

# A permeable lining for seepage pits

by R.F. Carroll and G.J. Ashall

Lining of pit latrines is of growing interest in many developing countries where improved and permanent non-sewered sanitation is being installed. In particular, where mechanized emptying by powerful suction tanker is intended, an effective permeable lining is necessary to prevent ground erosion under the latrine and eventual collapse of the floor and superstructure.

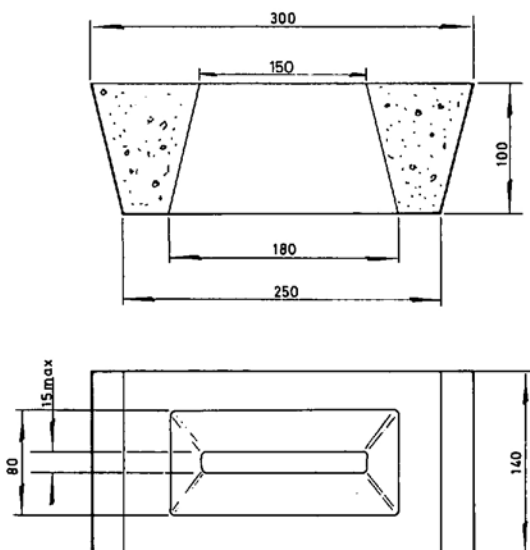
IN FURTHERING latrine improvements, the Building Research Establishment has developed a moulded concrete lining block which, although originally designed to line pit latrines, could also be used to line soakaways and shallow wells.



*A lined percolating pit, using purpose-made concrete blocks.*

An effective foundation for the latrine floor and superstructure can be provided by a pit lining. This lining will also allow seepage to the surrounding ground of water and liquids resulting from excreta decomposition.

Materials commonly used for lining pit latrines and soakaways are fired clay bricks, concrete blocks, large stones or pre-formed concrete rings. Gaps in the lining, about 10 to 15mm wide, should be provided for seepage, usually achieved by leaving vertical joints unfilled or by perforating the blocks or rings. The top 0.5 metre of a lining should be mortared in to form a ring beam on which the floor is located. Backfilling the excavation around a pit lining with gravel can improve the seepage capacity of a soakage system installed in



*Figure 1. Steel mould with dimensions provided.*

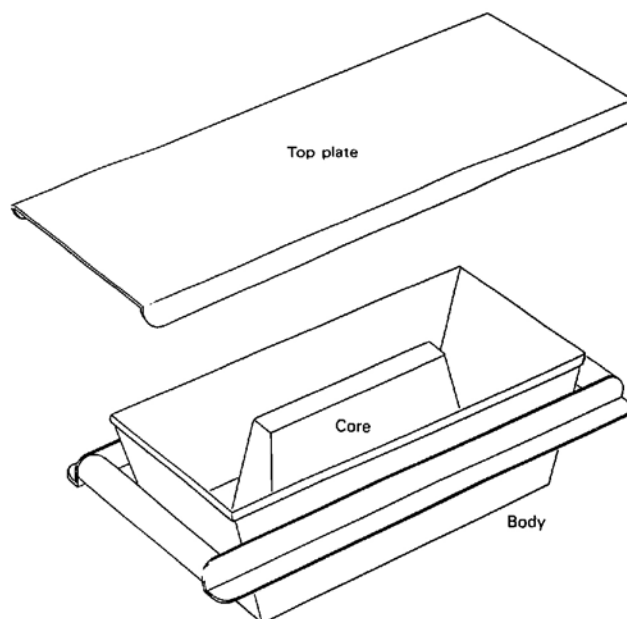
ground of low permeability, for example, clayey loam soil. This provision can significantly increase the previous area available for the passage of liquids to the ground.

The BRE lining system is based on a purpose-made concrete lining block that is easy to make in a simple hand mould on site, is easy to install because the blocks are laid without mortar (except the top courses), is self-supporting because of the surrounding soil pressure, and is likely to be cheaper than systems using building blocks or naturally occurring stones that require mortar.

## The BRE lining system

The lining system has the following features:

- Moulded perforated concrete block with angled end faces (see Figures 2 and 3), laid without mortar.

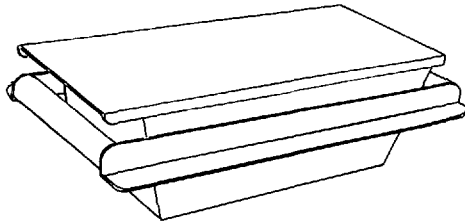


*Figure 2. Steel mould for concrete lining block.*

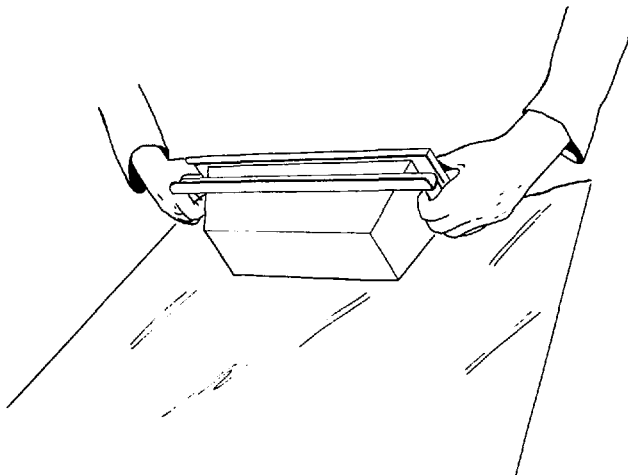
## Making a block



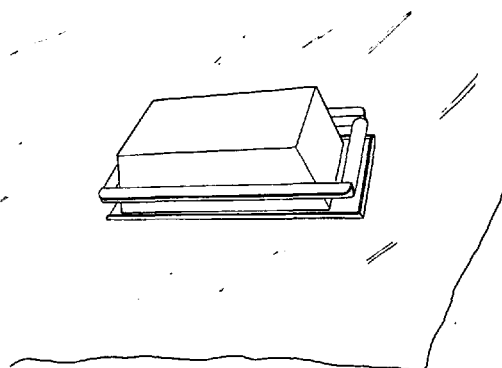
1. Fill mould with concrete, compact with back of shovel and finish level with top edges of mould 'body'.



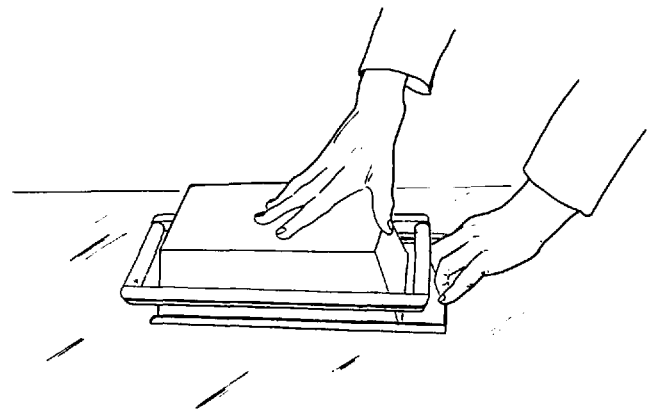
2. Place 'top plate' in position over mould 'body', side lips down.



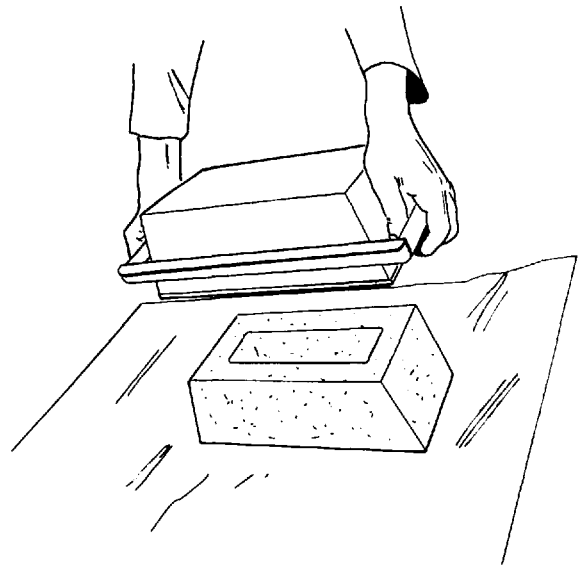
3. Lift up filled mould, holding 'top plate' securely, and turn mould over.



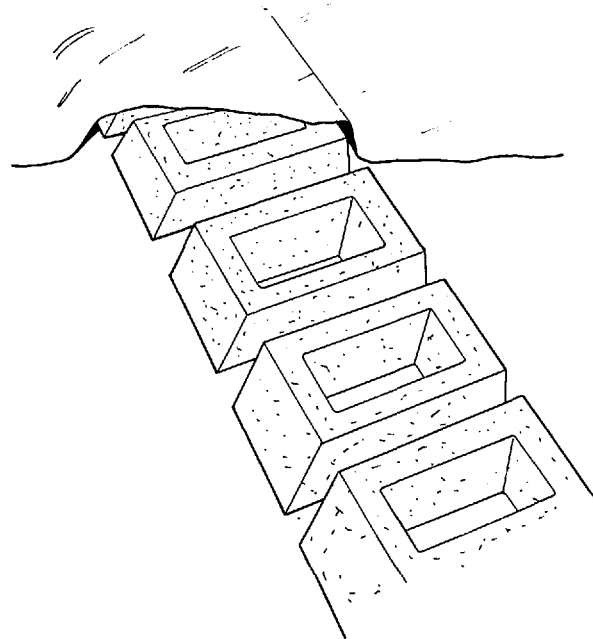
4. Place filled mould upside down on a plastic sheet on flat ground. 'Top plate' will now be underneath.



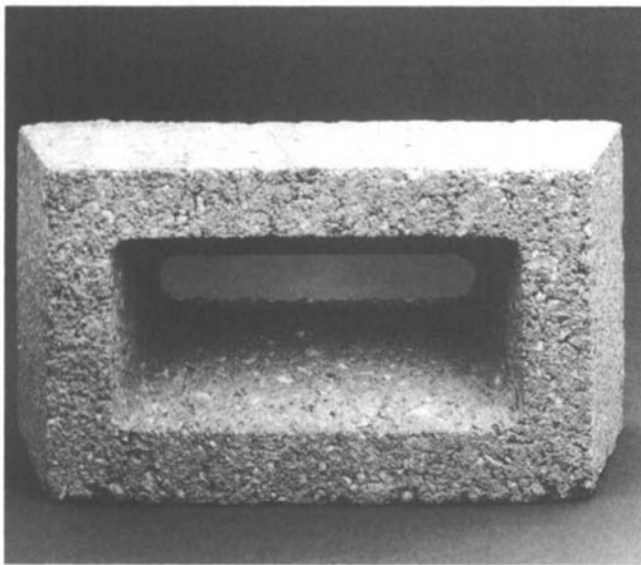
5. Hold mould stationery with one hand and withdraw 'top plate' from under 'body', using end lip as finger hold.



6. Lift mould 'body' vertically, clear of concrete block.



7. Blocks laid in rows, covered and kept damp. Leave to cure for at least seven days before handling.



- Top 0.5 metre of lining uses solid blocks, mortared in to form a ring beam foundation for a floor or cover slab.
- Thirteen blocks laid end-to-end make a circular course of one metre diameter (see Figure 1).
- Concrete mix (by volume): one part Portland cement to eight parts aggregates (aggregates ideally graded from 10mm to sand). If only sand is available, the concrete mix should be: one part Portland cement to six parts clean sand (5mm down). Add only sufficient water to allow a handful of mix to be compressed, and just stick together.
- The cured blocks should have a compressive strength (at 28 days) of about 10N/mm<sup>2</sup>. Experimentation is advised with local materials, and if necessary, adjust the cement content to give an adequately strong and durable block.
- The lining blocks can be laid directly on a clean but level floor of a pit without a separate foundation.

### Making the block mould

Fabricated from 1mm mild steel sheet. The top edges are beaded for stiffness, and the corners welded. Side stiffener angles should be 25 × 25mm, with tubular handles 20mm diameter, spot-welded to the body.

The centre 'core block' can either be fabricated from 1mm steel sheet or can be an oiled hardwood block. The core block should be removable to allow solid blocks to be moulded. In this way the core block can be secured with screws through the base of the body. Alternatively, a second mould would be required to make the solid blocks.

A loose 'top plate' measures 350 × 150mm with 10mm turned down lips on three sides.

### Application of the lining system

This concrete block lining system has been installed in a large low-income housing scheme in northern Botswana. Further experience of the production and use of this type of block is sought by BRE Overseas Division, with information on costs relative to alternative local lining options for pit latrines and soakaways.

Another application of this type of block lining is envisaged for lining shallow wells. Care is necessary in the design of the well head and the apron to protect the water source from contamination by well users and animals.



### References

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5. Watts, S.B. and Wood, W.E., *Hand-dug Wells and Their Construction*, Intermediate Technology Publications Ltd., London, 1976.

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