Building the Thai jumbo water jar using a brick form

by Brian Latham*

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THE Thai water jar, or *ong* as it is called in Thai – graceful, functional and affordable. What more could you ask for in water storage?

Used in Thailand, Kenya and other countries to store collected rainwater for drinking, the basic cement mortar model has grown in size from the traditional but relatively small 250 litre model that Watt described[1,2] to wire-reinforced 7-10cu metre jumbo jars that I inspected with Professor Thamrong Prempridi of Bangkok's Chulalongkorn University. Although jars this large are a rarity, the 1.8cu m tank is very popular throughout Thailand's north-eastern region. Professor Thamrong has seen a rapid increase in their numbers in the three years they have been in use in areas such as Chaiyapum.

The jumbo jar's popularity is due to many factors. First, the price is low. Commercial varieties are available for 500 Baht (US $23) delivered. The price per cubic metre is below that of other types of water tanks as shown in Table 1. Second, storage can be bought when the villagers can afford it. Houses may have as many as five jumbo jars, each one bought when cash was available, such as after a harvest. Third, the jar is of transportable size and weight so that small local factories can build it. Alternatively, it can be built on the spot, in which case it can be larger than 1.8cu m.

All in all, a beautiful piece of technology but the next question is how to build it.

Watt reported on a technique involving a hessian sack that was filled with sand as a mould. He illustrated the method for the 250 litre size and it was left to the reader to expand the hessian sack to 4cu m. However, in practice, it is difficult to find and handle 2 to 4cu m of material and give the sack sufficient rigidity and strength to construct a jumbo jar.

Larger jars

However, a method has been devised to build jars from 1.5cu m upwards and is being widely used in Thailand. With the support of groups such as the Siam Cement Co, the government departments for Non-formal Education and Community Development, and non-government agencies such as the Appropriate Technology Association and the Iodine, Iron and Clean Water Project, people are being taught how to build the tanks. Local jar factories such as the one I visited with Jean-Renè Rinfret of Canadian Universities in Service Overseas (CUSO) south of Khon Kaen, have sprung up as a cottage industry. Trained local technicians are building tanks on a private contract basis in some villages and many have been built under seasonal employment programmes of the government.

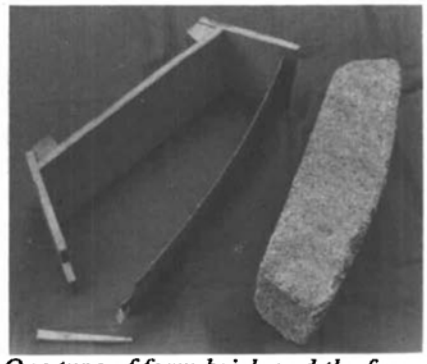
The method used involves a number of specially produced cement bricks as temporary forms. Dr Sanchai Limpiyakorn, director of ATA, suggested using 11 different layers of 8 bricks each, each layer having a brick with a different curvature! Dr Romsai of the Iodine, Iron and Clean Water Project and the commercial factory used a single design of brick. It is bevelled at the edges and curved on the outside face. About 90 bricks are needed for each jar.

The construction sequence is as follows:

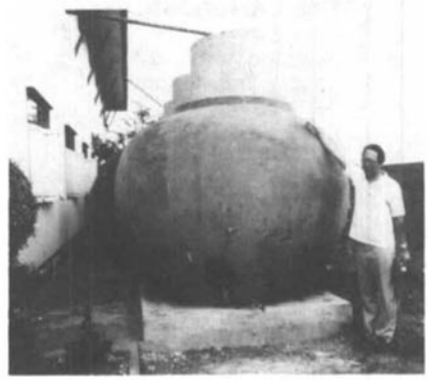
1 A base 1m in diameter and 50-60mm thick is poured. This may be flat but is often raised in the middle by 30-50mm. Number 8 wire (0.5-0.7mm) was used in a star pattern for reinforcing the base in the agency tanks but not in the factory jar.

2 After the base has hardened (24 hours), the bricks are assembled to give the desired shape. Part bricks may be needed.

3 The top of the form is made of small pieces of available lumber (300-450mm by 60mm) stacked to taper to the opening whose 650mm diameter is shaped by a galvanized metal ring.



One type of form brick and the form used to prepare it
Photo: Iodine and Clean Water Project



Professor Thamrong of Chulalongkorn University beside an unusually large jumbo jar Photo: B. Latham

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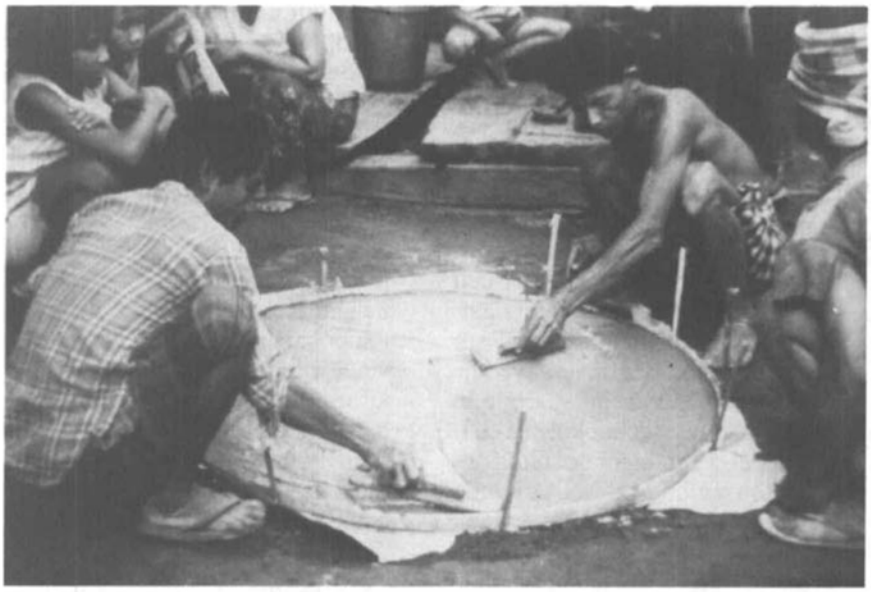
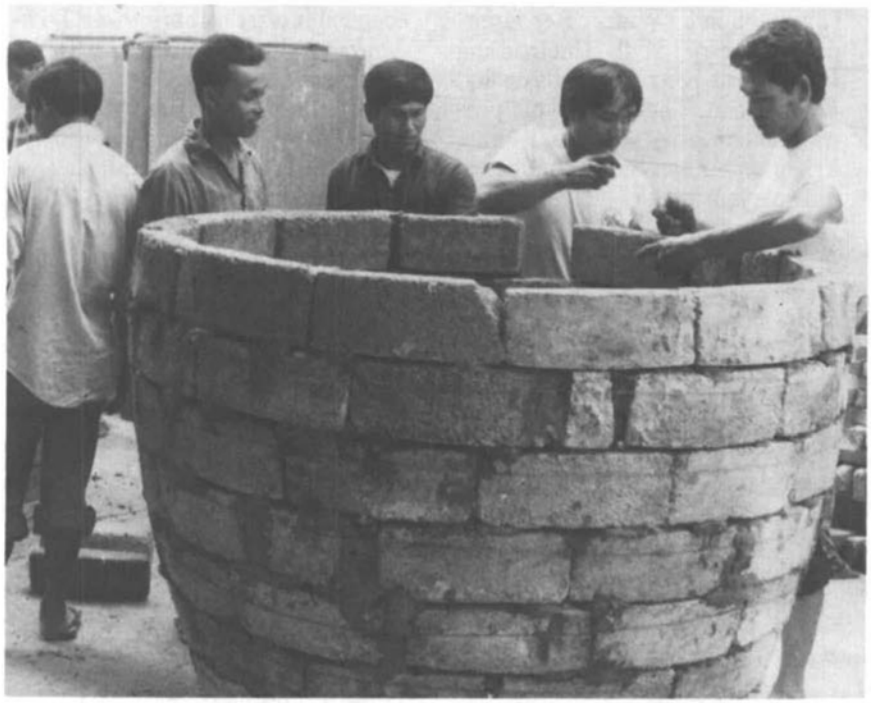
Type	Volume cu m	Materials Total	Materials per cu m	Full price Total	Full price per cu m
Jumbo jar	1.8	300	165	500	280
Bamboo-reinforced concrete	11.3	4,200	370	7,000	620
Plastic (commercial)	1.1			3,500	3,200
Glass-fibre reinforced concrete (commercial)	1.8			3,600	2,000

Table 1. Costs of individual small water storage tanks



Pouring the base of the jar *Photo: ATA*



Assembling the form from bricks and mud 'mortar' *Photo: Iodine and Clean Water Project*

4 A mud of non-organic soil is mixed up and used as a temporary mortar between the bricks, which are not closely butted together. Bands of light wire can be used to hold the bricks in place.

5 The skeleton is covered with the mud and smoothed to shape. The mud will be thicker in some places because the standard brick's curvature will not match the jar's curvature at all heights.

6 Construction then proceeds in the same way as Watt described. Concrete is applied to the mud form in two layers of 20mm each. Wire reinforcement is applied between layers. ATA advises using a vertical/horizontal grid at 150mm intervals but the factory used a spiral with loops 150mm apart. Some jars have bamboo reinforcement.

7 In 24 hours, when the concrete has hardened, the form is easily removed from the inside because the mud starts to give way. Bricks and mud are removed for re-use.

8 The interior and exterior are finished with a cement slurry, the opening is finished with a thick lip, and a decorative moulding is applied to the top edge. The slurry is usually coloured red or black, again for decoration.

9 The tank is allowed to cure in the shade for a week and is delivered by truck. With little or no reinforcement, the jars would not be expected to stand the rigours of delivery but the tanks were rolled about the

ATA

THE Appropriate Technology Association of Thailand (ATA) promotes technologies for rural development. It is a private non-profit organization which advocates a co-operative approach, placing emphasis upon community participation and the co-ordination of government and private sectors.

Its current projects in water resources development include the construction of simple rainwater storage tanks, deep and shallow wells, the *pvc* handpump, diaphragm pump and small hydraulic ram pumps.

One particularly successful partnership involved ATA and the committee of Religion for Development and Mahachulalongkorn Buddhist College. A hundred monks from the dry north-eastern provinces were trained in the construction of simple rainwater storage tanks. The monks then worked alongside other people in their home villages to build demonstration tanks, generating enthusiasm for the technologies.

ATA's research programme examines technologies to see whether they have any relevance to the needs of rural Thailand, given the resources available. They are then tested in a laboratory by ATA technicians in co-operation with the Faculty of Engineering at Chulalongkorn University in Bangkok. Field testing of prototypes then takes place in villages before the technology is spread.

Applying mud to the outside of the bricks *Photo: ATA*

Two 20mm coats of cement plaster with reinforcement between them make up the walls of the jar
Photo: B. Latham

factory and skidded onto trucks without apparent damage.

Additional features of the jars are galvanized metal covers and an optional tap for removing the water. This can be set into the base and contents gauges can also be included.

The quality of the jar construction varies greatly. The factory jar that I saw was made to minimum standards of concrete strength and reinforcement. Similar complaints were also mentioned about the jars built by local or travelling artisans. The purchaser has obvious difficulty in determining how the jar was made.

The form bricks are an ideal means of constructing the jars as they involve a minimum of handling of form materials compared to the filled gunny sack. If there are delays in construction for any reason, the form will not adhere to the concrete. The bricks are relatively inexpensive and can be made of any light cement mixture because they do not have to be built to high tolerances. They are also reusable so their initial cost is spread over a number of jars. The speed of construction is increased as well. The factory could produce about 1 jar per worker per day.

Further information

Professor Thamrong Prempridi,
(Civil Engineering Department, Chulalongkorn University, Bangkok, Thailand) has done research on many types of village technology. He is very familiar with the north-eastern region and sits on the board of the Appropriate Technology Association.

Dr Romsai Suwanik,
(Iodine, Iron and Clean Water Project, Faculty of Medicine, Mahidol University, Bangkok 10700, Thailand.) The I & CW Project is particularly interested in correcting iodine and construction project as well.

Dr Chanchai Limpiyakorn,
(Appropriate Technology Association for Development, ATA, 125/3 Soi Santhipap 1, Suph Road, Sripharya, Bangkok, Thailand.) Dr Chanchai is a professor at Chulalongkorn University. The Association is a training group in the appropriate technology field. It trains people in bamboocrete construction methods as well as jumbo struction methods for water tank construction as well as jumbo jar construction.

Jean-René Rinfret,
(Small Scale Water Resources project, c/o Civil Engineering Department, Khon Kaen University, Khon Kaen, Thailand.) This project deals mostly with small-scale irrigation but has built a number of ferrocement tanks.

Population and Community Development Association (PDA)
(8 Sukhumvit Road 12, Bangkok 10110, Thailand.) This group is known for its bamboo-reinforced poured-concrete tank. But some jumbo jars are built in Mahasarakham province where some villagers cannot afford the tank and where roofs are below the tank's 3m height. However, it has built some jumbo jars in Mahasarakham Province where some villages cannot afford PDA's usual type. The roof height of their houses is also traditionally less than the 3m height of the PDA tank so that rainwater could not be collected.

References

1. Watt, S. B. 'Water jars from cement mortar'. *Appropriate Technology*, Vol 2, No 2, pp 10-11, London, UK, 1975.
2. Watt, S. B. *Ferrocement Tanks and their Construction.* Intermediate Technology Publications, London, 1978.

Loading for shipment from the factory yard *Photo: B. Latham*

After finishing and hardening, two of the characteristically-shaped jars in place *Photo: Iodine and Clean Water Project*