HANSRUEDI RUTZ

# RURAL SANITATION AND LATRINE CONSTRUCTION

## A FIELD MANUAL FOR CAMEROON

SATA-HELVETAS
SWISS ASSOCIATION FOR TECHNICAL ASSISTANCE

## INTRODUCTION TO DRAFT

This draft for a manual on rural sanitation and latrine construction is an attempt to compile information of various puboications and adapt it with my personal experience gathered during three years to the local situation in Southern Cameroon. I had the idea that these existing publications cover a field too large with too many possibilities but are not concise enough in some technical aspects that are not familiar to a person not related with building. Even if all the technical knowledge is widely used in Cameroon, some combinations proposed are not familiar to technicians. Since most probably a person promoting any sanitation programme is coming rather from the medical side, he must be clarified about the importance of some technical aspects.

The first part is giving some hints on other points that should be considered for improved samitation, besides latrine construction. Also some ideas on important facts for the promotion of sanitation programmes I have thought to be useful. This first part is largely influenced by the booklet of Arnold Pacey. " Rural Sanitation".

### Request for comments

My work in Cameroon was related with "building" and "education", but not with primary health care and community participation and animation. Also I have never built any of the proto types proposed in the manual. I therefore like to request comments on the manual from such persons especially that have experiences on one of the fields mentioned above. Any comment, positive or negative, short or extensive is most apreciated, Of course I would like much to have critical, constructive and extensive comments. A questionnaire is joined to give some ideas about questions I would be interested about. Any person sending an even partly filled questionnaire will get a copy of the final print.

### Demonstration latrines

Shisong Hospital has the intention to construct demonstration latrines according to the recommentations of the manual and to relate the experiences to me. Such practical experiences are of prime importance to

me and, kindly request every person having such practical experiences to write it back to me. If a group or organisation has the intention to set up any programme to test the manual, this would be most welcomed. SATA Building Training Centre Kumba, P.O. Box 153, could assist them in getting samples for the form works.

## Target group

The manual has not been written for any specific programme and therefore also has not a known target group. It is intended to be addressed to any person concerned about improvement of rural sanitation in Cameroon and probably other countries. I have tried to use a simple language, with terms and settings as used in the anglophone part of Cameroon. However, it can not be avoided that some technical terms of different fields are used that are not familiar to every body. The intention was to achieve a general understanding for a person directing a programme; to make understandable after introduction by such a person to a village health worker; and to be completely clear in all technical aspects to the one person supervising that specific aspect.

## Thanks

I like to thank the staff of Shisong general Hospital, Nso, and the Department of Preventive Medicine, Bui Division for their encouragement and help and to SATA for providing me with transport and other services. A special thanks goes to Miss Jessie Tarke Nung for her excellent typing job!

Shisong/Kumba, August 84

Hansruedi Rutz

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C O N T E N T S



T E C H N I C A L  P A R T

## INTRODUCTION

Health care has always been considered a field of main importance on the way to development, both by development organisations as by government. In Cameroon this is not less the case and the Government has given it further emphasis by adopting the ambitious international goal "health for all by the year 2000" as a target for its own efforts in that field.

Health is not just the absence of an apparent sickness, but a state of well-being that includes more than merely physical factors. The state of health for a country can not be determined by the number and distribution of medical installations - hospitals, health centres, pharmacies and health posts - and less even by statistical values as hospital beds or medical doctors per inhabitant. Health starts with every basic things right by the person concerned or the family. There are three main factors of health care:

- nutrition
- sanitation/hygiene
- cure/drugs.

Even if all the three factors are important and only a combination of the three brings good results, nutrition probably is the major point. Next follows sanitation/hygiene, as a measure to be taken into every-days life of the whole population and adopted as a part of its wn culture, thus limiting cure to only a few special cases.

## 1. EXTENT OF SANITATION PROGRAMMES

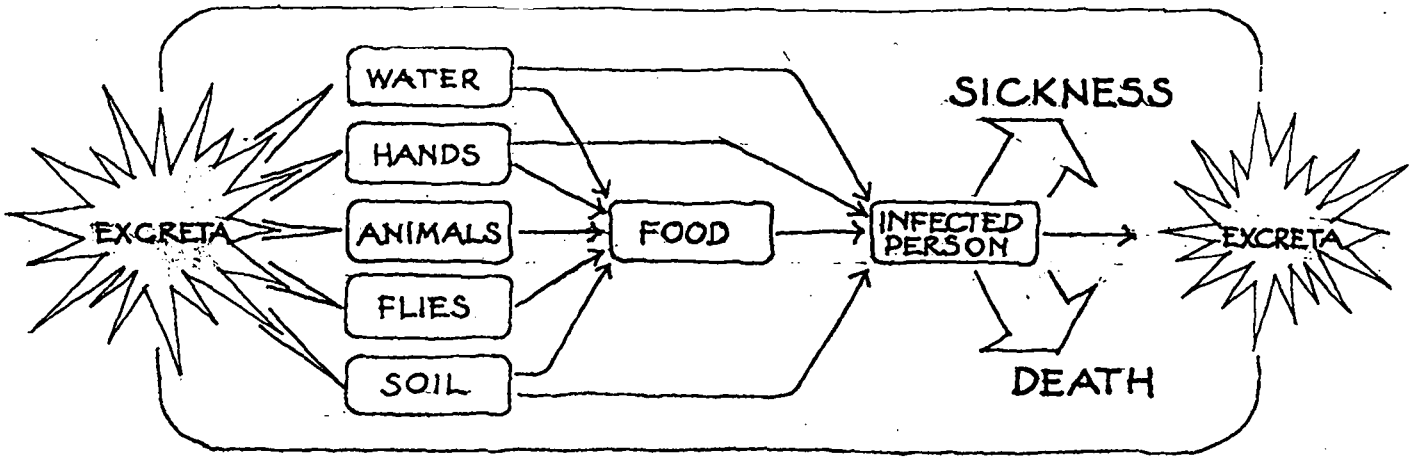
### 1.1. Importance of Sanitation

Medical personnel in rural areas is often struck by the frequence of diseases that appear related to deficient hygiene and sanitation. Following the saying, that prevention is better than cure, programmes are set up to improve the state of sanitation. The importance of such programmes can be seen from the large numbers of death occuring in developing countries with small children that are caused by diarrhoea and enteritis.

But it would be wrong thinking only in diseases that cause sickness and death, even if these are the most striking ones, a good number of diseases coming from bad sanitation however - especially interstinal parasites like worms - may not show directly, but just make the infected person weak and apathetic. These parasites eat away the food needed to build up the body, often the best part of it. Some authors say, that in some places half of the food grown by the rural population is used to feed the parasites. It is abvious, that parasites and intestinal infections (diarrhoea, enteritis) considerably aggravate the consequences of malnutrition. For small children, these diseases may harm largely their physical and mental evolution.

## 1.2 Prevention of Infection

Most of the germs (virus, bacteria, worm-eggs etc.) that cause these sicknesses are contained in the excreta of human beings and spread by different ways to other persons. The diagram below shows how a person can get infected and become a source of infection itself.




As much as possible, all ways of transmitting these infections should be barred. The table below shows, which precautions are most promising for different diseases transmitted through excreta:

● = most effective
○ = relevant improvement

| | Toilet Latrine (1) | better water-supply (2) | better washing (3) | better food hygiene |
|---|---|---|---|---|
| Typhys, cholera | ○ | ● | ○ | ○ |
| Amoebic - and bacillary - Dysentry, | ○ | ● | ● | ● |
| Diarrhoea Gastro-enteritis | ○ | ● | ● | ● |
| Infectious Hepatitis | ○ | ● | ● | ● |
| Hookwork (Necator) | ● | – | – | – |
| " (Ancylostoma) (4) | ● | ○ | ○ | ○ |
| Round- and Thread-worms | ● | ○ | ● | ○ |
| Tapeworms | ● | – | – | ● (5) |

(1) Latrines must always be kept very clean.
(2) protect water from pollution.
(3) washing of hands after defecation and before cooking and eating.
(4) wearing of shoes is an effective precaution against hookworms.
(5) cook or roast meet throuroughly.

## 1.3. How to Improve Sanitation

Sanitation for many is just a synonyme for methods to deal with human excreta. But there is much more about it. Sanitation has to do with "to live sane" both in sane, healthy conditions as with sane habits. Sanitation can not be improved through a simple construction of a latrine or a water-supply. These things are secondary, as the preceding table has shown, latrines are only in some cases of poor sanitation a possibility to improve it, and they only do so if they are properly used, maintained and kept scrupulously clean. If not, the may even become a source of infection rather than prevent it.

Before dealing with latrines, some other points of importance will be mentioned here. They should be checked. If they are found to be had, they should be improved before starting to build latrines.

## 1.4 Water Supply

An improved water-supply has two consequences for sanitation. One is to eliminate infection by water for drinking, cooking and eventually washing of food and glasses, plates ,etc. Here it is important, to have clean water, or good water quality.

The second point is to use more water for the general hygiene, especially for all sorts of washing, the body as well as clothes and other household things. Here, the importance is more water or the quantity. For this second purpose, it is still better to use water that is not so clean - provided it is not badly infected - rather than to do no washing!

If water is clear, it does not also mean that is is not polluted. On the other hand, dirty water has not also to be bad water. Maybe it only contains earth, but is healthy. Water from a stagnant pool or water that is smelling should not be used for drinking.

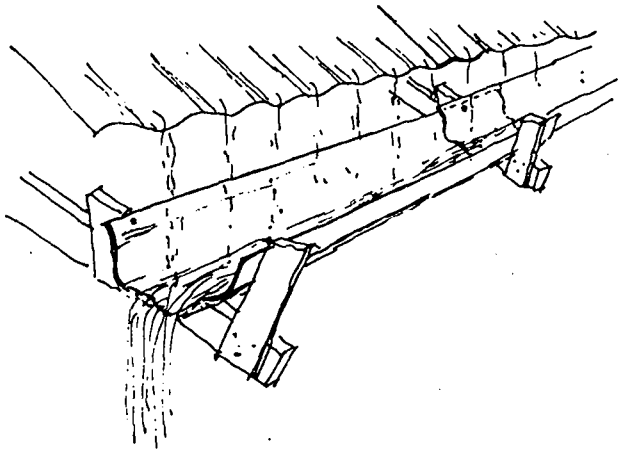
When speaking of better water and water-supply, we must not only think in pipe-born water. Very often the water-supply of a household can be improved without a pipe system:

1.4.1 Improvement of water point: The place where water is normally fetched has to be controlled. It should be upstreams from the place people are bathing, clothes are washed and where animals drink. For drinking water, a spring is preferable to a stream, a stream with no villages above to one with such possible pollution. If the use of such water can not be avoided, the habits of the people upstream should be checked to exclude a pollution with human excreta. It is this type of pollution that is by far the most dangerous.

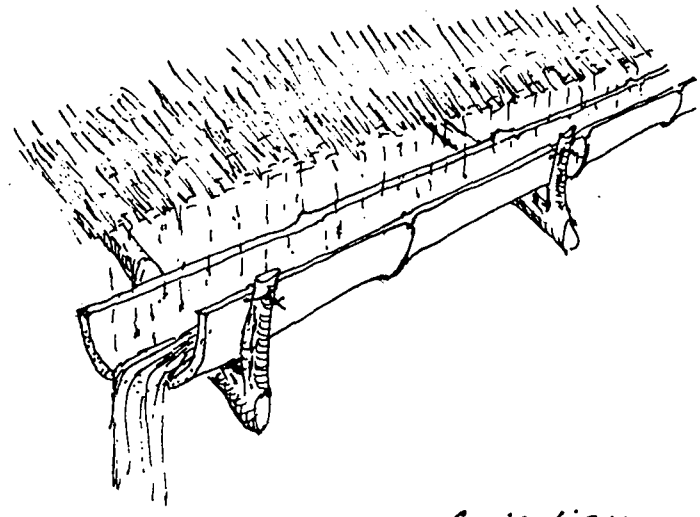
1.4.2 Wells: The soil is a most potent filter for infective germs. Wells therefore in most of the cases provide good water. Wells are one of the cheapest methods for rural water supplies in developing countries. Some books about the construction of wells will be given in the references.

1.4.3 Rainwater: In the southern part of Cameroon, during 8 - 9 months sufficient rainwater could be collected to supply a family. (A roof surface of 5 x 4 m will supply 2'000 - 6'000 l/month.)

The drawings show, how a gutter can be made from a zinc-sheet cut in three stripes to give almost 6 m length of gutter, or from a large diametre piece of indian bamboo.



gutter made of zinc sheet



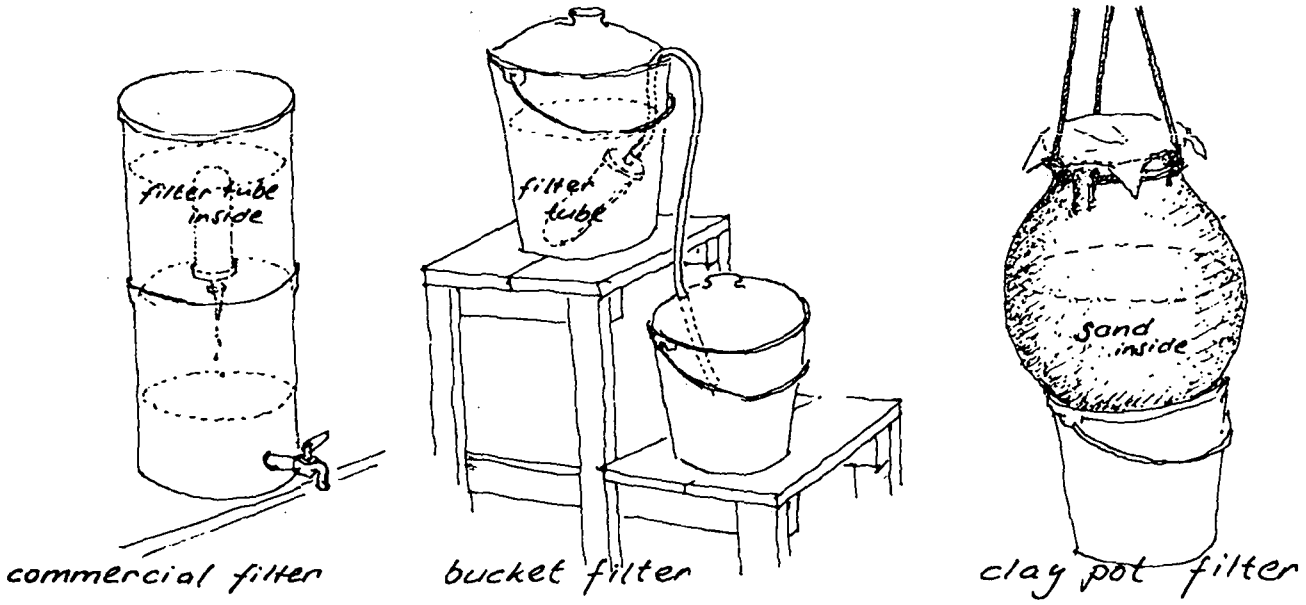
gutter made of indian bamboo

The best containers are plastic drums. But also old oil drums, earthen pots or any other container can be used.

Rainwater is normally very hygienic and stays good for a long time. In some parts rainwater is stored safely for several months. However, the container should be protected from leaves falling in it and especially human contamination. To scoope water, always the same vessel should be used.

1.4.4 **Boiling:** If water from a polluted source has to be used or if several cases of diarrhoea occured with the people drinking the same water, then the water for drinking should be boiled. This is especially important for small children that are attacked first and suffer most.

1.4.5 Filtration: Water can also be cleaned by filtration. There are commercial filters with two recipents, where the water flows from the upper one through a ceramic filter tube to the lower one. With such a filter tube, a plastic tube and two buckets, a filter can be improvised. The water will flow from the upper bucket to the lower, if the plastic tube is filled with water and then lowered to the downer bucket (see drawing).




Another type of improvised water-filter consists of an unglazed clay-jar, halfway filled with sand, and a water bucket below. If water is filled into the jar, it will slowly filter through sand and jar to the bucket below. On the surface of the sand a layer of harmless bacteria develop that destroy the bad germs.

When the water is not flowing easy anymore, the sand is taken out, a cupful set aside, the rest washed and rinsed thouroughly and then placed back to the jar again. The old sand is then spread on the surface of the newly washed sand to encourage the growing of biological filter again.

## 1.5 General Cleanliness

The general cleanliness can help a lot in improving the state of sanitation. Many signs show to persons concerned with health-care how a family is behaving in that aspect. If the compound is kept clean, with no rubbish laying around the house, the building properly maintained, then chances are that also the inside of the house and the people living in it are clean. To some points however, special attention should be paid:

1.5.1 Child cleanliness: Children suffer most from parasites and intestinal infections. If a small child is weak, a severe diarrhoea may cause its death. On the other hand, faeces of small children are more likely to be handled carelessly and to transmit infection.

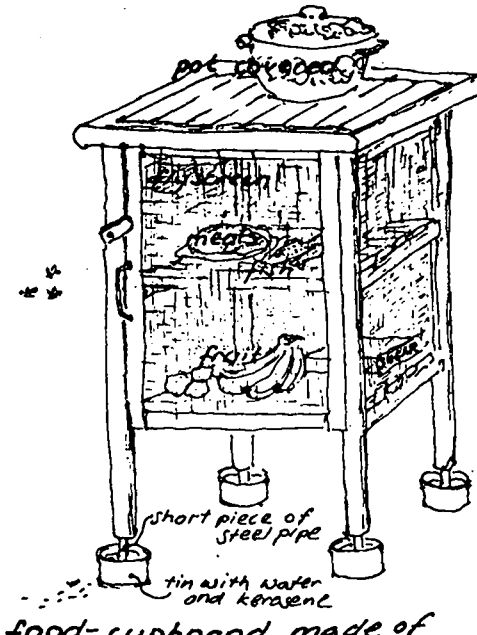
Babies and sma,, children should be supervised. If they are defecating, excrements should be immediatly removed and the baby cleaned. Soiled baby towels and clothes should be washed seperatly from other clothes, in a basin that is afterwards very well cleaned and the water poured out far away from a stream or a source of water where people get drinking water. (These rules apply to all washing that is soiled with excrement. It still has major importance with excrements from sick people!) It is also important to wash the hands after having cleaned the child or soiled clothes.

1.5.2 Washing habits: The importance of washing - especially washing the hands should be streassed again and again. Even if sometimes it means considerable changes in the habits of a household and needs some special efforts, water and soap for washing should be kept available, the water being used only once.

1.5.3 Cooking and food storage: Thourough cooking is important to prevent infection, especially for meat and fish! When roasting meat of fish, not even a small part inside should remain raw. If the food is cooked, it should be covered to prevent the access of flies. Food that remained for many hours after cooking can get dangerous. This applies not so much to food cooked in a packet of leaves as e.g. Koki, and in a lesser degree to starchy foods like plantains or foo-foo, but is especially important with food having protein like soups with fish or meat. If leftover soup is again well cooked the food can still be used.

No foodstuff should be stored directly on the floor. Hanging of bags of baskets may be some help to prevent access to rodents (rats etc.) and ants. Very large quantities of precious food are destroyed by insects, rodents and humidity. After knowing type and quantity of normally stored foodstuffs, storage facilities should be discussed, studied and promoted.

A simple food-cupboard to protect food from insects can be constructed from raphia and some mosquito-wire-mesh.

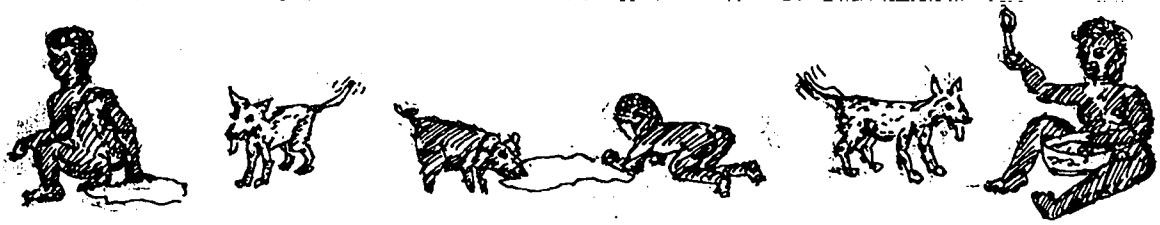



food-cupboard made of raphia

1.5.4 Waste disposal: The way how waste is disposed of shows very good how clean a family is living. Waste that can rot, as pealings etc., should be placed on a compost pile at least 15 m away from the house. If animals are fed on such waste, the feeding should be in the animals enclosure if there is one or at the compost pile. On the compost pile, also cut grass, leaves and animal manure can be thrown. Rotten compost is an excellent fertilizer for the garden.

For waste that does not rot like broken glass, tins or plastic, a pit should be dug. Brake bottles completely and cover tins with earth, so no standing water is created where mosquitos can breed. Also liquid waste should properly be disposed of. No potholes should ever form from waste water. The best is to create a soak-away, especially if washplaces are provided near the compound (see technical part).

1.5.5 Animals: Animals must be looked well after. Animals should always be tied or fenced, not to destroy any food crop. Animals must be kept out of the compound or even the house. In some places, it is common that pigs or dogs feed on human excreta. This is a very inhygienic habit. If it can not be prevented, it should be seen that these animals do not get in contact with persons, especially with small children.



## 1.6 Latrines

If taking in account all the previous points, it may show that latrine construction is not the most urgent matter. If a family is not used to cleanliness, chances are that the latrine also would not be properly maintained and cleaned and so get a health hazard itself.

On the other hand, latrines also have not to be necessarily promoted if excreta are regularly burried after defecation or in very sparesly populated areas, where by habit the people defecate far away from the house.

However, latrines should be promoted if:

- Defecation is polluting the water (shitting in or near a stream etc.)
- A village or town is very densly populated.

Another place where latrines always should be promoted is at schools. Not only is there a larger health risk due to the large number of school-children. But it is educationally adviseable to introduce the use of latrines to children at school. One teacher should be responsible to watch over the cleaning of the latrine. The importance of cleaning latrines as well as other sanitation aspects should be continuously taught and discussed in school. One latrine (hole) should be foreseen for each 40 children.
Urinals for boys and girls should be built seperately.

## 1.7 Checklist of health hazards

Before just promoting any measure of sanitation, the present situation should be watched closely and be analyzed. The following list may help to pinpoint the two or three features of a village of individual household, where sanitary improvement is needed.

The village:

1. Do people defecate so that the excreta are kept away from places where other people walk and where flies can reach them (e.g. by burying or far inside the bush)?
2. Are childrens faeces immediatly removed?
3. Do people defecate away from sources of drinking water?
4. Is the drinking water source different from the place where people bathe, animals drink and clothes are washed?
5. Do the people have a protected water source or a possibility to get unpolluted water?
6. Do they use that water for drinking and cooking? If not, why?
7. Is the village kept clean, rubbish removed and potholes drained?

The household:

1. If the household has a latrine, is it clean, is the pit sealed and covered?
2. Is the preferred material for anal cleaning (e.g. paper) always available?

3. Is the house clean and free from flies and other insects?
4. Does the family have clean drinking water?
5. Are there containers for storing water, and are they kept covered and clean?
6. Is there soap and a basin for washing the hands?
7. Do people regularly wash hands after defecating, before cooking and eating?
8. Are animals kept out from the compound and are they secured from destroying food crops?
9. Is there a compost pile and a waste pit? Are they properly used?
10. Is the kitchen clean and convenient for hygienic preparing and storing of food?
11. Are there washplaces for persons, pots and plates, clothes? Are they properly constructed and drained?

## 2. THE PROMOTION OF SANITATION PROGRAMMES

In most of the cases, people think in medical care and drugs when they hear speaking of health. There, a direct effect in many cases can be seen, as opposed to sanitation and nutrition, where only after some time changes may be noted, and these still not in a very obvious way. Health is not perceived as a state, that has to be taken special care of to maintain it, but as a normal thing, that has to be restored as quickly as possible when it is troubled.

Therefore, people might be reluctant to spend 5.000 FCFA and some additional work in the construction of an improved latrine, that might last for many years, and still spend amounts up to several thousand francs every few month to cure sicknesses that could have been prevented.

It is the task of a health worker and any development agent, to point out the relation between health, nutrition and sanitation. Programmes to bring health-care closer to the villages always should include aspects of sanitation and nutrition. Since the people very often are eager to have a health post with drugs and small possibilities of cure in their village, such provisions should be connected with sanitation programmes. So before even bringing a health post to a village, it could be demanded that the state of sanitation must be

improved first. Even if first aid never can be denied, it should be expressed while administrating drugs and curing, that improvements in sanitation are expected and are a condition to get cure. Frequent visits and check-ups in the compounds should ensure a proper sanitation.

## 2.1. Teaching methods

Normally, after having set up a health-committee, meetings are called in to teach the subject. Such meetings should not resemble lectures, where one person is standing in front and telling what to do. They should have as much participation from the villagers as possible. The meeting will resemble a discussion, where all participants express their thoughts under the direction of the health worker. The teacher will not give a lesson, but animate and supervise a direct exchange of ideas and complete it with his own knowledge.

Even if teaching with visual aides - blackboard, posters, drawings - is preferable to pure lecturing, many people may not easily understand a drawing. It is always better to teach with help of real, life-size examples. So the villagers should attend the construction of a sample latrine and be instructed on the different steps of the building process there. Or you could go to a compound, where good examples of washplaces, kitchen arrangement or waste disposal can be seen.

As much as possible, teaching should be done in the language people can understand best, using their own terms and names of things, basing on their own knowledge. An educated person from outside may have more authority, so more people would show up at a meeting and more people would promise to take some action, if only for fear. It is also possible that this person from outside has more knowledge and knows better how to explain things clearly. But is has been noticed very often, that people turned up very numerously to meetings with authorities and also agreed very much on the needs for improvement, but rather to please the authority than because they have understood and been convinced. A local person may not have so much apparent impact, but questions and doubts are much more likely to be raised towards him.

It is necessary that the local teacher is backed by the authorities in different ways:

- It must made clear through an introduction and frequent presence, that the supervising authority is standing behind the programme and the teacher.
- The teacher has to have a good knowledge of the topic, aquired with intensive help of the supervisor.
- Results and problems with educating and promoting have to be constantly discussed and the methods adapted with help of the supervisor.

  Encouragement has to be given to the teacher.

## 2.2. Social pattern of the village.

Before starting with a programme, it is necessary to have knowledge of the social pattern of the village. Very often, rivalries are found between certain families, quarters or ethnic groups in a village. If not taken properly into consideration, a programme may fail because of such barriers.

In every village there are natural leaders, persons whose opinion is sought by a larger number of villagers and whose examples are more likely followed. These natural leaders or opinion makers have to be found out and tried to be convinced first. Only in few cases they also have an official function like quarter-head or committee chairman. Very often these persons are not announcing themselfs as leaders, but wait in the background until they are asked. They can be in favour or opposed to the programme. In any case it is essential to discuss with them, seek their opinion and make them agree with or support the programme.

## 2.3. The role of women

It is women who are most involved with sanitation. They carry the water, prepare food, do laundry and wash the children. The problem to watch over small childrens defecation and excreta is among the most important for health, and it is the women who can deal with that problem. A man that is convinced on the importance of sanitation can try to convince his woman, but a woman that is convinced can do almost everything by herself. It is therefore important to include women as a main factor in every programme. It is also good to engage women as health workers.

A difficulty with building of latrines and other sanitation facilities is the fact, that is is the task of men to construct them or arrange for construction. The men therefore also have to be included and given the importance they usually like to have. A similar problem is with the mans animals destroying women's food-crop plantations. All these problems of tradition distribution of tasks to men and women has to be taken in consideration.

Normally, men and women should be together in meetings, both sides expressing their ideas. Especially women should be encouraged to talk. But sometimes it may seem advisable to have seperate meetings. This is the case if e.g. the women as a group are convinced and willing to cooperate, but the men are reluctant. In meetings among women they can discuss what pressures they should take individually or as a group to convince the men.

## 2.4. Traditional customs and beliefes

Everywhere there are traditions that may favour or hamper a programme. It is very important to find out about these traditional customs and beliefes. They should be taken serious and not be laughed about. Very often they had a good reason at the beginning as e.g. the belief of the Bororo that it is very bad to defecate on top of another persons excrements.

Sometimes such traditions have lost their reasons. But when the belief is known, it may be more easy to fight against it. If people e.g. belief, that excrements are a part of the person with which somebody getting hold of it could do witchcraft against the "owner", and therefore oppose to latrines, you may tell them that it is safer to put the excrements in a deep latrine pit than openly behind a bush.

## 2.5. House to house visit

To secure the largest possible spread to a programme, house-to house visits are necessary. Meetings may give an introduction to the subject, but it is only in discussions face to face that the real problems might show up. It is important to encourage rather than to intimidate people. Action should come out of a certain pride and self-esteem and not from fear of any punishment. As in meetings, also in these private discussions it may be better not to ask "how do you do this",

but rather "how do people normally do it". Most probably you will then get an answer that shows the interlocutor slightly better than "the rest of the people".

Personal visits have to be repeated to see progress and give further assistance and encouragement. If little has been done, do not lightly blame the people of lazyness. First check the following questions:

- Have they understood and recognized for themselves the importance of the improvement?
  If not: Try another way of teaching them, still more adapted to their own individual reasoning.
- Do they really have access to the material resources as local building materials, tools, money to purchase materials?
  If not: Assist them in how to get it, help borrowing tools from neighbours. Adapt the proposals so that they match with their resources.
- Do they have the capability (knowledge, skill, perseverance, trust in their own force) to implement the improvement?
  If not: Assist them with practical teaching, show them examples and instruct about special details there. Encourage them continuously.
- Is there a sociological hinderance, e.g. is the husband opposed to latrine construction or does the grandmother think that too much washing is bad for small children?
- Try to speak together with the adopting and the opposing party and try to overcome the blockage.

## 2.6, Village health committees

It is a good idea to have a committee that is especially interested in improving health. Here the subject can first be discussed and adapted to the local setting. Some of the following questions should be covered:

- What habits of hygiene do actually exist in the village? Which can be modified to promote better sanitation and which do harm to health?
- Do local technical solutions exist for sanitation problems?

What is good about them and where are weak points?

- Which problems are most important and should be tackled first?
- What are the attidudes of people to "modernization" and to "tradition"?
- Is there a contradiction between the beliefes that people have and the new ideas presented? To what extend should they be considered?
- How can and should the programme be adopted to local conditions (tradition, habits, materials, income, technical solutions etc.)

After having helped in the launching of a programme, the health committee together with the supervising authority and the health worker should constantly appraise the results and try to find solutions for the overcoming of blockages.

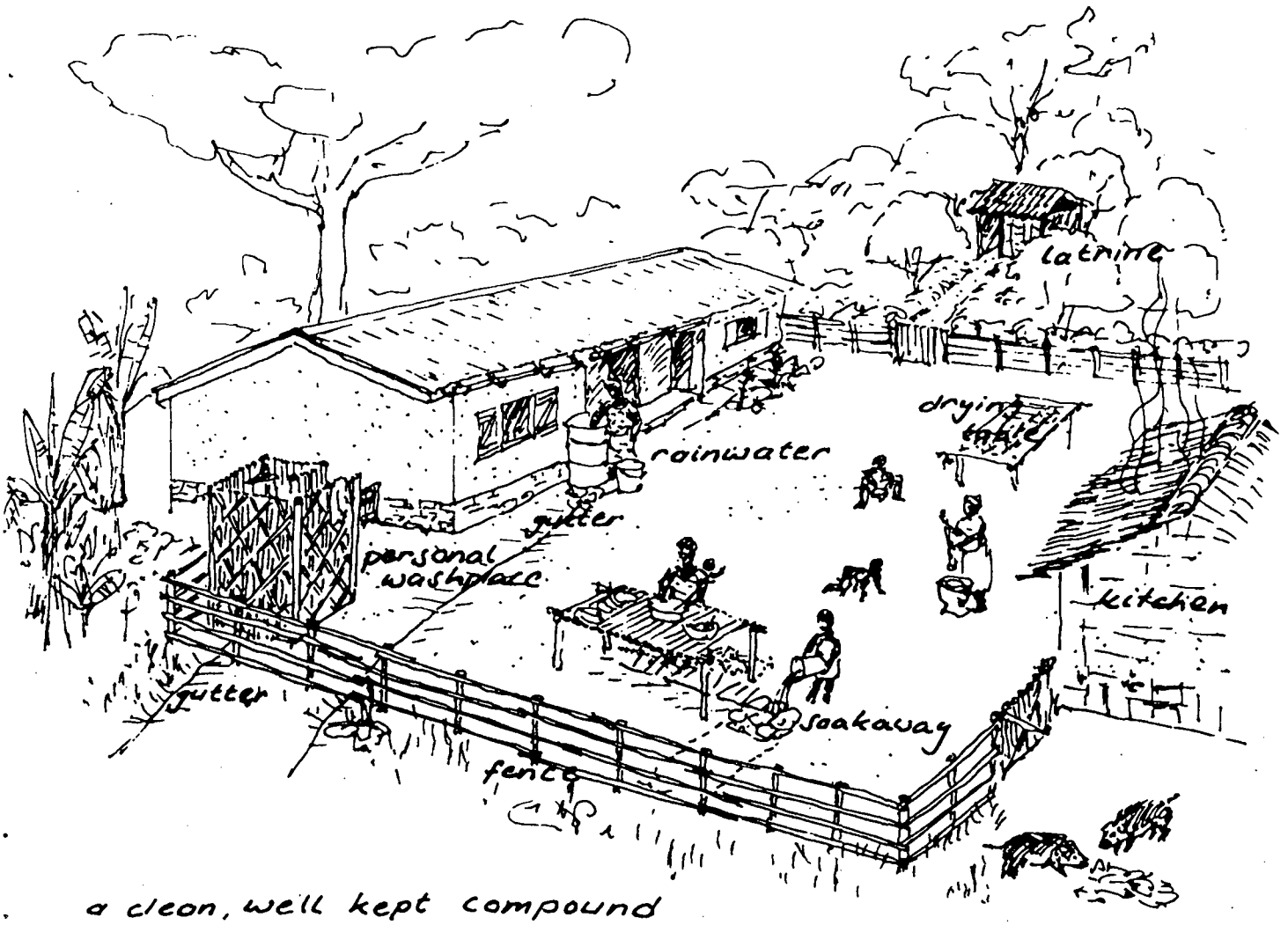
## 2.7. Health workers

The most crucial point of a sanitation programme is the existance of an initiative animator, in this manual normally called health worker. It must be understood that his work needs incentive. This is not just material recompensation but also that the animator feels personally rewarded by the work he is doing. Important for such a feeling is a notion of success and of response from the people. To this, a continous support and encouragement by the supervising authority can largely contribute. However, if substancial work is expected from and done by the health worker, he also has to be given a material recompensation. As a general idea, this recompensation should not come from an outside organisation or from a government service, but from the population benefitting from the programme. A connection of sanitation with the drug-administration in a health post could provide the funds needed.

## 2.8. Conclusion

The danger of thinking in terms of "programmes", as in this manual, is that the term implies a target to reach in a certain limited time and does not care too much about what happens afterwards. A programme may hope to stimulate a change of sanitation habits, but obviously it is only the people that can carry it through. What is wanted is a change that people take into their own culture and accept as a part of their

lifestyle, and which will therefore benefit their health for always. It is important therefore to start with the assets that people already have and with their own aspirations. The improvements therefore should build upon their local habits and beliefes, the use of local materials and skills, but also they should help them achieve some of their own social goals.




a clean, well kept compound

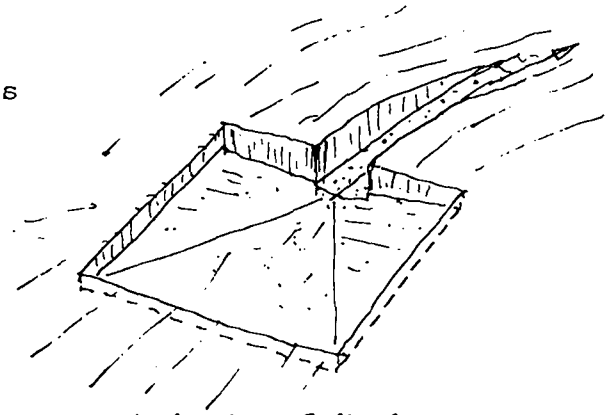
T E C H N I C A L  P A R T

## 3. WASHPLACES

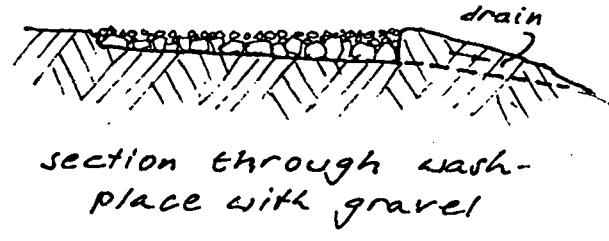
If water is available, especially if it is available near the house, different types of washplace can be helpful to improve both washing habits and prevent pollution of drinking water. Here are given some ideas how such washplaces could be constructed or improved.

### 3.1 Personal Washplace (shower)

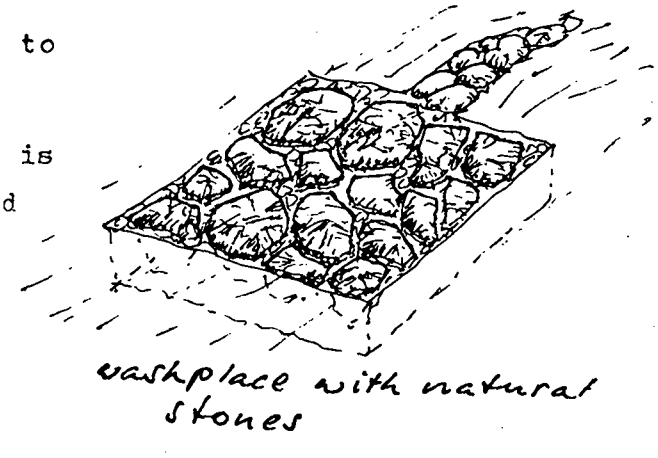
Places for people to wash are found in many compounds, but in most of the cases they could be improved. Normally they are lacking proper floor - improvement and drainage. Three methods can be suggested. In all three, first the side where the water drains has to be chosen. (Towards the slope or where the soakaway is made).



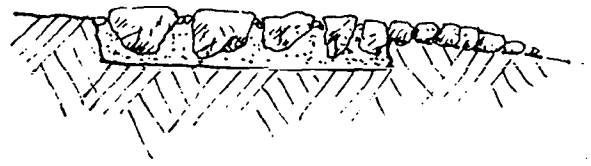

If gravel and medium stones are available, the ground is dug in the size of the washplace (1m by 1m is a good measurement) in a way that the pit is at least 5 cm deep and sloping from all sides to the drain, which should be about 10 cm deep. The drain should slope also about 5 cm in 1 metre (5%) and lead to the slope or the soakaway. The pit is then filled with the largest stones down and finer gravel to level up.



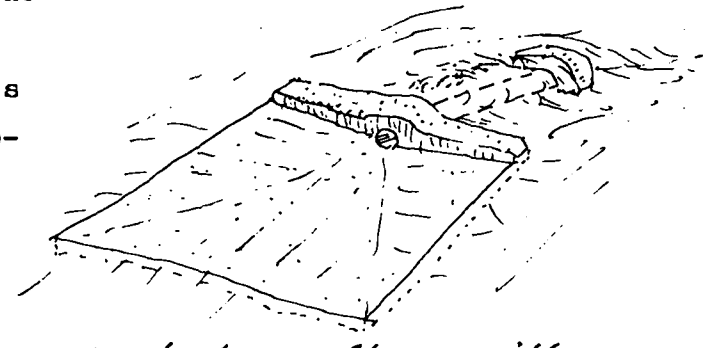

If large stones are available, a pit is prepared in a similar way. It should be as deep as the thickness of the stones and the dug earth is left inside and mixed with water to form a mud like the one used for mudblocks.



The surface should also be sloping 5% to the drainage. The stones are then placed hard into the mud, the flattest side facing up, and embedded well. The surface of the stone should be about 3 cm above the mud and the spacing of the stones also 3-5 cm from each other. The mud between the stones is then levelled well, maintaining always the slope. The spaces between the stones still may be protected with smaller stone-chips. The washplace should not be used until it well dried. (It is better to do it during dry season.)

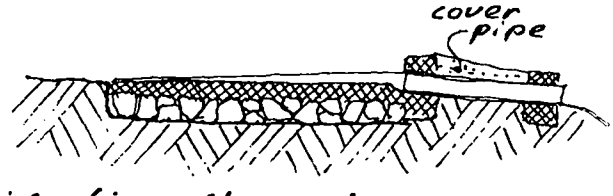


section through washplace with stones



washplace floor with cement

If <u>cement</u> is available, the best is still to make a <u>concrete-slab</u>. A hardcore of about 10 cm thickness should be made from stones, all the openings filled with smaller stones or chips and rammed very well with a log. The hardcore has to slope about 2% to the drain. The hardcore is then covered with a stiff 1:2:3 concrete of at least 4 cm thickness and immediatly topped with cement paste. (See about preparing concrete, casting and topping in the chapter on concrete-slab latrine.) For the drainage, it is best to provide a short piece of pipe in the way shown in the sketch. If not, the drain has to be made with large stones, where the water can soak into a channel like in the first example, or to form a gutter with cement joints. Like that, washing out of the rim can be prevented.




section through cement-floor washplace

The enclosure can be made very simple with reed, raphia-mats, raphia-pannels or any other convenient materials. A roof is not very necessary, but convenient to protect the clothers when it is raining.

Some people may like to join a cement-slab washplace with latrine. How this can be done is shown in the plate "concrete-slab latrine".

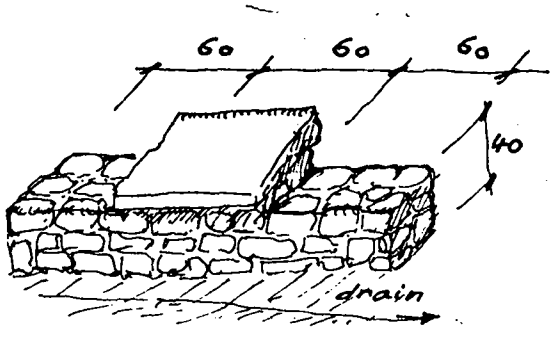
However, it is not very much recommended, because if made wrongly it can endanger the latrine pit. (See also: "Dry or wet latrine")

## 3.2. Washplace for plates and pots

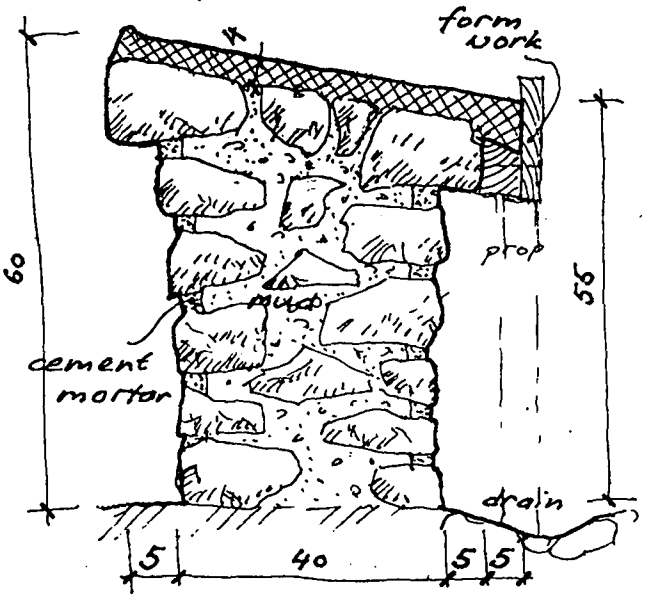
A place should be accomodated to wash cooking utensiles. Important is a table where to dry the washed things and a proper drainage. The table can easily be made from sticks and bamboo. To the side should be a soakaway for the waste water. The ground below the table is sloping to the soakaway. It is good to pave the place where to stand with stones or gravel. Also a simple roof may be convenient. Remainings of food should not be washed down the soakaway. They may block it and also are a health hazard. They should be thrown to the compost pile.

## 3.3. Laundry place

If water is available near the house, it is also more convenient to have a place prepared to do laundry. Build a base from stones. Mud mortar may be used, but the joints should be scraped out and filled with cement mortar. The slab is made in a similar way as the one for a shower. The small base on the side is to place the basin and should also be sealed with cement mortar on top so no water can drain inside the waken the mud-mortar. Drainage of the washplace is essential. The place where to stand also should be improved with stone slabs or gravel. For measurements and details see sketch.




Laundry place and two stands for basin



## 3.4. Drainage

For every washplace, drainage is important. If the ground is sloping, drainage can be made by simply providing a gutter leading away from the place. However, if water can not flow free, a soakawy should be built. This is a pit in the ground, where the water has enough time to seep through the walls and the bottom of the pit to the earth. Important is the surface of walls, not the volume of the pit. So if the pit is made in the form of a trench, long and narrow, you have to do less digging and find less filling material then with a square or round form. The needed surface of a soakawy depends on the amount of water and the permeability of the ground. This is low in clay and very high with gravel, so in clay the trench must be larger. For a normal lateritic ground, a trench of 35 cm wide, 80 cm deep and 1,00 - 1,50 m long should be enough.

After digging out the trench, it must be packed with stones or coarse gravel and the top 10 cm with well rammed clay or earth. It there is a pipe leading to the soakawy, it should enter the trench just below this earth packing, the same as for a gutter. Such a gutter also should be packed with stones. Surface water from rain should not enter the soakaway, nor from the surroundings to the washplaces.

## 4. URINALS

Urinals should be constructed in places where many men meet, like markets, drinking houses, schools etc. They consist simply of a soakaway trench without earth topping and an enclosure. The floor should preferably be covered with gravel.

Urinals can not be prevented from smelling, so they should be built away from the buildings. However, they must be clearly visible or known, to ensure use. Urine is transmitting almost no diseases. (An exception is transmission of bilharzia when urinating in a standing or slow flowing water.)

## 5. LATRINES

There is a wide variety on how to dispose relatively safe of human excrements. They may range from individually burying the faeces up to a water-flushed toilet with sewerage. Of all the different types of disposal, only three will be described in this manual. They are dry pit latrines, which means that they have a pit where water can seep away and no water is used for the proper functioning of the latrine. Any latrine that is simpler as the "local latrine" described in this manual should not be promoted, because it likely to create health hazards rather than improvements.

More sophisticated solutions as e.g. the pour-flush latrine and the aqua-privy are too expensive and too complicated to construct for rural Cameroon. (Details about these solutions can be found in the literature.)

Before describing the technical aspects of latrines, three subjects of general concern should be discussed:

### 5.1. Dry or wet pit?

It has been said that the latrines described do not need water for a proper functioning. Any liquid added to the pit can seep through the walls to the soil. The question is if despite of this, water should be added except the one contained already in the excrements (80 - 90% of the volume!) and the one used for cleaning the concrete slab. If more water is added, the accumulation of digested excrements grows about ⅓ less than with "dry" excrements, that means, the pit can last for ⅓ of the time longer. Some people also think that the odours are reduced if some buckets of water are thrown to the pit daily. It is common that washplaces and latrines are connected, the water draining to the pit. If this is properly done with the help of a pipe so that the flow of water will not touch the walls of the pit, it can be accepted.

However, other sources say, that fly- and mosquito-breeding is increased in wet pits. If water is used in pits, about a glass-full

of kerosene per week should be thrown to the pit to prevent such breeding. Latrines with earth floor should not see any water! In any case, rainwater and surface water should not drain into the pit, especially not between pit and platform.

## 5.2. Flies

mosquitoes!! maybe only secondary problem?

One function of the pit is to prevent flies from carrying infectious germs. Flies are attracted by the smell of excrements and they breed in faeces. However, flies dislike darkness and very soon seek the light.

To prevent the danger of flies, certain measures can be taken:

- The pit must be sealed all around except for the hole.
- The hole should always be covered.
- The slab must any time be kept free of excrements.
- The house should be as dark as possible, but not too dark, because then the latrine will not be kept clean. Never should direct sunlight shine on the shitting-area.

A good way to prevent the danger of the flies is with the ventilated latrine, because there only few flies get to the pit, the ones in the pit will try to escape through the vent pipe where the escape is blocked so they die, and the flies attracted by the odours outside of the vent pipe can not be infected.

## 5.3. Reuse of excreta

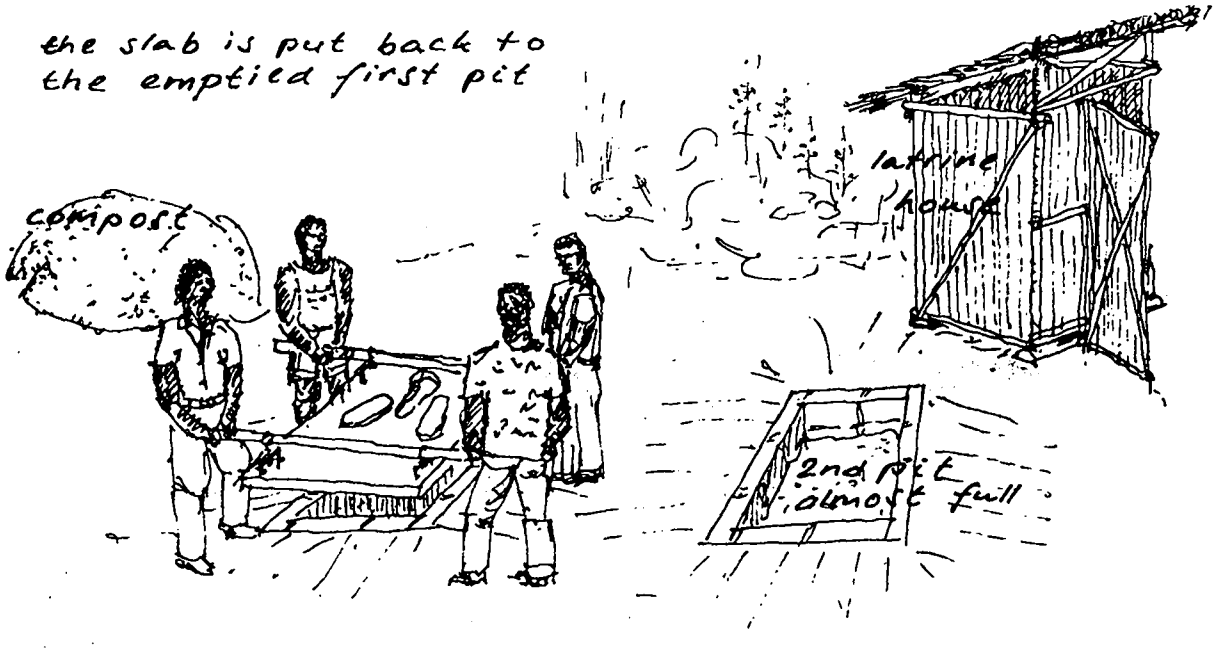
— free planting - manure

In many places, in Cameroon as in other parts of the world, there are strong feelings against handling human - and even animal - excreta. It may seem of small use to advocate the reuse of excreta. However, even if the disgust from excreta may be in part a psychological barriere to infection, the tendency should be to think of excreta as a possible useful product. Human excreta and animal manure are a valuable part of a natural life cycle. Urine and excreta contain large amounts of nitrogene, phosphor and potassium. These are elements of major importance for any plant grow. Especially in developing countries, it is a lavish waste of precious materials not to use excrements again as fertilizer. It may be interesting to note that in some developing countries as China or Vietnam there is

a real struggle among farmers to get all the excrements to compost it and use in the fields. Also in developed countries, animal manure and treated sludge from human excreta-sewerage are largely used in agriculture.

The most simple method for reuse is through the so called two-pit system. This means that a pit is made as described later and the platform put. The size of the pit, that is the depth, should not be too deep, so that the pit will be filled in one to two years (see under "pit" and "volume"). When the pit is almost full, a new pit is made in the same way as the first and the platform as well as the house transferred to the new pit. The old one is then filled up with at least 30 cm of earth and left for anaerobic (= needing no air) compostation. When the second pit is almost full, the first one is dug out again.

The excrements in it have by then composted to an odorless fertilizer containing no bacterias or worm-eggs. It can be used as healthy, valuable fertilizer for gardens or the field.



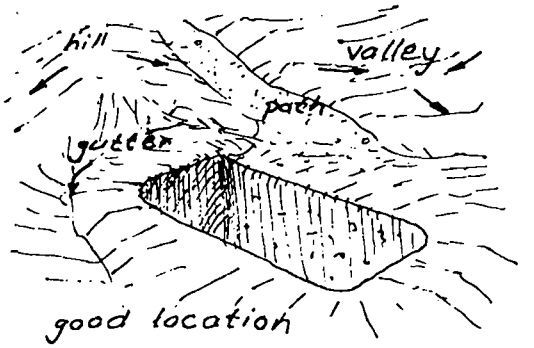

The platform and the superstructure is now moved back to the first pit again, so it is ready for use and the second pit is sealed with earth as the first one before. All the wood ash from the kitchen should be sprinkled over the fresh excreta. This will prevent odours and improve compostation.

## 5.4. Location of a latrine

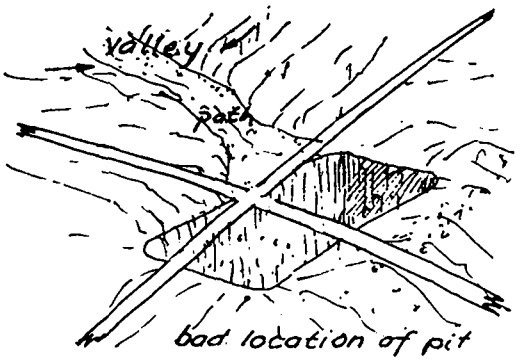
The best location for a latrine can only be considered on the compound itself. The following points have to be regarded:

- The latrine should be away from the house. Optimum distances range from 6 to 15 metres. The further away it is, the less the nuisance by odours and flies. The closer, the more likely it will be kept clean.

- The pit should not reach the groundwater-level. If wells are used and therefore the depth of the groundwater-level is known, the pit should end at least 3m above the highest water-level with a wet pit, and 1.50 m above water-level for a dry pit. The pit should be at least 20 m distant from the well, in a direction downstreams to the supposed water flow of the well. (In most cases this is in the direction the ground is sloping.) If there is a spring, in a radius of 100 m above the spring no latrine should be built.




- The pit should be made where the natural ground forms a hill rather than in a valley, so that all surface water can be drained away from the pit. Also rather place the long side in the direction of the slope.



## 5.5. Parts of a pit latrine

A pit-latrine consist of three main parts, that can be regarded individually. Even if they have a certain relation in the way that a simple platform most probably also will get a simple superstructure, this has not necessarily to be so. Knowing the local conditions, a combination has to be sought to get an optimum of the important requirements:

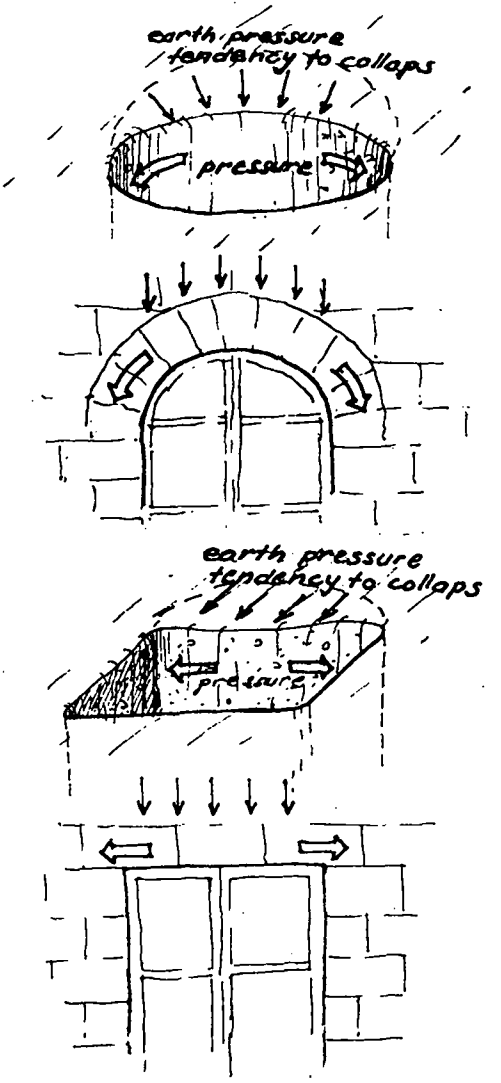
- hygienic
- safe
- affordable
- acceptable

However, it has to be stressed that with the question on which part to economize, the slab should be the last! A good made concrete slab is the centre-piece to last many years, during which the other parts - made more economic - could still be improved.

### 5.5.1. The Pit:

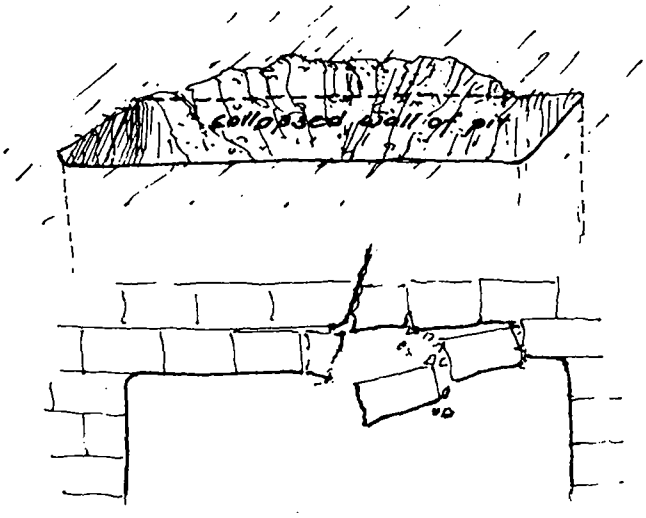
It is important to ensure that the pit can not collaps. This depends from the form and the soil stability.

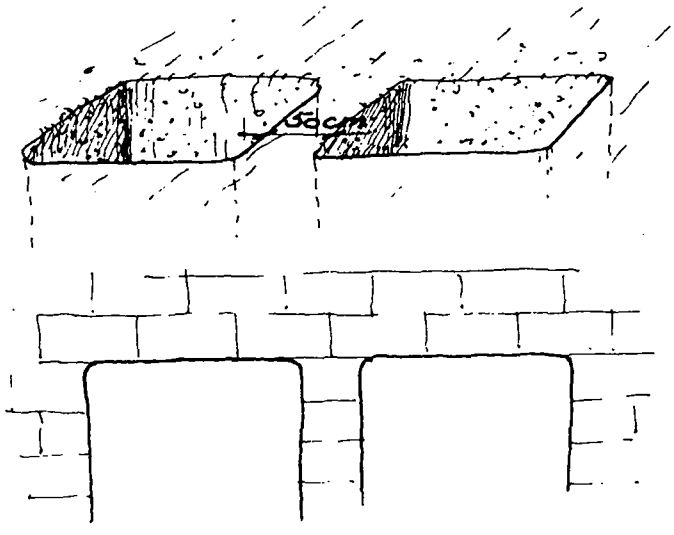
The most stable form for a pit is the round form with small diametre. We can imagine the walls of a pit acting like a lintel over a window. The circular form is like an arch, while the rectangular form is like a straight lintel. The wider a pit (or the larger the span of a lintel) the more we have a danger of collapsing. As the hight of the window is of no importance for the strength of the lintel, so it is only the longest side of the pit that has to be considered, regardless how narrow the pit. The relation of length to width should not be more than 2.5 : 1. For long pits as often used in schools for



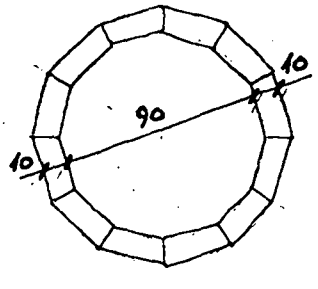
may be not so useful as remark 26 ref. lower paragraph

multiple latrines, the same rule applies. The pits are dug in a line leaving always a wall of untouched earth of at leat 50 cm width between them. If the upper rim of the pit is reinforced, this base should be connected at these seperating walls (pressure).

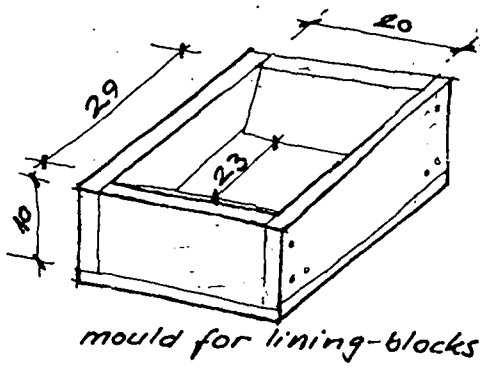



The villagers in most of the cases have an idea about <u>soil stability</u>. In many parts of southern Cameroon we find lateritic soils that are quite stable. In such soils, pits with large dimensions may be dug safely. But if sandy soils are encountered, special precautions have to be taken. It is best to chose a round form with small diametre (80 - 90 cm) and to limit the depth. Rather dig a new pit after a few years than cause a fatal accident! Lining of a pit is a costly operation and needs quite some technical know-how to be properly made. If lining a considered, the pit has to be dug and reshaped very neatly and the lining built up directly touching the earth walls. Backfilling has to be avoided, since it may cause unequilibrated pressures. Also water




pit with lining




mould for lining-blocks

will soak there. For lining, special trapezoidal blocks could be cast, in the same way as normal cement blocks, but with a special made form. For laying these blocks no mortar is needed. In dry soils, lining also could be made from split indian bamboo or sticks. Then it is better to make the pit square to allow a good propping of the sticks.

Normally, the top soil is lose and has less stability. Also is any collapsing most likely to start from the upper rim. The platform will give additional pressure to this part. That is why in all the examples given, a reinforcement of this upper rim as a base for the platform has been suggested. All soils are less stable when wet. Therefore it is most important that no water can soak into the pit, especially not at its upper rim.

In swampy soils no latrine should be dug. If the ground-water-level is very high (less than 1.50 m below the ground) building up a base can be considered to increase the volume. Also length and width may be increased. The same applies for very stony grounds or where rock is quickly reached. Normally in these cases, a good selection of the site can avoid quite a lot of problems. Also foresee the volume in a limited size to last for about 2 years and then move the latrine (compostation!).

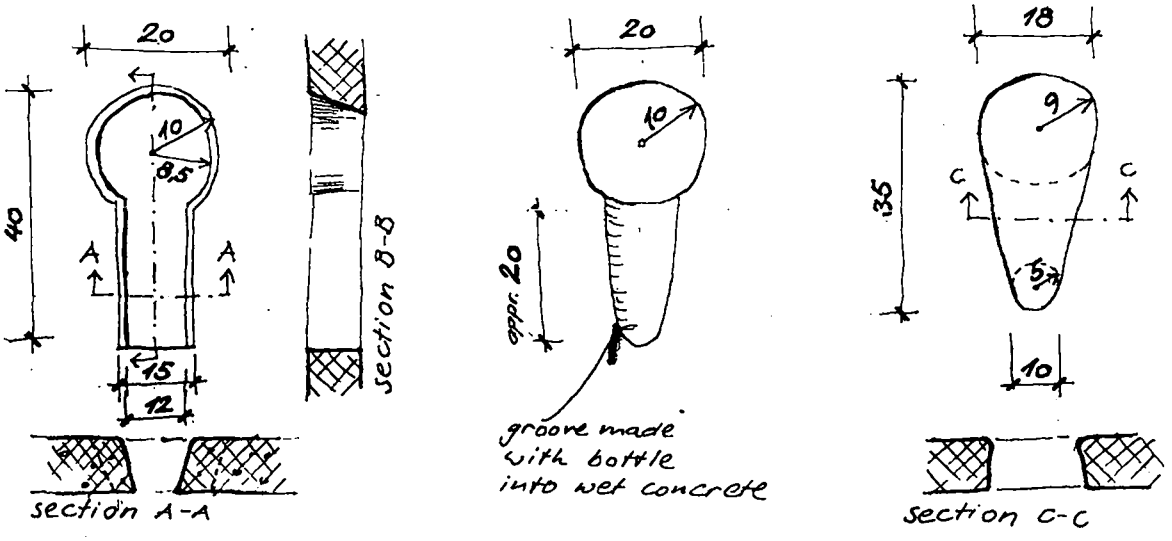
The size of the pit must allow to achive a good volume and still to be spanned easily with sticks or a slab. A width of 80 cm - 1.00 m is recommended. The length can be 90 cm - 2.00 m. The depth of the pit depends on the number of users and the expected lifespan of the pit, on wether the content should be composted and reused, and of the height of the groundwater-level. If no reuse is foreseen, the pit should be as deep as possible, about 6 - 10 m.

The necessary volume depends much on the anal cleansing materials and if only excrements or also other refuse it thrown to the pit. A figure of 0,06 $m^3$ per person can be taken as average volume per year. This means that a pit of 90 cm x 1.00 m and 2.00 m deep (= 1.70 m useful depth for composting) would serve a family of 12 persons for about 2 years. A pit of also 90 cm x 1.00 m and 8.00 m deep would last the same family for 10 years.

(calculate: $\frac{\text{length x width x depth}}{0.06 \text{ x persons}} = \text{years}$ e.g. $\frac{0.90 \text{ x } 1.00 \text{ x } 8.00}{0.06 \text{ x } 12} = 10$)

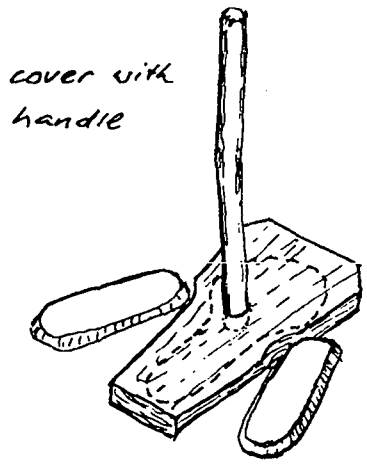
5.5.2. The platform or floor: The platform covering the pit is the most important part for hygiene. The best is a smooth, hard, waterproof surface as provided by a concrete slab. Whenever it is affordable, a concrete platform should be recommended. If any subsidiary is provided by a programme, it should be used to help in distributing the largest number possible of safe platforms, leaving the rest to the householders. For the construction of concrete slabs, a good supervision is essential to achieve strong and smooth slabs.

A reasonable healthy floor can also be constructed of wood (bush-sticks) and a layer of rammed earth. Here it is very important to keep the platform dry from rainwater and urine. This increases the lifespan of the wood, but especially will prevent the development of hookworm larvae. These larvae die if the latrine floor is always kept dry. Cleaning should be done by sprinkling wood-ash to the floor and sweeping it through the hole into the pit.



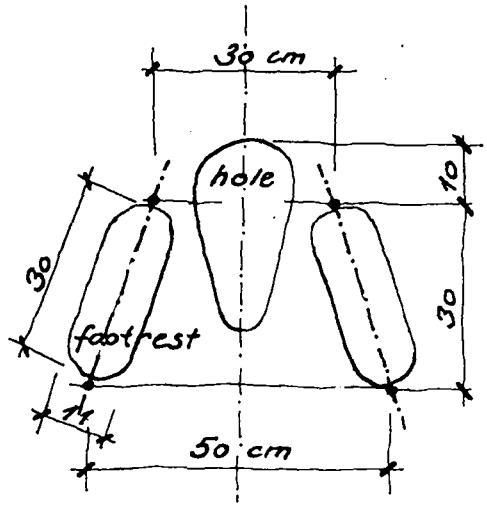

possible forms and dimensions for holes

The hole should be large enough to prevent soiling of the platform but not too large so that a small child could fall through. A good form is an egg - or keyhole shape having a width of 15 - 20 cm and a length of 30 - 40 cm. If just a round hole is made, a channel should be provided in the platform in front of the hole to drain the urine to the pit. The whole platform always should also be sloping to the hole.




The hole should always be covered. It is good to provide a cover with a stick. Like that is is more easy to handle and therefore more likely that it is put back again. Also will it not be soiled.

The platform should be provided with footrests of about 30 cm length and 10 cm width. They are placed in a way to be 30 cm apart behind and 50 cm in front. The end behind should be 10cm from the behind rim of the hole. The footrests are sloping the same as the platform. They ensure a proper squatting position and therefore prevent soiling of the platform. They also will provide a cleaner place to stand than the lower part of the floor.




correct position of foofrest

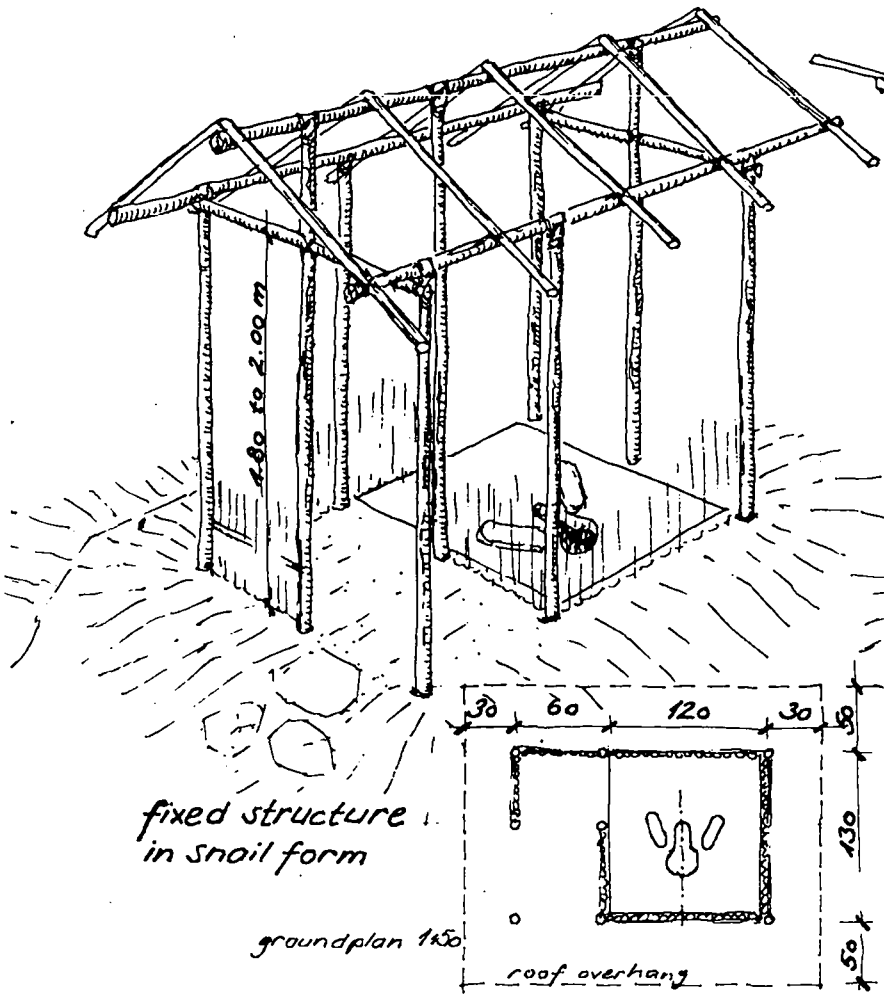
5.5.3. The superstructure or house: It has two main functions:

- keeping the floor dry from rain
- provide privacy.

The first point is of prime importance for mud-floors. The condition of the roof should regularly be controlled in these cases.

The latrine superstructure should be built in the same way as the house of the family. When there are different standards of houses it should be constructed in the same way as the kitchen. If the latrine has a lower building standard than the kitchen, it will probably not be kept clean enough. If the standard is higher, it is doubtful wether it is properly used by all and not just an object of prestige. The use of the same building methods also express, that the latrine is a part of the compound and guarantee that the owner is familiar with the techniques needed for construction and maintenance. Some possibilities for latrine-houses are shown with the examples. An excellent material for the manufacturing of walls is raphia-bamboo. The raphia stalks are joined to vertical pannels. Any bracing should be on the outside, so that the inside is smaooth.

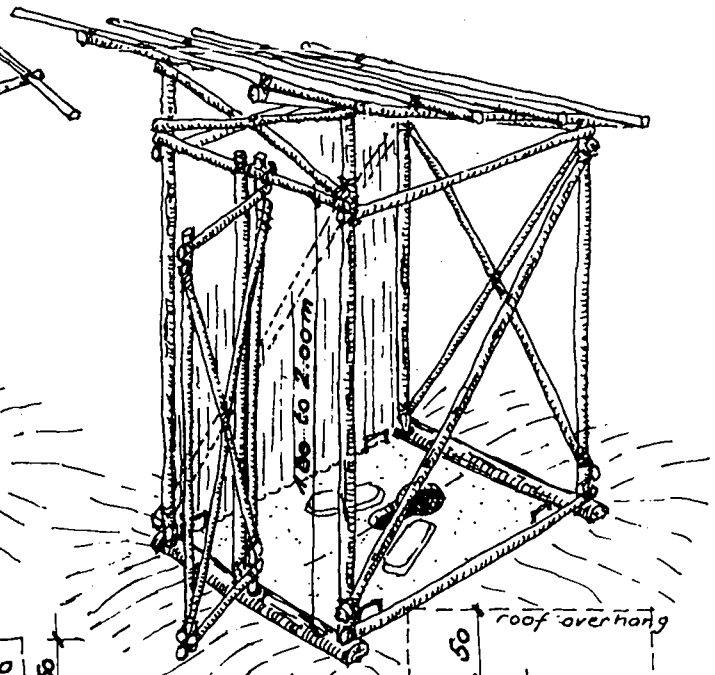
# SUPERSTRUCTURES



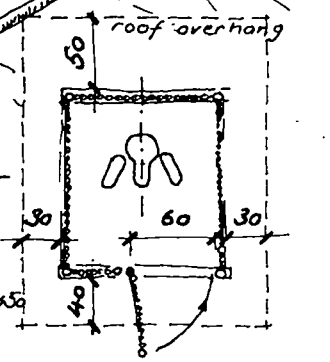

fixed structure in snail form




groundplan 1:50

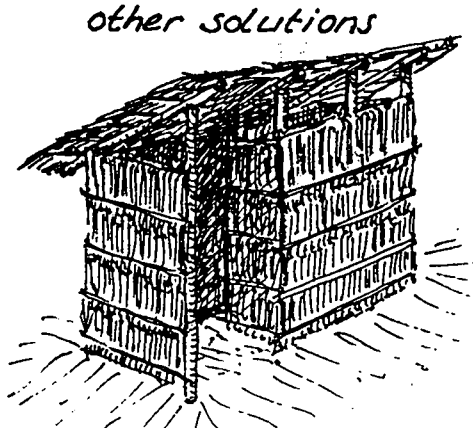



portable structure with door

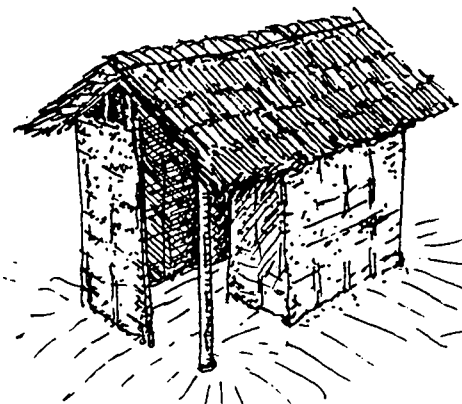



groundplan 1:50

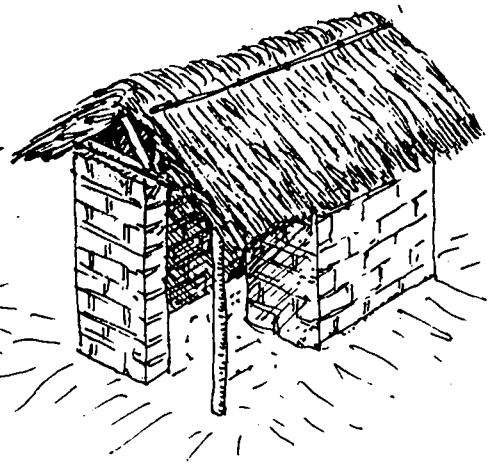
other solutions



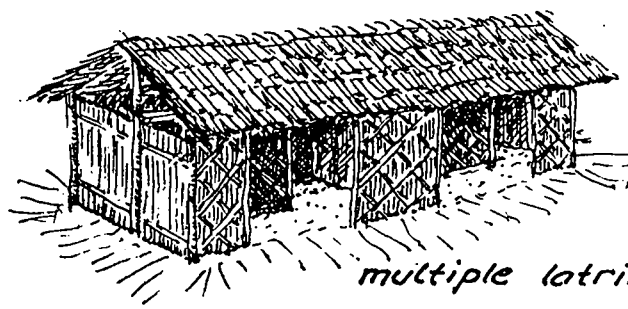
palm thatches and lean-to roof



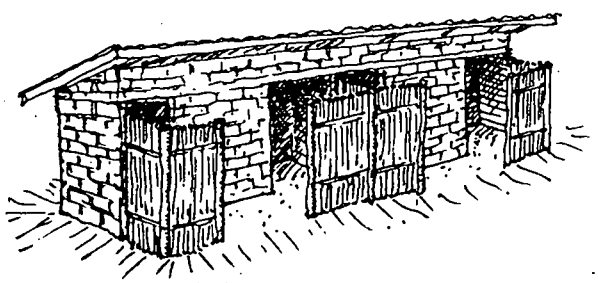
poto-poto with palmthatch roof



mud-blocks and grass roof



multiple latrines



7/8/84 HRR

Generally, the walls around the hole should be as smooth and water-proof as possible, to allow cleaning with water. A possibility that is very suitable for mud-block or poto-poto houses is the cladding of the walls inside with zinc-sheets to a height of at least 1.00m. The roof can be of any common roofing material as palm-thatches, grass or zinc-sheets, as long as it is water proof.

## 5.6. The Local Latrine

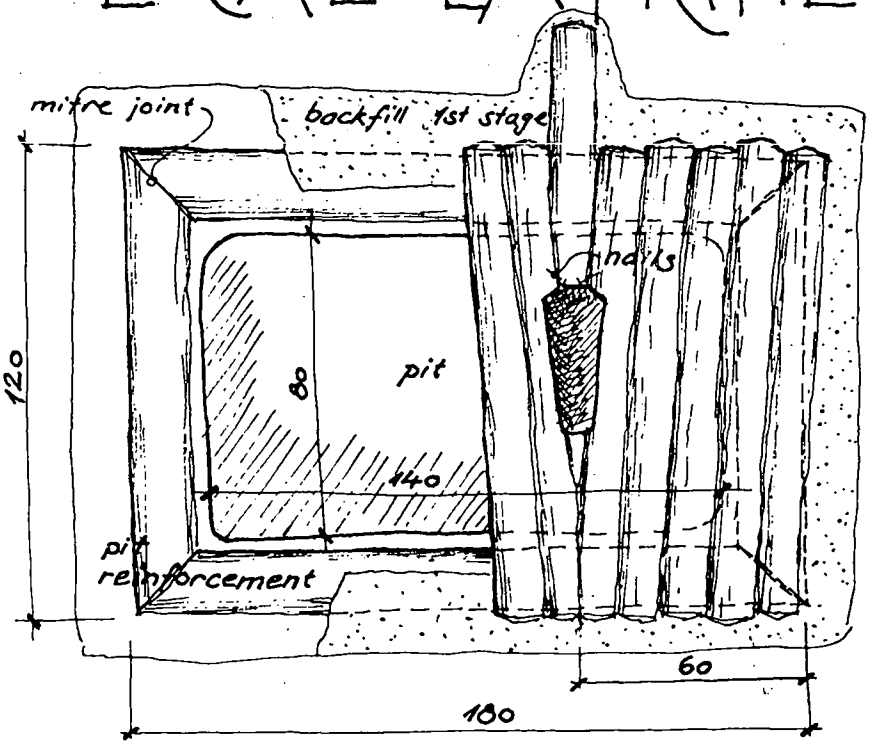
A type of latrine that does not need the purchase of any materials is called here "local latrine". Even if such latrines could be constructed very independently by the villagers, they still need a close supervision for the correct execution of some construction details and for maintenance. It is the type of latrine that harbours the most health hazards.

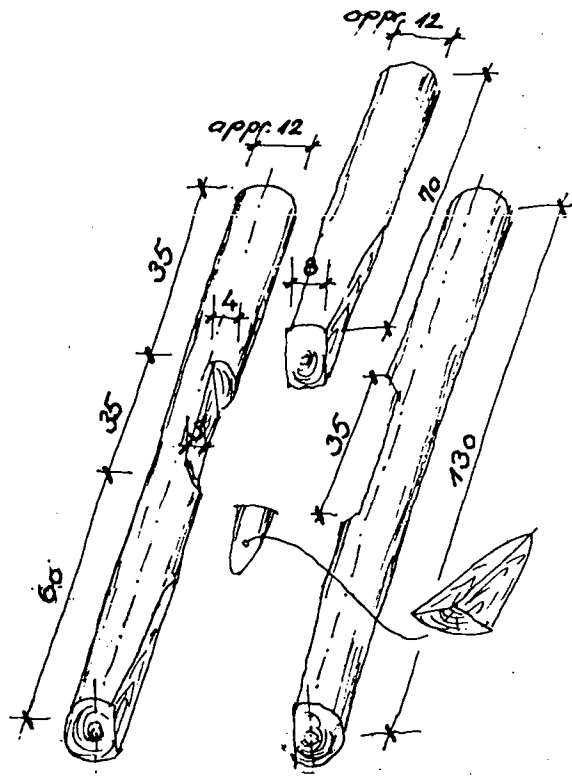
Construction:

- The dimensions are chosen in any convenient measurement, e.g. 80 cm x 1.40 m for the pit.
- The necessary wood is prepared. Needed are strong bushsticks of at least 12 cm diametre, 1.30 m long, and logs of about 18 cm diametre for the base, 2 pieces of 1.20 m and 2 of 1.80 m. Sticks with smaller diametre resist much less to the attack of insects and funghi. The bark should be removed. Painting the wood with old motor-oil may help a little bit to preserve them longer. Any other commercial wood-preservative is too expensive and of only limited effect. Money should rather be used to build a concrete platform.

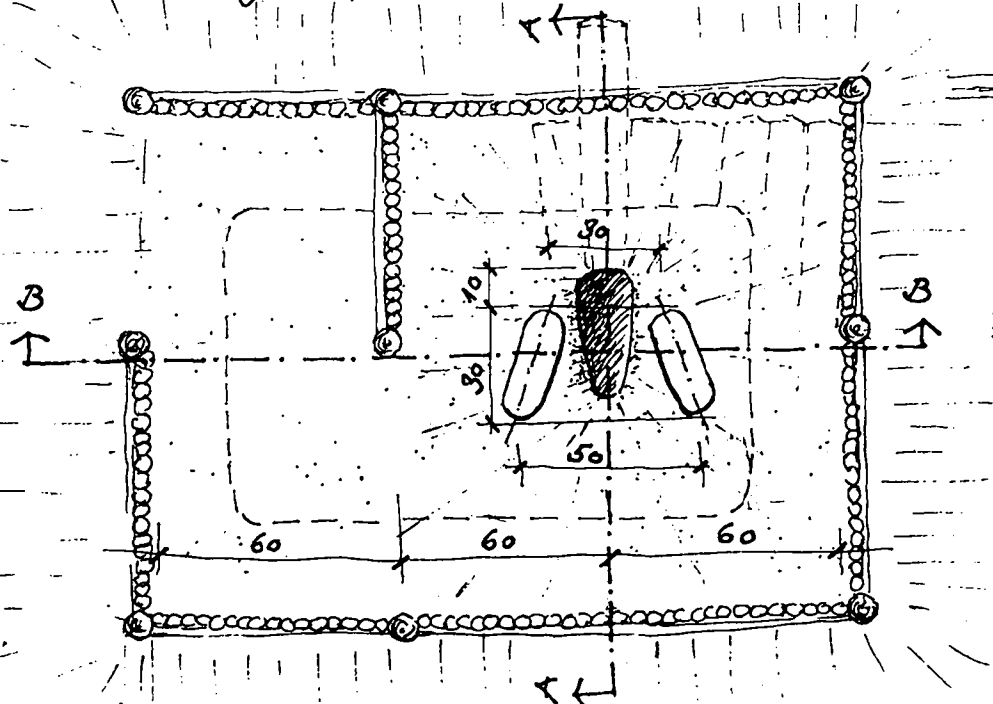
  In the forest areas, often chainsawn timber of good hardwood quality is easy available in villages. (Ironwood/Azobe, Camwood/ Padouk or others). Only in these cases where just the fuel for the chainsaw has to be paid, and with such good quality wood, sawn wood should be used. Scantlings are used for the base and boards of at least 3 cm thickness for the covering. If the boards are smoothly planed on the upper side, no earth covering is necessary.

# LOCAL LATRINE

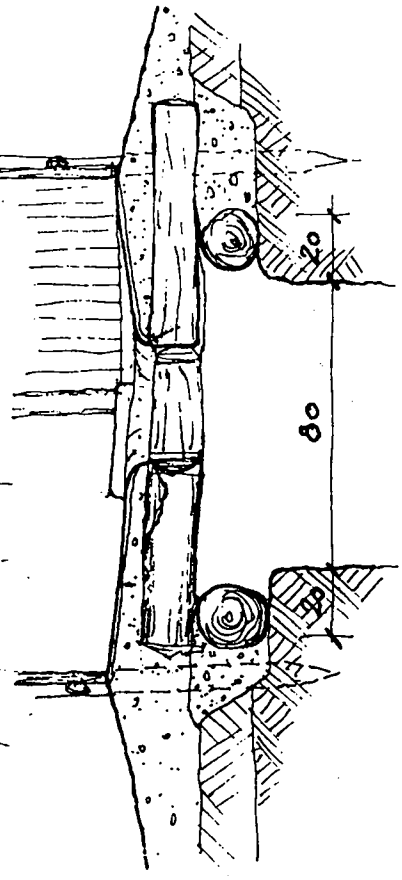


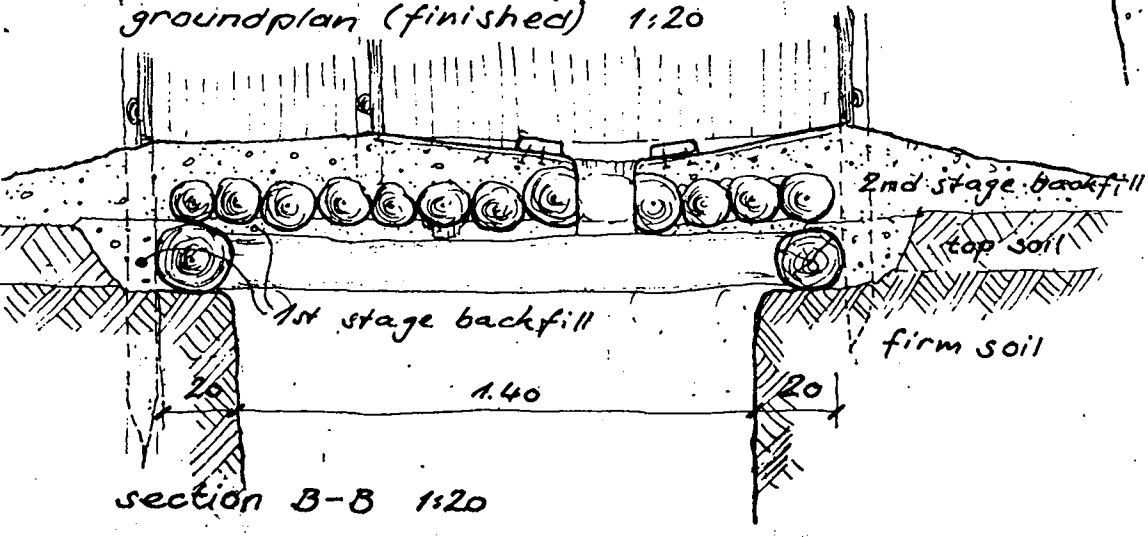

1st stages of construction




groundplan (finished) 1:20



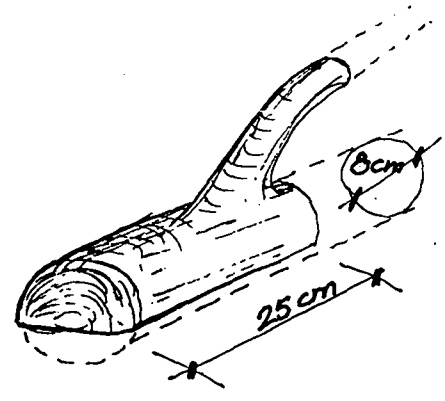

section A-A




section B-B 1:20

3/8/84 HRR

- Materials for the house, especially roofing materials, also should be prepared now to ensure the floor is covered as soon as it is made.
- First dig the topsoil about 1.60 m by 2.20 m as deep as the diametre of the logs for the base and remove it far away. Then dig the pit 80 cm x 1.40 m to the desired depth and place the earth close to the pit.
- The wood for the base is cut with an angle of 45° (mitre joint) in the corners to resist pressure. Place the base and backfill to the upper rim with well rammed earth. (For any backfilling and covering always use soil from the pit, not topsoil.)
- Covering sticks are prepared to form the hole (choose the ones with largest diametres) and placed first as shown in the plan. The additional logs are placed right and left of the hole. If a stick is bent, the bend should face down.
- To cover the platform some of the excavated soil is mixed with water so that it can be formed, but does not stick to the hands. It is better to leave the mud for one or two days.
- The openings between the covering sticks are filled with smaller branches grass or raphia. The mud is spread over the platform and well rammed with a special tool made from a branch. The thickness of the mud layer should be about 6 - 10 cm and sloping to the hole. If the hole is not long but round, form a drain for urine.

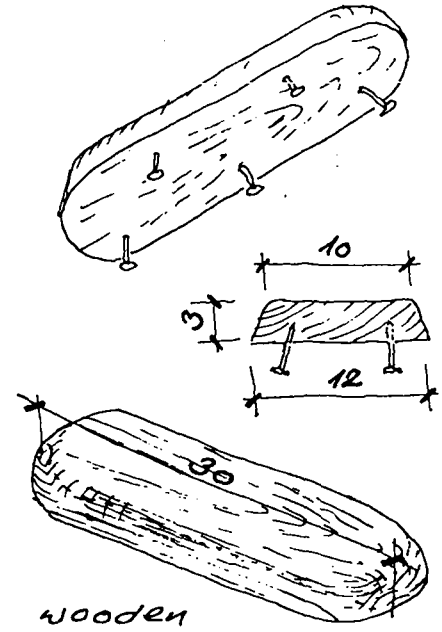


battering tool, made from a stick with branch

- The remaining excavated soil is packed sloping to the outside around the platform.
- The structure for the house is erected and roofed.
- A mixture of 1 headpan dry, loose woodash (without stones larger than 5 mm) and 1 headpan dry, loose woodash (without pieces of charcoal) are mixed to a mortar consistency. The mud of the platform is wetted and the plaster applied and smoothened like

the usual cement floor topping.

- The footrest are placed in the wet topping. They are made from 3 cm thick hardwood, planed sandpapered and provided with some protruding nails or screws (about 2 - 3 cm) on the underside and hammered into the mud. The floor is left unsed until completely dry. If cracks develop, they should be filled with the same mud/ash mixture and smoothened.
- When the floor is completely dry it is painted with old motor-oil, including the footrest.




wooden foofrest

5.6.1. Building programme for local latrines: Most of the building techniques necessary for this latrine are familiar to normal villagers. However, if in a region a large number of latrines have to be constructed, technical assistance should be given. For general health questions, the health worker is the right person, but for this technical assistance probably another person should be recruited. In every village there are skilful persons that normally assist in the construction of local houses. Such a person should be assigned as supervisor to the building-programme. He and the health worker first take part in the construction of a demonstration latrine in the village under the direction of a technician trained by the programme - direction. Such a demonstration latrine always should be built in a village, even when no programme is intended. It should be at a place where many people can see it, as the health post, the school etc.
The following describtion will give an idea, how a latrine programme could be directed by one of these local supervisors.

For construction, the householder needs the following tools:

- ladder, about 8 m long.
- hoe, cutlass
- bucket with 10 m rope

. battering tool (selfmade)

If possible also:

. spade, pickaxe

. axe, saw

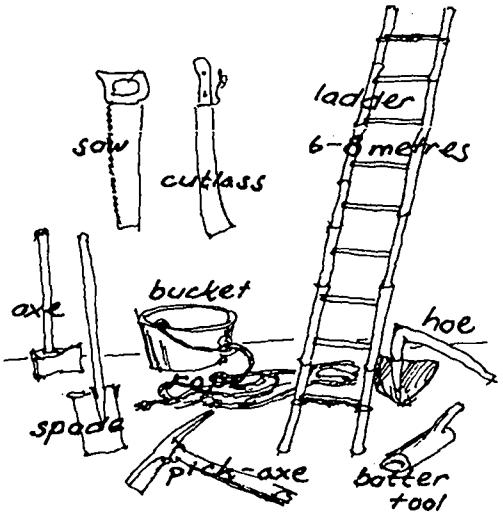
The supervisor will provide:

. metre, nails, hammer

. headpan, sieve, trowel, steel float

. prefabricated footrests

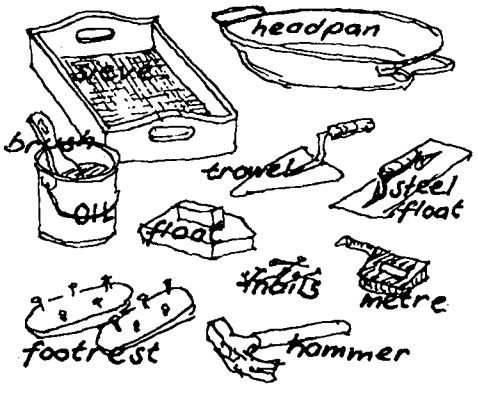
. old motor oil and brush




tools of the house-holder

Building process:

. The householder, supervisor and health worker decide on the location, dimensions and construction method of the latrine. The house-holder is instructed about tools and exact list of materials to prepare.




tools of the super-visor

. The house-holder prepares all building materials, namely wood (sticks) roofing materials (ready made palm-thatches, grass or zinc-sheets) materials for walls (raphia pannels, mud-blocks, sticks and bamboo for poto-poto etc.)

. The supervisor checks the materials and gives further instruction for its preparation (cutting of wood). The pit is set out.

. The householder removes the topsoil and digs the pit. All material is prepared as assigned.

. The supervisor checks the pit and helps the householder to place the wood correctly. Indicates about backfilling, covering of platform with mud and construction of house (roof).

. The householder is doing this.

- The supervisor controlls. Applies the mud/ash topping and fixes the footrests. He "seals" the latrine with thread or string so it is not used already.
- After enough time for drying, the supervisor checks for cracks, and paints the platform with old oil. The latrine is now ready for use.

The placing of the footrests - provided by the project - could serve somehow as a "quality label", certifying that the householder did all the construction tasks completely and correctly. Having "official footrests" will probably serve as an incentive to make the latrine according to recommendations.

## 5.7. Concrete Slab Latrine

The concrete-slab latrine should be promoted whenever this is affordable. The slab unlike the wooden covering, is safe for dozens of years and can be used again and again by simply transferring it to a new pit. If any money is used for a latrine, it should be used for such a platform.

A good supervision for the slab construction is important to guarantee stability and smoothness.

Construction:

- Materials for slab, pit reinforcement and house are prepared (except cement!)

**Materials for slab:**

1 headpan cement = $^{2}/_{5}$ bag
2 headpans sand
3 headpans gravel
} concrete

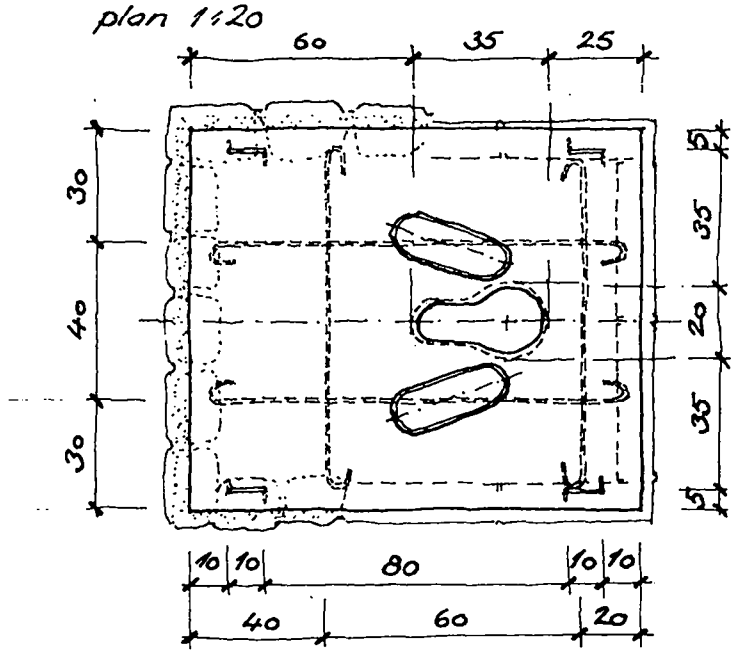
6 m reinforcement rod Ø 6 mm

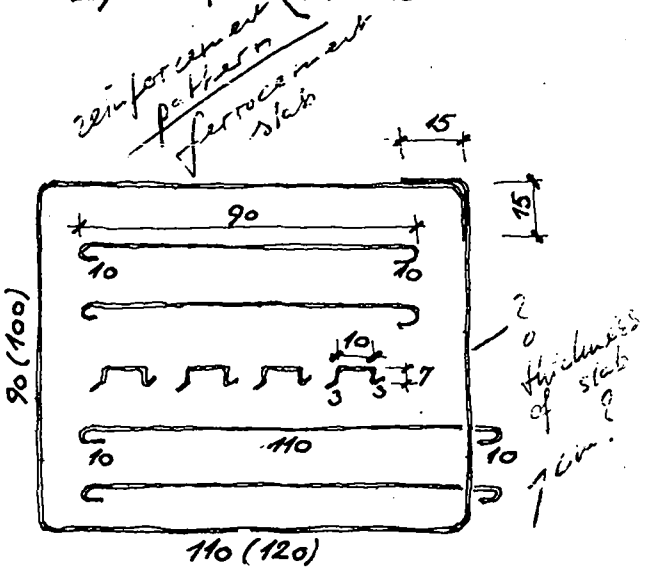
½ headpan sand = 2 parts
cement = 1 part
} topping

Materials for base:

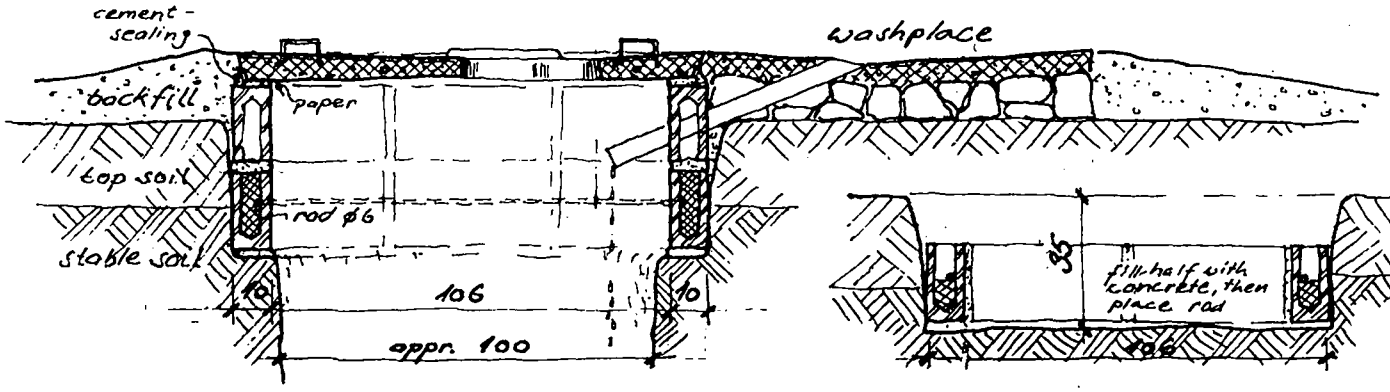
With stones
6 headpans concrete 1:2:3

# CONCRETE-SLAB LATRINE



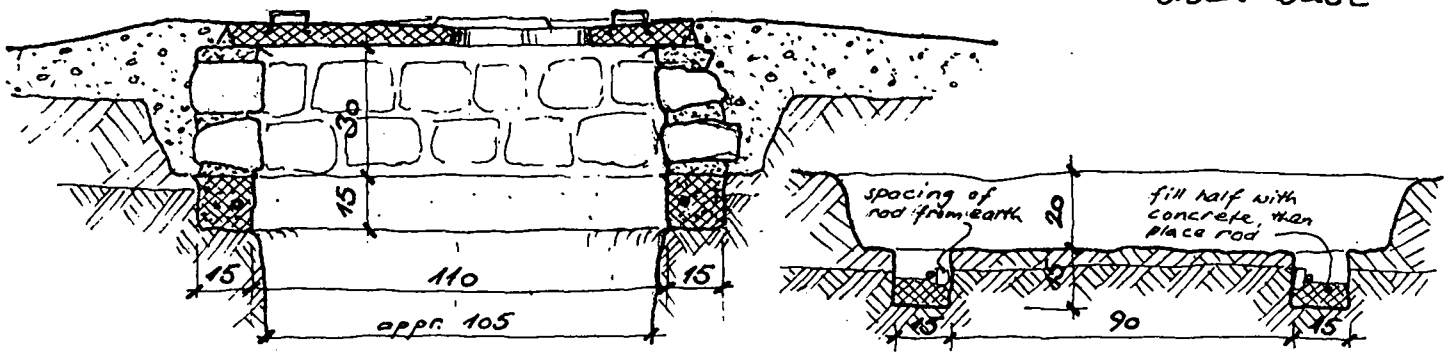




reinforcement 1:20
rods ø 6mm, total length 10,70 m
(measurements in brackets for stone-masonry base.)



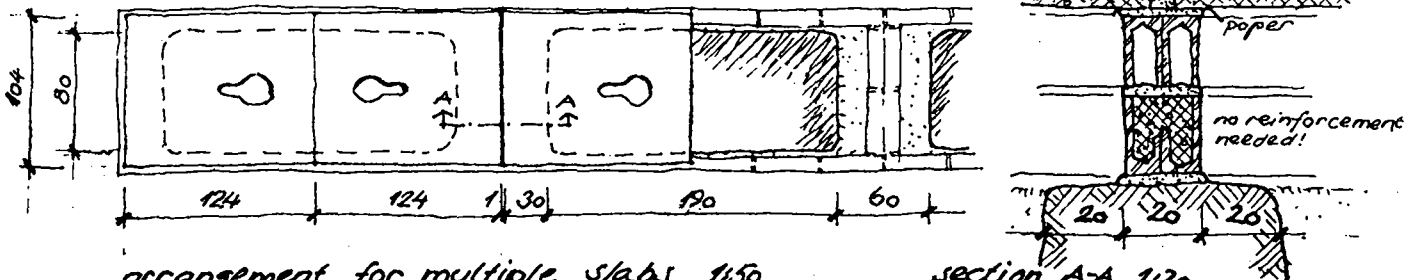

section 1:20 cement block base

start construction cement-block base




section 1:20 stone masonry base

start construction stone masonry base



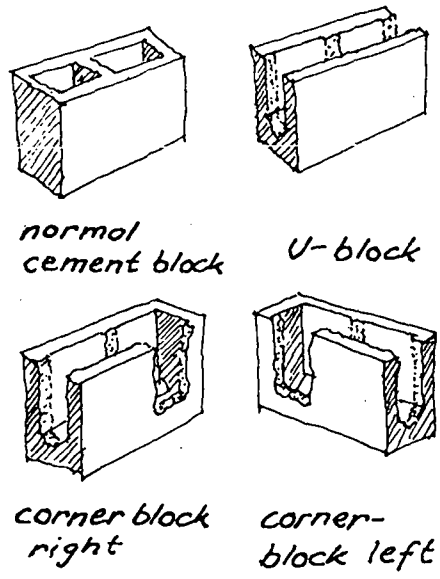

arrangement for multiple slabs 1:50

section A-A 1:20

6/8/84 HRR

4.70 m rod Ø 6 mm
appr. 70 masonry stones
appr. 5 headpans mortar 1:6

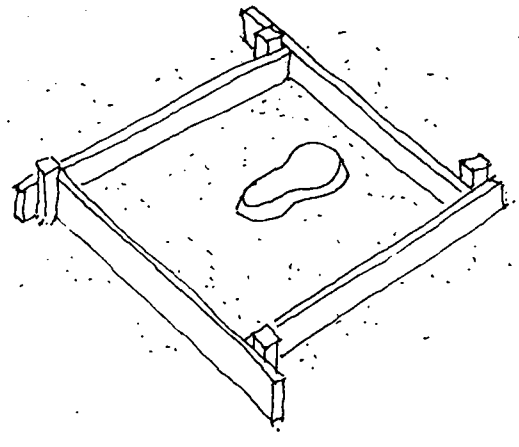
With cement blocks:
3 headpans concrete 1:2:3
4.30 m rod Ø 6 mm
10 blocks 10 cm normal
6 U-blocks straight
2 U corner-blocks left
2 U corner-blocks right
appr. 3 headpans mortar 1:6




. The topsoil is dug out in the size of the pit reinforcement. For stone masonry 20 cm deep, with level bottom. A trench 15 cm deep and 15 cm wide is dug, outside measurements 1.40 m x 1.20 m. The trench is halfway filled with well rammed concrete, the rod placed in a way that it is towards the inside of the pit, but always having at least 3 cm distance from the earth wall (use small stones for spacing) then the rest of concrete filled, and rammed. The stone masonry can now be erected.

For cement blocks we dig 35 cm deep exactly to the outside measurements of 1.26 m x 1.06 m. The U-blocks are placed on a layer of mortar close to the walls of the pit and the inside gaps close with mud. After filling well rammed concrete halfway, the rod is placed as close as possible to the inside wall of the U-blocks (it may touch the wall), then completely filled and rammed. The next course of blocks can immediately be laid.

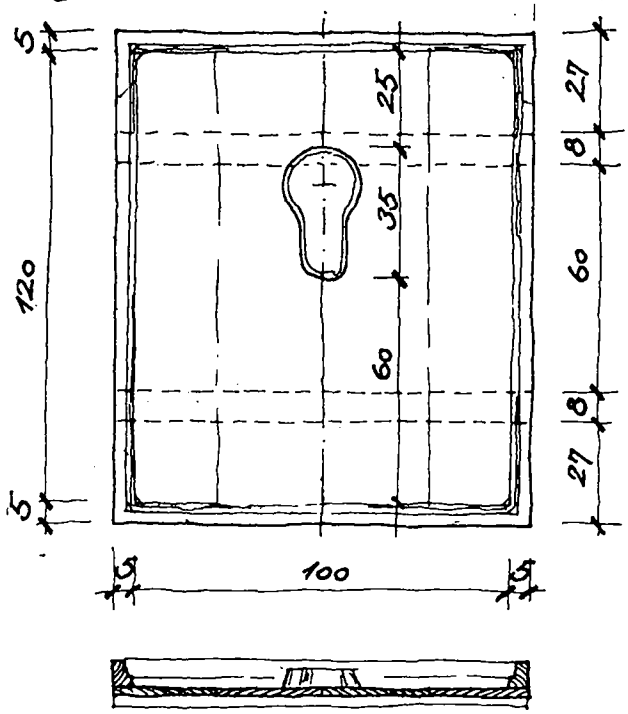
. The form for the slab is prepared. If more than an isolated slab have to be cast, it is advisable to provide a wooden formwork for multiple use as shown in the plate "formworks", If not a pit with level floor of 1.20 m x 1.00 m and walls 7 cm high is dug in the ground. Another possibility is to place 7 cm high boards (see sketch) on a levelled floor.



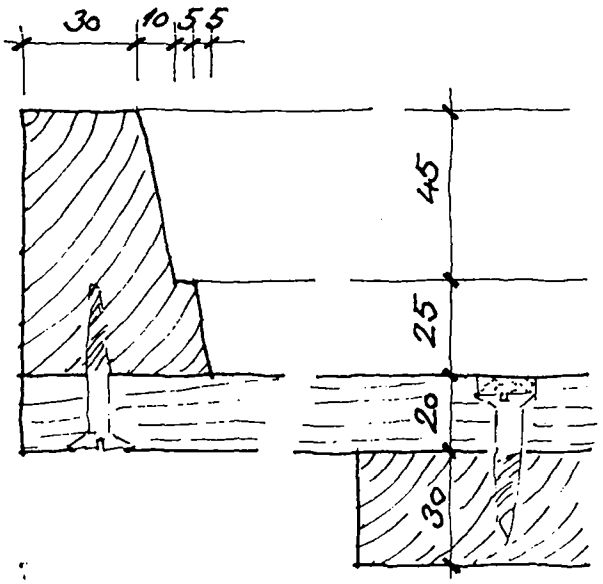
# FORMWORKS

durable wood like Iroko, Mahogany. etc.

## slab 1:20

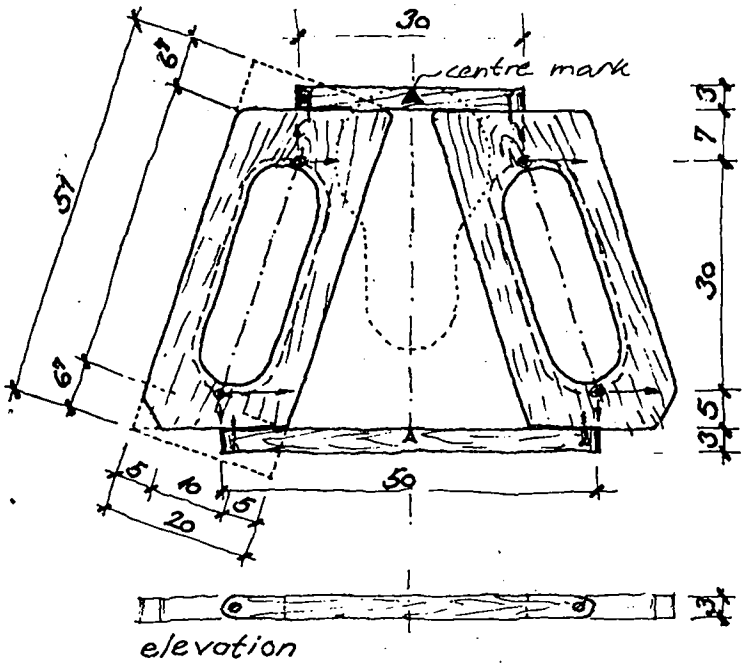




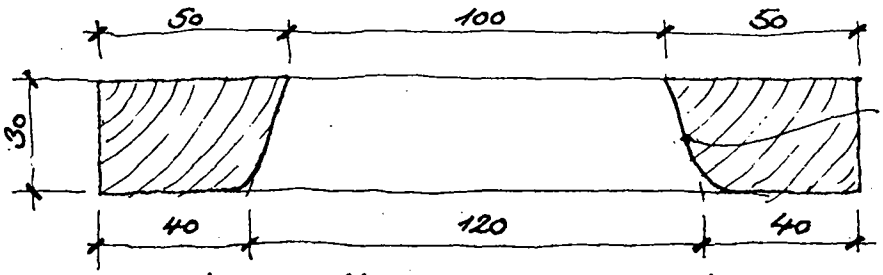




detail-section 1:2 (in mm)

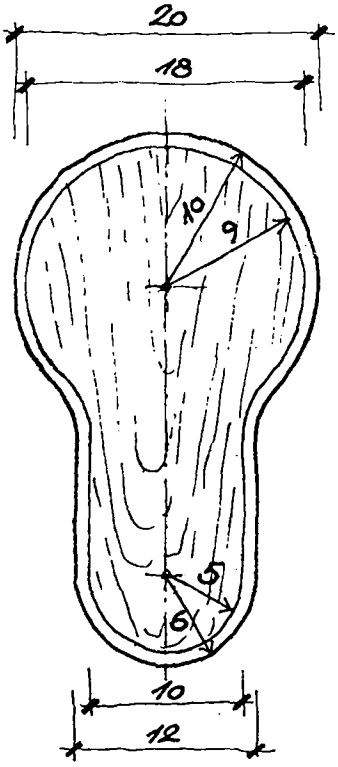
## footrest 1:10



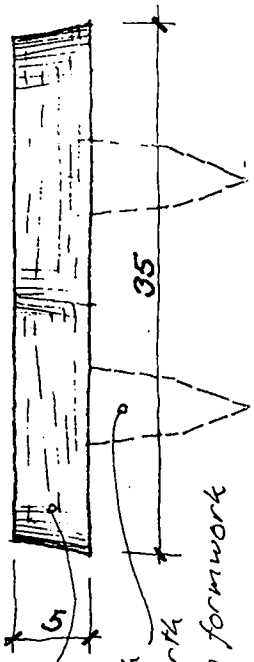

elevation




detail-section 1:2 (in mm)




hole 1:5




sides varnished and sandpapered

pegs only used with dug-out form in earth if not screwed to formwork

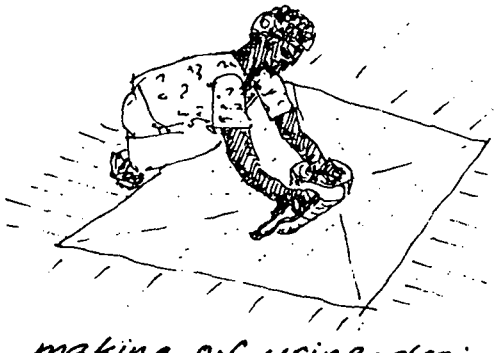
4/8/84 HRR

The wood has to be oiled and the whole form well watered (also an earth form!)

- Materials for concrete are mixed 3 times dry and 3 times wet. Only add little water to get a very stiff concrete! Too much water makes the concrete less strong. If no dry cement powder can be seen any more, there is enough water.
- Spread a first layer of about 2.5 cm in the formwork and ram very well. It is good to mark this height with battens or a rebate in the formwork. Place the rods, fill with well rammed concrete and screed the surface to get the necessary slope. Note that the form for the hole is only 5 cm high.
- Immediately after casting spread the topping on the fresh concrete and work it well into the surface with the float. Smothen it with the steel float. Take special care around the hole to make the inlet round. If you only have a round hole (banana-stem) make a urine drain with a bear bottle. Hammer in handles into the wet concrete.
- Place the formwork for footrest. Scrap the concrete out to get a good bond and fill with very well rammed, stiff concrete. Remove form very carefully. Smoothen surfaces and round all corners.

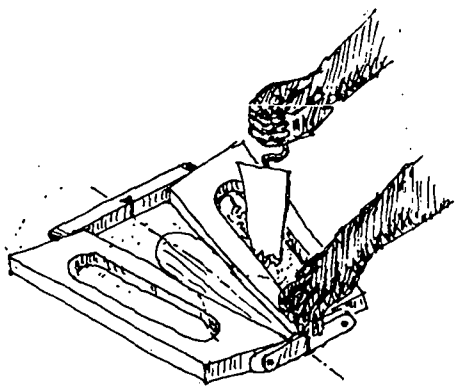
second part casting and ramming

screeding the slope

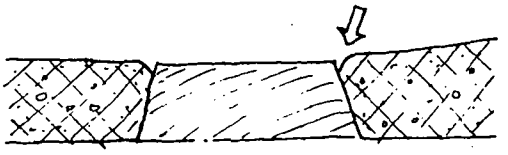


making of urine-drain with a bottle

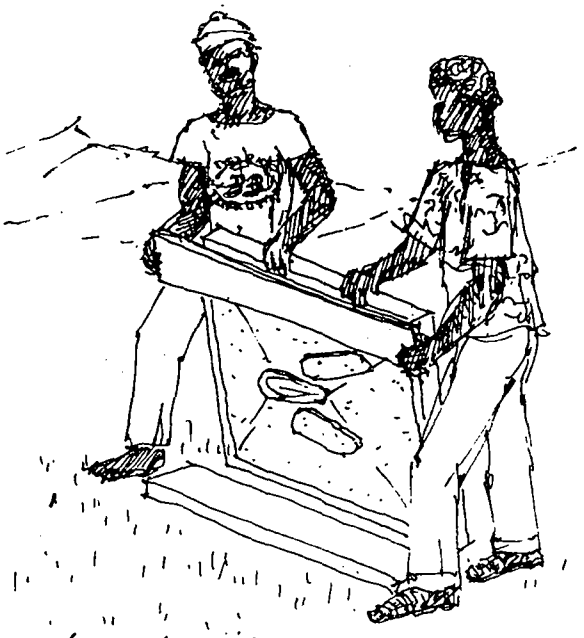
- Cover the slab with two layers of bababa leaves or grass. It must be watered every morning and evening during 2 weeks and always remain covered.
- If the wooden formwork is needed for other slabs, after three days the slab can be turned very carefully and the slab placed on the floor with the help of boards. Use one board to retain the slab in the form, so it can not fall out. Loosen the formwork by tapping with light strokes of the hammer and lifting the form. The fresh slab still has to be covered and watered again to complete the two weeks.
- When the pit reinforcement has been cured for two weeks, start digging of the pit to desired level.
- When curing of the slab is finished, spread a thin layer of very plastic mortar on the base, cover with cement-bag paper and place slab on top of paper. Remove exceeding paper and seal with a little mortar all around.
- Ramming of excavated soil in a slope around the platform and construction of superstructure as in local latrine.



roughening before casting of footrests



rounding of cement around hole-form



turning the slab

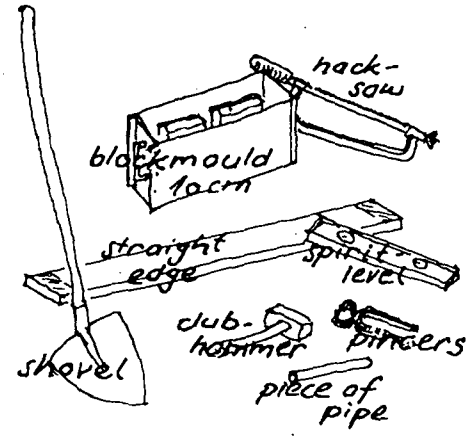
5.7.1. Building programme for cement-slab latrines: A good idea would be to promote a programme, where the purchased material (cement and rod, appr. 7.000 FCFA 1984) would be partly or fully subsidized by the project and supervision granted. Local materials as stones, sand, gravel and materials for the house had to be provided by the householder, as well as general labour.

Tools for the householder in addition to the ones used for local latrine:

- Clubhammer for shaping stones and making gravel from stones

Tools for the supervisor:

- metre, spirit level, straight edge
- shovel, headpan, trowel, wood - and steel float
- club hammer, hacksaw, piece of pipe (for iron bending), pincer
- formworks for slab, hole, footrest
- blockmould 10 cm




additional tools needed for concrete-slab

Building process:

(S: indicates tasks to be undertaken by supervisor and householder together, H: indicates work of householder alone)

S: Preliminary discussions, setting out of pit, instruction on materials.

H: Preparation of all local materials, digging of topsoil, moulding of blocks.

S: Checking materials, casting of base reinforcement, building of base, casting and finishing slab.

S: After 3 days checking of curing, eventually remove formwork for slab.

H: After 2 weeks excavation of pit

S: Placing of the slab

H: Finishing backfill and construction of superstructure

As is made clear from this description, that the most difficult part - requiring a skilled mason as supervisor - and also the most expensive and labour intensive for skilled work is the construction of the base.

However, the important part is the slab and not the base. If the adoption of the whole construction process described is considered as too costly or too complicated, concrete slabs can still be used without a base, even if it is not much recommended.
Conditions are that the soil is very stable and the drainage around the pit perfectly done.

Multiple concrete-slab latrines: For schools and public use, multiple latrines may be required. The same model as described can be adapted for that purpose with pits of 80 cm x 1.90 m and intermediate earth walls of 60 cm. The slabs are placed back to back (see plate "concrete slab latrine").

## 5.8. The Ventilated Pit Latrine

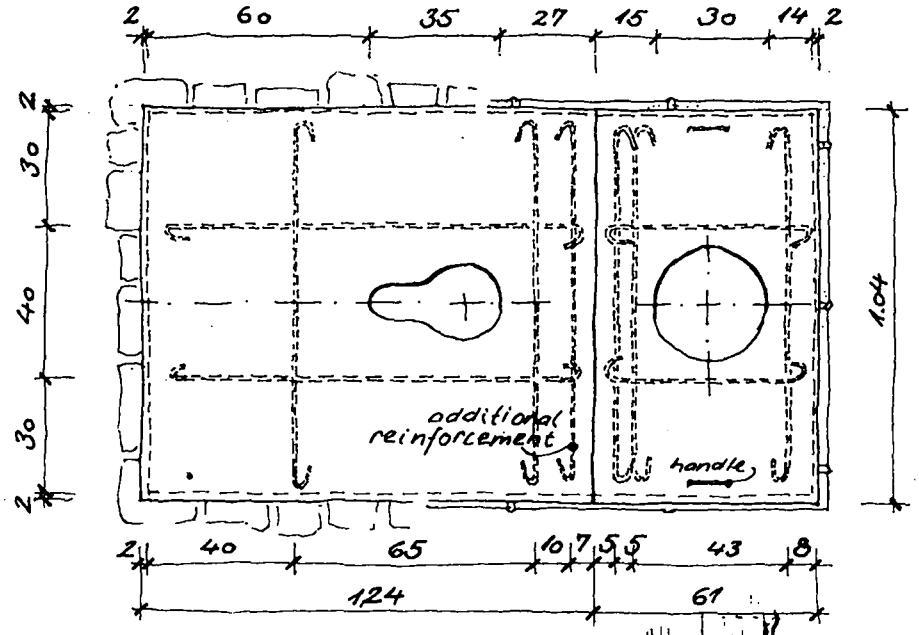
The concrete slab latrine is rather safe against direct infection - provided it is kept clean - but is still not free from flies, unless it is very deep or the cover is always scrupulously put. There also are bad smells from the latrine that make a use unpleasant, especially if the hut has little ventilation.

A good way to overcome these inconveniences is to provide the latrine with a ventilation pipe. The updraft in the pipe will cause a constant air movement in through the hole in the slab and out through the pipe. To ensure this air-movement, the pipe has to have a minimal diametre of 15 cm with smooth walls as PVC or Asbestos, and of at least 20 cm with rough walls as the other solutions suggested. The pipe has to have a height of at least 3 m and to project 50 cm over the roof of the superstructure. No house or tree should obstruct the free flow of winds.

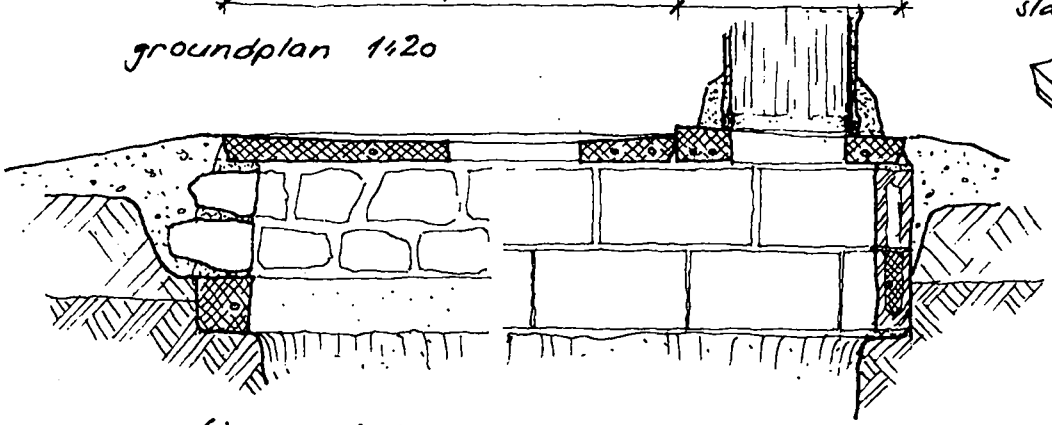
The opening of the vent-pipe is covered with mosquito-mesh. Flies in the pit are attracted by the light entering through the vent-pipe and fly up there. Since the exit is blocked, they finally die.

A cover for the slab-hole should still be provided, but it should have nailed battens of about 2 x 2 cm on the bottom, so that some opening remains. This will ensure that the air is escaping through the larger hole, the vent-pipe, and entering through the small one, the covered slab hole. It also makes sure that the only light entering to the pit is coming through the vent pipe.

# VENTILATED LATRINE

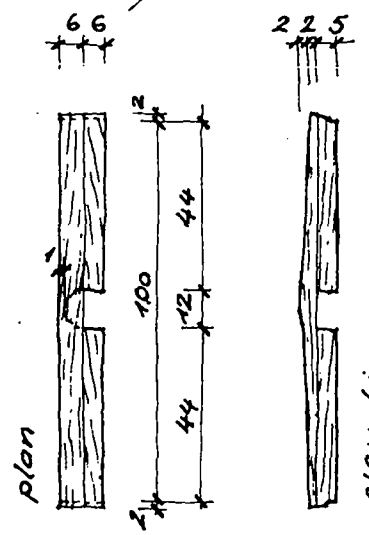



groundplan 1:20

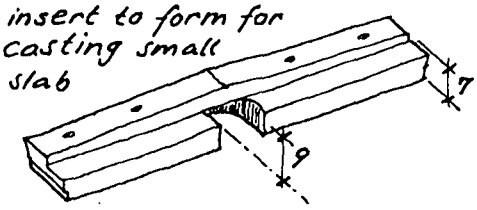


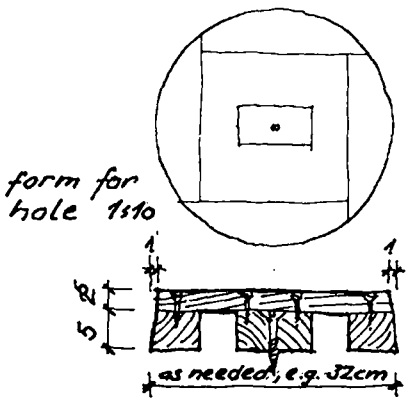
section 1:20

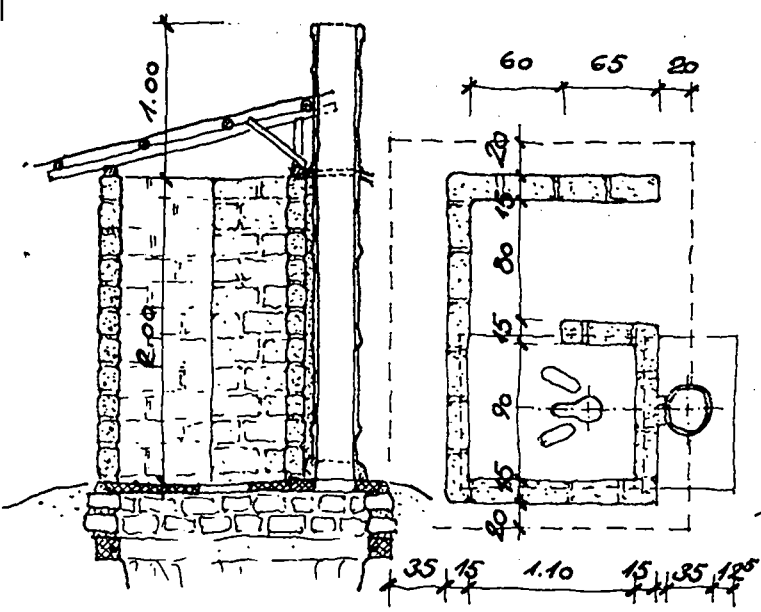
slab thickness



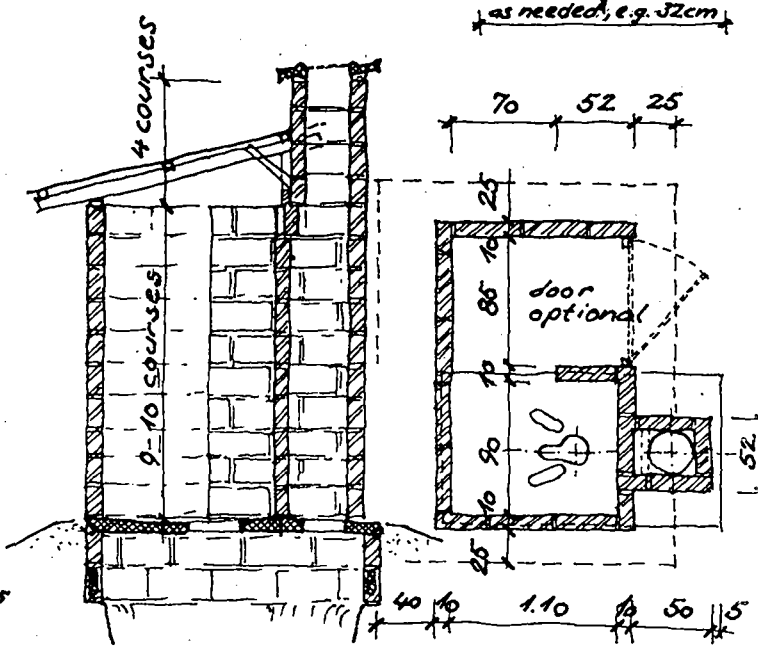

insert to form for casting small slab




section and groundplan 1:50
mud-blocks and ferrocement chimney



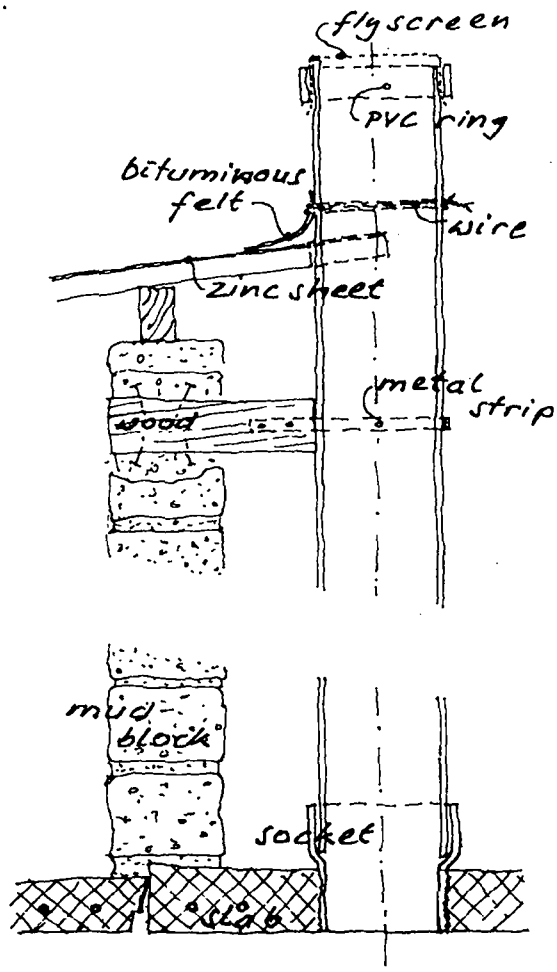

section and groundplan 1:50
10cm cement-blocks

10/8/84 HPR

The construction of the latrine follows the procedure described with the concrete-slab latrine. The plate "ventilated pit latrine" shows how the formwork for the usual slab can be adopted for casting an additional slab of 60 cm x 1.00 m. If cast locally, the overall thickness should be of 8 cm. The diametre of the hole is chosen according to the diametre of pipe.

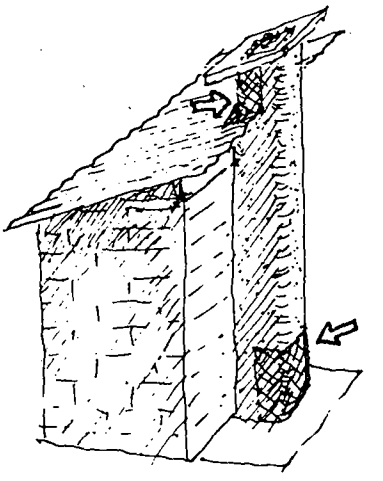
5.8.1. Vent pipes: They can be of different materials according to availability and costs.

PVC is the most suitable material for vent pipes, if it is UV-stabilized, but it is very expensive. From one length of 6 m two pipes can be made. The socket is cut off with a length of 8 cm pipe, roughened with a rasp and cast directly in the slab. The pipe is then glued into the socket and held at the upper level of the wall with a bracket (steel strap and a piece of wood). A ring or about 5 cm is cut from the pipe and widened with heat to fit over the pipe. The fly-screen is then laid over the pipe and fastened with that ring.

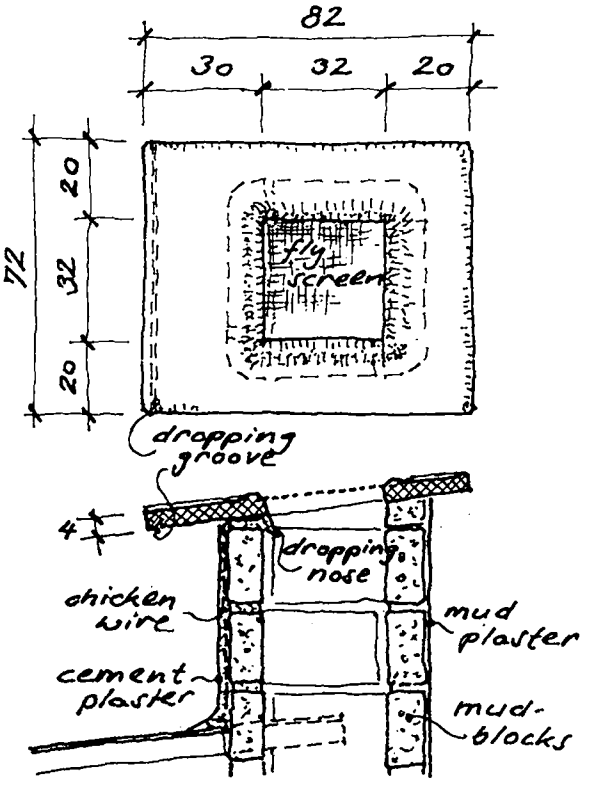



Asbestos has been widely used for watersupplies in Cameroon but is now more and more replaced by PVC and steel pipes. Therefore, it may be possible to get asbestos pipes from some old stock. If not, they are also very expensive and not easily available. The fly-screen may be fixed with a ready made socket ring, available in the same place as the pipe.

Built flues will probably be the cheapest and most adapted solutions for Cameroon. Cement blocks or mud blocks may be used. fabricating mudblocks of 10 x 20 x 40cm. The inside should be made as smooth as possible without mortar extruding from the joints. All joints must be tight, cement blocks pointed. Mudblock flues are rounded at the corners and first plastered with mud (adding of some chopped straw or other fibres will make it more resistant). The parts where water can splash (bottom and behind part over roof) are wrapped with chicken wire 50 cm high. The whole chimney is then painted with a slurry of cement and water and the parts with chicken wire plastered, so that the wire-mesh is completely covered. The rest of the chimney better should not be plastered.



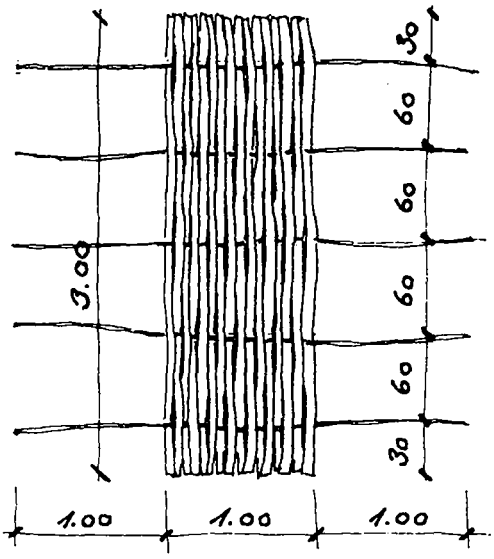
chicken wire-mesh reinforcement



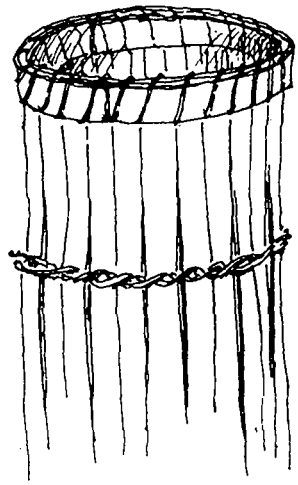

Both types of flues need a prefabricated covering slab of concrete, sloping to the roof, sealed very well to the chimney. Any sealing of the chimney is most important in this upper part, because it is here where the flies try to escape! The fly-screen is fixed on this covering slab with cement mortar.

Ferrocement pipe on raphia structure: A cheap vent-pipe can be made on a structure of split raphia-bamboo. A mat is woven from 3m long strips with rather stiff, narrow crossing strips every 60 cm. The mat has a width of 1 m, the crossing strips extending another metre to each side. The mat is now rolled to a tube, the crossing tied together. The top and the bottom of the tube get secured with strips

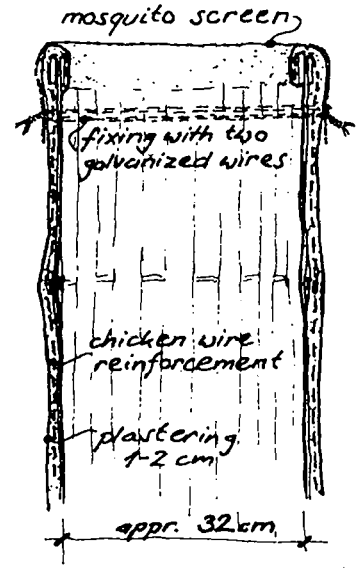
inside and outside tied together. A piece of 3.10 m chicken-wire is wrapped around the substructure and bent inside at top and bottom. The flyscreen is fixed with wire at the top. Now the whole structure is plastered with mortar of 1 part cement to 3 parts sand. The morter should have a thickness of about 1 cm and cover well the wire-mesh. (If the mortar is applied with hand, use a rubber glove.)




raphia- or indian-bamboo mat for skeleton



joined to tube, ends secured




section through finished tube

Passing through roof: With the measurements of the latrine given as an example, the vent pipe will pass through the projection of the roof. Special precautions have to be taken there. Especially when mud-blocks are used for the chimney or the house, no leaking may occur, not to destroy the blocks. So the passage has to be sealed carefully, best with cement mortar. Since most of the owners that will like to have a ventilation of the latrine probably chose a zinc-sheet roof, again precautions must be taken. Cement is attacking Aluminium badly. The sheet therefore have to be protected where they will get in contact with cement. The best would be a protective painting with bituminous paint. If not at hand, a simple resinoid paint ("oil" paint) may also help. Another method is to cover the portion concerned well with a piece of plastic. A reinforcement of this cement seal with wire-mesh will help to prevent it from breaking off.

## LITERATURE


On sanitation and latrines:

1. * Pacey, Arnold: Rural sanitation. Intermediate Technology (IT) Publications, London 1980
(a most useful booklet on sanitation programmes. Planning and appraising)

2. * Wagner & Lanoix: Excreta disposal for rural areas and small communities. WHO, Geneva 1958
(basic book on very different solutions for excreta disposal, extensive)

3. * Hoffman & Heijnen: On-site, low-cost sanitation options IRC, Rijswijk (The Hague) 1981
(condensed, clear publication on different latrine types and bio-gas digesters, partly summary of 2.)

4. * Golladay, Frederick: Appropriate technology for water-supply and sanitation. World Bank, Washington 1983.
(discussing problems to be considered when setting up large scale, government directed programmes, less consise than 1.)

5. * Technology Advisory Group (TAG): TAG technical notes No. 5,6,8,9. World Bank, Washington 1983.
(a serie or publications about a programme to promote ventilated latrines in Botswana, very extensive, large govenment programme)

6. * Feachem & Cairncross: Small excreta disposal systems. IT Publ. London 1978 (a booklet covering most low-cost latrines)

On water supply and other aspects:

7. Cairncross & Feachem: Small water supplies. IT Publ. London 1978
(a handbook on village water supply, giving also examples for small scale filters)

8. Watt & Wood: Hand dug wells and their construction, IT Publ. London 1977 (the best hand-book on wells)

9. Watt S.B: Ferrocement water tanks and their construction IT Publ. London 1978.
(a handbook describing cheap, large capacity rainwater tanks.)


* Publications used for this manual

Appendix 1

## Raphia

In this manual, the use of raphia has been widely recommended for different purposes.

Raphia is a species of a palm that grows in different types in the whole southern Cameroon. However, the largest occurencies are found in the West- and Northwest-Provinces, where there is also the most spread use. Raphia is distinguished from other palms that it has no or almost no trunk and the large fronds are growing directly from soil level. It grows in wet, often, also small streams and close to swampy areas.

Raphia is one of the most versatile plant used in Cameroon. The stalks of the fronds are up to 6 m and more long with diametres of 6 - 4 cm, have a smooth, hard, fibrous skin and a softer core. These stalks are used for house construction, fences, furniture, carrying poles and dozen other purposes. Baskets are woven from the outer skin or from the split stalk, the same as different types of mats. The young leaves provide bast for weaving of bags and making strings and the grown leaves are used to manufacture palm-thatches for roof covering. Last but not least, the raphia-palm supplies a widely used palm-wine.

When used as stalk, raphia normally is refered to as bamboo, distinguished as raphia-bamboo from the normally known bamboo, here called indian-bamboo.

In most of the cases where raphia is recommended in this manual, indian-bamboo could be taken as a replacement, even if it is not as ideal as raphia.