

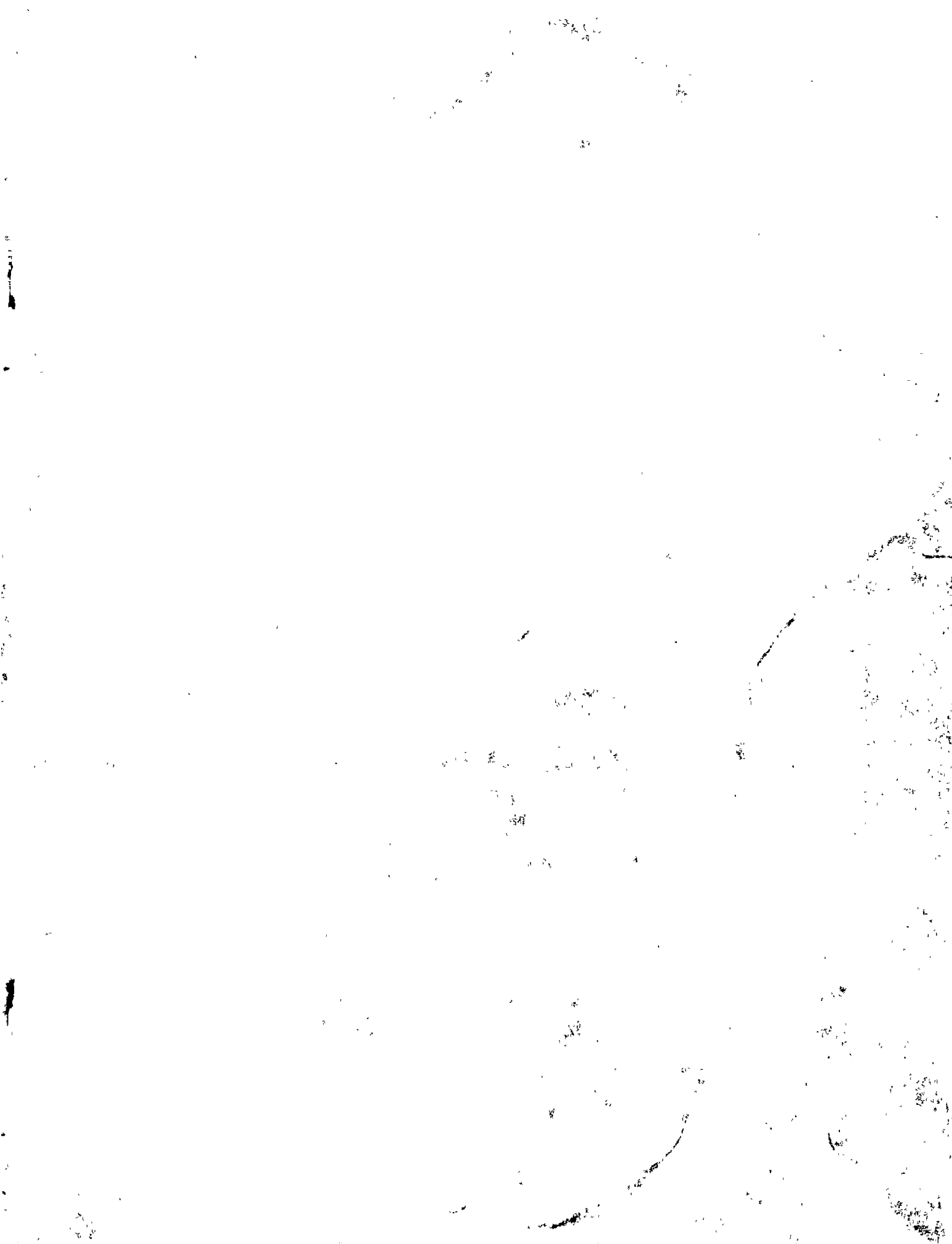
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# SANITATION

For Rural India



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# SANITATION FOR RURAL INDIA

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## FORWORD

National Environmental Engineering Research Institute (NEERI) has been engaged in rural sanitation programmes and development of appropriate technology for the same since its inception. In collaboration with Zilla Parishad, Nagpur it has constructed over 1200 latrines of its design and assessed the beneficial effects of these on the health status of the user communities.

In keeping with Seventh Plan objectives and the goals of the International Drinking Water Supply and Sanitation Decade (1981-90) of the United Nations, NEERI is providing R & D support for the success of the programmes by providing the implementing agencies with information and expertise relating to design, construction, use and maintenance of the pour flush water seal pit latrines and other low cost sanitation systems.

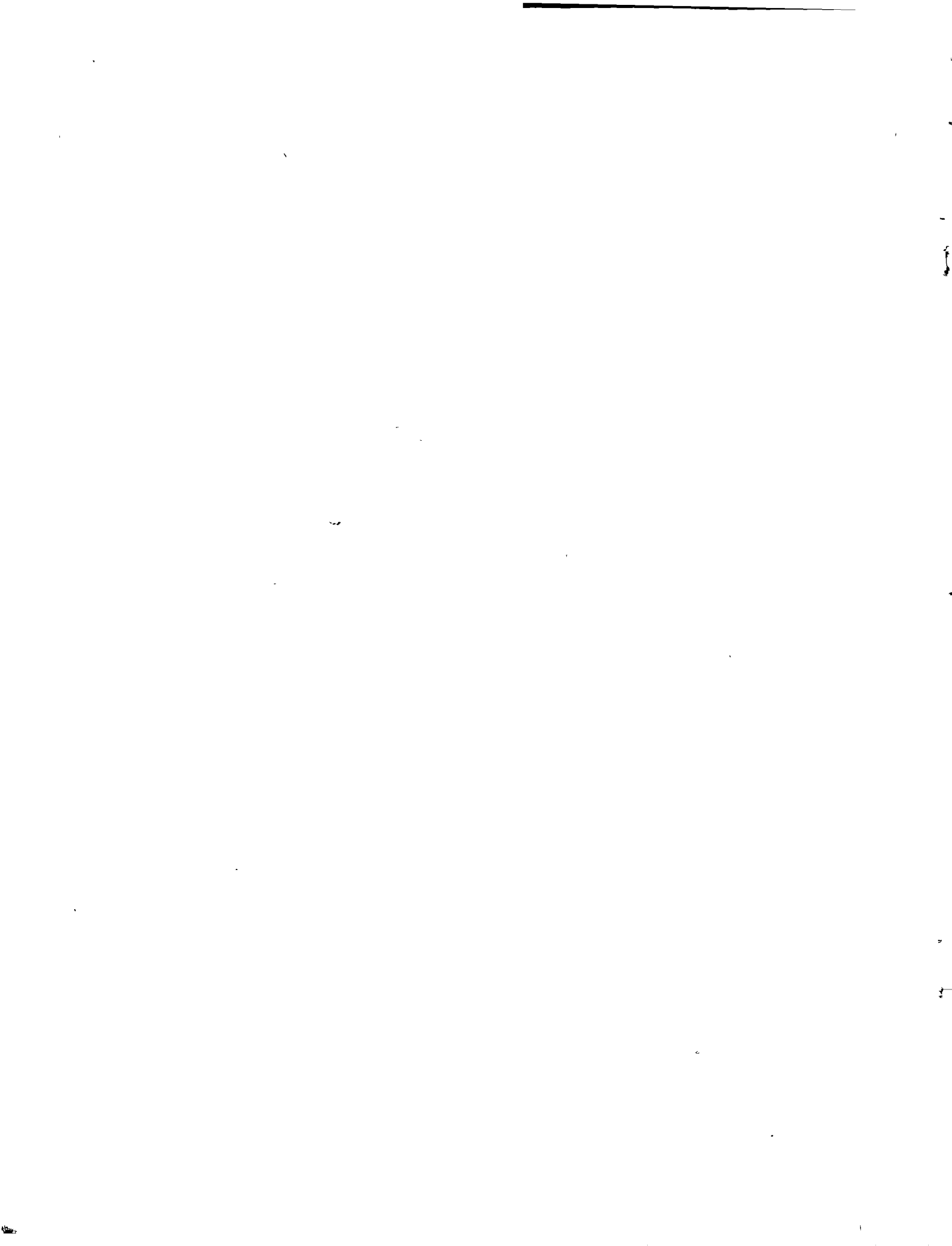
The sanitary latrines as evolved by NEERI are simple and easy to construct at a low cost. NEERI provides training to rural artisans in the art of casting of cement concrete water closet pans and traps and the construction of the pour flush pit latrines. It also supplies to the Public Health Engineering and Panchayat Raj Departments as cost, cement concrete moulds to be used for casting of pans and traps.

This brochure is intended to meet the needs of any organisation contemplating to promote rural sanitation and will be very useful to rural planners environmental engineers and administrators.

Nagpur  
June 5, 1986



(K. R. Bulusu)  
Acting Director



# Sanitation for Rural India

## Introduction

1981-90 has been declared as the International Drinking Water Supply and Sanitation Decade by countries all over the world. In this Decade the Government of India had proposed to provide by 1991 water supply to 100% and sanitation facilities to 25% of the estimated rural population of 597 million. In 1981 hardly 2.8 million people or 0.5% of the population in the rural areas has any means of sanitation and the target envisaged providing it for the remaining (i.e. 146.45 million) people by 1991. The task is gigantic and involves heavy monetary and technical inputs. Developing countries like ours have again many constraints (e. g. financial, material and personnel) for undertaking such programme and hence even for reduced targets of covering 5% of population all efforts will have to be made to simplify and economise the schemes to be undertaken and to use local materials and man-power to the maximum extent possible.

Sanitation of rural areas comprises disposal of human excreta, animal dung and agricultural residues in a manner avoiding nuisance and danger to health. This brochure describes the design, construction and use of simple and economical sanitary latrine system evolved and proved through actual field experiments and extension work by NEERI for on-site treatment and disposal of human excreta.

## The Rural Scene

Sanitary disposal of human excreta is an important aspect of environmental sanitation. It is one of the first basic steps which should be taken towards assuring clean and safe environment in the rural areas of our country. The term rural is considered here as areas where agriculture is the chief or even sole occupation, there is lack of diversity of skill and where dwellings are scattered or in small groups. More than 75% of India's population comes under this category of rural population. They are economically poor, educationally backward and are not socially organised. Variation in climate, soil, physiography, culture and customs are noticed from region to region. Although these variations may influence the type of excreta disposal methods, defecation in open fields has been the most common. Thus, the problem of safe disposal of human excreta in rural India is complex and a gigantic task.

## Open Defecation

One of the major deficiencies environmental sanitation in these areas is that latrines are conspicuously absent. Because of this, people resort to defecation in open fields and sheltered places in the vicinity of water sources and excreta along with its potential disease

causing organisms are left exposed for vectors of transmission to spread diseases to susceptible hosts. In some areas, some service type of latrines have been introduced by local self government. But these are not always satisfactory and become insanitary as they are not properly maintained.

### Family Latrines

The pathogenic organisms in the human excreta cause soil and water pollution. These organisms can remain alive in moist soil for some time (Table I) and are easily transmitted to food articles and drinking water sources. The rural population is constantly exposed to infection and this risk continues for generations.

This is evident from high prevalence of ankylostomiasis, ascariasis, cholera, diahorrea and other gastro intestinal diseases in rural populations. Infants and children are the most affected. It has been estimated that atleast 50 million cases of infection and five million deaths occur every year arising primarily from improper disposal of human waste. This problem, therefore is of prime importance for improvement of the health of the nation and calls for immediate attention. The first thing to be done is to discourage defecation in open by providing family latrines and thus containing the excreta in a manner that it will not pollute surface soil, water or be accessible to flies. In this task the development of a suitable type of latrine which is clean and sanitary is of fundamental importance to create the necessary public awareness in favour of using them.

**TABLE I : SURVIVAL OF HUMAN PATHOGENS**

Pathogens	Survival time
Viruses	Less than or equal to 6 months but generally 3 months
Bacteria	Less than or equal to 3 months but generally 2 months
Protozoa	Less than or equal to 10 years but generally 2, days
Helminths	Less than or equal to 7 years, but generally 2 years

Consumption of contaminated food and water causes fresh infection in the community and thereby perpetuate ill health. Hookworm larvae can enter the human body by penetrating through delicate skin between toes of the feet when people walk bare foot over soil contaminated by human excreta. All such transmission can be prevented by use of latrines which would contain the fecal matter in closed underground pits and not allow the rain, storm water or flies to have any access to it. The disease causing organisms in the excreta would then die a natural death when stored for two years.

### Benefits

The sanitary latrines of NEERI design give the following benefits to its users :

- \* Prevents contamination of the soils and sources of drinking water and thereby reduces sickness due to water borne infections, diseases and worm infestation amongst the rural communities;



- \* Will curtail medical bills and thereby the expenditure to be incurred by individuals as well as the Government on Public Health and Welfare Schemes.
- \* Improved health status of the rural communities will help to increase agricultural production and enable a vast majority in rural communities to rise above the poverty line.
- \* Reduction in odour and fly nuisance in village surrounding and it would improve the aesthetics of the place.
- \* Useful manure rich in NPK is available.
- \* Immense convenience to all the users especially the old, sick, disabled, ladies and children round the year.

### **Hand flushed water seal pit latrines**

Latrines of different designs have been developed in Afro-Asian countries in the past 30 years to suit the local conditions and habits of people. These are the dry pit latrines, board hole latrines, off-set compost-pit latrines, double vault compost latrines, aqua-privies and septic tank latrines. Of all the varieties, hand flushed water seal two pit latrines have been found to be sanitary and most appropriate for use in rural India.

### **Advantages of such latrine**

- \* Larger capacity of the pits (for treating and storing the excreta) as compared to a bored hole latrine;
- \* Permanent location and therefore no need to shift super structure every time a pit or bored hole gets filled up;
- \* Freedom from small and fly nuisance;
- \* Simplicity of construction requiring only semi-skilled labour which is available in villages. No special equipment is required such as an auger used in case of a bored hole latrine;
- \* Low cost compared to septic tank latrines or aqua-privies.

### **NEERI desing latrine**

In India hand flushed Water seal latrines have been promoted by different agencies such as NEERI, PARI, Lucknow, Rural Sanitation Unit of ICMR and Sulabha international. Latrines of NEERI design consist of a cement concrete marble mosaic finish water closet pan with a separate cement concrete trap of 19 mm deep water seal connected to two pits through 100 mm diameter glazed stone ware (SWG) or A. C. Pipes via junction chamber. Only one pit is operated at a time by keeping the inlet to the other pit blocked at the junction chamber. Faeces are discharged from the pan to the pit by abluition and flushing water. Water soaks into the soil below and around the pit while the face-

es get digested due to microbial action and is converted into humus. Its quantity has been estimated to be between 45 to 30 liters per capita per year so that it takes about 2--3 years for a pit of 0.9 m diameter and 0.95 m (usable) depth to get filled up when used regularly by a family of five persons. When one pit is full it is disconnected by blocking its inlet pipe at the junction chamber and the other pit is connected to the latrine and put into operation. The contents of the first pit are allowed to mature and dry out over a period of one to two years when the other pit is being used. It can be then removed and used as manure and the pit made ready for subsequent use.

The digested material (humus) collected in the pits is rich in fertilizing elements N, P, K, and can be used as an excellent manure thereby returning at intervals as a part of the cost of construction of the latrine to its owner/user.

The space required for construction of these latrines including the pits and their active leaching zone is not very large (e. g less than 10 m<sup>2</sup>). Houses in rural areas will normally be able to accommodate such type of latrine for the use of family members. Where space available is less, two neighbouring households can jointly use a common set of pits connected to separate latrine enclosures and share the manure formed in the pits.

Experience has shown that except in special circumstances community latrines are a failure in rural areas. No agency working in villages in our country would undertake the responsibility of maintenance of these latrines. Lack of cleanliness, privacy and distance to be walked are also other obstacles in the use of community latrines. NEERI has therefore recommended the construction of latrines for every individual household or family in rural areas.

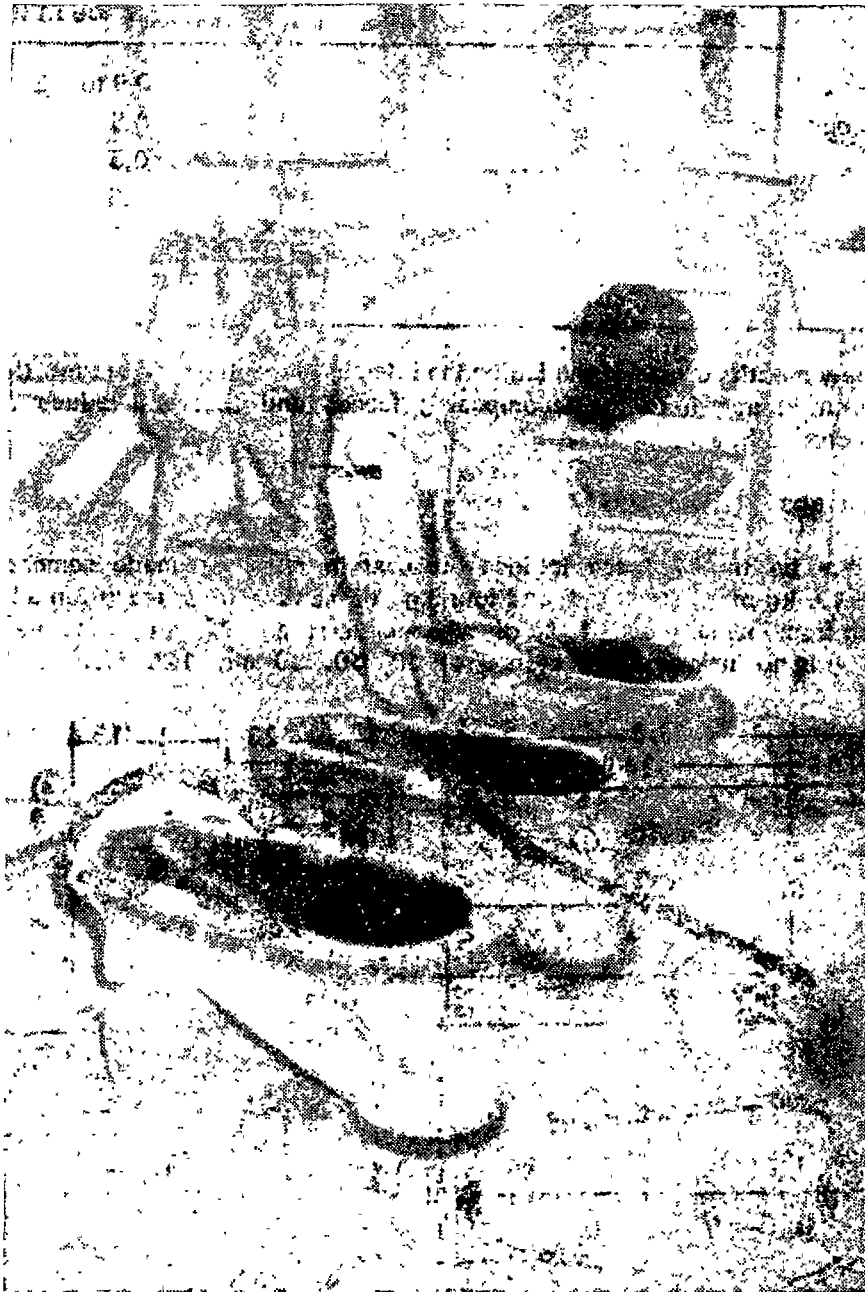
### **Location**

Water used for flushing of pan and entering into digestion cum soakage pits of the latrines and that released by the decomposing excreta seeps through the surrounding soil and may reach ground water table or the foundations and substructures of neighbouring houses so as to make these damp and weak. Bacteria (some of which would be pathogenic discharged by sick persons and carriers) and chemical contaminants may enter the ground water and make it unsafe for drinking purposes. It is therefore necessary that the pit latrines are kept on the downstream side of any well (supplying drinking water to the rural communities) and at sufficient distance from wells and other structures depending upon the type and texture of the soils. Recommended safe distances between pits and wells for different types of soils are as under.

- i) Fine textured soil such as clay (effective particle size 0.2 mm. or less) -6 metres.
- ii) Coarse soil (effective particle size 0.2 to 0.3 mm )-15 meters.
- iii) If the soil is still coarser, a site study will have to be undertaken to decide upon the safe distance.



pans and traps are easy to make for village artisans, strong and rugged and can withstand rough handling and usage likely to be met in rural areas.



Cement Concrete WC pans under preparation at Institute's Rural Sanitation Workshop

#### **Soakage cum digestion pits**

These are important components of the latrine system. These eliminate conveyance of excreta and provide for self contained and on the spot treatment systems. Constructed behind the latrine, these pits receive (one at a time), digest and store the excremental matter for the desired (2 to 3 years) period. These are constructed circular in shape 90 cms inter-

nal diameter and 1.5 to 1.8 m below ground. The sides of the pits are supported by providing a lining of suitable local available material e. g. honey combed brick 'jally', perforated old empty tar drums, pre-cast cement concrete burnt clay rings with holes. This lining is raised slightly (about 1 cm) above the ground and the upper 30 cm portion is made 'puckka' so as to prevent entry of storm water and to bear the load of the 5 cm thick reinforced cement concrete (RCC) cover placed on top of the pits. Flat dome or slab covers of reinforced cement concrete are made in two parts on site and kept on pits to protect anybody from falling in and to prevent access of flies and other insects to contents of the pits. About 5 to 8 cms thick earth layer and about 20 cms wide is made around the edges of the RCC cover to prevent entry of the insects like cockroaches which may work as vectors of transmission of disease germs.

### Fertilizing elements

The soakage cum digestion pits get filled up to the invert of the incoming pipe within about two to three years while being used by a family of five persons. The humus formed in the pit due to digestion of organic material contains valuable fertilizing elements such as nitrogen, phosphorous and potash. The approximate quantities of these contributed by a person per year are as under :

1. Nitrogen as N	:	1.46 kg;
2. Phosphorous as P <sub>2</sub> O <sub>5</sub>	:	0.87 kg;
3. Potash as K <sub>2</sub> O	:	0.83 kg;

Thus the quantities of manurial elements accumulated in the pit over a period of two years when used by a family of five persons would be 14.6 kg N, 8.7 kg P, 7.3 kg K together with 200 kg of dry humus. Considering the present day (1986) price of inorganic fertilizers in the country, the value of these manurial elements work out to Rs. 5/- per kg each for nitrogen and P<sub>2</sub>O<sub>5</sub> and Rs. 1.40 per kg of K<sub>2</sub>O. At these rates the value of the fertilizing elements and the humus obtained after two years of usage from a pit in a rural latrine is about Rs. 151 (1986 price level). The latrine once constructed and properly maintained can serve a household for 20-25 years. The valuable fertilizing elements obtained by use of latrine will pay back the initial cost of the latrine construction within a period of six to eight years while the increased output in agricultural or vegetable product can meet and even exceed the latrine cost in two years.

### Construction under Special Site Conditions

Construction of this design requiresh modifications in area having high ground water table or hard impervious strata is hard and impervious the pits will not be able to leach out liquid contents and would then work like simple septic tanks. Separate leaching and absorption arrangements will have to be provided for the disposal of the effluent coming out of such pits by providing an overflow channell pipe. It may also be useful to treat such effluent first by passing it upward through another pit filled with 25 to 30 mm size hard burnt brickbats or stone aggregates which work as an anaerobic contact upflow filter. The effluent of such a filter will be more clear and less offensive and can be easily disposed off on land for gardening or absorbed in soakage trenches / pits.

Where ground water table is high, special embankments platforms of earth 0.6 to 90. metre high should be constructed and the latrine and the soakage cum digestion pits will be located over these. The bottom of pits should remain about 1 1/2 metres above the high ground water table so that the leachates from these would receive adequate filtration treatment before reaching the ground water. The contaminants will be thus excluded from entering the ground water.

Sealing the bottom of the pits by some impervious layer (e.g. cement concrete or tamped clay layer) and placing 0.5 m thick fine sand (less than 0.2 mm size) filter outside the closely spaced brick lining lengthens the passage of travel of polluting elements leaching out from pits, thus protecting the ground water against contamination by the leachates.

### **Superstructure**

The superstructure of latrines is an enclosure to give privacy to the users and also to protect the latrine pan and trap against any damage caused by natural and other elements and to prevent its choking from objects falling in. It can be constructed using locally available material to suit the choice of the user and the finances which can be made available by them for the construction. Some of the unconventional types have been suggested in Appendix II with their approximate present day (1986) costs.

It is better to construct the latrines in brick masonry using cement mortar so that these last longer and require low maintenance cost. The common specifications for a type design are given in Appendix III and these may be used if the latrines are to be constructed by a Government / Semi Government Department in a standard manner. The quantities of materials required for such construction are given in Appendix I.

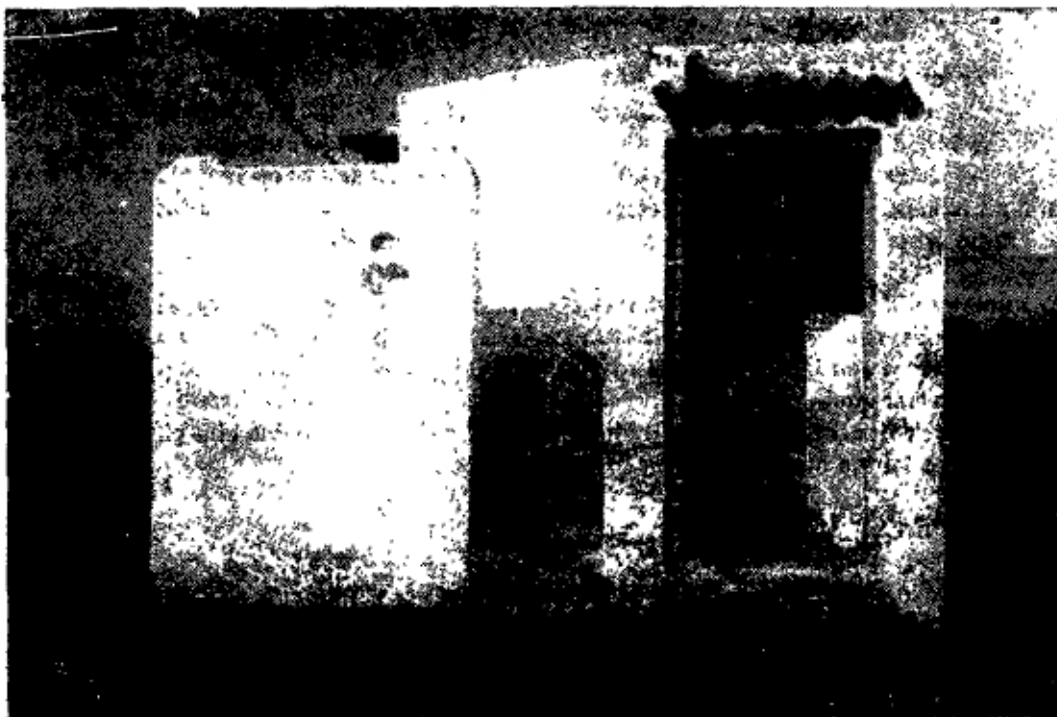
The villagers themselves can also construct these latrines by taking help of the local mason and providing own labour (shramdan) towards unskilled work. These can be then built in stages (as given below) when finances are limited.

1. Construction of the sub-structure with only one pit at appropriate place in plan and ordinary enclosure without any roof.
2. Construction of the second pit and the diversion chamber at proper place left for the purpose.
3. Construction of permanent type of superstructure.

### **Latrines for Rural Schools**

Schools have been established in almost all medium and large size villages in the country. There is an urgent need to educate the children about sanitation, personal hygiene and inculcate in them the habit of using latrines. NEERI has, therefore, designed a latrine block for schools in rural areas as shown in the Fig It consists of two hand flushed water seal latrines, one for boys and another for girls and a urinal block for boys. The faeces along with urine fall in a common soakpit where these are digested microbially. A small water

tank has been provided in the urine blocks such that it serves both latrines and the urinals. The cost of construction of such a block will be about Rs. 5000/- (at 1986) price level).



Latrine block for schools in rural areas

A set of cement mosaic finish, urinal pot and connecting (50) mm diameter) cement pipe in the above block as cast by NEERI at Nagpur costs about Rs 50/- per set.

#### Latrine Maintenance

The latrines give trouble free service if maintained welll by carrying out repairs and by using the latrines properly. The following instructions would prove useful in achieving this objective :

- \* Leaves, paper or any such articles should not be used as a cleaning material. Only water should be used :
- \* The pan should be made wet by pouring small quantity of water (e g. quarter litre) before every use This would act as a lubricant and would prevent sticking of excremental matter to it ;
- \* The pan should be flushed clean by pouring necessary quantity (e. g. 1<sup>1</sup>/<sub>2</sub>-2 litres) of water after every use ;
- \* The pan and the trap should be cleaned using a brush with handle and by pouring sufficient quantity of water daily or at least once a week to remove any substance sticking to it and to prevent accumulation which would attract further depositions;

- The latrine enclosure should not be used for bathing or for washing of clothes. The water used for these would cause heavy load on the leaching pit which may overflow, spreading out fresh excremental matter and causing both nuisance and health hazard.

When one pit is filled up upto the invert level of the incoming pipe it is disconnected from the latrine at the junction chamber and the other one is then connected to the latrine. After about 1 1/2 to 2 years the excreta collected in the first pit would get completely digested and converted into dry humns. This can be then easily removed by means of *Phawaras* and the pit is kept open to atmosphere for a week or so to dry. It can be then connected to the latrine when the second pit is filled up and disconnected.

In many villages the users of latrines are reluctant to empty the pits by themselves, as they consider such work to be below their social status. Educating the people will be necessary where such latrines are being constructed so as to motivate the people to empty the pits when required. Alternatively some agencies can be established at block level to undertake the work of emptying any filled pits at some reasonable charge for connecting the same to the latrine at appropriate time.

### **Community Participation**

In order to derive the benefits of clean and safe environment all households in rural need to construct sanitary latrines of NEERI's design and use these regularly. The concept of construction of latrine in houses and using these is quite new to the rural communities who have been used to the method of defecating in open. In order that the rural communities would accept and adopt the new system of sanitary latrines they will have to be explained first the need for and the benefits of the same and then be so motivated to participate in the programmes of building latrines in their houses. This requires imparting in simple local language both general and health education to all the section of the rural communities e.g. the old; adults, young, women and children. Such education should contain general information about environment and its effects on all human beings, water borne intestinal diseases, their causitive agents, modes of trasmission and the role of sanitary latrines of NEERI's design in intercepting the same. Voluntary agencies and social organisations should be involved in such educational programmes and for motivating the people. As the majority of the people in the rural areas of our country are uneducated (and even illiterate), the educational methods to be of adopted should be of audio-visual type like the tape slide and film shows, exhibitions through charts, drawings, posters and models, short skits and one-act plays. Demonstration latrines should be then constructed at commonly visited places like the schools, office of the Panchayat Samithi, to acquaint the people with the latrine, its construction and use

### **NEERI's Work and Experience**

In collaboration with Zilla Parishad, Nagpur' NEERI undertook a project of constructing pour flush water seal pit latrines of its disign in some villages near Nagpur and assessed its impact upon the environment and the health of rural community. Over 1200 latrines of the household type were constructed in 10 village and the health status of users was monitored. It was observed that rate of helminthic infections got reduced by about 20% when 70% of the people were using regularly these larrines. The other important observations made and the experiences gained were as under :



1. Imparting general education and prior motivation of the people is necessary before undertaking any programme of construction of new systems of sanitation.
2. Voluntary agencies and social workers can play an important role in the above mentioned work. However, if these are not available at a place the programme authorities will have to themselves do this work so as to motivate the people in accepting the programme.
3. Necessary quantity of water (about 25 litres per day per family) should be available for flushing and cleaning of latrine and especially in the summer season at places where this programme is to be executed.
4. Local artisans be given training to cast cement concrete pans and traps of NEERI's design to be used in the latrine construction and be supplied at cost moulds for the purpose. They should also be given training for the construction of latrines.
5. Although subsidies may be given to the economically weaker section of the communities to meet the cost of the construction of latrines the beneficiaries should be made to give their voluntary unskilled labour to initiate their involvement in the sanitation programme.
6. The work of construction of latrines is to be carried out in scattered localities and hundreds of houses having varieties of site situations. The type design of the latrine cannot therefore be used in toto and would remain as guideline only. Suitable modification will have to be done in the layout and construction of the latrine without adversely affecting the basic principle or the objective of the programme.
7. Health education will have to be also given, during the construction programme, to promote personal hygiene without which the mere usage of latrines may fail to give the desired impact upon the health status of the rural communities.
8. Community participation and inculcating a sense of pride in having and using a latrine is necessary to be developed for the success of the programme.
9. People should also be given education and training for use and maintenance of latrine and there should be regular surveys carried out to see that the latrines are maintained well and used properly. Arrangements for emptying of the filled up pits be also made through some agency or the users themselves.
10. The staff of implementing agencies can succeed in meeting the objective of the programme only if they have a sense of commitment and involvement in the project and sympathy with the rural poor.

### **The Challenge**

Today, the mass media has a decisive impact on the life of the rural population. A new media, the video has brought in its wake the video culture which is rapidly making inroads in all spheres of life in India. The video offers tremendous scope for mass communication. Interesting, well planned and imaginative programmes by newspapers, All India Radio and Doordarshan can create greater general awareness and mobilise public opinion for improving the quality of life and economic status of India's rural population by means of better sanitation.

The Rural Sanitation Programme has many positive effects. It promotes economic and social as well as human development and is a good investment for a nation like India which is aspiring for an around and accelerated pace of development to meet the challenges of the 21 st Century.

### Appendix- I : Procedure for Construction of Sanitary Latrine of NEERI's Design

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#### Materials required and Site selection

1.	Bricks (locally made	1050 Nos,
2.	Sand	1.7 m <sup>3</sup>
3	Shingle	0.5 m <sup>3</sup>
4	Cement	3 bags
5.	Steel bar, 6 mm dia, 10-m long	11 kg
6.	Cement concrete pan and trap of NEERI design	1 set
7.	Asbestos cement pipe 100 mm dia	2 1/2 m
8.	Corrugated asbestos cement sheet roofing 1 2m wide, 2m long	1 No.
9.	Locally made, ready made door frame shutter of country wood, with usual fittings	1 No.

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This should be first purchased and kept at the site, selected before starting of the construction.

For construction of latrine, the site should be near the house so that all members of the family can use it easily. It should have suitable downward slope around and the soil below should not be hard and impervious. The site should be preferably 15 m away from any underground drinking water sources

After the selection of a proper site, the layout (as shown in Figure) for excavation of foundation of latrine is marked by using lime/ash, or any other white material. Excavation work is then carried out as per the shape and depth given in the drawing.

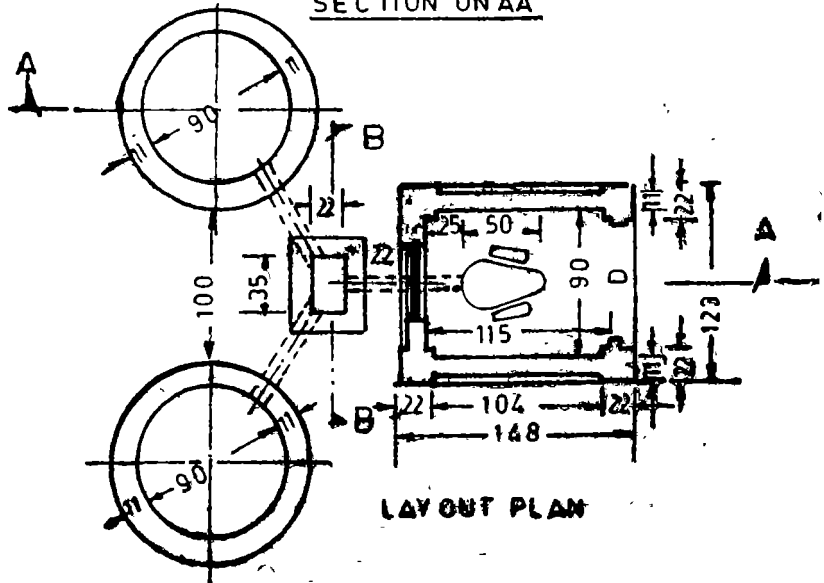
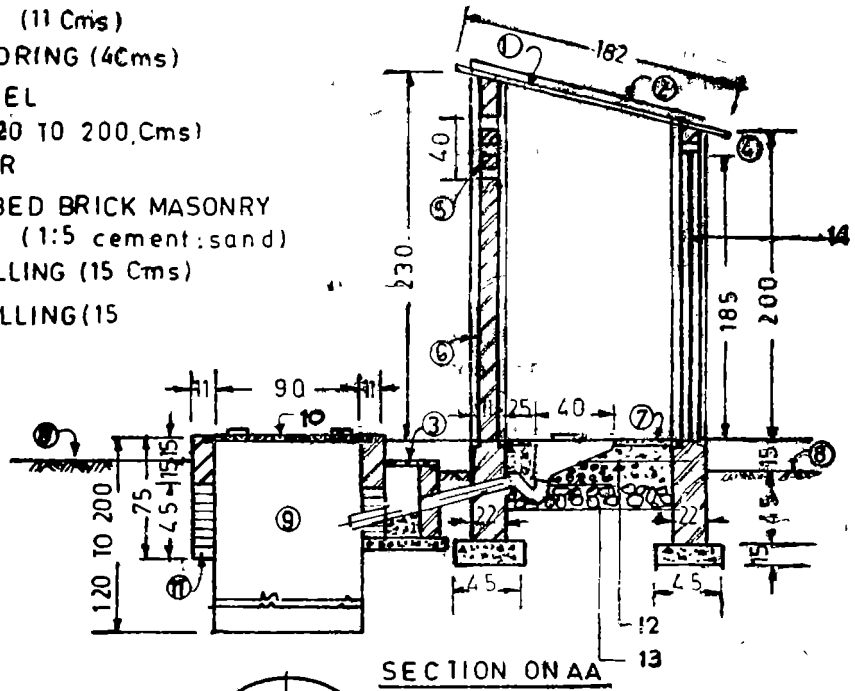
#### Construction for Foundation

##### Pan, trap fitting

A mixture of 1 3 6 of cement, concrete, 15 m thick, is laid first as the base. Then a 22 cm thick brick wall is constructed over it upto a height of 15 cm above the ground level in cement mortar (1 5). The outer length and breadth of the latrine chamber are 148 cm and 123 cm respectively, and the 22 cm thick walls upto plinth level is built accordingly. While constructing the foundation and plinth the lower end of the trap is connected to the junction chamber with 100 mm dia pipe and the upper end of it connected to the pan and the joints are made using 1:1 cement mortar. Proper precautions must be taken while fitting of trap and care should be taken to see that no gap is left to allow the foul gases to escape out from the soak pit into the latrine chamber.

**INDEX**

- 1 ASBESTOS CEMENT SHEET
- 2 COPING
- 3 JUNCTION CHAMBER
- 4 LINTEL
- 5 HONEY COMBED BRICK VENTILATOR
- 6 BRICK WALL (11 Cms)
- 7 CEMENT FLOORING (4Cms)
- 8 GROUND LEVEL
- 9 SOAK PIT (120 TO 200.Cms)
- 10 R.C.C. COVER
- 11 HONEY COMBED BRICK MASONRY (1:5 cement:sand)
- 12 MURRUM FILLING (15 Cms)
- 13 BOULDER FILLING(15
- 14 DOOR



Latrine section and Layout plan

After completing the pan-trap fitting, small size rubble and coarse sand upto 15 cms and 'murum' is spread over it and compacted. Then 8 cm thick layer of 1:2.4 cement concrete mixture is placed on it and a top coating is given with a neat paste of cement for making it impervious and smooth.

### **Junction Chamber**

Pieces of bricks and shingle are filled into the foundation pit of the chamber and base cement concrete is placed upto the invert level of connecting pipes. A 35 cm X 22 cm X 30 cm high brick masonry chamber having 11 cm wide wall and plastered with cement mortar (both from inside and outside) is constructed over it. The incoming connecting pipe from latrine and outgoing pipes to the soakage pits should be kept and fixed in correct position (both in plan and elevation), at the time of construction of chamber only.

### **Soakage pits**

Before construction of the lining to the pits, the bottom surface is made wet. A circular brick wall (11 cm wide and 90 cm inner diameter) is constructed over the wet surface in (1:6) cement mortar to a height of 15 cm. The upper portion of the lining is then constructed using honey combed brick wall (by keeping 3 to 5 cm spacing between two bricks) upto the invert level of the incoming pipes from the junction chamber. Construction of the lining above the level of pipes is done in the normal manner to a height of 2 to 5 cm above the ground level.

### **RCC cover**

Four half round cages of 1 m diameter made of 6 mm diameter steel bar by keeping 13 cm spacing between them to work as reinforcement to the R. C. C. covers for the pits. Handles of the same steel bar are made and fixed in the middle of the cages to lift and move these from the pits later when required. A 45 cm X 30 cm rectangular cage is also made of on similar lines for the R. C. C. cover of the junction chamber.

The cages so built are kept nearly  $1\frac{1}{2}$  cm above the ground level over some old papers and 1:2.4 cement concrete is spread and compacted embedding these to form a five cm thick cover. These are kept covered with wet pieces of gunny bag for a day then immersed in a water tank for at least seven days for curing to get the required strength. These are then placed over the pits and junction chamber accordingly.

### **Wall Construction Superstructure**

22 cm X 22 cm thick brick columns are constructed on the four corners of the foundation of the latrine work and leaving open the front side for fixing the door. On the remaining three sides 11 cm thick wall is built, the height of the rear side wall being 2.3 m and the side walls are made sloping from the back to the front by reducing their height from the rear to the front from 2.3 to 2.15 m. For providing lighting and ventilation, a brick mesh window of 22 X 22 cms size is left in the rear wall with its sill at a height of 1.20 m.

These brick walls can also be constructed out of mud mortar and their outer faces pointed using 1:3 cement mortar or these can be built in (1:4) cement mortar if finances

are limited for the construction of brick walls bamboo matting coated with coal tar any such cheap material can also be used to make the superstructure which has no sanitary significance and is merely an enclosure for privacy of the user.

Care be taken see that all the brick masonry construction work is kept watered for a period of ten days.

### Door

A simple braced and ledged door shutter 1.80 m X 70cm X 2cms thick made of country wood and having a frame of 5 X 6 cms which is often available locally is then fixed. Old tar drum sheets or bamboo matting fixed on bamboo frame can also be used to work as door shutter when sufficient finances are not available.

### Roof

Asbestos cement sheet, country or mangalore tiles, or an old tar drum sheet can be used as a roofing material. If enough funds are not available, bamboo matting or hay supported on bamboo rafters can also be used for making the roof.

In this way, a pour flush water seal two-pit latrine can be constructed within three days by a mason and two helpers, if the layout is given and the pits and excavation for foundation have already been dug.



Low cost designs for latrine superstructures

**APPENDIX—II : Specifications and costs of different types of superstructures**

Specifications	Estimated cost (Rs ) 1986
1) Side walls, roof and door shutters made of bamboo matting painted with coal tar.	150
2) Side walls, in 4 $\frac{1}{2}$ " thick locally made bricks in mud mortar and pointing in, 1:2 cement mortar, old tar drum sheets used for making roof and the door shutter.	250
3) 2 $\frac{3}{4}$ " thick brick in edge precast masonry panels for side walls (in 1:6 cement mortar) and roof. Door shutter made of plain AC sheet fixed on simple wooden frame.	400
4) 4 $\frac{1}{2}$ " thick brick masonry side walls in 1:6 cement mortar and plastered both inside and outside using 1:6 cement mortar, roof made of corrugated AC sheet fixed on wooden support and a country wood single leaf door shutter painted in oil paint and with an aldrop.	900

**APPENDIX—III : Construction notes and specificates**

1) Cement concrete foundation	:	1 : 5 : 6
2) Brick masonry	:	Plinth 25 cm, CM (1:6) Soakage pit 11.5 cm CM (1:6) 30 cm from top and rest honey comb, ventilators 11.5 cm honey comb.
3) Soakage pit	:	90 cm dia and 150 cm deep with 5 cm thick RCC cover in 2 halves.
4) Door	:	75 cm X 185 cm Frame, 75 cm X 6 cm hard wood shutter, 180 cm X 70 cm single shutter in hard wood.
5) Roof	:	AC sheet or any low cost material like hay or country tiles, wall plate and rafters 7.5 cm X 5 cm in hard wood.
6) Plaster (plinth)	:	12 mm thick in CM (1:6) over murum and brickbats filling on plinth.
7) Plaster (walls)	:	12 mm thick in CM (1:6) over walls
8) White washing	:	Two coats
9) Approximate cost of construction for : two pit latrine.	:	Rs. 1150/- at Nagpur, 1986 price level (without roof and door), Rs. 1400/- (with Asbestos cement sheet roof and country wood door).

(CM : Cement Mortar)

**APPENDIX-IV: Quantities of materials required for construction of a two-pit latrine****(A) Upto plinth level (Substructure)**

<b>Item</b>	<b>Quantity</b>
1) Locally made bricks	650 Nos.
2) Sand	1 m <sup>3</sup>
3) Metal/Shingle	0.5 m <sup>3</sup>
4) Cement	1.72 bags
5) Steel for pit covers	11 kg
6) Pan & trap set	1 No.
7) 100 mm dia SWG pipe 600 mm long	2 Nos.

**(B) Above plinth level (Superstructure)**

1) Locally made bricks	400 Nos.
2) Sand	0.7 m <sup>3</sup>
3) Cement	1.25 bag
4) Country/local wood for door & roof	1 wood (0.09 m <sup>3</sup> )
5) Corrugated Asbestos Cement roof cover sheet	1.8m <sup>3</sup> (1.7 × 1.05)
6) Fixtures for door	Lumpsum
7) Oil paint for door	Lumpsum



Standard masonry for latrine superstructure





