WEDC

MOBILE NOTE 9

Latrine slabs: design

Introduction

Providing sanitation for all is a major global challenge involving many complex issues. The user of a latrine however, will have more local concerns such as the condition of the latrine slab. This is one of the key components of the most common type of sanitary facility.

This note is the first of a series of four notes that highlight the design, manufacture and maintenance features that help to improve the safety and comfort of users.

Loughborough University

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Definitions of ‘latrine’

A latrine is a structure that contains a toilet and in some cases, somewhere to bathe. It is usually separate from a residence. The latrine slab is a platform over a vault with a drop hole or a flush pan into which a user excretes. The slab may incorporate a squat-plate with footrests or a seat on a pedestal.

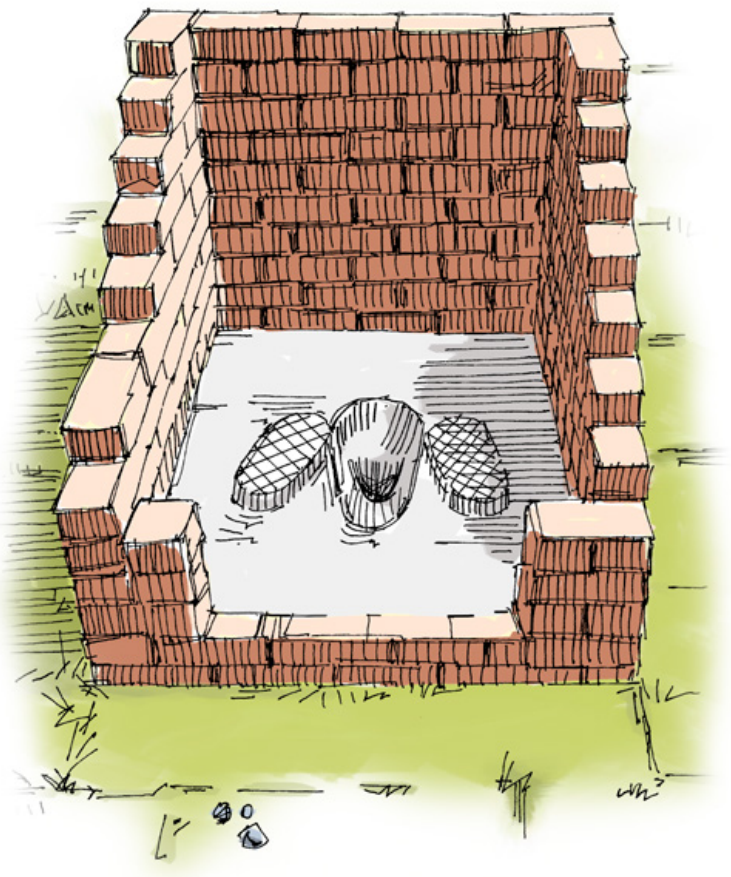

Figure 1. Simple pit latrine with a slab under construction

The design of a simple latrine slab is a basic structural problem for an engineer. However, as the slab forms a critical part of a sanitary facility for most people living in low-income countries, the design criteria also need to include issues relating to user preference, culture, gender, health, economics, maintenance and sustainability, as well as those related to construction where size, shape and surface finish are features that need to be considered alongside those of strength and durability.

The importance of the slab

Simple latrines are buckets, pits or tanks containing excreta. The user defecates into the vault by squatting or sitting, releasing urine and faeces through a drop hole in a slab. The user will not necessarily be able to see where the excreta are deposited, but the slab will usually be visible.

Dignity

Defecation is often a private activity and subject to cultural constraints. Being able to go to the toilet in a pleasant, private and clean location is valued by many societies and so the slab needs to meet user needs and preferences. It should be strong and secure.

Additionally, people want to be able to use a latrine without getting their feet wet or their clothes dirty, so the slab should be able to be cleaned easily.

Excreta may be deposited into a pit, a cess pit, a tank, a composting chamber, a bucket, a bag, or a sewer. In this note, the word vault is used as a general term for these options.

Health

Excreta-related diseases, such as diarrhoea, are spread when people come into direct or indirect contact with faeces. People may come into direct contact with faeces left on the slab and ingest pathogens, particularly if they do not wash their hands thoroughly after defecation.

As the slab needs to be clean, the hole must be large enough to enable people to defecate directly into the vault, and if they do miss the drop hole, enable deposits to be removed with ease.

Indirect contact with faeces can be caused by flies feeding or breeding on

a dirty slab or within the vault itself and subsequently landing on food. So controlling flies will therefore reduce the transmission of disease.

Hookworms breed in moist soil and will penetrate the skin if people do not wear shoes. If people infected with hookworm foul the slabs, especially slabs with a mud surface, the parasite can be easily transmitted to other users.

Safety

People will not want to fall into the vault! They will need to be confident that the slab will not break or topple. They should also be able to use the latrine without tripping or slipping, and snakes, spiders, scorpions and other creatures should be prevented from entering the latrine too.

Two rough planks or a few logs placed over a deep hole as illustrated in Figure 3 are real-life examples, but they are not safe.

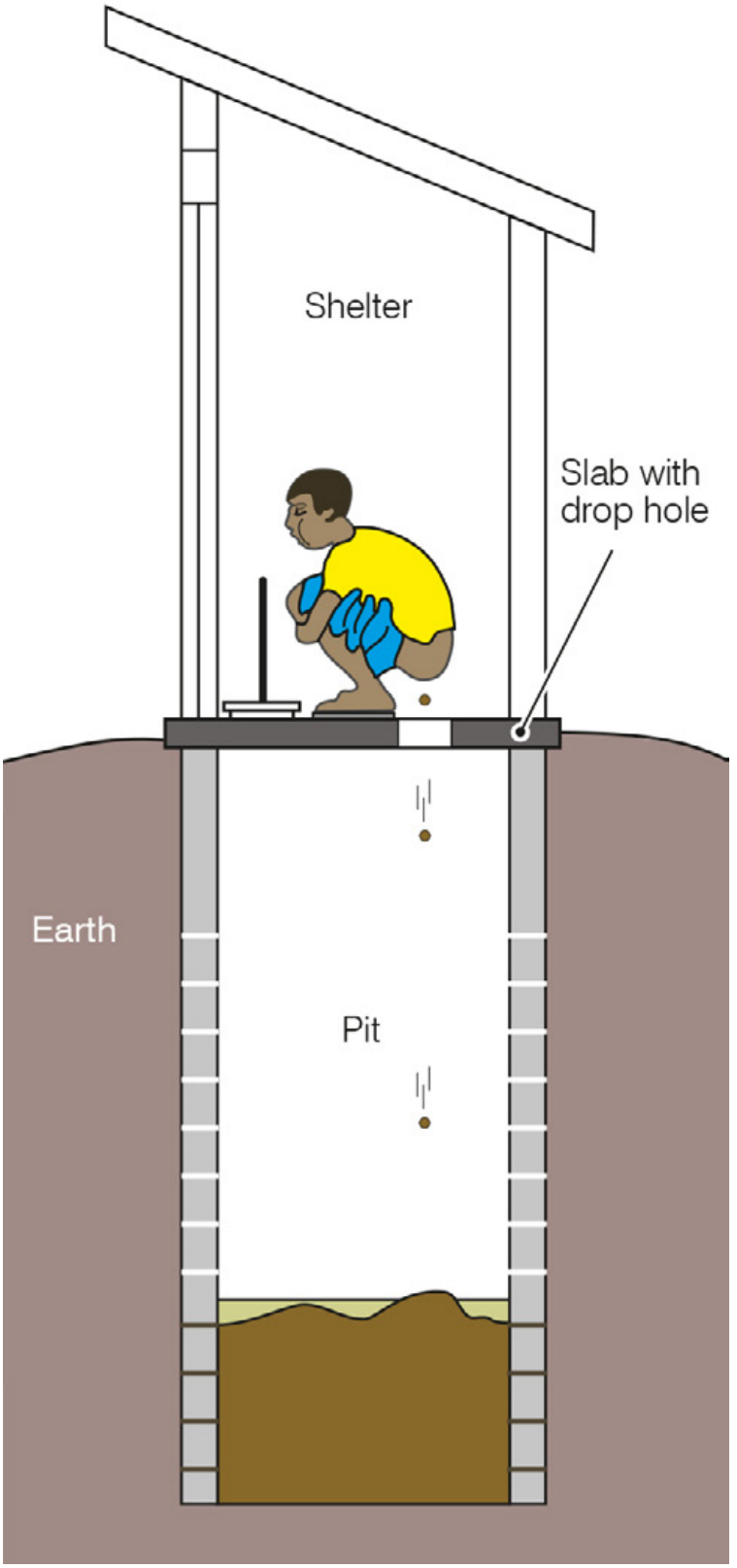

Figure 2. A simple pit latrine

Culture

Cultural, religious and personal preferences are critically important. For example, Muslims will not want to face Mecca as they defecate, so the latrine and slab should face another direction. People usually prefer to face the door of the latrine rather than defecating with their back to the entrance, so there needs to be enough space to allow users to turn around in the cubicle.

To squat or sit?

The human body is best suited to squatting for defecation but sitting to go to the toilet may be preferred, particularly for people with limited mobility who may be unable to squat. Footrests need to be provided for those who squat so they are elevated from the floor and draining fluids. For people who prefer to sit, a pedestal and seat should be provided and placed directly over the drop hole or pan.

Different designs of latrine slab have evolved to suit local preferences, conditions, uses and users. The platform, drop hole and footrests all need to be considered carefully.

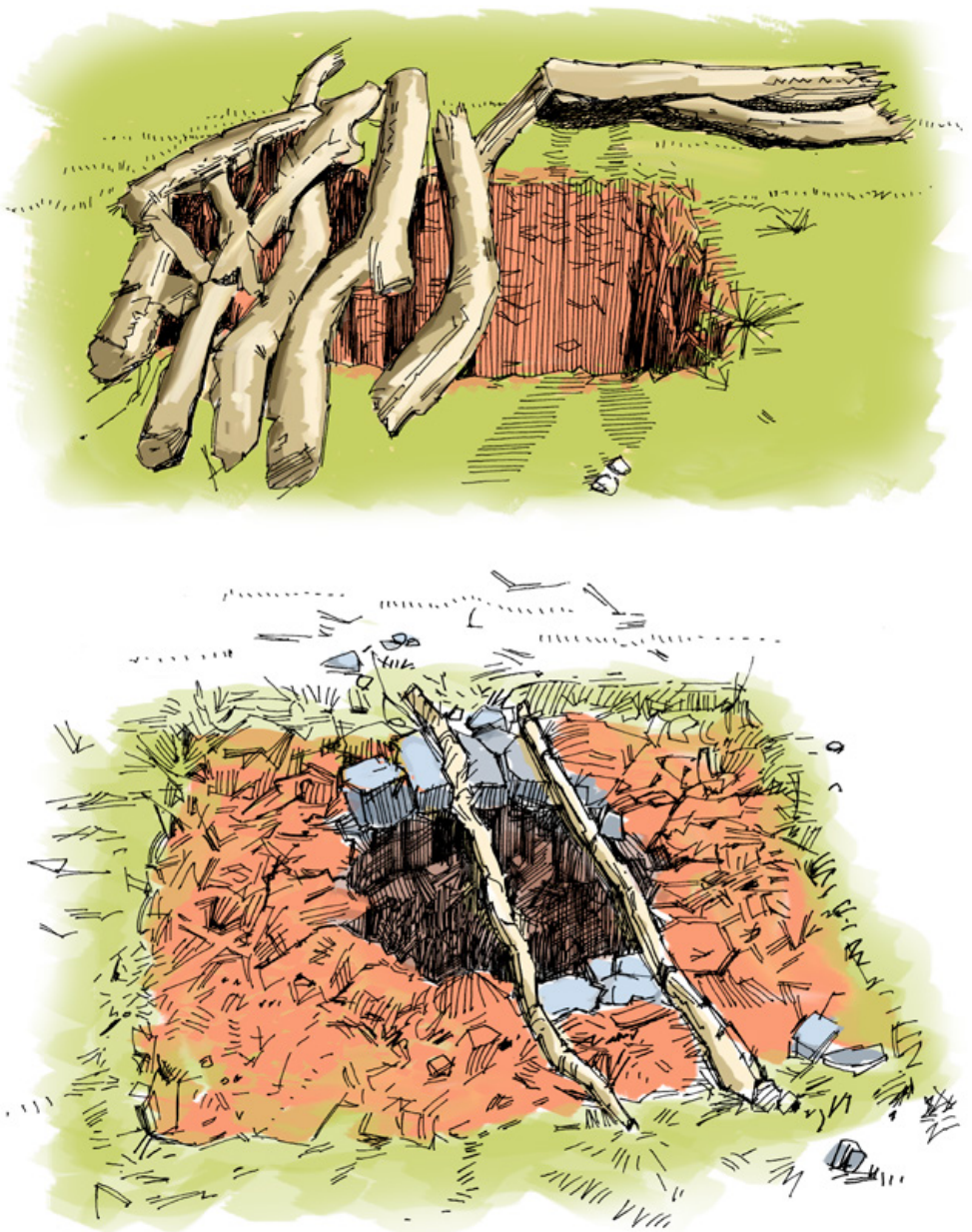

Figure 3. Open pits with logs and sticks

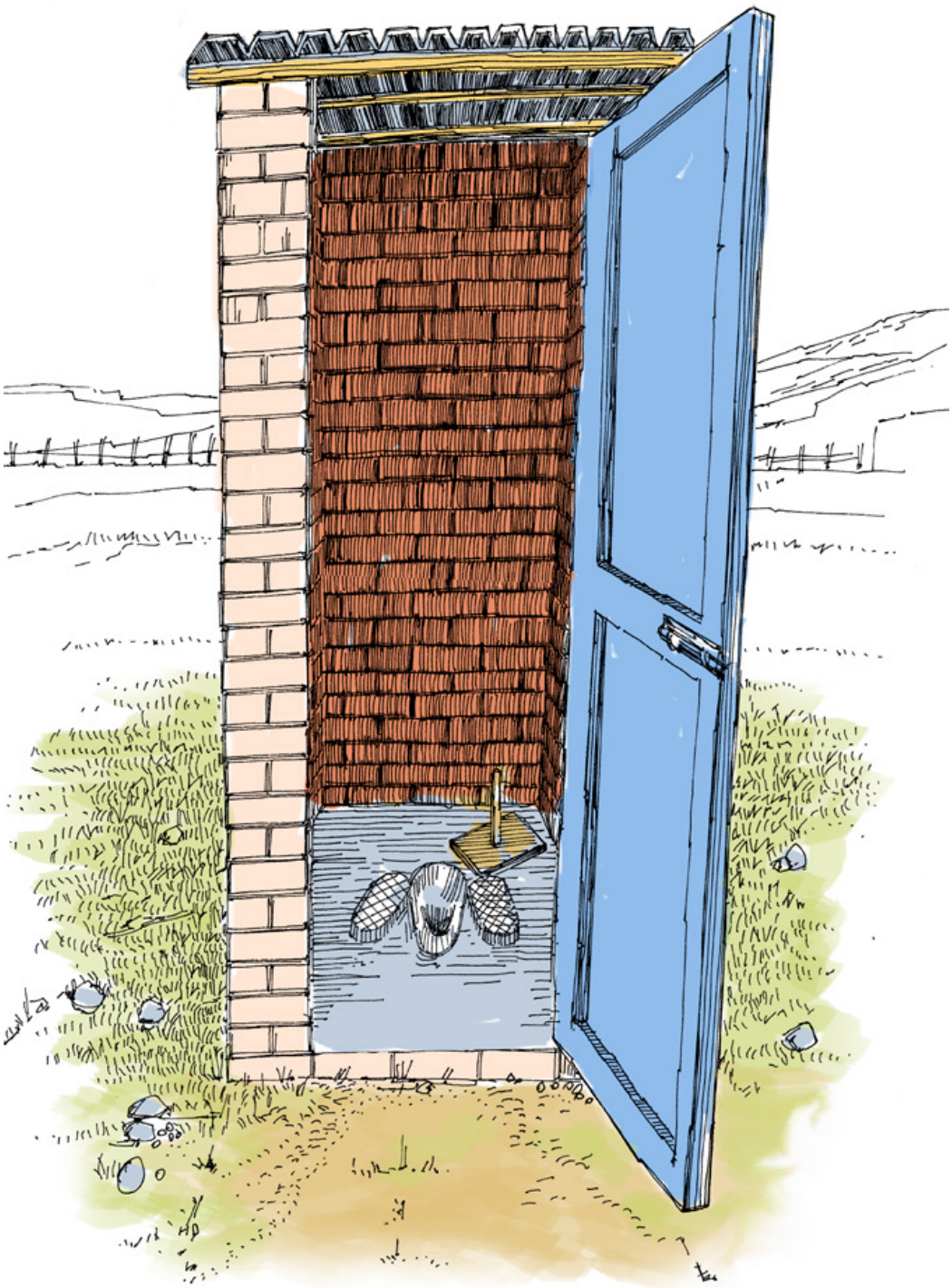

Figure 4. Squat plates will suit some users

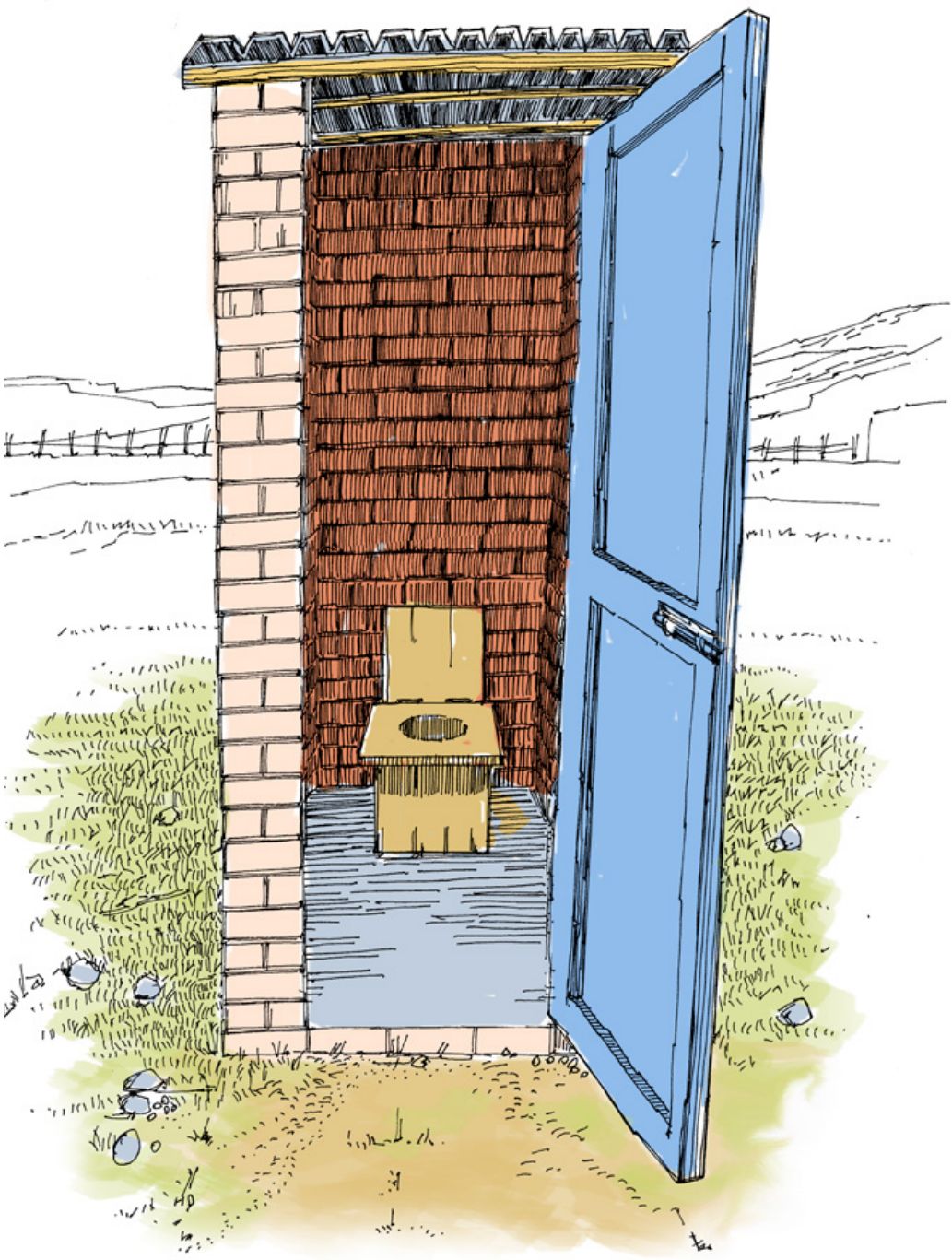

Figure 5. Seats will suit other users

Size and shape

Clearly, a slab forming a platform over a vault will have to be larger than the void underneath. It should be large enough to allow the slab to rest on a solid foundation.

The size and shape of the slab will also relate to the dimensions of a 'superstructure' – the building, shelter or screen that gives privacy to the user.

The dimensions of the superstructure may be larger than those of the vault, to allow people space to manoeuvre easily and for the assistance of children or infirm people.

Rectangular slabs may suit the design of many different types of superstructure and some methods of slab construction. They may be easier to transport and store. However, it is easier to excavate a circular pit and a circular excavation is more stable.

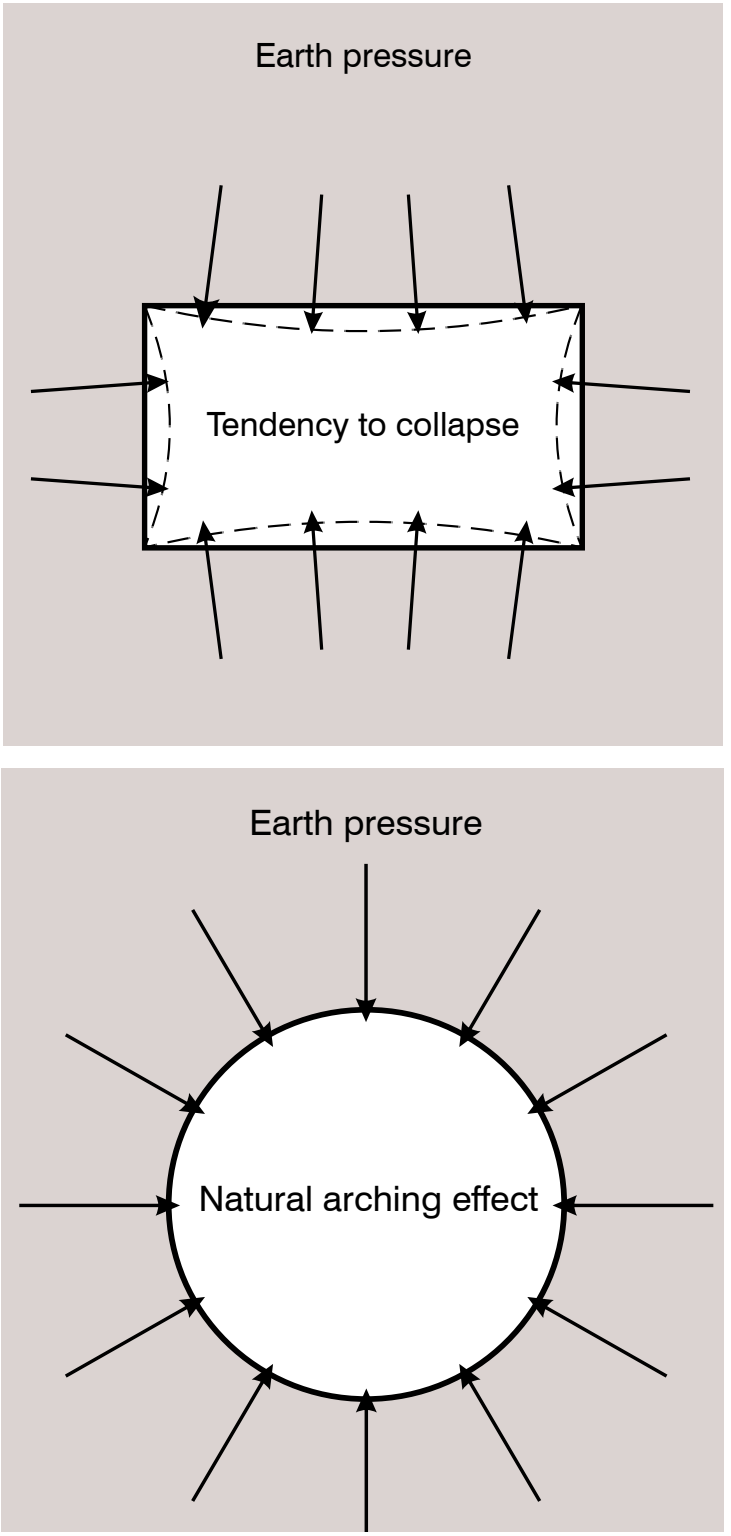

Figure 6. It is easier to excavate a circular pit and a circular excavation is more stable

The slab needs to be easy to move, so it should be made as light as possible and no bigger than it needs to be. To make it easier to move, the slab can be made in sections and fitted together on site.

Cost

The type of slab will be heavily influenced by what people are able and willing to pay. It may be necessary to raise people's awareness of the importance and value of latrine use and maintenance to encourage them to pay for a suitable facility.

Time

Durability. The choice of slab may depend on how long it needs to last. A simple slab can be made from mud and poles, but it will not be as durable as those made from more substantial materials, such as concrete. A concrete slab may last for many years, even beyond the life of the vault that it covers.

Construction. One factor in choosing a slab will be the length of time it takes to make. Some concrete slabs can be made in a few hours but take two or three weeks before they are strong enough to use.

Wooden slabs may be used sooner, though they may require painting to protect them from rot. As plastic slabs are made in a factory, the time it takes for delivery will be more significant than the time it takes for manufacture.

It is important to plan for the time it takes to make a slab; a concrete slab may need to be cast before the vault is constructed, to allow time to for it to gain maximum strength so that it is ready as soon as the vault is complete.

If many slabs are required, then stockpiling will mean that they can be delivered as required.

Delivery. The slabs have to be transported from where they are made to where they are used. Heavy or fragile slabs will have to be made near the latrine (cast in situ). Slabs can be cast directly over the vault, but this requires temporary formwork to shape the slab and support it until it is strong enough to be used. It may be easier to cast the slab next to the vault and then position it once it is ready.

Where slabs are prefabricated or precast, they need to be robust enough to withstand transportation to the site but light enough for people to lift them. Some plastic slabs are designed to stack on top of each other to make transport and storage in warehouses more efficient.

Slabs may also need to be moved once a vault is full and needs emptying. Handles to facilitate removal can be installed during manufacture.

Place of manufacture

Locally-made slabs do not need transporting very far and can be tailored to the needs of the local population. This can limit the type of slab produced, however.

Making and selling latrine slabs can be a good way of generating an income for local people.

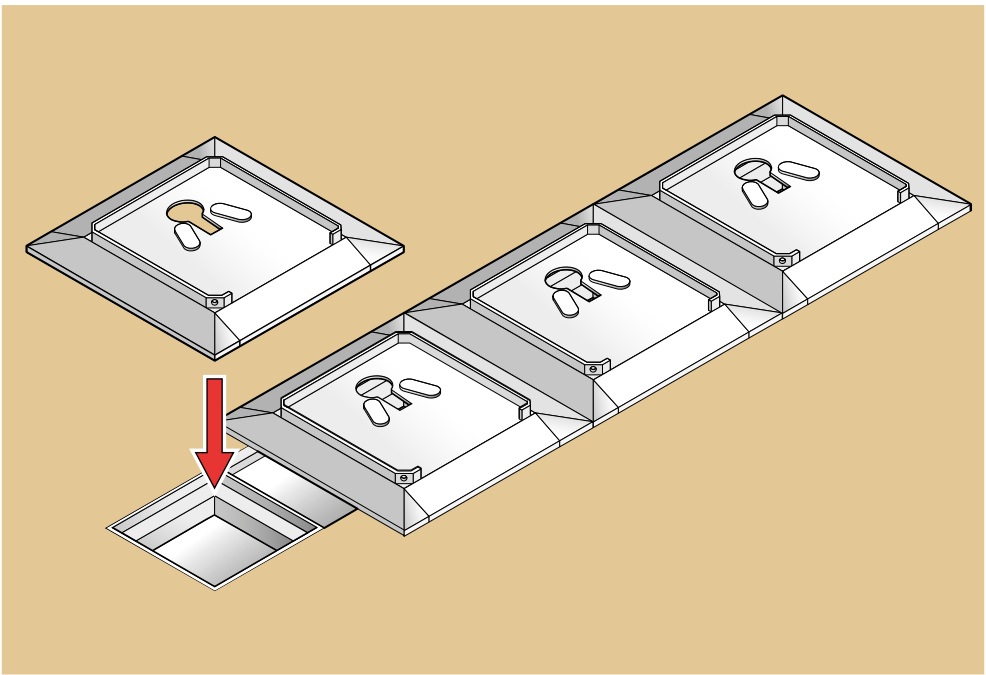

Figure 7. Prefabricated plastic slabs are useful when responding to an emergency

Figure 8. Circular slabs can be rolled into position, making them easier to move over short distances

Drop holes or pans

Faeces can either drop directly into a pit or can be flushed into a tank or sewer with water. A pour-flush pan includes a water seal, which helps to control smells and flies, and screens the user from the contents of the pit. Although pans require water for flushing, a small quantity is sufficient. Nevertheless, a water supply has to be provided in or near the latrine.

The pan is often made separately from the rest of the slab and later inserted into the hole. This allows different materials to be used for the slab and the pan.

Some latrine designs have two holes; one for faeces and one for urine. This requires a more complex slab design. In public latrines, separate urinals can be provided for both men and women.

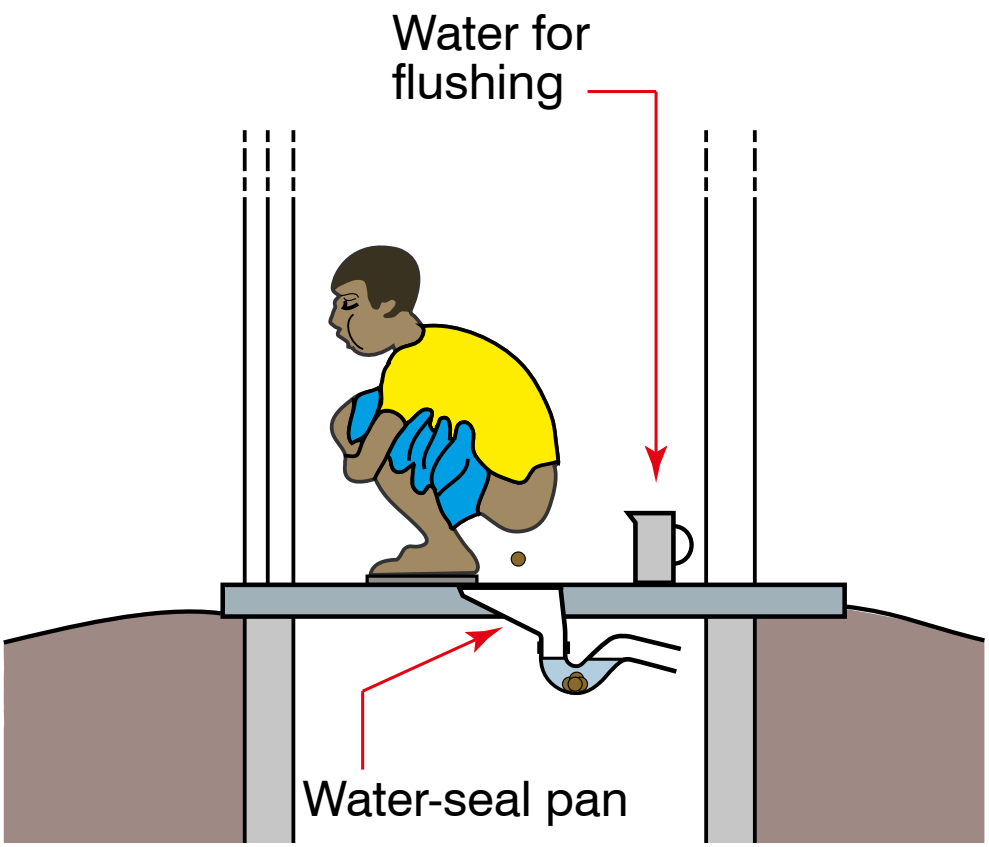

Figure 9. A pour-flush pan

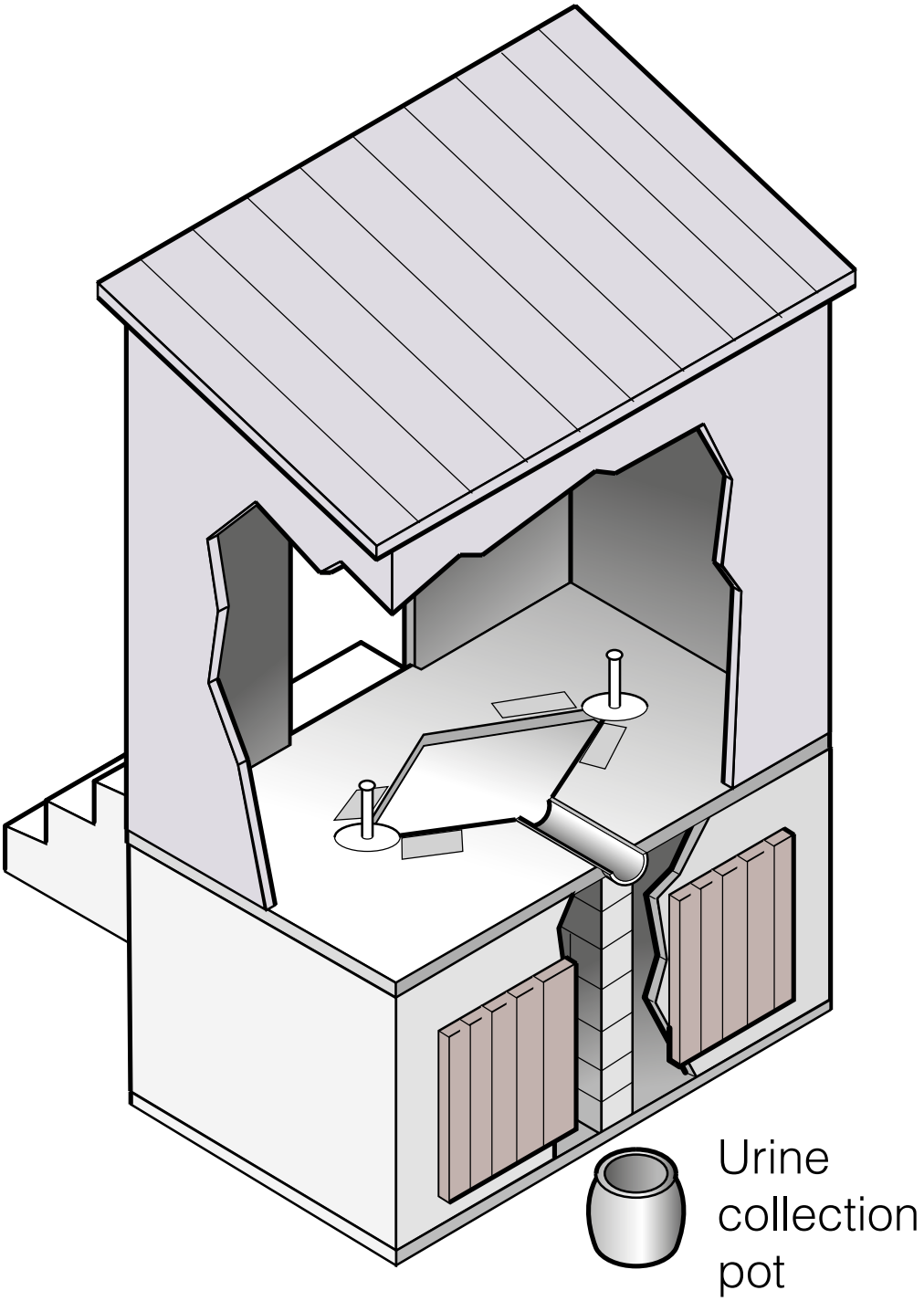

Figure 10. Urine diversion toilets require specific slab designs

Drop hole size and shape

The size of the drop hole is a critical feature. If it is too large, people (especially children) may fear falling into the vault. If it is too small, users may find it difficult to deposit faeces and urine directly into the vault and foul the slab instead. In shared latrines, providing an alternative slab with a small hole would cater for the needs of children.

There are many variations in the shape of the hole. A 'keyhole' that is 160 – 180 mm in diameter and 250 - 400 mm long is often recommended, but circular, triangular and rectangular drop holes can also be used, depending on user preference and the skills of the person making the slab. Pour-flush pans tend to be oval and pedestals are often circular.

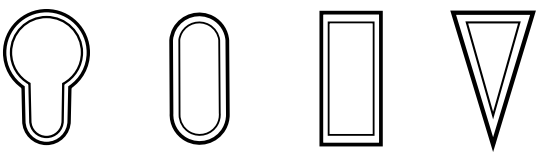

Figure 11. Keyholes and alternative hole shapes

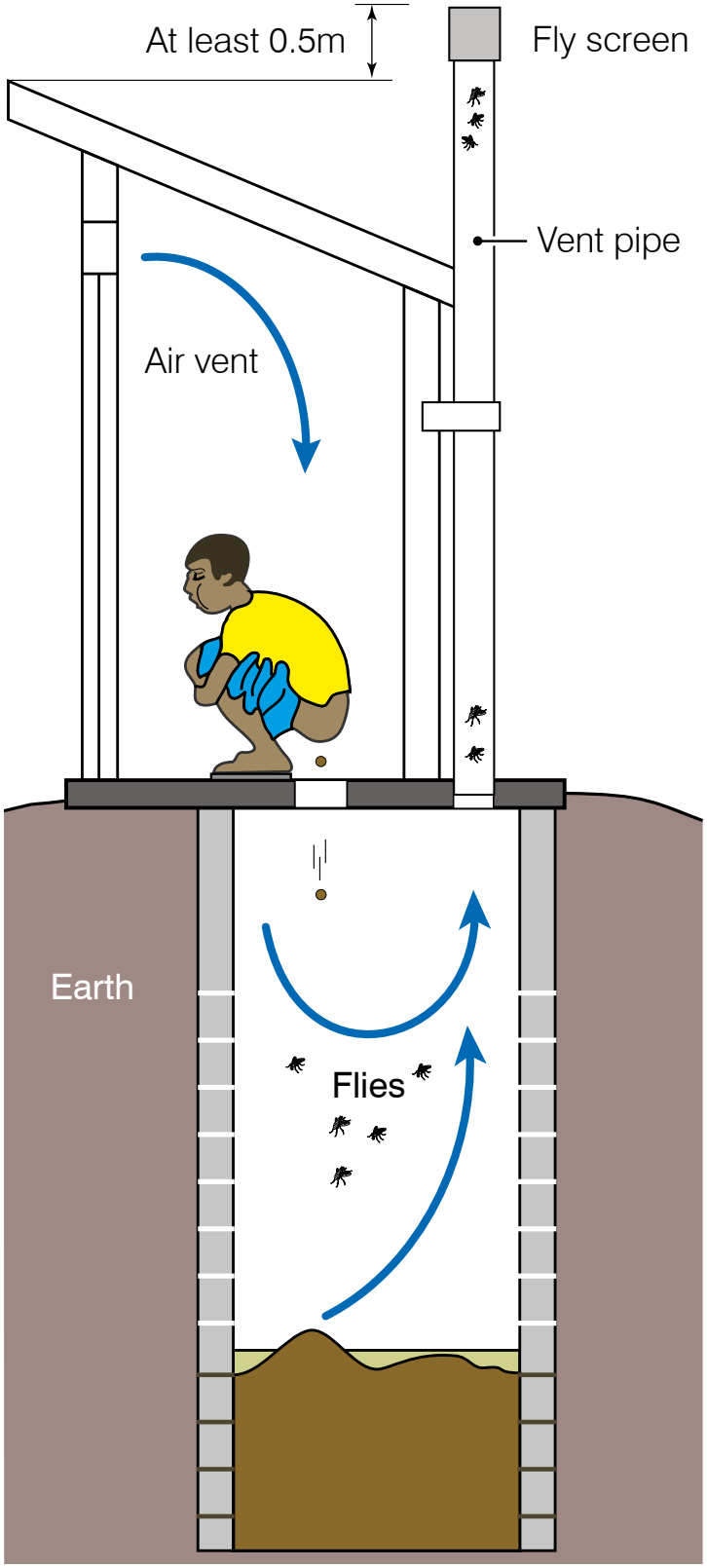

Figure 12. The design of the slab can direct the flow of air

Ventilation

Some latrine designs incorporate a vent pipe, to draw foul smells out of the latrine cubicle and divert flies away from the latrine to the top end of the pipe. This requires another opening in the slab.

Seats and pedestals

A seat on a pedestal can be provided for both drop holes and pour-flush pans. The sides of the pedestal need to be wider than the hole to prevent fouling. The seat could be square or circular and around 350mm high, depending on user preferences. People may want to tuck their feet back or to the side slightly so a square box, though simple to make, may not be the most comfortable option. Seats can also be removable, allowing people the choice of squatting or sitting. Defecation may not always be a private activity, especially when small children are trained to use the toilet. Latrine slabs can have more than one hole.

Even if children go to the toilet by themselves, they may prefer using a smaller drop hole.

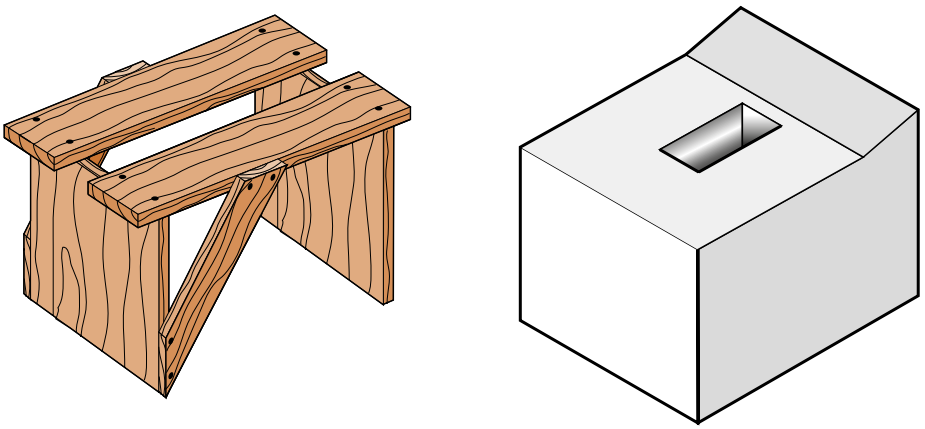

Figure 13. Seats made of wood or concrete

Surface finish

The surface of the slab should not be slippery but should be easy to clean. Painting the slab can improve the surface, filling holes that would otherwise trap dirt, stopping urine soaking into the slab and generally making the latrine more attractive.

It could also be covered with ceramic tiles or a plastic floor covering.

Some concrete slabs are decorated with patterns, but these can be more difficult to clean especially if the pattern is etched into the concrete.The surface should also slope towards the hole, to channel splashed urine or water into the pit.

Footrests

Raised footrests have several purposes:

- They allow users to locate the correct position as the squat down
- They help users to position themselves correctly over the drop hole if they go into the toilet in the dark or if they have limited vision or restricted mobility.
- As they are raised, users do not have to stand in any water or excreta present on the slab. This reduces hookworm transmission.
- The surface of the footrests can be rendered less slippery than the remainder of the slab.

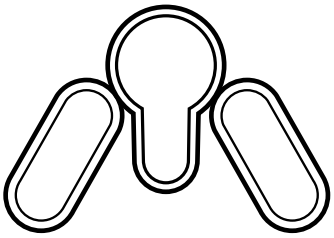

Figure 14. Consider local preferences before adopting standard designs

The recommended height of the footrests varies between 10 and 100 mm high. Finding the best position and size for the footrests should be established in consultation with users. The angle people squat at can vary. School latrines should be designed to suit children's requirements.

Lids and covers

Lids are used to control flies and smells. To ensure that it fits tightly, a concrete lid can be cast using the drophole as a mould (lining the hole with a plastic sheet so it can be moved once it has set).

A handle can be cast into the lid to make it easier to lift.

Some people do not want to touch the lid, so a rope or longer pole can be used to lift it, or it can be opened by foot.

A hinge also helps position the lid. This can be made from the inner tube of an old car tyre.

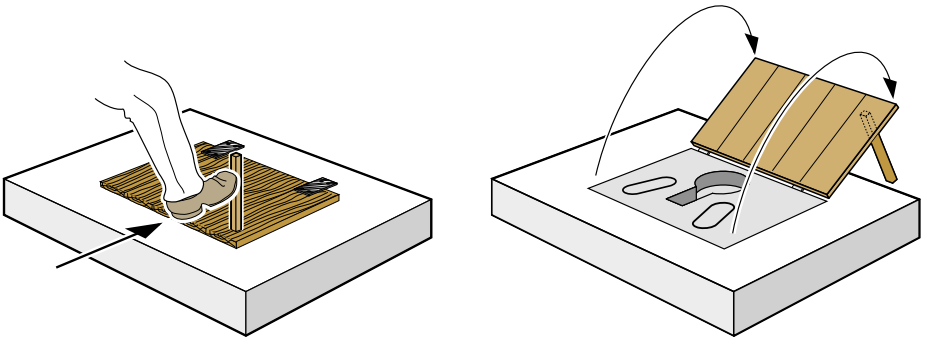

Figure 15. Simple lids can keep out snakes and other creatures

People will be more confident that snakes, spiders, scorpions or other creatures are being kept out of the hole if lids are used. They will need to replace the lid in the hole once they have finished, so some level of promotion and instruction may be necessary.

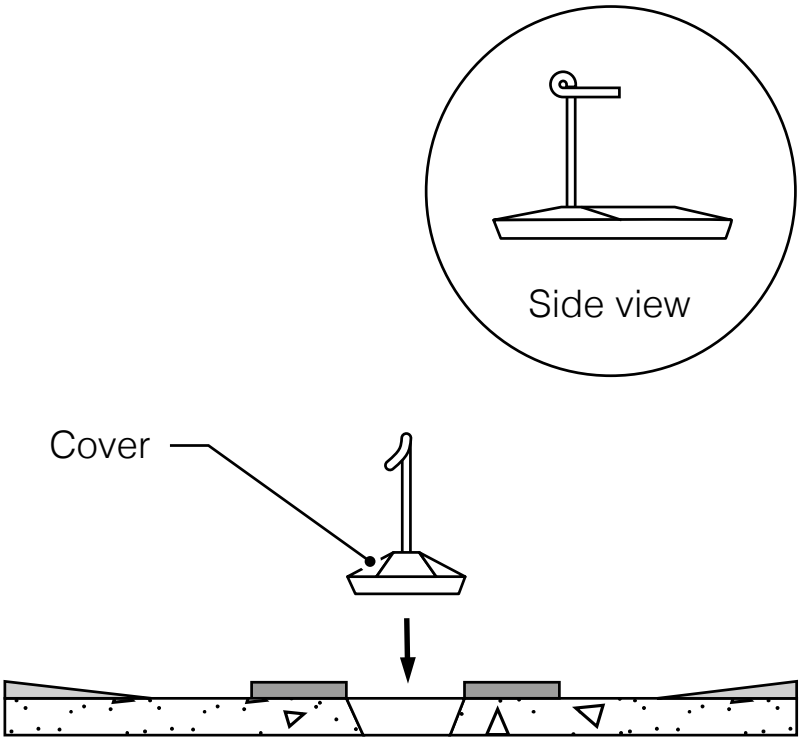

Figure 16. A close fitting lid can control flies and smells

Some latrines (such as ventilated improved pit latrines) do not have a tight-fitting lid, as the air is directed in such a way to reduce the number of flies present in the latrine and to reduce odour. Pans with a water seal do not need a lid either.

Other features

Handles may be included for lifting all or part of the slab, especially if the slab

will need to be moved to empty the vault (or transferred to a new site when the original vault is full).

Provision for use by people with disabilities

Latrines can be adapted to meet the specific needs of people with disabilities.

Making latrines larger or providing supports and adapted seats may be required.

It is important that the user is assisted to select and adapt the latrine for their own needs rather than an 'expert' deciding this for them.

The best option, however, is to ensure that the needs of disabled people are considered before the latrine is built in the first place.

Good advice on this is available from Jones and Reed (2005).

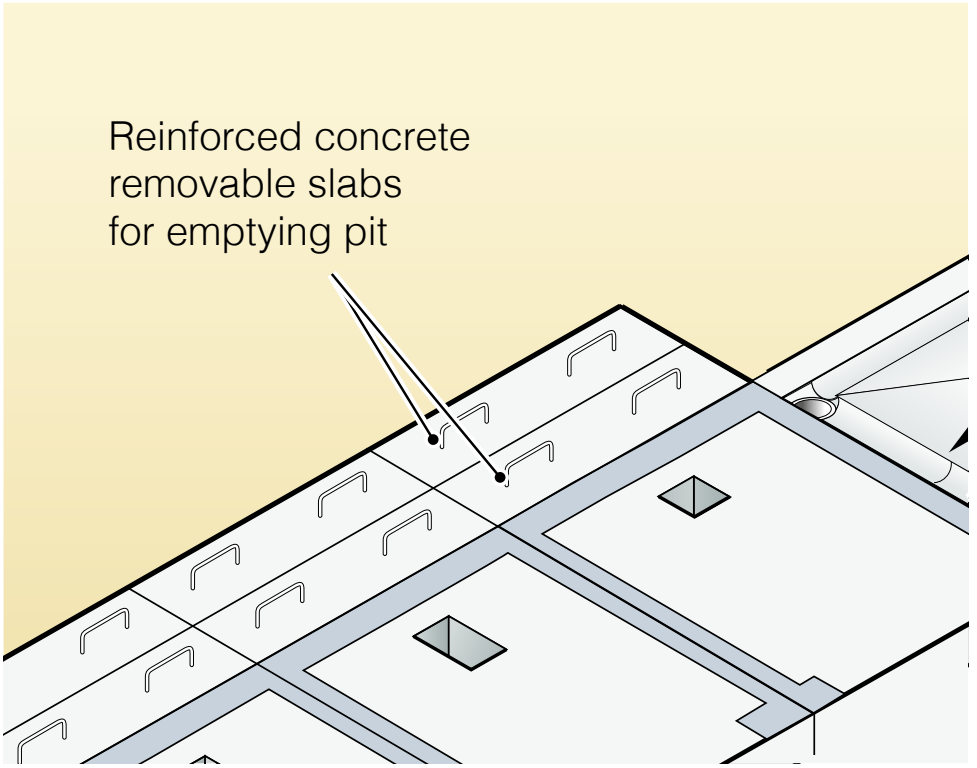

Figure 17. Handles can make removing the slab easier

Handholds and supports. Whilst not strictly part of the slab, many users will find a handhold or bar useful to steady themselves and to help them to squat and stand up. Pregnant women and people with reduced mobility should be consulted to ensure that they are able to use the slab with ease. The support may be attached to the wall of the latrine, be fixed to the slab or set into the ground.

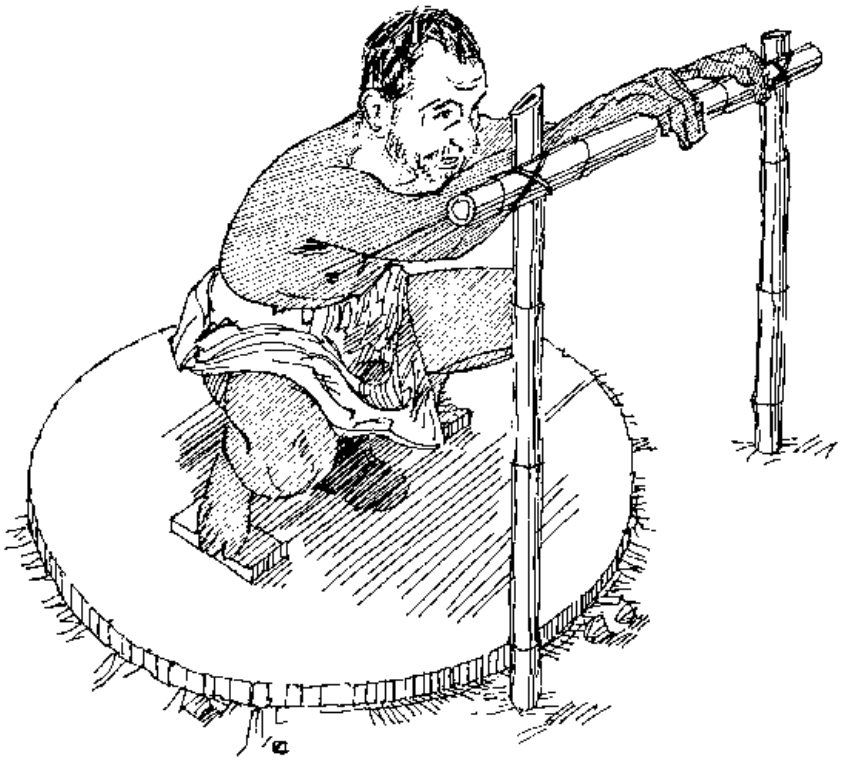

Figure 18. Handholds to support the user

Brushes and buckets will need to be provided so the slab can be cleaned.

These need to be stored somewhere secure and accessible.

Anal cleansing materials vary and include paper, leaves and water. A dry place to store these may be needed.

Drainage. If people use water in the latrine for anal cleansing or for cleaning menstrual cloths, wastewater needs to be directed into the pit and not outside the latrine which would pose a health risk and cause offence and embarrassment. The slab, however, should be raised above the surrounding ground level to ensure that surface runoff during rainstorms does not flow into the vault. If the latrine has a facility for bathing, water should be directed away from the drop hole in dry toilets, to avoid filling the vault with water.

Moulds

Moulds are a method of improving construction that can be used by local craftsmen with only basic training, enabling them to improve the quality of locally-made concrete slabs and sanplats. These can be wood or plastic with plastic moulds enabling a suitable surface-finish to the concrete.

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