Water for the World

Designing Slabs for Privies

Technical Note No. SAN. 1.D.1

The slab is the floor of the privy. It covers the pit and has a hole through which to defecate. Designing a slab involves selecting the type of slab (squatting or sitting), deciding which improvements the privy will have, calculating the dimensions of the slab, and determining the materials, labor, and tools needed to build it. The products of this process are design drawings of the slab and improvements, if any, and a detailed materials list. These items should be given to the person in charge of construction.

This technical note describes how to design a slab and arrive at these end-products. Read the entire technical note before beginning the design process.

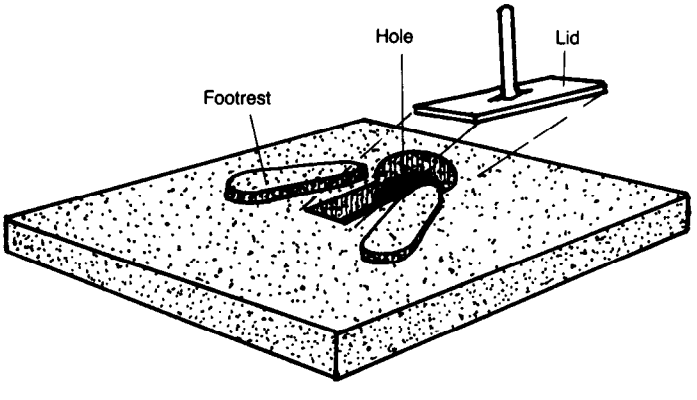
Materials Needed

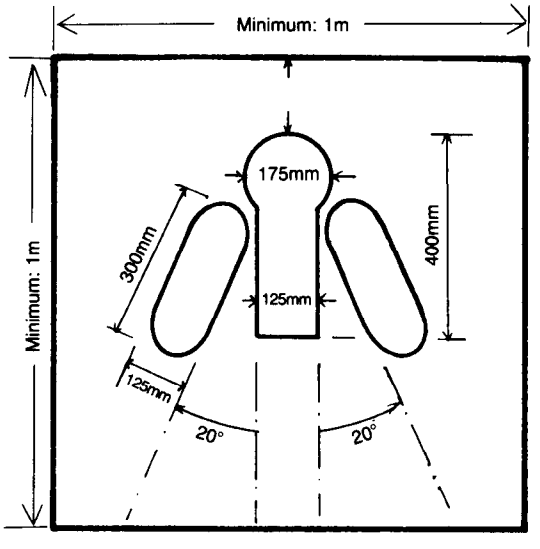
Measuring tape - To check dimensions of previously constructed items (pit, base around pit, or pour-flush bowl, for instance)

Selecting Slab Type

The type of slab selected depends on whether the users prefer to squat or sit when defecating.

Squatting Slab. The main features of a squatting slab are a hole, a pair of footrests, and a lid to cover the hole. See Figures 1 and 2.





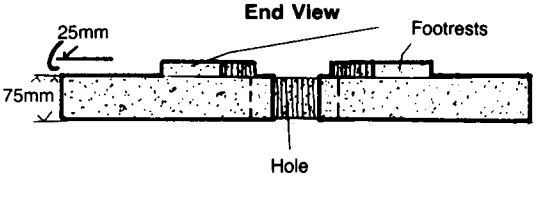


Figure 1. Squatting Slab

The hole is generally key-hole shaped, about 400mm long, and 125mm wide at the narrow end. The wide end is a circle 175mm in diameter. The back edge of the hole usually should be about 150mm from the back wall of the privy which, depending on the design, may be at the edge of the slab. If the distance between the wall and the hole is less than 150mm, there may not be enough space to squat. If the distance is more, there is a greater risk of soiling the floor. The distance between the edge of the hole and the edge of the slab may be greater than 150mm if the privy has a vent pipe.

Since the footrests ensure that the privy user is positioned correctly over the hole, their placement is important. They are oval-shaped, about 300mm long, 125mm wide, and 25mm high.

The lid should cover the hole but not fit inside it. It should have a handle. See Figure 2.

Sitting Slab. The main features of a sitting slab are a hole, a pedestal or riser, a seat, and a lid to cover the seat.

The hole is 250-300mm in diameter and should be about 150mm from the back wall of the privy which may be at the back edge of the slab, depending on the design. See Figure 3.

The pedestal is 275-350mm high and has the same inside diameter as the hole. The thickness of the pedestal walls depends on the materials used.

The seat is attached to the top of the pedestal. Its outside measurements are equal to or greater than the outside measurements of the pedestal. The seat has a hole in the center 200mm in diameter. A second seat with a smaller hole (150mm) in diameter can be included for children.

The lid covers the seat and is often attached to the back of the seat with a hinge. See Figure 3.

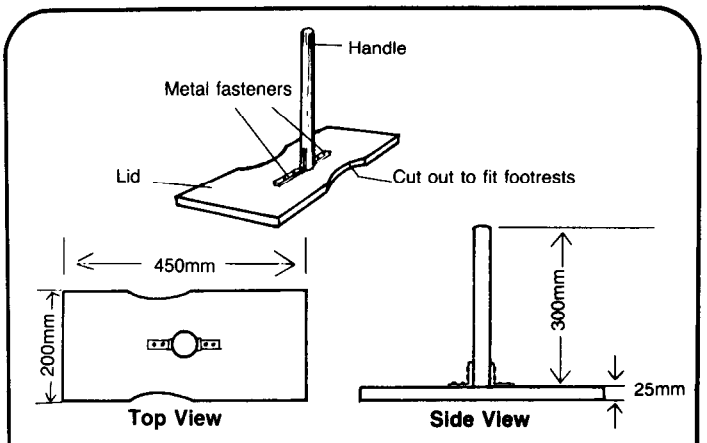


Figure 2. Lid for Squatting Slab

Determining Improvements

The main improvements to a privy are a vent pipe, a pour-flush bowl, an off-set pit, or a combination of the three. Any privy improvement will modify the slab design.

Vent Pipe. If the privy is to have a vent pipe, the pit must be about 300mm longer than a pit for an unimproved privy (see "Designing Pits for Privies," SAN.1.D.2). The slab must also be longer by about 300mm. This means that the distance from the back edge of the squatting hole to the edge of the slab is 450mm--150mm for the basic design plus 300mm for the vent pipe. See Figure 4. The slab has a hole 100-150mm in diameter, depending on the size of the vent pipe, and is positioned as in Figure 5. The vent pipe can be made from a sheet of tin or galvanized metal and should be topped with a fly-proof screen.

Pour-Flush Bowl. If the privy is to have a pour-flush bowl, the squatting hole may not be key-hole shaped. The shape of the hole must conform to that of the bowl, and often the bowls are prefabricated as shown in Figure 6. The bowl should be positioned to flush forward, to prevent erosion of the pit wall.

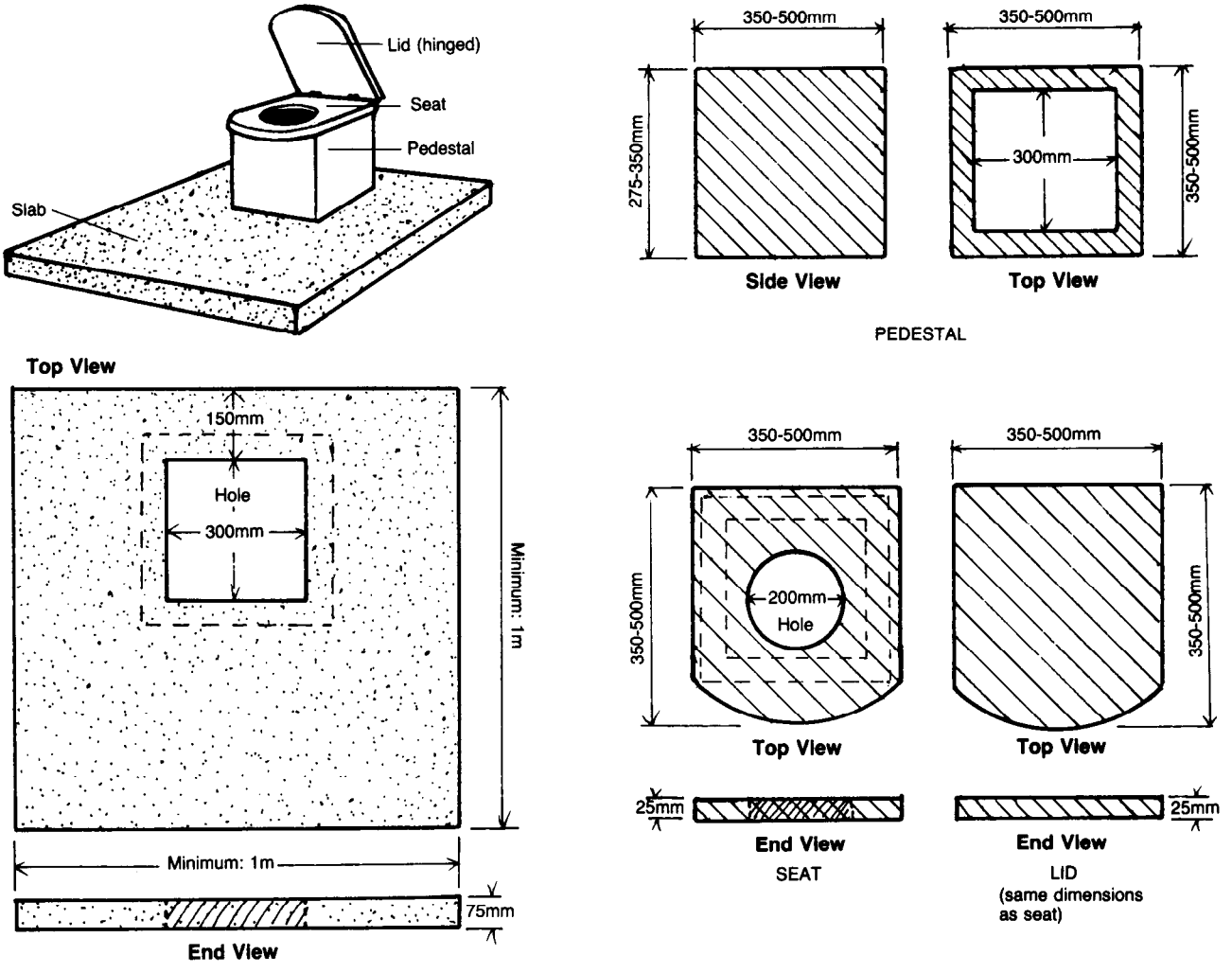


Figure 3. Sitting Slab with Pedestal, Seat and Lid

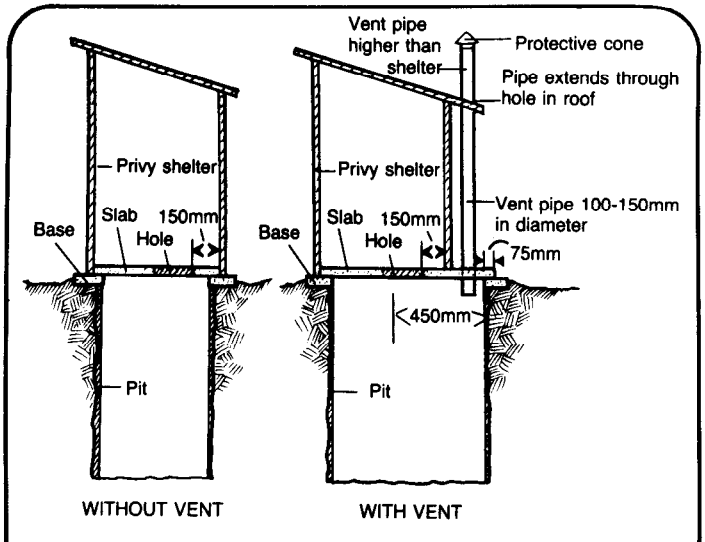


Figure 4. Comparison of Privies with and without Vent

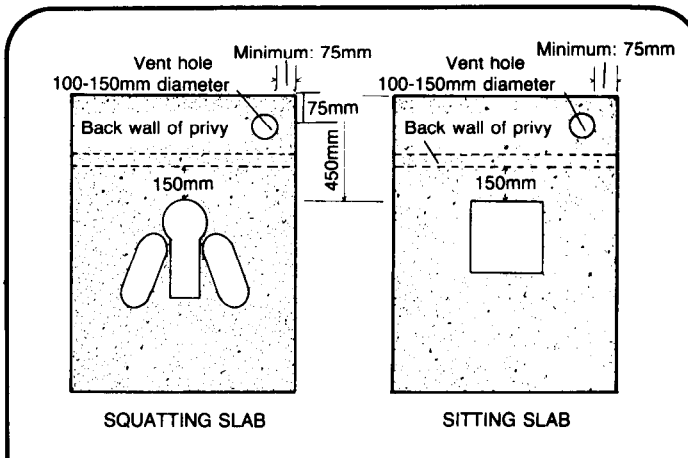


Figure 5. Top View of Slabs Showing Vent Hole Placement

Off-Set Pit. The slab for an off-set pit rests on a platform made of wood, bricks, or concrete and has a metal chute attached to the hole. The chute can be made from a sheet of tin or galvanized metal. It enters the pit below ground level at a downward angle of 50° to 60°. The upper end is mortared to the bottom of the slab and encircles the squatting hole. The lower end narrows to about 200mm in diameter and extends about 100mm beyond the pit wall. See Figure 7. The pit must have a cover which can be made in one piece or in sections. If the cover is made of concrete, it should be made in sections for easier handling as shown in Figure 8. The cover must be strong enough to prevent persons from falling into the pit.

Combination. If there is a combination of improvements, each improvement will modify the design of the slab as described above. For example, a privy with a vent pipe and a pour-flush bowl must have a longer slab to accommodate the vent and a specially shaped hole for the bowl. There is one exception. The slab design for an off-set pit is the same whether or not the pit has a vent pipe, because a vent pipe used with an off-set pit extends through the pit cover, not through the slab. See Figures 7 and 8.

Calculating Dimensions

Unimproved, ventilated, or pour-flush privies must have slabs that cover the pit and overlap each edge

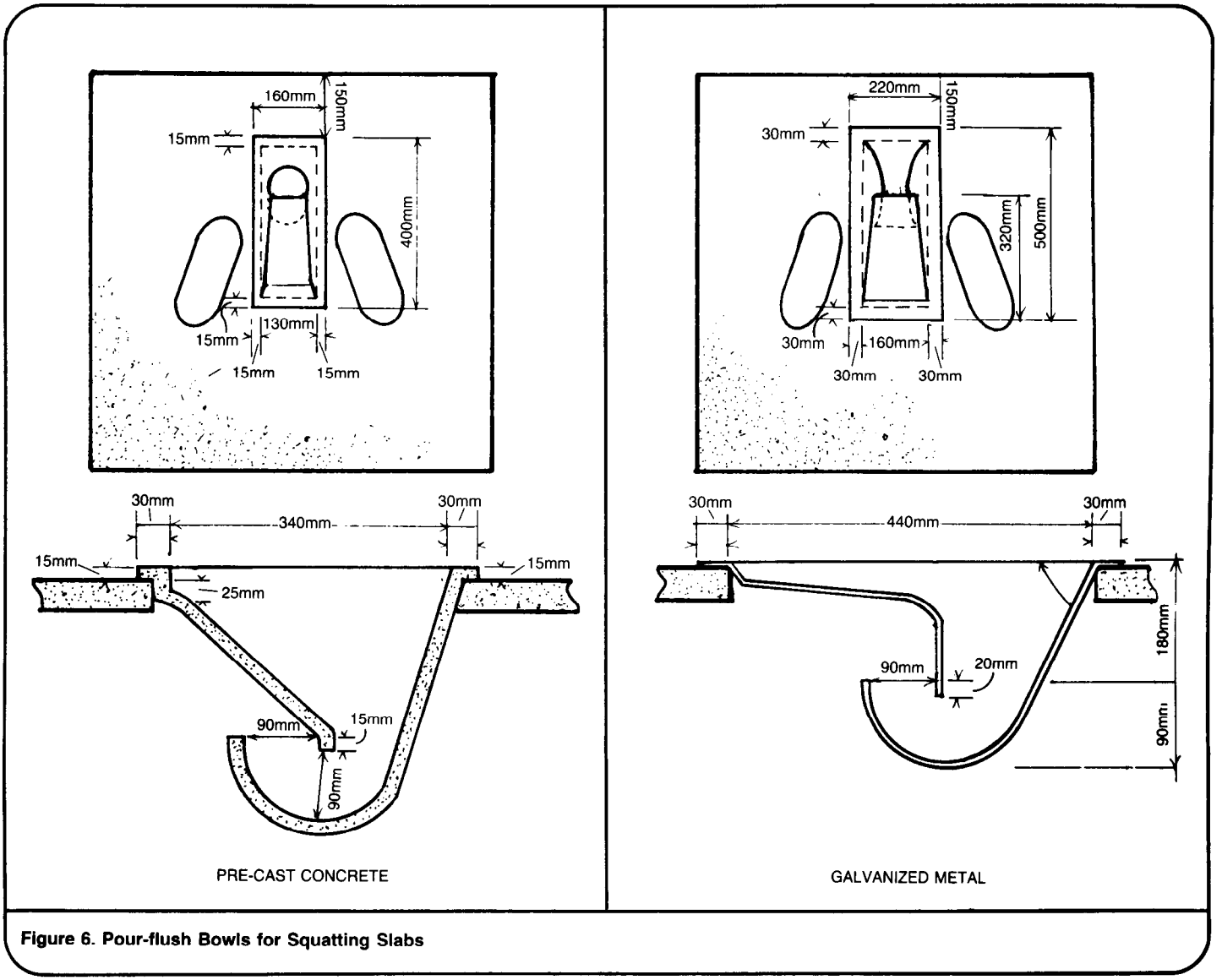


Figure 6. Pour-flush Bowls for Squatting Slabs

by at least 75mm. The length of the slab for these kinds of privies equals the length of the pit plus 150mm and the width of the slab equals the width of the pit plus 150mm. Worksheet A shows the steps in calculating slab dimensions. For example, suppose the pit is 1.5m long and 1.2m wide. Then the length of the slab is 1.5m + 0.15m = 1.65m. The width of the slab is 1.2m + 0.15m = 1.35m. See Worksheet A, step #1. For an off-set pit, the slab should be about 1m square. The thickness of a slab depends on the material used to make it. A reinforced concrete slab is 50-75mm thick.

The cover for an off-set pit must be large enough to cover the pit and overlap each edge by at least 75mm. The length of the cover equals the length of the pit plus 150mm, and the width of the cover equals the width of the pit plus 150mm. For example, suppose the pit is 1.7m long and 1.2m wide. Then the length of the cover is 1.7m + 0.15m = 1.85m. The width of the cover is 1.2m + 0.15m = 1.35m. See Worksheet A, step #3.

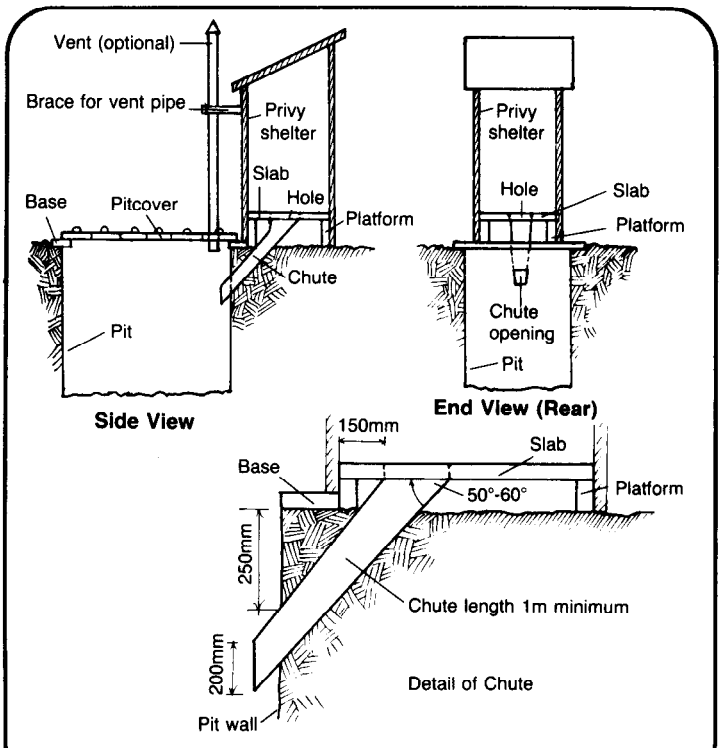
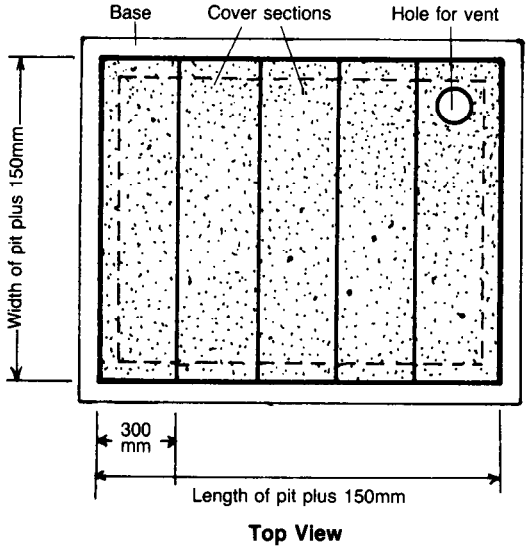
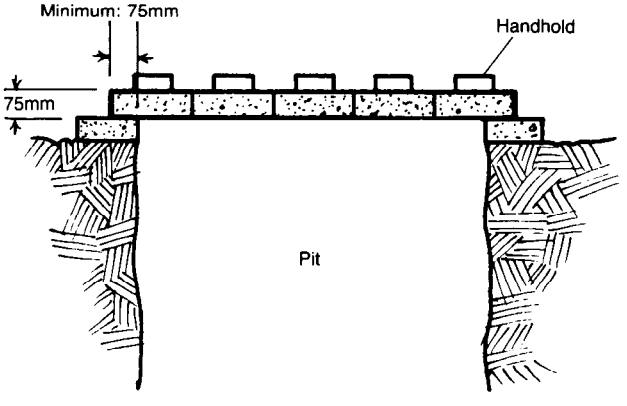


Figure 7. Off-Set Pit Privy



Top View



Side View

Figure 8. Cover for Off-Set Pit

Worksheet A. Calculating Dimensions

1. Slab (sitting or squatting) for unimproved, ventilated, or pour-flush privy:

   Length of slab = length of pit 1.5 m + 0.15m = 1.65 m
   Width of slab = width of pit 1.2 m + 0.15m = 1.35 m
   Thickness of slab (if concrete) = 50-75mm

2. Slab (sitting or squatting) for off-set pit privy:

   Length of slab = 1.0m
   Width of slab = 1.0m
   Thickness of slab (if concrete) = 50-75mm

3. Cover for off-set pit:

   Length of cover = length of pit 1.7 m + 0.15m = 1.85 m
   Width of cover = width of pit 1.2 m + 0.15m = 1.35 m
   Thickness of cover (if concrete) = 75mm

4. If cover is in sections:

   Length of each section = width of cover = 1.35 m
   Width of each section except one = 300mm
   Width of one section = 300mm plus necessary width to total entire length of the cover = 300mm + 50 mm = 350 mm
   Combined widths of sections = total length of cover = 300 + 300 + 300 + 300 + 300 + 350mm = 1850mm

(NOTE: To calculate quantities of concrete, see "Designing Septic Tanks," SAN.2.D.3.)

If the cover is reinforced concrete, it should be made in sections. The length of each section equals the width of the pit plus 150mm and the width of each section, except for one end section, is 300mm. The width of one end section must be 300mm plus whatever measurement is necessary to add up to the total length of the cover. For example, suppose the total length of the cover must be 1850mm. Then the cover would be made in six sections with widths of 300 + 300 + 300 + 300 + 300 + 350mm = 1850mm. See Worksheet A, step #4.

The thickness of a cover for an off-set pit depends on the material it is made from. A reinforced concrete cover should be about 75mm thick.

A vent pipe is 2-2.5m long and 100-150mm in diameter. A chute for an off-set pit is at least 1m long, with an average width of 200mm. Worksheet B shows how to calculate the dimensions of the materials needed to make vent pipes and chutes for off-set pits.

Worksheet B. Calculating Quantities of Material for Vent Pipe and Chute

Vent Pipe

Generally made from a sheet of tin or galvanized metal. The size of the sheet:

Length = height of privy shelter (from "Designing Privy Shelters," SAN.1.D.3) plus 0.6m
Width = diameter of vent pipe times 3.3

Example: Suppose that the height of the privy shelter is 2m and the diameter of the vent pipe is 150mm. Then the sheet of tin needed to make the pipe will have these dimensions:

Length = 2m + 0.6m = 2.6m
Width = 150mm x 3.3 = 500mm

(NOTE: The method used to calculate the width allows the edges of the sheet to overlap about 25mm when the pipe is made.)

Chute (for off-set pit)

Generally made from a sheet of heavy tin or galvanized metal. The size of the sheet:

Length = 1.5 times the distance from the front edge of the pit to the farthest edge of the hole in the slab.
Width = distance around the hole plus 25mm

(NOTE: The distance around the hole equals 2 times the length plus the width.)

Example: Suppose the hole in the slab is 150mm wide and 400mm long, and that the distance from the pit to the edge of the hole farthest from the pit is 700mm. Then the sheet of tin needed to make the chute will have these dimensions:

Length = 1.5 x 700mm = 1050mm
Width = distance around hole + 25mm
= 2 x (150mm + 400mm) + 25mm
= 1125mm

(NOTE: The "width" of the sheet may be longer than the "length.")

When the type of improvements and dimensions have been determined, prepare design drawings similar to Figures 1-9, showing correct dimensions and top and side views of the slab and improvements. Give these drawings to the person in charge of construction.

Materials List

Slabs can be made from a variety of materials, including reinforced concrete, wood or bamboo. Generally, they are made from concrete, because concrete is strong, long-lasting, and easy to clean.

A common mix by volume for concrete is one part cement, two parts sand, three parts gravel, and about 2/3 part water or enough water to make a fairly stiff mix. The cement should be Portland cement. The sand should be clean and sized fine to 6mm. The gravel should be clean and sized 6-25mm. The water should be clear. For details on calculating quantities for concrete mix, see "Designing Septic Tanks," SAN.2.D.3.

A concrete slab must have reinforcing material, such as steel bars 10mm in diameter, wire mesh, or split bamboo. To calculate the quantity of steel bars needed, draw a sketch similar to Figure 9, showing bars in place, and count the number and lengths of the bars. If wire mesh is used, the quantity is approximately equal to the area of the slab (length times width).

The reinforcing material must not block the hole in the slab. No part of it should stick out through the concrete.

The tools and labor required to build a slab depend on the materials used. If it is made of reinforced concrete, at least one worker should have some knowledge of or experience with concrete (mixing, pouring, and building forms). Common tools for working with concrete include hammer, saw, and nails for building forms; container, shovel, tamping rod, and trowel for mixing, pouring, and smoothing concrete.

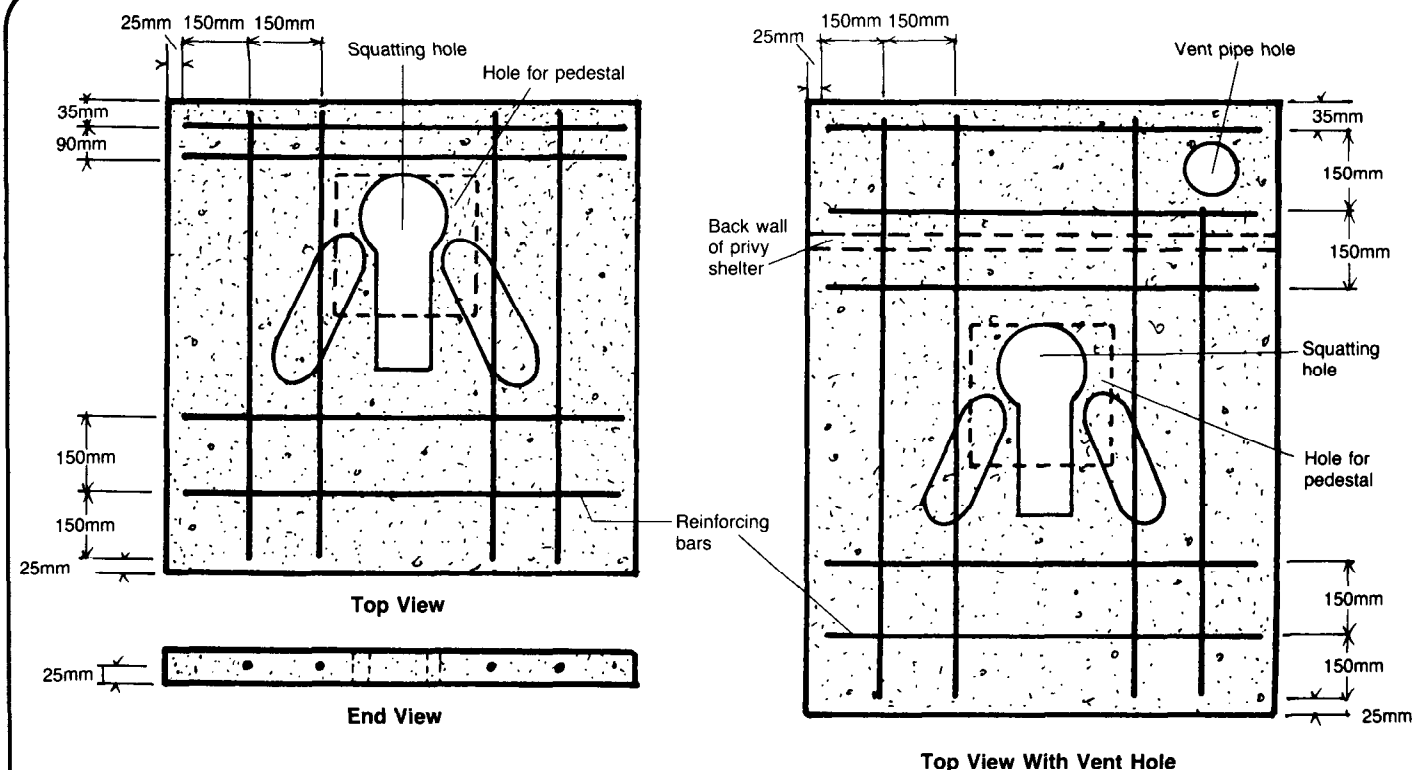


Figure 9. Placement of Reinforcing Bars in Concrete Slab

If the slab has a seat and pedestal, the pedestal can be made from brick, concrete blocks, or wood, and the seat can be made from wood. One-piece, ceramic seat-and-pedestal units may be available.

A cover made from wood should be provided for both sitting-type and squatting-type slabs. The cover for the seat and pedestal may be attached to the back of the seat with hinges.

A pour-flush bowl may be made from galvanized metal, concrete, molded rubber, or ceramic material. These units may be prefabricated and ready to install. A skilled craftsman could produce a galvanized metal or concrete pour-flush bowl using the design information in Figure 6. A metal bowl must have smooth, rounded edges dulled by a file. A concrete bowl must be cured in water for a week. A pour-flush bowl can be secured to the slab with concrete mortar.

A vent pipe can be made of galvanized metal by a semi-skilled workman using tinsnips, pliers, metal screws and a screw driver (or other means of securing the metal), and black paint and a brush to paint the pipe black. Or, a section of bamboo with the nodes knocked out could be used as a vent pipe.

A chute for an off-set pit can be made of galvanized metal by a semi-skilled workman using tinsnips, pliers, metal screws and a screwdriver, or other means of securing the metal.

A cover for an off-set pit can be made from wood, metal, or reinforced concrete. If concrete is used, the tools and skills of the workmen are the same as for a concrete slab.

When the materials needed have been determined, prepare a detailed materials list, similar to the sample in Table 1, showing types and quantities of all materials, tools, and labor needed to construct the slab and improvements, and the estimated costs based on local prices. Give the materials list and design drawings, similar to Figures 1-9, to the person in charge of construction.

Table 1. Sample Materials List

ITEM	DESCRIPTION	QUANTITY	ESTIMATED COST
Labor	Foreman	1	_____
	Laborer (some experience with concrete)	1	_____
	Laborers (to move constructed slab)	4-6	_____
Supplies	Portland cement	_____m^3	_____
	Sand: Clean, size fine to 6mm	_____m^3	_____
	Gravel: Clean, size 6-38mm	_____m^3	_____
	Water: Clear, drinking water preferred	_____liters	_____
	Wood (for concrete forms)	_____	_____
	Nails (for concrete forms)	_____	_____
	Reinforcing bars _____mm long	_____	_____
	_____mm long	_____	_____
	(or wire mesh)	_____m^2	_____
	Wood (for lid)	_____	_____

	If seat and pedestal:		
	Bricks (for pedestal)	_____	_____
	Mortar (cement, sand, water)	_____m^3	_____
	Wood (for seat and lid)	_____	_____

	Pour-flush bowl (prefabricated)	_____	_____
	Galvanized metal (for vent pipe)	_____m^2	_____
	Galvanized metal (for chute)	_____m^2	_____
	Metal screws or bands	_____	_____
	Screen (for vent)	_____	_____
Tools	Measuring tape	1	_____
	Shovel	2	_____
	Bucket	1	_____
	Container for mixing concrete	1	_____
	Trowel	1	_____
	Saw	1	_____
	Hammer	1	_____
	Tinsnips	1	_____
	Pliers	1	_____
	Screwdriver	1	_____
	Other	_____	_____

Total Estimated Cost = _____