

# Progress with ferrocement tanks in Papua New Guinea over the last 18 months

by Steve Layton

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VIRTU's ferrocement tank project was started as a 'community project' rather than one designed to generate income, VIRTU's normal method of working, but it has become a profit-making venture.

During the second half of 1982 and the beginning of 1983, large areas of the North Solomons Province of Papua New Guinea (PNG) were experiencing a prolonged period of drought and in the worst affected areas on the outer atolls the provincial government was forced to ship water in 44 gallon drums. Although the province had been promoting rural water supplies for some time, this drought illustrated the extent of the problem. Because rainwater harvesting was looked upon as one solution to providing water in these areas and commercially available tanks were not appropriate to the needs or resources of the people, the Community Works Section of the Provincial Government requested VIRTU to look into the possibilities of transferring ferrocement tank technology to the

rural areas of the province.

We have no recent data on the water consumption rate of the rural population or rainfall in the North Solomons province. However, a survey carried out on Nissan Island in 1983 which gathered information from 10 villages indicated that the average storage capacity per person there was 178 litres. The minimum requirement is 12 litres per person per day (supplied by a community stand-pipe) according to the World Health Organization, so this capacity is only enough for a 15 day supply. The survey results also showed that 66 per cent of the total amount of water was stored in old 44 gallon oil drums. Based on the Nissan survey it is estimated that the present storage capacity on the 11 islands and atolls is about 874,000 litres. Allowing for a 60 day period, the storage capacity required is in the region of 3,547,000 litres, this means we have a shortfall of some 2,673,000 litres. And to meet this demand by supplying fibreglass tanks, the Provincial Government or the people themselves would have to purchase tanks to the approximate value of K326,700.\*

\*1 PNG Kina = US \$ 1.138

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*The sections of the bottom mould are joined, and the first layer of chicken wire fitted*

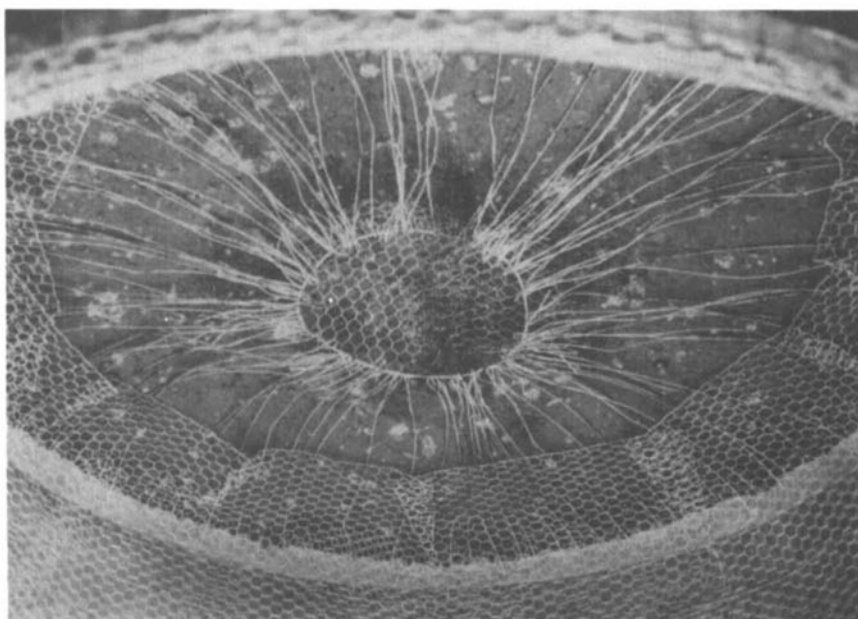
At present the PNG National Weather Service, which is based on Port Moresby, only has active recording stations on Bougainville and Buka. The most recent station to operate on the islands and atolls was located on Nuguria and was closed in mid 1979. However, it is possible to estimate a mean rainfall figure based on figures recorded between 1949 and 1979. We estimate that the average mean annual rainfall on the islands and atolls is 3,520mm.

After three months of design and trials, VIRTU's first promising tank began to take shape and very quickly

## VIRTU

VIRTU (Village Industry Research and Training Unit) is a technical (appropriate technology) section of the Division of Commerce in the North Solomons Province of Papua New Guinea. VIRTU was initially funded from a national government grant, but now is completely funded from within the province. The aim of the Unit is to promote rural-based income generating activities primarily in the less developed areas of the province. "At the time of writing, VIRTU has a staff of 8 full-time officers whose experiences cover a wide range of professional expertise. VIRTU is based in Kieta which is the second largest town in the province and its facilities include a well-equipped covered workshop and adequate office and storage space.

VIRTU is engaged in a number of projects ranging from an investigation and trials of locally produced chicken feed, to the training and establishing of small-scale sawmills. All of VIRTU's projects are carried out in conjunction with other division within the Provincial Government; however, special emphasis is placed on the relationship with the Division of Commerce.



*The tie wire and the second layer of chicken wire are in place*

after this field trials were carried out on Nissan, the largest of the outer atolls. Nissan was used not only because of its regular air services, but also because it has the province's largest population and hence the largest demand for water. Experience has shown that in general the meagre groundwater resources of the outer islands and atolls of the North Solomons cannot be successfully exploited.

### Only option

Therefore, it is felt that the collection of rainwater is the only viable option open to the people living on these islands and atolls.

Although initially the project was requested as a community development project, it was very soon realized that this approach had not succeeded in many parts of the country. And after reviewing a number of projects undertaken by various groups throughout PNG, it was found that their approach to the transfer of ferrocement tank technology had been very similar. In most cases the technology was 'given' to the people in the form of demonstrating the construction of one or two tanks at 'appropriate technology workshops' or 'village technology courses' with most of the effort being channelled towards encouraging the participants to construct one or two tanks on their return to their villages.

The approach taken by VIRTU is very different. We very quickly realized that if a tank could be designed to meet the criteria below it would be not only possible to produce large numbers of tanks in rural areas but also to give a financial incentive to the rural people to construct the tanks.

☐ The production process should utilize local rural labour resources

and encourage the establishment of small-scale rural industries.

☐ Materials, equipment and production techniques should be not only understood, but sustained by the people who are going to use them.

☐ Where possible, raw materials should be obtained locally, and where it is necessary to purchase them they should be types which are commonly stocked by local sales outlets.

☐ VIRTU tanks should be able to compete with commercially available tanks.

☐ They should be structurally sound enough to withstand the earth tremors which are common in the region.

☐ The size of a tank should meet the water needs of an average rural family and be within their financial reach.

As mentioned earlier, the first trials were carried out on Nissan Island, but before the trials members of VIRTU staff made a number of visits to the island to discuss with government officers, community government officials and village leaders the most appropriate way for the project to be established. During the discussions it was identified that the majority of the skills and resources were already present on the island and that if VIRTU could transfer the technology needed to construct the tanks the other aspects involved in the project would follow. The main non-technical aspects of the project were:

☐ Identification of a group of would-be entrepreneurs who would be able to give the time needed to

## Province and population

The North Solomons Province comprises two main islands, Bougainville and Buka, with a scattering of smaller islands and atolls: a total land area of 900,000 hectares. Bougainville is about 200km long and between 60 and 100km wide with two major mountain ranges, the Crown Prince Range in the South and the Higher Emperor Range in the North. The island of Buka is separated from Bougainville by a channel only 300 metres wide and about one kilometre long. The other islands and atolls are very much smaller in size and range in distance from the two main islands from a short 20 minute boat ride to, say, Saposa Island, to a 2 day trip to the Tasman Group.

A village survey conducted in 1980 as part of the Provincial System (PDS) provided information on residents, births and deaths in the previous 12 months, age structure of the population classified in four broad bands for each sex, the number of absentees, and migration in and out of each village. The total rural village population was 107,081. Of this, the population of the islands and atolls represented only 4.6 per cent.

The average annual rate of population increase between 1952 and 1980 was 3.1 per cent, one of the highest in PNG. The national rate is about 2.8 per cent. The North Solomons also has a higher than average fertility rate and a low mortality rate. This means that if the high growth rate is unchecked, the population will double in the next 23 years.

establish and maintain the project.

☐ Assisting these would-be entrepreneurs to develop the non-technical skills to operate a small-scale rural industry.

☐ Identifying ways in which the community government and village leaders could assist the project.

### Interest

Given the interest shown in the project by the people of Nissan, it did not take long for the project to develop. There

were social problems on Nissan caused by the presence of a large number of young, educated people who had insufficient land to grow coconuts to produce copra (49 per cent of the Nissan population is under 17 years of age). There were no other opportunities to earn money apart from the odd trade store or chicken project. It was decided that the tank construction project should try and utilize the resources these young people represented.

After a number of meetings the ten main youth groups on Nissan decided to send one member from each group to work and train with VIRTU staff and after training, form Nissan Construction (NISCO), a business group, to generate income from the sale of ferrocement tanks.

Also working with the VIRTU staff on Nissan was a Business Development Assistant (BDA). BDAs are employed by the Division of Commerce in the North Solomons to assist village businesses and to act as a liaison between the District Business Development Officers and village businessmen. Because the role of the Nissan BDA was important, he was sent to Kieta to work at VIRTU during the construction of the first few successful test tanks. This gave him an insight to the types of problems which could be faced in Nissan and the extra training needed to advise on possible solutions to these problems.

The training of the would-be entrepreneurs on Nissan took just under a month and was designed to be as intensive as possible. It consisted of NISCO's first contract to supply four tanks at two schools, a Health Centre and a village. The tank construction technique used a glass fibre mould designed to

- ☞ Support the re-inforcement wire during plastering and thus avoid the need for excessive wiring purely to support the re-inforcement during construction.
- ☞ Support the cement mortar during construction, thus reducing the level of skill needed to construct a tank and speed up the plastering operation which in turn allows for the mortar to dry uniformly.
- ☞ Assist the entrepreneurs to monitor



*Turning over the completed top of the tank*

the standard of their workmanship and the amounts of materials used.

- ☞ Be lightweight and robust and withstand repeated re-use.
- ☞ Ensure that all the tanks produced would have a uniformly attractive appearance.

The fibre-glass mould is made by adapting a commercially available fibre-glass tank. The tank moulds are made up of a top and bottom mould both of which are in two parts. The construction of a tank has been broken down into quick and easy steps totalling 13 hours work over three days.

### Reasons for success

Besides the tank production technique, other factors have made the project a success, not least of all the price of the finished tank compared to the cost of other commercially available tanks. The table below illustrates the marketability of the VIRTU designed tanks.

Since NISCO's training some 12 months ago, the group has generated a gross income of K7,200 (US\$ 8,193). There is a potential market for 30 to 40 tanks per year.

Material	Cost per instalment	Cost per litre after 10 years
Glass-fibre	K835 (US\$ 950)	1.5t (US\$ 1.7 cents)
Corrugated iron*	K260 (US\$ 295)	3.8t (US\$ 4.32 cents)
VIRTU tank	K200 (US\$ 227)	0.5t (US\$ 0.5 cents)

\*A corrugated iron tank has to be replaced on average every 18 months on the North Solomon's atolls

Following the project's success on Nissan, a number of other groups on the two main islands of Bouganville and Buka have been established and either supported by or wholly owned by community governments. Also the Provincial Division of Health has established a small team of workers to construct tanks at rural aid posts around the province.

This means that in the first year of production small-scale rural businesses in the province have gained approximately 6 per cent of the annual market for water tanks which represents a total gross income of K13,000 (US\$ 14,794). It is estimated that with the present training programme this share of the market could increase to between 12 per cent and 14 per cent next year.



*Forming the inside of the top half of the tank*

### Comparative costs of different types of tank