Appropriate Technology for Water Supply and Sanitation

Sanitation Alternative for Low-income Communities —A Brief Introduction

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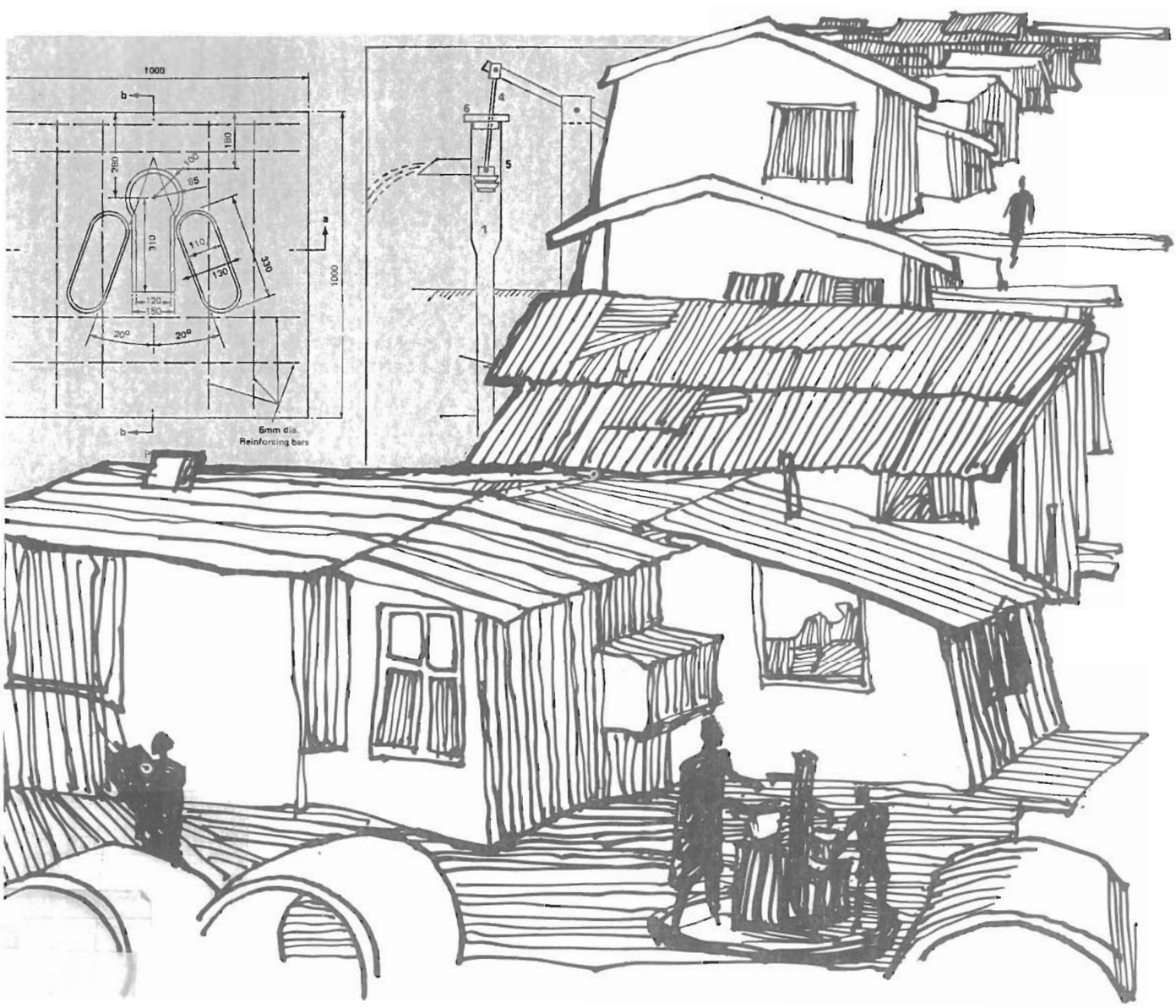

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A Contribution to the International Drinking Water Supply and Sanitation Decade

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benefits of conventional sewerage are attainable with other sanitation technologies that are not only less expensive but also do not require such large volumes of water for their proper operation.

3. Ventilated Improved Pit Latrines

The two principal disadvantages of simple (unimproved) pit latrines--namely that they smell and have serious fly nuisance--are reduced in the type of pit latrine known as ventilated improved pit (VIP) latrines. The single pit version, shown schematically in Figure III-1, was developed in principle in Zimbabwe in the 1970s[8], although its key component--the external vent pipe--has been used in somewhat similar latrines in South Africa since the early 1940s. The vent pipe eliminates odors completely since the air inside it heats up under the influence of solar radiation. For this reason the vent pipe should be painted black and located wherever possible on the sunny side of the superstructure. The warm air inside the vent pipe thus rises and escapes to the atmosphere so creating a downdraught of air through the squatting plate to replenish the air exhausted up the vent pipe. This circulation of air effectively exhausts odors emanating from the fecal material in the pit.

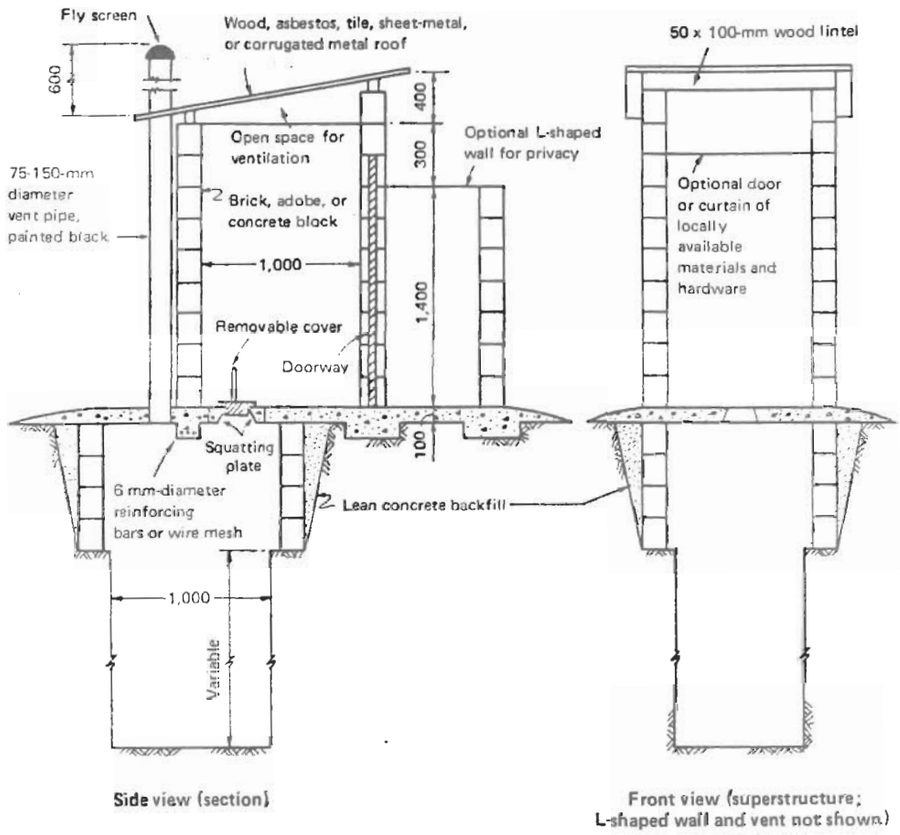
The vent pipe also has an important role to play in fly control; few flies will enter the pit as they will be attracted to the top of the vent pipe by the odors coming therefrom; if the vent pipe has a fly screen, they will not be able to fly down it and so enter the pit. Nonetheless a few flies may be expected to enter the pit via the squatting plate and lay their eggs. When new adult flies emerge they instinctively fly towards the light; however the only light they can see is that at the top of the vent pipe. The new flies will not however be able to pass the fly screen, and they will eventually fall down and die in the pit. Controlled experiments in Zimbabwe[9] showed that during a 78-day period 13953 flies were caught from an unvented pit latrine, but that only 146 were caught from a vented (but otherwise identical) pit latrine.

Although the single pit VIP latrine can be designed with a long life (up to 10 or more years) and to permit it to be desludged so that it can be a permanent structure, it is often more convenient and possibly less expensive to install a twin pit VIP latrine of the type shown in Figure III-2. In this version one pit is used for a given period (at least 12 months) until it is full, when the second pit is put into use; when that is full, the first is emptied and used again. Thus the excreta are never handled until they are at least 12 months old, when only a few Ascaris ova at most will be viable. Unlike a double vault composting toilet, no organic or inorganic materials are added to the pits, which both act as normal leaching

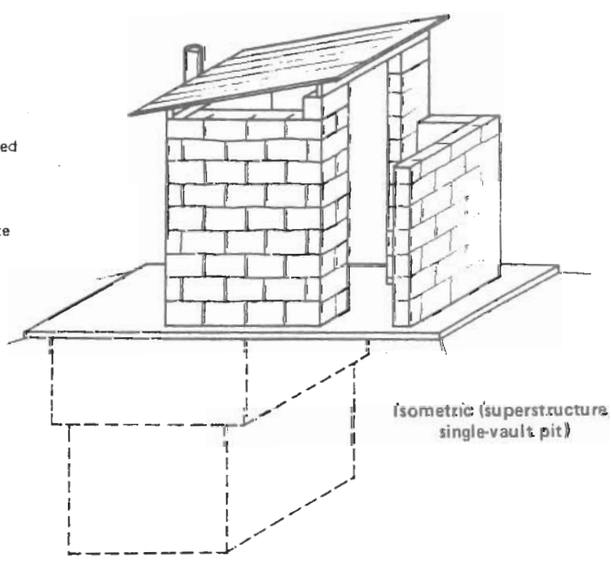
8. Morgan, P. R., "The pit latrine--revived," Central African Journal of Medicine 23, 1-4 (1977).

9. Ibid.

Figure III–1. Ventilated Improved Pit Latrine (measurements in millimeters) (millimeters)

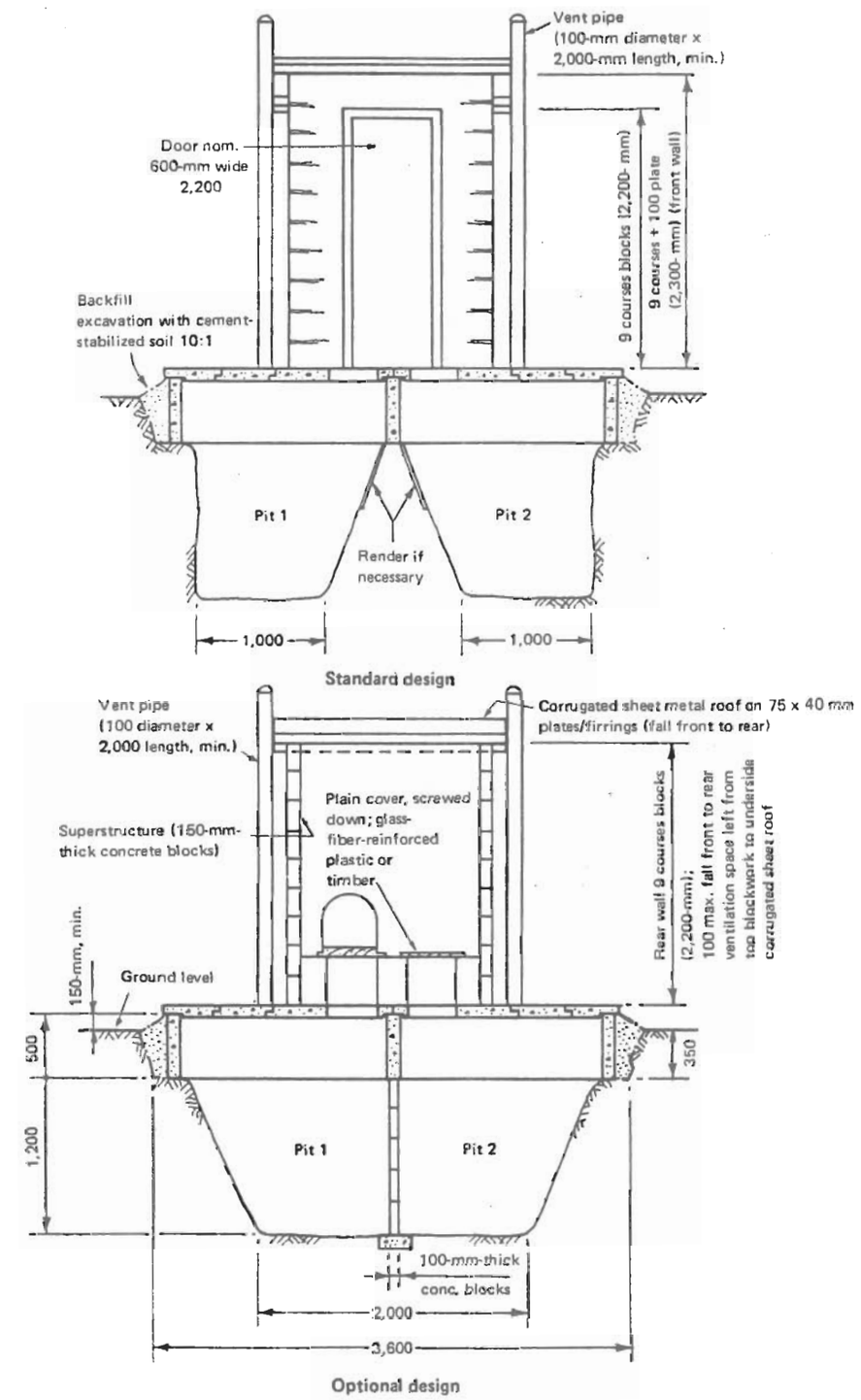


Note: Side view. Pedestal seat or bench may be substituted for squatting plate. An opening for desludging may be provided next to vent. Dimensions of the bricks or concrete blocks may vary according to local practice. Wooden beams, flooring, and siding may be substituted for concrete block walls and substructure.



Isometric (superstructure; single-vault pit)

Figure III–2. Ventilated Improved Double-pit Latrine (millimeters)



Source: Adapted from R. Carroll (1979).

pits. Unvented twin pit latrines are in fact traditional in some parts of the world, for example in the state of Santa Catarina in Brazil; the addition of a vent pipe to each pit is relatively inexpensive and reduces fly and odor nuisance.

The use of twin pit VIP latrines in urban areas presupposes of course the existence of a pit emptying program. Pit emptying may be done by the householder if he is able to use the humus-like material on his plot if he does not consider this operation to be socially unacceptable. Pit emptying may alternatively be a municipal function, which in practice may well have administrative difficulties, or it may be a private-sector function, for example collection by local farmers or by a private concern which sells the material to local farmers or otherwise disposes of it.

4. Pour-Flush Toilets

Pour-flush toilets (Figure III-3) are very common in the Indian subcontinent and the Far East. They have three main advantages: low water requirements (1-3 liters per flush as opposed to 9-20 liters per flush for most cistern-flush toilets); complete odor elimination by the shallow water seal; and they can be located, if desired, inside the house, and not necessarily only on the ground floor. They are particularly suited wherever water is used for anal cleansing. Since flushing is done manually, they do not require a multiple tap in-house level of water supply; they are thus best used in conjunction with a yard tap level of water supply, although they can be used in conjunction with public standpipes if the standpipe density is such that the users can and will carry enough water home for their operation. As in the case of VIP latrines, probably the better long-term solution is to have twin pit pour-flush toilets, although this depends on the ease with which the pits can be desludged, whether desludging is to be done manually or mechanically and whether in high density areas there is sufficient room for twin pits. If desludging is to be done by hand, then to protect the health of the person carrying out this operation and to avoid the need for sludge treatment, twin pits each with a life of at least 12 months are preferable.

If the soil conditions are not suitable for on-site disposal, a pour-flush toilet is still feasible, but in this case it should discharge into a small two-compartment septick tank (Figure III-4); to reduce costs the septic tank may be shared by two or more adjacent houses. The first compartment receives only the pour-flush wastewater; after settlement, this passes into the second compartment which also receives directly all the sullage. This strategy ensures that the septic tank effluent contains fewer excreted pathogens and fewer fecal solids. The effluent may then be discharged into a small bore sewer or a covered stormwater drain. The small bore sewer is the preferred solution, although as an initial improvement it is often more cost effective to discharge the effluent into a stormwater drain. Simple treatment, such as an anaerobic upflow filter, may permit discharge of the effluent to stormwater drains on a permanent basis. The small bore (100- to 200-mm diameter) sewers need only be laid at nominal