing organism is known as a *pathogen*. Four types of pathogens cause disease:

- **Viruses**—Many viruses infect the intestinal tract of people and can be passed on in feces. They can survive outside the body in an inactive state. They can infect a new human host by ingestion or inhalation.
- **Bacteria**—They are found almost everywhere. They can enter a new host by ingestion (in water, food, or dirt), inhalation, through the eye (rubbing eye with fecally contaminated fingers), or by contact with an open wound. During infection, large numbers of bacteria will be passed in feces, thus allowing the spread of infection.
- **Protozoa**—They are often found in the intestinal tracts of humans and animals. Infective forms are passed as cysts in feces. They can often survive in this state for a long time until ingested by a new host.
- **Helminths** (worms)—They have massive powers of reproduction, producing great numbers of eggs, which are often passed in feces and which help to guarantee infection of a new host.

Main methods of disease transmission:

1. Fecal-oral, either directly or through water and food, for example, diarrhea, cholera, typhoid, and poliomyelitis. Example: Water in a protected well may be contaminated from a latrine that is situated too close to the well.
2. Fecal-oral, or through the skin, requiring a length of time outside the body in a suitable environment (usually warm, moist soil). For example, with ascaris (roundworm), trichuris (whipworm), and Ancylostoma (hookworm), infective larvae penetrate unbroken skin, usually the foot.
3. Infections requiring intermediate hosts—three main types:
   - Infections with aquatic intermediate hosts.
     - Schistosomiasis. Excreta from an infected person enters water. Eggs of parasite hatch and enter snail (intermediate host); parasite develops into infectious stage, leaves snail, and penetrates human skin.

- Guinea worm. Eggs break out of skin of infected person in water and enter Cyclops (intermediate host, a tiny water crustacean). Cyclops ingested by humans when drinking.
- Clonorchiasis (liver fluke). Infected excreta enter water, parasite enters snail (first intermediate host). Snail is eaten by fish (second intermediate host). Undercooked fish eaten by humans.

- Infections with land animals as intermediate hosts.
  - Taenia (pig and cow tapeworms). Pig or cow (intermediate host) ingests parasite eggs from infected person's feces; undercooked pork or beef is eaten by human.
- Infections with insects as intermediate hosts.
  - Most of these insects are water related, because the insects involved need water to breed, for example, plasmodium (malaria), Onchocerca (river blindness), filaria (elephantiasis in severe cases). Parasite passed from infected human to intermediate hosts—mosquito (malaria, filariasis) or blackfly (river blindness) when insects take a blood meal. Insects infect the next person they feed on.

Blocking Transmission Routes

This handout gives several examples of the ways certain contaminating activities can be blocked.

Object: Hands

Means of Contamination	*Means of Blocking Transmission*
1. Touching Feces	Wash hands after defecation
	Isolate feces
	Wash hands after attending to babies
2. Contact with fecally contaminated soil	Wash hands
	Stop defecation in fields
3. Contact with dogs' mouths	Wash hands after touching dogs
	Avoid touching dogs

Object: Food

Means of Contamination	*Means of Blocking Transmission*
1. Touched by hands	Wash hands before preparing, offering, or eating food
2. Touched by animals	Keep food in protected place
3. Touched by dirty utensils	Clean all utensils before cooking and eating
4. Contaminated in the field	Wash all fruits and vegetables thoroughly
5. Contaminated by parasites	Cook all meat and fish very well isolate feces so animals and fish cannot come into contact with them

Using Observation to Collect Information

Information collection by observation can prove as valuable as more formal means of information collection—meetings and interviews, for example—especially as an initial approach to a community.

Using observation to collect information is important, for the reasons outlined below.

- Observation can easily be carried out during initial visits while you are getting to know the community and they are getting to know you.
- Information gathered will help to direct a more formal survey to be carried out at a later date.
- Observation may yield information that people are reluctant to give if asked formally.
- Observation gives "true" information. In more formal meetings and interviews, people sometimes respond to questions with answers that they think the questioner wants to hear, or with information about what they indeed sometimes do when the situation is right—for example, when they are close to a latrine, when they have time, when they're not occupied doing something else.

  For these reasons, especially, observation is important in determining children's behaviors and mothers' behaviors with small children.
- Observation allows you to see the community interacting and to see who is respected and influential.
- Because observation provides "true" information on practices, it can give a starting point for modifying excreta disposal behaviors.

Case Example: Observing Excreta Disposal Behavior

A development worker collecting data on the disposal of children's feces paid an early morning visit to the young mother of a one-year-old child. She has visited with the young mother in the past, and they have had general discussions on infant care.

Arriving just after dawn, the development worker found that the mother had already lit the fire and swept the terrace in front of the house. When the mother noticed that her child had defecated on the ground, she covered the feces with sand, swept them up, and threw them in the dry drainage channel behind the courtyard.

The mother then dressed the child in a pair of light cotton pants, in which the child again defecated. The mother rinsed off the child with plain water and rinsed the pants in plain water, as well. The dirty water was then thrown on the ground in a corner close to the cooking area. The mother then went to wash herself with soap, dressed herself in clean clothing, and bathed the child with medicinal soap.

The same mother, in an earlier questionnaire survey, had responded to a question about children's feces disposal by saying that the child defecated in a pot, whose contents were thrown in a latrine.

Note: This case example is based on an actual occurrence. From WASH Technical Report No. 72, *Rethinking Sanitation: Adding Behavioral Change to the Project Mix*. Prepared by May Yacoob, Barri Braddy, and Lynda Edwards. July 1992.

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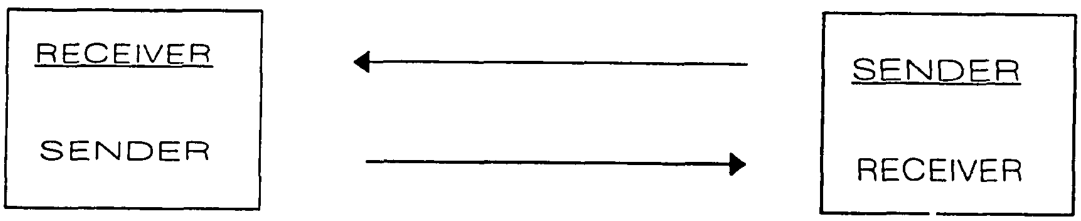
Facilitative Skills

A. Introduction

Communication seems like a simple process of sending and receiving information among people:



But it is one of the more complex things that humans do. We may think we are sending a clear message, but the person who receives it hears it differently from the way it was intended. Sometimes we are distracted and do not "hear" or listen very carefully. One way to ensure that effective communication is really taking place is to use the skills of paraphrasing, summarizing, and question asking—facilitative skills.

B. Facilitative Skills Contribute to Effective Meetings

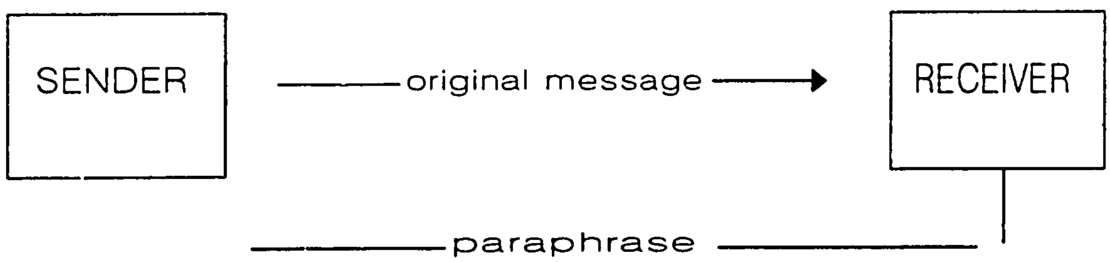
Meetings can be called for a variety of purposes. Some are held simply as a means to pass information. But, when held for the purpose of planning or problem solving, or whenever group participation is required, meetings need special leadership. For such meetings, development agents must be able to use facilitative skills competently. In addition to encouraging participation, using facilitative skills ensures that communication will be clearer and more accurate.

When a meeting leader or chairperson uses facilitative skills well, people contribute, meetings are productive, and the leader's work appears effortless. It looks natural. Because it looks so natural, people often assume that meeting leaders are born and not made. Although there is some truth in this, certain meeting leadership skills can be learned, and those skills will significantly improve your ability to lead meetings.

There are three very important facilitative skills that a meeting leader must use effectively: paraphrasing, asking questions, and summarizing. These skills are simple in concept and simple to understand, but they are not necessarily simple to carry out. With continued practice, one can become very adept in their use, however.

C. Paraphrasing

Paraphrasing is "capturing the meaning of a statement and saying it back to the other person in your own words":



Paraphrasing usually begins with such phrases as,

> "You are saying ..." [then say in your own words what has been said]
>
> "In other words ..."
>
> "I gather that ..."
>
> "If I understood what you are saying ..."
>
> "You mean ..."

The best way to paraphrase is to listen very intently to what the other person is saying. If, while the other person is talking, you worry about what you are going to say next or are making mental evaluations and critical comments, you are not likely to hear enough of the message to paraphrase it accurately.

It is helpful to paraphrase, so that you develop a habit of doing so. You can even interrupt to do so, since people generally don't mind interruptions that communicate understanding. For example, "Pardon my interruption, but let me see if I understand what you are saying...."

Example:

Person A — *It seems the basic problem is that some of the people don't know how to use the survey worksheet.*

Person B — *In other words, you see the problem as lack of know-how.*

Another example:

Person A — *I think the most important thing is to help people understand clearly how current practices are contributing to the problem.*

Person B — *So you are saying it's important to tell the people directly what kind of impact their behavior is having on the problem.*

D. Asking Questions

Asking questions is a critical facilitative skill. Questions can be asked in two ways—as closed questions and as open-ended questions.

Closed Questions

Closed questions generally result in yes/no or other one-word answers. They should only be used when you want precise, short answers. Otherwise, they tend to inhibit discussion. The closed question can be answered with one word.

Example:

Meeting leader: *Do you think that recommendation will work?*

Participant: *No.*

Open-Ended Questions

The open-ended question requires elaboration. Asking, "What do you like about that recommendation?" seeks information. How? What? Why? are words that often begin open-ended questions.

Examples:

Meeting leader: *What did you like about that recommendation?*

Participant: *I think it is a good strategy for resolving the issue, one that can be implemented without expending a lot of resources.*

Meeting leader: *What kind of progress are you making against your financial goals for this quarter?*

Participant: *Let's consider the first one a minute ... our numbers are as follows....*

E. Summarizing

The purpose of summarizing is to

- pull important ideas, facts, or data together;
- establish a basis for further discussion, or to make a transition;
- review progress; or
- check for clarity and agreement.

By using summarizing in a meeting, you can encourage people to be more reflective about their positions as they listen for accuracy and emphasis.

Summarizing requires that you listen carefully so you can organize and present information systematically. Summarized information ensures that everyone in the meeting is clear about what transpired in the just-completed portion of the discussion.

For example, as a meeting leader, you may summarize to ensure that participants remember what has been said or to emphasize key points made during a group discussion. Or, perhaps most important, you may use summarizing as a way to reach a decision or bring closure to a topic and move the meeting on to the next agenda item. In these instances, summarizing is very useful. The following are some starter phrases to help you begin a summary:

- *There seem to be some key ideas expressed here....*
- *If I understand you, you feel this way about the situation....*
- *I think we agree on this decision—what we are saying is that we intend to....*

An important value of summarizing is that it gives you the opportunity to check for agreement. If people do not agree, it is better for you to know during the meeting than to find out later when a task is not completed or a deadline is missed. One of the most common meeting complaints is that some meeting participants think an agreement has been reached, yet later things do not occur as planned. In many instances that is because there was not really agreement during the meeting.

As an example of summarizing, assume that someone named Joseph has talked for three or four minutes, and you summarize as follows:

Let me see if I have it straight, Joseph. First, you say the work is behind schedule, not carefully supervised, and finally, you are concerned about the number of hours laborers are taking to do the work, correct?

As another example, the meeting discussion has gone on for several minutes and you summarize as follows:

In talking about this issue, we have come up with three main points....

In summary, this facilitative skill is a deliberate effort on the part of a meeting leader to pull together the main points made by the person or persons involved in the discussion.

F. Other Facilitative Skills

There are a number of other helpful facilitative skills, some verbal, some nonverbal. Examples are

- nodding one's head
- picking up on the last word or two of someone else's sentence
- repeating a sentence, or part of a sentence
- saying, "That's good—anybody else have anything to add?"
- saying, "Uh-huh"

Extension Agent Role Play Sheet

You are an extension agent from the Community Development Agency of the Ministry of Public Health. One of the communities where you work is Koulika, where the Community Sanitation Committee has worked very hard to promote the construction of family latrines. You want to begin a sanitation education program in Koulika to make sure that people in the community will maintain the new latrines and make proper use of them.

You think that it is very important to carry out a survey of current excreta disposal practices in the community in order to plan appropriate sanitation education activities. The committee president thinks he knows that information already; you think he is not in touch with many parts of the community, and do not trust the information he claims to have. You think the survey should be conducted in a very organized manner, and you have specific ideas about what should be done and who should help you do it.

You want to do this survey next week, starting on Tuesday. It will take five days. On each of these days you will need two people to accompany you to translate and take notes, two to inspect existing family latrines for general maintenance and cleanliness practices, and two to spend time observing excreta behavior practices in each section of the community. You have to conduct the survey on these days because you are committed to work in another community the following week.

You are about to meet with the committee president to gain his support for the survey.

Committee President Role Play Sheet

You are the president of the Community Sanitation Committee in Koulika. You and others on the committee have worked very hard to promote the construction of family latrines in your community. You are one of the elders in the community, and your role as president has made you very popular with other people in the community.

You have been working with a young extension agent from the Ministry of Public Health to prepare for sanitation education activities. He is well intentioned, but his suggestions always seem unnecessarily complicated. For example, before receiving approval for ministry funding to support some of the latrine construction costs, he insisted on meeting not only with your committee, but with several other individuals in the community. He asked these people a lot of questions you thought were not important. In any case, you could have given him all of the information he needed, saving everyone a lot of time and trouble.

Now, this extension agent wants to start some kind of an educational program. You do not see the need to educate people about latrines, since they obviously know how to use them—they have been very excited about the new latrines. But you are willing to let him organize a few sessions, just to keep him happy. After all, it is important to maintain good relations with the Ministry of Public Health. However, he insists on talking to several people once again, even before he starts the educational program.

You are annoyed with this insistence, and you plan to talk him out of bothering more people in the community with a bunch of questions. You would be willing to give him all the information he needs yourself, since, after all, you represent the community, and they trust you.

You are about to meet with the extension agent to discuss your views on what he wants to do to prepare for the educational program.

Facilitative and Observational Skills

Reflection Questions

1. What do you want to especially remember to do or keep in mind when using observational techniques?
2. What are the important things you want to remember about using facilitative skills in this course and in your work?

Information Collection Worksheet
on Human Excreta Disposal Practices

What Information to Collect	From Whom/Where	How to Collect It	Data Collected
1. *Accepted Behavior**			
a. Places where people defecate			
■ Men			
■ Women			
■ Children			
■ Infants			
b. Places where infant diapers/feces are disposed of			

*The word *accepted* implies that the behavior is a general community norm.

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What Information to Collect	From Whom/Where	How to Collect It	Data Collected
c. Methods for cleaning excreta from			
■ infants (following defecation)			
■ in infant clothing/diapers			
■ in house or courtyard			
d. What is done with water used in cleaning excreta in the above situations?			
2. *Other Question Areas*			
a. Presence of feces			
■ near water sources			
■ in house/courtyard			
■ on exposed paper or other anal cleansing material			

What Information to Collect	From Whom/Where	How to Collect It	Data Collected
b. Types of anal cleansing materials			
c. Existing sanitation facilities/systems			
d. What do people describe as good sanitation practices?			
e. What do people say they need?			
f. What do people believe regarding the danger of feces? ■ adult feces ■ child/infant feces			

Sample of Completed Page of Information Collection Worksheet

What Information to Collect	From Whom/Where	How to Collect It	Data Collected
1. *Accepted Behavior*			
a. Places where people defecate			
■ Men	Men/children	Ask/observe	In farm fields In special area by river
■ Women	Women/children	Ask/observe	In farm fields In special area by river
■ Children	Women/children/men	Ask/observe	In trash heaps
■ Infants	Mothers/children	Ask/observe	In courtyard
b. Places where infant diapers/feces are disposed of	Mothers/children	Ask/observe	In trash heaps

Problems and Needs Exercise

Development agents must to be able to distinguish between community problems and needs so that they can help the community identify its real problems and not just its needs. Review the following list of statements and write "P" next to the problems and "N" next to the needs.

____ 1. Eighty percent of the adults in our community defecate in the community woodlot, leaving feces exposed.

____ 2. Most of the children 10 years old and under defecate indiscriminately in the community.

____ 3. There is no health professional in the community.

____ 4. We need one latrine for each family in the community to improve sanitary conditions.

____ 5. Twenty-five percent of the children in the community die before they are five years old. We need better health care.

____ 6. There is no place to buy oral-rehydration solution (ORS) in the community, so children suffer from diarrhea.

____ 7. Our children die of measles because the immunization team did not come to vaccinate the babies last year.

____ 8. Women are collecting drinking water from the swamp during the rainy season, and they do not boil it. We need clean water in the community. The closest good water is 5 kilometers away.

____ 9. We do not eat enough meat to stay healthy.

____ 10. Latrines attract flies and snakes. That is why some families don't want latrines near their homes.

Distinguishing Problems from Needs

Here are some answers to the problems and needs exercise.

The first four statements are easy to distinguish. The first two are problems and the next two are needs. That 80 percent of adults defecate in the community woodlot and that children defecate indiscriminately within the community are clearly problems. Both can have several causes and several solutions. The lack of a health professional in the community is a need that can be met by getting a health professional to work in the community. The lack of sanitary conditions in the community may be a generalized problem, but the need for a latrine for each house can be met by building one for each house. Whether this solution will provide sanitary conditions for the community depends on all the other reasons for the unsanitary conditions of the community.

The remaining statements are less clear and may be open to different points of view. In the opinion of the author,

- Statement 5 is a consequence of one or more problems—one of which may be improper excreta disposal. Possible solutions cannot be identified until the problem is further clarified—that is, why children are dying before they are five years old.
- Statement 6 is a need because the situation can be improved by having someone sell oral-rehydration solution (ORS) in the community. Even if ORS is available in the community, children will still suffer from diarrhea, because using ORS is only one of the things that people can do to resolve the prevalence of diarrhea. The lack of ORS is not a problem.
- Statement 7 is also a need because it focuses on the absence of the immunization team as a cause of the problem of measles.
- Statement 8 is a problem. The high-risk behavior identified is that women collect drinking water from the swamp and do not treat or boil it to make it safe for drinking. The statement describes a problem, for which the solution is to eliminate or modify the behavior—getting people to boil or treat the water before drinking it or bringing clean water closer to the community.
- Statement 9 is a need because all that has to be done is to provide more meat in people's diet. The statement that they need meat to stay healthy is not describing the problem that people are not healthy. Eating more meat may not in fact result in healthier people if the people are exposed to excreta and consequently suffer from dysentery, typhoid, and other diseases.

- Statement 10 describes a barrier to proper excreta disposal. The issue is not the location of latrines near the family home, but the perception that latrines attract flies and snakes. The presence of flies and snakes is caused by a number of situations that can be addressed; ways can be found to keep flies and snakes away from latrines.

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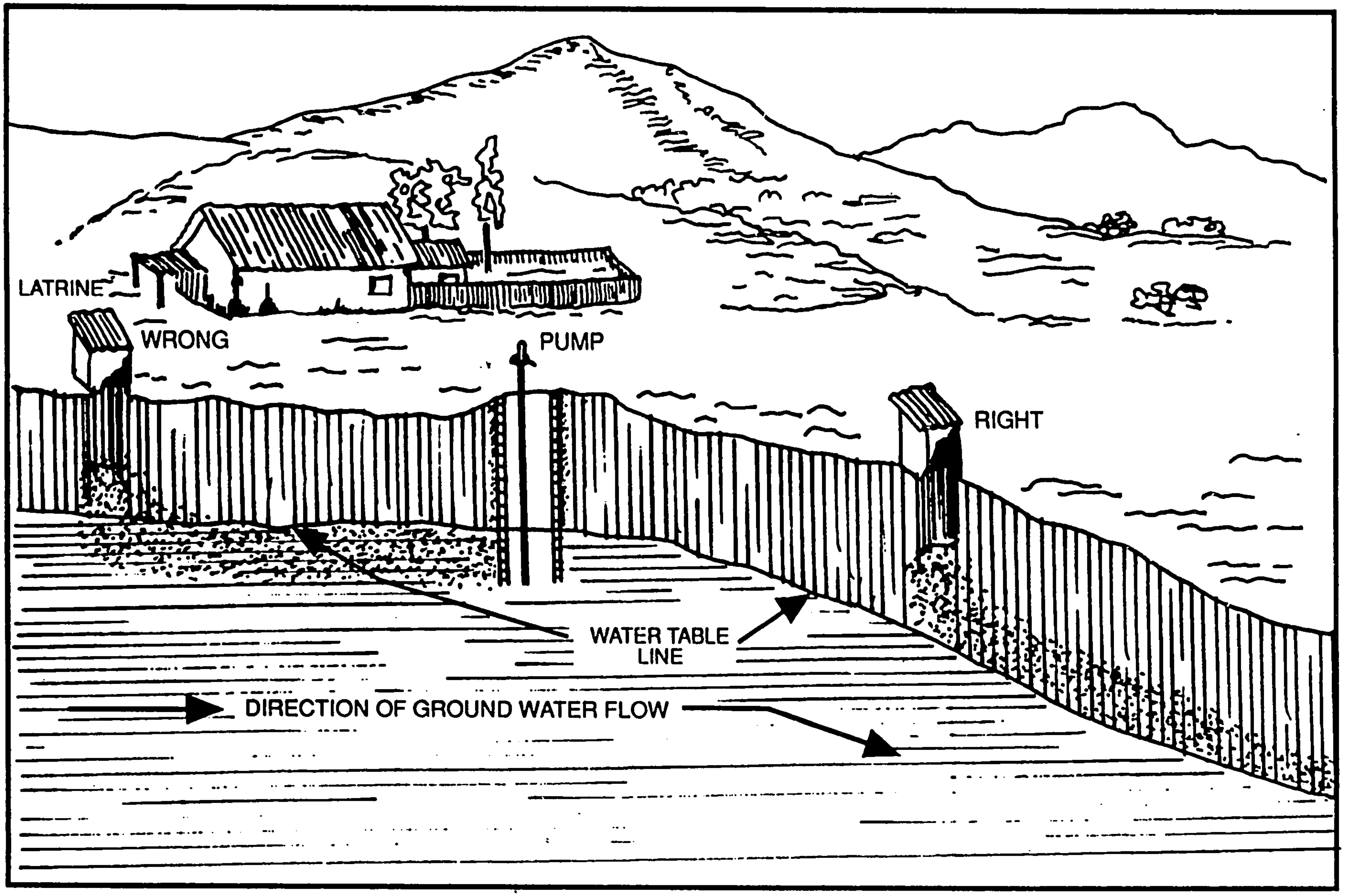
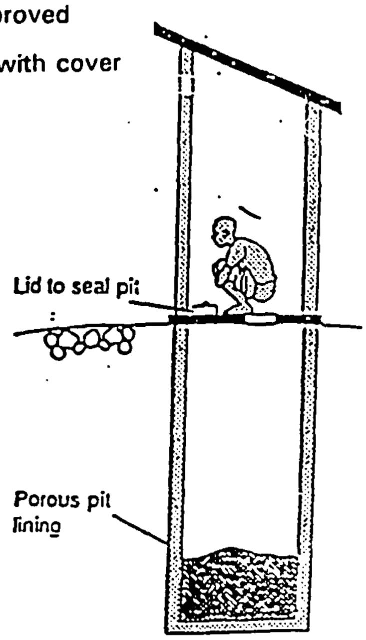
LEACHING PROBLEMS



Basic Types of Latrines

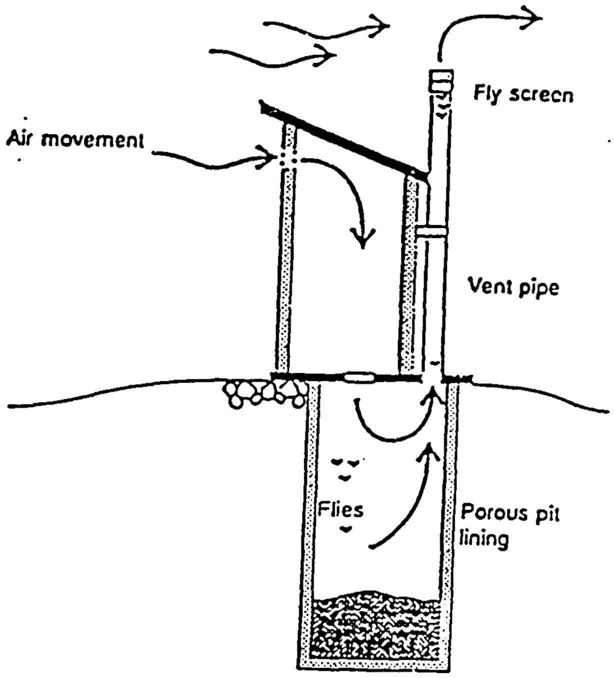
Handout 7-2

Simple improved pit latrine with cover



Type I

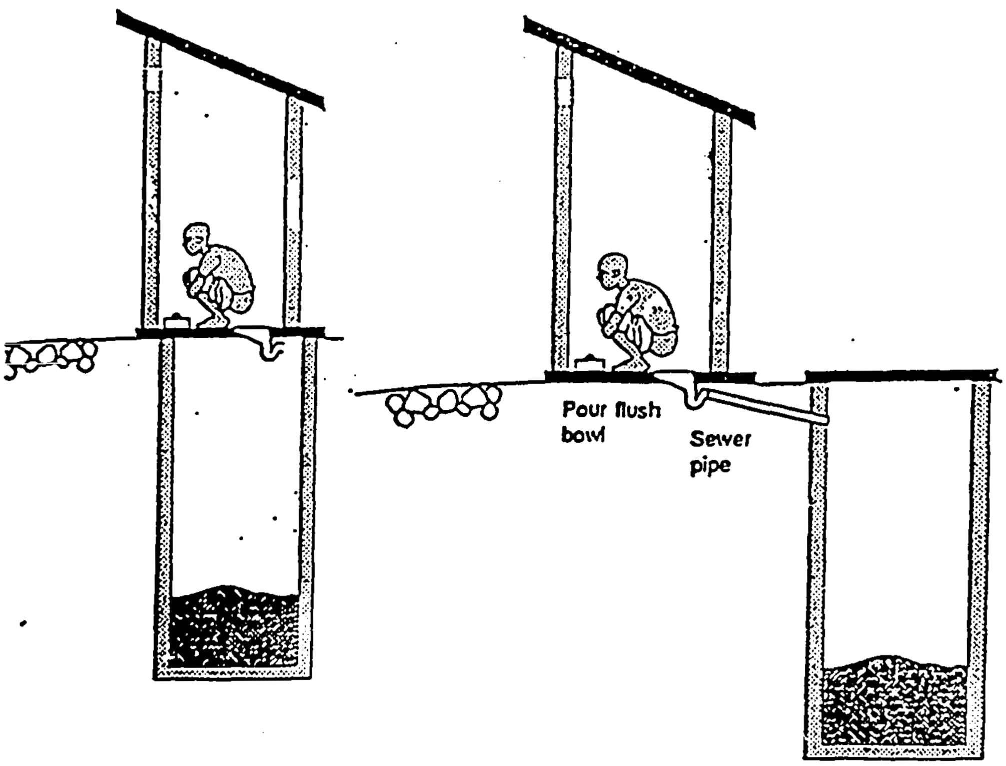
Ventilated improved pit latrine (VIP)



Type II

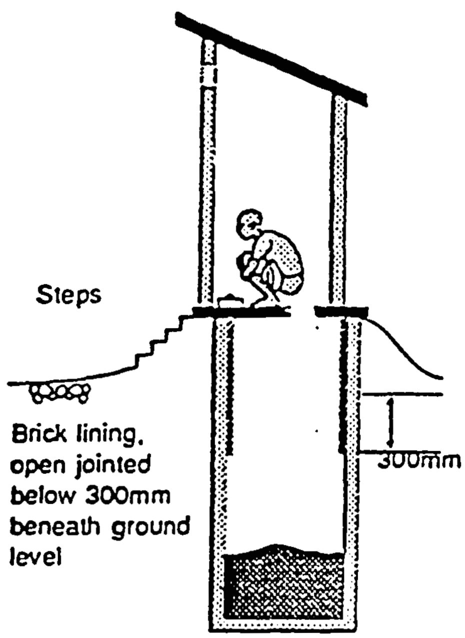
Simple pourflush latrine

Offset pour flush latrine



Type III

Raised platform latrine



Type IV

Basic Variations of Latrines

I. Simple Latrine with Cover

- This is the most basic and inexpensive of sanitary latrines. It consists of a slab, which can be built as described below, with a cover.
- The cover is frequently molded on the slab opening to form an effective seal when the pit is covered. The cover prevents access by insects and reduces the smell when the latrine is used. However, the cover is frequently forgotten or underestimated as an important aspect of the design, partially due to the added inconvenience of having to replace it after each use.
- The superstructure is frequently built without a roof.

II. VIP (Ventilated Improved Pit)

- The basic improvement of a vent differentiates this dry pit latrine from the pit latrine with cover. Wind passing over the top of the vent creates suction, which pulls air out of the pit.
- The vent can be made from different materials, although a rounded cross section and smooth interior are the most efficient (e.g., plastic pipe).
- The efficiency also increases with the diameter, or cross-sectional area, and the height of the vent, so the determining factor in choosing a vent is striking a balance between efficiency and cost. The top of the vent is screened to prevent the escape of flies after they have come in contact with the excrement.
- The superstructure should be constructed in such a way as to enhance the airflow through the vent pipe. That is, if the ventilation (screened window), or access way, of the superstructure is situated toward the incoming wind, the efficiency of the latrine vent will be increased.
- The interior of the latrine should be kept dark to ensure that flies try to escape toward daylight through the latrine vent instead of remaining in the superstructure.
- The slab and pit can be constructed as above without the cover, which actually prevents the flow of air. This design is efficient in reducing smells and the presence of flies in and around the superstructure (flies do tend to congregate around the outside of the screened vent, attracted to the escaping odorous vapors).

- The VIP is more expensive than the basic pit latrine due to the added cost of the vent pipe and the probable difference in superstructure.

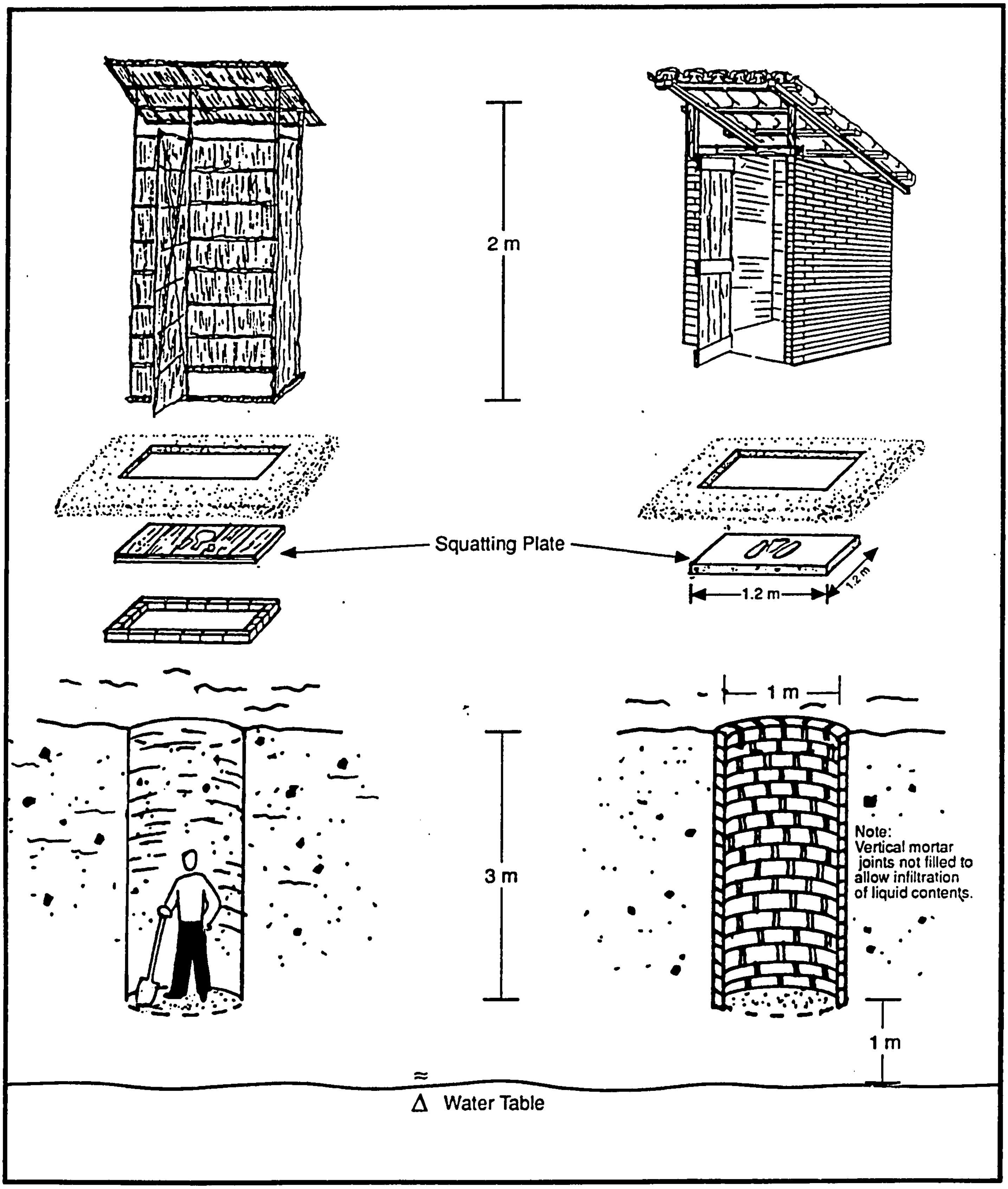
III. Waterseal/Pour Flush

- The waterseal latrine differs from the above "dry" latrines in the integral waterseal trap of the latrine slab.
- The waterseal forms a barrier to insects (from entering) and smells (from leaving) the latrine pit. It can be made of plastic, fiberglass, reinforced cement, or ceramic, and it is usually made separately from a larger slab that is designed for it.
- It permits a greater range of pit designs because the water flow can carry the excrement to offset pits. That is, pits can, but do not have to, be directly under the latrine slab.
- User preference for this design is usually high due to its similarity to conventional sewerage. It does require that a household have excess water, however, and in areas where this technology is not used, it requires more initial effort and resources to build the waterseal traps.
- It is sometimes more expensive than the VIP latrine, depending on the cost of the trap and the fact that all waterseal latrine pits should be lined.

IV. Raised Platform Pit Latrine

- The raised platform latrine is not a truly independent latrine type. It can be either a basic latrine with a cover or a VIP latrine. Because of its importance, however, the raised platform design is classified separately.
- The main use for this latrine is in areas with a high water table or rocky soil, that is, soil that is difficult to excavate.
- This latrine is generally more expensive than the other types because more materials are required to build up the pit walls to the specific height necessary.
- The pour flush design is rarely used in conjunction with the raised platform pit latrine because it would partially offset one of the main purposes of this design, which is to limit the leaching of wastes into a groundwater source.

LATRINE COMPONENTS



A. Shelter

The major differences among the latrine types will be the slab and pit design. The shelter can be made of any material that provides privacy and is structurally sound, feasible, and acceptable to the users. The shelter can also limit access by vectors that would otherwise come into contact with the excreta.

The shelter can be made of a variety of materials, such as wood, wood and thatch, mud bricks, concrete block, brick, and so on. The cost in labor and material is thus widely variable, but the shelter is frequently the most costly latrine component.

The resources devoted to shelter construction also depend on the expected life of the latrine. A latrine that is designed to last for 10 years is usually built of more substantial and costly materials than one designed to last 3 years.

B. Pit

The pit is dug in permeable soil and holds the excreta. The bottom of the pit should be at least 1 meter above the groundwater level in the wet season. (In places where the groundwater level is high, the raised platform latrine could be used.) The size of pit will vary depending on the number of users, permeability of the soil, type of anal cleansing material used (if thrown into the pit), and the desired lifetime of the pit. It could be either round or square in cross section, but a round pit is more efficient and slightly more stable than a square pit.

The upper edge of the pit has a base or ring beam, which supports the slab and superstructure; it is generally slightly elevated to prevent water from entering the pit. A seal is formed with clay or concrete between the base and slab to prevent insects from gaining access to the pit contents. A lining for the pit walls may be needed, depending on the stability of the soil, to prevent the walls from collapsing.

In areas where the water table rises close to the bottom of the pit, the bottom can be lined with an impermeable material, such as clay. This will inhibit the process of leaching directly below the latrine.

C. Slab and Fixtures

Four basic slab types will be covered in this section. They are reinforced concrete, ferrocement slab, concrete without reinforcement (Sanplat), and a wooden slab. All latrine types have one of these slab types or a variation of them. The pour flush latrine requires a specialized fixture—the waterseal trap—as an integral part of the latrine slab.

The slab covers the pit and has a hole near the center through which to defecate. The slab can vary significantly for the different latrine types. Variations are also possible when dealing with a single latrine type (e.g., a simple slab with cover can be built of concrete or wood). Latrine slabs have either a squatting hole or a pedestal and seat for upright sitting during defecation; this depends on local preference. The slab is generally made of reinforced concrete, but it can be made of concrete without reinforcement if a specialized design is used. Another alternative is wood. In all cases, the slab should be smooth for ease of cleaning.

Reinforced Concrete Slab

The reinforced concrete slab is the most widely used slab type. It consists of cement, gravel, sand, water, and reinforcing material. The reinforcing material is usually iron bars, but other materials can be used, such as bamboo.

This slab has the following advantages over the other slab types:

- It can be easily produced "on site" by someone with basic experience in building with concrete.
- It is easy to keep clean because it can be made very smooth.
- It can be customized to individual preferences, such as by the addition of a pedestal or foot pads.

There are also disadvantages:

- It is heavy, making it difficult to transport.
- It is subject to breakage during transport.
- It is not as efficient in use of materials as the ferrocement slab or the Sanplat (see below).

The reinforced concrete slab can also be used in conjunction with latrine types other than the simple pit with cover and the VIP latrine. The slabs for a waterseal or compost latrine frequently involve reinforced concrete construction. In systems with specialized fixtures, such as the waterseal latrine, the reinforced slab is the base that holds the fixture.

A reinforced concrete slab can be built to smaller dimensions to make it lighter and allow it to be more easily moved from a slab-making center to the place where it will be installed. It can then be mounted on a pit with an extended base.

The fact that the slab must overlap the sides of the pit is frequently overlooked. As a result, an unplanned expense is incurred to either make the latrine slab larger or to move the ring beam toward the pit in order to make the slab fit.

Ferrocement Slab

A ferrocement slab is very similar to the reinforced concrete slab and is, in fact, a type of reinforced concrete slab. The difference involves the type of reinforcement used and the amount of cement and sand needed (this slab does not require gravel).

This slab utilizes two layers of a wire screen instead of the iron bars mentioned above. Materials are conserved in this design because the slab can be built with less than half the thickness of the above design. Since it requires less material than the reinforced concrete slab, it is lighter. It does require more attention in construction, however, because it is more sensitive to construction flaws.

Sanplat

The Sanplat is a concrete slab that does not need reinforcing material. Its arched design gives it sufficient strength to withstand the same pressures as the more common reinforced slabs.

The main benefit of the Sanplat is that it is very economical in the use of materials; it uses less cement than the reinforced concrete slab and no reinforcing material. It is therefore lighter. The Sanplat can also be used as a slab for the VIP latrine*.

The difficulty encountered with the Sanplat is in its design. A mold must be made to give the slab its shape. It may be difficult to convince a local builder to undertake the project if he is not used to building without reinforcement. If this is a problem, it may first be necessary to build and test a demonstration slab to alleviate the builder's concerns.

Wooden Slab

Slabs can also made of wood or bamboo. Wooden slabs are easily built on-site by local craftsmen when raw materials are available. They are usually constructed over the pit so there is no need to transport them. However, care must be taken because wood decomposes rapidly in tropical climates. The use of pretreated material is recommended to give the slab longer life. (NOTE: A pretreated material is recommended, but the cost of the pretreating often exceeds the cost of a reinforced concrete slab.)

A wooden slab should be covered with an impervious material such as a coat of mortar or clay, to reduce the presence of pathogens that can exist in a porous slab.

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*For additional information on Sanplat design, contact Björn Brandberg, General Manager, SBI Consulting International; Rattaregarden, Box 217, S-53030, TUN, Sweden, Tel: +46-(0)510 80050 and Fax: +46-(0)510 80434.

Waterseal Trap

The waterseal trap can be built of many materials, such as concrete, ceramic, galvanized metal, or fiberglass. The trap usually consists of two parts, a bowl and a waterseal. The trap should be made as smooth and as nonporous as possible for the easy passage of excreta.

A latrine with a waterseal trap is more difficult to make because a specialized mold is needed when building it from concrete or ceramic. The initial costs are also higher than for the other choices. The mold can be manufactured by an individual who is highly skilled in working with these materials. However, the waterseal is well suited for mass production. It can be manufactured at a central location and, because it is light, it can be transported much more easily than the reinforced concrete slab.

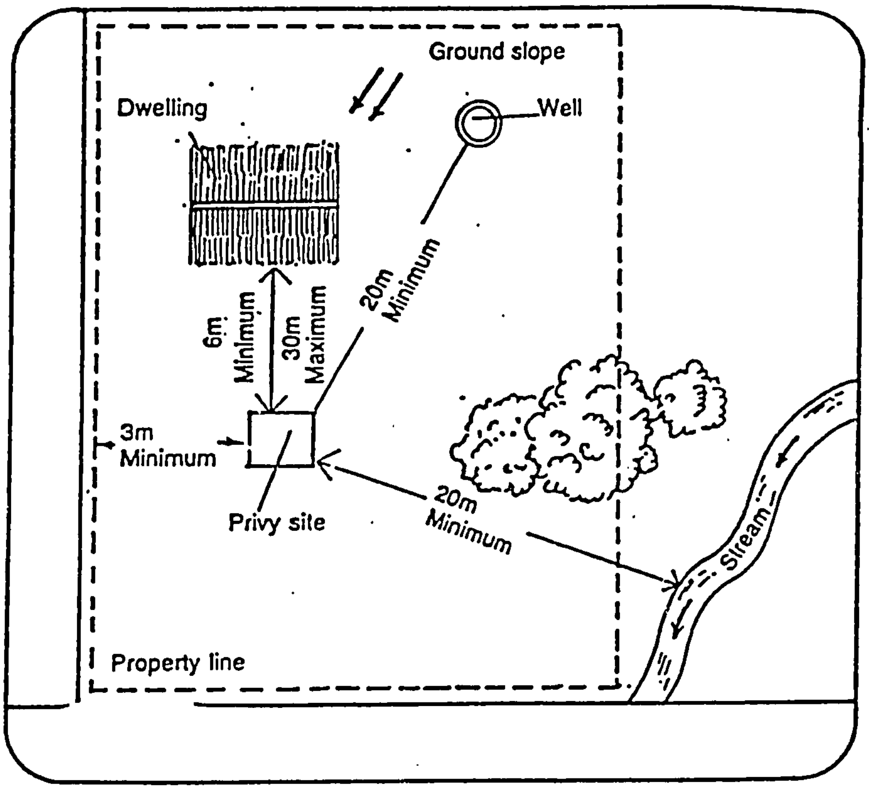
The waterseal does have difficulty passing solid anal cleansing materials. Thus, if the waterseal is used in an area where this type of material is employed, the users should dispose of this material outside the latrine; it should then be burned or buried.

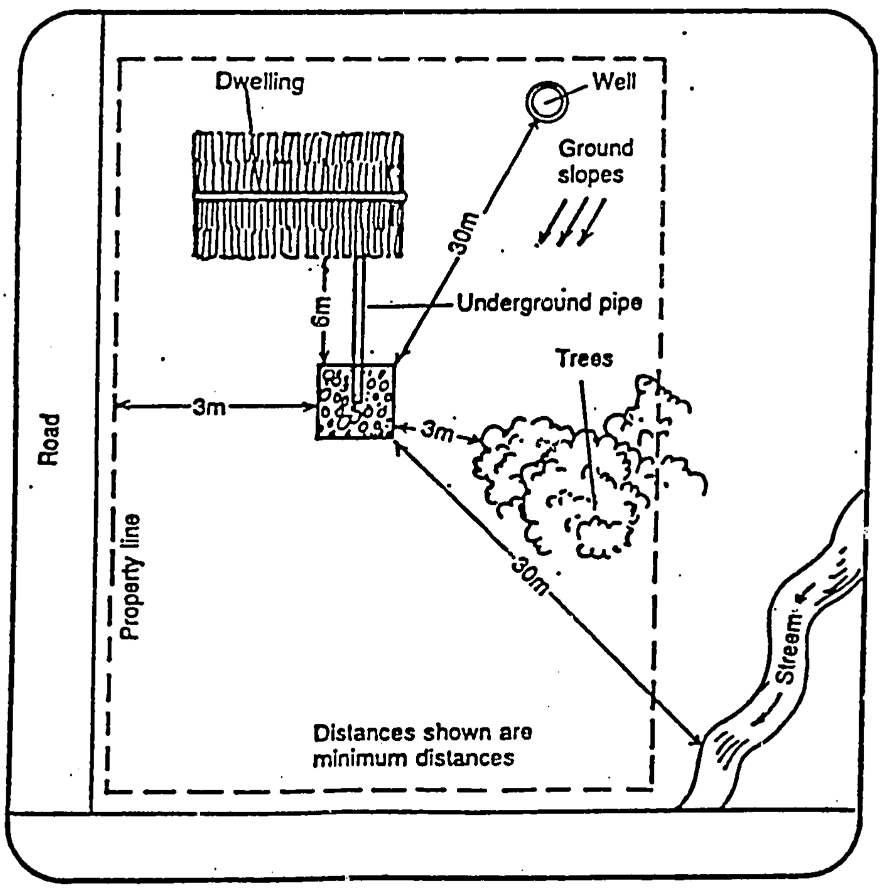
The slab, commonly of reinforced concrete, for the waterseal trap is usually made on or near the site where the latrine is being installed.

Advantages/Disadvantages Of Latrine Types

Latrine Types	*Advantages*	*Disadvantages*
1. Basic Latrine with Cover	- Inexpensive - Does not require water	- Disagreeable smell
2. Pour Flush Latrine	- Does not require permanent superstructure - Small land requirement on plot - Control of flies and cockroaches if cover is used	- Requires reliable water supply - Difficulty in passing solid wiping material - Increase in cost due to need to line pit
3. Raised Platform Latrine	- Inexpensive - Does not require water - Control of flies - Less smell in latrine - Small land requirement on plot	- Higher cost of pit lining and steps ding to elevated platform
4. Ventilated Improved Pit Latrine	- Absence of smell in latrine - Control of flies - Contents of pit not visible - Most closely resembles conventional sewerage - Control of insects with cover or vent - Small land requirement on plot - Can be built in areas of rocky soil or high water table	- Extra cost of vent pipe and superstructure - Darkened interior inhibits use by some groups, especially children

Siting of Latrines





A. Water Sources and Water Table

The water table is the distance between the ground level and the level at which water is encountered. Simply digging a hole and measuring this distance will give the depth of the water table. One must be cautious, however, because the water table depth will probably not be the same in every area in the community; it could also vary in the same area depending on the season. (In the rainy season it will be higher.)

The water table is frequently "tapped" by using a well for a community or individual water source. By incorrectly siting the latrine, a water source could be polluted by the latrine contents. Therefore, it is recommended that the latrine not intrude on a water table that people are using as a water source.

The latrine should also be sited at a safe distance from a water source such as a well. The "safe" distance will be different for the different latrine types.

Due to gravity, the leachate will flow a greater distance vertically down from the bottom of the pit than laterally from the pit walls. Therefore, the distance from the water table below the latrine has more relative importance than the distance from a well.

B. One's House, Neighbor's House

The following siting considerations are also important:

- A large excavation in close proximity to the house could undermine the foundation of the house.
- The opposing argument is that the latrine should be close enough to be considered convenient, thus enhancing its use.
- In the case of a wet system, the increased water content of the soil around the pit will have an adverse effect on the stability of the soil.
- A hand-washing facility should be located between the latrine and house to make hygienic practices more convenient. However, this convinience should not override the recommended siting distance from a groundwater source.

C. Soil Type

Soil type influences where and what kind of latrine is built. Soil type can vary within a relatively small area. Some soils will prevent the installation of certain latrine types.

However, the soil type can change with depth. For this reason, experimentation involving the excavation of test holes should be tried before installing a latrine, or before looking for

an area with a more appropriate topsoil. For example, some areas have a very sandy topsoil, but beneath the topsoil a suitable soil type may be found.

D. Land Availability

In crowded peri-urban areas, land availability may be so limited that it could affect the latrine type, or even whether latrines are an appropriate intervention. Latrines are usually not feasible at population densities above 350 people per hectare, and most peri-urban areas have more than 350 people per hectare.

Latrine Site Observation Questions

1. What aspects of siting are involved in the demonstration latrine?
2. Were all the criteria of good siting followed?
3. What could have been improved in the siting? How?
4. What type of slab is being prepared?
5. How much/what kind of material is being used?
6. What steps are involved in slab construction?
7. What is the soil type?
8. Who are the users of the latrine?
9. Do the users know the importance of latrines? Do they know how to use latrines? Do they like the design of the latrine?
10. Are there hand-washing facilities in the area?
11. Is there evidence of human excreta in the area? Animal excreta?

Factors in Latrine Choices—User Preferences

Satisfying user preferences greatly increases the proper use and maintenance of the latrine. In satisfying this factor, the users become an integral part of the sanitation program. They become more than the beneficiary: They become the implementer and owner.

Some of the factors involved in personal choice are included below.

A. Status

An individual will want a latrine that is seen as increasing his or her standing in the community. Frequently, however, the preferred personal choice is not feasible or affordable to the individual or the implementing agency.

The role of the development agent is to explain the possibilities and the difficulties in the application of various technologies. Rather than make the choice, the development agent can assist the community members in making the appropriate choice.

B. Aesthetics

Most people will want a latrine that is appealing to the eye and that emits minimal odor. A latrine design can be altered superficially without affecting its operation; this allows individuals to personalize their latrine. The development agent should be ready to make some suggestions to enhance the aesthetics of a latrine choice.

C. Quality

A single latrine design can be built to many different standards. In general, however, a well-built latrine will have greater acceptance and proper use than one of inferior construction.

D. Ease of Use

The design that requires the least amount of care is a vital aspect in personal choice. Ease of cleaning, time of operation, problems encountered in operation—all are important considerations. Moreover, because the abilities and concerns of individual family members differ, the "ease of use" to one family member is not necessarily the same throughout the household. An effort should be made to make all family members comfortable.

E. Privacy

In most cultures, it is an embarrassment to be seen using the latrine. A latrine will have greater acceptance if it is designed and sited to limit the visibility of the user on entering the latrine and once inside.

F. Behavioral

The latrine design should consider the defecation behaviors of the user. Do those behaviors constitute a health risk? How can the behaviors be addressed in the latrine design and the latrine still be acceptable to the user? Can they be changed? These questions constitute an important aspect in ensuring continued and proper use of the latrine.

G. Cultural

A design must be appropriately presented, constructed, and sited based on culturally accepted practices. For example, in some cultures, men and women use different latrines. In this case, two latrines could be built for a household, and they could be built to satisfy the preferences of the gender using them.

Factors in Latrine Choices—Design Feasibility

Designs that are feasible should be presented, and in a way that potential users understand the advantages and constraints of the different options.

Physical conditions generally rule out certain types of latrines. The following are limiting factors:

- Presence of a nearby well or the water table may prevent the use of a leeching latrine.
- Rocky soil is difficult to excavate, which could make a latrine design with a deep pit impractical.
- Soils that are mostly or all clay inhibit the flow of liquids through them. Thus, fluid from a leeching latrine will infiltrate the clay around the latrine very slowly, which reduces the latrine's life.
- Materials for a latrine must be either locally available or transportable.
- The siting criteria must be observed, that is, proximity to houses, distance from a water source, depth of water table, and so on.

A design must also be chosen based on the abilities of the available skilled labor.

Factors in Latrine Choices—Cost/Financing

A. Introduction

Basic cost criteria in making the right latrine choice are as follows:

- What are the costs?
- How do you reduce them?
- Who is going to pay them?
- Who is going to be paid?
- What is the payoff period for the investment?

There are several perspectives to consider in responding to these questions, including those of the individual, agency, government, and private enterprise. The combination of all the factors discussed below will influence the choice of design. The necessary information should be quantified and itemized before implementing a sanitation program.

B. Individual

The following questions should be addressed when considering the cost to the individual:

- How much can people afford?
- How much are they willing to pay, and in what ways (their time or other resources)?
- Can the amount they pay be spread over time (credit)?

To answer these questions, it is helpful to examine some of the basic motivations of individuals with respect to the allocation of personal resources. These motivations revolve around cost versus benefits, awareness of benefits, and easing costs.

Cost Versus Benefits

The relationship between cost and benefit is a vital one. Because the extent of a person's resources is limited and must cover a variety of personal needs, the individual must choose his or her expenditures carefully.

The priority associated with an expenditure is based on the perceived benefits gained from the expenditure. The benefits can be either short term, such as food and clothing, or long term, such as housing.

Any new activity that requires resources necessitates a shifting of priorities. Spending resources on an improved sanitation facility will reduce resources for other activities. Thus, the benefit gained or the value placed upon a sanitation facility must be greater or equal to that of the activity that must be given up or reduced. Often a community member's resources are already stretched to the limit, so the introduction of an additional cost may be untenable.

As the benefits of a certain activity increase, the resources allocated to that activity also increase. This linkage relates to the difference between ability to pay and willingness to pay.

Ability to pay is based on the measure of an individual's resources, whereas *willingness to pay* involves the measure of resources as well as the individual's willingness and decision to part with them. The transition from ability to pay to willingness to pay involves an increase in the user's awareness of benefits. An increase in an individual's willingness to pay may be accomplished by increasing his or her perception or awareness of benefits associated with the expenditure.

For example, an individual may be more willing to make a larger investment in an activity if the benefits are correspondingly greater. If this individual has a choice between two latrines, one priced at $500 that will last 10 years, and one that costs $300 but will only last 3 years, what should he or she consider in making the choice? While the $300 latrine costs more initially, its cost divided over its period of operation would be $100 a year, versus $50 a year for the $500 latrine.

Awareness of Benefits

One of the major obstacles to getting an individual to allocate resources for a personal excreta disposal system is the difficulty of quantifying the benefits gained from such a system. In comparison, the benefits of a water system, which supplies a readily accessible supply of water, are clearly evident in the everyday life of a community member.

While improving individual sanitation on a community-wide basis can be seen as a public benefit, the initial expenditure required to build a latrine is largely carried by the user. Therefore, there must be a personal benefit associated with an improved sanitation facility.

The development agent can overcome this obstacle by building awareness of the more obvious benefits, as outlined in the section above on user preferences. These benefits include privacy, convenience, and status, as well as the less apparent benefits of public health—for example, costs for medicines and the loss of productivity due to illness can be reduced by improved sanitation, including the addition of a sanitary latrine. The cost of treatment is much greater than the cost of prevention. The benefit is a reduction of other costs borne by the individual.

Easing Costs

A high initial investment is required for the installation of a sanitary excreta disposal system, which can make it unattainable to individuals. In contrast, the installation of a community water supply system is generally spread out among all community members over time, which results in affordable monthly payments.

This difference necessitates a higher degree of individual commitment in building a latrine than does a community water supply. It is for this reason that a self-help approach is applied by many agencies. The agency may supply the basic building materials, slabs, and technical assistance to offset the individual's costs, but the individual is expected to provide the remainder of the materials and the labor involved, such as for pit excavation and shelter construction.

However, the usual self-help approach is limiting. While it does reduce the individual's costs, it assumes that the user not only has the time to provide this labor but also the ability and knowledge of certain techniques of construction to carry it out effectively. Because most users are unskilled in these techniques, it is an inefficient use of their time. Moreover, the time they spent working on their latrine results in an opportunity cost—while they are working on their latrine, they do not make money nor are they able to devote time to their families. Hiring a builder, therefore, tends to be a more efficient use of their resources than building it themselves.

Another way to reduce the high initial expenditure for a latrine would be to spread the cost out over time, as is done for a water system. A system of credit could be developed for affordable monthly payments. This would increase the attainability of the latrine for those unable to afford the installation cost in one lump payment.

In convincing community members to part with resources in order to improve their sanitation system, it would be helpful to present them with a proven design. This proven design would increase their understanding and confidence in the system, and thereby reduce the perceived risk involved in making the investment. This reduction in perceived risk could lead to an increase in the resources that an individual is willing to devote to the new construction.

With the right combination of lowered costs and increased user's awareness of benefits, the development agent will boost the access of community members to improved methods of sanitary excreta disposal.

C. Agency

The parameters of the implementing agency must be understood by the development agent and community members.

- How much is the implementing agency going to provide?
- What are its costs and constraints?
- How is the project going to be implemented, and who is going to do it? It is in the interest of the agency to keep the costs as low as possible in order to reach the largest number of beneficiaries. At times, an agency's resources are spread too thin in an attempt to encompass all of the perceived needs of a community. As a result, the effects are difficult to sustain and project failure is common. With limited resources, the projects must be targeted more narrowly and with an emphasis on sustainability.

Effective Demand

To target the assistance, the agency must first find the effective demand in any particular community. The *effective demand* is a combination of individual demand and all available or attainable resources that allow the implementation and sustenance of a project. The box on the next page illustrates effective demand. By targeting the effective demand, the project's agency can narrow the project's scope and make the project's goals more attainable.

Associated Costs

The cost of the material and technical assistance that an agency may provide for a sanitation program is usually far less than the total cost it bears. The agency also bears the costs associated with the provision of materials, such as transportation and storage. In addition, the agency also incurs indirect costs, that is, costs associated with the program that do not fall into the above categories, such as administrative overhead, personnel (salaries of technical agents as well as support staff, drivers, and program managers), training, and monitoring and evaluation.

Cost of the Development Agent's Time

The cost of the time a development agent spends on community education and supervising of a sanitation program is borne by the agency. Most agencies have a variety of development programs, and the development agent's time is split among them. Spending more time with one program, such as sanitation, reduces the time he or she is able to spend on the other programs. Thus, the development agent must utilize time efficiently in order to accomplish various tasks. The cost of the development agent's time is a vital concern to the agency.

An Example of "Effective Demand"

An assessment is made in a community to determine the members' sanitation needs. This assessment is made by development agents associated with a public health agency. The assessment is based on the level of diarrheal disease associated with poor sanitation, the sanitation practices in the community, and the general condition of sanitation facilities in the community. In the resulting report, based on this information, 80 percent of the homes need a new or improved sanitation facility. This is the NEED.

The agency has a limited budget and cannot afford to supply the materials and labor required for the construction of latrines for 80 percent of the homes in the community, so the assessment team is again sent to the community. This time team members go to each house to ask community members if they are interested in improving their latrine or building a new one. The majority of the responses are affirmative. Many of the community members say they would like a new latrine but they are unable to afford one. The resultant report from the team is that 80 percent of the households need latrines and 60 percent of them want latrines. This 60 percent is the DEMAND.

This demand percentage would still require too great an expenditure for the meager resources of the agency. The agency decides on a plan of action whereby it will provide increased education to the community in general and set up a technical assistance program. This program will provide the services of a skilled latrine builder to all community members who decide to improve their latrine or build a new one with their own resources.

The team again goes into the community, this time to explain the different latrine options, including rehabilitation and upgrades, and the costs associated with the different options that the community members would be expected to pay. After the team members discuss the options, they write down the households whose members are willing to bear the cost associated with their choice—20 percent of the community. This percentage represents the EFFECTIVE DEMAND.

Cost of Community Self-Help Labor

The utilization of community self-help labor has a direct and negative impact on the time of the development agent.

In comparison to having a skilled builder constructing the latrines, an unskilled community member will require much more supervision in executing the same tasks. This impact is especially noticeable when the construction is in a community different from the one where the supervisor lives because since each time supervision is needed the supervisor must travel to that community.

> *Example:*
>
> A skilled builder may take three days to build a latrine due to his technical skills and ability to spend the entire day working on it as he is contracted to do. On the other hand, an unskilled community member could take three weeks, because he or she must juggle time between constructing the latrine, making money, and other concerns.
>
> The supervision required for the construction is also an issue. The skilled builder should be supervised during the important steps of construction, such as slab construction, but that supervision is confined to the three-day period. The unskilled community member will need considerably more supervision for the same important steps, as well as supervision for the less important construction steps, due to his or her lack of proficiency.

D. Government

Is there a government subsidy? Does the government supply materials?

Governments face the same resource limitations as do agencies. Their programs and concerns are much larger in scope and complexity, however.

Many of the government's program objectives may coincide with those of agencies, but due to the necessity of covering the wide range of other programmatic concerns, the government ministry is perhaps less able to commit the amount of resources needed. Even so, the government ministry involved with sanitation should be consulted in the planning of any program. While the material resources available may be limited, this ministry would have invaluable information based on past experience. Reviewing this information would undoubtedly ease the job of development agents in finding out why projects succeeded or failed in the past.

Other resources provided by the government may be in the form of personnel such as teachers, health workers, extension workers, and clinic staff. Such personnel see many people in the course of their work, and thus they form an important network for development agents.

If the development agents are informed about the sanitation program and are brought into the planning process, the amount of time they have to spend on promotion or education can be reduced.

The key is to seek out and identify the resources that are available and to determine how they can be most efficiently utilized.

E. Private Enterprise

What is available from the private sector?

An effective demand will create an incentive for the involvement of private enterprise. The private sector is very efficient at low-cost production, but it may be unaware of the effective demand in a community. Contacting the market/private enterprise sector, informing them of the specific needs, and discussing payment options will often be all that is needed to involve the sector in filling the effective demand. At times, more education may be needed in order to accomplish the task.

Some of the latrine components are ideally suited for the involvement of small enterprises, such as slab, seat, or waterseal trap manufacture. Finding out what the market will offer is a necessary step in determining the most economical latrine choice.

Apart from materials (cement, bricks, rebar), the market will also supply skilled labor for the construction of the latrine. As mentioned before, hiring a good local builder will save time and money.

Quality control will be an issue in utilizing the private sector, because private enterprises will attempt to fill the demand as cheaply as possible. Their materials can sometimes be inferior.

Determining Soil Suitability

Determining soil suitability for disposal of excreta is important because some soils cannot safely be used for disposal systems. Systems in unacceptable soils can cause serious health hazards, including contaminated drinking water.

Determining soil suitability involves (1) evaluating soil types, (2) locating bedrock and groundwater levels, and (3) determining soil permeability.

A. Evaluating Soil Types

An important question concerning soil is how fast it will allow waste liquid to percolate or flow into it. If the waste liquid percolates too quickly, the soil will not have a chance to treat it by removing disease-causing substances or agents, and the waste liquid may seep into and contaminate the groundwater. If the waste liquid does not percolate quickly enough, it may overflow to the ground surface, causing serious health hazards.

Different types of soils percolate waste liquid at different rates. Some types of soil are acceptable for disposal systems; others are not.

B. Identifying Soil Types

The six basic types of soil are

- sand
- sandy loam
- loam
- silt loam
- clay loam
- clay

They can be identified by sight and feel. When testing soil by feel, test it both when dry and moist.

Sand

Individual grains are easily seen and felt. A handful of sand squeezed when dry will not hold its shape; squeezed when moist, it will barely hold its shape, crumbling when touched.

Sandy Loam

Contains a large percentage of sand, so sand grains can be seen and felt. Squeezed when dry, a handful of sandy loam will not hold its shape; squeezed when moist, it holds its shape and forms a cast that will not break when handled carefully.

Loam

Has a fairly smooth, yet slightly gritty feel; clods crumble easily. Squeezed when dry, loam forms a cast that can be handled carefully without breaking; squeezed when moist, the cast can be handled freely without breaking.

Silt Loam

Feels soft and floury; clods are easily crumbled. Squeezed when dry or wet, silt loam forms a cast that can be handled freely without breaking. A small ball of moist soil pressed between thumb and finger will not form a ribbon.

Clay Loam

Fine-textured; clods are hard. Moist clay loam is plastic and, when squeezed, forms a cast that can withstand considerable handling without breaking. A small ball of moist clay loam pressed between thumb and finger forms a thin ribbon that barely sustains its own weight.

Clay

Fine-textured; clods are very hard. Wet clay is plastic and usually sticky. A small ball of moist clay pressed between thumb and finger forms a long ribbon.

Sandy loams, loams, and silt loams are suitable soils for disposal systems. Sands, clay loams, and clays are unsuitable.

Note that soil at depth is almost always heavier than at the surface. For example, a sandy topsoil will very likely have a sandy loam beneath it, making it suitable for a latrine. Conversely, a silt loam topsoil may well have a clay loam or clay beneath it, rendering it unsuitable for a latrine.

Soil testing should be carried out at the surface and when the test hole is about 1 meter deep.

C. Locating Bedrock Levels and Groundwater

Most disposal systems require a minimum of 1 meter of pervious soil below the bottom of the system and above the highest bedrock, impervious layer, or groundwater level. The most direct method of locating bedrock, impervious layers, and the groundwater is to dig a test hole. The hole should be 1 meter deeper than the bottom of the proposed pit.

Bedrock

Bedrock or impervious layers are easily identified in a test hole because they become extremely difficult to dig and the soil consists mostly of rocks, shale, or tightly packed, consolidated material.

If bedrock or impervious layers are reached before the test hole reaches the proper depth, the proposed system cannot be constructed as designed. There are three choices: (1) select another site; (2) redesign the proposed system, if possible, to make it shallower but still with its bottom 1 meter above bedrock or impervious layers; or (3) select and design an alternative system that can be used at this site.

Groundwater

The same hole used to test for bedrock can be used to find the groundwater level. Groundwater is easily located in a test hole. After a few hours, the hole will fill with water to the groundwater level. Since the highest yearly groundwater level must be found, and since groundwater levels fluctuate throughout the year, test for groundwater during the wettest season.

If the highest groundwater level is encountered before the test hole reaches the proper depth, the proposed system cannot be constructed as designed. There remain the three choices noted above.

If soil type, bedrock layer, and groundwater level are all acceptable, and the proposed system is a pit or VIP latrine, the system can be constructed on the site without further testing.

Case Examples—Latrine Choices

Case I

A latrine program was implemented in the small community of Maltopo. The lead agency involved provided all material components of a VIP latrine and expected the community to provide for the manual labor needed for the construction. The agency also provided technical assistance for the construction phase of the project, but very little formal promotion of the benefits associated with the latrines. The latrines were well built, but they were misused and became soiled and unsanitary.

The following were some of the problems:

- Users did not like the darkness associated with the latrine. Some did not use it. Others made openings in the walls, without screening, to let in more light, which also allowed flies to enter.
- Several women covered the screened windows to ensure privacy. This inhibited the flow of air through the latrine, which increased the odors inside the latrine.
- The fly screen on the vent was removed and used for other purposes. This allowed flies to leave the pit after coming in contact with the contents.
- People did not properly dispose of their anal cleaning material, which posed a health risk.
- Some of the men considered the latrine as a status symbol to such an extent that they did not allow other members of the family to use it.

Questions

1. Why did the program suffer these problems?
2. What should the agency do to improve its procedures in future projects?
3. How could a development agent have promoted the program more successfully?
4. What are some possible solutions to the problems that these community members face?
5. How could these solutions be implemented?

Case II

A development agency approached the community of Rincon with the intent to help the community address its public health problems through the formation of a sanitation program. The agency attempted to find the most efficient way of increasing user participation and proper use of latrines.

The agency offered technical assistance to explain the range of feasible choices to the community and to educate the community on the importance of proper excreta disposal. The choices of latrines offered ranged from an inexpensive pit latrine to a $900 septic system.

Community members were to decide which type of latrine they wanted, provided they pay one-third of the total cost; the agency provided two-thirds of the cost. For example: (1) For a latrine that cost $100, $66 would be supplied by the agency and $34 would be supplied by the community member. (2) If the individual desired a $200 pour flush latrine, the agency would pay $133 and the individual would pay $67. The agency required that the community member raise his or her portion of the investment before the agency allocated its portion.

This approach proved very successful in providing very expensive latrines. People realized that the more resources they devoted to their latrines, the higher the subsidy they received from the agency, thereby increasing the value of their facility.

The major problem was that a great majority of community members chose the highest priced latrine, which quickly depleted project funding before all community sanitation needs and desires were addressed.

Questions

1. How did the agency avoid the implementation of a design that was not culturally acceptable?
2. How did the approach used by the development agency ensure the community's participation in the sanitation program?
3. What effect might this approach have on the proper use and maintenance of the latrine?
4. How could the problem be rectified?

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*Adapted from Final Evaluation of the CARE/Bolivia Child Survival and Rural Sanitation Project by Andrew Karp, Patricia Martin, and Sharon Guild. WASH Field Report No. 312, August 1990.

Case III

The community of Sanae has mainly an urban setting. People live in multistory housing; livestock are kept on the first floor and the living quarters are above. A squatting slab is located on the second floor. The excreta falls to an excavated area at the level of the foundation.

An agency tried to implement a sanitation program that promoted use of the VIP latrine due to its proven success in reducing odors and controlling disease vectors. The latrines were built close to each house and worked as designed.

However, the community members found the VIPs unacceptable and therefore did not use them. They had several complaints:

- The latrines were located outside the homes, which made them inconvenient compared with their previous systems.
- The outside location enabled people in the surrounding houses to see who was using the latrines, which embarrassed the users.
- Some of the latrines faced east, which was sacrilegious in the Sanae culture.

Questions

1. Why did the program suffer these problems?
2. What should the agency do to improve its procedures in future projects?
3. How could a development agent have promoted the program more successfully?
4. What are some possible solutions to the problems that these individuals face?
5. How could the solutions be implemented?

Case IV

An agency was involved in the building of pit latrines in the community of Nuhud. The agency provided the materials necessary for construction and technical assistance to the community. It also provided public health education, which increased the community members' desire for a sanitary latrine.

The community members were responsible for the labor involved in the construction of the facility. The latrine was designed with a wall between two squatting slabs, using the same pit, for use by the different sexes, as was generally accepted.

The construction went well, but several problems became evident when people started to use the latrines:

- The people of Nuhud were accustomed to using large quantities of water for anal cleansing and for washing after defecation. The soil around the pit was unable to absorb this quantity of water. It filled quickly with fluid.
- The community members were embarrassed to be seen walking to the latrine by members of the opposite sex, so they only used the latrine when someone of the opposite sex was not present.

Questions

1. How was the program successful?
2. What did the agency neglect to consider?
3. What could be done to upgrade the system?
4. How would the upgrades be implemented?
5. What would be the development agent's role in improving the existing situation?

Solutions to Case Examples

Case I

Each of the problems experienced has a solution. The steps to rectifying the situation begin with the community. What don't people like about the latrines and what can be done to address their dislikes? What current behaviors can be accommodated; which ones should be changed; which ones cannot be changed? The community members must be invited into the sanitation program and be able to feel confident that it will address their needs. They must be able to consider themselves participants rather than recipients.

Case II

Because the community members were able to choose which type of latrine they wanted and could afford, the question of a culturally acceptable latrine type did not surface. The facility was viewed and presented as an investment so that the participants would take pride in their latrines. This led to proper use and maintenance of the facility. Possible solutions to the major problem include the following:

- A set subsidy could be offered that would not change with differences in latrine choice. This approach would force those that desire a higher cost system to pay a greater percentage of the cost.
- The percentage subsidy could change based on the price level of the system. For example, if the agency offers to pay two-thirds the cost of the inexpensive latrine, it might offer to pay only one-half the cost of the next level of technology. The level of subsidy for the highest priced system might be only one-fourth or one-fifth of the total cost.
- In areas where the effective demand for improving sanitation facilities is great, a form of competition for the limited agency funding can be used to achieve the widest coverage.

  The agency could base the provision of its services on priority. Those community members who are willing to pay the greatest portion of the expense would be taken care of first. Thus, the first priority would be given to those people who need technical guidance only and are able to provide all other resources themselves. This approach would also increase the status of the sanitation systems by providing them first to those who most desire them.

Case III

A solution was provided after an in-depth study of the culture, which included personal preference. The indoor facilities were altered by combining certain aspects of the VIP latrine with the existing facility. The solution provided an upgraded and more desirable latrine without changing the people's cultural habits.

Case IV

After a study of the problems, the agency came up with the following solutions:

- To avoid overflowing of the pit by the quantity of wash water, a separate enclosure was constructed, at some distance from the latrine, with a sand and gravel bed. This enclosure was used for washing after defecation. The water was introduced more slowly to the soil by first passing through the sand and gravel bed.
- The separation walls inside the latrine were extended on the outside to prevent individuals from being seen as they approached the facility.

Quantitative and Qualitative Data

Quantitative Data

- to quantify/count certain things (latrines, pumps, etc.)
- the frequency of certain practices (times per week that latrine is cleaned)
- percentage of people's knowledge (16 percent know that dirty water can cause diarrhea)
- percentage of people's practices (22 percent do not use their latrines; 44 percent wash their hands before eating)
- usually a large sample but information is superficial rather than in depth
- method: usually a survey
- survey instrument is rigid; must be used in same fashion by all interviewers

Qualitative Data

- to explain certain practices, beliefs in detail:
  - why the latrine is cleaned once every two weeks; how it is cleaned
  - explanations of the causes of diarrhea
  - why 22 percent of the people do not use their latrines
  - why 44 percent of the people wash their hands before eating; why 56 percent do not
- usually a small sample but information is in depth
- methods: observations, individual or group interviews
- Methods are flexible. Initial questions and points to observe are defined by interviewer/observer. He/she must be alert and use creativity to ask additional questions or observe additional points as work proceeds.
- Typical qualitative questions:
  - why...?
  - how does...?
  - what are the advantages and disadvantages of...?
  - what is your opinion as to...?

Information Collection Worksheet on Human Excreta Disposal Practices

What Information to Collect	From Whom/Where	How to Collect It	Data Collected
1. *Physical Data*			
a. What is the predominant soil type in the community?			
b. Where in the community might the soil type cause a problem in the installation of latrines?			
c. Where would space for installation of latrines be a problem?			
d. How high is the water table? - in dry season - in wet season			
e. Which water sources would affect latrine siting?			

What Information to Collect	From Whom/Where	How to Collect It	Data Collected
2. *Human and Organizational Resources*			
a. Who is already doing what in the community?			
b. What relevant community committees exist?			
c. Who appear to be key leaders or influential people?			
d. What other community service groups exist?			
3. *Materials and Financial Resources*			
a. How willing are people to put resources into improving their sanitation?			

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What Information to Collect	**From Whom/Where**	**How to Collect It**	**Data Collected**
b. What materials are available in the market for latrine construction?			
c. What community, government, or other groups are willing to provide a subsidy or materials for latrine construction?			
d. How much skilled labor is there in the community, and of what type?			
e. What are peoples' priorities with their money?			

Principles for Conducting an Interview

Basic Steps in Interviewing	Examples of Interviewer Actions
1. Establish contract, set the climate and try to put person at ease.	■ Greetings ■ Welcoming ■ Ask person how he or she is doing.
2. Establish the purpose of the interview. Explain that the interview will be confidential and tell the person what will happen.	■ Review why you are interviewing. ■ Tell the person that you want to find out information that relates to sanitation programs. ■ Explain that you will ask some questions, and that he or she will have an opportunity to ask questions as well.
3. Gather information about the person by asking questions related to the interview purpose.	■ Ask open-ended questions where appropriate. ■ Put the person in a situation and ask what he or she would do.
4. Give the person a chance to talk about himself or herself.	■ Answer questions (these are a key to the way the person thinks).
5. Conclude the interview.	■ Tell the person what will happen next. ■ Thank the person for his or her time.

Making Good Concrete

A. Introduction to Cement

Cement is one of the most useful materials in construction. It can easily be mixed with sand and water to make mortar or with gravel sand, and water to make concrete. Mortar and concrete are among the strongest and most durable materials used for all types of construction around the world. Mortar is normally used as the bonding agent between bricks or rocks, and concrete is normally reinforced with steel bars and molded to the desired size and shape.

Cement is available in almost every country in the world. Sand and gravel are usually available locally. Occasionally it will be difficult to get cement for latrine construction either because there are other higher priority demands for the cement or because it is too expensive. It is impossible here to say how or even whether cement can be obtained in such a circumstance.

Of the two cement compounds, mortar and concrete, concrete is the stronger. This is because the rock that makes up the gravel itself is stronger than the concrete and so contributes to its strength. Sometimes the two can be used interchangeably where lack of materials or working conditions demand it. Remember that concrete is the stronger product and should be used whenever possible.

Note: The rest of this discussion deals specifically with concrete. The same procedures can and should be followed if mortar is used instead.

B. Ingredients of Concrete

Concrete is made from cement, sand, gravel, and water. These ingredients are combined in certain proportions to achieve the desired strength. The amount of water used to mix these ingredients is by far the most important factor in determining the final strength of the concrete. Use the least amount of water that will still give you a workable mix. Sand and gravel, which are sometimes referred to as fine and coarse aggregate, respectively, should be clean and properly graded. Cement and water form a paste, which when mixed, acts as a glue to bind the aggregates together in a strong, hard mass.

Proportions

- As noted above, there are four major ingredients in concrete: cement, sand, gravel, and water.

- Dry ingredients are normally mixed in certain proportions and then water is added. Proportions are expressed as follows: 1:2:4, which means that to one part cement you add two parts sand and four parts gravel. A "part" usually refers to a unit of volume. Example: A 1:2:4 concrete mix could be obtained by mixing 1 bucket of cement with 2 buckets of sand and 4 buckets of gravel.

- Proportions are almost always expressed as cement: sand: gravel, and they are usually labeled that way.

- There are many minor variations in the proportions used for mixing concrete. The most commonly used are 1:2:4, 1:2:3, 1:2.5:5.

Note: a 1:2:4 mix will go a little farther than the 1:2:3 mix and allows for using less then the best grade of sand or gravel than a 1:2.5:5 mix.

- Normal range for amount of water used to mix each 50 kg bag of cement is between 20 and 30 liters (for a 94 lb bag of cement, the range is between 4.5 and 7 gal).

- The watertightness of concrete depends primarily on the water/cement ratio and the length of moist curing. This is similar to concrete strength in that less water and longer moist-curing promote watertightness.

Choice of Ingredients

- Cement: The descriptions and properties given in this handout are specifically of Portland cement. This is the type most commonly used and hereafter will be referred to only as cement.

When used, cement should be dry, powdery, and free of lumps. When storing cement, try to avoid all possible contact with moisture. Store it away from exterior walls, off damp floors, and stacked close together to reduce air circulation. If it could be kept completely dry it could be stored indefinitely. Even exposed to air it will gradually draw moisture, thus limiting even the covered storage time to between 6 months and 1 year depending on conditions.

- Water: In general, water fit for drinking is suitable for mixing concrete. Impurities in the water may affect concrete setting time, strength, and shrinkage and promote corrosion of reinforcement.

- Aggregates: Fine and coarse aggregates together occupy 60 to 80 percent of concrete volume.

- Fine aggregate: Sand should range in size from less than .25 mm to 6.3 mm. Sand from seashores, dunes, or river banks is usually too fine for normal mixes. (You can sometimes scrape about 30 cm of fine surface sand off and find coarser, more suitable sand beneath it.)

- Large aggregate: Within the recommended size limits mentioned later, the larger the gravel you use the stronger and more economical the concrete will be.
- The larger the size of the gravel the less water and cement will be required to get the same strength concrete.
- The maximum gravel size should not exceed:
  - one-fifth the minimum dimension of the member;
  - three-fourths the clear space between reinforcing bars or between reinforcement and forms. (Optimum aggregate size in many situations is about 2.0 cm.)

The shape and surface texture of aggregates affect properties of freshly mixed concrete more than they affect hardened concrete. Rough textured or flat and elongated particles require more water to produce workable concrete than do rounded or cubical aggregates, and more water reduces the final strength of the concrete.

It is extremely important to have the gravel and sand clean. Silt, clay, or bits of organic matter, even in low concentrations, will ruin concrete. A very simple test for cleanliness makes use of a clear wide-mouthed jar. Fill the jar about half full of the sand and small aggregate to be tested and cover with water. Shake the mixture vigorously, and then allow it to stand for three hours. In almost every case there will be a distinct line dividing the fine sand suitable for concrete and that which is too fine. If the very fine material amounts to more than 10 percent of the suitable material, then the concrete made from it will be weak.

This means that other fine material should be sought, or the available material should be washed to remove the material that is too fine. This can be done by putting the sand (and gravel if necessary) in some container, such as a drum. Cover the aggregate with water, stir thoroughly, let stand for a minute, and pour off the liquid. One or two such treatments will remove most of the very fine material and organic matter.

Another point to consider in the selection of aggregate is its strength. About the only simple test is to break some of the stones with a hammer. If the effort required to break the majority of aggregate stones is greater than the effort required to break a similar-sized piece of concrete, then the aggregate will make strong concrete. If the stones break easily, then you can expect that the concrete made of these stones will only be as strong as the stones themselves.

In very dry climates several precautions must be taken. If the sand is perfectly dry, it will pack into a smaller space. If 20 buckets of dry sand are put in a pile and 2 buckets of water are stirred in, you could carry away about 27 buckets of damp sand. If your sand is completely dry, add some water to it or else measure by weight instead of volume. The surface of the curing concrete should be kept damp. This is because water evaporating from the surface will remove some of the water needed to make concrete properly. Cover the concrete with building paper, burlap, straw, or anything that will hold moisture and keep the direct sun and wind from the concrete surface. Keep the concrete moist by sprinkling as often as necessary; this may be as often as three times per day. After the first week of curing, it is not necessary to keep the surface damp continuously (see "Curing Concrete" below).

Estimating Quantities of Materials Needed

1. Calculate the volume of concrete needed (length x width x depth).
2. Multiply the volume of concrete needed by 1.5 to get the total volume of dry loose material needed. The cement and sand do little to add to the volume of the concrete because they fill in the air spaces between the gravel.
3. Add 10 percent (1/10) for losses due to handling.
4. Add the numbers in the volumetric proportion 1:2:3 = 6 that you will use to get a relative total. This will allow you later to compute fractions of the total needed for each ingredient.
5. Determine the amount of cement needed by multiplying the volume of dry material needed (from step 2) by the cement's proportional amount of the total mix (e.g., amount cement needed = 1/6 x volume of dry materials).
6. Divide by the unit volume per bag, 33.2 liters per 50 kg bag of cement, or 1 cubic foot per 94 lb bag of cement. When figuring the number of cement bags, round up to the nearest whole number.

Note: This calculation, even with the 10 percent addition for handling losses, rarely leaves any extra concrete, particularly for small jobs requiring fewer than five hand-mixed bags of cement.

C. Construction with Concrete

Outline of Concrete Work

- build forms
- place rebar
- mix concrete
- pour concrete
- remove forms
- finish surface

- cure concrete

Each step in the process is described below.

Materials for Forms

The following materials are used to construct interior forms:

- Steel: Forms made of steel are durable and strong but are heavy, awkward, and expensive.
- Sheet metal: With a simple triangular interior support, forms made of sheet metal have proved to be successful. They are lighter and more maneuverable than steel forms but are not as strong and durable.
- Wood: This material is commonly used because it is lightweight and strong. It must be carefully bent, waterproofed, and reinforced.

  By using boards as wide as possible, form construction is made easier and quicker. It also reduces the number of lines on the concrete surface that form at the junction of two boards. Plywood is excellent, especially if it has a special high-density overlay surface. This allows for a smoother concrete finish, easier form removal, and less wear on the forms.

  If unsurfaced wood is used for forms, oil or grease the inside surface to make removal of the forms easier and to prevent the wood from drawing too much water from the concrete. Do not oil or grease the wood if the concrete surface will be painted or stuccoed.
- Earth: Any earth that can be dug into and still hold its shape can also be used as a form. Carefully dig out the desired shape and fill it with concrete. Once the concrete has set and cured it can be dug up and used where needed. A new form will have to be dug out for each piece of concrete poured.
- Other materials: Plastics and fiberglass are also occasionally used and continue to be experimented with as form materials. Fiberglass is much lighter than steel and, if handled carefully, lasts for a long time. Its cost and availability in developing nations seem to be the only factors limiting more widespread trials.

Concrete Reinforcement (Rebar)

Reinforcing concrete will enable it to bear much greater loads. Design of reinforced concrete structures that are large or must carry high loads can become too complicated for a person without special training.

Concrete alone has great compression strength but little tensile strength. Concrete is very difficult to squeeze (compression), but breaks relatively easily when stretched (put in tension). Reinforcing steel has exactly the opposite properties; it is strong in tension and weak in compression. Combining the two results in a material (reinforced concrete) that is strong in both compression and tension and therefore useful in a large number of situations.

Concrete is best reinforced with specially made steel rods that can be imbedded in the concrete. Bamboo has also been used to reinforce concrete with some success, although it is liable to deteriorate with time.

- Reinforced concrete sections should be at least 7.5 cm thick, although 10 cm is preferable.
- The reinforcing bar (rebar) usually comes in long sections of a given diameter.
- Exactly how much rebar is needed in a particular pour will depend on the load it will have to support. For most concrete work, including everything discussed in this manual, rebar should take up 0.5 to 1 percent of the cross-sectional area.
- Reinforcing bars should also have clean surfaces free of loose scale and rust. Bars in poor condition should be brushed thoroughly with a stiff wire brush.
- When placing rebar in a form before the concrete is poured, it should be located
    - at least 2.5 cm from the form everywhere.
    - in a plane approximately one-third of the way into the thickness of the pour from the bottom of the structure or slab.
    - in a grid so that there is never more than three times the final concrete thickness between adjacent bars.
    - no closer than 3 cm to a parallel bar.
- Rebar strength is approximately additive according to cross-sectional area. Four 4-mm rebars will be about as strong as one 8-mm rebar. The cross-sectional area of four 4-mm rebars equals the cross-sectional area of a one 8-mm rebar.
- The rebars should be arranged in an evenly spaced grid-type pattern with more and/or thicker rebar along the longest dimension of the pour.
- All intersections where rebars cross should be tied with thin wire.
- When one rebar is tied onto another to increase the length of the rebars, the overlap should be 20 times the diameter of the rebar and be tied twice with wire.

Rebar Size	Overlap
6 mm	12 cm
8 mm	16 cm
10 mm	20 cm
12 mm	24 cm

- Larger sizes of rebar often have raised patterns on them, which are designed to allow them to be held firmly in place by the concrete. Smaller sizes of rebar are generally smooth. When using smooth rebar, always make a small hook at the end of each piece that will be in the concrete. Without the hook, temperature changes may eventually loosen the concrete from the rebar, thereby destroying much of its reinforcing effect.
- Rebar should be carefully prepared so that the rebar is straight and square. Sloppy rebar work will result in weaker concrete and waste rebar.
- For particularly strong pieces or where small irregular shapes are being formed, the rebar can be put together in a cage-like arrangement. Use small rebar for the cross sections and larger rebar for the length. This system is used to reinforce pieces like a cutting ring, with its irregular shape, or perhaps a well cover, which may have many people standing on it at one time.
- Where possible, it is usually best to assemble rebar inside the form so that it will fit exactly.
- The proper distance from the bottom of the pour in a slab can be achieved by setting the rebar on a few small stones before the concrete is poured or simply pulling the rebar grid a couple of centimeters up into the concrete after some concrete has been spread over the whole pour.

Mixing Concrete by Machine or by Hand

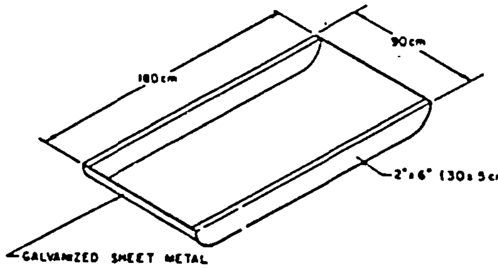
Mixing by Machine

Concrete must be thoroughly mixed to yield the strongest product. For machine mix, allow 5 or 6 minutes after all the materials are in the drum. First, put about 10 percent of the mixing water in the drum. Then add water uniformly with the dry materials, leaving another 10 percent to be added after the dry materials are in the drum.

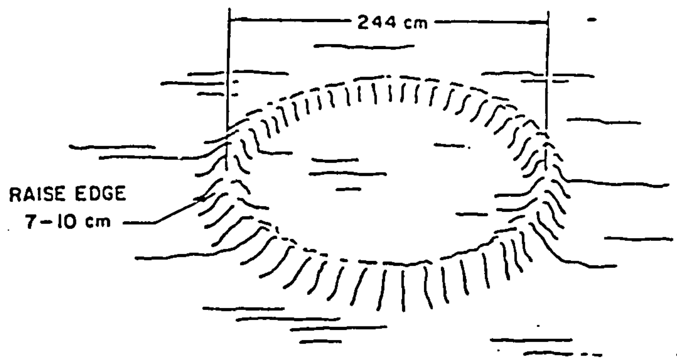
Mixing by Hand

On many self-help projects, the amount of concrete needed may be small or it may be difficult to get a mechanical mixer. If a few precautions are taken, hand-mixed concrete can be as strong as concrete mixed in a machine.

The first requirement for mixing by hand is a mixing area that is both clean and watertight. This can be a wood and metal mixing trough or simple round mixing floor, as shown below.



Wood and Metal Mixing Trough



Mixing Floor

Use the following procedure:

1. Spread the fine aggregate evenly over the mixing area.
2. Spread the cement evenly over the fine aggregate and mix these materials by turning them with a shovel until the color is uniform.
3. Spread the mixture out evenly, spread the coarse aggregate on it, and mix thoroughly again. All dry materials should be thoroughly mixed before water is added.

A workable mix should be smooth and plastic—neither so wet that it will run nor so stiff that it will crumble. If the mix is too wet, add small amounts of sand and gravel, *in the proper proportion*, until the mix is workable. If a concrete mix is too stiff, it will be difficult to place in the forms. If it is not stiff enough, the mix probably does not have enough aggregate, thus making it an uneconomical use of cement.

When work is finished for the day, be sure to rinse concrete from the mixing area and the tools to keep them from rusting and to prevent cement from caking on them. Smooth shiny tools and mixing surfaces make mixing surprisingly easier. The tools will also last much longer.

Pouring Concrete Into Forms

To make strong concrete structures, it is important to place fresh concrete in the forms correctly.

The wet concrete mix should not be handled roughly when it is being carried and put in the forms. It is very easy, through joggling or throwing, to separate the fine aggregate from the coarse aggregate. Do not let the concrete drop freely for a distance greater than 90 to 120 cm (3 to 4 ft). Concrete is strongest when the various sizes of aggregates and cement paste are well mixed.

Properly proportioned concrete will have to be worked into place in the form. Concrete that would on its own flow out to fill in a form completely would be too wet and therefore weak.

When pouring concrete structures that are over 120 cm high, leave holes in the forms at intervals of less than 120 cm through which concrete can be poured and which can later be covered to permit pouring above that level. Alternatively, a slide could be used through which concrete could flow down to the bottom of the form without separating. Any "U"-shaped trough wide enough to facilitate pouring concrete into it, narrow enough to fit inside the form, and long enough so that the concrete can slide down the chute without separating will work.

As the concrete is being placed, it should be compacted so that no air holes, which would leave weak spots in the concrete, are left. This can be done by tamping the concrete with some long thin tools or vibrating the concrete. Tamping can be accomplished with a thin (2 cm) iron rod, a wooden pole, or a shovel.

The concrete will be compacted to some extent as it is moved into its final position in the form. However, special attention must be paid to the edges of the pour to make sure that the concrete has completely filled in against the form. If the forms are strong enough, they can be struck with a hammer on the outside to vibrate the concrete just enough to allow it to settle completely in against the forms. Too much vibration can force most of the large aggregate toward the bottom of the pour, thus reducing the overall strength of the concrete.

Finishing

Once the concrete is poured into the forms, its surface should be worked to an even finish. The smoothness of the finish will depend on what the surface will be used for. Where more concrete or mortar will later be placed on this pour, the area should be left relatively rough to facilitate bonding. Where the surface will later be walked on, as for example, the floor of a latrine, it should be somewhat rough to prevent people from slipping on the concrete when its surface is wet. This somewhat rough texture can be achieved by finishing with a wooden float or by lightly brushing the surface to give it a texture. A very smooth finish can be made with a metal trowel. Overfinishing (repeated finishing) can lead to powdering and erosion of the surface.

Curing Concrete

After the forms are filled, the concrete must be cured until it reaches the required strength. Curing involves keeping the concrete damp so that the chemical reaction that causes the concrete to harden will continue for as long as is necessary to achieve the desired strength. Once the concrete is allowed to dry the chemical hardening action will gradually taper off and cease.

The early stage of curing is extremely critical. Special steps should be taken to keep the concrete wet. Once the concrete dries, it will stop hardening; after this happens it cannot be rewetted in the field to restart the hardening process.

Covering the exposed concrete surfaces is usually easier than continuously sprinkling or frequently dousing the concrete with water, which would otherwise be necessary to prevent the concrete surface from becoming dry. Protective covers often used include canvas, empty cement bags, burlap, plastic, palm leaves, straw, and wet sand. The covering should also be kept wet so that it will not absorb water from the concrete.

Concrete is strong enough for light loads after 7 days. In most cases, forms can be removed from standing structures, like bridges and walls, after 4 or 5 days, but if they are left in place they will help to keep the concrete from drying out. Where concrete structures are being cast on the ground, the forms can be removed as soon as the concrete sets enough to holds its own shape (3 to 6 hours) if there is no load on the structure and measures are taken to ensure proper curing.

The concrete's final strength will result in part from how long it is moist cured. As can be seen from Figure 10-1, concrete will eventually reach about 60 percent of its design strength if not moist-cured at all, 80 percent if moist-cured for 3 days, and almost 100 percent if moist-cured for 7 days. If concrete is kept moist, it will continue to harden indefinitely.

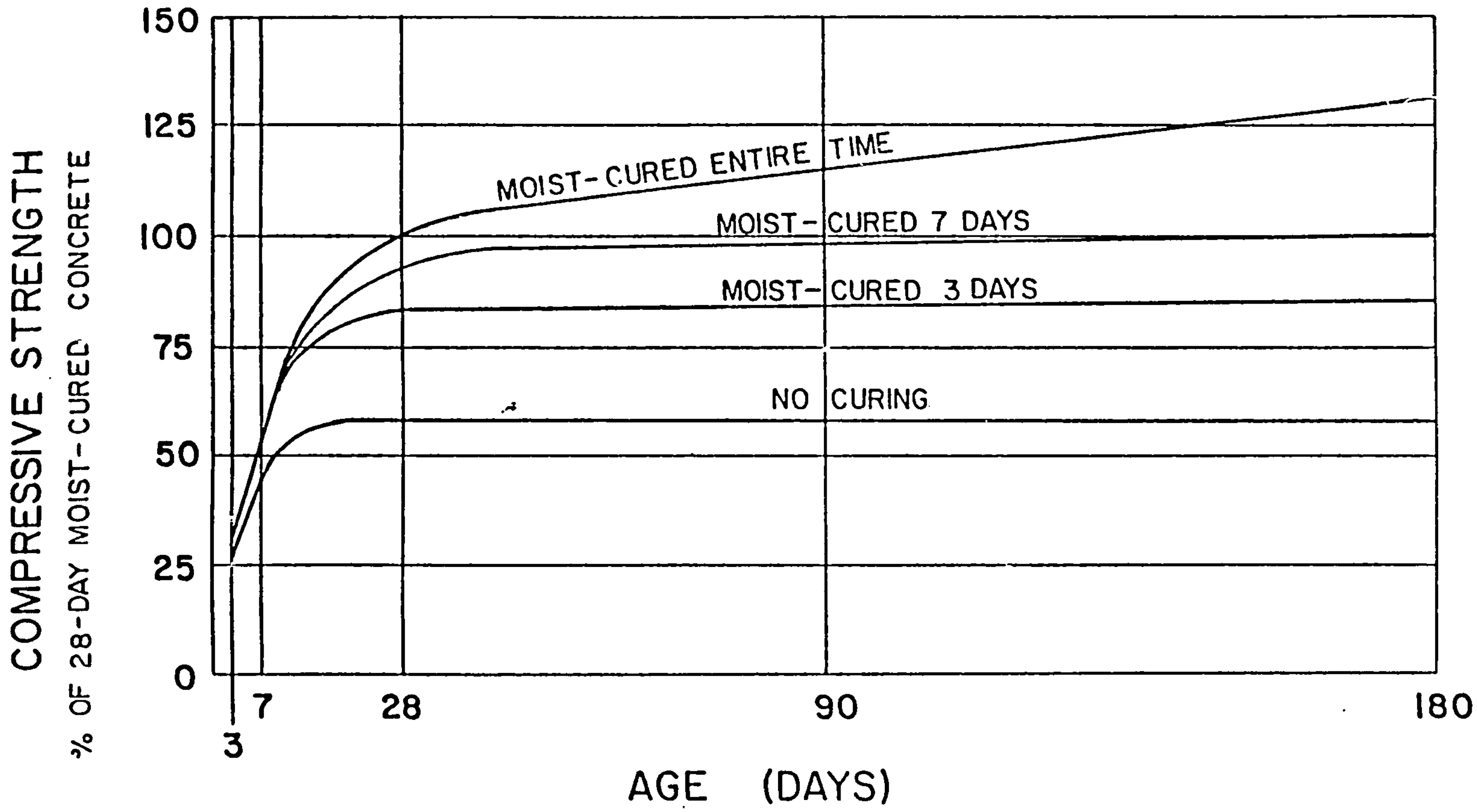


FIGURE 10-1

Compressive strength of concrete

Key Design Components

A. Base

- Prevents erosion around the slab.
- Supports the slab and superstructure.
- Prevents access by insects (if a seal is formed with the slab).
- Prevents runoff from entering the pit (if the base is raised).
- Can be made of any durable material that can be sealed with the slab (e.g., brick, concrete block, poured concrete, wood).
- Can be built up to form a wall to expand the volume of a latrine as for a raised platform pit latrine.
- Functions also as foundation of superstructure in certain cases.

B. Pit Design

- Can be made of any cross-sectional shape (although a round shape is the most stable and efficient).
- Should be made with a large enough storage capacity to last several years.
- Should be built in reasonably permeable soil.
- Should not intrude on the water table that is utilized as a drinking water source. (In areas of high water table, a raised platform pit latrine can be used. An impermeable layer of clay can also be placed on the pit bottom to inhibit leaching into the water table.)

C. Pit Lining Design

- Used in unstable soil to shore the pit walls.
- Used in waterborne or sealed system (although not needed in all cases).
- Adds support to the base, slab, and superstructure in unstable soil.
- Requires spaces in the lining to allow the liquids to infiltrate into the surrounding soil.
- Should be built to last for the design life of the pit.

D. Latrine Slab

- Can be made of various materials (e.g., reinforced concrete, wood) and in various or different shapes to fit the pit (e.g., round or square).
- Cement is the most common slab construction material; it can be used to form different slabs: reinforced concrete, ferrocement, and Sanplat.
- Some slab or slab fixtures are better suited to mass manufacturing processes.
- Must be made smooth and nonporous for easy cleaning and to reduce the transmission of diseases.
- Can have different components, such as a pedestal seat, foot pads, or a customized component for a specific user (e.g., a smaller seat and drop hole for children).
- A seal between the slab and base can be formed of cement or clay.
- Slab fixtures, such as the waterseal trap, can be built of concrete, ceramic, or sheet metal, and should be manufactured by a skilled local craftsman.

E. Ventilation

- Will decrease the odors of the latrine.
- Will keep the latrine interior dry.
- Must be screened to prevent access to insects.

For VIP vent:

- Can be made of many materials, but a smooth, rounded cross section is the most efficient, such as plastic pipe (must be without curves).
- The larger the cross-sectional area of the vent, the better it will work; a minimum of 15 cm is recommended for round cross sections and a minimum of 23 cm per side of a square one.
- Must extend from the pit to a height above the surrounding buildings to reduce the odor; should not be placed in an area near trees, which would inhibit the flow of wind across the top of the vent.
- The ventilation of the superstructure should be oriented toward the prevailing incoming wind; this will increase the efficiency of the vent in reducing the odors of the pit.
- Must be equipped with a fly screen—stainless steel or aluminum is recommended.

F. Superstructure

- Can be constructed from any material that is structurally sound, has enough space, and is acceptable to the user.
- Must provide protection from the elements, privacy, and a pleasant atmosphere.
- A comfortable atmosphere encourages proper latrine use.

For VIP latrine,

- The interior should remain dark to prevent flies from escaping from the superstructure after coming into contact with the pit contents. If this factor inhibits its use by small children, an adjustment should be made to make it comfortable for all family members.

Estimating for Construction

A. Base Design

A base can be made out of poured concrete, wood, brick, and other material. It must be wide enough to support the concrete slab. (See Figures 10-2 and 10-5 at the end of this handout.)

The quantity of materials needed to construct the base depends on the type of material and the size of the pit. One way to estimate the quantity for a brick, concrete block, or concrete base is to calculate the distance around the top of the pit. This distance is called the periphery; it is equal to twice the length plus twice the width.

Base Made of Brick or Concrete Blocks

When constructing a base made of bricks or concrete blocks, place them side to side, around the pit.

For example,

- If a pit is 1.2 m long and 1 m wide, the perimeter (P) equals:

  P = (2 x 1.2) + (2 x 1) = 4.4 m

If the width of one concrete block is equal to 20 cm, how many blocks would it take to make a two-layer base?

If the concrete block width is 20 cm, it will take five of them to make a meter. Multiply the number of blocks per meter by the number of meters in the periphery by the number of layers:

Number of blocks = 5 x 4.4 x 2 = 44 blocks needed.

Base Made of Poured Concrete

The quantity of poured concrete needed is the area of the outer base trench minus the area of the pit cross section multiplied by the depth of the base.

For example,

- A base is 15 cm wide and 7.5 cm thick and the cross-sectional dimensions of the pit are 1 m by 1 m.

Since the width of the base extends to both sides of the pit, the outer area is 1.3 x 1.3 = 1.69 m^2; subtracting the 1 m^2 of the pit gives you the cross-sectional area of the base, which is 0.69 m^2. This number is then multiplied by the thickness (7.5 cm = 0.075 m) to get the volume of concrete needed—0.052 m^3 of concrete.

A poured concrete base should be reinforced. Iron bars or bamboo can be used.

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B. Pit Design

Common limitations when considering pit designs are the presence of a high water table or rocky soil. Some solutions to these problems follow (also see Figure 10-3):

- Elevate the pit by extending the pit base above ground level and adding steps up to the latrine slab, as for a raised platform latrine.
- Build pits that are shallower in such a way that the materials used can be readily recycled because the pit will fill more quickly.
- Use an above-ground system.

Other major points:

- A pit should have a large enough storage capacity to last several years.
- It should be built in a reasonably permeable soil (see Handout 8-4 on "Determining Soil Suitability").
- It should not intrude on the water table that is utilized as a drinking water source (the bottom of the pit should be at least 2 m above the water table).

Decisions regarding pit design and size should be based on the following factors:

- latrine technology (wet or dry system)
- number of users
- design life of the pit
- whether anal cleansing solids will be thrown into the pit

The design life of the pit is the time it takes for the latrine to fill, after which the latrine has to be emptied or rebuilt. The design life depends on the size of the pit, type of latrine, number of users, and type of solid anal cleansing material used (if thrown into the pit).

As a general rule, it is more economical to dig a deeper pit to increase the volume than to increase the cross section. It the cross section is increased, the base and slab dimensions must also be increased.

To calculate the pit size, the following formula can be used:*

$V = 1.33 \times C \times P \times N$

where,

V = the volume of the pit in m^3,

C = the pit design capacity in m^3/person-year,

P = the number of users, and

N = the design life in years.

C is the amount of excrement from a single person that is left in the pit after a year, along with cleansing material used. The value of C depends on whether it is a dry or wet pit (see see Table 10-1).

The factor of 1.33 is incorporated to ensure a clear space above the remains of the excreta at the end of the design period.

TABLE 10-1.
The Value of Pit Design Capacity (m^3 per person per year)

Wet Pit		**Dry Pit**	
Anal Cleansing Water	Anal Cleansing Solids	Anal Cleansing Water	Anal Cleansing Solids
0.04	0.06	0.06	0.09

Pit Design and Size: An Illustration

A family of four wants a waterseal latrine that will last for 10 years. They use a solid cleansing material but dispose of it outside the latrine by burying it. The soil at the selected latrine site will readily absorb the water used in flushing the latrine.

In this example,

C = 0.04 m^3/person-year

P = 4 people

N = 10

V = 1.33 zero x 0.04 x 4 x 10 = 2.1 m^3.

The volume of the pit should be 2.1 m^3.

For a rectangular pit,

$V = H \times L \times W$

where,

H = height,

L = cross-sectional length, and

W = cross-sectional width.

If we choose to make a square pit, L and W will be equal. If L and W equal 1 m, how deep does the pit have to be to provide a volume cf 2.1 m^3?

$2.1 = H \times 1 \times 1$

We find that H is equal to 2.1 m.

C. Pit Lining

There are variety of ways and materials for lining a pit: concrete blocks, timber (wood), bamboo, brick, and so on. (See Figures 10-3 and 10-4.) If the soil is unstable, any of these materials can be used to shore the pit walls.

The critena for selecting a material are strength and cost. The material must be strong enough to last the design life of the pit yet inexpensive enough to be affordable.

To determine the quantity of material needed for lining, you must calculate the overall area of each side of the pit walls. This is done by multiplying the depth by the width of each wall, and adding them together. If the walls are extended above the ground level, as in a raised platform latrine, the area of the extension must be included to obtain total material requirements.

Example 1

If a pit is 2.5 m deep and has a rectangular cross section of 0.8 m by 1 meter, the quantity of material needed would be calculated as follows:

Wall surface area $= 2.5 \times (0.8 \times 2 + 1 \times 2) = 6.5$ m^2.

If there are 100 bricks per square meter, then

6.5 m^2 x 100 bricks/m^2 = 650 bricks needed.

If one-third the bag of cement is needed to provide mortar to build a 1 m^2 section of wall, approximately one-half of the quantity would be needed when constructing a pit wall.

In a pit wall, mortar is not used in the vertical spaces between the bricks to allow the liquids in the pit to soak into the surrounding soil.

How much cement is required to build the pit walls?

Bags of cement = 1/2 x 1/3 x 6.5 = 1.1 bags.

Example 2

If the pit design is used as in Example 1, but the walls are each raised 1 m to accommodate a raised platform latrine, the quantity of materials needed would be calculated as follows:

Wall surface area = 3.5 x (0.8 x 2 + 1 x 2) = 12.6 m^2.

Bricks required:

12.6 m^2 x 100 bricks/m^2 = 1,260 bricks needed.

Cement required:

The calculation for cement required would be slightly different because the wall above the ground level would be built with mortar in all the spaces, as for a house. The amount of cement required for the wall portion below the ground level would be the same as in Example 1, 1.1 bags, so only the mortar needed for the above-ground portion needs be calculated.

Above-ground wall surface area = 1 x (0.8 x 2 + 1 x 2) = 3.6 m^2.

Total cement required:

Bags of cement = 1.1 bag + (1/3 x 3.6) = 2.3 bags.

The quantity of any material needed for lining the pit can be calculated in the same manner. An easy method for doing this is to measure a square meter of a building made of the same material as the lining will be, then determine the amount of the material in that square meter. Remember that spaces must be left in the lining to enable the liquids in the pit to infiltrate into the soil surrounding the pit. If no spaces are left, the latrine will fill more quickly.

D. Latrine Slab Design

Slabs can be made of many materials (see Figures 10-6 through 10-9). Concrete is the most common, strongest, and most versatile of these materials. For this reason, this discussion focuses on latrine slabs made of concrete.

All slabs should overlap the latrine base by 10 cm on each side to form a good seal.

Reinforced Concrete Slab (Figure 10-7)

- Consists of the following materials: cement, sand, gravel, water, and reinforcing material (usually steel bars).
- A common thickness for reinforced concrete slabs is 10 cm. The width and length may vary (or the slab may be round), but they are usually not more than 1.5 m.

Concrete is mixed in different ratios:

1:2:3 indicates 1 part cement:2 parts sand:3 parts gravel

1:2:4 indicates 1 part cement:2 parts sand:4 parts gravel

Constructing a reinforced concrete slab involves the following steps:

1. build forms
2. place reinforcement
3. mix concrete
4. pour concrete
5. remove forms
6. finish surface
7. cure concrete

See Handout 10-1: "Making Good Concrete" for a discussion of each step.

Ferrocement Slab (Figure 10-8)

The ferrocement slab is slightly different from the reinforced concrete slab. The material components of the concrete do not include gravel as in the reinforced concrete slab; the reinforcement is a large mesh screen (chicken wire) cut to the dimensions of the slab. Two layers of screen are required, and sometimes three are used.

With ferrocement construction, less material is required because the wire mesh forms a stronger bond with the other material components. Thus, the ferrocement slab weighs less.

A ferrocement slab can be made with a thickness of only 2.5 cm and will be as strong as a reinforced concrete slab. The ratio of cement to sand in a slab is 1:2.

Calculating the Materials Needed for a Reinforced Concrete Slab: An Illustration

What are the material requirements of a slab that is 10 cm thick and 1 m square if a 1:2:4 mixture is used? How much rebar is needed if the reinforcement is placed every 20 cm along both axes of the latrine slab?

1. Volume of slab = thickness x length x width

   $0.10 \times 1 \times 1 = 0.1 \text{ m}^3$

2. The sand and cement add little to the volume of the slab because they fill the spaces (air pockets) within the gravel.

   Based on this, 0.1 m^3 gravel is needed.

3. Since the ratio of sand to gravel is 2:4, the sand needed is half as much as the gravel, or 0.05 m^3.

4. The volume of cement needed is one-fourth of the volume of gravel, or 0.025 m^3.

5. How many bags of cement is this?

   It depends on the size of the bag (they can be different from one country to another).

   What if we assume that a bag is 50 kg?

   A 50 kg bag has a volume of 33.2 liters (1 m^3 = 1,000 liters) or 0.0332 m^3. Comparing this number with that in step 4, a little less than one-third of the bag will be left over after the slab is made.

6. What is the rebar requirement?

   If rebar is placed every 20 cm, four pieces will be needed along each axis for a total of eight. They are cut to approximately the same length of the slab, so 8 m of rebar are needed.

Calculating the Materials Needed for a Ferrocement Slab: An Illustration

Calculate the material requirements of a ferrocement slab to fit over a square pit with dimensions of 1 m by 1 m.

1. If the pit is 1 m square, the slab should be 1.2 m by 1.2 m in order to overhang the edges of the pit.
2. Volume of the slab: 1.2 x 1.2 x 0.025 (thickness) = 0.036 m^3.
3. How much of this volume is sand and how much is cement?

   Since the sand does not form air pockets to the extent of the gravel in the reinforced concrete slab, it will amount to two-thirds of the volume of the slab.

   2/3 x 0.036 m^3 = 0.024 m^3 sand.

   The volume of cement required is half of the sand volume given the 1:2 ratio, or 0.012 m^3.
4. How many bags of cement are needed if we use 50 kg bags of cement?

   We use the same calculation as in the previous example. A 50 kg bag of cement has a volume of 33.2 liters or 0.0332 m^3. We can see by comparing this amount with the amount of cement required (0.012 m^3) that the ferrocement slab will use about one-third of the bag.
5. How much chicken wire is required?

   This is calculated by multiplying the area of the slab by 2, because two layers of screen are involved.

   2 x (1.2 x 1.2) = 2.88 m^2.

Sanplat

Sanplat is a name for a particular latrine slab that does not require reinforcement (see Figure 10-9). The unique arch design gives it sufficient structural stability to support itself without reinforcement. It also requires less cement than a reinforced concrete slab of the same dimensions.

It can be built as above in terms of the concrete mixture, but a specialized form is required to create the arch.

Waterseal Trap (Figures 10-8 and 10-10)

The waterseal trap can be made of different materials by a skilled artisan. The basic design of the traps depends on whether they are to be used for an offset pit or a pit directly under the slab. Examples of each type (with corresponding latrine diagram) are shown in Figure 10-10.

E. Ventilation

Sufficient ventilation will help reduce the bad odors in the latrine superstructure. A screened window can easily be located between the superstructure walls and the roof. All openings should be screened to prevent flies from entering the latrine superstructure. (See Figures 10-11 and 10-12).

VIP latrines have a vent pipe. This pipe can be made of local materials, and can be built—just as the latrine superstructure—by a local builder. The alternative is to make it from plastic piping. It is generally recommended that the pipe be 15 cm in cross section or larger; however, a 10 cm pipe has been shown to work in an area with a consistent wind. The junction of the pipe (of whatever material) and the latrine slab must be sealed to prevent the escape of flies. A common problem in the operation of the VIP latrine vent pipe is that the latrine is located near tall buildings or trees. These objects block the flow of wind around the vent pipe, which can reduce or nullify the air circulation in the latrine.

The function of the fly screen is vital in preventing flies from escaping the pit. It must be maintained after installation if it is to work effectively.

F. Superstructure

The superstructure should be built by a local house builder—someone who is familiar with local materials (see examples in Figures 10-13 and 10-14). This builder should be contacted to assist with calculating the materials needed. He or she should also be a good resource to identify where different materials can be obtained.

Great care should be taken in choosing the materials, as well as the builder, for the superstructure because it not only provides privacy for the user but is also the most visible component of the latrine. As such, the proper and continued use of the latrine can depend on the quality of the structure.

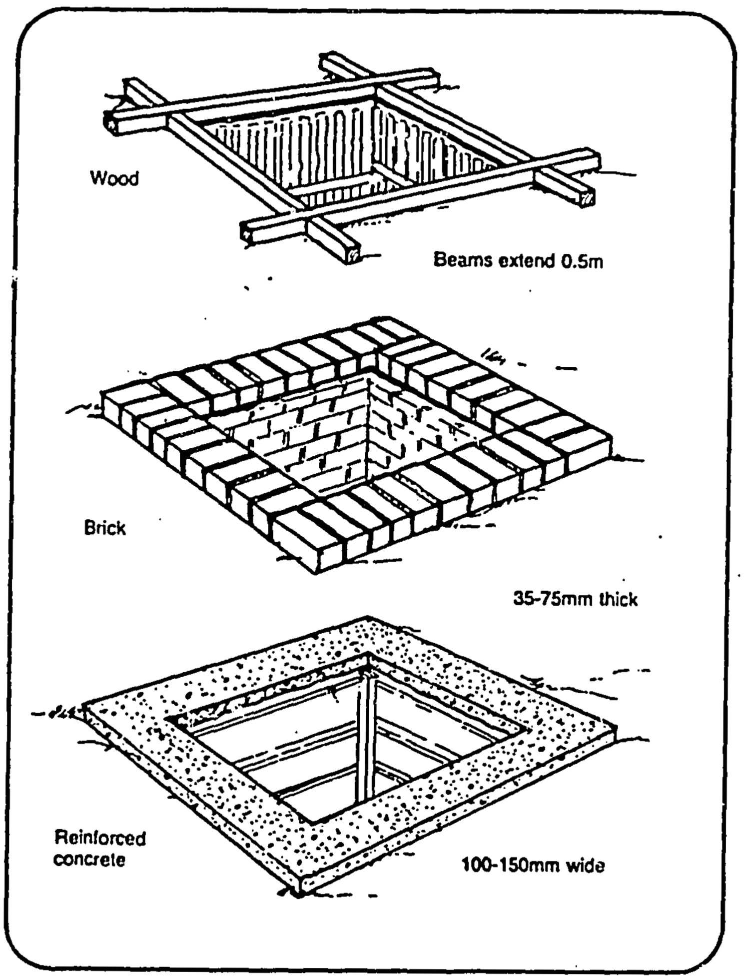


FIGURE 10-2
Diagrams Showing Bases Made of Various Materials

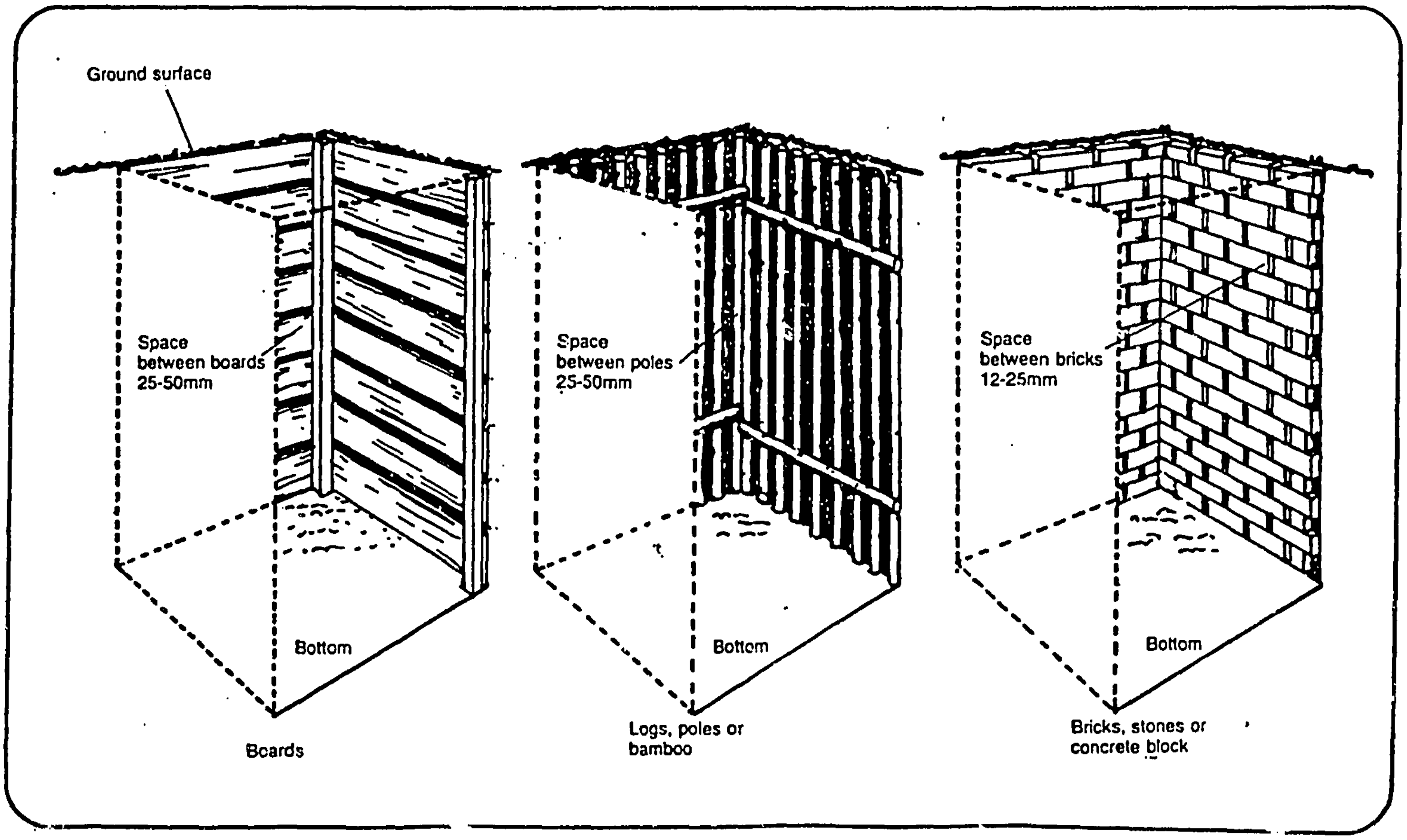
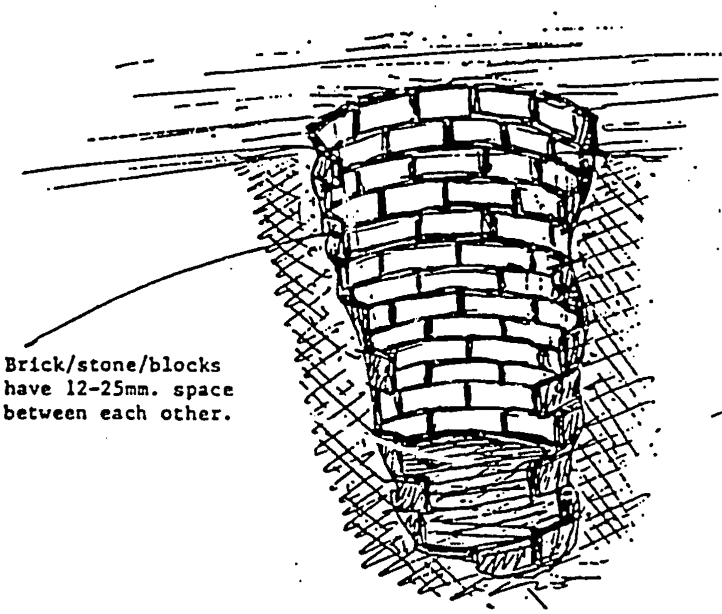
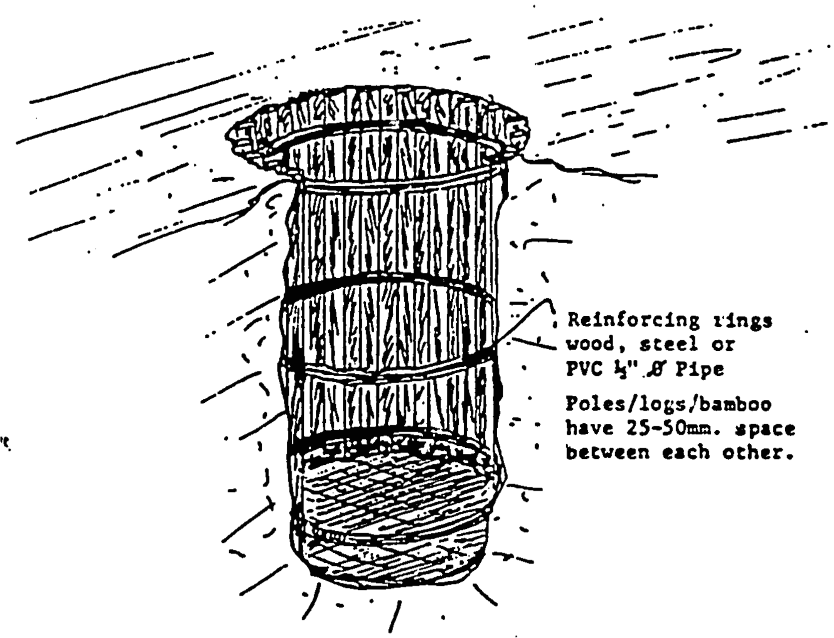


FIGURE 10-3
Pit Linings Made of Vario -- Materials

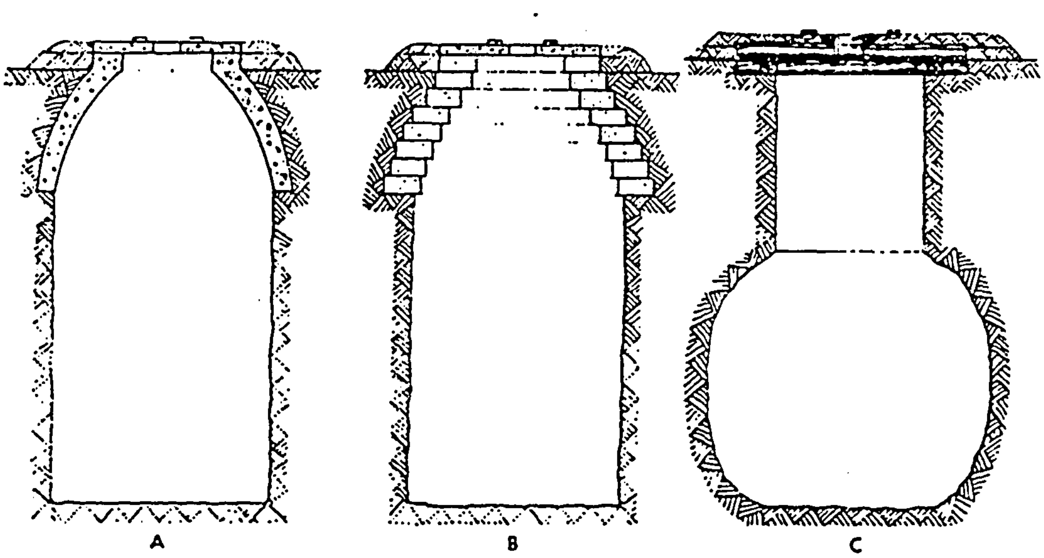


Cutaway View of Completed Pit



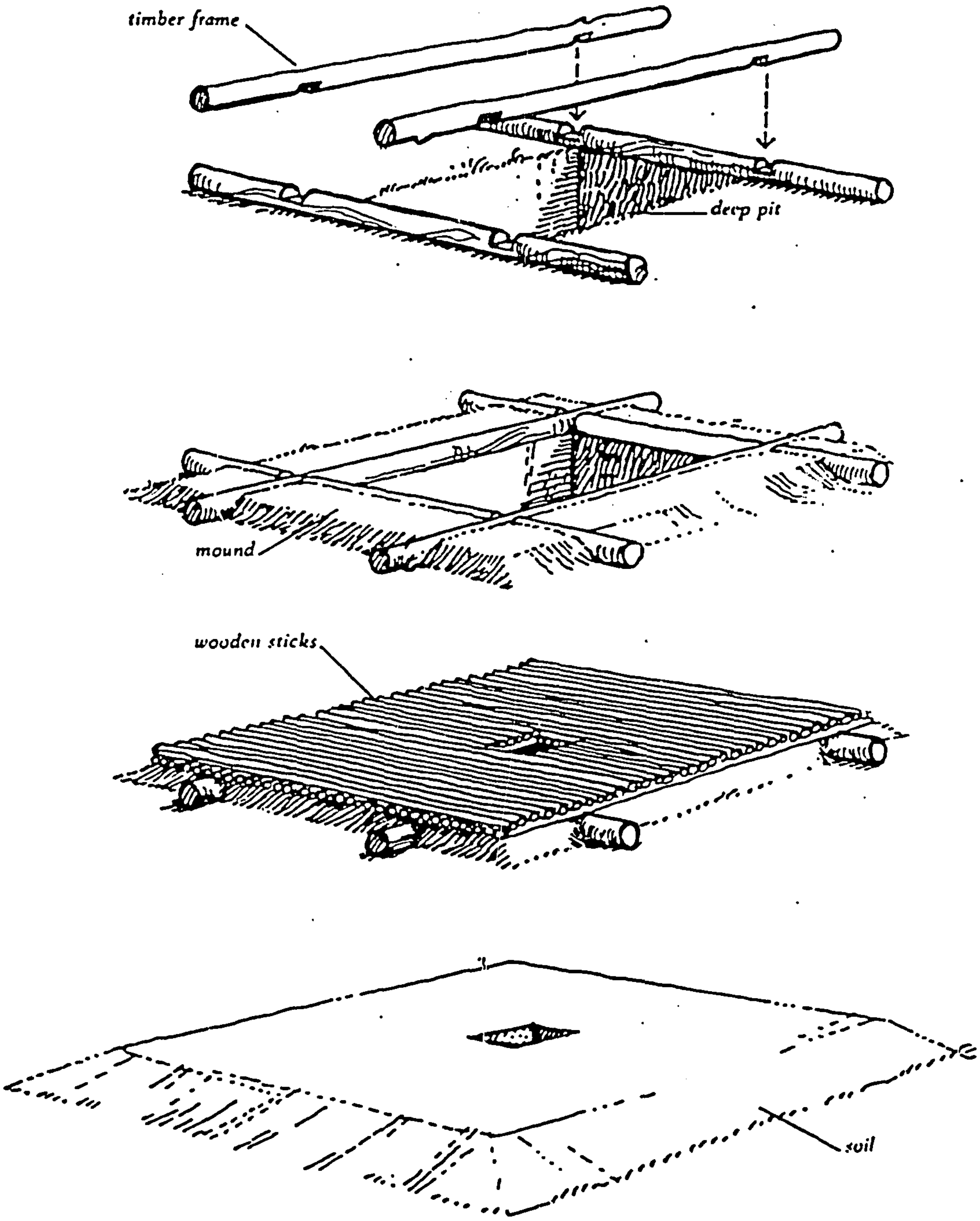
Cutaway View of Completed Pit

FIGURE 10-4
Pit Linings for Round Latrine Pits



Large-volume pits with small floors and superstructures

FIGURE 10-5
Base and Pit Variations

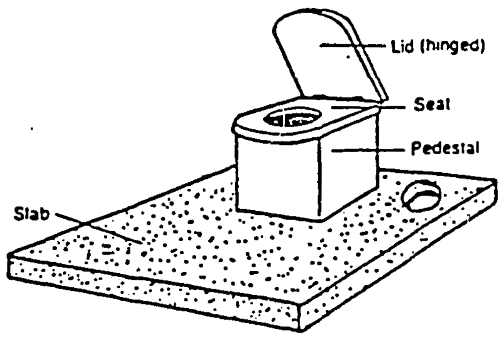


A squatting slab made of timber and soil

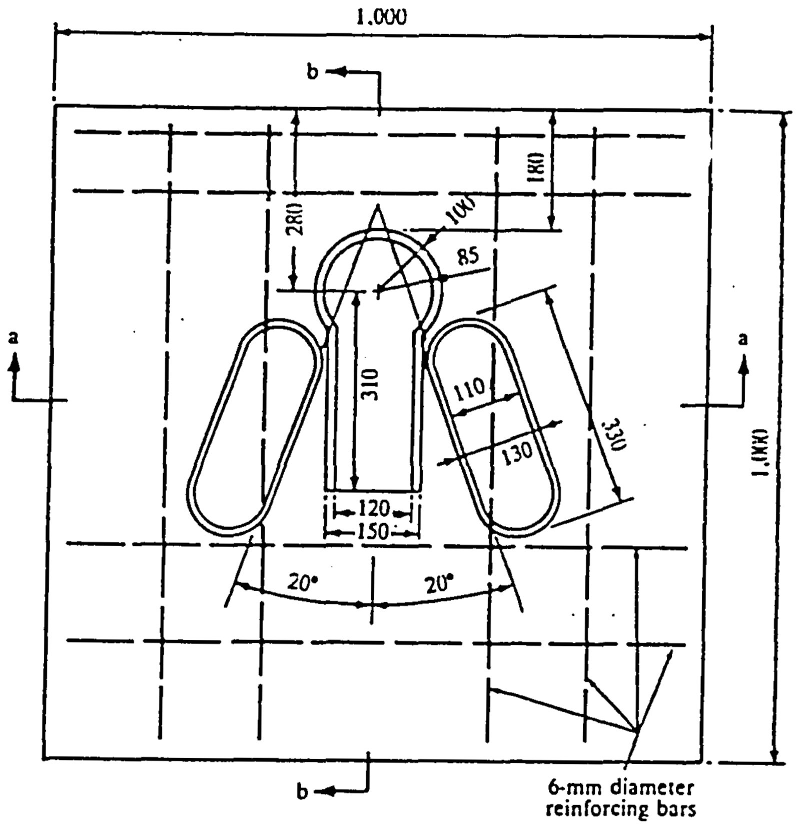
FIGURE 10-6
Example of Wooden Slab

Concrete Squatting Plate

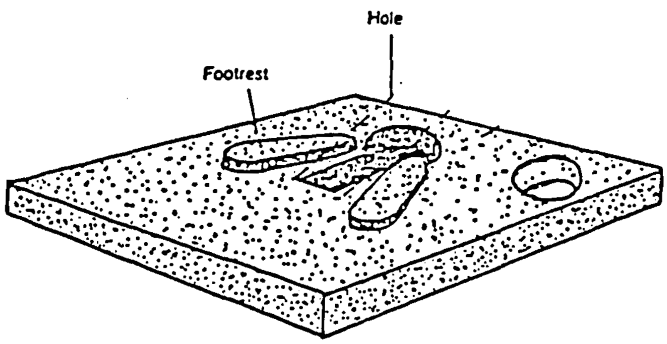
(millimeters)



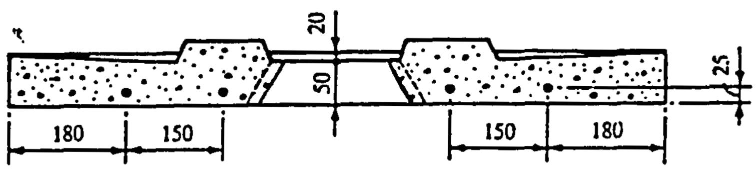
Sitting Slab with Pedestal, Seat and Lid



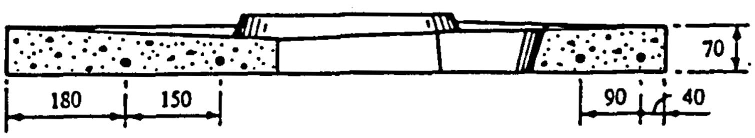
Plan



Squatting Slab



Section a-a

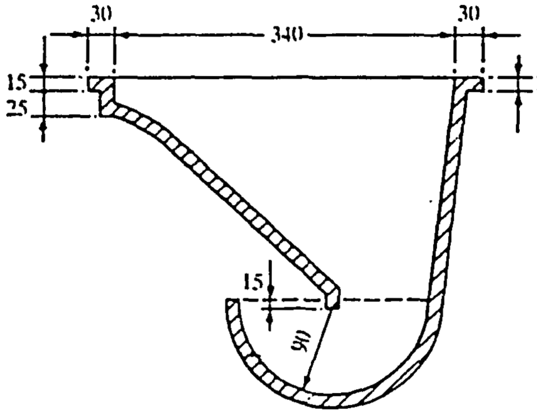


Section b-b

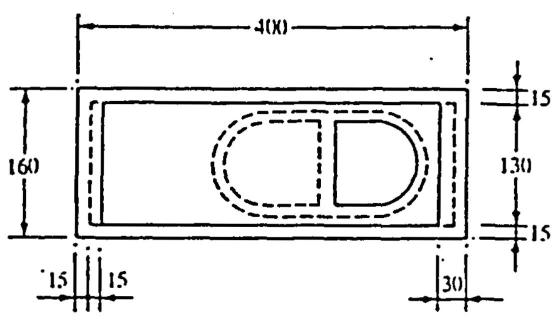
FIGURE 10-7
Reinforced Concrete Slab with Optional Pedestal Seat

Water-seal Squatting Plate for PF Toilets Located Immediately above the Pit

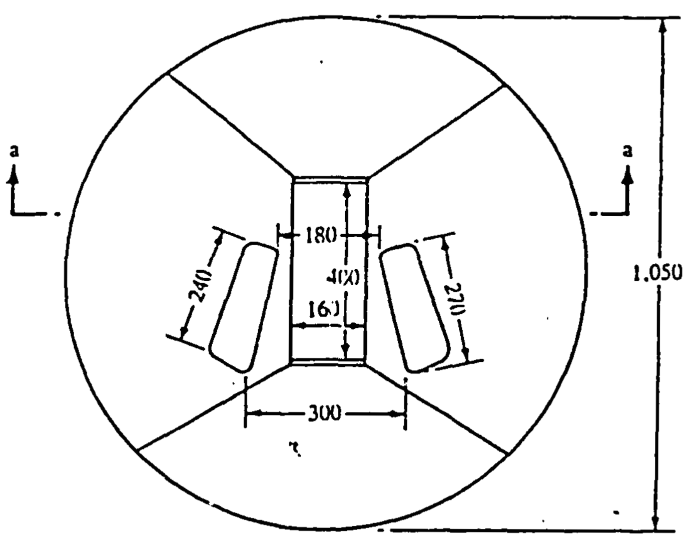
(millimeters)



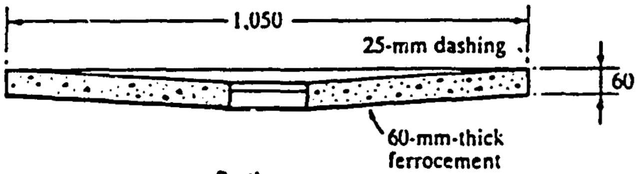
Sectional elevation



Plan of water seal



Details of squatting plate



Section a-a

FIGURE 10-8
Ferrocement Slab and Waterseal Trap

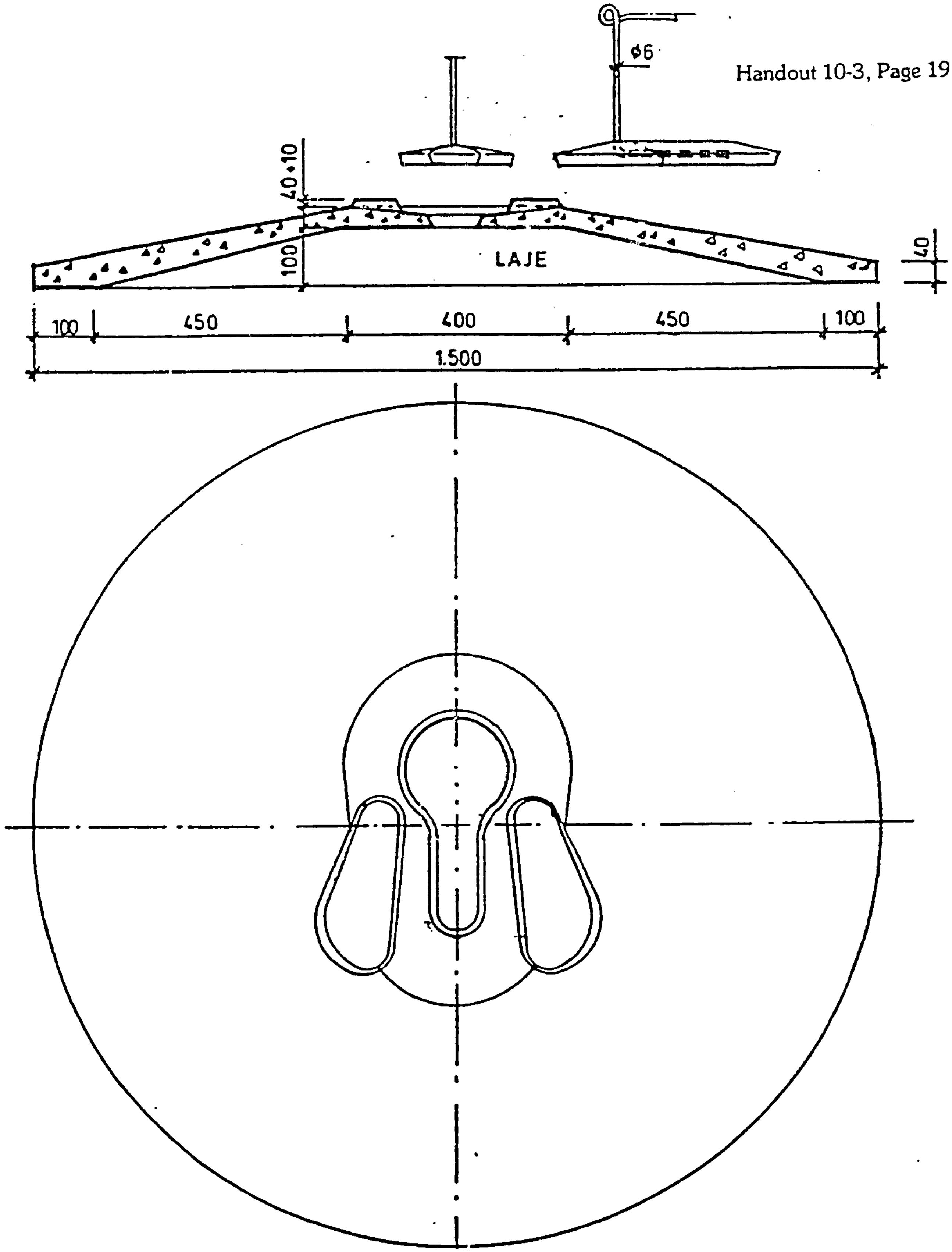
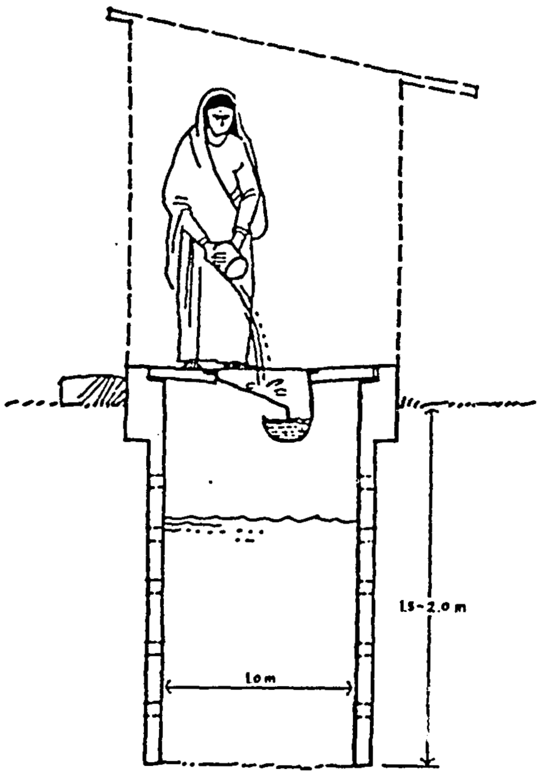
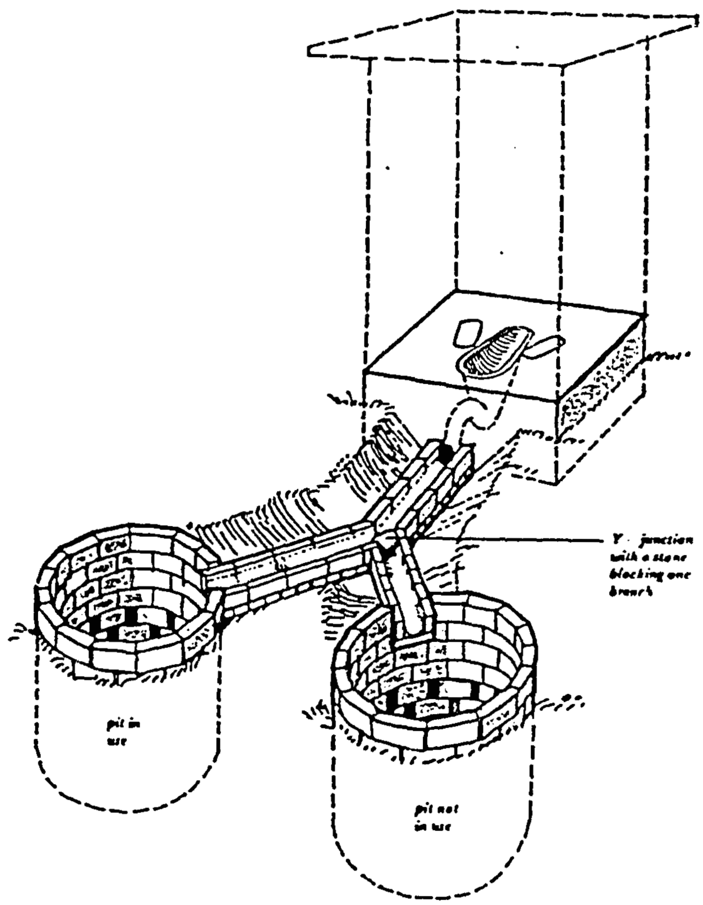


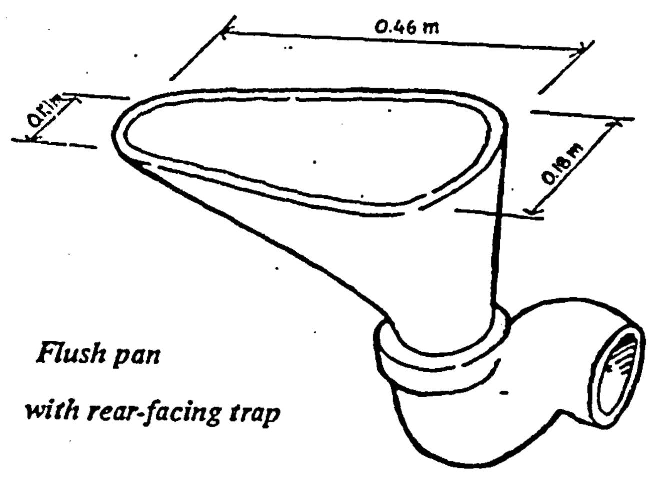
FIGURE 10-9
Sanplat Latrine Slab

A pour-flush latrine with pan and water-seal trap directly above the pit. Dimensions are in meters.

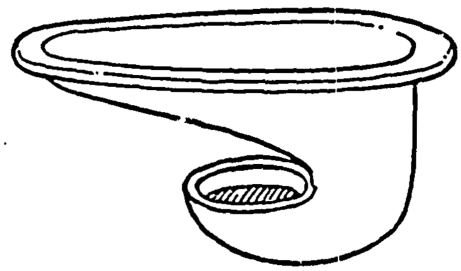




A pour-flush latrine with two pits. Drains and receptacles still to be covered.



Flush pan with forward-facing trap



Flush pan with rear-facing trap

FIGURE 10-10
Diagrams of Latrines with Waterseal Trap

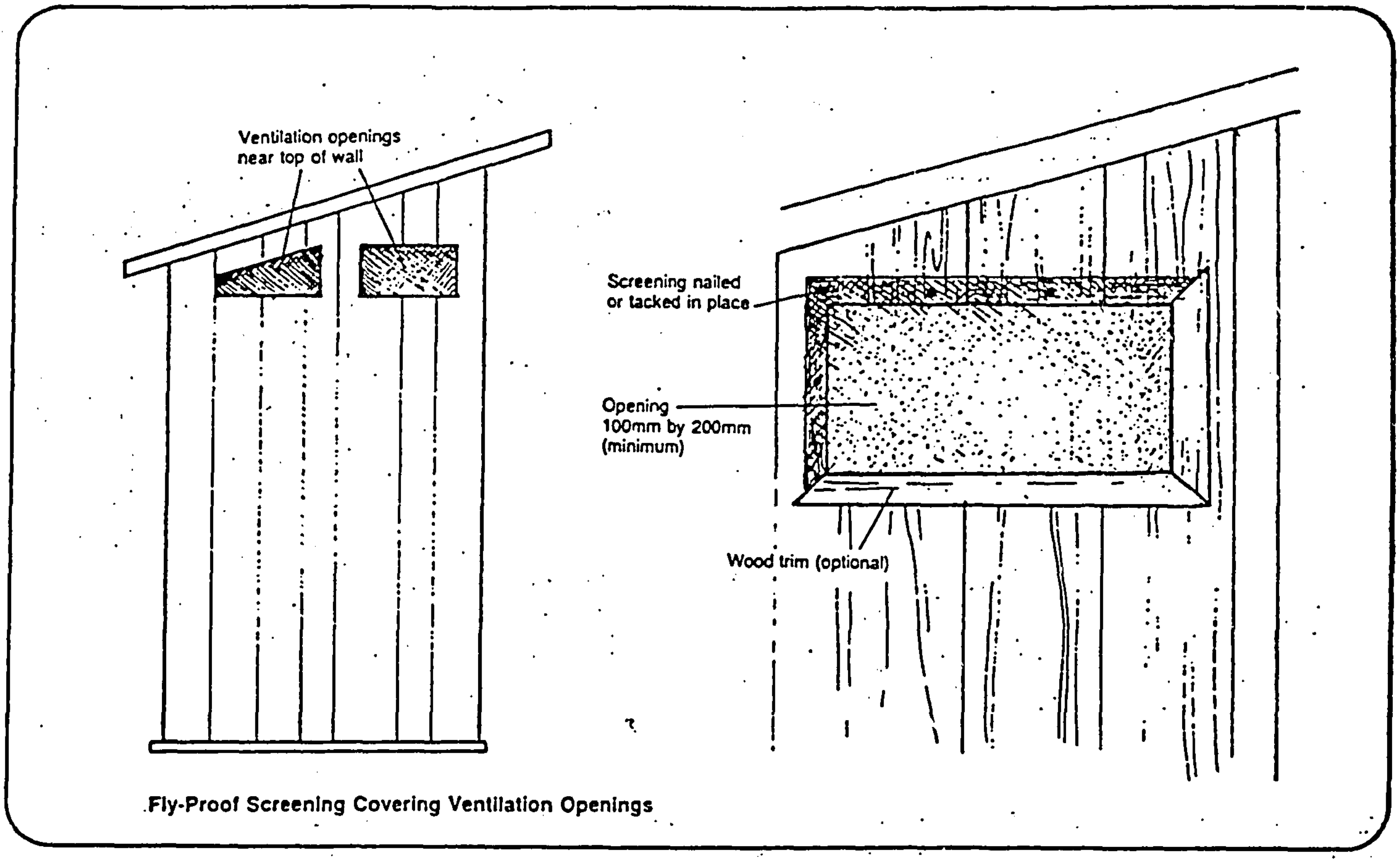
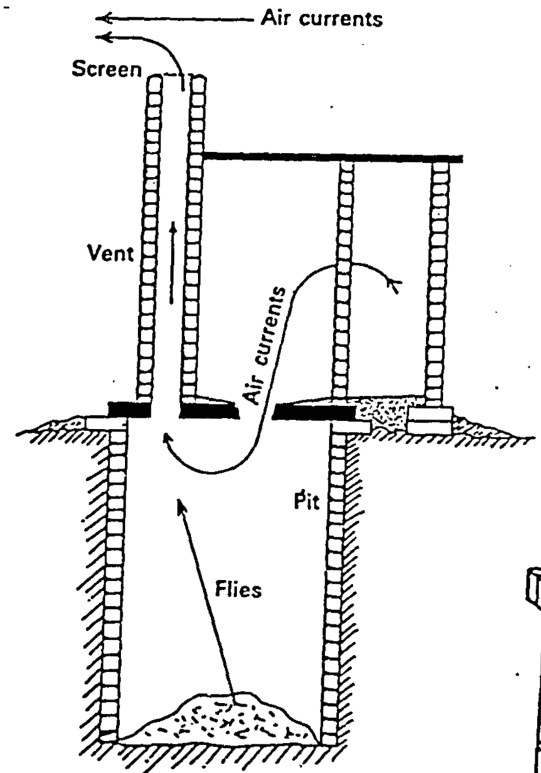
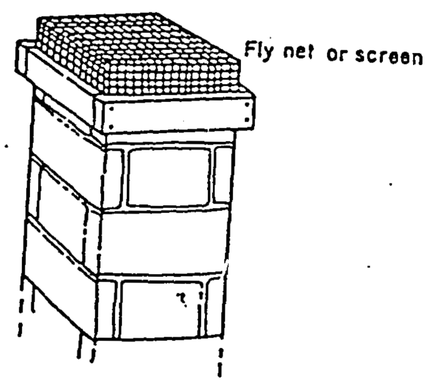


FIGURE 10-11
Examples of Superstructure Ventilation



Blair Latrine.



Brick vent pipe with arched flyscreen.

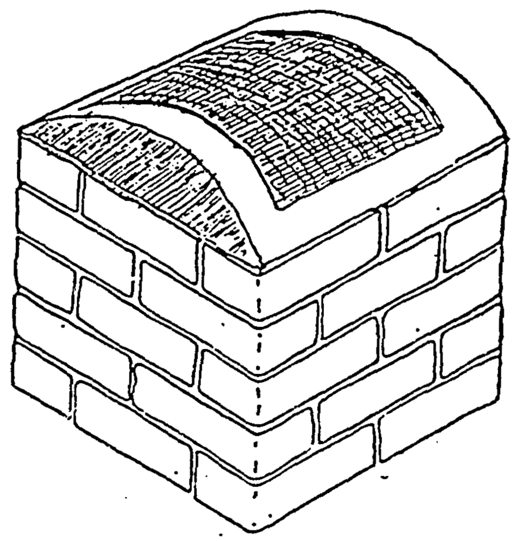


FIGURE 10-12
Vent Pipe Variations

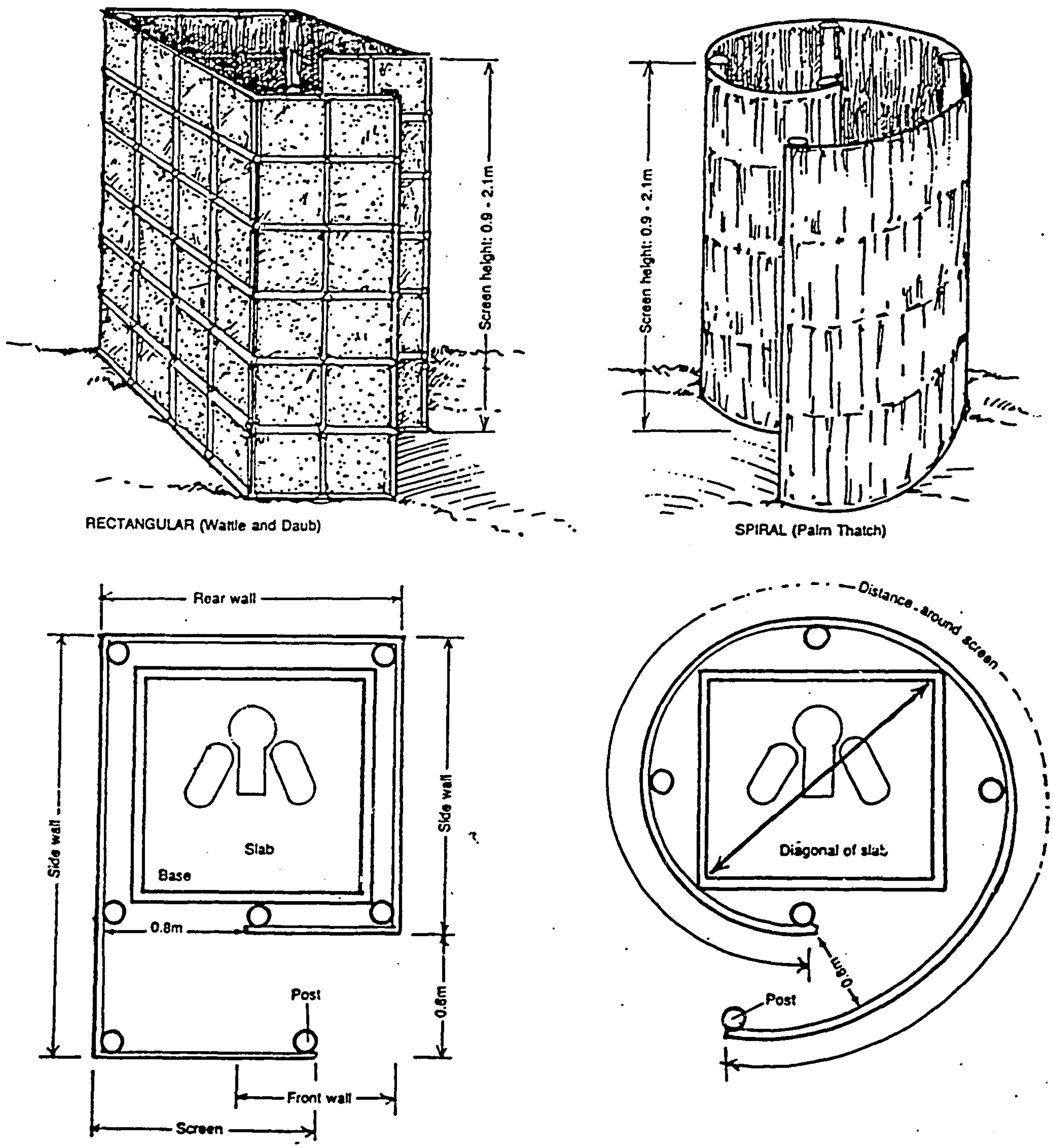
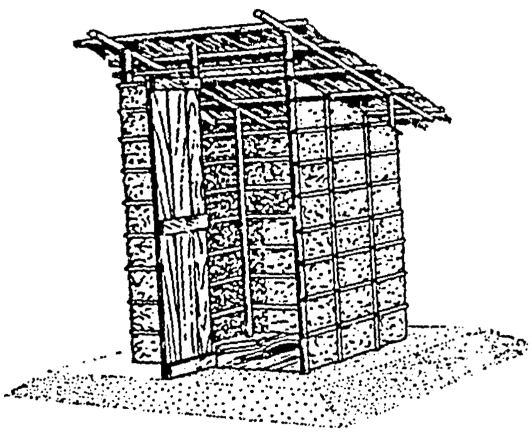
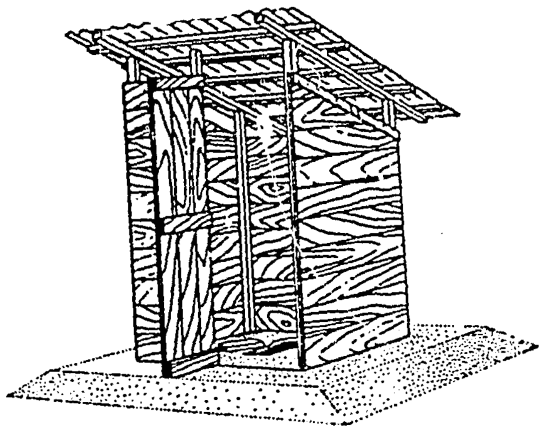


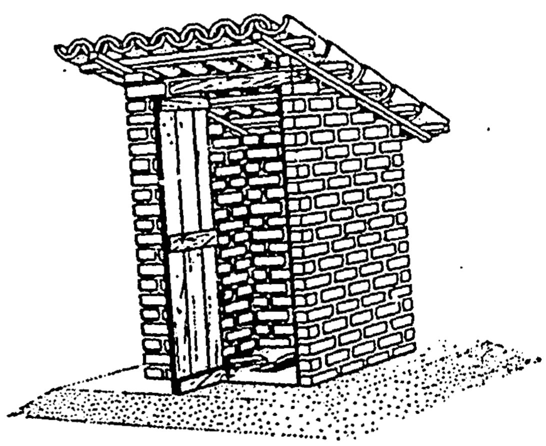
FIGURE 10-13
Simple Superstructures



. Mud and wattle walls and palm-thatch roof

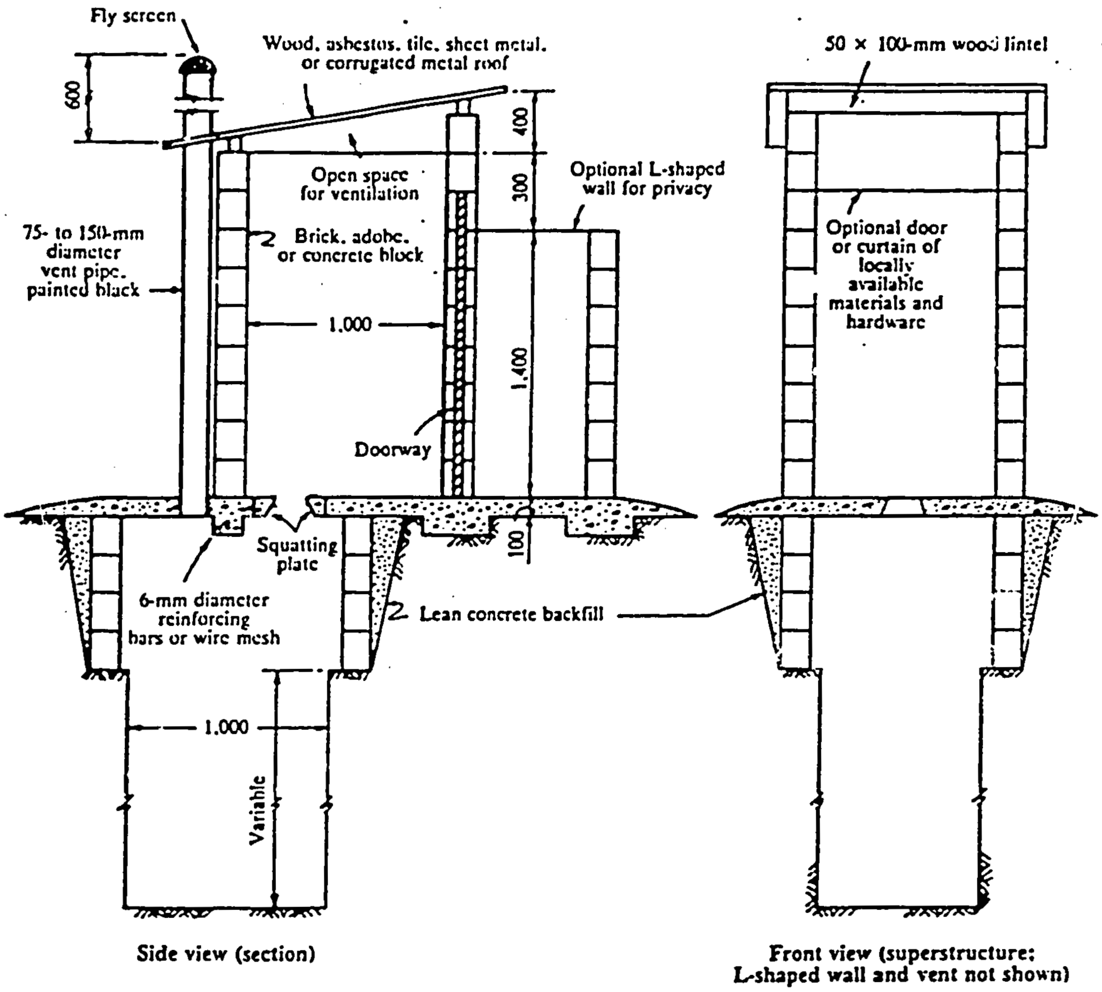


. Timber walls and corrugated iron or asbestos-cement roof



C. Brick walls and tile roof (an alternative is concrete block walls and corrugated iron or asbestos-cement roof)

FIGURE 10-14
Superstructures Built of Various Materials



Note: In the side view, a pedestal seat or bench may be substituted for the squatting plate. An opening for de-sludging may be provided next to the vent. Dimensions of the bricks or concrete blocks may vary according to local practice. Wooden beams, flooring, and siding may be substituted for concrete block walls and substructure.

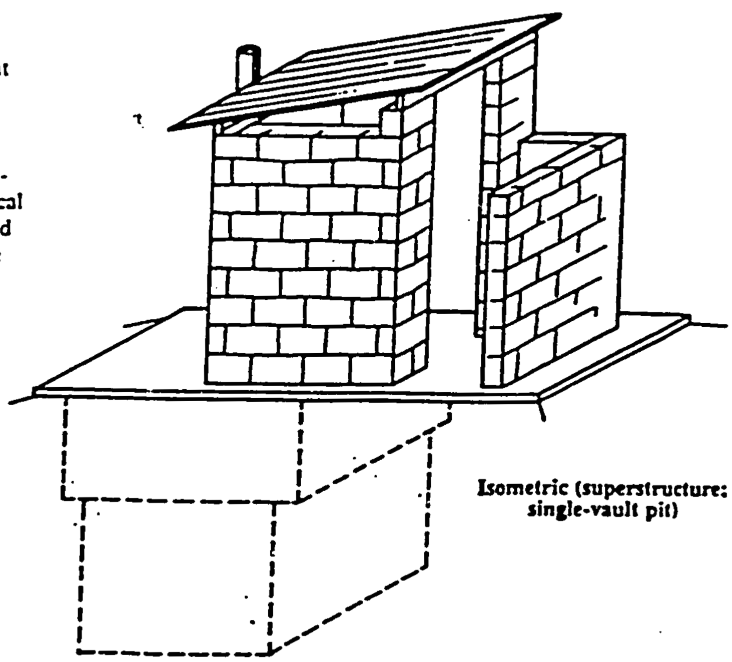


FIGURE 10-15
VIP Latrine Design

Material, Transport, and Labor Requirements and Costs

A. Key Points in Cost Calculations

- The total cost of a latrine is composed of material, transport, labor, and indirect costs.
- Total cost = material cost + transport cost + labor cost + indirect costs.

B. Calculating Material Costs

- The total value of all materials that go into the making of the latrine.
- To calculate the material cost,

1) Calculate the amount of materials needed for each latrine component by
   - making a list of all materials involved in that component (e.g., a reinforced concrete slab is made of cement, sand, gravel, water, and reinforcing material),
   - calculating the volume or area of the component, and
   - calculating the amount of each material needed to fill that volume or area.
2) Add the quantities of each material needed for all the components (e.g., all the gravel needed for the components).
3) Determine the unit cost of each material.
4) Multiply the unit cost of the material by the quantity needed.
5) Add all the material costs to get the total cost.

Keep in mind that,

- Each component of a latrine is made from a variety of materials, and different components could involve the same material, such as wood or cement. Therefore, it is easier to focus on an individual component, calculate the requirements for a particular material, and then add the requirements of all the components for that material.
- In the best of programs, there is some unavoidable waste of material or unforeseen need for additional material. To avoid delays at crucial construction steps, an extra amount of each material is usually ordered. An excess of 10 percent of each material should provide a sufficient safety factor.

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C. Calculating Transport Costs

- The total cost for bringing all materials to the construction site.
  - If centralized manufacturing of components is done, there will also be transport costs after manufacturing.
- Transport usually involves both local and external transport costs.
  - Transport is often needed for locally available materials, such as gravel and sand.
  - Transport is often needed for materials not available locally, such as cement or brick.
- Another factor in transport costs is the loading and unloading cost.
- To calculate the transport cost,
  1) Determine where necessary building materials are located.
  2) Contact transporters to determine the rate of transport, combining the materials available in that area.
  3) Add the individual transport costs to determine the total transport cost.

D. Calculating Labor Costs

- Labor can be split into two general categories: skilled and unskilled.
  - The time requirements of each category will differ.
  - There are also levels within a category, for example skilled labor for latrine construction could consist of a foreman, mason, and a carpenter.
- To determine the labor cost,
  1) Define the work that needs to be done on each component.
  2) Estimate the number of days it will take to accomplish the work.
     - It is advisable to consult with a skilled builder to estimate the days.
  3) Estimate the number of workers needed, skilled and unskilled, to accomplish the task.
  4) Multiply the rate of each worker by the number of days that worker will be needed.
  5) Add the labor cost for each component.
  6) The total labor cost will be the sum of the labor costs for each component.

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Example of Material Cost Calculations

1. How much would 300 bricks cost if the unit price is $40 for 500 bricks.

   To find the cost, multiply the unit price by the ratio of the number of bricks needed to the number of bricks per unit.

   Cost = $40 x 300/500 = $24.

2. If 30 m of rebar are needed at a cost of $1.50 per meter, the cost of 30 m would be

   Cost = 30 m x $1.50/m = $45.

3. If 1.6 m^3 of cement are needed and the price of a 50 kg bag is $20, how many bags are needed and what will they cost?

   The volume of a 50 kg bag is 0.0332 m^3; to calculate the number of bags, divide the total amount needed by the volume in one bag.

   Volume of cement = 1.6 m^3/0.0332 m^3 = 48 bags.

   Cost = 48 x $20 = $960.

Example of Transport Cost Calculations

1. A town is located three days travel from an urban center where building supplies are available. A total of 1,750 bricks is needed for the construction of latrine shelters. If one truck costs $60/day for transport and can haul 500 bricks in one load, what is the total transport cost?

   First, find the number of loads necessary by dividing the total number of bricks needed by the number of bricks per load.

   Number of loads = 1,750/500 = 3.5.

   The transporter must make four trips to carry all the bricks to the town. The transport cost is the number of trips multiplied by the number of days per trip and then by the daily rate of transport.

   Total transport cost = 4 x 3 days x $60/day = $720.

2. Gravel and sand are needed at a construction site. The quantities needed are 1.5 m^3 of gravel and 0.75 m^3 of sand. The materials are locally available, and transport (a horsecart) costs $3 per load. If the transporter can move 0.5 m^3 in a single load, how many trip will he have to make? What will be the transport cost?

   These items should be moved separately, so divide the volume of each material by the amount the transporter can move in one trip.

   Number of trips

   1.5/0.5 = 3 trips for gravel

   0.75/0.5 = 1.5 trips for sand

   The total number of trips is five.

   Total transport cost = 5 x $3 load = $15.

Example of Labor Cost Calculations

1. If an unskilled laborer can excavate 0.8 m^3 of soil for a pit latrine in one day at a rate of $7/day, how long will it take him to dig a hole 1.2 m by 1.3 m by 4 m deep? How much will he be paid?

   First, calculate the volume of the pit.

   Volume = 1.2 x 1.3 x 4 = 6.24 m^3.

   Then, divide the pit volume by the amount the laborer can dig in a day in order to find the number of days it will take.

   No. of days = 6.24/0.8 = 7.8 days.

   To calculate his pay, multiply the number of days by his daily rate.

   Total pay = 7.8 x $7/day = $54.60.

2. If a skilled builder and two unskilled laborers can build 3 latrine bases in a day, how many days will it take them to build 17 bases? If the daily pay rate of the skilled builder is $20/day and that of the unskilled laborers is $8/day, how much will the total labor cost be?

   To find the number of days it will take them to build the bases, divide the total number of bases by the number they can build in a day.

   Total number of days = 17/3 = 5.7 days.

   To find the total labor cost, multiply the total number of days by the daily rates of each of the workers, then add them together.

   Total labor cost = 5.7 x [(2 x $8) + $20] = $205.20.

Small Group Activity—Material Requirements and Costs

The following information is to be used for the calculation of material requirements and costs for the latrine type assigned to your group.

Given for all assignments:

- Cement comes in 50 kg bags (33.2 liters or 0.0332 m^3).
- Reinforced concrete ratio to be used is 1:2:4 (cement:sand:gravel).
- Ferrocement ratio to be used is 1:2 (cement:sand).
- Material requirements for the superstructure will not be included.

Group 1: Basic Latrine with Cover

Given:

- Latrine base: bricks that are 10 cm wide; two layers needed.
  - Base to be made by lining the bricks side by side in two layers.
- Pit dimensions: 2.5 m deep, 1 m wide, 1.2 m long.
- Lining needed: brick lining that has 65 bricks/m^2.

  The cement required to make the mortar for the lining is one-sixth of a bag per m^2 of lining surface area.
- Slab: ferrocement and chicken wire.

Questions:

1. How many bricks in the base?
2. How many bricks in the pit lining wall?
3. How much cement is needed for the mortar in the lining?
4. How much cement, sand, and chicken wire are in the latrine slab?
5. What are the total material requirements and their cost?

Group 2: VIP Latrine

Given:

- Latrine base of poured concrete: 15 cm wide, 10 cm deep.
  - Reinforcement of one rebar around the latrine base.
- Pit dimensions: 2 m deep, 1 m wide, 1.4 m long.
- Lining: not needed.
- Slab: reinforced concre'e (10 cm thick) with rebar; rebar is placed every 20 cm in both directions of slab.

Questions:

1. How much cement, sand, gravel, and rebar is needed in the base?
2. How much cement, sand, gravel, and rebar is needed in the slab?
3. What are the total material requirements and their cost?

Group 3: Waterseal/Pour Flush

Given:

- Pit base: poured concrete, 15 cm wide and 7 cm deep with rebar around circumference.
- Pit dimensions: 1.4 m deep, 1 m wide, 1 m long.
- Lining needed: concrete blocks—15 blocks/m^2. Assume no mortar needed.
- Slab: reinforced concrete slab (thickness of 10 cm) with reinforcement every 20 cm along both axes.

Questions

1. How much gravel, sand, cement, and rebar is needed in the base?
2. How many concrete blocks are required for the lining?
3. How much gravel, sand, cement, and rebar is needed in the slab?
4. What are the total material requirements and their cost?

Group 4: Raised Platform Latrine

Given:

- Latrine base: no real base because lining is continued from pit bottom, up through the ground surface to support the raised platform.
- Pit dimensions:

  Cross section: 1 m wide, 1.2 m long

  Depth below ground = 1 m

  Height of walls extending above ground = 1 m.
- Material needed for lining and exposed wall: brick is used for both—65 bricks/m^2 of wall surface area.

  The cement required to make the mortar for the portion of the wall below ground level is one-sixth of a bag per m^2 of lining surface area. For the above-ground portion, one-third of a bag per m^2 of wall surface area is needed.
- Slab: ferrocement and chicken wire.

Questions:

1. How many bricks are needed in the lining and the wall above ground level?
2. How much cement is required for the lining and wall?
3. How much cement, sand, and chicken wire is needed in the latrine slab?
4. What are the total material requirements and their cost?

Cost Sheet

Item	Unit	Cost/Unit	Transportation Required
Local Materials			
- Gravel	1 m^3	$ 2	2 loads/m^3
- Sand	1 m^3	$ 2	2 loads/m^3
- Locally made vent (3m)	1	$15	---
External Materials			
- Cement (50 kg)	bag	$20	15 bags/load
- Concrete blocks	100	$60	200/load
- Bricks	100	$40	500/load
- Rebar	100	$ 6	--
- PVC pipe (15 cm)	6 m	$30	--
- Screen (1 cm)	1 m^2	$ 3	--
- Screen (2 mm)	1 m^2	$ 5	--
- Waterseal trap	1	$10	--
Labor			
- Skilled builder	day	$20	
- Unskilled laborer	day	$ 6	
Transport			
Local	load	$ 4	
External	day	$60	

Note: Some materials that are located in the urban centers do not require much space for transport, so they can be included with other items that are being transported. However, if no other items are being transported from these centers, they must be transported at the standard daily rate.

Materials can be combined to make up one load if there is sufficient room for all the materials.

This same cost sheet is used in the next small group task. The prices of these items could reflect the costs in the country where the workshop is being given. The costs of some items may be negligible, such as fractions of a cubic meter of sand, and transport costs should not be included. Some fractions of materials should be rounded up, for example, cement bags and rebar.

Note that in all cases, the participants will calculate only a portion of the material requirements (costs) of their latrine. The calculations will focus on the most critical or hard-to-calculate components.

Solutions to Handout 11-5

Group 1: Basic Latrine with Cover

1. Perimeter = 2 x 1 + 2 x 1.2 = 4.4 m

   Number of bricks = 2(4.4 x 0.1) = 88 bricks.

2. Pit wall area = 2.5 [(2 x 1) + (2 x 1.2)] = 11 m^2

   Number of bricks = 65 x 11 = 715 bricks.

3. Cement required for mortar in lining = 1/6 x 11 m^2

   = 1.8 bags.

4. Slab volume = 0.025 x 1.2 x 1.4 = 0.042 m^3

   Two-thirds of volume is sand, so 2/3 x 0.042 = 0.028 m^3 sand

   Cement = 1/2 sand or 0.014, almost 1/2 bag

   Chicken wire = area of slab x 2 = 1.2 x 1.4 x 2 = 2.4 m^2 chicken wire.

5.

Bricks	803	$321.20
Sand	0.028 m^3	---
Cement	2.3 bags (3 bags)	$60.00
Screen	2.4 m^2	$7.20

Total cost: $ 388.40.

Group 2: VIP Latrine

1. Calculate the outer area of the latrine base and subtract the inner area of the pit. This area is multiplied by the thickness to find the base volume:

   Area of base = [1 + 2(0.15)] x [1.4 + 2(0.15)] - (1 x 1.4) = 0.81 m^2

   Volume = 0.81 x 0.1 = 0.081 m^3

   The gravel fills the volume, so 0.081 m^3 of gravel is needed.

.460

Volume of sand = 1/2 gravel = 0.04 m^3

Cement = 1/4 gravel = 0.02 m^3 (under 2/3 of a bag).

The rebar for the base is simply the measure of the perimeter, or 4.8 m.

2. Volume of slab = 0.1 x 1.6 x 1.2 = 0.192 m^3

Gravel volume = 0.192 m^3

Sand volume = 0.096 m^3

Cement volume = 0.045 m^3 or 1 1/3 bags

Length of rebar = 6 x 1 + 4 x 1.4 = 11.6 m.

3.	Gravel	0.0273 m^3	--
	Sand	0.0136 m^3	--
	Cement	2 bags	$40.00
	Rebar	16.4 m (18 m)	$18.00

Total cost: $ 58.00.

Group 3: Pour Flush/Waterseal

1. Area of base = [1 + (2 x 0.15)] x [1 + (2 x 0.15)] - 1m^2 = 0.69 m^2

Volume of base = 0.69 m^2 x 0.07 = 0.048 m^3

Volume of gravel = 0.048 m^3

Volume of sand = 0.024 m^3

Volume of cement = 0.012 m^3 or over 1/3 bag

Length of rebar = 4 m.

2. Area of lining = 1.4[2 x 1 + 2 x 1] = 5.6 m^2

No. of blocks = 5.6 m^2 x 15 blocks/m^2 = 84 blocks.

3. Volume of slab = 0.10 x 1.2 x 1.2 = 0.144 m^3

Volume of gravel = 0.144 m^3

Volume of sand = 0.072 m^3

Volume of cement = 0.036 m^3 or just over 1 bag

Length of reinforcement = 4 x 1 + 4 x 1 = 8 m.

4.	Gravel	0.192 m^3	--
	Sand	0.096 m^3	--
	Cement	1.5 bags (2 bags)	$40.00
	Rebar	12 m	$12.00
	Concrete blocks	84	$34.00
	Waterseal trap	1	$10.00

Total cost: $ 96.00.

Group 4: Raised Platform Latrine

1. Pit wall surface area

   Height of wall = height below ground + height above ground
   = 1 m + 1 m = 2 m.

   Therefore, wall area = 2 [(2 x 1) + (2 x 1.2)] = 8.8 m^2

   Number of bricks = 65 x 8.8 = 572 bricks.

2. Cement requirement in lining and wall:

   Because the cement requirement is different depending on whether it is above or below ground, the surface areas should be calculated separately.

   Surface area of lining = 1 [(2 x 1) + (2 x 1.2)] = 4.4 m^2

   Surface area of wall = 1 [(2 x 1) + (2 x 1.2)] = 4.4 m^2

   Cement requirement for lining = 1/6 x 4.4 m^2 = 0.73 bags

   Cement requirement for wall = 1/3 x 4.4 m^2 = 1.45 bags

   Total cement requirement for lining and wall is 2.2 bags.

3. Slab volume = 0.025 x 1.2 x 1.4 = 0.042 m^3

   Two-thirds of volume is sand, so 2/3 x 0.042 = 0.028 m^3 sand

   Cement = 1/2 sand or 0.014 m^3, almost 1/2 bag

   Chicken wire = area of slab x 2 = 1.2 x 1.4 x 2 = 2.4 m^2 chicken wire

4.	Bricks	572	$228.80
	Sand	0.028 m^3	---
	Cement	2.7 bags (3 bags)	$60.00
	Chicken wire	2.4 m^2	$7.20

Total cost: $ 296.00.

Small Group Activity—Planning for Materials, Transport, and Labor in a Construction Program

All of these scenarios are set in the country of Taganis. They involve mainly small communities located in different parts of the country and with different needs. Each small group is in charge of a sanitation program for a particular community in Taganis.

The monetary unit is the Tagani dollar.

Examples of necessary calculations are included in Handout 11-9.

Scenario I

The community of Taduli is about to begin its first sanitation program. It is a small community of 20 houses and is quite a distance from the urban center in which certain building materials can be located.

The program will be initiated with 5 latrines, which will be built at the school, at the community center, and at houses of community members who expressed an interest in improved sanitation and were able to make a contribution toward the cost of the latrine.

New latrine construction will consist of

- 2 basic latrines with cover
- 2 VIP latrines
- 1 pour flush (or waterseal) latrine

Taduli is located 5 days' travel from an urban center where nonlocally made materials can be purchased; transport time is 5 days.

Scenario II

The large town of Mibalu is upgrading many of its latrines due to the increased affluence of the community. It is located quite near an urban center, and all construction materials are readily available there. The community has recently upgraded its water supply to enable the use of pour flush latrines, which had been previously impractical.

New latrine construction will consist of

- 1 raised platform latrine

Upgrades will consist of

- 5 basic pit latrines to become 5 VIP latrines
- 5 VIP latrines to become 5 pour flush latrines

Mibalu is located 1 days' travel from an urban center where nonlocally made materials can be purchased; transport time is 1 day.

Scenario III

In the rural community of Sinkan, the sanitation program is being initiated with some upgrading and new latrine construction because there are very few latrines in the community. The community is located at a relatively short distance from the capital, but the roads are very rough and the trip takes 3 days' travel.

The community had formed an agricultural cooperative for the purpose of sharing farm equipment and loans for the purchase of seed hybrids. It has recently expanded its program to include latrines. The latrine "buyers" pay a monthly loan payment toward the full cost of the latrine. Because it is a generally poor community, the loan payments are spread over two years.

New latrine construction will consist of

- 2 VIP latrines
- 2 basic latrines with cover

Upgrades will consist of

- 2 basic pit latrines to become 2 VIP latrines

The community is located at 3 days' travel from an urban center where nonlocally made materials can be purchased; transport time is 3 days.

Scenario IV

In the village of Malaro, a latrine program has been initiated with the assistance of the government on a pilot basis. The cost and success of the pilot will be evaluated by the Department of Health to determine if such a program is viable.

The government is providing 25 VIP slabs and fly screens for use in the program; 5 of the latrines require elevated platforms because they are to be built in areas with a high water table. New construction will consist of

- 20 VIP latrines, with government assistance
- 5 raised platform latrines with vent pipe, with government assistance

This community is located 2 days' travel from an urban center where nonlocally made materials can be purchased; transport time is 2 days. Transport of the slabs and screens is not provided. Ten slabs can be transported (with screens) from the urban center in one load.

Small Group Activity—Information Common to all Scenarios

A. General

- All latrines have a pit directly below the slab.
- Compost latrines have two above-ground compartments.
- Cement comes in 50 kg bags with a volume of 0.0332 m^3 or 33.2 liters.
- Reinforced concrete mix of 1:2:4 (cement:sand:gravel) to be used.
- Ferrocement and mortar mix of 1:2 (cement:sand).
- Bricks: 15 cm long, 10 cm wide, 6 cm high; for a wall of brick, 65 bricks/m^2 of surface area are needed.
- Concrete block: 38 cm long, 18 cm wide, 18 cm high.
- All upgrades require the time of one skilled builder and one unskilled laborer for one day, plus one-half bag of cement, in addition to the specific material requirements.

B. Latrine Bases

- Basic latrine with cover: base to be built of one layer of concrete block.
- VIP: base to be built of two layers of brick.
- Pour flush/waterseal: base to be built of poured concrete (dimensions: 15 cm wide and 7 cm thick) with two lengths of reinforcing rebar along each side.
- Raised platform latrine: no real base.

C. Material Estimating Requirements for Materials in Base

<u>Brick</u>

- For a base, bricks are to be laid side by side (with the 10 cm by 6 cm end facing the pit). If a 2 cm mortar joint is used, the brick width (for calculation purposes) would be 12 cm.

- To find the number of bricks that would be needed around the perimeter of the pit, first find the number of bricks for each meter. This number can be calculated by dividing 1 m by the width of the brick plus mortar, or 12 cm.
- Assume that 8.3 bricks will make 1 m.
- To calculate the total amount of mortar required, the mortar required for 1 brick can be multiplied by the number of bricks needed. In this case, the amount of mortar required for a single brick is the thickness of the mortar joint (0.02 m) multiplied by the length (0.2 m), multiplied by the width, plus the depth. In this case the mortar required for 1 brick is 0.00072 m^3. To calculate the amount of mortar needed for each meter of base, multiply this by the number of bricks in each meter.

  $8.3 \times 0.00072\ m^3 = 0.0060\ m^3$.
- If the mortar used is like that used in the ferrocement ratio, 1:2, the amount of sand required for each meter would be 0.004 m^3.
- The cement required for each meter would be approximately 0.002 m^3, or 0.06 bags.
- To calculate the amount of bricks, cement, and sand required for a base, multiply the amount of each needed for 1 m by the number of meters in the perimeter of the base. For a base of two layers, double the figure.

Concrete Block

- Due to the larger size of the concrete block, 1 course will be laid for the base, with its long side (38 cm by 18 cm) facing the pit. Making the same calculations as above,
  - The area of 1 block face = 0.072 m^2
  - The length of a block with a 2 cm mortar joint = 40 cm
  - The number of blocks per meter = 1 m/0.4 m = 2.5 blocks
  - The amount of mortar required for 1 block = 0.0021 m^3
  - The amount of mortar required for each meter = 0.0021 $m^3 \times 2.5$ = 0.0053 m^3
  - The amount of sand required for each meter = 0.0035 m^3
  - The amount of cement required for each meter = 0.00175 m^3, or 0.05 bags.
- To calculate the amount of blocks, sand, and cement for a base, multiply the amount of each needed for 1 m by the number of meters in the perimeter of the base.

Poured Concrete

- To calculate the amount of cement, sand, and gravel in a poured concrete base, first find the volume of the base. This volume can be calculated by finding the area of the base and then multiplying it by the thickness. The area of the base is the area of the outer edge of the base minus the inner area of the pit.

  Example:

  If a square pit has dimensions of 1 m by 1 m and a base that is 20 cm wide and 10 cm thick, how much gravel, sand, and cement is needed?

  The area of the base's outer edge is

  $(1 \text{ m} + 0.4 \text{ m}) \times (1 \text{ m} + 0.4 \text{ m}) = 1.96 \text{ m}^2$.

  The inner area is 1 m^2.

  The area of the base $= 1.96 - 1 = 0.96 \text{ m}^2$.

  The volume of the base $= 0.96 \times 0.1 = 0.096 \text{ m}^3$.

- The amount of gravel needed would be the same as the volume, because the other components take up the volume of the spaces between the gravel.
  - Volume of gravel $= 0.096 \text{ m}^3$
  - Volume of sand $= 1/2 \times 0.096 = 0.048 \text{ m}^3$
  - Volume of cement $= 1/4 \times 0.096 = 0.024 \text{ m}^3$
  - No. of bags of cement = 0.024/0.0332 = 0.72 bags, or almost 3/4 bag.

D. Labor Requirement and Labor Cost for Base

- Three bases/day require 1 skilled, 1 unskilled laborer.

  Three bases, of any type, can be built in 1 day by a skilled and unskilled laborer.

- To calculate the labor cost,
  - divide the number of bases needed by three to obtain the number of days needed to construct all the bases;
  - multiply the number of days needed by the daily rate for skilled labor and unskilled labor separately.
- Add the amounts to obtain the total labor cost for base construction.

E. Dimensions of Latrine Pit

- VIP and basic latrine with cover: square pit—1 m long, 1 m wide, 2.5 m deep.
- Pour flush/waterseal: square pit—1 m long, 1 m wide, 1.5 m deep.
- Raised platform latrine pit dimensions:
  - 1.2 m depth below ground
  - 1 m above ground (total pit depth = 2.2 m)
  - 1 m by 1 m square pit.

F. Labor Requirement and Labor Cost for Excavation

- Excavation rate: 2 m^3 soil/day for 1 unskilled laborer.

  An unskilled laborer can excavate 2 m^3 of soil per day.
- The total number of days needed for the excavation is the volume of the pit divided by the excavation rate.
- The labor cost is the number of days multiplied by the unskilled labor rate.
- The volume of the pit = width x length x depth.
- For the raised platform latrine, excavation is needed only for the portion of the pit below ground level.

G. Pit Lining

- All waterseal latrines need a lining; lining material to be built of concrete block; assume no mortar needed.
- VIP and basic latrines are built in stable soil, so they do not need a lining.
- Lining and walls of raised platform latrine are to be made of brick; 1/3 bag of cement required per square meter of surface area of wall above ground, 1/6 bag per square meter of lining below ground surface.

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H. Estimating Material for Lining

- To calculate the material needed for the latrine lining, first calculate the area of the pit walls. That number is then multiplied by the amount of lining material that will fit into each square meter.
- For the example of the concrete block:
  - The area of 1 concrete block face with the mortar joint = 0.072 m^2.
  - The number of the blocks in a square meter is

    1 m^2/0.072 m^2 = 13.9 blocks/m^2.
  - If a pit has a wall area of 16 m^2, the number of blocks required would be 13.9 x 16 = 222 blocks.
- For an example of the calculation for a brick lining, see Handouts 11-5 and 11-7.

I. Labor Requirement and Labor Cost for Pit Lining

- For concrete block lining--4 m^2/day by 1 skilled, 1 unskilled laborer.
- For brick lining--3 m^2/day by 1 skilled, 1 unskilled laborer.
- The above lining areas can be built in 1 day by 1 skilled builder and 1 unskilled laborer. The total labor required would be
  - the area of the pit walls divided by the labor requirement.

  This calculation would give the number of days required to build the lining. There is no difference between the time required for constructing the lining below the ground surface and the walls extending above the surface, as in a raised platform latrine.
- To find the labor cost, multiply the number of days by the rates for skilled labor and unskilled labor separately; then add the costs to obtain the total cost for constructing the pit lining.

J. Slab Construction

- VIP, waterseal, and raised platform latrine: use ferrocement slabs (dimensions: 1.2 m by 1.2 m by 0.025 m) with two layers of reinforcing screen.
- Basic latrine with cover: use reinforced concrete slabs (dimensions: 1.2 m by 1.2 m by 0.075 m) with reinforcement of rebar every 15 cm along width and length of slab.

K. Materials Estimate for Slabs

- To calculate the amount of materials in a slab, first calculate the volume.
- Example 1: Reinforced Concrete

  What are the material requirements of a reinforced concrete slab with dimensions of 1.3 m by 1.4 m by 0.1 m, with rebar spaced every 15 cm along both axes of the slab?

  Volume of slab= 1.3 x 1.4 x 0.1 = 0.182 m^3

  Volume of gravel = 0.182 m^3

  Volume of sand = 1/2 x 0.182 = 0.091 m^3

  Volume of cement = 1/4 x 0.182 = 0.046 m^3

  Bags of cement = 0.046 m^3/0.0332 m^3 = 1.4 bags, or almost 1 1/2 bags.

  - To calculate the rebar, divide the width and the length of the slab by the spacing between the rebar and subtract 1. This calculation will give the number of rebar pieces. Then multiply the number of pieces by the length and width to find the total length.
  - Number of rebar pieces along the length = 1.3/0.15 - 1 = 7.7
  - Number of rebar pieces along the width = 1.4/0.15 - 1 = 8.3
  - Total length of rebar = (7.7 x 1.3) + (8.3 x 1.4) = 22 m.
- Example 2: Ferrocement

  What are the material requirements in a ferrocement slab that is 1.5 by 1.4 by 0.03 and has two layers of reinforcing screen?

  - The volume of the slab is calculated in the same way as above; however, the material components are different.
  - Volume of slab = 1.5 x 1.4 x 0.03 = 0.063
  - The volume of sand required is two-thirds of the total slab volume of 2/3 x 0.063 = 0.042 m^3
  - Volume of cement = 1/2 x 0.042 = 0.021 m^3
  - Number of bags = 0.021/0.0332 = 0.63 bags
  - The reinforcement required is the area of the slab multiplied by 2 = 2 x (1.5 x 1.4) = 4.2 m^2
  - The calculation of poured concrete walls is determined in the same manner.

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L. Slab Labor Requirement and Labor Cost

- For reinforced concrete slabs and ferrocement slabs:
  - 1 skilled builder and 2 unskilled laborers can build 3 slabs/day.
  - To calculate the number of days required for the construction of latrine slabs, divide the number of slabs needed by 3. Multiply that amount by the daily rate of 1 skilled builder and 2 unskilled laborers separately to find the labor cost of each. Add the two amounts to obtain the total labor cost.

M. Superstructure

In a typical situation, a picture of the shelter would be given to a master builder for an estimate of the material requirements and labor requirements and costs, as he or she is familiar with local construction practices and material estimates. He or she would then make up a list of requirements and costs for submission to the program implementer for approval. Listed below are materials, labor, and transport costs to be used for each type of superstructure in the scenarios:

- Wood
  - material cost: $60
  - labor cost: $30
  - transport cost: $10 (wood is locally available in each scenario)
- Concrete Block
  - material cost: $110
  - labor cost: $60
  - transport cost: $20 for each traveling day from urban center
- Brick
  - material cost: $150
  - labor: $80
  - transport cost: $20 for each traveling day from urban center

  This cost does not include

  - vent pipes (each vent also requires 0.04 m^2 screen)

- screening material for windows (1 m^2 required for each superstructure)

For example, if 5 VIP latrines are to be made of concrete blocks in a town that is located 3 days travel from an urban center, the following calculations would be made to determine the costs for the 5 superstructures (excluding cost of fly screen and vent pipe).

- material cost = 5 x \$110 = \$550
- labor cost = 5 x \$80 = \$400
- transport cost = 5 x 3 days x \$20 = \$300

Cost = \$550 + \$400 + \$300 = \$1,250

For the total cost, the cost of 5 vent pipes and screening material would be added.

Solutions to Handout 11-8

Material and labor requirements for the construction of each latrine type are calculated below. The quantities are then multiplied by the number of the types in each scenario.

If upgrades are being made, only the new materials necessary for the upgrade (plus 1 skilled builder, 1 unskilled laborer, 1/2 bag of cement) need to be determined. The old latrine components can be salvaged.

From this information, the transport cost can be calculated for each scenario.

Note: The only real choice involved is the type of shelter. Since different shelter types can be used, a solution for the superstructure is not included here.

A. Material and Labor Requirements for Each Latrine Type

1. *Basic Latrine with Cover*

Base

Materials: concrete block, mortar (sand, cement)

No. of blocks =	2.5 blocks/m x 4 m = 10 blocks
Volume of sand =	0.0035 m^3/m x 4 m = 0.014 m^3
Bags of cement =	0.05 bags/m x 4 m = 0.2 bags

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 2.5 m = 2.5 m^3
Unskilled labor required =	2.5 days/2 = 1.25 days

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Slab

Materials: gravel, sand, cement, rebar

Volume of slab =	1.2 m x 1.2 m x 0.075 m = 0.11 m^3
Volume of gravel =	0.11 m^3
Volume of sand =	1/2 x 0.11 m^3 = 0.055 m^3
Volume of cement =	1/4 x 0.11 m^3 = 0.022 m^3
Bags of cement =	0.022 m/0.0332 m^3 = 0.7 bags
Length of rebar =	2 x [(1.2 m/0.15 m) -1] = 14 m

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2

Total Materials Required

Gravel	0.11 m^3
Sand	0.069 m^3
Cement	0.9 bag
Concrete blocks	10 blocks
Rebar	14 m
Superstructure	1
Screen (2 mm)	1 m^2

Total Labor Required

Skilled	0.7 day
Unskilled	2.25 days

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2. *VIP Latrine*

Base

Materials: bricks, sand, cement

No. of bricks =	2 (layers) x 8.3 bricks/m x 4 m = 67
Volume of sand =	2 x 0.004 m^3/m x 4 m = 0.032 m^3
Bags of cement =	2 x 0.06 bags/m x 4 m = 0.5 bags

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 2.5 m = 2.5 m^3
Unskilled labor required =	2.5 days/2 = 1.25 days

Slab

Materials: sand, cement, screen (1 cm)

Volume of slab =	1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand =	2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement =	1/2 x 0.024 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) =	2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows and vent (2 mm) = 1 m^2
Vent pipe (3 m) = 1

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Total Materials Required

Sand	0.056 m^3
Cement	0.9 bag
Brick	67 bricks
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2
Vent pipe (3 m)	1

Total Labor Required

Skilled builder	0.7 day
Unskilled laborer	2.25 days

3. *Pour Flush/Waterseal Latrine*

Base

Materials: gravel, sand, cement, rebar

Area of base =	(1.3 m x 1.3 m) - 1 m^2 = 0.69 m^2
Volume of base =	0.07 m x 0.69 m^2 = 0.048 m^3
Volume of gravel =	0.048 m^3
Volume of sand =	1/2 x 0.048 m^3 = 0.024 m^3
Volume of cement =	1/4 x 0.048 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Length of rebar =	2 x (4 x 1.3 m) = 10.4 m

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	1 x 1/3 day = 1/3 day

Pit Excavation

Volume of pit =	1 m x 1 m x 1.5 m = 1.5 m^3
Unskilled labor required =	1.5/2 = 0.75 day

Lining

Materials: concrete block

Area of walls =	4 x (1 m x 1.5 m) = 6 m^2
No. of blocks =	6 m^2 x 13.9 blocks/m^2 = 84

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Labor required:

Time =	$6(m^2)/4(m^2/day)$ = 1.5 days
Skilled =	1 x 1.5 days = 1.5 days
Unskilled =	1 x 1.5 days = 1.5 days

Slab

Materials: ferrocement of sand, cement, screen (1 cm)

Volume of slab =	1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand =	2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement =	1/2 x 0.024 m^3 = 0.012 m^3
Bags of cement =	0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) =	2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled =	1 x 1/3 day = 1/3 day
Unskilled =	2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2
Waterseal trap

Total Materials Required

Gravel	0.048 m
Sand	0.048 m
Cement	0.8 bags
Concrete block	84
Rebar	10.4 m
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2
Waterseal trap	1

Total Labor Required

Skilled builder	2.2 days
Unskilled laborer	2.5 days

4. *Raised Platform Latrine*

Base

No base required.

Pit Excavation

Volume of pit below ground = 1 m x 1 m x 1.2 m = 1.2 m^3
Unskilled labor required = 1.2/2 = 0.6 days

Lining

Materials: brick and cement

Area of lining wall below ground = 4 x (1 m x 1.2 m) = 4.8 m^2
Area of walls extending above ground = 4 (1 m x 1 m) = 4 m^2
Total wall surface area = 8.8 m^2
No. of bricks = 8.8 m^2x 65 bricks/m^2 = 572 bricks
Cement required = 1/6 bag x 4.8 m^2 + 1/3 bag x 4 m^2 = 0.8 + 1.3 = 2.1 bags

Labor required:

Time = 8.8 m^2/3 m^2/day = 2.9 days
Skilled = 1 x 2.9 days = 2.9 days
Unskilled = 1 x 2.9 days = 2.9 days

Slab

Materials: ferrocement of sand, cement, screen (1 cm)

Volume of slab = 1.2 m x 1.2 m x 0.025 m = 0.036 m^3
Volume of sand = 2/3 x 0.036 m^3 = 0.024 m^3
Volume of cement = 1/2 x 0.024 m^3 = 0.012 m^3
Bags of cement = 0.012 m^3/0.0332 m^3 = 0.4 bags
Screen (1 cm) = 2 (layers) x 1.2 m x 1.2 m = 2.9 m^2

Labor required:

Skilled = 1 x 1/3 day = 1/3 day
Unskilled = 2 x 1/3 day = 2/3 day

Superstructure

One of the three types.

Miscellaneous

Screen for windows (2 mm) = 1 m^2

Total Materials Required

Sand	---
Cement	2.5 bags
Brick	572
Screen (1 cm)	2.9 m^2
Superstructure	1
Screen (2 mm)	1 m^2

Total Labor Required

Skilled builder	3.2 days
Unskilled laborer	4.2 days

B. End Solution to Each Scenario

The material quantities can be put onto a cost sheet and multiplied by the unit cost to find the cost associated with each program (excluding the shelter).

Scenario I

New latrine construction:

- 2 basic latrines with cover
- 2 VIP latrines
- 1 pour flush (or waterseal) latrine

For the total materials required in Scenario I,

multiply

2 x materials in 1 basic latrine

2 x materials in 1 VIP latrine

1 x materials in 1 pour flush latrine.

These materials added together will be the total material requirements.

The amount of labor is calculated in the same manner.

Total Materials Required

Gravel (m^3)	2 x 0.11 + 1 x 0.048 = 0.27 m^3
Sand (m^3)	2 x 0.069 + 2 x 0.056 + 1 x 0.048 = 0.3 m^3
Cement (bags)	2 x 0.9 + 2 x 0.9 + 1 x 0.8 = 4.4 (5 bags)
Concrete block	2 x 10 + 1 x 84 = 94 blocks
Bricks	2 x 67 = 134 bricks
Rebar (m)	2 x 14 + 1 x 10.4 = 38.4 m (or 7 lengths of 6 m rebar)
Screen (1 cm) (m^2)	2 x 2.9 + 1 x 2.9 = 8.7 (9 m^2)
Superstructure	2 x 1 + 2 x 1 + 1 x 1 = 5 superstructures
Screen (2 mm) (m^2)	2 x 1 + 2 x 1 + 1 x 1 = 5 m^2
Vent pipe (3 m)	2 x 1 = 2 vent pipes
Waterseal trap	1 x 1 = 1 trap

Total Labor Required

Skilled builder (days) 2 x 0.7 + 2 x 0.7 + 1 x 2.2 = 5 days
Unskilled laborer (days) 2 x 2.25 + 2 x 2.25 + 1 x 2.5 = 11.5 days

Scenario II

New latrine construction:

- 1 raised platform latrine

Upgrades:

- 5 basic pit latrines upgraded to 5 VIP latrines
- 5 VIP latrines upgraded to 5 pour flush latrines

In this scenario, the materials for one complete raised platform latrine are needed. For the upgrades, new slabs will only be needed for the 5 pour flush latrines, because the slabs for the 5 VIP latrines that are being converted to pour flush latrines can be used for the basic pit latrines that are to be upgraded to VIPs. The vent pipes from the VIPs being converted can also be used, assuming that they are not built as part of the superstructure. It is assumed that the superstructures for the upgraded latrines can be reused.

Recall that each upgrade requires one-half bag of cement and a day's work from a skilled builder and an unskilled laborer. For the total cement and labor required for the upgrade (aside from the new slabs for the pour flush latrines), multiply the number of upgrades by the above values.

Total Materials Required

Sand (m^3)	5 x 0.024 = 0.44 m^3
Cement (bags)	1 x 2.5 + 5 x 0.4 + 10 x 0.5 = 9.5 (10 bags)
Screen (1 cm) (m^2)	1 x 2.9 + 5 x 2.9 = 17.4 (18 m^2)
Superstructure	1 x 1 = 1
Screen (2 mm) (m^2)	1 x 1 = 1 m^2
Waterseal trap	5 x 1 = 5 traps

Total Labor Required

Skilled builder (days)	1 x 3.2 + 5 x 1/3 + 10 x 1 = 14.9 days
Unskilled laborer (days)	1 x 4.2 + 5 x 2/3 + 10 x 1 = 17.5 days

Scenario III

New latrine construction:

- 2 VIP latrines
- 2 basic latrines with cover

Upgrade:

- 2 basic pit latrines ---> 2 VIP latrines

In this scenario the materials needed for the new construction would be

2 x materials for 1 VIP latrine

2 x materials for 1 basic latrine.

The inputs needed for the upgrade would be vent pipes, cement, and labor, as noted above. As above, it is assumed that the superstructures and slabs can be reused for the upgrades.

Total Materials Required

Gravel (m^3)	2 x 0.11 = 0.22 m^3
Sand (m^3)	2 x 0.069 + 2 x 0.056 = 0.25 m^3
Cement (bags)	2 x 0.9 + 2 x 0.9 + 2 x 0.5 = 4.6 (5 bags)
Concrete block	2 x 10 = 20 blocks
Bricks	2 x 67 = 134 bricks
Rebar (m)	2 x 14 = 14 m (or 3 lengths of 6 m rebar)
Screen (1 cm) (m^2)	2 x 2.9 = 5.8 (6 m^2)

Superstructure	2 x 1 + 2 x 1 = 4 superstructures
Screen (2 mm) (m^2)	2 x 1 + 2 x 1 = 4 m^2
Vent pipe (3 m)	2 x 1 = 2 vent pipes

Total Labor Required

Skilled builder (days)	2 x 0.7 + 2 x 0.7 + 1 x 2 = 4.8 days
Unskilled laborer (days)	2 x 2.25 + 2 x 2.25 + 1 x 2 = 11 days

Scenario IV

New latrine construction:

- 20 VIP latrines, with agency assistance
- 5 raised platform latrines with vent pipes

In this scenario the slabs and fly screens are provided (transport is not), so the material calculations will include the following components:

- pit excavation
- construction of bases for VIP latrines
- superstructure
- construction of raised lining for raised platform latrines

Total Materials Required

Sand (m^3)	20 x 0.032 = 0.64 m^3
Cement (bags)	5 x 7.1 + 20 x 0.5 = 20.5 (21 bags)
Bricks	5 x 572 + 20 x 67 = 4,200 bricks
Superstructure	5 x 1 + 20 x 1 = 25 superstructures
Screen (2 mm) (m^2)	5 x 1 + 20 x 1 = 25 m^2
Vent pipe (3 m)	5 x 1 + 20 x 1 = 25 vent pipes

Total Labor Required

Skilled builder (days)	5 x 2.9 + 20 x 1/3 = 21.1 days
Unskilled laborer (days)	5 x 3.5 + 20 x 1/3 + 20 x 1.25 = 49.2 days

Notes: **Materials and labor for slab construction are not necessary in this scenario.** This scenario provides the only example of integrating the VIP and raised platform latrine types.

Effective Presentations—A Planning Checklist

A. Key Points

- Develop clear, simple objectives. Identify key messages and write them down for yourself. Orient the key messages to what the participants will be able to do or say by the end of your session with them.

  In your planning, think about the following questions:

  - ☐ What do I want the participants to learn/remember? What's really important?
  - ☐ What are the principal points I want to make? How will I sequence them?
  - ☐ What visual aids will I use? How do I want them to look?
  - ☐ What fun activities could I use to get my messages across—songs, theater, or role plays?
  - ☐ What examples will I use to illustrate what I mean?

- Keep the presentation short, with a few key points (20 to 30 minutes maximum for the entire presentation).
- Use all the facilitative skills (asking questions, paraphrasing, summarizing, using encouragers). Ask open-ended questions to encourage discussion of people's own experience and their reactions to the subject matter.
- Give examples and anecdotes to reinforce key points. Make sure they are familiar to participants and that you understand them well.
- Show simple visual aids to illustrate key points, such as pictures, clear drawings, and written material where appropriate.

B. Proceed Using Three Steps

1. *Introduction*

- Greetings.
- Describe what you want to discuss (objectives).
- Ask related questions drawing on the participants' experiences.

2. *Discuss Key Points*

   - Explain key points.
   - Use illustrations or other visual aids if possible .
   - Ask questions to relate points to participants' experiences.

3. *Conclusion*

   - Review and summarize key points.
   - Ask questions to verify comprehension and draw conclusions.
   - Discuss how the participants can apply the key points.
   - Thank them for participating.

Operation and Maintenance Concerns

Operation

- capacity
- ventilation
- waterseal trap

Capacity

The most evident operational concern common to all latrine technologies deals with the capacity of the latrine. Eventually, all latrines fill, so an effort must be made to plan for a transition.

Depending on the resources involved, this transition presents an opportunity for upgrading the latrine. Whether this option is utilized or not, all salvageable materials are taken from the old latrine site for use in constructing the new latrine or for some other purpose. Doing so can substantially reduce the cost of the new latrine.

It is generally accepted that the transition should occur when the excrement in the latrine reaches a level of 1 to 0.5 m below the slab. The latrine is then filled with earth or a combination of earth and organic waste. This distance (1 to 0.5 m) prevents pathogens from making their way to the surface where users will be exposed.

Ventilation

Blocked ventilation will lessen the air currents flowing through the latrine, which could cause the interior of the latrine superstructure to become or to remain damp. Good air circulation will also result in lessening smells in the latrine.

Occasionally, the vent pipe of the VIP becomes partially blocked, thus reducing the effectiveness of the technology. Typically the problem is caused by spider webs. Eliminating this problem is a relatively easy procedure but the vent should be checked periodically.

Waterseal Trap

As mentioned previously, utilization of the pour flush technology requires an excess of water for its proper and continued functioning. A minimum of 10 liters/person/day is recommended in excess water. For example, an eight-member family using the latrine would require an excess 80 liters of water per day.

At times, the waterseal can become clogged by waste material or wiping material that is thrown into the latrine. Another cause is the use of insufficient water in flushing the latrine.

Maintenance

- cleanliness
- repairs

Cleanliness

Perhaps the most simple, yet the most important, maintenance for a latrine is keeping it clean. This will limit contact with excreta, reduce flies in the latrine, reduce smells, increase latrine use, and improve the appearance of latrines.

Repairs

The repairs needed by a latrine will, in most cases, be obvious, as maintenance problems are commonly manifested in the superstructure or latrine slab.

Cracks in the slab or slabs with broken masonry constitute the most serious problems. The resulting weakness of the slab could cause it to fall into the pit along with whoever is on it, not to mention allowing the access of vectors to the fecal material. These problems should be rectified immediately. Whether the slabs need to be replaced or can be repaired should be decided by an experienced builder.

Cracks or breakage can also occur in the waterseal trap. This can result in higher water requirement for flushing; access of vectors to excreta; increase in smell; leakage of water onto latrine floor; or total nonfunctioning. Most waterseal traps are difficult to repair so will probably need to be replaced.

Common problems in the superstructure usually consist of small repairs such as rips in the fly screen, repairing the door hinges, etc. While the repairs needed for these items are minor, they are often neglected, which allows access to insect vectors and could lead to reduced use. A well-maintained latrine encourages use.

Team Task: Assessing Existing Latrines

- The team will be given 30 minutes at each latrine:
  - 20 minutes to inspect the latrine, and complete their notes
  - 10 minutes for discussion

  At each site, address the following questions:
- How would you assess the original construction?
  - What is the age of the latrine?
  - What building materials were used?
  - What was the level of quality of construction?
- How would you assess siting?
  - What is the proximity to water sources?
  - What is the water table?
  - What is the likelihood of flooding during heavy rains?
  - Is the soil of a suitable type to allow percolation of wastewater?
  - To what extent is the latrine being used properly?
- What is the current state of repair?
  - superstructure
  - slab
  - pit (look for cracks in cement, signs of subsidence)
- What are the possibilities for upgrading the latrine? (For example, to convert a pit latrine to a VIP, do you need a new slab? Can the superstructure be reused?)
- How would you assess the state of maintenance?

Demonstration Latrine

- How would you assess the quality of construction?
- What might you have done differently?

Monitoring and Evaluation

A. Monitoring

Monitoring has two key components:

- Continued observation of the prevalence of high-risk behavior, both the frequency and the degree of exposure to excreta.
- Continued observation of ongoing interventions.

Prevalence of High-Risk Behaviors

High-risk behaviors are defined as behaviors that allow (or even promote) exposure to excreta. Examples include

- defecation in areas where excreta may come into contact with the individual or others or contaminate a water supply,
- nonwashing of hands (with soap) after defecation,
- allowing domestic animals to defecate in areas where their excreta may come into direct contact with people or a water supply,
- handling of properly isolated excrement before it has decomposed to the extent that all pathogens are inviable,
- not maintaining the cleanliness of the latrine, and
- not properly disposing of wiping material.

Ongoing Interventions

Examples of key questions for monitoring ongoing interventions include

- Sanitation education activities
  - How well are people understanding the message?
  - To what extent are appropriate groups (groups exhibiting high-risk behaviors) being targeted?
- Newly completed latrines
  - How would you rate user satisfaction?
  - How well does the facility satisfy the main purpose of latrines, that is, isolation of excreta?

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- Are acceptance and use of the facility achieved by all members of the family?

Observation during site visits is the best way to monitor, as opposed to written letters and reports or secondhand accounts. Observation during site visits requires sensitivity.

Observable indicators of change may include

- cleanliness of a latrine
- signs of latrine use
- absence of improperly discarded wiping material
- absence of excreta around the latrine or house
- basic pit latrines are covered when not in use
- small children know how to use the latrine properly
- observance of hand washing after latrine use

B. Evaluation

Evaluation is defined as follows:

> Planned review of program successes and failures, cost to benefit ratio, and recommendations for future programs.

Looking Back over the Year

In general, programs should be evaluated once a year. Important questions to ask in looking back over the year might include the following:

- To what extent are the latrines functioning properly?
- To what extent are they being used?
- What is the remaining life of each latrine?
- What have been the major problems?
- How strong is community interest?
- What does the community view as the benefits of the program?
- What are benefits of the program? (In terms of improved health status, reduced diarrhea, and sickness and death among small children.)

- How have the interventions affected the high-risk behaviors?
- Which high-risk behaviors are still evident? To what degree?

Looking Ahead to the Coming Year

One important outcome of an evaluation is clarification of the key questions that should be considered over the coming year. Important questions to ask in looking ahead to the coming year might include the following:

- To what extent is there interest in upgrading latrines? In constructing new latrines?
- How has the situation changed in the community? (For example, does it have an increased or reduced water supply that would make other latrine options feasible?)
- In what ways would the community benefit from a refresher course in sanitation education?
- How could the gap between current high-risk behaviors and improved behaviors be bridged? (problem clarification)
- Have new high-risk behaviors been identified? How could they be addressed?

Considering Overall Recommendations

Important questions in considering overall program recommendations would include

- What's going well? What could be improved?
- What lessons have been learned from the past year?
- How should these lessons be applied to other communities?

Emphasize that—as in monitoring—the best evaluation method is observation during site visits.

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Three-Month Action Plan

Activities to Undertake	Resources Needed	People to Contact	By When

Evaluation Form

1. Goal Attainment

Please circle the appropriate number to indicate the degree to which the workshop goals have been achieved. On the scale of 1 to 5, 1 equals "not achieved" and 5 equals "very much achieved."

A. Describe appropriate approaches for developing an excreta management program in the community.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

B. Identify the excreta disposal behaviors of a community and the impact of those behaviors on health.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

C. Collect information to assist in the development of an excreta management strategy.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

D. Analyze critical factors in determining appropriate latrine selection.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

E. Describe the design requirements for four types of latrine.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

F. Develop a latrine construction program plan, supervise construction, and assess and upgrade existing latrines.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

G. Apply interactive techniques to sanitation education.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

H. Monitor and evaluate sanitation interventions.

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

I. Develop an action plan to implement a sanitation improvement program "back home."

Not Achieved		Somewhat Achieved		Very Much Achieved
1	2	3	4	5

Comments:

2. Course Feedback and Learning

Please answer the following questions as fully as possible so that the trainers can learn how effective the training course methodology was.

A. What have been the most positive things about this course? Comments:

B. What have been the most negative things about this course? Comments:

C. What one thing stands out as important to you in this workshop? Comments:

D. What things have you learned that you did not know before? Comments:

3. Course Organization and Training

A. What comments do you have about the way the course was planned and organized?

B. What be done in the future to improve a course like this?

C. What specific steps in developing a community sanitation and latrine improvement program do you feel you will need to learn more about in order to promote and develop a program successfully in the future?

D. What feedback do you have for the trainers?