RAJIV GANDHI NATIONAL DRINKING WATER MISSION
MINISTRY OF RURAL AREAS & EMPLOYMENT
GOVERNMENT OF INDIA

REPORT OF THE NATIONAL EXPERT COMMITTEE

ON

TECHNOLOGICAL OPTIONS FOR IMPLEMENTATION OF RURAL SANITATION PROGRAMME IN INDIA

SANITATION

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RAJIV GANDHI NATIONAL DRINKING WATER MISSION
MINISTRY OF RURAL AREAS & EMPLOYMENT
GOVERNMENT OF INDIA

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24th December 1996

FOREWORD

Rural Sanitation Programme in India has been receiving consistent attention ever since the formulation of the Centrally Sponsored Rural Sanitation Programme (CRSP) in 1986 and subsequent inclusion of Rural Sanitation in the Minimum Needs programme (MNP) in 1987. In many states the programme has already found a place in their political agenda. Besides the efforts made by the government, private initiative - particularly amongst the user groups, has been catching up remarkably. The Rajiv Gandhi National Drinking Water Mission (RGNDWM) of the Ministry of Rural Areas and Employment has recently initiated a massive Information, Education & Communication (IEC) strategy with a view to sustain this trend through awareness generation aiming at enhanced community involvement in the programme. Adoption of sanitary practices largely being dependent on the socio-cultural and economic criteria, it is appropriate to provide a freedom on the selection of technology by the interested families which suit them the best instead of adopting any particular design during the course of programme implementation.

The GOI with a view to document useful information on relevant technologies pertaining to sanitation, had constituted a National Expert Committee on Technological Options as to be adopted under Rural Sanitation Programme. This documentation thus prepared in the form of a report of the committee, aims at providing sound technological guidelines among the implementing agencies and users who could mutually benefit from the programme delivery through selection of appropriate technology. The report includes Evolution of the Concepts and Technologies pertaining to sanitation, State-of-the-Art of Existing Technologies, Operation and Maintenance, Human Resources Needs, Training, Research & Development as well as Appendices containing technical drawings of few options and corresponding quantity estimates.

I would like to extend my sincere thanks to the members of the Expert Committee with a particular reference to the Drafting Sub-Committee who have provided significant contribution and consistent follow up for finalizing this report. Let me also take this opportunity to extend my thanks to Mr P K Sivanandan, the erstwhile Chairman of the National Expert Committee and Jt Secretary and Mission Director (RGNDWM) for initiating the report preparation. I hope the State level nodal agencies/NGOs will make rationale use of information as contained in the report. However, comments on this report and information on further appropriate technologies are always welcome as these will enable us to update the report in due course.

[PALAT MOHANDAS]

PREFACE

As a follow-up to the Report of the Expert Committee on Sanitation, the Ministry of Rural Areas and Employment, Government of India constituted a National Expert Committee on Technical Options for implementation of the Centrally sponsored Rural Sanitation Programme with a view to providing suitable technical guidelines for the programme.

The Terms of Reference of the committee was as follows:-

- To suggest suitable technical options for implementation of Rural Sanitation Programme taking into account the existing model being used by various states, other guidelines on low cost sanitation brought out earlier by various organizations/ departments like UNDP/ Ministry of Urban Affairs and Employment and other materials on the subject

- To suggest technical options for other construction components for implementation of Rural Sanitation Programme.

- To critically review the programmes in the technical aspects of implementation and suggest measures for improvement.

- To formulate suitable cost reduction parameters for different components for the implementation of the programme.

- To suggest modalities for Human Resource Development and training, and to identify the Research and Development needs.

- Any other matter which is considered useful in achieving the objectives of the Expert Committee and in coordination and effective implementation of the sanitation programme with regard to the technical aspect.

The Committee met twice in Delhi in the Office of the Rajiv Gandhi National Drinking Water Mission at CGO complex, Lodhi Road, New Delhi, and once in the Structural Engineering Research Centre (SERC) complex at Ghaziabad to work out the frame of the report preparation. The Committee also formed a Sub-committee to work intensively on compilation of information and drafting of the reports. The composition of the National Expert Committee and the Drafting Sub-committee are given in the attachment (a) & (b) respectively.

The report of the Sub-committee was discussed at length with members of the National Expert Committee and their comments have been incorporated in the report as presented in the subsequent sections.

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LIST OF ACRONYMS

AIIH&PH	:	All India Institute of Hygiene and Public Health
BDO	:	Block Development Officer
CRSP	:	Centrally sponsored Rural Sanitation Programme
DWCRA	:	Development of Women and Children in Rural Areas
FC	:	Ferro Cement
FRP	:	Fibre-glass Re-inforced Plastic
GOI	:	Government of India
IAY	:	Indira Awas Yojna
ICDS	:	Integrated Child Development Services
IEC	:	Information Education and Communication
ITN	:	International Training Network
MNP	:	Minimum Needs Programme
NGO	:	Non Governmental Organization
NSS	:	National Sample Survey
NREP	:	National Rural Employment Programme
RCC	:	Re-inforced Cement Concrete
RGNDWM	:	Rajiv Gandhi National Drinking Water Mission
RLEGP	:	Rural Landless Employment Guarantee Programme
RKMLP	:	Ramakrishna Mission Lokosiksha Parishad
R&D	:	Research and Development
SERC	:	Structural Engineering Research Centre
VIP	:	Ventilated Improved Pit
WC	:	Water Closet
WHO	:	World Health Organization

EVOLUTION OF CONCEPTS AND TECHNOLOGIES PERTAINING TO SANITATION : A HISTORICAL PERSPECTIVE

Introduction

Sanitation is receiving increasing attention of the development planners with the rapid change in human and natural habitat. Primarily the sanitation services cannot be provided in isolation without addressing the issues related to provision of safe water, and hence, they together occupy a key position in the development process. They largely influence the economy and socio cultural dynamics of a community and thus, attribute to the long term benefits. However, the medium term benefit is associated with health which is also a matter of great concern specially in the developing countries According to World Health Organization (WHO) estimates, eighty percent of all the illnesses in the developing countries are associated with safe water and sanitation which could have been effectively prevented. These diseases follow the faecal-oral route of transmission (**Annexure - I : Disease Transmission**) By adopting sanitation, (the cleanliness practices that affect health) this transmission route is broken. The excreta of a sick person or of a disease carrier contains causative agents or germs (pathogens) which occupy the central position in the disease transmission cycle. Excreta disposal is, therefore, the main focus of sanitation related activities. The benefit of sanitation, is well conceived if the other relevant practices are adopted as a "way of life".

In the rural sector, considerable coverage has been achieved in water supply (more than ninety percent) though its benefits are still not visible in terms of the reduction in the incidence of water related diseases. This is, most probably, due to an inadequate coverage in rural sanitation (about nineteen percent) Inadequate felt need at the community level possibly played a major role for rhe rural sanitation to become a very late starter compared to the rural water supply. It was only in the fiscal year 1985-86 when rural sanitation came under the purview of the then Ministry of Rural Development, and the Centrally Sponsored Rural Sanitation Programme (CRSP) was launched. Thus the present estimated rural sanitation coverage of nearly nineteen percent is the outcome of the joint effort of the Government of India, the State Governments, local activists and the responsive families who participated in the programme during last ten

years. For the promotion of rural sanitation a number of initiatives were taken up to start with. The propagation of the trench and pit latrines in the rural areas (known as Bardoli) and the Wardha Latrines are examples of such early initiatives. The experiences of these initiatives provided direction for shaping the Rural Sanitation programme over a period of time. The recent experiences of Medinipur, Allahabad, Alwar, Gujarat, Periyar and others suggest that more emphasis should be given to the flexibility in technology choice as also to the development of alternate delivery systems.

Historical Development

Sanitation as is known today in its primitive form, had its origin in England in the eighteenth century when the water closet in a very elementary form was introduced with toilets This type of a toilet got quick acceptance though the sanitation condition did not improve much, because a scientific excreta disposal system was absent at that time. It was a common practice to let excreta and waste water (liquid waste) into cesspools which were the virulent sources of infection. As a result, the foul gases were conveyed directly to the household from the cesspool which was usually built at the basement. In order to prevent such bad odour, traps containing a water seal, was developed at the end of the eighteenth century. This development brought forward a revolution in home sanitation and began to be used increasingly However, a large number of households continued to be connected to cesspools and not to sewers because till then hydraulically efficient sewers were not developed. Moreover, the manual collection of night soil continued even in England till the early nineteenth century.

Tremendous development had taken place on the sewage transportation during the latter half of the 19th century. More stress was given on sewers for carrying the sewage to a safe disposal site. Since no treatment process was developed at that time, the water bodies generally became the victims of such untreated sewage disposal. However, around the same time, the land disposal of sewage was initiated in Greece and Germany and the primary treatment of sewage in the USA. It was during the end of nineteenth century when the conventional off-site sewage treatment system was developed and again received fast acceptance. The first on-site disposal system, the septic tank, was developed during the latter half of the nineteenth century in France and was introduced in the United States and UK for the areas where the off-site conventional systems were not available.

Initiatives in India

India inherited the sanitation activities from the colonial period and thus, adopted the sewer based conventional systems for city dwellers. Due to its high cost on capital investment, operation and maintenance, even in the Indian cities, the sanitation coverage could not match the population growth. Rural areas remained virgin from sanitation intervention due to limited technology options, inadequacy of service delivery mechanism and due to low priority as rural development was never a matter of concern during the British rule. It was Mahatma Gandhi whose development paradigm was rural based and brought the rural problems in the forefront through his convincing leadership during the liberation movement.

Village Sanitation

Divorce between intelligence and labour has resulted in criminal negligence of the villages. And so, instead of having graceful hamlets dotting the land, we have dung heaps. The approach to many villages is not a refreshing experience. Often one would like to shut one's eyes and stuff one's nose; such is the surrounding dirt and offending smell. If the majority of the Congressmen were derived from villages, as they should be, they should be able to make our villages models of cleanliness in every sense of the word. But they have never considered it their duty to identify themselves with the villagers and their daily lives. A sense of national or social sanitation is not a virtue among us. We may take a kind of a bath, but we do not mind dirtying the well or the tank or the river by whose side or in which we perform ablutions. I regard this defect as a great vice which is responsible for the disgraceful state of our villages and the sacred banks of the sacred rivers and for the diseases that spring from insanitation.

M.K. Gandhi

Thus, after independence (1947) the Indian leadership redressed the rural development process when rural sanitation started receiving attention. As a spread effect of urban sanitation, toilets with septic tanks were constructed at limited public and private rural locations. They did not match the rural economy and thus did not get wider replication. A need was felt at that time to develop a suitable sanitation technology for Indian rural conditions. The work initiated by the All India Institute of Hygiene and Public Health (AIIH&PH) in 1940s to improve borehole latrines in rural areas (SINGUR 1940) was intensified after independence and by the year 1954 the institute developed the dug well latrine, a modification of borewell. It has a single leaching pit and is flushed with the same water used for anal cleaning.

Even after independence, it took considerable time, to take a programmatic thrust to rural sanitation. In 1954, the Rural Sanitation Programme was introduced as a part of the Health Sector of the Government of India with the objectives of i) Improved Health and ii) Elimination of Scavenging. The simple and locally produced sanitary components like squatting-slab, pan and trap were being distributed mostly free of cost through Community Development Blocks among the rural community under the programme. The Scavengers Rehabilitation Programme discarded all such latrines that required handling of fresh excreta. This strategy provided direction for development of alternate design options. The Planning Research Action Institute (PRAI), Lucknow, in the late 1950s introduced the two-pit design and propagated the concept of using alternate pits by which manual handling of raw human excreta could be avoided. The design of the pits allowed at least two years of time to fill up the first pit after which the excreta was to be diverted to the second pit. During the next two years when the second pit was also supposed to be filled up, the content of the first pit would have already turned into harmless humus and be easily cleaned manually and put to use and so on. The harmless humus of the pit content (as was in the case of first pit mentioned above) could be used as a soil conditioner, a potential supplement to the agriculture sector benefit. In 1954, Water Supply and Sanitation were brought under the purview of the Central Public Health and Engineering Organization (CPHEO) of the Ministry of Works and Housing, Government of India. During this stage Low Cost Sanitation was introduced as the on-site sanitation system in rural areas.

In accordance with the UN Water Conference held in Mar Del Plata (1977), which recommended the decade 1981-90 as the International Safe Drinking Water and Sanitation

Decade, India endorsed the sectoral importance and reflected in the National Plans and Programmes for water supply and sanitation. Community participation, building up of public opinion and promotion of technically sound (socially acceptable and affordable) sanitary facilities were the important strategies adopted in the programme. At the beginning of the decade (1981-1990) a target was proposed to achieve hundred percent coverage in safe water and twenty-five percent coverage in rural sanitation by the end of the Seventh Five Year Plan (1985-90). However, during mid-decade review, it was realized to have a realistic target and hence scaled down the coverage target as eighty five percent for the rural water supply and five percent for the rural sanitation.

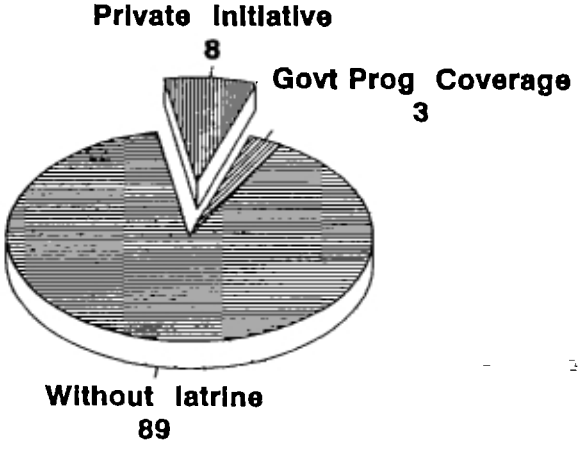
During the Seventh Five year Plan (January 1986), the construction of the sanitary latrine was taken up in rural health sub-centres, schools, anganwadis, and in rural households under the Rural Landless Employment Guarantee Programme (RLGEP), the National Rural Employment Programme (NREP) and the Indira Awas Yojna (IAY). As an integral component, the schemes had initiated the people's participation for use and maintenance through health education. Voluntary organizations, local opinion leaders, Integrated Child Development Scheme Workers, Primary Health Workers and similar agencies were involved in health education using mass media, films and other communication channels. The Central Rural Sanitation Programme (CRSP) was launched in October 1986, with resource sharing between the Central and State Governments. In November 1986, rural sanitation was also included under the twenty point programme. From 1987-88 rural sanitation was included under the Minimum Needs Programme (MNP) and in the other State Development Plans. Several innovative strategies on sanitation were taken up during the Seventh Plan. Initiatives of Rama Krishna Mission for sanitation promotion on a self help basis, the package approach to sanitation in Alwar, the Nirmala Gram Yojna in Mysore, Clean Village approach in Periyar, NGO networking for sanitation promotion coordinated through the Environmental Sanitation Institute Ahmedabad, are some of them. Based on the experience of the Seventh Plan, the CRSP was revised in 1993 incorporating flexibility in design option; alternate delivery system and graded subsidy.

(Some of the significant sanitation land marks can be seen in **Annexure II)**

Need for a guideline on sanitation technology options :

The spread special effect of the Government's subsidized sanitation programme was noticed only in 1990 when the National Sample Survey (NSS) published its report of the forty-fourth round (carried out in 1989). It shows a total rural sanitation coverage of eleven percent while the government programmes contributed to only three percent coverage This eight percent difference is, therefore, attributed to households going for latrines on their own, without any government subsidy. Of course unlike the government scheme through which only two-pit latrines were constructed, these households (eight percent) went in for various types to what they had the access with respect to know how, construction material and cost.

RURAL SANITATION COVERAGE
(In Percent)



Ref : NSS Survey 44th Round Published In Sep 1990

Vast divergence in India suggests that technology, as to be adopted for sanitation promotion should cater not only to the socio-economy and geohydrology, but also to the availability of construction material, skill and delivery mechanism This has been reconfirmed from the Medinipur initiative of RKMLP where twelve different models were promoted (cost range Rs. 270 to more than Rs.3000) without providing any subsidy (Annexure - III) The revised CRSP guidelines (1993) although recognizes the adoption of appropriate design to suit the local conditions, most of the states continued to construct only one design, the two-pit latrine. Most

probably, this was due to the inadequacy of readily available documentation on the technology range for sanitation systems from where one can choose. The Expert Committee on Rural Sanitation Programme, constituted by the then Ministry of Rural Development and Government of India in March 1994, strongly recommended to develop a guideline on technology choice as contains in their report of October 1994. Guidelines thus developed will provide an ample opportunity to : i) the interested families to choose their own units what they can afford now with the provision of upgrading (Sanitation Upgrading: **Annexure - IV**) when the situation improves and ii) the implementing agencies to identify the appropriate design for the subsidized programme, keeping in view the consistency with the living environment of the beneficiary families (again in accordance with upgrading over time).

STATE-OF-THE-ART OF EXISTING TECHNOLOGIES

Technological options for excreta disposal :

Several selected design options for the excreta disposal systems are discussed in this chapter covering the use and maintenance, skill requirement, availability of construction material, suitability for various geohydrological condition and possible upgradation These designs are either being used in India or have potential for adoption. Other on-site sanitation systems although being used elsewhere successfully have been, however, excluded from this chapter due to their non suitability under the Indian context in broader sense.

i) Indiscriminate vs discriminate defecation

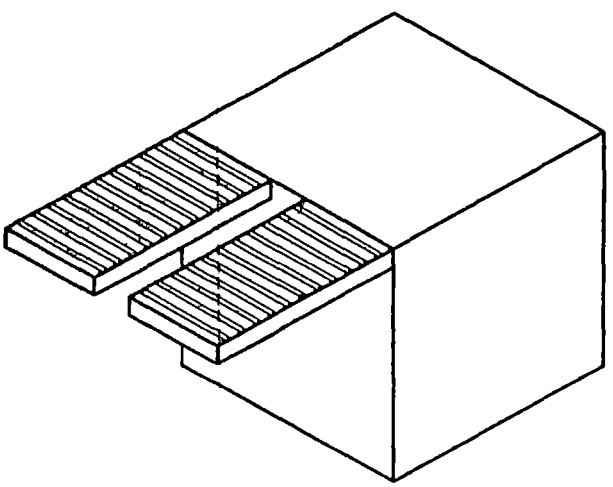
While indiscriminate defecation is the root cause of major public health nuisance, sometimes suggestion is made to adopt discriminate defecation as an alternative method in line with upgradation approach. It stipulates defecation at a place away from the community, in rubbish and manure heaps, in the bush and similar remote places. Open defecation, however, encourages fly breeding that helps spread excreta related diseases. In moist ground, the larvae of intestinal worms develop and there are chances of faeces and larvae to be carried by human, animal and rodent. Surface runoff from places where the people have defecated results in surface water pollution. In view of the suspected health hazards and the degradation of the environment, open defecation is generally and strongly discouraged as this contradicts the whole idea of safe disposal by which excreta should be confined in such a way that the cycle of reinfection from excreta-related diseases could be broken.

ii) Pit Latrine

A pit latrine essentially has a pit for accumulation and decomposition of excreta from which liquid infiltrates into the surrounding soil. Based on the construction type, the pit latrines can be classified into three major categories :

a) **Shallow pit latrine**

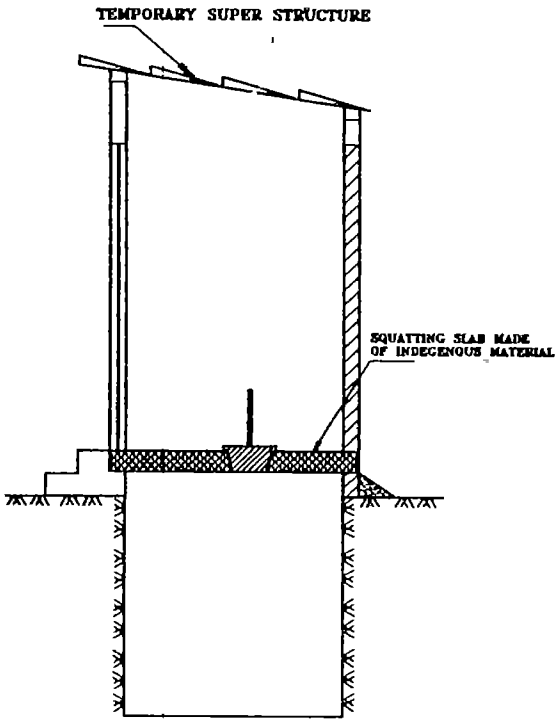
Under this option, a small hole is dug using a trowel (khurpi). After each defecation the excreta is covered with soil. This is sometimes known as the "cat" method. Bigger pits of about 300 mm deep may also be constructed which will last for several weeks. Excavated soil is heaped beside the pit from which some of it is put over the faeces after defecation. Large bacterial population in the topsoil helps decomposition in the shallow pits. Once the pit is filled up another pit may be dug in the vicinity thus providing continuity for excreta disposal without any substantial investment. Nevertheless, flies breed in numbers and hookworm larvae can spread around the holes.



b) **Simple pit latrine**

The simple pit latrine is one of the oldest type of latrine. It has a squatting slab placed over a pit. Circular pits have more stability than the square or rectangular ones. Diameter of such pit should be more than 700 mm which will facilitate workability for excavation but should not be more than 1000 mm in which case the risk of side collapsing and the cost of platform increase substantially. The depth may be limited to 1 m to safeguard against ground water pollution. The earthen mound will facilitate raising the platform level and hence protect the runoff

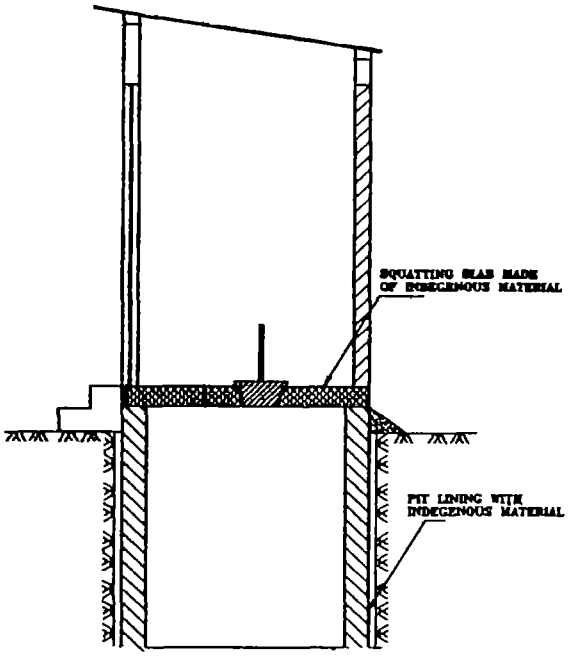
from going inside the pit. A simple squatting platform with a squatting hole may be made using local materials like bamboo, wooden logs etc. A squat-hole cover made of locally available material could be used for covering the pit content after each use of the latrine.



c) Latrine with lined pit

In places where the soil is very loose, a pit latrine is constructed with a lined pit. Twigs, split bamboo matting, an old drum, brick work, stone masonry and similar construction may be adopted for pit lining. All other components should remain the same as in the case of simple pit latrine (unlined pit).

The superstructure of a pit latrine should be as simple as possible because of required frequent shifting of the latrine from one place to another (when the pit is filled up) By and large, technically a pit latrine can be constructed all over India except in high water table (within 2 m form surface)/ water logged conditions and in hard rock formation (where digging of a pit needs special attention). Otherwise, this is highly labour intensive and can be constructed virtually with no



cash expenditure. To start with, specially during the habit formation stage, adoption of a pit latrine is a wonderful option possessing a high degree of upgrading over time.

3. Waste recycling :

This type of excreta disposal system comes one step above the pit latrine in the vertical scale of sanitation upgrading. Many design options come under this category though in view of the scope of CRSP, discussions have been limited to the following two types:

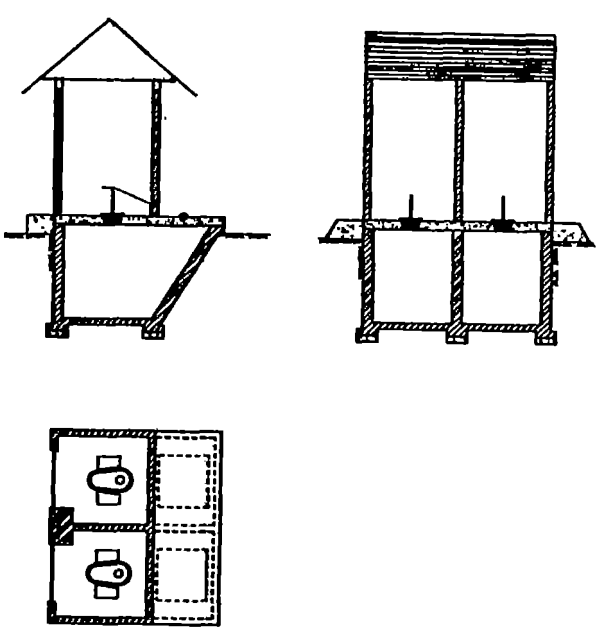
a) Bucket latrine

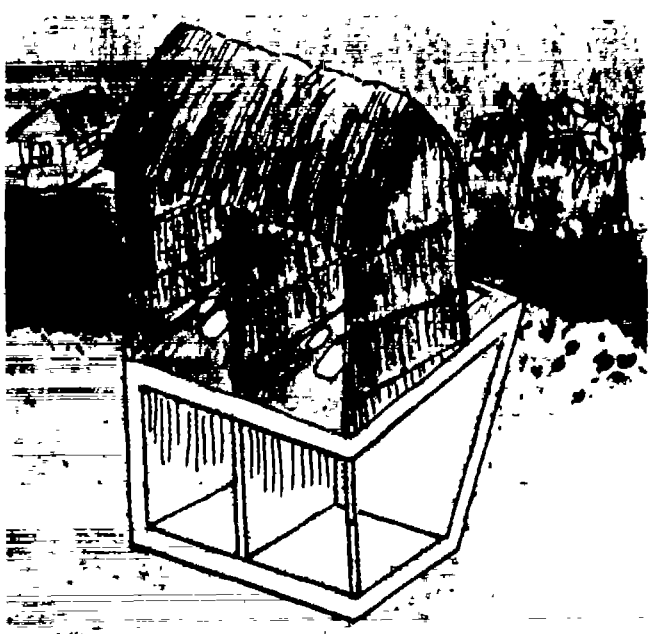
A bucket latrine (also called service latrine) has a bucket or any other container for the retention of excreta (and sometimes separate containers for urine collection and for storage of anal cleaning material). Excreta thus collected is periodically removed by scavengers for treatment or use in the agricultural field. The scavengers are supposed to collect excreta during

late night (thus excreta got the name night soil, historically) when there is less vehicular and human traffic. Theoretically, by adopting appropriate precautions the high health risk of a bucket latrine can be overcome, though in practice it is hardly done. Moreover, in India eradication of scavenging is one of the Government's high priority social upliftment programme and hence discarded for adoption under Rural Sanitation Programme.

b) Composting latrine

In a composting latrine, excreta is converted into a reasonably safe compost for use in the agricultural field. Excreta in this type of latrine is collected in a watertight tank to which ash or vegetable matter is added. Under controlled moisture content, the mixture decomposes to form a good soil conditioner in about four months time. Pathogens are killed in the dry alkaline compost which is safe for application in the agricultural field. Compost latrine could be of two types i) Continuous Composting and ii) Batch Composting. While in the former type, only one chamber is constructed, in the latter type, two chambers are constructed next to each other which are for alternate use. A gas vent is provided to reduce the smell in the squatting chamber.

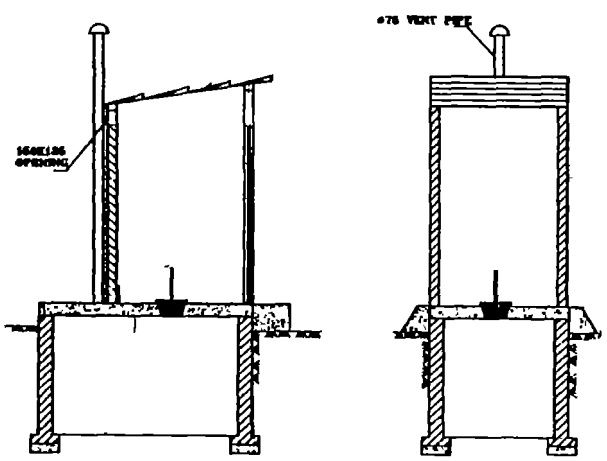


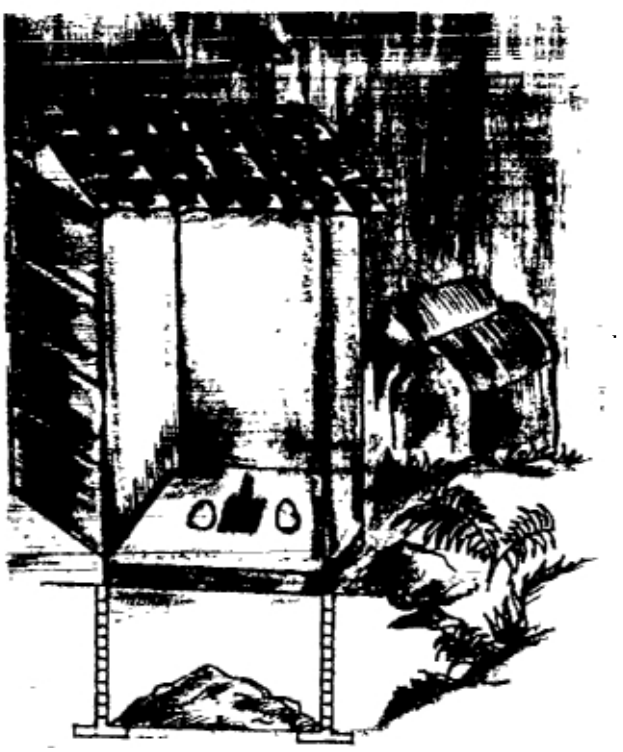


The composting latrine is suitable for the community which does not use water for anal cleaning. Some superstructure with roof is required to prevent rain water coming into the composting chamber. If urine is not collected separately and vegetable matter and ash is not added regularly, the compost latrine may start malfunctioning. Besides, maintaining specified time interval between compost emptying is often very difficult and, therefore, possesses a tremendous health risk.

4. Ventilated improved pit (VIP) latrine:

A ventilated improved pit (VIP) or ventilated pit is an improvement over a lined pit latrine. A pipe is provided in a VIP latrine extending above the latrine roof, with a fly-proof netting across the top. The difference of air pressure between the squatting hole and the vent top maintains a continuous air flow and hence the odour nuisance is reduced. The inside of the superstructure is kept dark which discourages the entrance of flies. Moreover, the fly netting at the vent top keeps the flies (if there are any) arrested within the pit and thus reduce to fly nuisance. If two pits are constructed for alternate use, a VIP latrine can be used for a fairly long time for safe excreta disposal and ranks much higher in the vertical upgrading ladder.

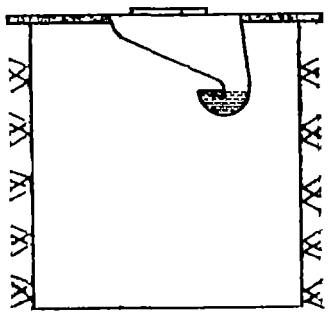




The VIP latrine is suitable for water scarce area where people do not use water for anal cleaning purpose and ground water table is more than 2 m below the pit bottom. The use of water for anal cleaning will create pooling and hence a mosquito nuisance. In India, the VIP latrine has good potential specially in the arid regions where water supply is scarce and people use soft materials for anal cleaning instead of water.

5. Waterseal latrine:

It is characterized by the waterseal in its squatting bowl or pan. Some water always remains at the bottom of the pan after it has been used. Waterseal serves as a barrier between excreta and outside environment and thus prevents bad odour coming from and the insects reaching the excreta. The conventional waterseal latrine is constructed by connecting a cistern to a commode or Asian Pan (bottom slope 15^0 - 20^0 and an S-trap with 50 mm water seal). About 12 - 20 litres of water is required to flush these latrines. Availability of so much of water just for flushing is often not possible, specially in the rural areas of developing countries.



As an improvement to this, the pour-flush waterseal latrine has been developed. A pour-flush latrine has a steeper pan with the bottom slope 25^0-30^0, a 'p' trap with a waterseal of 20-30mm. As a result of these improvements the excreta in the pan is flushed out by pouring small quantity (2-3 litres) of water. Thus, the name Pour-Flush Waterseal Latrine.

In accordance with Sanitation Upgrading approach a pour flush water seal latrine may be any of the following three types:

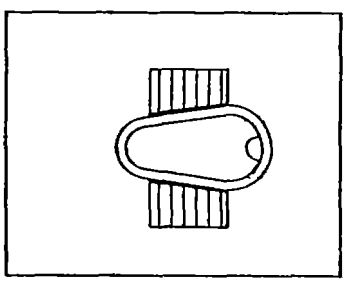
a) Direct pit water seal latrine

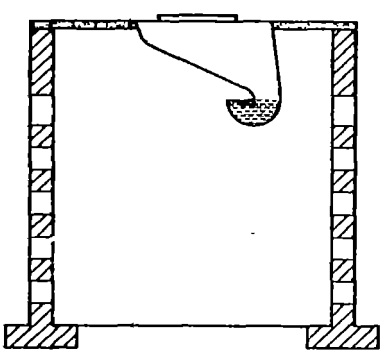
b) Waterseal latrine with single offset pit

c) Two pit waterseal latrine.

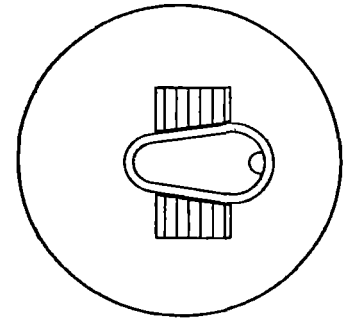
a) Direct Pit Waterseal Latrine

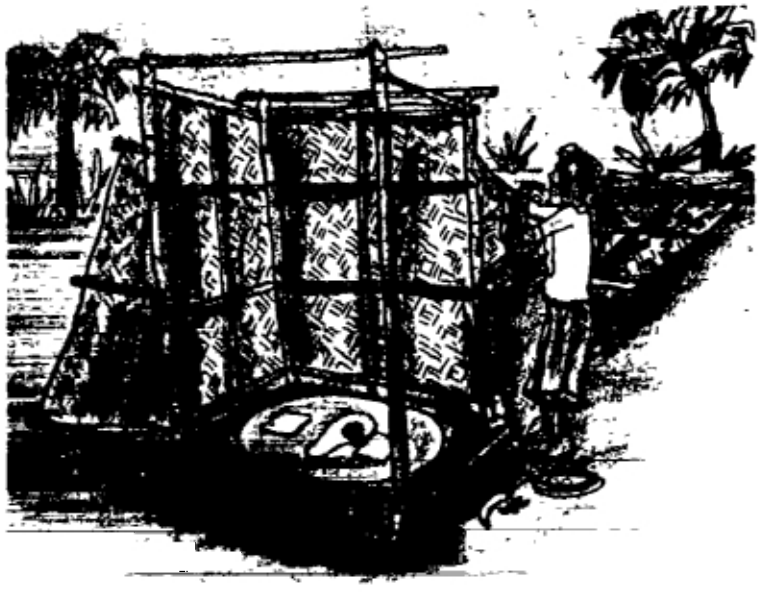
This unit consists of a squatting slab monolithically cast with a steep cement pan. The pan of a direct pit latrine has an in-built water seal. The slab can be of either a circular or a rectangular shape. The reinforced cement concrete (RCC) and the ferro-cement (FC) constructions are common for slab construction. A pit is dug in the ground and the squatting slab is placed over it.Normally no pit lining is required in the case of hard and compact soil. However, in the case of loose soil, the pit is to be lined in order to prevent side collapsing. The size of the pit should be such that it takes two years to get filled up. A temporary superstructure is built for privacy and protection.





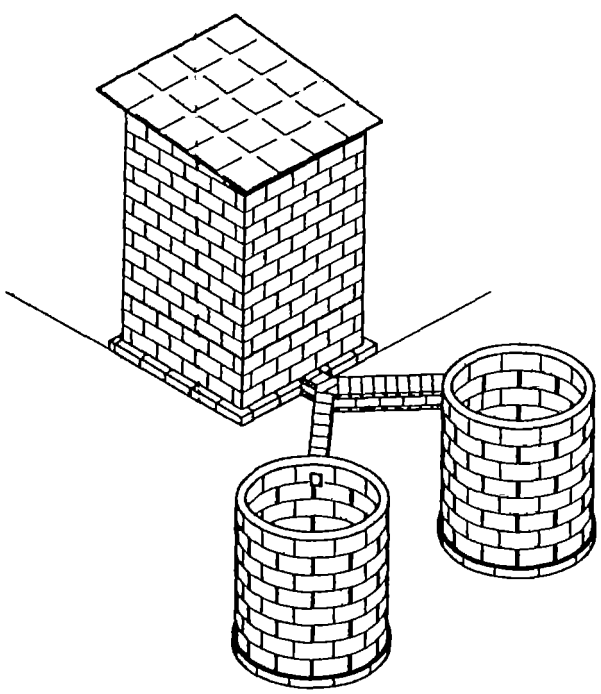
After defecation, 2-3 litres of water is poured to flush the excreta out of the pan. The excreta accumulates in the pit where decomposition takes place. The gas formed during decomposition escapes through the joints/openings of the pit lining and is absorbed by the surrounding soil The effluent is leached out and absorbed by the soil while the solid part (sludge) accumulates in the pit. Thus, on prolonged use a pit gets filled up. When this happens, a second pit is constructed and the squatting slab and superstructure are shifted over it. The filled up pit is covered with a thick layer of soil and allowed to be stabilized for about two years. During this time the contents of the filled pit will have become organic humus and safe for handling. When the second pit also gets filled up, after two years or so, the first pit is cleaned, the squatting slab and superstructure shifted back over it and thus a continuous operation of a direct pit latrine is achieved. Since the superstructure has to be shifted repeatedly, only a temporary construction is recommended for this type of latrine.





b) Two-pit Water Seal Latrine*

The two-pit waterseal latrine is a complete excreta disposal system which on one hand fulfills all the sanitary requirements and on the other hand, provides continuous operation with minimal effort. The main components of a two-pit latrine are the waterseal pan/trap arrangement, squatting platform, junction chamber, two pits and the superstructure. The squatting platform is a raised pucca floor, constructed with appropriate foundation. The pan of the two pit latrine has a steep bottom slope which allows easy flushing of excreta. The outlet of the pan is connected with a P-



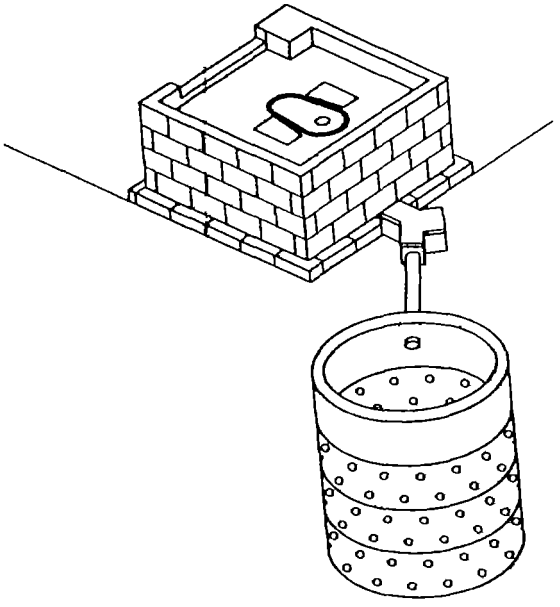
* Under the Sanitation Upgrading sequence this type of latrine comes after the next type which is " c) Waterseal latrine with Single Offset Pit". But for ease in understanding it has been described in advance.

trap. On flushing, some water always remains in the P-trap and forms a 'waterseal'. The water seal prevents the bad odour coming from and the insects reaching the excreta. The outlet of P-trap is connected with a junction chamber either by using a pipe or by constructing a covered brick drain. The junction chamber has one inlet (connected to the P-trap) and two outlets (connected to the leach pits) which are for alternate use. A temporary or permanent superstructure is constructed for privacy and protection.

For making a two-pit latrine operational, one of the outlets of the Y-junction in the junction chamber is blocked while the other outlet is kept open to the corresponding pit. After defecation, 2-3 litres of water is poured to flush the excreta out of the pan. The excreta accumulates in the first pit, where decomposition takes place. The gas formed during decomposition escapes through the joints/openings of the pit lining and is absorbed by the surrounding soil. The effluent is leached out and absorbed by the soil while the solid part (sludge) accumulates in the pit. The dimensions of the pit should be such that it takes at least two years to be filled up. Once this happens, the flow of excreta has to be diverted to the standby second pit. For doing this, one has to remove the cover of the junction chamber, open the outlet connected to the second pit, block the outlet connected to the first and filled up pit and replace the junction chamber cover. The contents of the filled pit will become organic humus and safe for manual cleaning in about two years. When the second pit also fills up, in the next two years, the first pit is cleaned manually and the same operation is repeated to divert the flow of excreta from the second pit to the first pit as was follwed initially. Thus the two-pit pour flush waterseal latrine provides a continuous operation.

c) Water seal latrine with single offset pit

The pour flush latrine with a single offset pit comprises of a waterseal pan, a squatting platform, a junction chamber and a superstructure similar to a two-pit waterseal latrine. However, it has a single offset pit instead of two pits as described in (b) above. The pit is constructed away from the squatting platform. A pipe is used to connect the squatting platform to the pit through a junction chamber. A temporary or permanent superstructure is constructed for privacy and protection.



A single offset pit latrine functions exactly in the same way as a two-pit latrine. Once the single offset pit fills up, another pit is dug at a safe distance away from the first pit (distance between the two pits should be at least same as the depth) and connected with the junction chamber with a pipe. The flow of excreta is diverted to the new pit by blocking the outlet at the junction chamber. The content of the filled up pit is left undisturbed for two years after which it will have become organic humus and safe for manual cleaning.

When the second pit also gets filled up, in the next two years, the first pit is cleaned manually and the outlet opened at the junction chamber to divert the flow of excreta from the second pit to the first pit exactly in a way similiar to the two-pit latrine. Thus a single offset pit latrine eventually turns into a two-pit one over a period of time.

6. Supplementary List of Excreta Disposal System:

The technological options so far discussed are few of the many which have the potential for rural application. Therefore, there is no reason to consider the technology options discussed

in this report as exclusive, rather they could be expanded, based on future development by including well documented other appropriate options, if there are any already in practice, in India or else where.

The Septic tanks and Bio-gas based excreta disposal systems are also in practice in rural India. They are costlier however, than the systems discussed previously Without getting into any controversy of their respective positions in the sanitation upgrading, it can be concluded that these systems will not come under the purview of CRSP from the cost point of view But, for the benefit of the families who are willing to construct these facilities, keeping in view all relevant factors like operation, maintenance and risk these two types of technologies are discussed separately in **Annexure - V & VI.**

Technology Selection :

The crucial part of sanitation promotion is Technology Selection. Instead of recommending any particular design it is always advantageous to have a dialogue with the community, that offers a range of options. This will provide them the opportunity to choose the one based on their taste and capacity. This will also make the community feel involved in the programme and provide better understanding on the preference to a set of options. Nevertheless, it is advisable to carefully prepare the gross list keeping in view the geohydrological conditions, availability of construction materials, availability of skilled manpower and after-construction services/advise, possible upgrading, ground water pollution aspect, health and environmental risks and cost factors. Comparison of various excreta disposal systems against these parameters have been given in **Table - I.** While the table provides gross comparison, it should not be used rigidly, since sanitation is dependant so much on local variations which are often not possible to document adequately. In such cases an overall judgement of the implementing functionaries should prevail.

The technologies so far discussed in this chapter, possess a reasonable degree of upgrading. For example, a family belonging to a low income group will find it difficult to spend any cash for their latrine to start with. In such a case the family can construct a simple pit latrine using indigenous materials like old wooden log, bamboo etc. By the time the pit is filled up due to prolonged use, the family will start appreciating the benefit of a latrine in terms of convenience and hygiene and most likely to go for a better one while constructing the new latrine. The next

better option as listed above is a lined pit latrine which they can construct in the vicinity. A lined pit latrine may also get filled up in another two years time, by when the family most likely will realise the necessity of a more durable latrine even at a higher cost. It is likely that if at that point of time the family had adequate information on other type of latrines it would adopt a better option, (say, direct pit watrseal or offset single pit latrine) even at a higer cost.

A single direct pit waterseal may be constructed keeping the vision of making a two pit waterseal following the sanitation upgrading sequence. For doing so, one has to foresee the location of the two pits, squatting platform, junction chamber etc. well in advance. Based on the affordability, if a family is not in a position to invest the entire cost, it can start with a direct pit latrine by constructing a pit in the location as would be required for a two pit latrine. A waterseal squatting plate if placed over that pit will fulfill all the criteria of a sanitary latrine which could safely serve the purpose for two years or more before it is filled up. When this happens, a new pit has to be constructed in the place where the second pit would have been located if a two-pit latrine had been constructed. This new pit again can be made into operational latrine by shifting the squatting platform from the first pit (filled up). If the second pit is also filled up in another two years time, the squatting platform and junction chamber of the two pit latrine can be constructed in the specified areas and both the pits could be connected as in the case of a two-pit latrine. This completes the sequence of upgradation to the highest order and can be seen that while the aspiration of construction of a two pit latrine was a dream for a family at the beginning due to insufficient funds, distribution of investment over a period of time (in this case more than four years) made that dream come true without much effort.

Specific geo-hydrology demands a specific consideration for technology selection. For example, waterseal latrines that possess excellent hygienic qualities (due to having waterseal) may run dry and become non-functional in an arid region where water itself is a scarce resource. Again, pit latrines will become non-functional in a high a water table, water-logged and flood prone areas and can pose tremendous health risks Moreover, groundwater pollution possibility is another dimension which has also to be looked into carefully for technology selection. Some of the precautions to be taken for water logged/high water table area and groundwater pollution are given in **Annexure VII.**

Superstructure:

In general, the construction of any unit under on-site sanitation systems have two components, the substructure (which remains under ground) and the superstructure (which remain above the ground). The substructure of a latrine contains the functional part and crucial for technical soundness and structural stability. Except for privacy and convenience, the superstructure hardly contributes to any other factor to which performance of a latrine is dependent. But the superstructure is the only part which is visible and hence, there is a tendency to go for an expensive superstructure from the aesthetic point of view A pucca superstructure may cost as much as fifty percent or more of the total cost while temporary, semi-pucca or kuchha superstructure may drastically cut down the total unit cost. Moreover, use of locally available materials will make it more labour intensive and further reduce the cost. While one cannot ignore the taste and choice of a family for a better superstructure, it should be looked into critically. so that a compromise is achieved in this regard. During the preparation of area specific guidelines, indication is to be given for a reasonable superstructure under the programme, with a provision of better ones for the interested families

Precautions Against Pollution:

Most of the technologies discussed in this booklet are based on leach pits. It is therefore necessary to look into the pollution aspect especially associated with contamination of groundwater from leaching pits. The effluent from a leach pit contains pathogens and chemicals that would contaminate the ground water and ultimately the surface water A depth of two meters of unsaturated sandy or loamy soil below a pit is likely to provide an effective barrier to the ground water from being polluted. Where the ground water is shallow, an artificial barrier of sand around the pit can be provided to avoid pollution. In this regard some specific cases with respect to ground water pollution are discussed below.

a) High Ground Water Condition

To deal with high ground water condition, it is advisable to raise the level of the pit. The excavation work should be carried out during dry season in areas of high ground water table. The lining of a pit in such a location is extended along ground level throughout the entire depth. The lining above the ground should be sealed by plastering both the sides

In case the infiltration area is provided below ground level, the raised portion of the pit should be surrounded by a mound of soil. The section of the lining above ground (excluding the top 50 cm) can be used for the infiltration provided the mound is made of permeable soil, well compacted with a stable side slope and is thick enough to prevent the filtrate percolating out of the sides. However, this is not recommended for clay soils as the filtrate is likely to seep out at the base of the mound rather than infilitrate in the ground.

b) **Water Logged Condition**

In water logged areas, the pits are raised above the flood water level It may not be necessary to raise the pits above the plinth level of the house, because when water rises above the plinth, the residents will have to, in any case, vacate the house. In such water logged areas, the earth should be filled and well compacted in layers all around the pits, up to the plinth level only.

General Precautions

The following precautions should be taken while siting a pit :

i) Drinking water should be taken from the ground water at a point where there is no chance of faecal pollution from the leach pits.

ii) In the homogenous clay soil the chance of ground water pollution is almost nil from a leach pit provided the bottom of the pit is more than 1.90 m above the ground water table.

iii) The distance between the water source and the latrine depends on the soil condition. The safe distance between a water source and a latrine in homogenous clay and black cotton soil should be at least 6.50 m.

iv) If the soil at the bottom of the pit is composed of clay or sand with effective size of 2 mm or less and the velocity of flow of ground water is upto 0.90 cm per day, the safe distance of 6.50 m holds good.

v) If the soil is coarser than 0.3 mm (effective size) and the sub-soil velocity is greater than 0 90 cm per day, an envelope of fine sand (30 - 60 cm thick) of effective size 0.2 mm should be placed around the latrine pit and at the bottom to protect the ground water pollution from the pits.

Use and Maintenance

a) Pit latrine (lined and unlined)

The squat hole cover has to be removed before using the latrine A latrine user has to take appropriate squatting position so that the excreta falls directly into the pit. Irrespective of anal cleaning practices ("washers" and "wipers"), anybody can use this type of latrine. But use of plentiful water will create pooling condition in the pit - leading to mosquito problem and early filling. However, for an average Indian family (six persons) it will take about a years time at least before it is filled up. Once filled up, the squatting plate is removed and the pit is covered with a thick layer of soil. A second pit is dug nearby: the squatting platform may either be shifted if the condition remains alright or a new squatting platform may be constructed for bringing the latrine under use again.

b) Ventilated Improved Pit Latrine

The excreta goes into the pit through the squat hole. The continuous flow of air removes the smell resulting from the decomposition of excreta. The gases that come out of the pit pass to the atmosphere from the top opening of the vent pipe. If a door is fitted, it should be kept shut at all times (except, when entering or leaving) to keep the inside of the latrine reasonably dark But there should be a gap, normally above the door, for air to enter. The area of this gap should be a at least three times the cross sectional area of the vent pipe The vent pipe should be provided with a proper screen for fly control. Proper attention should be paid for keeping the latrine clean. Pouring water down the vent pipe once a year must be carried out to remove spider webs.

c) Pour Flush Latrine

To use a waterseal latrine, it is mandatory to arrange the water required for anal cleaning and the flushing of the latrine. Before use, the pan has to be made wet by pouring some water. This will prevent the excreta from sticking on to it. After defecation, excreta should be flushed by pouring 1 to 2 litres of water.

The latrine pan has to cleaned once a day by using a broom and water. Use of phenyl/ bleaching powder should be avoided while cleaning the pan. Special care should be taken that stones, garbage, cloth pieces and other solid waste are not put into the pan which may cause blockage in the latrine. If the latrine is not functioning due to blockage, the following steps could be taken to make it functional :

— **In case of a direct pit waterseal latrine**: remove all solids from the pan and flush it with plenty of water. If the blockage still persists, fill the pan with water and allow time for the blockage to soften. Flush again with plenty of water. If blockage persists even after, check whether the pit is full, by lifting the squatting plate. If it is full, dig a new pit and shift the squatting plate and the superstructure over to it. Provide a layer of thick soil over the filled up pit to prevent flies from breeding.

— **In case of a two-pit waterseal latrine blockage** : remove all solids from the latrine pan and flush the pan with plenty of water. If it is still blocked, fill the pan with water and allow time for the blockage to soften Flush again with plenty of water. If blockage persists even after, check the junction chamber and drain. If either of them is blocked, clean with a broom and flush. If blockage still persists, check whether the pit is full by lifting the pit cover. If it is full, put a plug in the drain leading to the filled up pit. Remove the plug from the other drain in the junction chamber so that the excreta is now diverted into the empty pit.

Table..I

Comparative Analysis of Various Systems

Type	Hygiene	Rural Appli-cation	Water Requi-rement	Ease in Constr-uction	Use & Maintenance	Recommended Geo-hydrology	Pollution Risk	Cost	Remarks
1 Indiscrimi-natory Defecation	Very bad	Yes	Not mandatory	Very easy	Very easy	Nowhere in particular	High for surface pollution	No Cost	Should not be recommended
2 Discrimi-natory Defecation	Bad	Yes	-Do	Very easy	Very easy	Thinly populated area	-Do-	-Do-	Generally should not be recommended unless extremely needed
3. Single Pit Latrine	Moderate	Yes	-Do-	Very easy	Very easy	All over except in high water table & water logged areas	Less in case water table 2 m below pit bottom	Negligible	Except in thickly populated areas this can be an option to start with
4 Lined Pit Latrine	-Do-	Yes	-Do-	Easy	Very easy	-Do-	-Do-	Very low	-Do-
5 Bucket Latrine	Very bad	Institut-ional arrangement is requirement for O&M	-Do-	Easy requirement	Installation Arrangement Required	Any where	High risk on environment	High	From the point of view of social upliftment programme of rehabilitation of scavengers, this option is discarded.
6. Compos-ting (Continuous)	Bad	Yes	Water should not be used for anal cleaning	Need manpower training	Precaution necessary from the hygiene and environment point of view	Not suitable in low lying and water logged areas	If precautions are not taken	High	Has potential for resource recycling but very difficult to observe precautions
7. Composti-ng (Batch)	Bad	Yes	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-

Type	Hygiene	Rural Appli-cation	Water Requi-rement	Ease in Constr-uction	Use & Maintenance	Recommended Geo-hydrology	Pollution Risk	Cost	Remarks
8. Ventilated Improved Pit (Single)	Fair	Yes	-Do-	-Do-	Easy	Low water table area	Not much	High	Suitable for water scarce area where people do not use water for anal cleaning
9 VIP (Double pit)	Fair	Yes	-Do-	-Do-	-Do-	-Do-	-Do-	Very High	-Do-
10 Single pit (Unlined) Water seal latrine	Excellent	Yes	Needs Water	easy	easy	Hard soil conditions with low water table (more than 3m from ground surface) not much below	Not much	Low	Fulfills all the criteria for a sanitary latrine
11 Single pit (Lined) water seal	Excellent	-Do-	-Do	-Do-	-D0-	Low water table, loose soil	-Do-	Low	-Do-
12 Single offset pit water seal	Excellent	-Do-	-Do-	-Do-	Do-	Low water table	-Do-	Moderate	-Do-
13 Two-pit water seal latrine	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-	High	-Do-
14 Septic Tank	-Do-	-Do-	-Do-	Needs a little	-Do-	Almost everywhere	-Do-	-Do	Suits individual to community level installation

HUMAN RESOURCE NEEDS, TRAINING, RESEARCH AND DEVELOPMENT

Need for Human Resource Development

The International Decade of Water and Sanitation (1980-90) experienced the greatest problem in mobilizing skilled manpower to design and construct appropriate technological options pertaining to sanitation, especially in the rural areas. The existing gap of human resource development needs to address following basic issues.

— Long term awareness, education and behavioural orientation of the community in order to create a better sanitation awareness and literacy in the rural areas

— Long term training programme for technical staff at the project management level.

— Short term training for awareness and sensitization programme for the field staff of the various implementing agencies with respect to technology choice, innovative approaches and social/behavioural issues.

Human Resource development in the rural sanitation sector, therefore, requires development of qualified and motivated manpower comprising of both technical and social aspects covering the following area:

— Sanitation awareness and hygiene education

— Technical training on appropriate technology

— Project planning, implementation and monitoring

The target group for training should comprise of (i) Decision makers, (ii) Implementation functionaries and (ii) Grass root level functionaries as discussed below:

Category of personnel	Area of Training
a) Decision Makers	i. Awareness with respect to linkages between sanitation and health, innovative strategies for sanitation promotion. ii. Construction, maintenance and cost implications of sanitation investment and project finance.
b) Implementing functionaries (District level officials of PHED Panchayati raj, District Administration etc.)	i. Sensitization on sanitation programme, planning and designing of sanitation project in the district. ii. Information pertaining to appropriate sanitation technologies. iii. Design of area specific facilities and coordination with interdisciplinary functionaries.
c) Field level functionaries (technicians/ overseers, community workers and job assistants)	i. Project.execution, spot check, monitoring and reporting. ii. Baseline, KAP & other investigative survey works and assist the community in selection of technology, construction and maintenance of the assets.
d) Grass root level functionaries (motivators, health workers etc.)	i. Awareness on sanitation, hygiene education. ii. Motivate the community towards improvement of home sanitation and personal hygiene.

Details of functionaries of different categories are given below :

i) **Grass root level functionaries:**

a) Anganwadi workers (Covering Gram Sevak and Savikas)

b) Health workers (Covering Gram Sevak and Savikas)

c) School teachers

d) DWCRA Group Organization

e) Youth Club Members (Male and Female)

f) Mahila Mandals (Presidents and Secretaries)

g) Panchayat Members

h) Handpump Mechanics

ii) **Field Level Functionaries**

a) BDO and the block extension staff

b) Public Health Centre Doctors/Supervisors

c) Chief District Publicity officer / ICDS Supervisors/ Functionaries of DWCRA (Mukhia Sevak)

d) Junior Engineer / Master Mason

iii) **Implementing Functionaries**

a) Collector/District Magistrate/CEO and other district development officials such as: PHED/Panchayat/RD Authorities/ Health/Education/ DRDA/Information and Public Relation/Social Welfare/ ICDS/ local NGOs.

iv) **Decision Makers (State Level Functionaries)**

a) Policy makers of the Nodal Department, Rural Development, Public Relation, PHED, Health, Education, Women and Child Development, ICDS and Social Welfare.

In order to make the training cost effective and sustainable, training should be institutionalized as far as possible. In this regard inclusion of sanitation in the curricula of engineering and polytechnic courses and in the training programmes of the State Training Centres will be most useful.

Training Needs Assessment

Assessment on training needs should originate with micro level task analysis of various levels of rural sanitation functionaries. On a rough assessment it is found necessary to train about six trainers at the District Training Cell at the beginning and two trainers in each block.

Training Institute, R & D and Curricular Modifications, Existing Training Institute.

i. I.T.N centre
ii. Regional key institutes
iii. Regional T.T.T.Is
iv. Engineering colleges/ Polytechnic
v. Community Polytechnics
vi. NG - Training Institute
vii. PHED Training Centres
viii. Other Institutions involved in RWSS

It is necessary to involve more NGOs at District and Block levels along with local technical institutions e.g. engineering colleges, community polytechnics. A few more regional key institutions of ITN is also required.

Curricular Components :

The existing curricular structure in engineering colleges and polytechnics basically cover the conventional Water Supply and Waste Disposal systems. As the present system does not provide a base for low cost appropriate technology concepts for rural sanitation, attempts should

be made to provide required exposure in this field keeping the existing balance between the Diploma and Degree linkage.

Requirements of Research and Development Inputs for Rural Sanitation:

Inputs are required in the following areas:

1. To develop affordable techniques with different materials for W.C. pan and trap, superstructure, lining of pit etc.

2. To devise ways of operation and maintenance of individual/community latrines and other sanitary facilities.

3. Composting of household wastes and nightsoil, develop simple and hygienic methods of making compost with household waste and nightsoil, leading to income generation.

4. Community friendly design of integrated bio-gas system for treatment of excreta and animal wastes and utilization of gas. Develop and undertake field studies on integrated approach for the treatment of excreta, use of bio-gas and utilization of effluent for agriculture and aquaculture.

5. Design of low cost waste collection and disposal system.

6. Design of package waste water collection and treatment units for small communities.

7. Design and evaluate community latrines attached to bio-gas plants.

8. Community organization patterns, study and develop sociological and health education, promotional methods for community acceptance, participation for maintenance and operation of sanitary facilities and identify role of women.

9. Design of sanitary latrines suitable for different Geo-hydrological regions (rocky/ impervious soil/water logged areas/coastal areas).

10. Epidemiological studies on the impact of sanitary facilities on human health, other aspects of quality of life.

11. To study water pollùtion due to pit privies and make micro level field studies on travel of groundwater pollution for different soil conditions.

12. To design and develop mechanisms for removal of human excreta/sludge. Develop simple systems, vacuum tankers etc. for clearing cesspools and septic tank desludging.

13. Studies on technical and other manpower requirement for providing total coverage of rural sanitation including other components of sanitation

RECOMMENDATIONS

The Expert Committee on Technological Guidelines strongly feel that there should be a flexibility on technology choice rather than adopting a single technology under CRSP. This will provide ample opportunity to the families for constructing their own household sanitation facilities. Appropriate policy changes in CRSP guidelines is, therefore, envisaged.

ii The concerned states should provide a range of options as would be appropriate under the prevailing geo-hydrological and socio-economic conditions of the communities for which the programme is going to be implemented. The states may also enhance the list of technologies based on the available documentation as will be appropriate for the physical area concerned.

iii As far as possible flexible approach is to be adopted in line with sanitation upgrading over a period of time. This will enhance participation of the families in the programme and development of a sense of ownership resulting in proper use and maintenance of the units

iv The various designs as discussed in the preceding chapters are some of the potential options and are not in any case to be considered as exclusive. Rather the list of options may be revised time to time by incorporating subsequent developments in this sector.

v The technologies discussed in the booklet have a varied degree of efficiency, with respect to cost, sanitary quality and ease in operation/use/maintenance. Nevertheless, there should be a minimum sanitary quality of the technologies to be adopted under the programme.

vi "Water seal" latrine should be considered as the minimum standard as this ensures sanitary quality Thus a latrine under CRSP should fall at least in one of the following categories.

a) A direct pit unlined water seal, comprising of a squatting plate with a built-in water seal trap.

b) A direct pit water seal latrine with a lined pit.

c) An offset single pit water seal latrine.

d) A two pit water seal latrine.

vii For the communities who do not use water for anal cleaning, either due to water shortage or due to continued cultural practices, other latrines like VIP or composting latrines may be adopted under the CRSP programme

viii Nonetheless, the families should not be discouraged from constructing other conventional latrines at their own cost as some of those, if used properly, will conform to the quality near to a sanitary latrine.

ix The CRSP funds should be used judiciously for enhanced coverage of the rural families with sanitation facilities For doing so emphasis has to be given for ensuring the functional components of a latrine. This means, the underground structure is crucial compared to the physical structure above the ground (superstructure). The CRSP money, therefore, has to be utilized only to compensate part of the sub-structure in line with maintaining sanitary quality of latrines. The construction of superstructure can be left with the families concerned.

x While providing subsidy under the CRSP both economical condition of the beneficiary families and cost effective design should be adhered to. For example, the subsidy can be made available to the below poverty line (BPL) families.

xi While working out the amount of subsidy for the BPL families the design aspect has also to be kept in mind To enhance the outreach of the CRSP allocation subsidy may be administered in a graded fashion ranging more for least cost option and less for comparatively higher cost option For example, for the categories (a), (b), (c) and (d) of the latrines as indicated in recommendation (vi) above, the subsidy amount may be fixed at 75%, 50%, 40% and 25% respectively.

xii Each state should have a trained group of professionals who are conversant with pros and cons of technology choice. While submitting the scheme to the GOI, the state concerned will ensure that they possess the required professional group through which the scheme will be implemented. In case the state does not have a trained professional group they should consult a recognised training institute and arrange for the required training which also should form a part of the scheme to be submitted to the GOI.

ATTACHMENT

Attachment. a

Composition of the National Expert Committee

1.	Sh. Palat Mohandas & Mission Director, Rajiv Gandhi National Drinking Water Mission, Ministry of Rural Areas & Employment, Govt. of India, C.G.O. Complex, New Delhi 110 003.	Chairman
2.	Sh. Ishwarbhai Patel Director, Environmental Sanitation Institute, (Safai Vidyalaya) Ahmedabad.	Member
3.	Sh. A.K Roy Chairman (Technical), Sulabh International Social Service Organization, New Delhi.	Member
4.	Dr. D.N Trikha Director, Structural Engineering Research Centre, (CSIR) Sector-19, Kamla Nehru Road, Ghaziabad- 201 001.	Member
5.	Sh. P.C. Sharma Head, Material Science Division Structural Engineering Research Centre, (CSIR) Sector-19, Kamla Nehru Road, Ghaziabad- 201 001.	Member
6.	Sh. B.B. Rau Former Adviser, Technology Advisory Group, UNDP/World Bank, Ameerped - 500 016 Hyderabad.	Member
7.	Sh V.S. Chauhan Retired Chief Engineer, A-A10, S.C. Aliganj, Lucknow, Uttar Pradesh.	Member

8.	Sh. H.C. Srivastava Former Director, Institute of Engineering & Rural Technology. Allahabad.	Member
9.	Sh. Paneer Selvam India Country Programme Manager UNDP, New Delhi.	Member
10.	Mr. S. Huda Project Officer (Sanitation) UNICEF, 73, Lodhi Estate, New Delhi 110 003.	Member
11.	Sh. S.M. Naverkar Nirmal Gram Nirman Kendra, P.O Gangapur (B.O) Nasik- 351598	Member
12.	Sh. A.R Subbaiah Deputy Secretary RGNDWM GOI New Delhi	Member
13.	Prof. P.K. Bhattacharya Consultant (Sanitation), Rajiv Gandhi National Drinking Water Mission Ministry of Rural Areas & Employment. Govt. of India C.G.O, Complex, New Delhi 110 003.	Member & Jt. Convenor
14.	Sh. D.K. Bhalla Deputy Secretary, Rajiv Gandhi National Drinking Water Mission Ministry of Rural Areas & Employment. Govt. of India C.G.O, Complex, New Delhi 110 003.	Convenor

Attachment..b

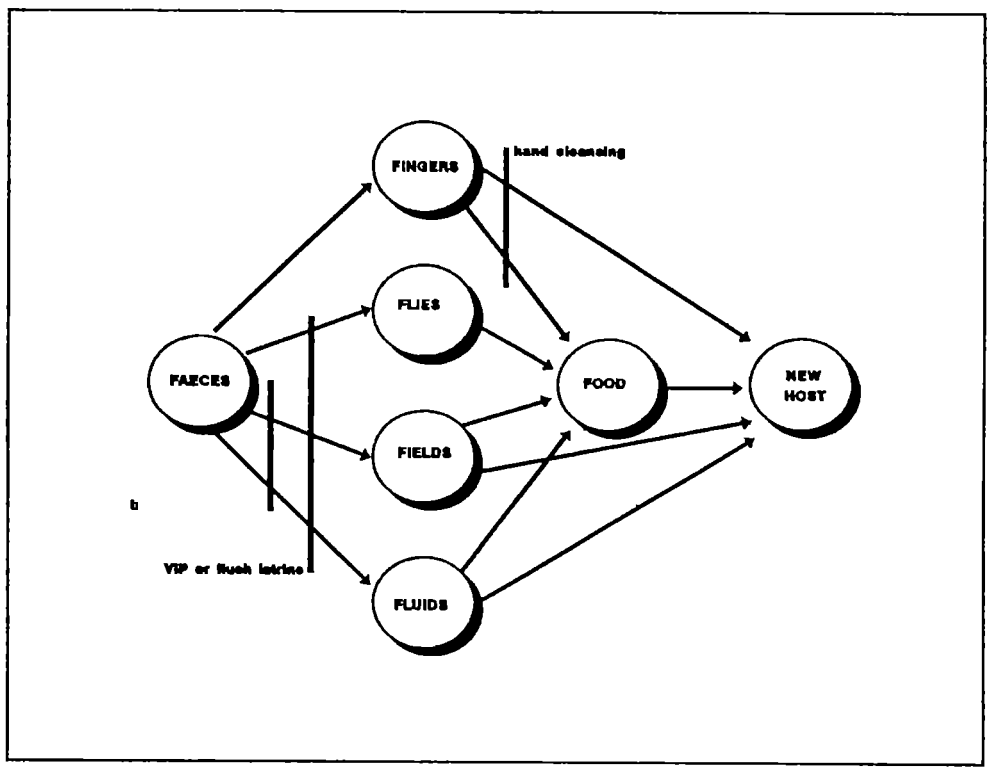
Composition of the Drafting Sub-Committee

1.	Sh. Palat Mohandas & Mission Director, RGNDWM, C.G.O. Complex, New Delhi 110 003.	Chairman
2.	Sh. P.C Sharma Head, Material Science Division, SERC (CSIR), Ghaziabad	Member
3.	Mr. S Huda Project Officer (Sanitation), UNICEF New Delhi	Member
4.	Prof. P.K. Bhattacharya Consultant (Sanitation), RGNDWM C.G.O, Complex, New Delhi	Convenor

Annexure - I

DISEASE TRANSMISSION

In order to live a meaningful life and to make use of the full potential of human beings, it is essential that one does not suffer often, at least from preventable diseases. Safe water, sanitation practices and clean surroundings can ensure this to a large extent. But in India some 1800 million person hours are lost every year due to diarrhoeal diseases alone which could have been averted if appropriate steps were taken. The diarrhoeal diseases are transmitted through the **faecal-oral route**. Human excreta of a sick person or a carrier contains pathogens which can potentially cause disease. In the course of daily routine, these pathogens find ways to reach human intestine via mouth and proliferate. Through excretion, this cycle continues. The Figure below graphically presents the faecal-oral-faecal route of transmission and the potential barriers for breaking the same.



Other severely debilitating diseases like poliomyelitis, tetanus, malaria, filaria, guineaworm infestation, trachoma etc. are also related to water and sanitation. Water and sanitation together, thus, occupy a key position in community health. As the diagram shows, it is neither the technology, nor the hygienic behavior in isolation, but both of them if adopted in a systematic manner that can break the transmission cycle. The various components which are associated in this regard are:

- Safe handling of drinking water
- Safe disposal of waste water
- Safe disposal of human excreta
- Solid waste disposal
- Home sanitation and food hygiene
- Personal hygiene
- Sanitation in the community/settlement

This range of activities together can pose substantial improvement in the quality of life, specially in the rural context, in order to reduce the drudgery and unnecessary sufferings caused by preventable diseases. Sanitation thus should be adopted with a holistic approach encompassing the above seven components as a way of life, to have positive bearing on health.

Annexure..II

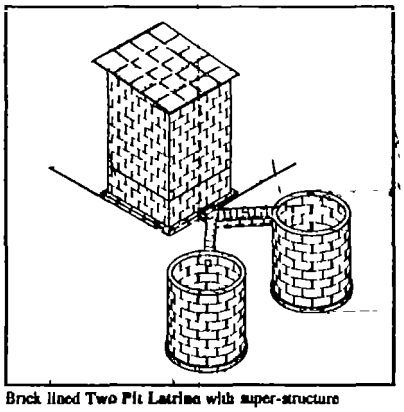
IMPORTANT SANITATION LANDMARKS

2500 BC	The Mohanjo Daro civilization had developed a drainage system where waste water from each household went into main sewer/drain.
2000 BC	In the tomb of King of the Third Ur Dynasty (South East of Temenos), toilet with a long drain was used
1000 BC	Flush type toilets were used in the Bahrain Islands in the Persian Gulf.
69 AD	Vespasianus (Otto Empire) levied Tax on toilets for the first time.
1214	Public toilets, manned by scavengers in Europe, were constructed for the first time.
1596	John Harrington invented the Water Closet (W.C.).
1668	Edict issued by the Police Commissioner, Paris, for construction of toilets in all houses.
1772	Paid toilets were constructed for the first time in Europe.
1782	John Gaillait invented the Water Seal Trap (Patented).
1824	First Public Toilet was constructed in Paris
1842	The Public Sanitation Law was presented before the Parliament by Edwin Chadwick.
1848	The New Public Sanitation Law was enacted in England. Water Closet (WC) in each house was made obligatory.
1869	Sewage water used as manure on experimental basis

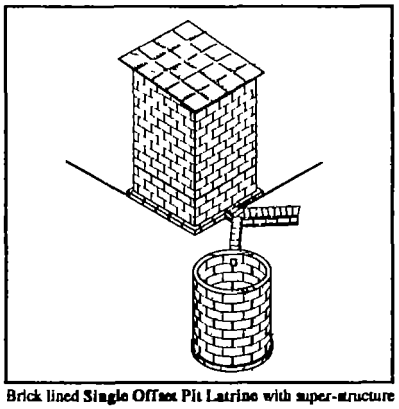
1870	J.R. Man developed the Siphon Type closet.
1881	John Louis Mouras patented the Septic Tank which he first built in his house in Versoul, France.
1883	First Ceramic Toilet by Thomas Turiferd for Queen Victoria.
1943	The appointment (October 1943) of the Health Survey and Development Committee (Bhore Committee).
1947	India attains independence from the British Scavenger Liberation was part of the Freedom Movement
1949	The formation of Scavenger's Living Condition Enquiry Committee.
1951	Water Supply and Sanitation included in the First Five Year Plan Document (1951-1956).
1953	The establishment of Central Public Health Engineering Organization in the Ministry of Health, GOI (A national level nodal technical body to assist the Ministry of Health on water supply and sanitation).
1955	Model Public Health Act - Prepared by the Dasgupta Committee.
1956-61	Second Five Year Plan Document (Active campaign for environmental hygiene)
1956-61	Research-cum-action (RCA) Project on Environmental Sanitation initiated by the Ministry of Health, GOI at Singur (West Bengal), Ponamallee (Tamil Nadu) and Najafgarh (Delhi).
1959	The appointment (June 1959) of the Health Survey and Planning Committee (Mudaliar Committee).
1960	The appointment (April 1960) of the National Water Supply and Sanitation Committee (Simon Committee).

1961	The publication of a Technical Document on Rural Latrine Programme by the Directorate General of Health Services, Mmistry of Health, GOI
1968	The Committee to study the working and service conditions of sweepers and scavengers (National Commission on Labour).
1969	The India Country Report (JC 16/UNICEF-WHO/WP/69.1) on assessment of the environmental sanitation and water supply programme - Geneva, 5 -6 March 1969.
1973	The subject of water supply and sanitation transferred from the Ministry of Health to the Ministry of Works and Housing and Local Self Government.
1974	The launching of the Minimum Needs Programme (MNP). The environmental improvement of the slums was included under MNP.
1978	A GOI/WHO/UNICEF collaborated National Seminar held at Patna (Bihar) on the conversion of bucket privies into the sanitary water-seal latrine (25-27 May 1978).
1981	The launching of the International Drinking Water Supply and Sanitation Decade (IDWSSD) Programme in India (1st April 1981).
1983	The National Master Plan on International Drinking Water Supply and Sanitation Decade Programme.
1983	The adoption of the National Health Policy for achieving "Health for all by the year 2000"
1985	The transfer of the Rural Water Supply and Sanitation Programme from the Ministry of Works and Housing to the Ministry of Rural Areas and Employment.
1985	The Technology Advisory Group (TAG) published the detailed specifications for the Two Pit Latrine construction in March 1985.

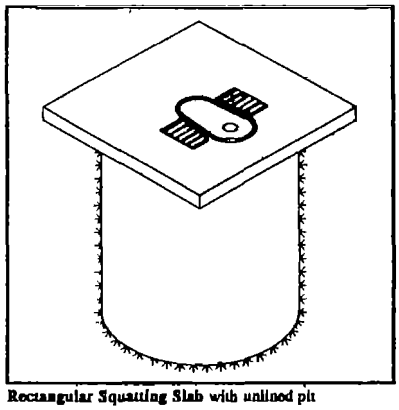
1986	The Rural Sanitation Programme was taken up (Jan 1986) under the National Rural Employment Programme, Rural Landless Employment Guarantee Programme, Indira Awas Yojana and a number of other state schemes.
1986	The Centrally sponsored Rural Sanitation Programme (CRSP) was launched
1987-88	The Rural Sanitation Programme was included under MNP. It was also included under GOI's 20-point programme as an important element.
1991	The Centrally Sponsored Low Cost Sanitation Programme for the conversion of dry latrine to the low cost sanitary latrines in urban areas was launched with a view to liberate and rehabilitate all the scavengers by the end of the 8th Five Year Plan (1992-97).
1992	The National Seminar on Rural Sanitation (16-18 September 1992) was organized by the Ministry of Rural Development.
1993	The CRSP was revised.
1994	The Report of the Expert Committee on Rural Sanitation Programme (Mishra Committee Report) MRD, GOI.
1995	The National Consultation on Mission Approach to Sanitation.



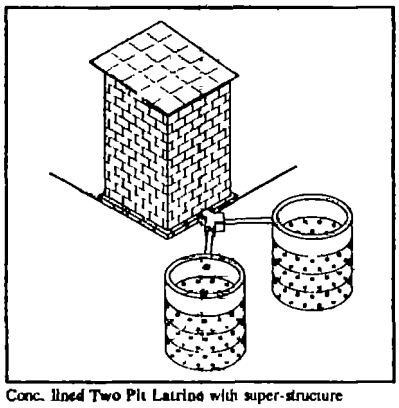
Brick lined **Two Pit Latrine** with super-structure



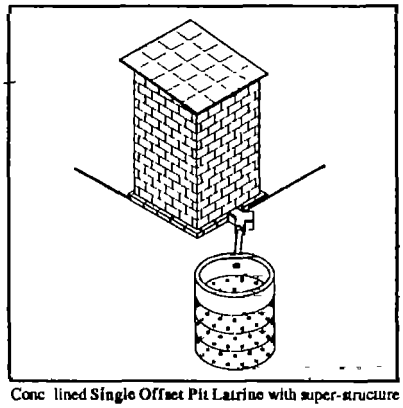
Brick lined **Single Offset Pit Latrine** with super-structure



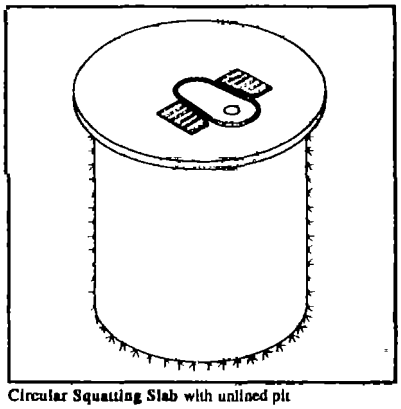
Rectangular Squatting Slab with unlined pit



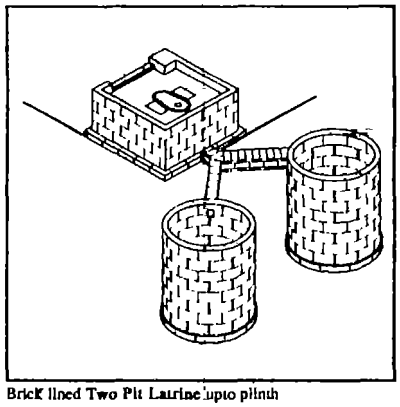
Conc. lined **Two Pit Latrine** with super-structure



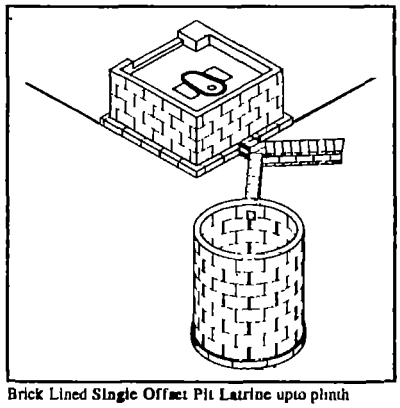
Conc lined **Single Offset Pit Latrine** with super-structure



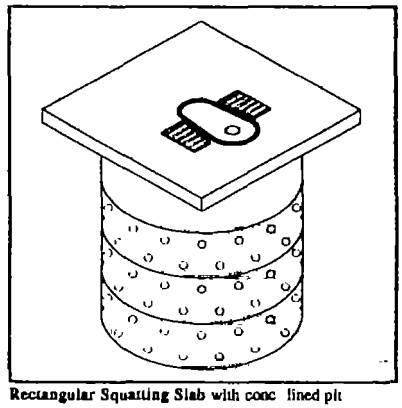
Circular Squatting Slab with unlined pit



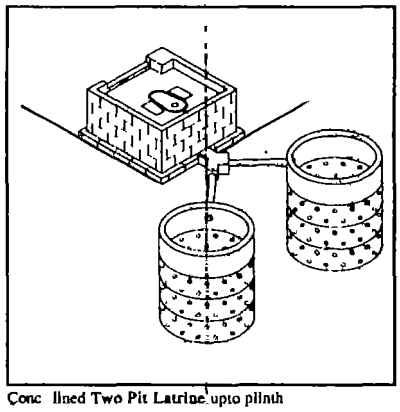
Brick lined **Two Pit Latrine** upto plinth



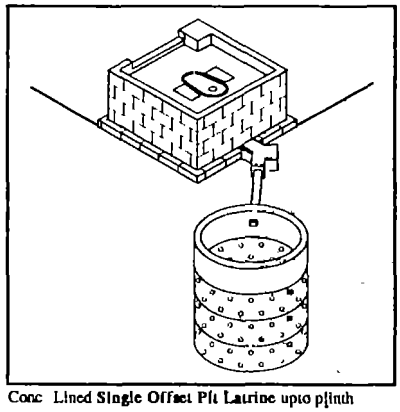
Brick Lined **Single Offset Pit Latrine** upto plinth



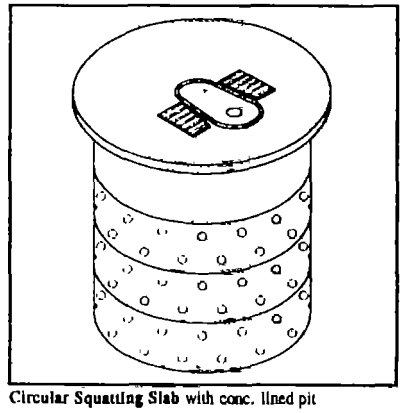
Rectangular Squatting Slab with conc lined pit



Conc lined **Two Pit Latrine** upto plinth



Conc Lined **Single Offset Pit Latrine** upto plinth



Circular Squatting Slab with conc. lined pit

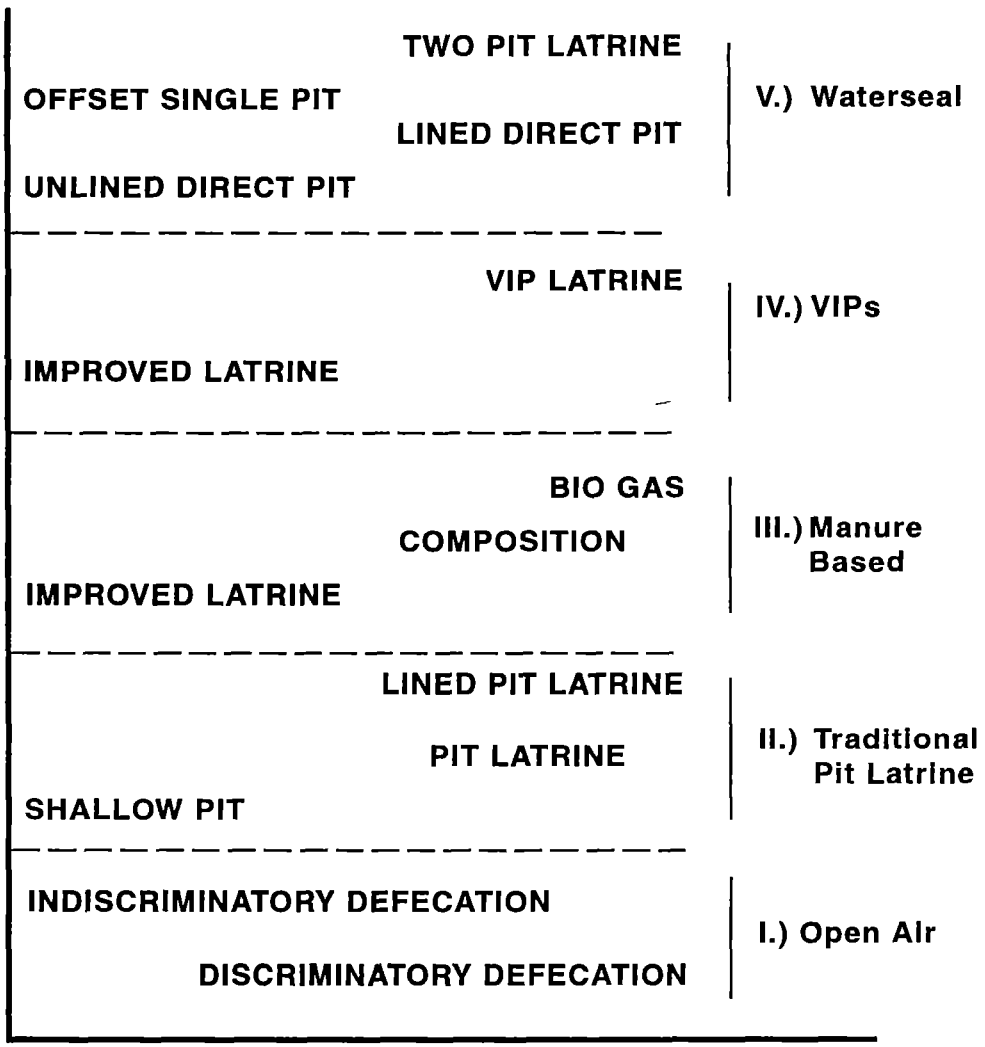
Annexure - IV

SANITATION UPGRADING

The construction of sanitary facilities by a household need not be considered as a one time effort Just as a family improves its own house and the surroundings along with an increase in its socio-economic status and a change in the quality of life, it can also upgrade the sanitary facility constructed at one point of time. The rationale behind it is clear. The two pit pour flush latrines which is a low cost option when compared to the other conventional excreta disposal systems like the septic tanks or the sewerage system, is still high cost for certain segments of the population. Between indiscriminate open defecation and water seal latrines, one can identify several options, each one being an improved system over the other in a sequential form A pictorial description of the sequence is given in the folowing figure. This movement from one alternative to another alternative (which is better than the previous one) in the ladder is what can be called the Sanitation Upgrading Approach. This approach takes into account the affordability of different population groups and at the same time is flexible enough to allow the household to upgrade the facility by certain additions/alterations as may be appropriate at a particular point of time.

Sanitation upgrading could take any of the three courses such as i) lateral upgradation ii) vertical upgradation iii) both lateral and vertical upgradation. For example a simple pit latrine can be upgraded to a lined pit latrine when the functional quality does not change and hence is a lateral upgrading. When a lined pit latrine is upgraded to a direct pit water seal latrine its functional quality changes (in this case by introducing water seal device) and hence is a vertical upgrading. Similarly if a simple pit latrine is upgraded to a direct lined pit water seal latrine it is both lateral and vertical upgrading. Thus, there could be a number of alternatives from where a family can opt for the best suited one, depending upon its interest and commitment for sanitation.

SANITATION UPGRADING



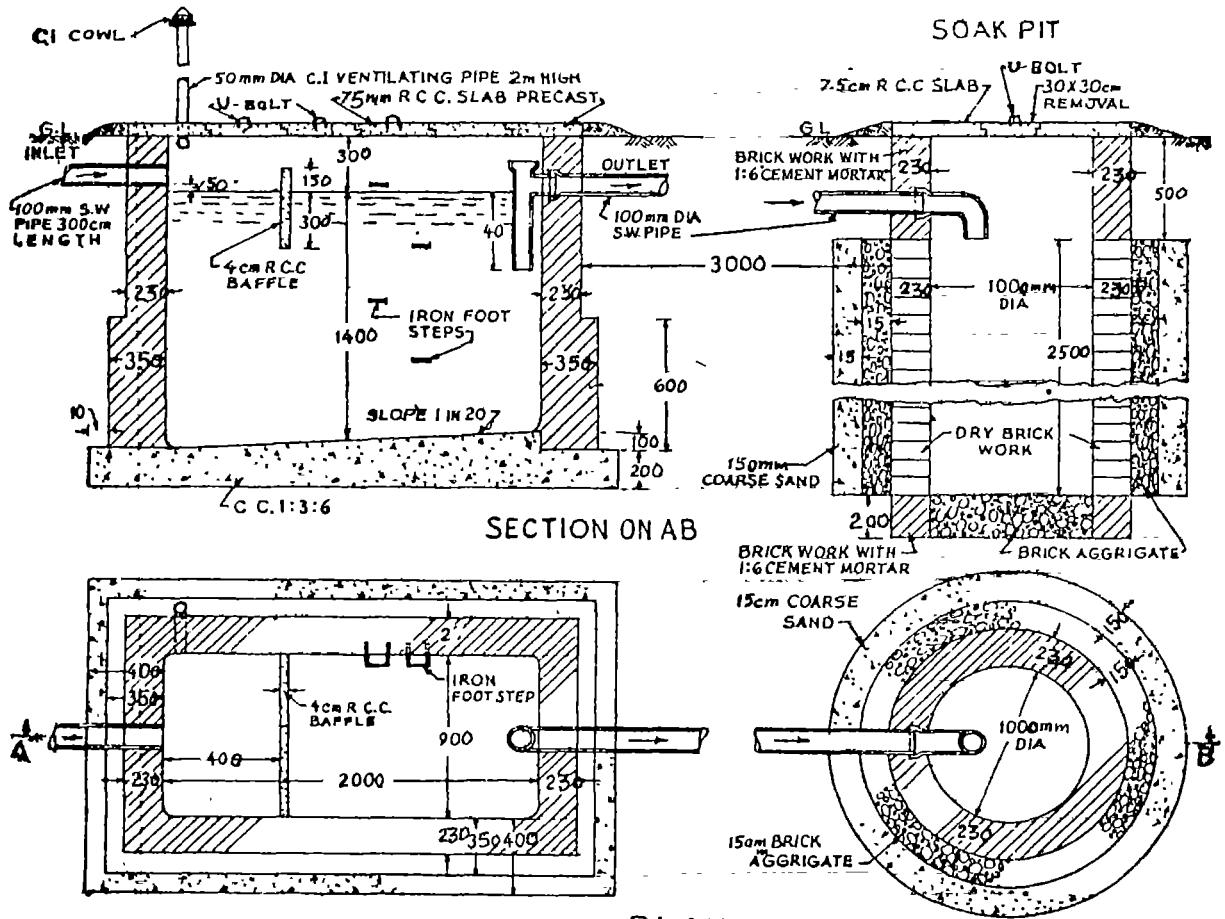
Annexure-V

SEPTIC TANK

Septic tanks provide a moderately priced excreta treatment in locations where the construction of sewerage systems is not available. For rural areas, the septic tanks offer a limited use, specially for locations with a high water table. However, institutions like schools, dispensaries or families who can afford the cost and manage the quantity of water required, a septic tank system for excreta disposal could be a good choice. The system consists of a water-tight settling chamber into which raw excreta is delivered through a pipe. The excreta is partially treated in the tank through separation of solids to form the sludge The effluent from the tank infiltrates into the ground through a soak pit or drains. The following figure shows details of a rectangular septic tank and soaking pit as could be constructed using brick masonry. Precast cylindrical vertical septic tanks with or without automatic desludging facility have been developed (SERC-G) and a very large number of these units have been installed in various types of geo-hydrological conditions. These precast ready to install units are cost effective and save construction time.

Advantage: Comfortable, easy and clean in use, the latrine rooms are free from smell and avoid water table pollution to some extent, if the necessary precautions are taken.

Disadvantage: High in cost, needs more water, sludge handling needs extra precaution, the soil condition must be permeable.



ALL DIMENSIONS IN CENTIMETRE UNLESS OTHERWISE SPECIFIED

SEPTIC TANK FOR 25 USERS

Annexure V

Annexure-VI

BIO GAS

The organic waste matter like animal dung and human excreta are used for the biogas production through an anaerobic process in a biogas digester. The organic matter decomposes at a relatively high moisture content (90 to 99.5%) in the absence of oxygen. The biogas consists mainly of methane (65%), carbon dioxide (35%) and traces of ammonia, hydrogen-sulfide and some other gases. Methane being a highly combustible gas, is largely used as fuel for domestic consumption. The process also involves a break down of proteinous materials into amines and fertilizers such as nitrates and ammonia.

The biogas system can provide the rural communities a cheaper and dependable source of fuel free from pollution, a good quality manure and a solution to the problem of deforestation for getting firewood. Three types of biogas plants are popular:

1. Janta Type-Fixed Dome.

2. KVIC Type (the most popular type and is hence the commonly installed one).

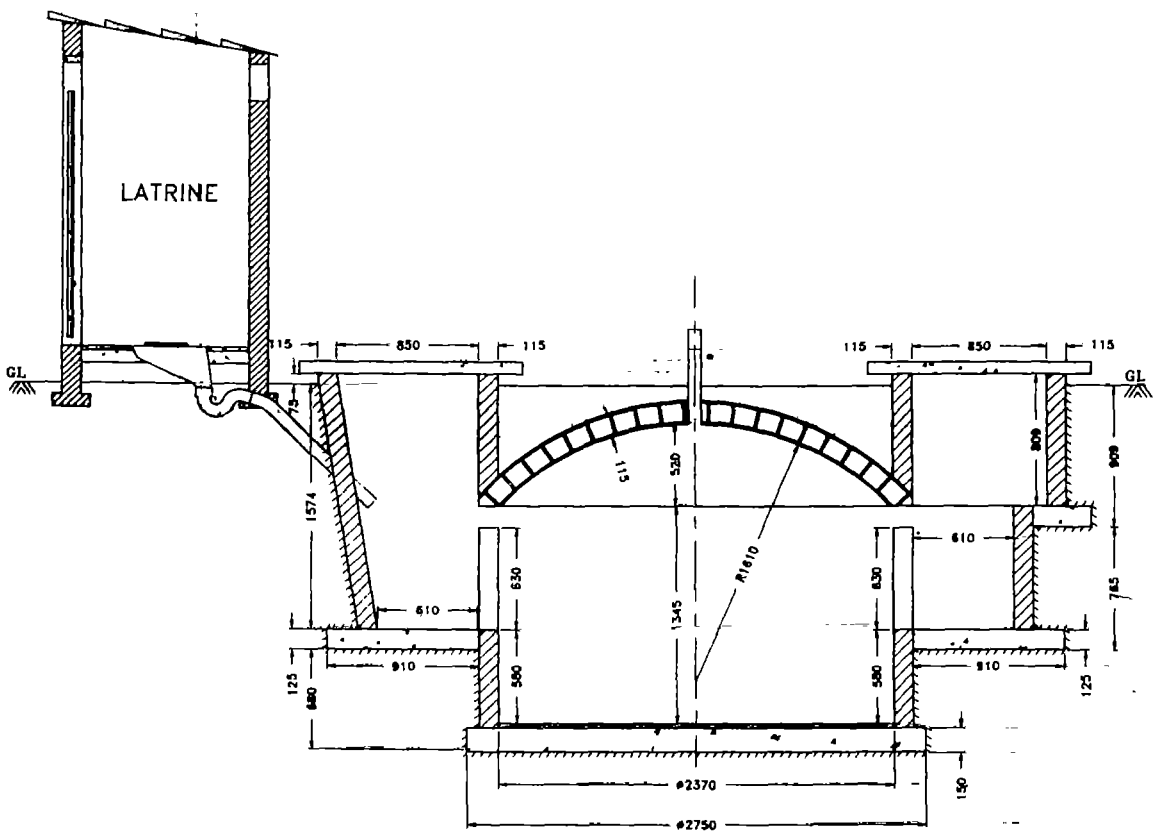
3. Deenbandhu Model - Fixed Dome type.

The rural latrines can be easily connected to any of the popular type of plants like KVIC, Janta and Deenbandhu models. Human waste (excreta) is fed into these mixed feed plant to reduce the requirement of cattle dung. When the latrine is directly connected to the biogas plant digester as shown in the figure (Annexure..VI) the handling of human waste is totally avoided. Water is a basic need for running a biogas plant and 50 to 150 litres of water is required for a 3 cubic meter capacity plant. A biogas unit is enough for a family of 6 to 8 persons. Any of the existing running plants can be converted into a mixed feed plant by connecting a latrine.

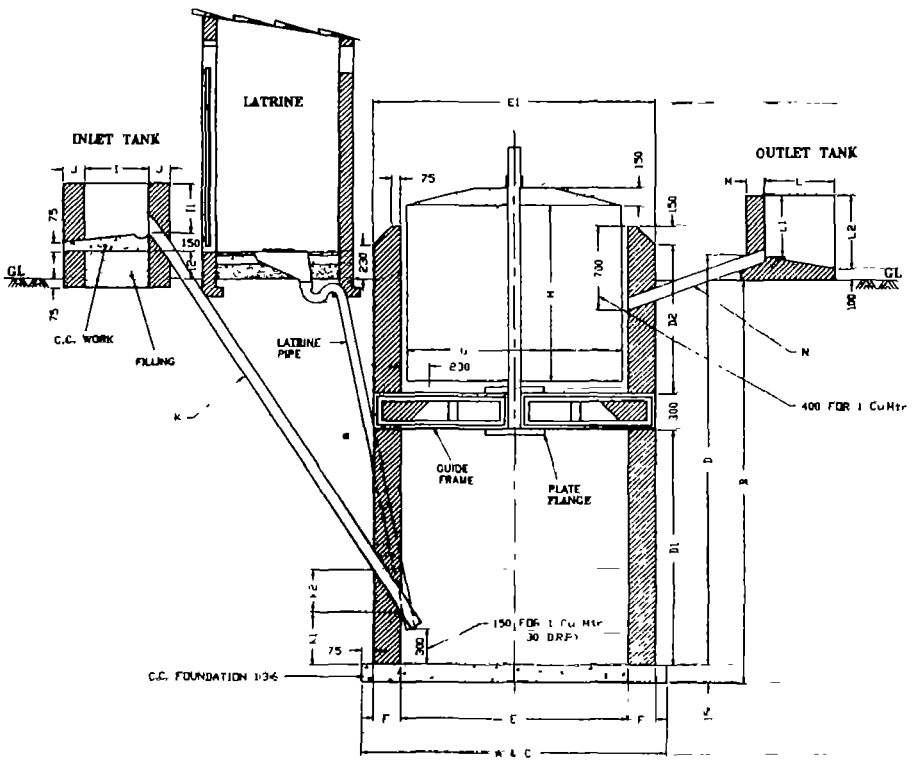
Some of the problems related to biogas are : lack of awareness, social acceptance of human waste-cattle dung digesters, corrosion of steel gas holders due to improper maintenance, lack of facilities for repair of gas holders in villages.

For solving some of these problems, a creation of general awareness should be taken up in rural areas regarding advantages of biogas, the manure obtained, health hazards of using fire wood and deforestation. The construction of a biogas digester using ferro cement saves space, cost and construction time. Painting of the steel gas holders with better coatings improves the life many times. SERC (Ghaziabad) has successfully demonstrated the use of ferro cement for the Déenbandhu model with latrine connected for the I.I.T. Delhi/CORT Project.

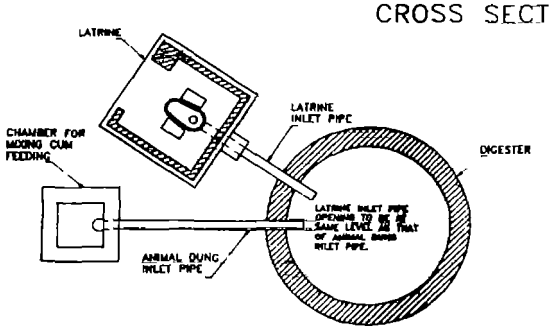
Methane generation is temperature dependent and practically stops at temperatures below 10 degree Celsius. Hence the operation of biogas is limited to the colder regions. Digesters need regular and measured feeding with a properly mixed feed Biogas is used mainly used for lighting, cooking and the running of diesel engines as a partial substitute to diesel, depending on quality of gas. One meter cube of biogas is equivalent to 0.66 litre of kerosene, 3.7 kilogram of firewood and 13 kilogram of cow dung cakes.



JANATA MODEL
(CROSS SECTIONAL VIEW)



CROSS SECTIONAL VIEW



LATRINE CONNECTION WITH BIOGAS PLANT DIGESTER
– ADDITIONAL COST ON PIPE CONNECTION APPROX. FIVE THOUSAND –1996

KVIC MODEL

Annexure VI

Annexure-VII

Pit latrine in the water logged/flood prone and the high sub-soil water areas

- The pits should be raised above the ground level to a height such that the invert of the incoming pipes/drains is just above the likely flood water or the subsoil water level. The latrine floor level will need to be raised due to the raising of the pipe level (please refer to the figures of Annexure VIII)

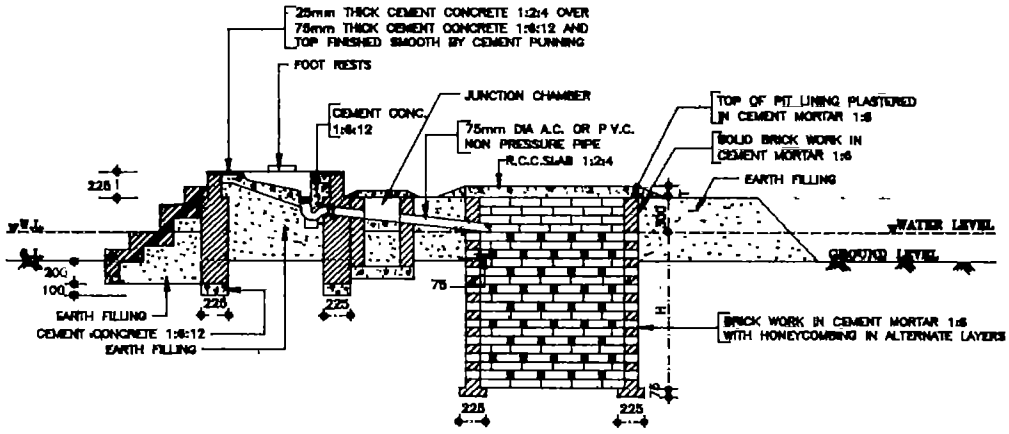
- Provide 1000 mm width, compacted earth filling around the pits located in the water logged or flood prone areas.

- Design the pits as wet pits taking the infiltration rate for the type of soil.

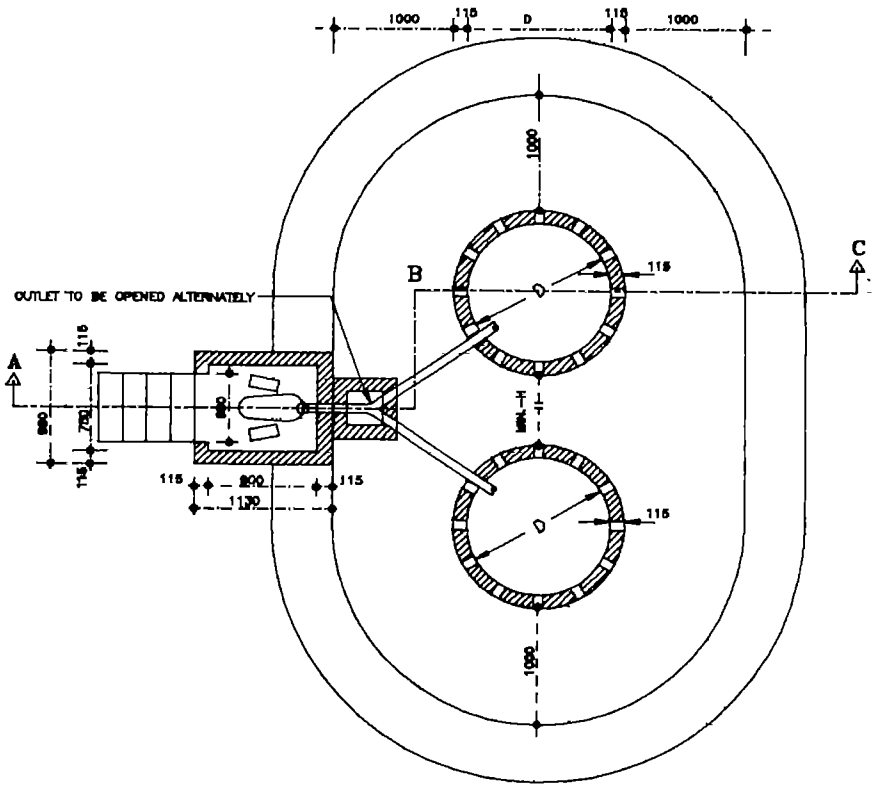
Special situations for the installation of the leach pits

When the leach pits are to be installed in special conditions like the pits in the water logged, flood prone and the high subsoil water areas, snowy regions, rocky strata, soils with low infiltration capacity and locations with space constraint.

Please refer to page 5 tp 10 : TECHNICAL GUIDELINES ON TWIN PIT POUR FLUSH LATRINES - Published by the Ministry of Urban Development, Government of India and Regional Water and Sanitation Group - South Asia UNDP/World Bank, Water & Sanitation Programme, 55 Lodi Estate, New Delhi.



SECTION A–B–C

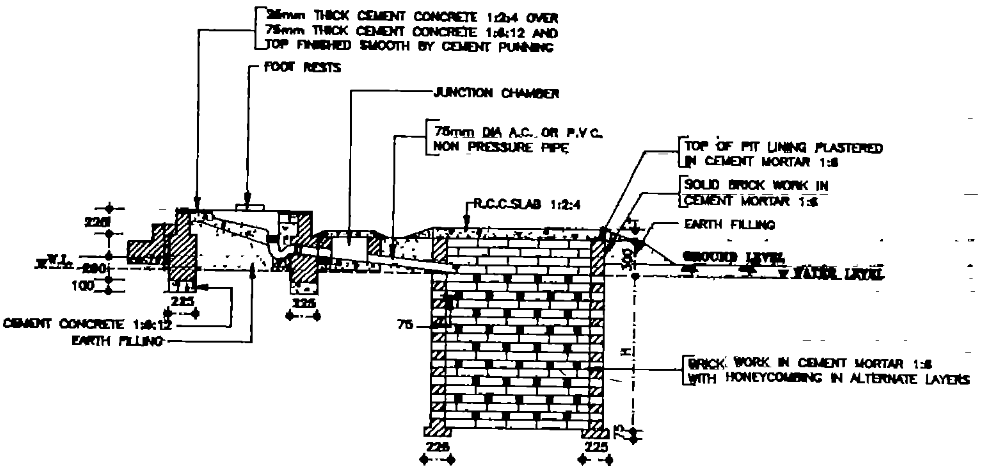


PLAN

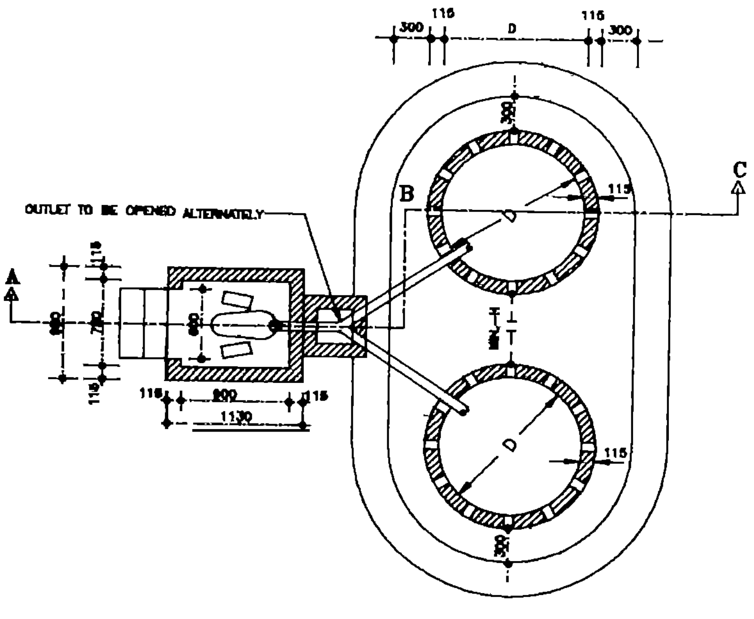
Scale. 1 50
All dimensions in mm

POUR FLUSH LATRINE IN WATER LOGGED AREAS

Annexure VII



SECTION A–B–C



PLAN

NOTE:–
WATER TABLE LESS THAN 300mm BELOW GROUND LEVEL

Scale 1·50
All dimensions in mm

POUR FLUSH LATRINE IN HIGH SUB-SOIL WATER AREA

Annexure VII

DRAWING AND ESTIMATE OF A FEW TECHNOLOGICAL OPTIONS

Basic Considerations:

This chapter of the report deals with the approach for estimating the cost of various units as may be encountered during the implementation of the CRSP. Instead of arriving at the cost of any standard latrine design, it is considered appropriate to break down the cost against the basic components like a pit, superstructure, brick drain, pit cover, squatting platform etc This will provide more flexibility for selecting a convenient design by the implementing agencies/ individuals/families through combining various components as they may consider most suitable. Under no circumstances, of course, the sample components, as contained in this chapter, are to be considered as explicit, but should be referred to as a guideline while working out the total cost of a latrine.

The estimates have been presented, as far as possible, against the quantity of materials, labour etc. instead of showing the cost against the mere schedule of work. The quantity estimates will be useful to the implementing agencies for working out the actual cost based on the prevailing market price at a particular area where a project is to be executed. The agency will also be able to add a proportionate cost if substantial transportation/or incidental expenditure is envisaged based on the prevailing local condition.

Materials :

Since the household latrines are meant for individual families and expected to be constructed on cost sharing basis, it is very difficult to adopt any standard specification for various materials as to be used in the construction work. Nevertheless, estimating without specification becomes meaningless. However, some of the material specifications as followed during the course of estimating in this chapter are as follows:

a) **Bricks** should be sound, free from cracks, flaws and lumps; should not absorb water more than 1/6 of its weight after immersing in water for 1 hour. The desired crushing strength is 75 kg/sq cm (Size : 228 X 114 X 75 mm^3).

b) **Cement** ordinary portland cement as available in local market (preferably Grade-33).

c) **Sand** coarse sand of fineness modulus 1.2 - 2.2 consisting of hard, sharp and angular grain and should pass through 5 mm square mesh. Sand should be clean and free from dust, dirt and organic matters. Sea sand should be avoided

d) **Coarse Aggregate** should be of hard broken stone of granite/sandstone/ quartz/similar quality or could be of well burnt brickbats; free from dust, dirt, and should be of uniformly graded size ranging from 5 to 20 mm.

e) **Pans and Traps** should be made of fibre-glass/ceramic/cement-concrete/mosaic etc. The trap should be of the shape of "P" (not of "S" shape) having a 20 mm waterseal. The pan should be with a bottom slope of 20°-30°.

Earthwork :

The earthwork estimate is based on compact alluvial soil (clay, loam, sandy loam etc). For hard clay, partially weathered rock and hard rock, the estimate of earthwork may need corresponding modification.

Unit rates :

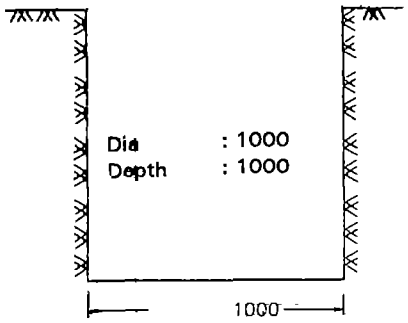
The unit rate calculation of various items of work and material is associated with a particular location and time This is crucial in view of transportation, easy availability of materials, general living cost (affecting the cost of skill and unskilled labour) and cost escalation over time. Unit rates as mentioned in this chapter are based on the prevailing market condition in the city of Delhi (and its suburb) during the month of December, 1996

Some of the unit rates as referred to, during the course of estimating are given herewith.

Remarks: The major part of the estimating was carried out by an outside agency under the supervision of Mr. P. C. Sharma of SERC Ghaziabad.

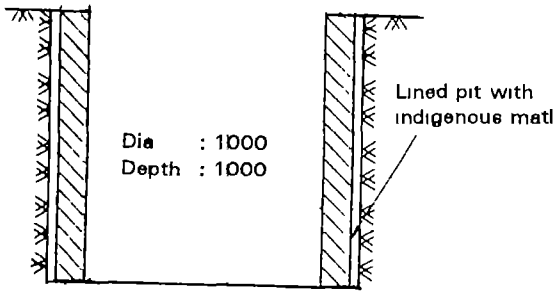
Unit Rates

SL.#	Item	Unit	Rate per unit (Rs)
1	Earth work in excavation	cum	30
2.	Bricks	pc	1.30
3.	Bamboo matting for pit lining	sqm	30
4.	Cement	bag	140
5.	Sand	cum	400
6.	Stone ballast/brick chips	cum	400
7.	Steel	kg	15
8.	Wood for squatting platform	cum	7000
9.	22g wire mesh (12 mesh)	sqm	35
10.	Stone slab (60 mm thick)	sqm	280
11.	Stoneware pipe (100 mm dia,600 mm long)	pc	25
12.	90 mm dia PVC Pipe	m	23
13.	FRP Pan with Trap (ISI marking)	set	300
14.	Mosaic pan, trap and foot rest	set	150
15	Cement pan, trap and foot rest	set	100
16.	Ceramic pan, trap and foot rest	set	200
17	Balli Pillars	m	25
18.	Hessian Cloth	sqm	25
19.	Thatch	sqm	35
20.	0 63 mm thick CI sheet	sqm	160
21.	Unskilled labour	m-day	60
22.	Skilled labour	m-day	100



1 Estimate of an Unlined pit

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Unskilled labour for excavation	0.5	m-day	60	30
Total				30



2. Estimate of a lined pit usIng bamboo matting

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs)
1. Bamboo	5	m	20	100
2. Bamboo matting	4	sqm	30	120
3. Unskilled labour	1	m-day	60	60
4. Contingency	LS			20
Total				300

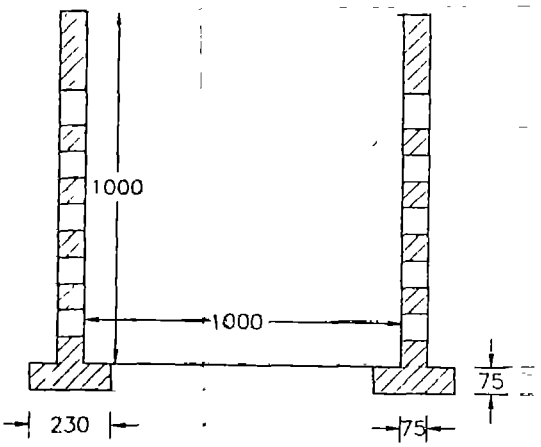
3. A lined pit using earthen rings

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs)
1. Earthen rings	9	pc	10	90
2. Unskilled labor	1	m-day	60	60
3. Contingency				20
Total				170

Remarks : In case of using the indigenous materials cost will be different as indicated below·

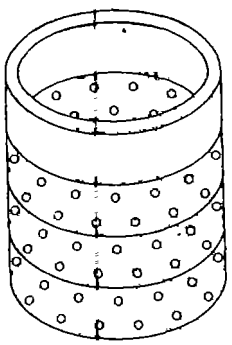
using drum sheet as lining material: Rs 180

using wooden log as lining material: Rs 500



4. A lined pit with honey comb brick work (1:6)

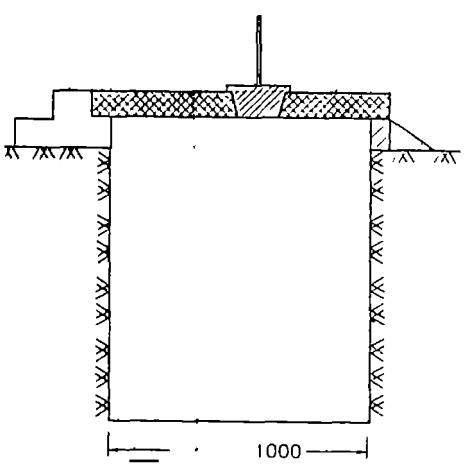
Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs)
1. Bricks	150	pcs	1 30	195
2 Cement	0.10	bag	140	14
3 Unskilled labour	1	m-day	60	60
4. Skilled labour	0.5	m-day	100	50
5. Contingency				11
Total				330



Dia & height of an RCC ring are 1000 & 250 resp

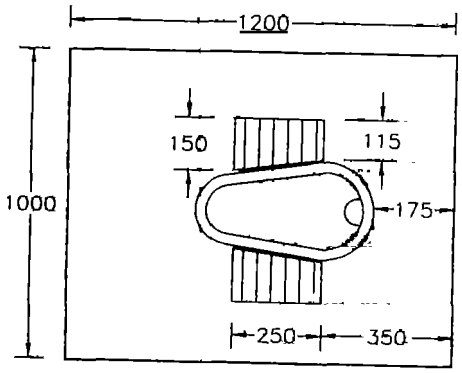
5. A lined pit with RCC rings

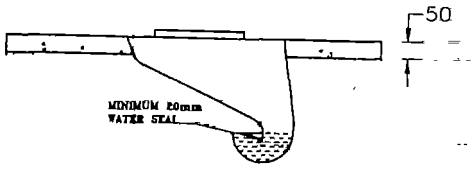
Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs)
1. Cement	1	bag	140	140
2. Sand	0 06	cum	400	24
3. Stone/brick chips	0.12	cum	400	48
4 Steel	6	kg	15	90
5. Unskilled Labour	0.5	m-day	60	30
6. Skilled labour	1	m-day	100	100
7. Contingency				18
Total				450



6. Wooden squatting platform (including hole cover)

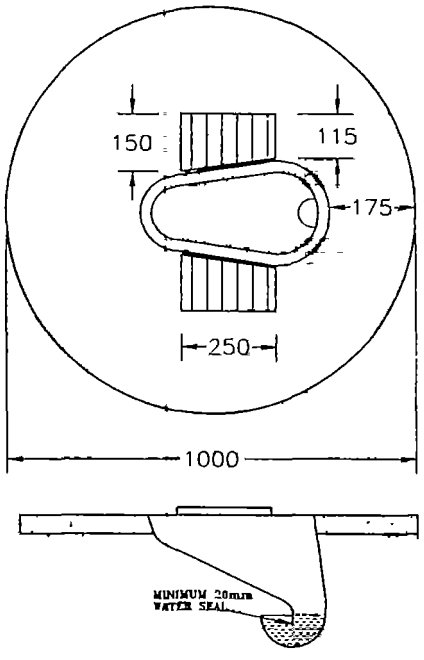
Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1 Timber	0.05	cum	7000	350
2. Skilled labor	1	m-day	100	100
3 Nails, pegs etc	LS			20
4 Contingency	LS			10
Total				480





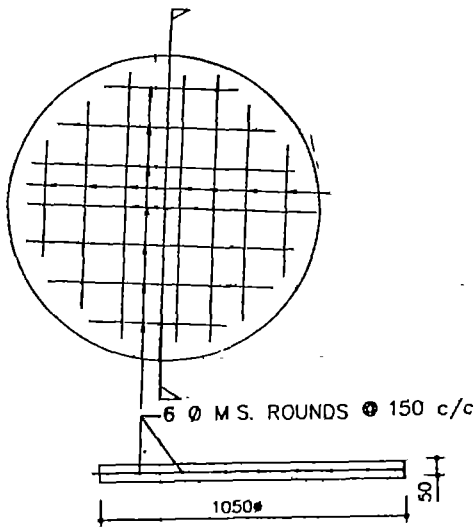
7. RCC squatting slab with waterseal cement pan

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Cement	0 4	bag	140	56
2. Sand	0.03	cum	400	12
3. Stone/brick chips	0 07	cum	400	28
4. Steel	3.5	kg	15	53
5. Cement concrete pan with trap	1	set	100	100
6 skilled labour	0.5	m-day	100	50
7 Contingency	LS			11
Total				260



8. Ferro cement squatting slab and waterseal cement concrete pan

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs)
1. Cement	0.33	bag	140	46
2 Sand	0 03	cum	400	12
3. Wire mesh	2	sqm	35	70
4. Plasticizer	0.3	ltr	40	12
5. CC pan with trap	1	set	100	100
6. Skilled labour	0.5	m-day	100	50
7. Contingency	LS			10
Total				300



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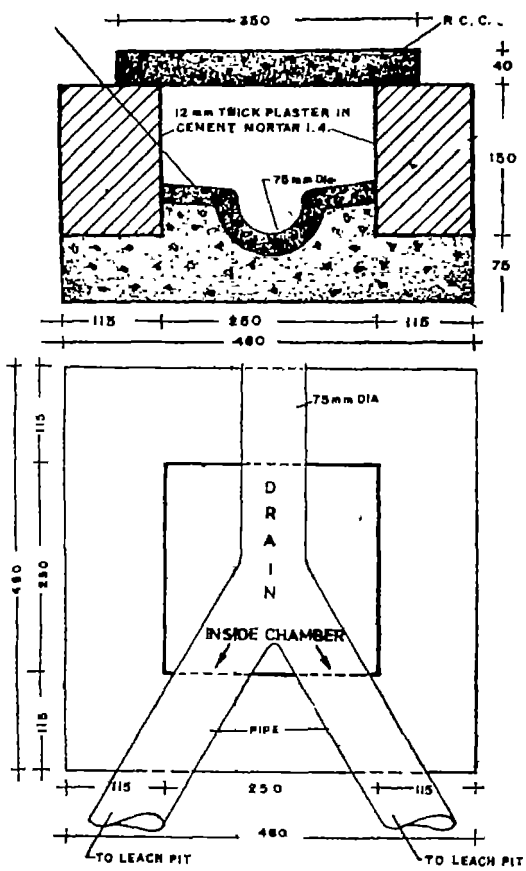


9. A re-inforced cement concrete (RCC) pit cover

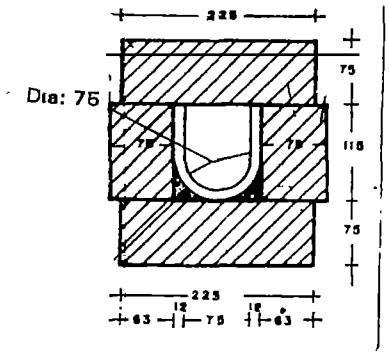
Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Sand	0.02	cum	400	8
2. Stone chips	0.04	cum	400	16
3. Cement	0.25	bag	140	35
4. Steel	2.5	kg	15	38
5. Skilled labour	0.5	m-day	100	50
6. Contingency	LS			13
Total				**160**

10. A stone pit-cover

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs)
1. 60 mm thick stone slab (in 2 pieces)	1.1	sqm	280	308
2. Contingency	LS			12
Total				**320**

11. A masonary junction chamber for a two-pit latrine

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs.)
1. Earth work	LS			5
2. Bricks	45	pcs	1.3	59
3 Cement	0.3	bag	140	42
4. Sand	0.04	cum	400	16
5. Stone/brick chips	0 45	cum	400	18
6. Steel	1.5	kg	15	23
7. Skilled labour	0.5	m-day	100	50
8. Contingency	LS			17
Total				**230**



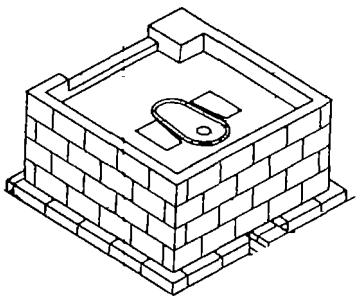
12. Masonary brick drain for a two-pit latrine

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Earth work	LS			5
2. Bricks	115	pcs	1.3	150
3. Cement	0.5	bag	140	70
4. Sand	0.075	cum	400	30
5. Skilled labour	0.5	m-day	100	50
6. Contingency	LS			15
Total				**320**

13. Stone-ware drain piping for a two-pit latrine

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs.)
1. 100 mm diameter stoneware pipe (600 mm length)	4	pcs	25	100
2. Skilled labour	0.25	m-day	100	25
Total				125

Remarks: For PVC pipe, the cost will be app Rs 500



Length : 1230
Width : 1030
Above ground : 230
Below ground : 225

14. A masonary squatting platform upto plinth level

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Earth work	LS			5
2. Bricks	106	pcs	1.3	138
3. Cement	0.4	bag	140	56
4. Sand	0.6	cum	400	54
5 Stone/brick chips	0.013	cum	400	5
6. Stone ballast	0.015	cum	140	21
7. Skilled labour	0 5	m-day	100	50
8 Unskilled labour	0.5	m-day	60	30
9. Contingency	LS			21
Total				380

15. Superstructure with mud-wall

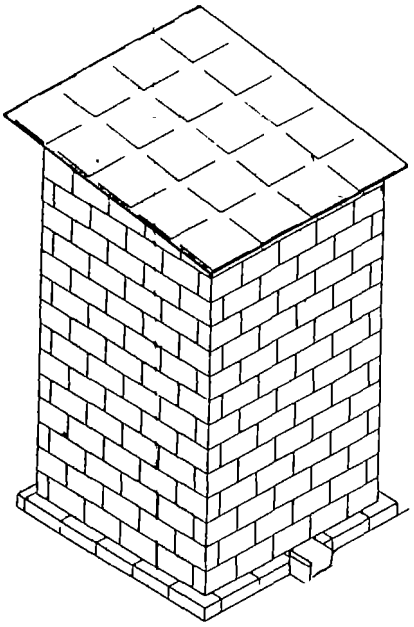
Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Moulding of mud	1	cum	50	50
2. Wood preservatives	LS			50
3. Unskilled labour	1	m-day	60	60
4 Contingency	LS			20
Total				180

16 Superstructure with hessian cloth

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Hessian cloth	6 7	sqm	23	154
2. Split bamboo	12	m	10	120
3 Unskilled labour	1	m-day	60	60
4. Contingency	LS			16
Total				350

17. Superstructure with tin sheet

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. 4 balli pillars (100 mm diameter)	12	m	25	300
2. 0.63 mm thick tin sheet (2 X 0.8 m)	12	sqm	160	1920
3. Skilled labour	0.5	m-day	100	50
4. Contingency	LS			30
Total				2300



Remarks: Roof construction has not been included in the estimate

18. Superstructure with 115 mm brick work (1:6)

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Bricks	268	pcs	1.30	348
2. Cement	1 2	bag	140	268
3. Sand	0.25	cum	400	100
4. Steel	2	kg	15	30
5. Unskilled labour	2	m-day	60	120
6. Skilled labour	2	m-day	100	200
7 Contingency	LS			34
Total				1100

19 Superstructure with 75 mm brick work

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1 Bricks	175	pcs	1.30	228
2. Cement	1	bag	140	140
3. Sand	0.2	cum	400	80
4 Unskilled labour	1	m-day	60	60
5. Skilled labour	1	m-day	100	100
6. Contingency	LS			22
Total				530

20. Re-inforced cement concrete (RCC) roofing

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs.)
1. Cement	0.6	bag	140	84
2. Sand	0 04	cum	400	16
3. Stone/brick chips	0.08	cum	400	32
4 Steel	6	kg	15	90
5. Unskilled labour	0.5	m-day	60	30
6. Skilled labour	0.5	m-day	100	50
7. Contingency	LS			8
Total				310

21. Stone-slab roofing

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs)	Amount (Rs.)
1 60 mm thick stone -slab (2 pieces)	1.5	sqm	280	420
2. Skilled labour	0.25	m-day	100	25
3 Contingency	LS			5
Total				450

22. Wooden door

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Ordinary timber (20 mm thick)	0.04	cum	7000	280
2. Fittings	LS			70
3. Skilled labour	1	m-day	100	100
Total				450

23. Door with wooden frame and CI sheet

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs.)
1. Wood work for door frame	0.025	cum	7000	175
2. Fittings	LS			70
3 C I sheet	1 5	sqm	160	240
4. Skilled labour	1	m-day	100	100
5. Contingency	LS			15
Total				**600**

24. Door with Iron frame and GI sheet

Description of material /labour/item	Qty	Unit	Rate/ Unit (Rs.)	Amount (Rs)
1. 25 X 25 X 3 mm Iron angle	9	m	15	135
2. Fittings	LS			70
3 G I sheet	1.2	sqm	160	192
4. Welding	LS			100
5. Contingency	LS			23
Total				**520**

Use of sample estimates:

The estimates worked out (24 in number) in the preceding section comprises of various items as might come handy to the implementing agencies covering a varied range of geo-hydrological and socio-economic conditions. For example, in cases where the soil is hard and the water table is 3 meter below surface level, there is no need to provide any lining for a pit construction. An unlined pit, therefore, may be constructed at an estimated cost of Rs 30 (estimate No 1) Similarly, if soil condition requires to construct a lined pit then one of the pit from the four different types (Estimate No 2, 3, 4 or 5) may be chosen as per the economic condition of the family or depending upon the policy of the state as they will consider appropriate for adoption in the sanitation programme.

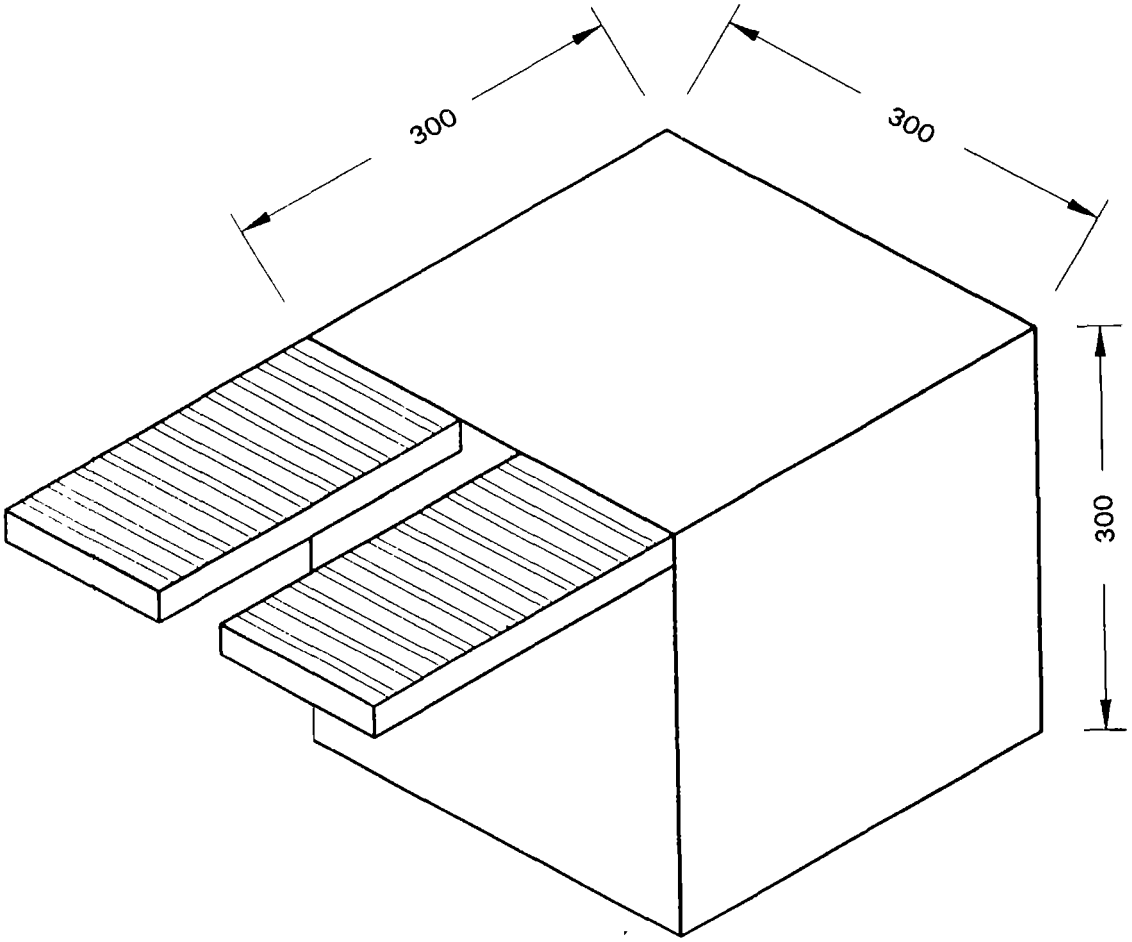
Summary of the estimates as discussed earlier is given below showing the range of various construction for different components:

Component	Description (Estimate No. Prefixed)		(Estimated cost(Rs)
I. Pit construction	1.	Un lined pit	30
	2.	Lined pit with bamboo matting	300
	3	Lined pit with earthen ring	170
	4.	Lined pit with honey-comb brick work (75mm thick)	330
	5.	Lined pit with RCC rings	450
II. Squatting platform (direct pit)	6.	Wooden squatting platform	480
	7	RCC squatting platform (waterseal)	260
	8.	FC squatting platform (waterseal)	300
III Pit cover	9.	RCC pit cover	160
	10	Stone pit cover	320
IV. Junction chamber	11	Masonry junction chamber for a two-pit latrine (*)	230
V Connecting drains	12.	Masonry brick drain	320
	13.	Stone-ware drain piping PVC drain piping	125 500
VI. Squatting platform with plinth and foundation	14.	Masonry squatting platform	380
VII Superstructure	15.	Mud-walled suprstr	180
	16.	Hessian cloth suprstr	350
	17	Tin sheet suprstr	2300
	18.	115 BW suprstr(1:6)	1100
	19.	75 BW suprstr (1.6)	530
VIII Roof	20.	RCC (1:2:4) roofing	310
	21	Stone slab roofing	450
IX Door	22.	Wooden door	450
	23.	Wooden frame & CI sheet	600
	24.	Iron frame & GI sheet	520

(*) Alternate material like using 'Y' segment of pipes or plastic junction chamber may reduce the cost substantially.

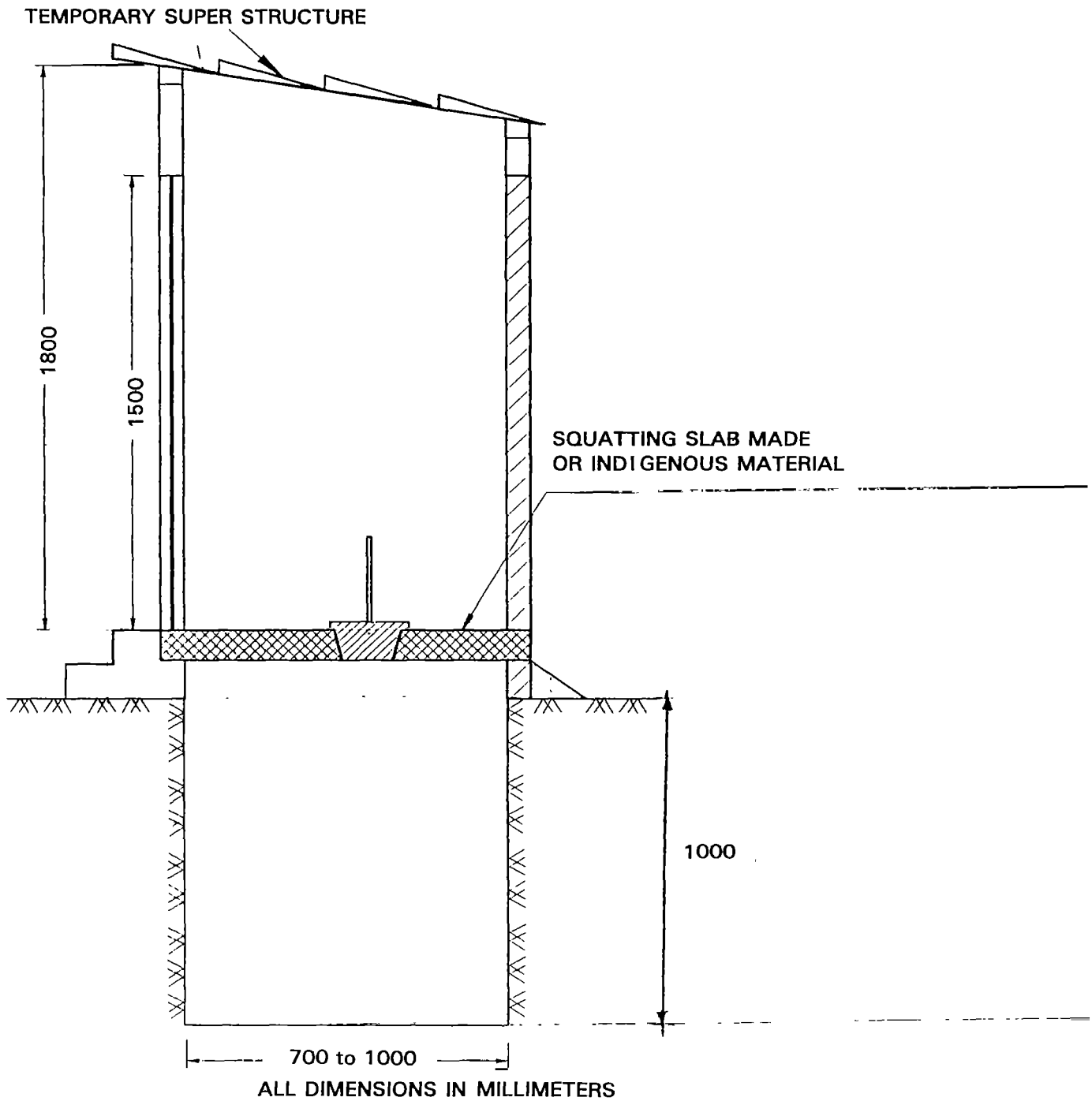
Depending upon the local situation, the implementing agencies need to develop similar estimates by including the local practices as may be appropriate. Thus, if a latrine design is chosen comprising of an unlined pit (Estimate No. 1) with a ferro cement squatting slab (Estimate No. 8) and a mud-walled superstructure (Estimate No. 15), the total cost of such latrine will be Rs 30 + Rs 300 + Rs 180 = Rs. 510. The cost of other types of latrines may also be worked out, similarly.

As a ready reference, the drawings of nineteen different types of latrines are attached which the concerned implementing agency may find handy while selecting a particular type under the CRSP and work out the construction cost based on the criteria discussed in the preceding sections.



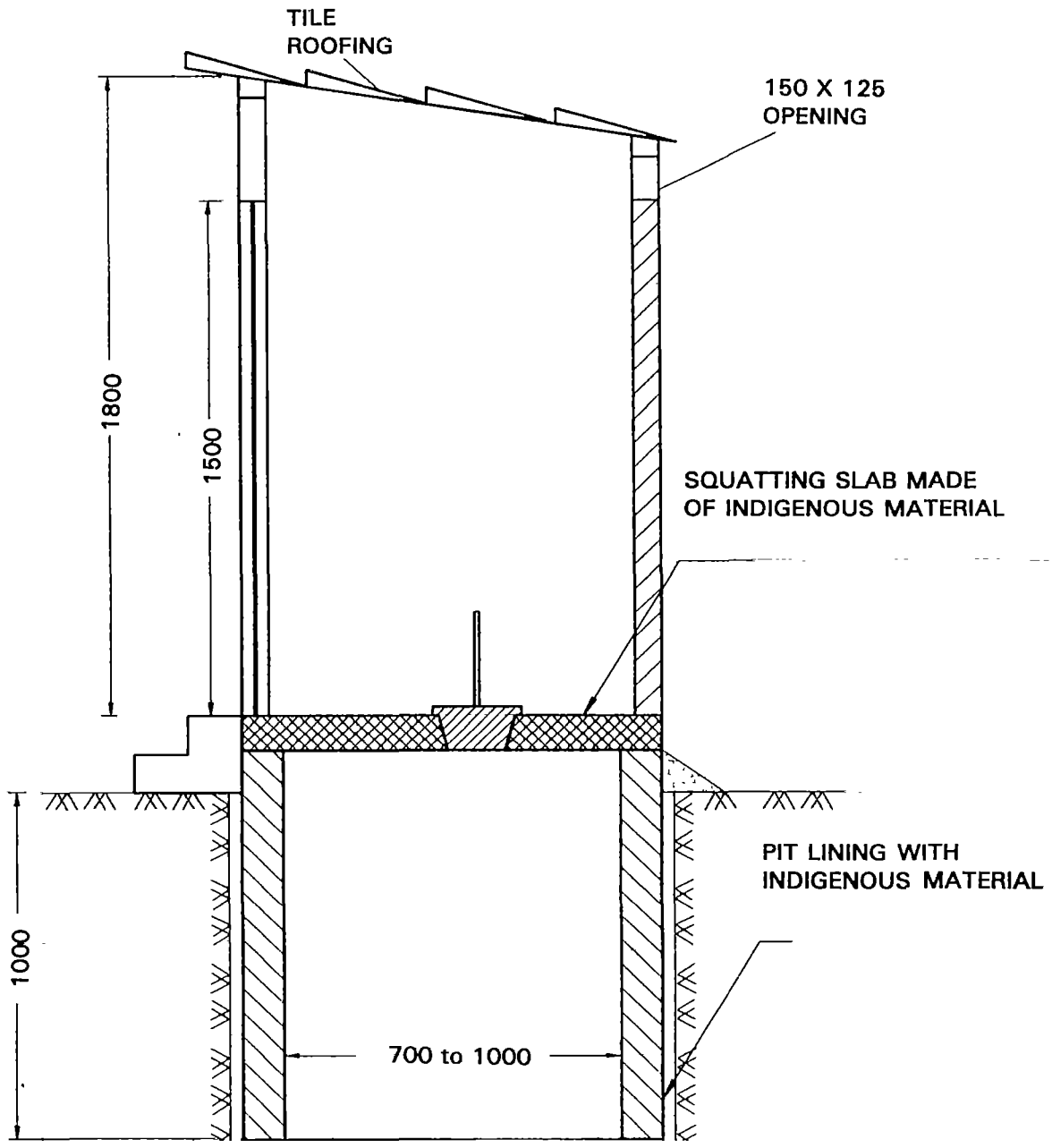
ALL DIMENSIONS IN MILLIMETERS

SHALLOW PIT LATRINE (Unlined)



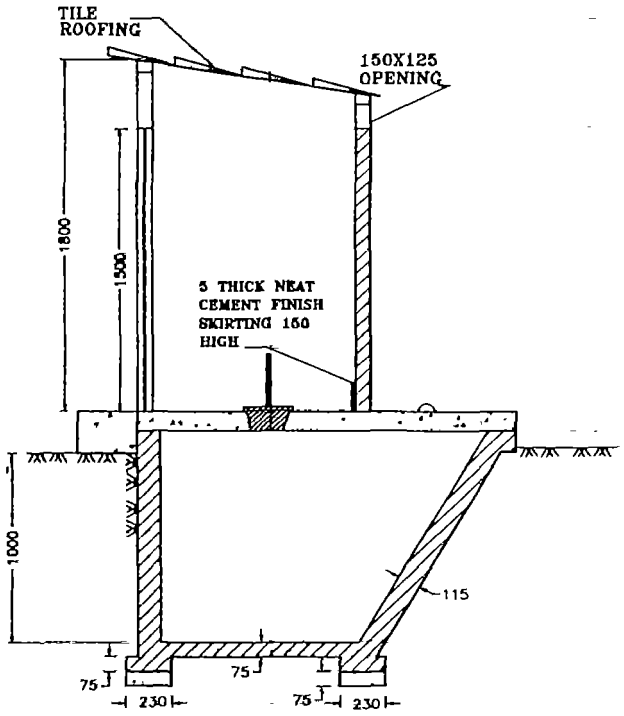
ALL DIMENSIONS IN MILLIMETERS

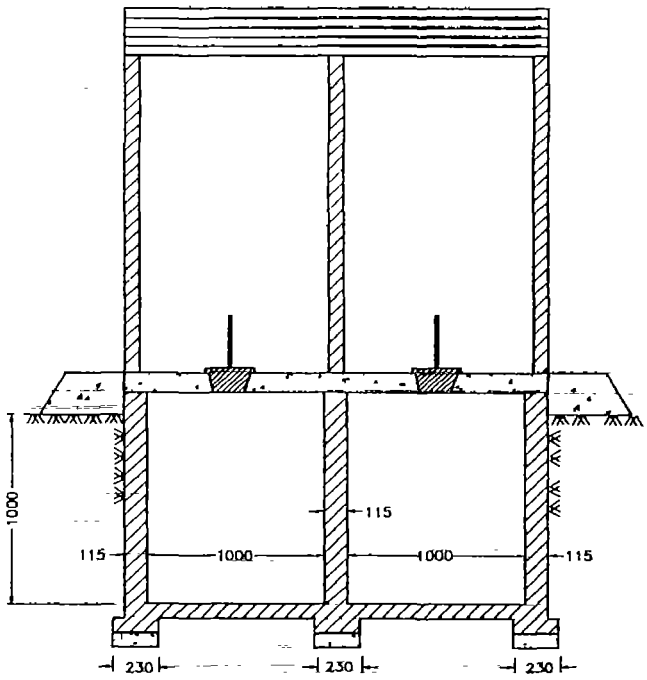
SIMPLE PIT LATRINE (Unlined)

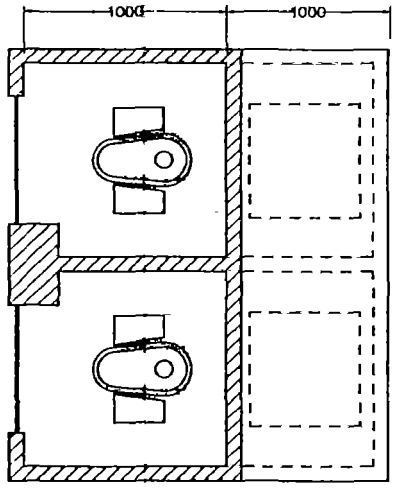


ALL DIMENSIONS IN MILLIMETERS

LATRINE WITH LINED PIT

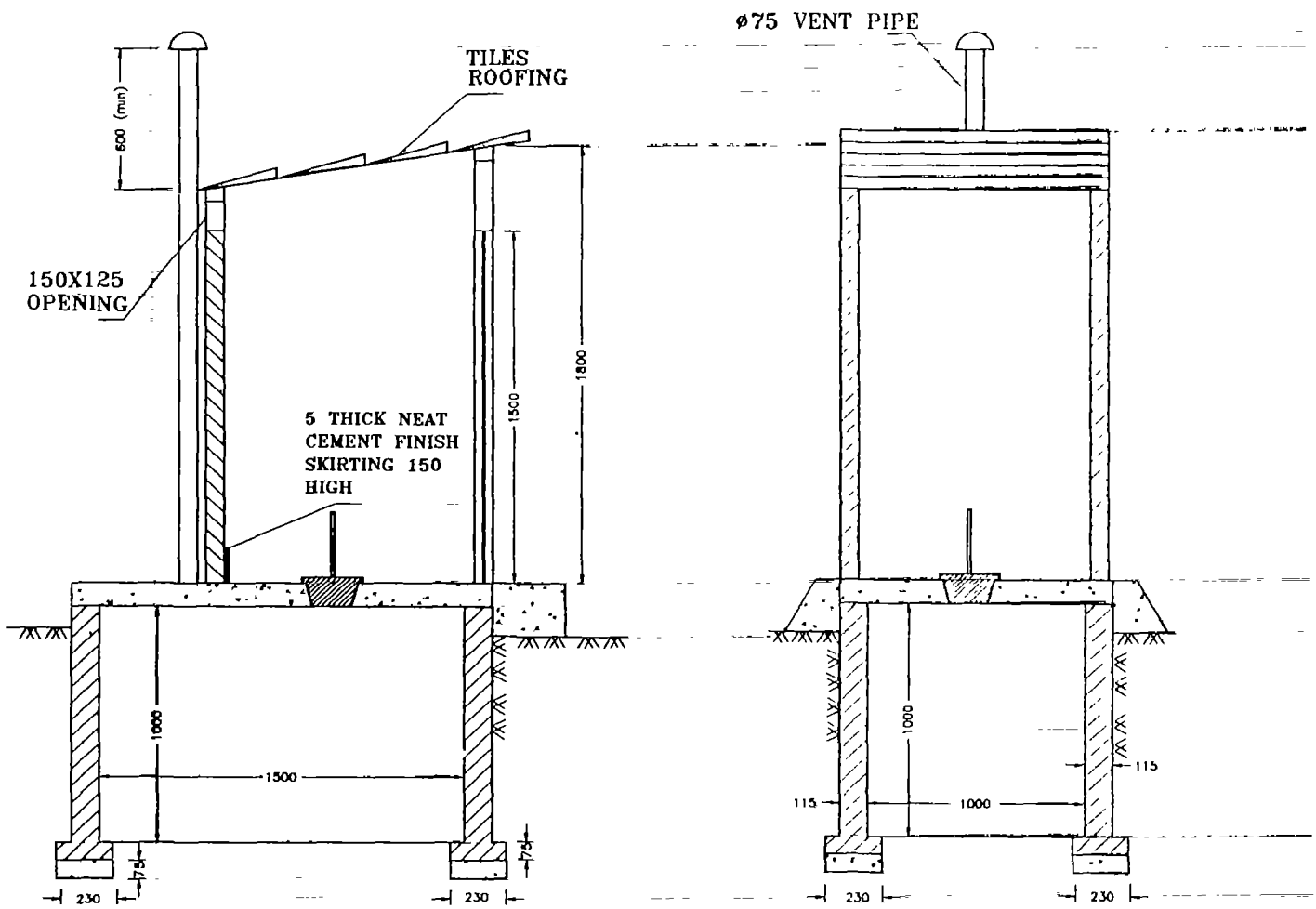






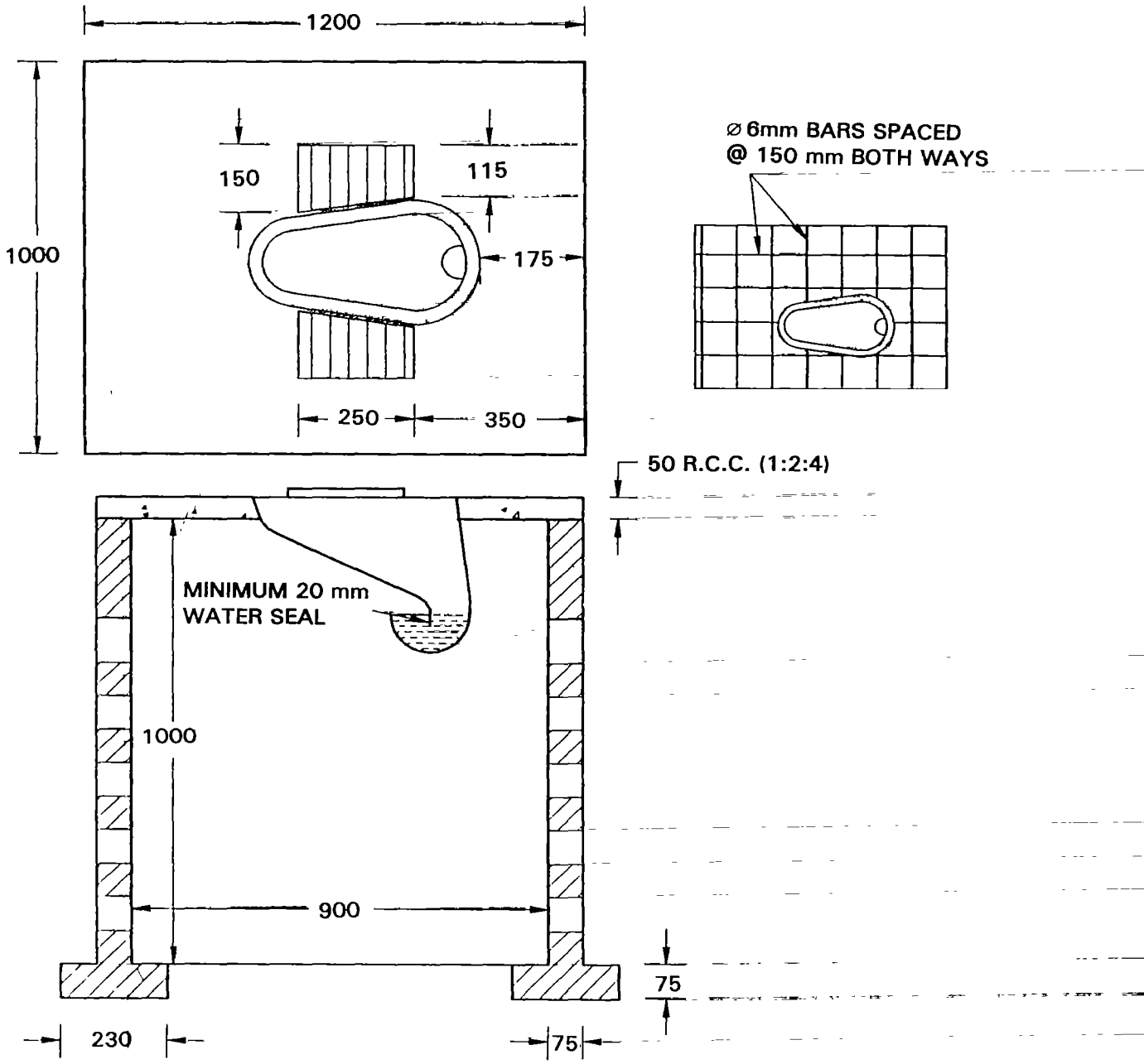
ALL DIMENSIONS IN MILLIMETERS

COMPOSTING LATRINE



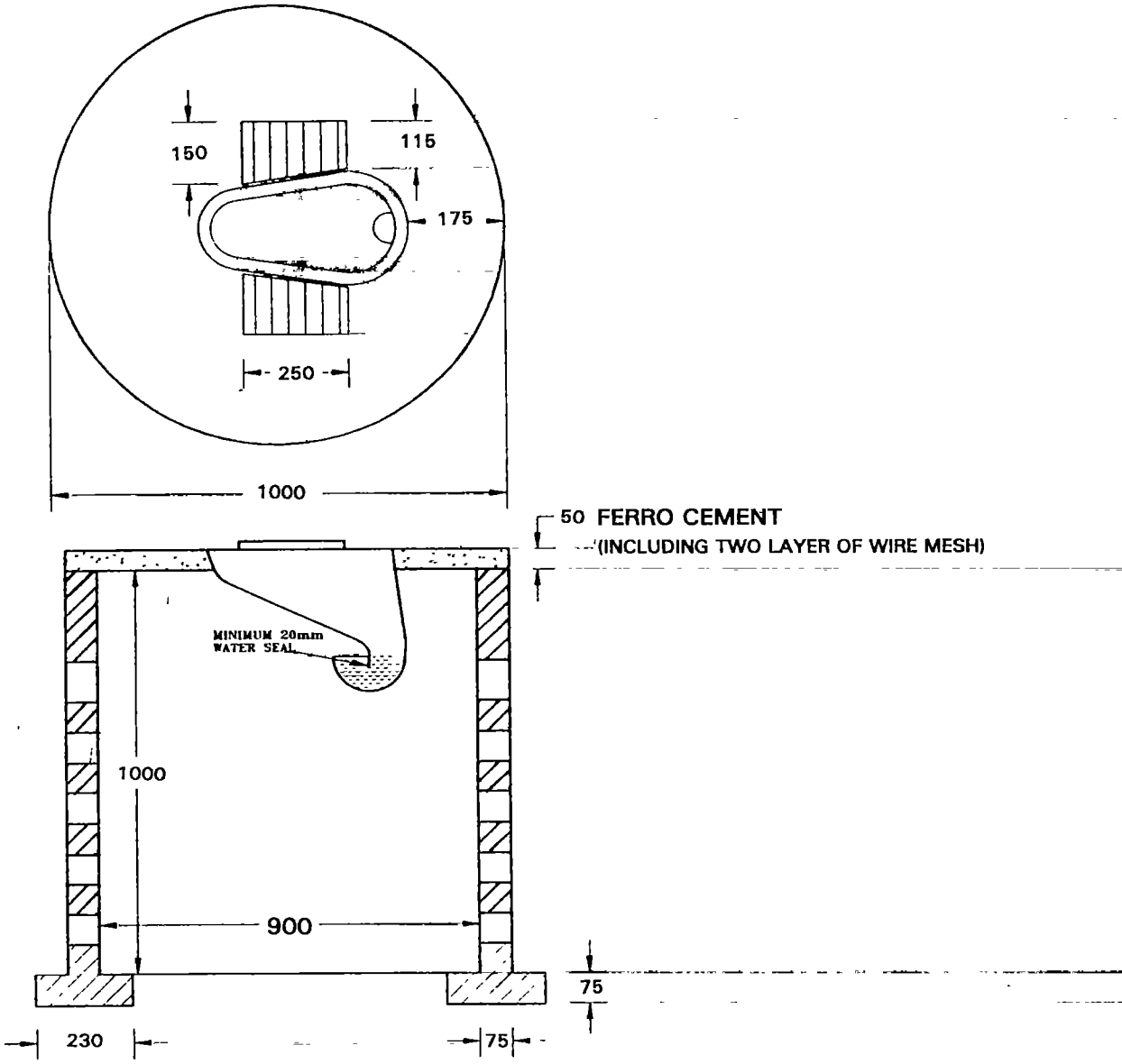
ALL DIMENSIONS IN MILLIMETERS

VENTILATED IMPROVED PIT LATRINE



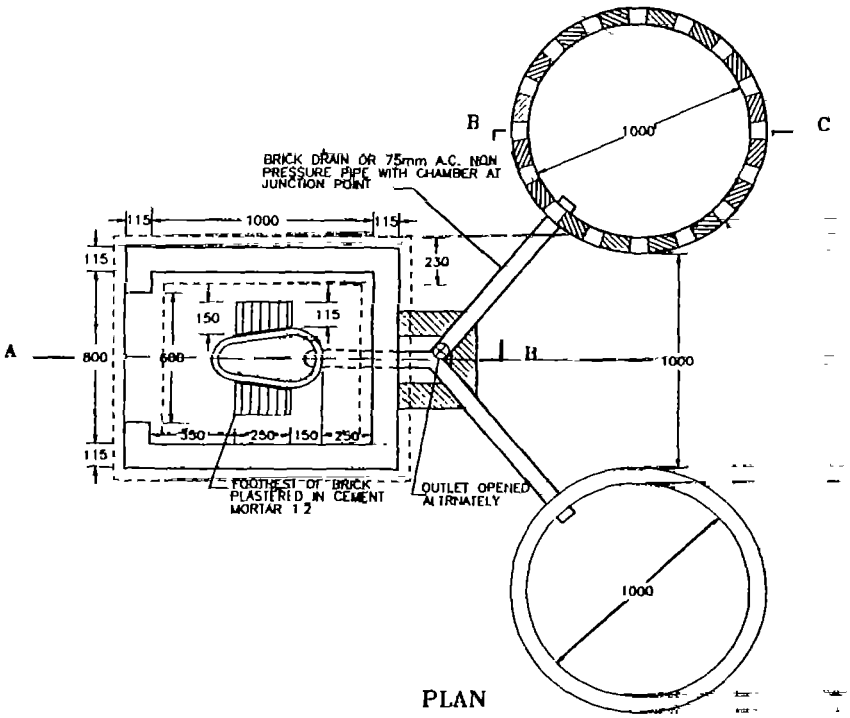
ALL DIMENSIONS IN MILLIMETERS

RECTANGULAR SQUATTING SLAB

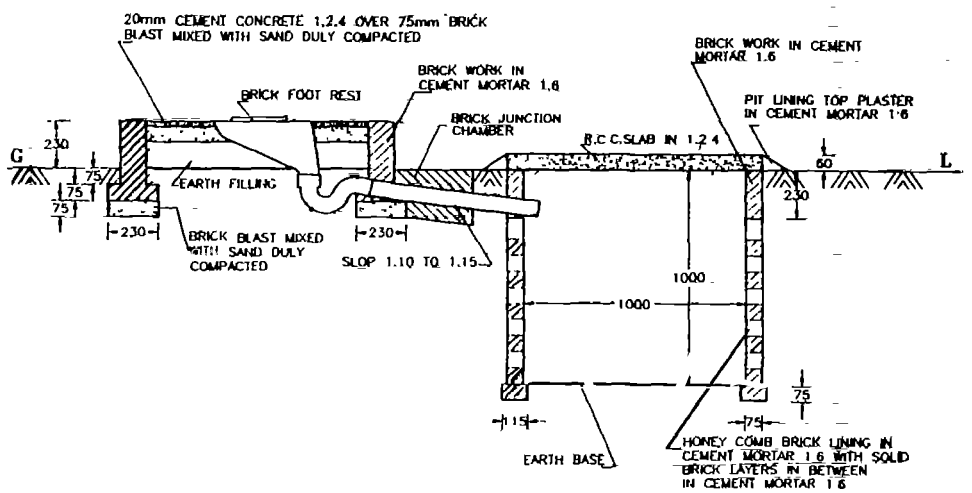


ALL DIMENSIONS IN MILLIMETERS

CIRCULAR SQUATTING SLAB



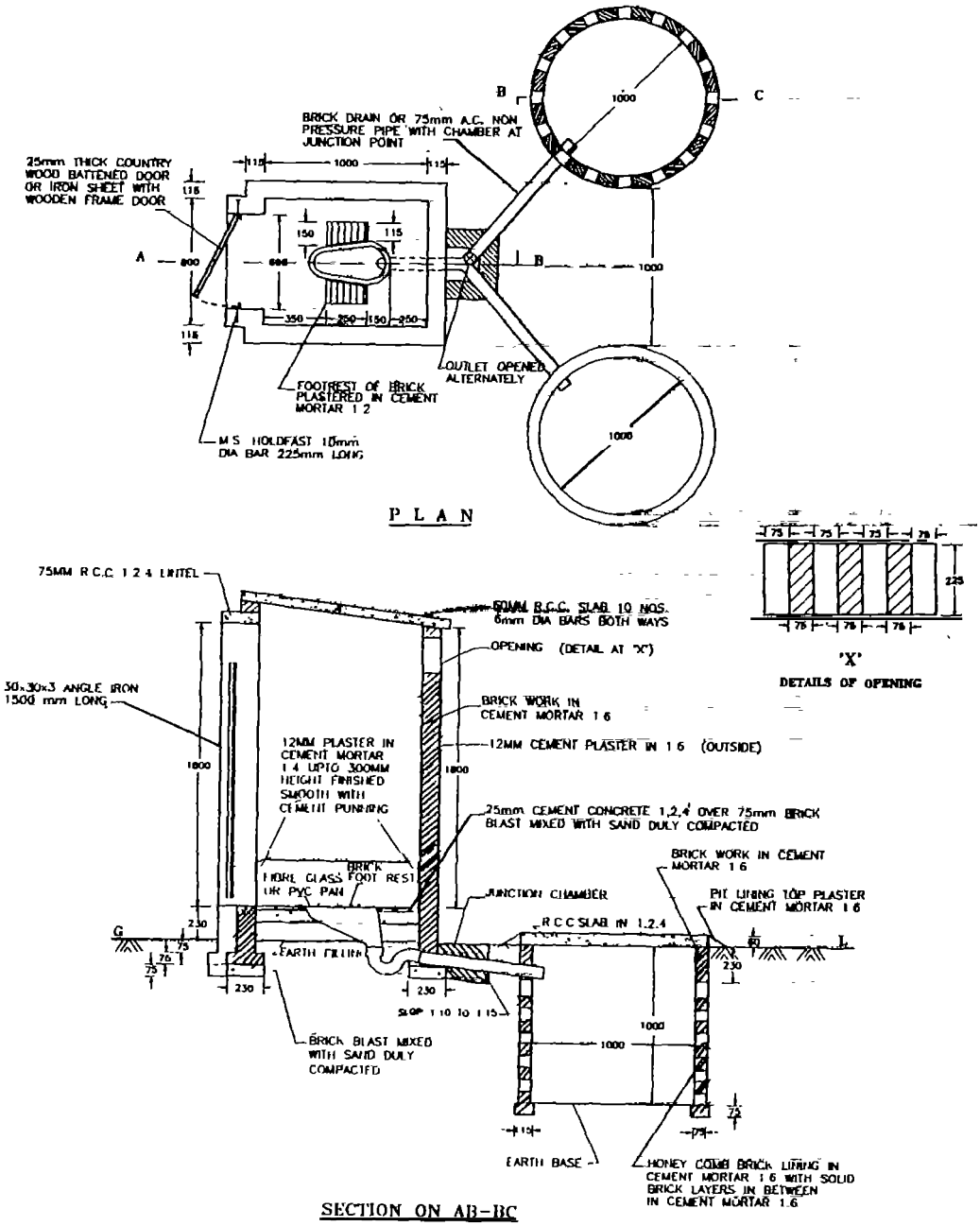
PLAN



SECTION ON AB–BC

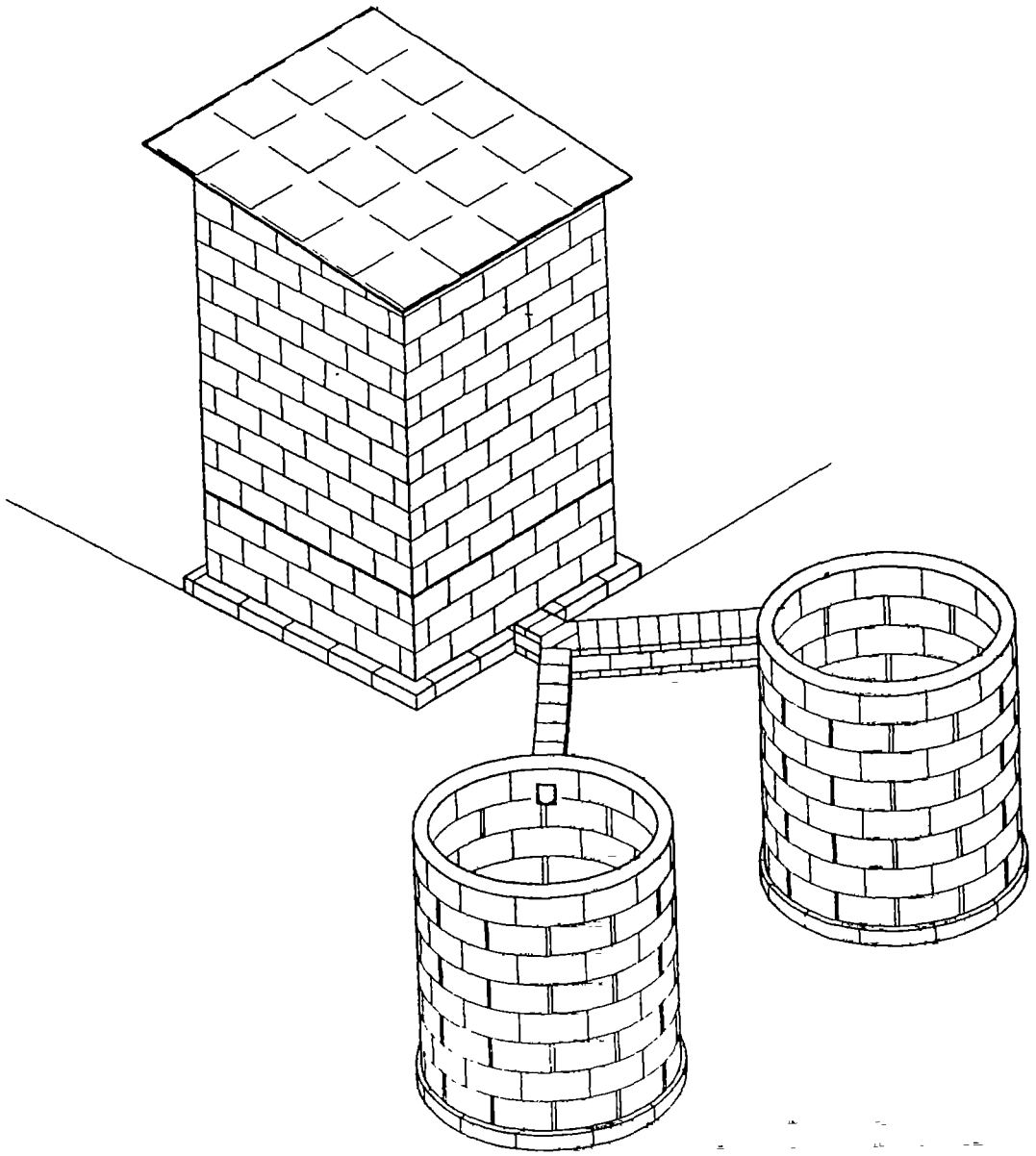
ALL DIMENSIONS IN MILLIMETERS

WATER-SEAL POUR FLUSH LATRINE (OPTION 1)

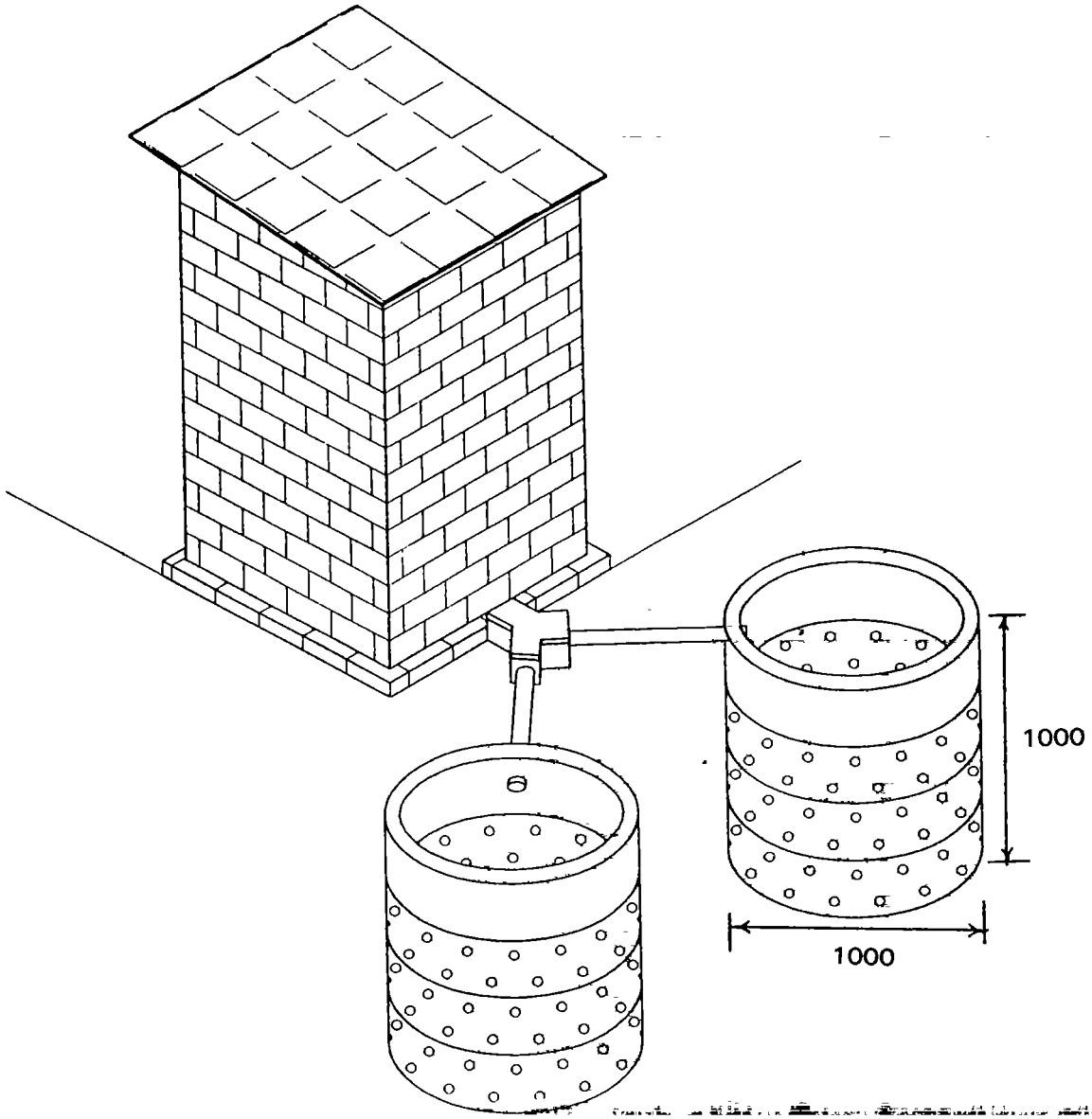


ALL DIMENSIONS IN MILLIMETERS

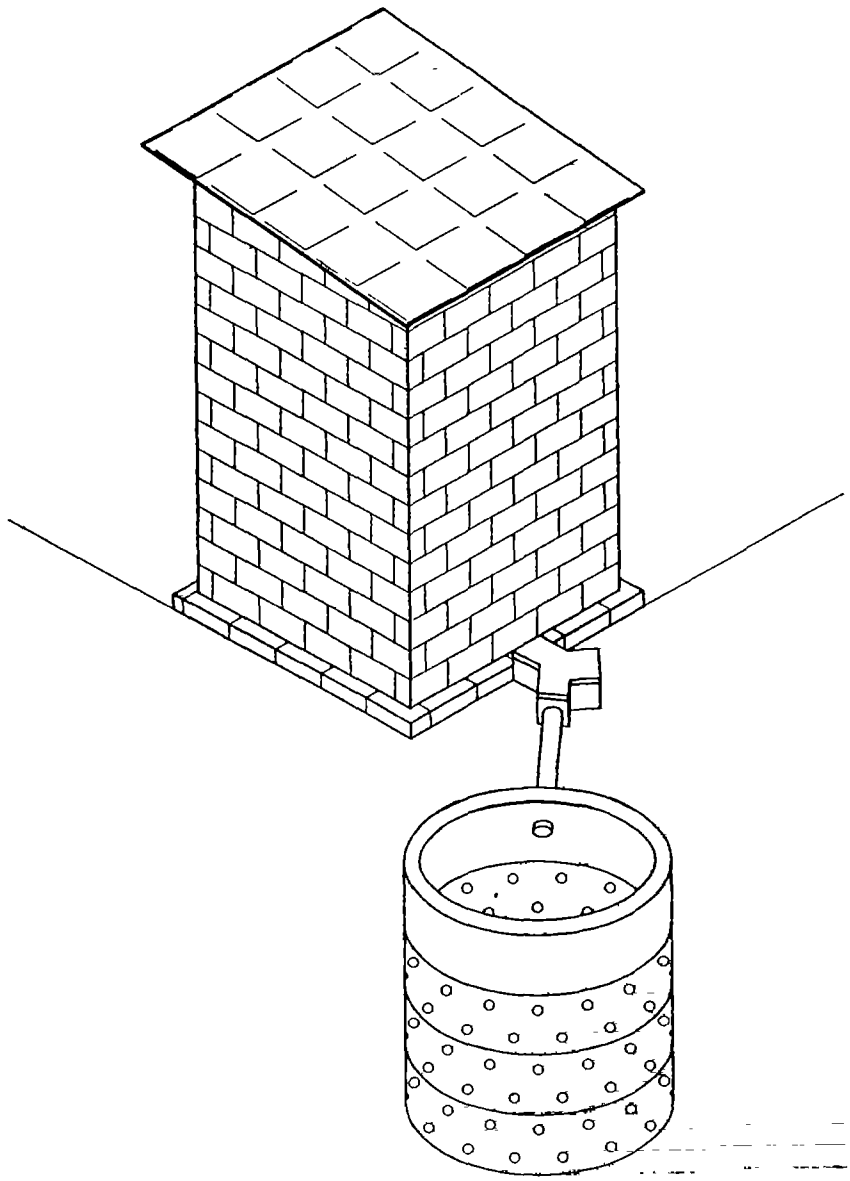
WATER-SEAL POUR FLUSH LATRINE (OPTION 2)



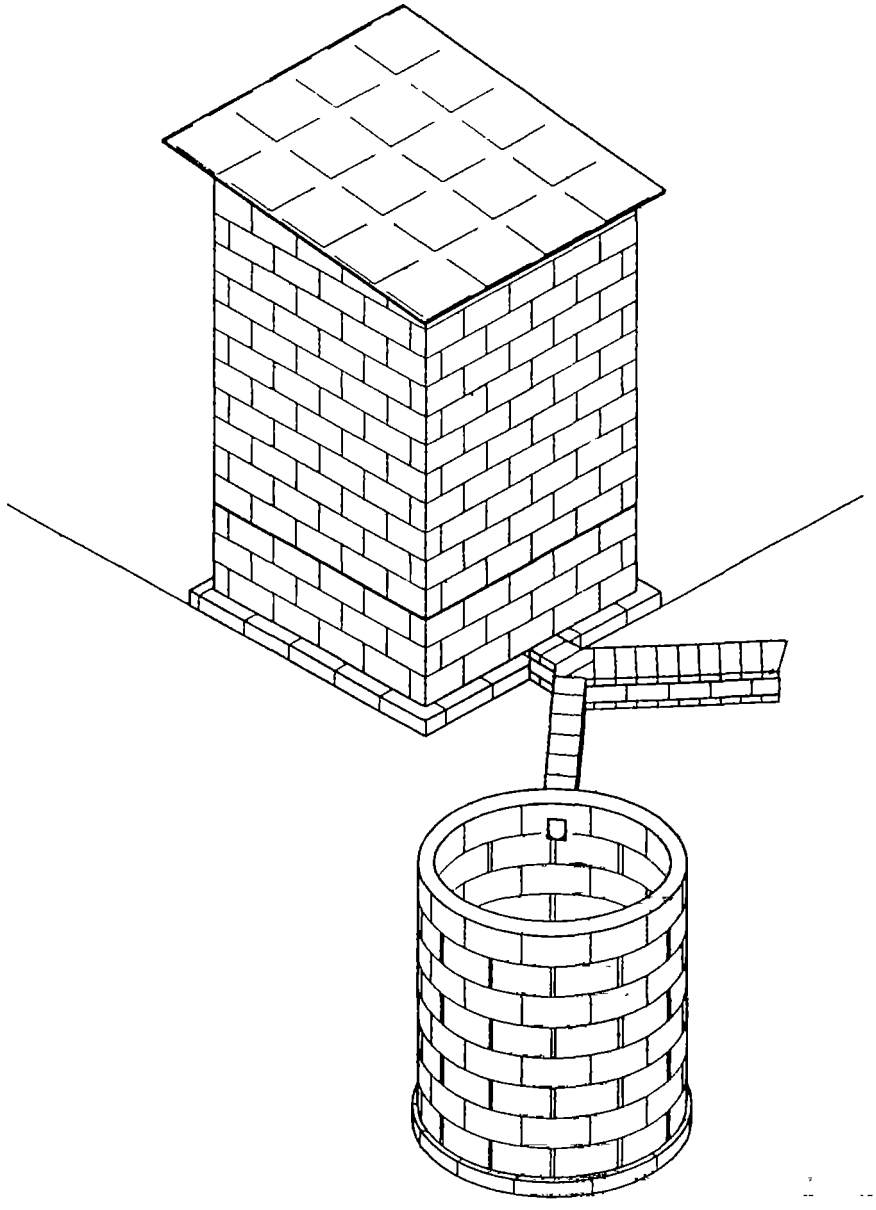
TWO PIT LATRINE (Brick Lined) WITH SUPER STRUCTURE



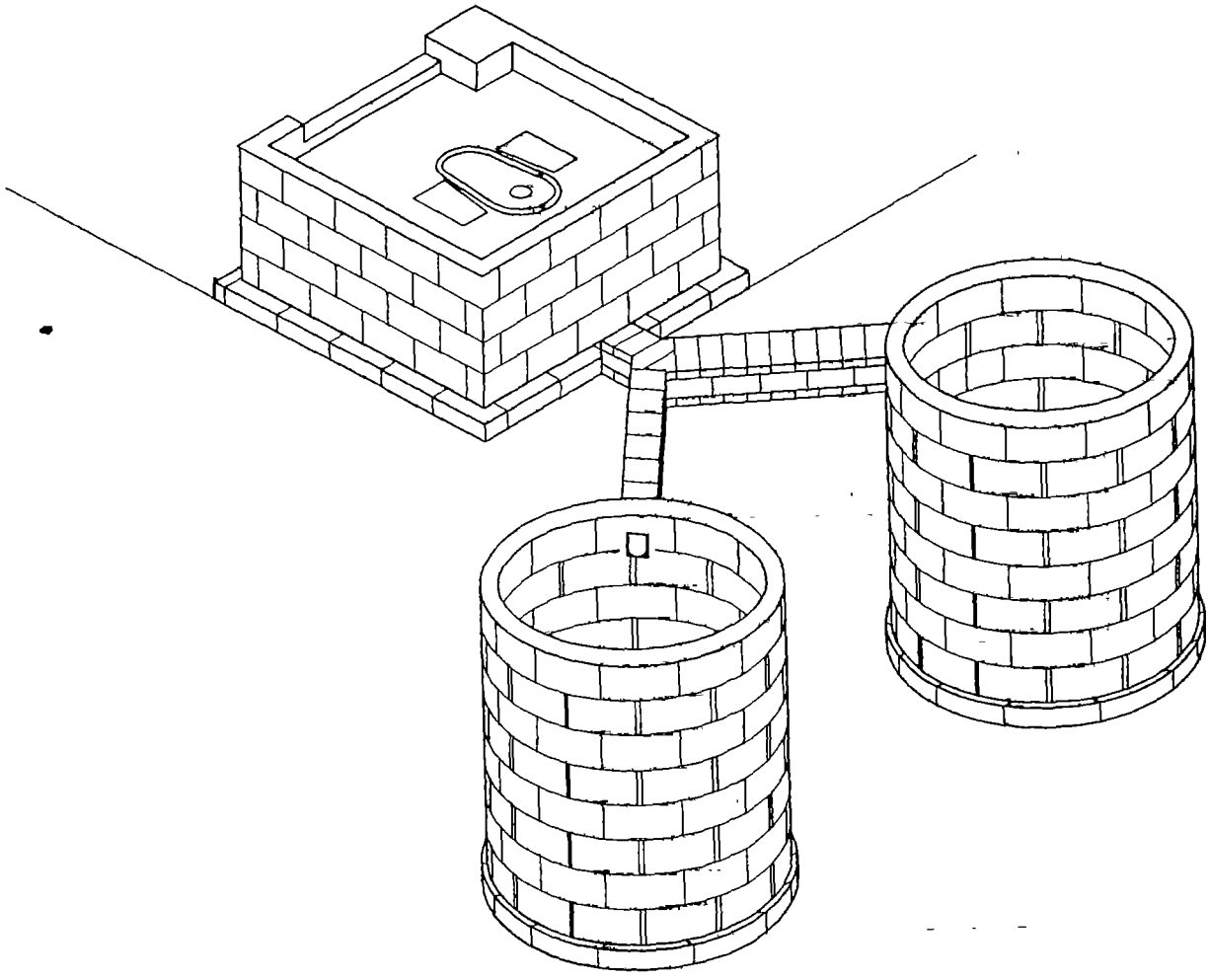
TWO PIT LATRINE (Conc. Lined) WITH SUPER STRUCTURE



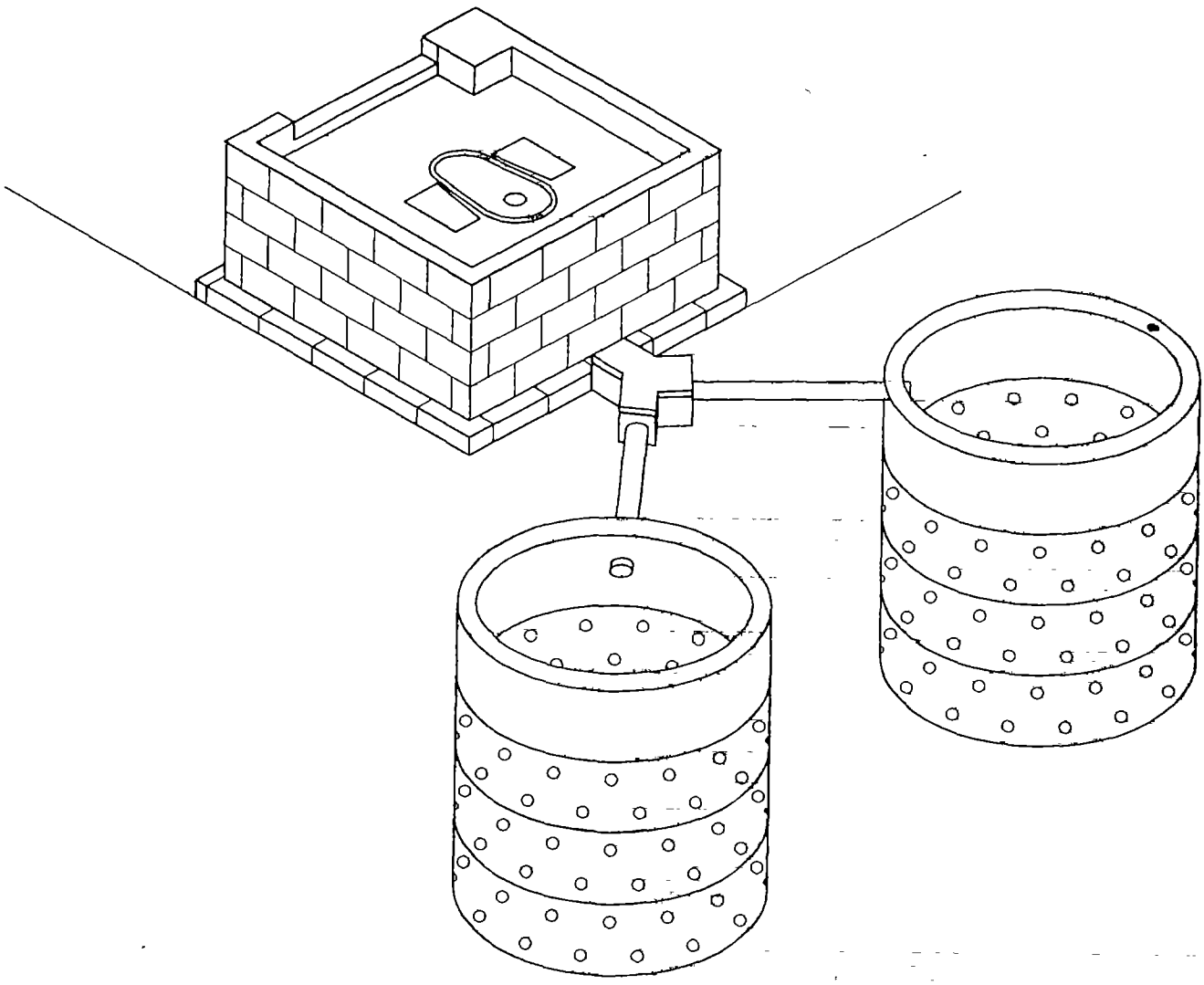
SINGLE OFFSET PIT LATRINE (Conc. Lined) WITH SUPER STRUCTURE



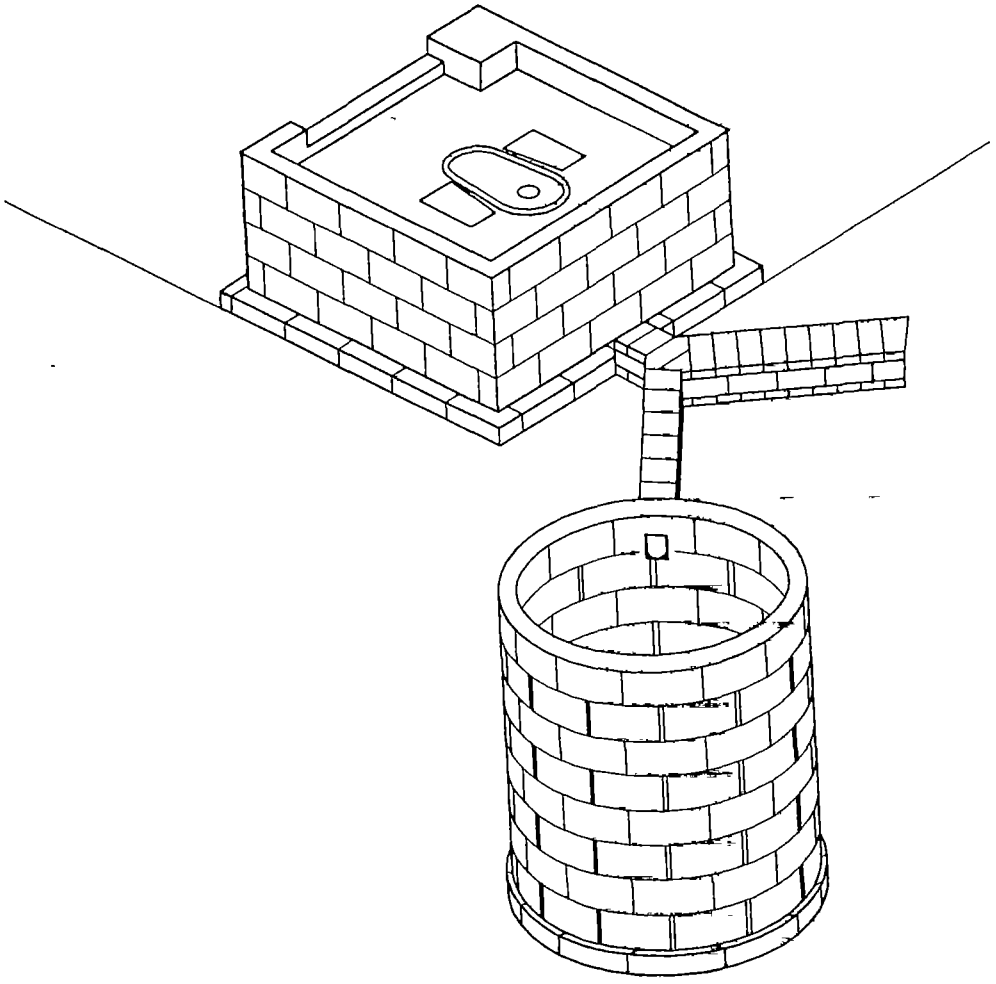
SINGLE OFFSET PIT LATRINE (Brick Lined) WITH SUPER STRUCTURE



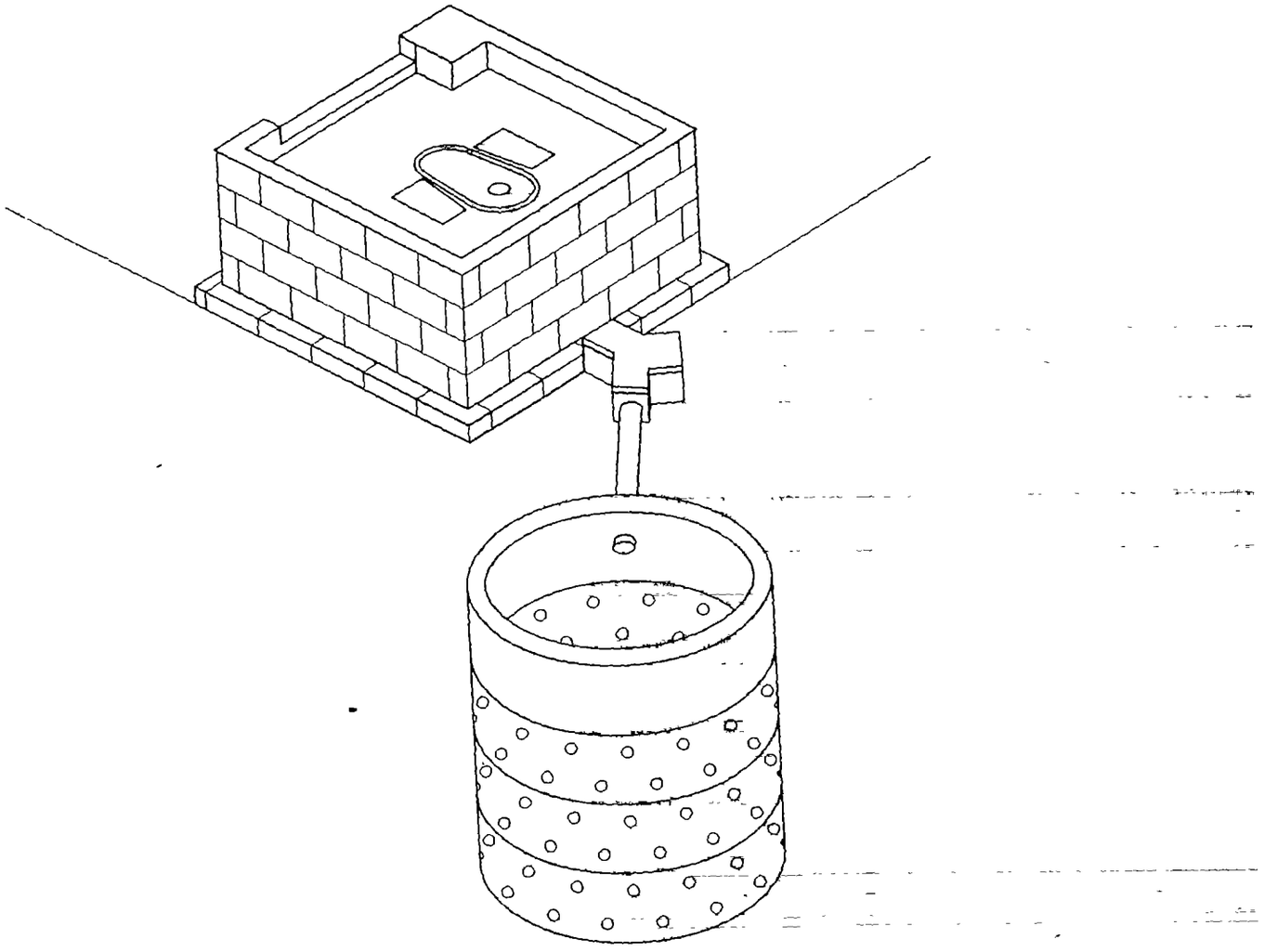
TWO PIT LATRINE (Brick Lined)
UPTO PLINTH LEVEL



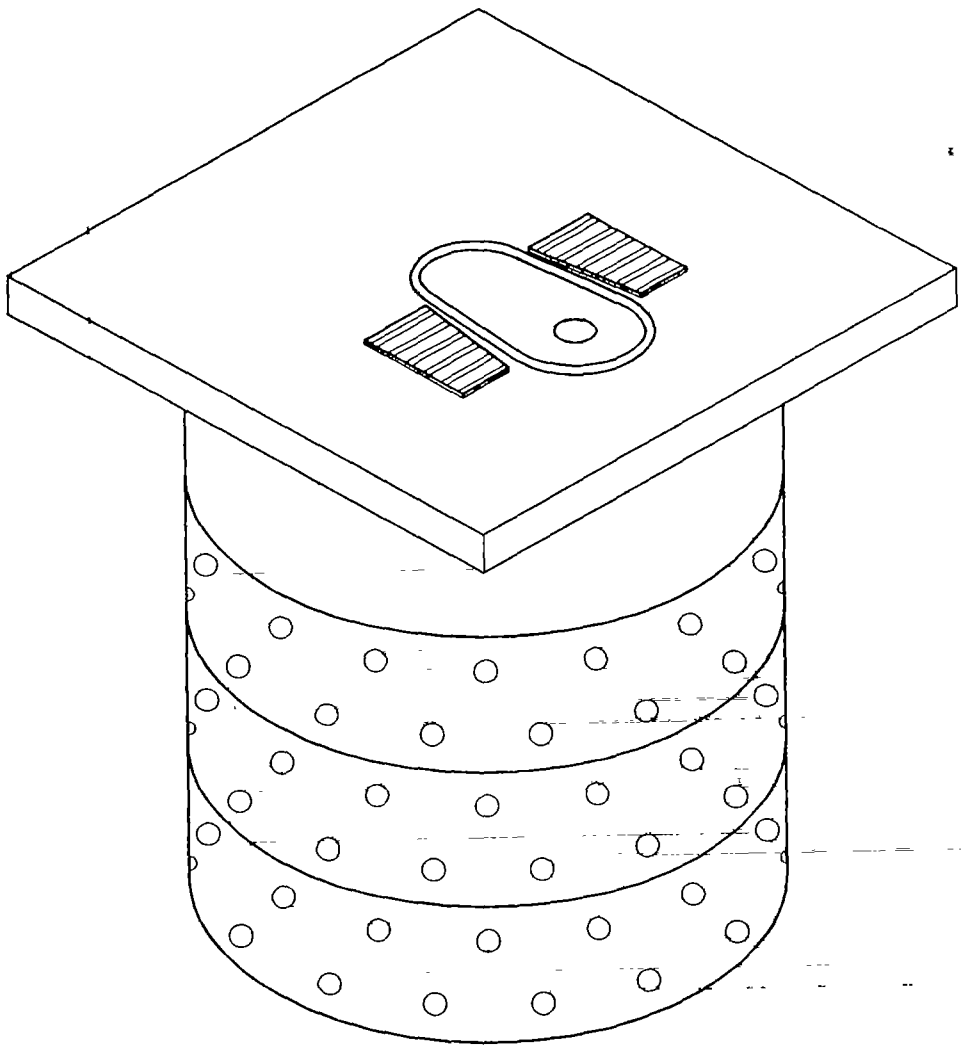
TWO PIT LATRINE (Conc. Lined)
UPTO PLINTH LEVEL



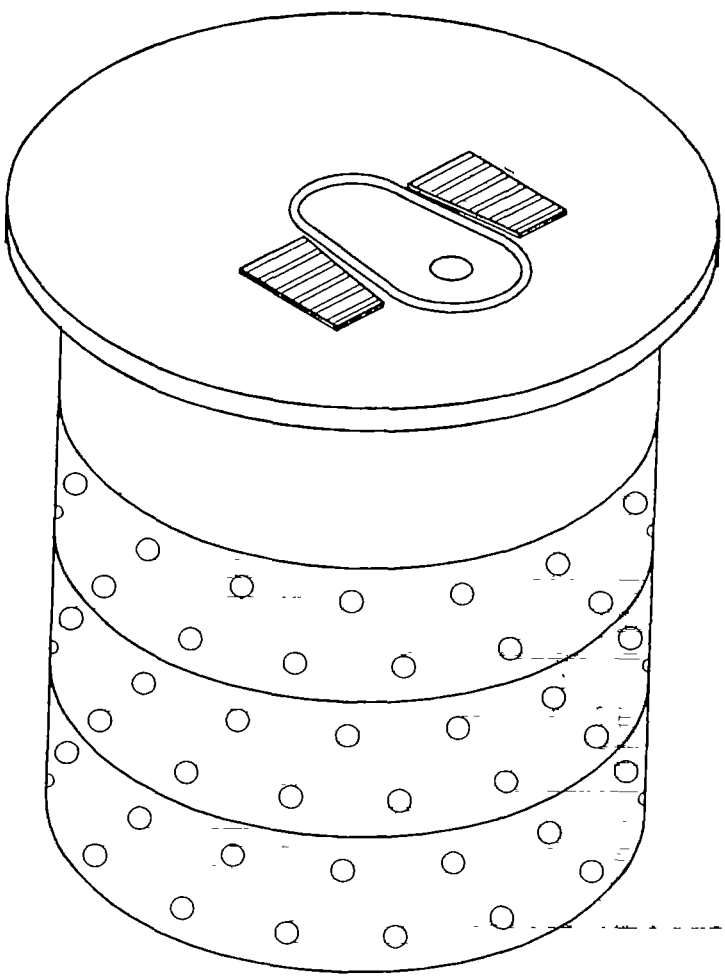
SINGLE OFFSET PIT LATRINE (Brick Lined) UPTO PLINTH LEVEL



SINGLE OFFSET PIT LATRINE (Conc. Lined) UPTO PLINTH LEVEL



RECTANGULAR SQUATTING SLAB



CIRCULAR SQUATTING SLAB

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