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Case study 12

12m^3 / 14.5m^3 Brick water tank, Thailand

Introduction and background

As with the previous Case Study, much of the information for this Case Study is taken from a paper presented by Chayatit Vadhanavikkit and Suthipol Viwathanathepa of Khon Kaen University, Thailand at the Rainwater Catchment Regional Seminar and Workshop, held in Khon Kaen in 1983.

As well as working on the development of the ferrocement water storage tank, a similarly shaped brick tank has also been developed for use with rainwater catchment systems. Two tanks sizes were built, both with a

diameter of 2.5m, but one with a height of 2.5m (giving a capacity of 12m^3) and the other with a height of 3m (giving a capacity of 14.5m^3).

In Thailand bricks a commonly used for the construction of water storage containers. The benefits and drawbacks of brick tanks are listed below.

Benefits	Drawbacks
Brick is a commonly found building material in many parts of the world, and are easy to manufacture where suitable soil is available.	Bricks have a low tensile strength and provide little resistance to the stresses set up in a water tank.
Building with brick requires no formwork and the shape can be varied as required.	Brick tanks, therefore, require extra reinforcing if a significant tank height is required.

Most masons are accustomed to working with bricks.	If not properly constructed, the life of a brick tank will be short.

Table 1 The benefits and drawbacks of brick tanks

Five tanks were built and tested by the authors of the paper.

Technical detail

The 14.5m^3 version of the tank is shown in Figure XX1. The general principle of construction is that the single thickness brick wall is reinforced externally with steel wire and reinforced internally with hexagonal steel mesh. Both inside and outside are plastered to cover the reinforcing and to make the tank water tight. The roof style is similar to that in the previous Case Study, and so will not be considered.

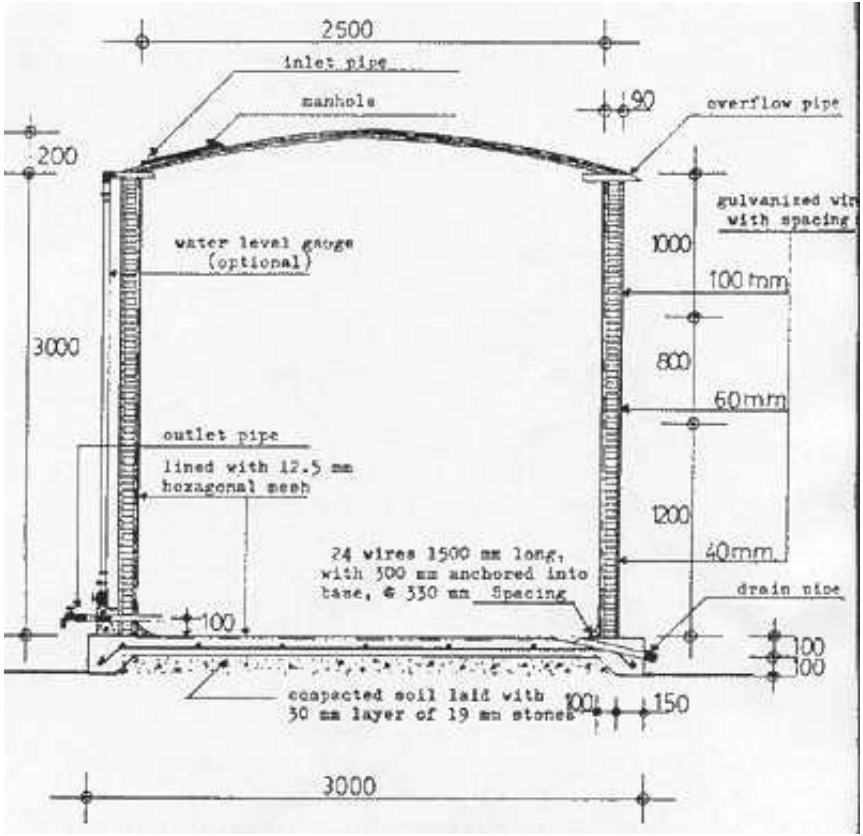

Figure 1 Detail of the 14.5m^3 water storage tank

Construction

The base

The ground is prepared with compacted soil and stone to accept a base of 3m diameter. The concrete base is laid to a depth of 100mm, with reinforcing steel of 9mm diameter laid both radial and concentrically at a depth of 50mm. A series of 24 galvanised steel wires, 1.5m in length, are cast into the base at a diameter of 2.3m. These are later nailed to the internal surface of the brick wall and plastered, giving extra resistance to shear at the base of the tank. They are buried to a length of 300mm.

The wall

A circular brick wall is constructed to a height of 3m. A mortar of 1:4 (cement:sand) is used, but the construction should be carried out in steps, with a maximum increase in wall height of 800mm before allowing the mortar to harden. The whole wall can be completed in two days. A plumb line was used occasionally to check the line of the wall. It is important that all the gaps between the bricks are filled as well as possible.

Figure 2 - a partially finished brick tank showing external rendering and hoop reinforcement (Chayatit Vadhanavikkit)

Plastering the outer surface of the wall

A mortar of 1:3 cement:sand is used for the plaster. A cement slurry is applied to the joint at the base of the wall. Rough plastering is applied and then galvanised binding wire is wound around the tank and embedded in the soft

plaster. A series of three closely spaced wires are wound around the base of the tank and then single wires are wound at the following spaces:

Height	Spacing
below 1.2m	40mm
1.2m to 2.0m	60mm
above 2.0m	100mm

Two rounds finish off the top of the tank. It is recommended to work upward, plastering approximately 500mm per stage, so that the plaster remains soft enough to accept the wire. The wire should be wound tightly at all times. The wire should be unwound smoothly from the coil, avoiding twists and knots. Wire can be joined by simply tying knots.

A trowel finished layer of plaster 10mm thick is applied finally.

Figure 3 - inner tank wall surface showing wire mesh in place

Plastering of inner surface of the wall

The tie wires, which were embedded in the base, are now nailed to the wall. Now the whole of the inner wall surface is lined with hexagonal wire mesh (figure 3 above). This achieved by cutting nine 3.5m legths of mesh and running them vertically up the walls with a 30mm overlap. The mesh is held in place with short flat head nails. The base is also covered with mesh. The surface is then plastered to cover the mesh entirely. Later, a cement slurry is applied to give water tightness.

The roof

As mentioned earlier, the roof is constructed in a similar manner to that in Case Study 11. Curing is also carried out as described here.

Figure 4 - roof construction for both ferrocement and brick tanks

Construction materials

	$12m^3$		$14.5m^3$	
Material	**Quantity**	**Cost**	**Quantity**	**Cost**
Silica cement (50kg bag)	22		24	
Bricks	2500		3000	
Stones (19mm)	$1m^3$		$1m^3$	
Sand	$2.5m^3$		$3m^3$	
Steel bar (9mm)	8 bars		8 bars	
Hexagonal wire mesh*	1 roll		1 roll	
Galvanised wire	17kg			

No. 12 (2.7mm) No. 11 (3.3mm)			25kg	
Flathead nails	0.5kg		0.5kg	
Tying wire	0.5kg		0.5kg	
Pipes and fittings				

*Roll size 0.91m x 45.7m (3 x 150)

Return to top of page
Return to index page