WEDC

MOBILE NOTE 11

Latrines slabs: structural considerations

Introduction

Often a latrine slab is positioned over a vault and it has to support its own weight and the weight of the user.

If the vault is rectangular, a series of slabs may be designed to span across the width of the vault. If the vault is round or square, the slab can be supported all the way around, and so can be thinner.

This note examines these and other structural considerations.

Loughborough University

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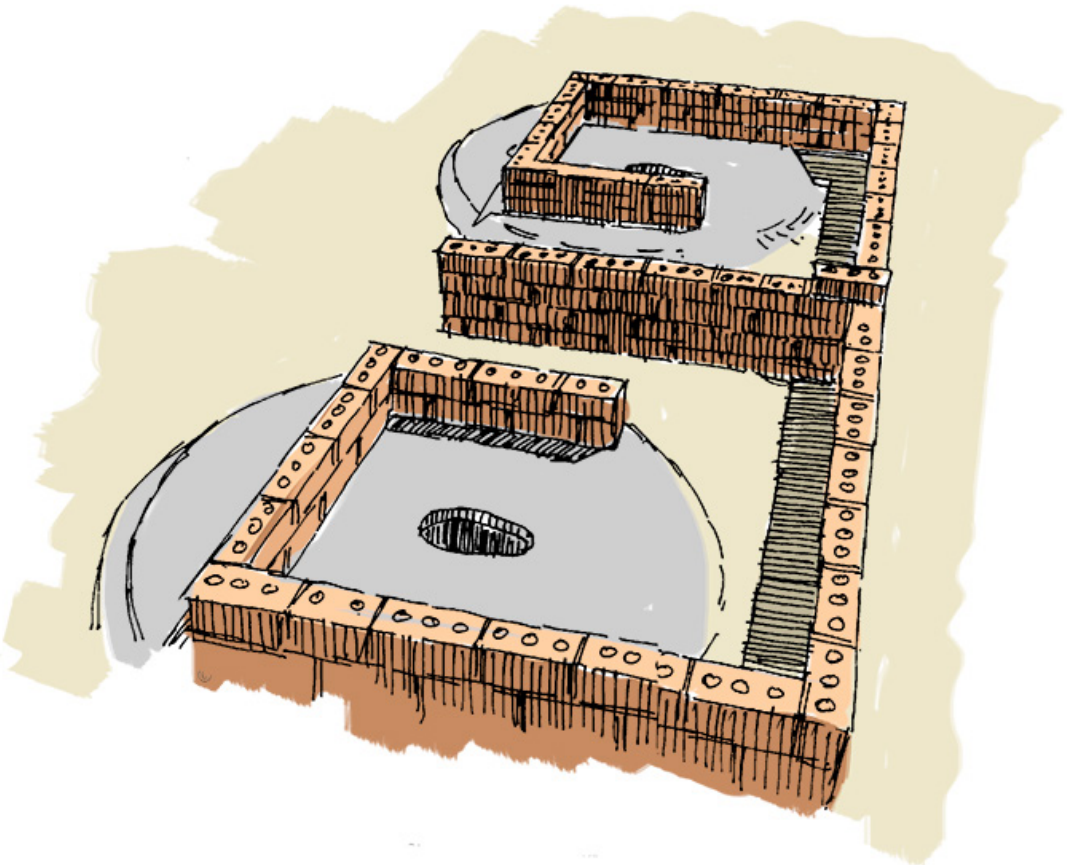

Ideally, the superstructure or shelter should be placed so that it does not rest on the slab, as this will add extra load. The slab will have to be stronger if it does have to support the superstructure. It would also means that the whole structure would have to be demolished to gain entry into the vault.

Poles and beams. These can be placed underneath the slab and span the vault. The slab still needs to be strong enough to span the beams but the load will not be so great so the slab can be thinner and lighter. The beams can be made of reinforced concrete, metal or wooden poles.

Integral supports. If the slab is made strong enough to support itself, it can be placed directly onto the foundation. Placing steel reinforcing bars in a concrete slab during construction can provide such strength. For plastic slabs, increasing its overall thickness would

make it stronger but it would also make it very heavy. It is possible to make just some areas thicker with a 'waffle' or 'ribbed' pattern on the underside of the slab.

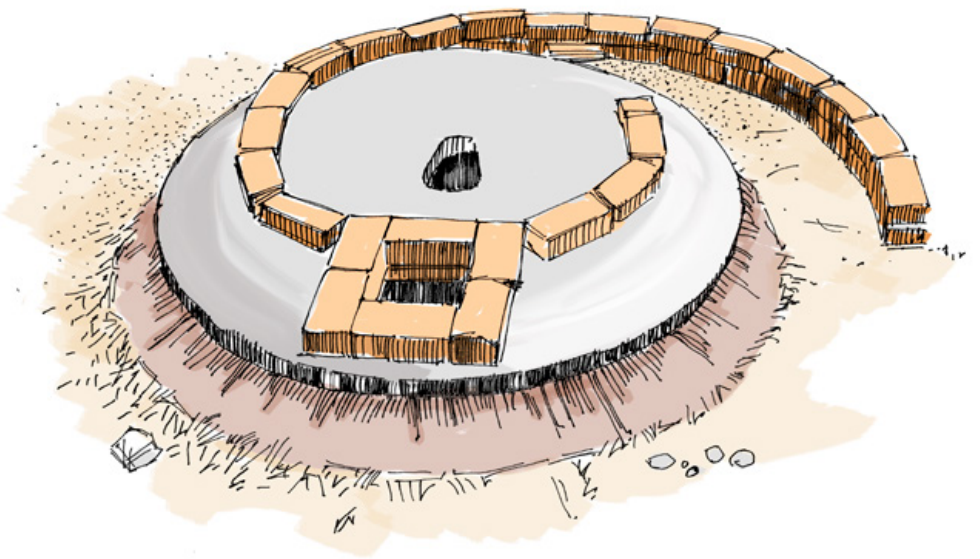

Figure 1. A round slab providing the foundation for part of the wall of the superstructure

Offset latrines. The squatting slab does not have to be situated directly over the vault if the pit is offset. Connected with a pipe, the squatting slab can be placed directly into the ground and would not have to support the weight of the user.

The vault can be covered with a cheaper slab or even just a board covered in soil, provided people are prevented from walking over it.

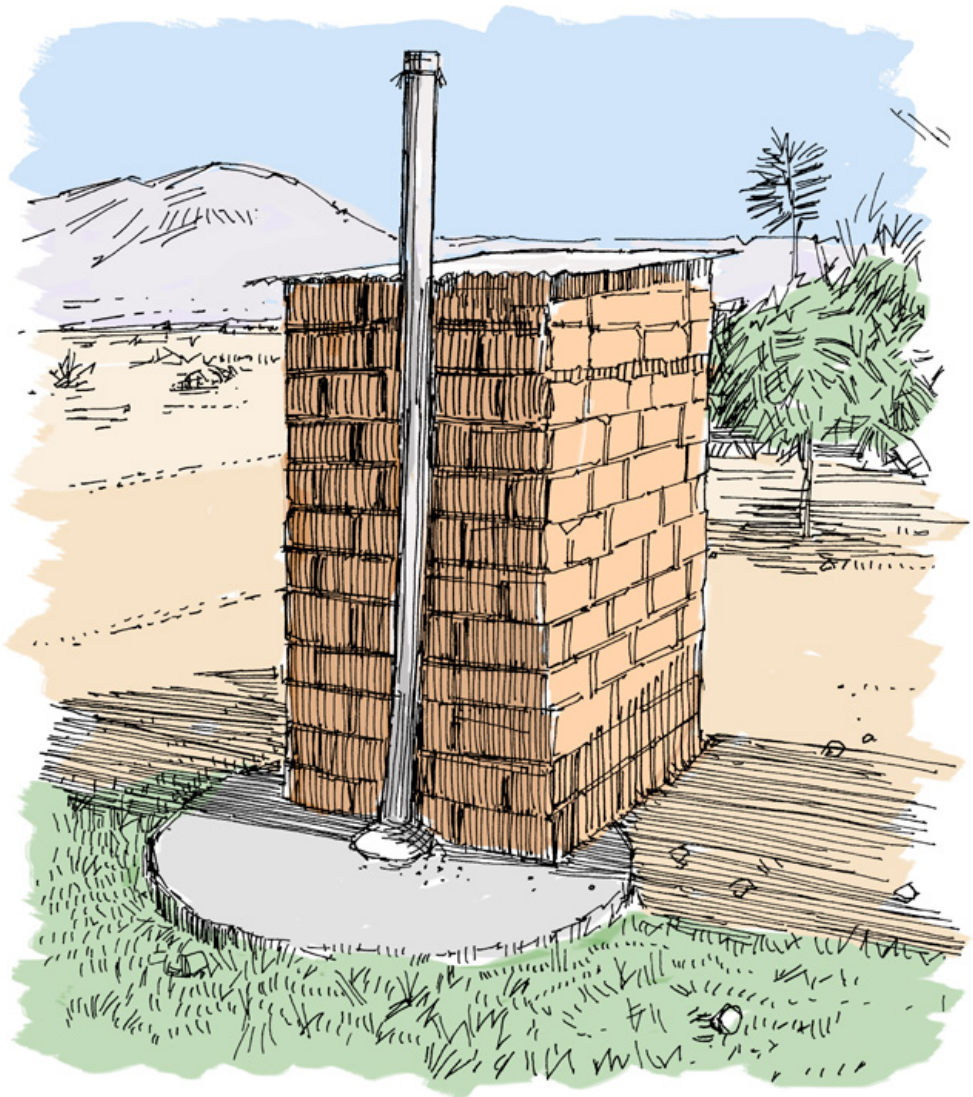

Figure 2. An partially offset latrine

Foundations

If a slab is to span a vault, it needs to be laid on a firm foundation. Slabs must overlap the edge of the vault by a sufficient amount to provide support and a seal.

The foundation should extend below the ground level to firm ground, perhaps connected to the lining of the vault.

If the lining is strong and secure, made out of bricks, for example, the overlap can be about 50mm all around.

If the vault is not lined at all and the slab just rests on the earth, then at least 200mm is required.

A 1,100mm diameter hole would therefore need a 1,200mm diameter slab if it was lined and structurally strong, but a slab would need to be 1,500mm in diameter if there was no lining.

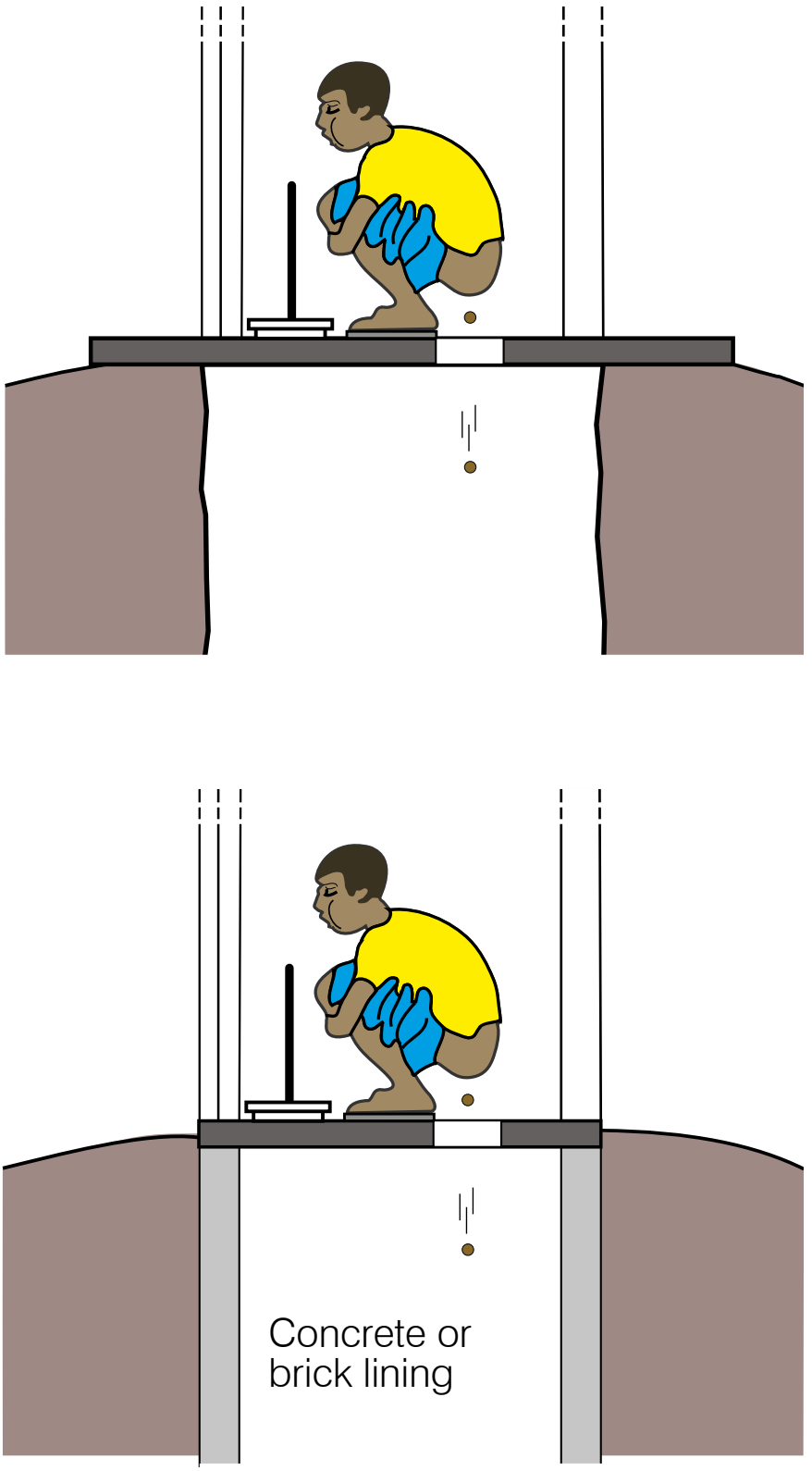

Figure 3. Well-supported slabs can be smaller

One form of foundation is ‘corbelling’, where the lining of the vault is built to reduce its diameter, creating a cone shape. The slab has only to span a reduced diameter, therefore, so it can be smaller and thinner.

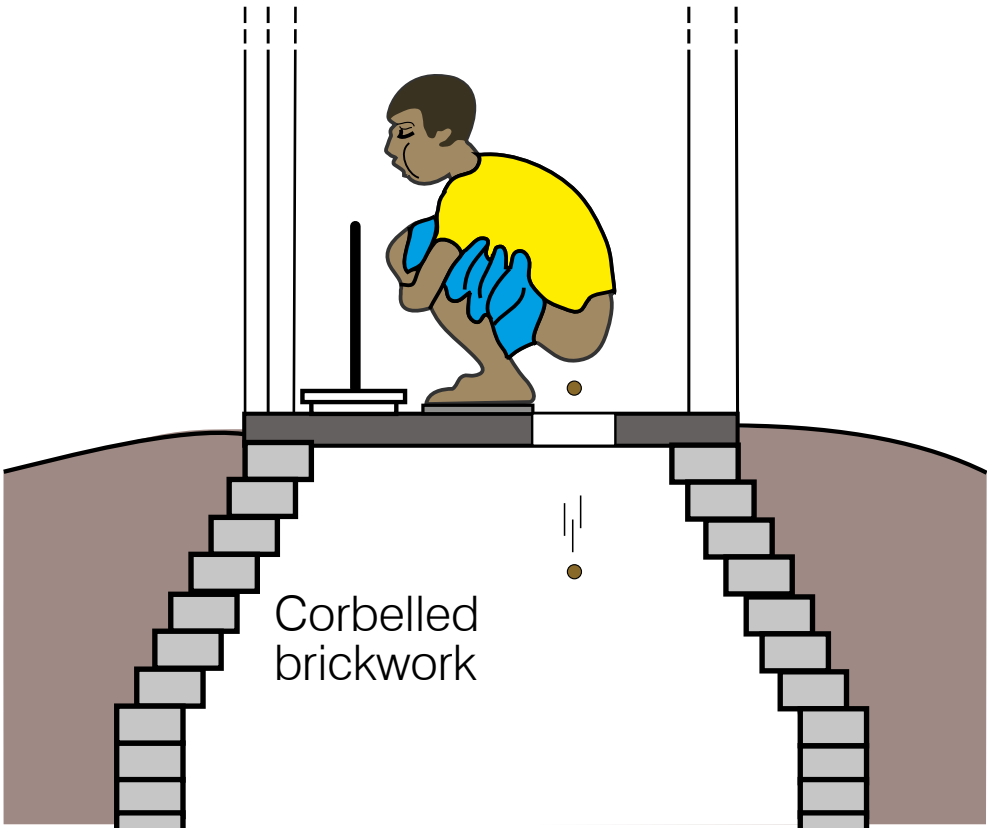

Figure 4. Corbelled brickwork lining

Foundations need to be level to ensure that slabs are level as well. This allows for proper draining and continuous

support. If parts of the slab are unsupported it may rock and be placed under unnecessary strain. Gaps between the foundation and the slab allow flies and vermin to enter the pit and odours to escape, so these should be avoided.

To ensure the slab is supported all round the edge of the vault, and to close gaps, the slab can be bedded on a layer of mortar or at least softer soil. If a cement-based mortar is used it will form a basic foundation as well as seal the pit, preventing water and vermin from entering. If the slab will be moved sometime in the future, this mortar could be made from a weak mix, to make its the removal easier.

Testing slabs

Wherever slabs are made, they should be tested to ensure that they are strong enough to support the load they are designed for. They should be able to carry a load greater than that expected

during their use. This is called a ‘factor of safety’. One method is to ask several people to stand on a slab at the same time, with the slab supported on bricks over safe ground to simulate the span of a vault.

Figure 5. Testing the slab

In addition, the slab can be supported in just a few places during testing. Most slabs are designed to be supported all round their edge or by beams

underneath the slab. Reducing the amount of support, the slab is under extra strain, providing a further factor of safety for testing.

The slab should not be too strong however, as this is wasteful and can make the slab too heavy to move.

If the design of the slab is new, people may be wary of using it, anxious that it might break. Testing should take place publicly, to demonstrate its strength. A plastic slab should also be trialled to see that it is acceptable to the users.

When to test

Concrete takes time to gain strength. The cement in the concrete reacts with the water to bind sand and stones together firmly. This reaction takes about a month for the concrete to gain maximum strength, so testing should not take place until the slab has cured for a few weeks.

Curing is the process of maintaining the concrete in a damp stable state for this period.

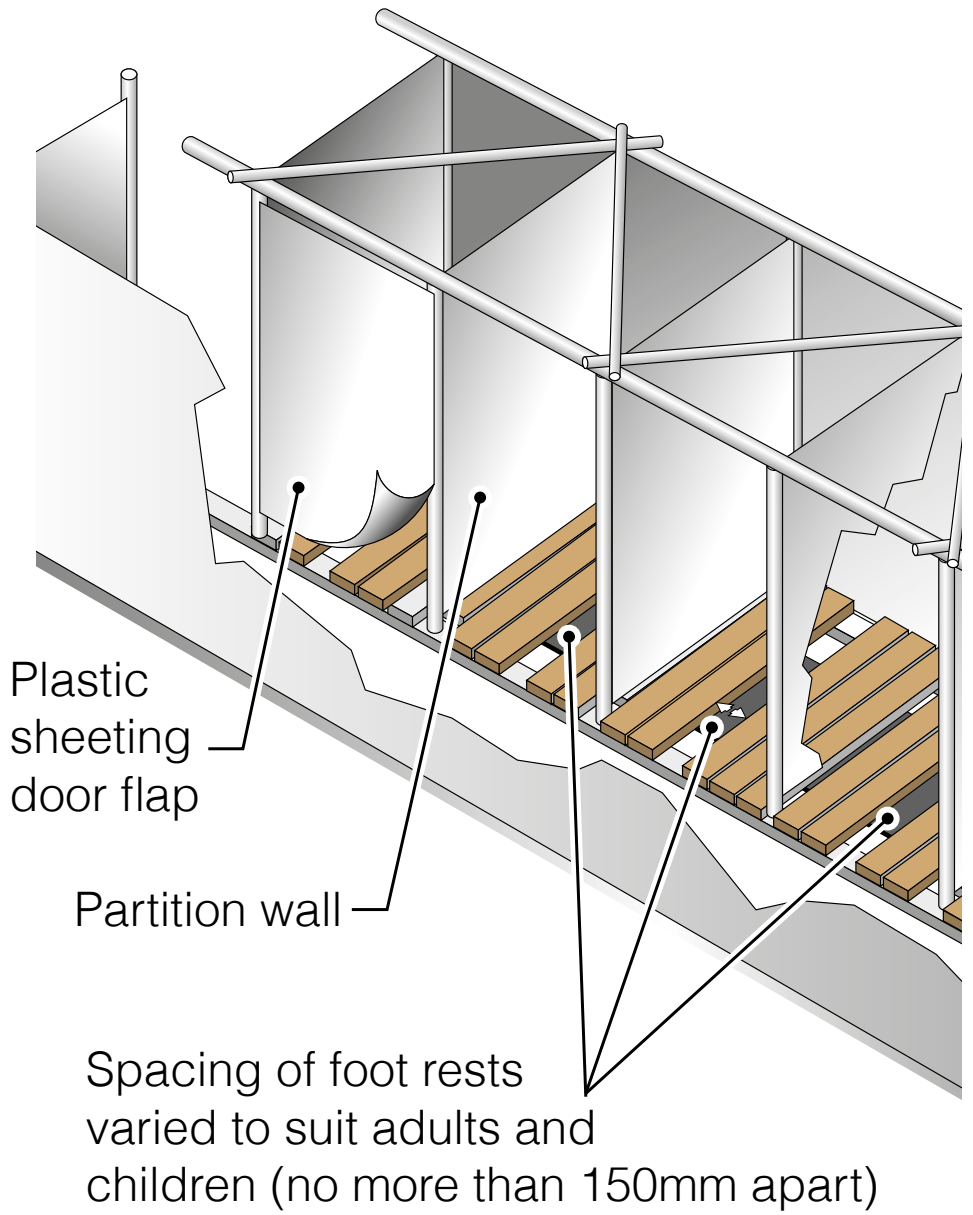

Figure 6. Temporary wooden slabs may only be acceptable in the initial stages of an emergency

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