Building the Thai jumbo water jar using a brick form
by Brian Latham*

Brian Latham collected the material for this article while on a Canadian International Development Agency scholarship. He is now working for Cowater International**, consultants.

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 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-Rene 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 Limplyakorn, 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.

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**Table 1. Costs of individual small water storage tanks**

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

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*Box 2423, Ottawa, Canada K1P 5W5.
**406-151 Sparks Street, Ottawa, Canada K1P 5C3.

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Photos: Brian Latham
Assembling the form from bricks and mud 'mortar'

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 rain-
water 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 Mahachul-
longkorn 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 along-
side 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 labora-
tory by ATA technicians in co-
operation with the Faculty of
Engineering at Chulalongkom
University in Bangkok. Field
testing of prototypes then takes
place in villages before the
technology is spread.

Pouring the base of the jar

Assembling the form from bricks and mud 'mortar'

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 curva-
ture will not match the jar's
curvature at all heights.

6 Construction then proceeds in the
same way as Watt described. Con-
crete 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 re-
moved 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 reinforce-
ment, the jars would not be expected
to stand the rigours of delivery but
the tanks were rolled about the
bricks.

Applying mud to the outside of the
bricks

Photo: ATA

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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, Sriparya, 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 construction 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.

References

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 northeastern 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.) 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.

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.

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