Feature — Science and Technology

Different Placement of Overhead Water Tanks

by Mustak Ahmed

WATER reservoirs are of two types; underground and overhead. The Principle of proposed reservoir placement is: "The overhead water reservoir is to be installed in a place where its water holding walls are not touched by direct sunlight, rain water and dew drops, but they should have touch of air flow as and when required."

Building with staircase

Normally the overhead reservoir is made of RCC or GI sheet and is placed upon the roof or over the staircase with necessary distribution piping system. This has some difficulties. On the other hand, if the reservoir is placed/ suspended just under the roof of the staircase, some of the difficulties will be remedied, and some advantages will be available.

A comparison of the existing and the proposed systems of overhead water reservoir is given below regarding their different aspects.

Disadvantages of existing reservoir upon the roof of building or staircase

1. Water-holding walls of the reservoir get heated during summer due to direct exposure to sunlight and create big difference between water temperature and ambient temperature. Similarly, during rainy season and winter nights, water becomes very cold due to direct touch of those walls with rain water and dew drops respectively and again big difference happens between water temperature and the ambient temperature. But the above differences of temperature are uncomfortable and annoying to the water users.

2. An extra GI or RCC or plastic structure above the staircase or the roof hampers beauty of the building.

3. All six sides (roof, four walls and floor) of the reservoir are to be built as a cube upon a costly base or four pillars (in the case of RCC reservoir).

4. Better construction strength is required for the reservoir to protect it from wind pressure which also effects the building's foundation strength to some extent (strong wind often displaces GI tanks).

5. Scorching heat of sun, rain water for days after days and drops of dew in winter decrease the durability of the reservoir due to loosening of molecular binding of the wall's concrete caused by frequent and high temperature difference between the inner and outer side of the walls during sunny morning, sudden rain in summer noon and dewfall in winter evening. (In these times, molecules of one side of the wall expand due to high temperature while molecules of another side of the wall contract due to low temperature and thus weaken their mutual binding strength). In the presence of photo synthesis facility, different kinds of plant may grow to weaken the wall and later pollute the water.

6. Due to comparatively higher water lifting level, bigger lifting pressure is necessary from the pump, electricity consumption is higher and water misuse is more.

7. The maintenance workers face difficulties and become annoyed while working in the heat of summer for cleaning, repair etc, of the reservoir.

8. Any leakage or problem remains unnoticed if people keep casual surveillance over the roof or staircase, creating salt accumulation or crack on the roof or walls which require costly and inconvenient maintenance.

Advantages of proposed reserveroir

1. Water holding walls will not come at all in touch with sunshine, rain water and dew drops during summer, rainy season and winter nights respectively. So water temperature in the reservoir will remain very near to the ambient temperature and will give comfort to the water users.

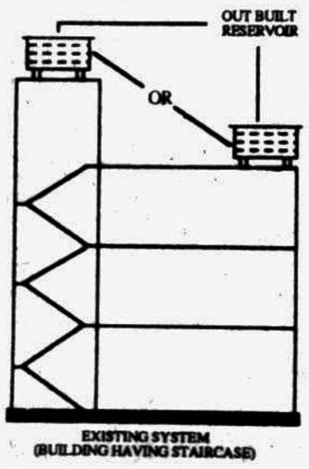
2. The reservoir will remain hidden under the roof and will give the building a regular cube-like beauty without any extra projection (after construction of the topmost floor).

3. Cost of roof and base/ pillars of RCC reservoir will be omitted (staircase roof will work as reservoir roof) even if the beams are to be built under the reservoir

4. Due to hidden existence within building, construction strength will be required to hold the water pressure only and wind pressure will have no influence on the building foundation (no wind will displace GI or plastic tanks).

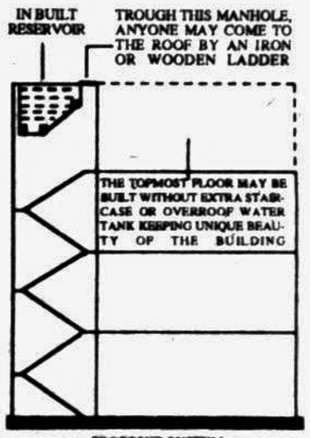
5. Sunshine, rainwater and dewdrops will not reach the reservoir walls and thus give bigger life span and less maintenance requirement for them.

DRAWING NO. A-1



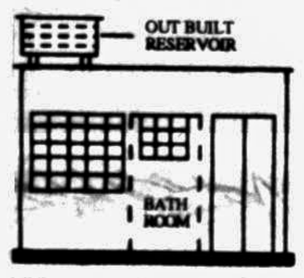
EXISTING SYSTEM (BUILDING HAVING STAIRCASE)

DRAWING NO. A-2



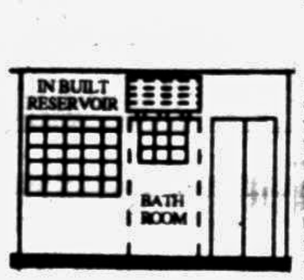
PROPOSED SYSTEM (BUILDINGS HAVING STAIR CASE)

DRAWING NO. C-1



EXISTING SYSTEM (BUILDING WITHOUT STAIRCASE)

DRAWING NO. C-2



PROPOSED SYSTEM (BUILDING WITHOUT STAIRCASE)

6. Due to less lifting height of water, there will be less lifting pressure requirement for the pump, less amount of electricity consumption for the same amount of water lifting and water misuse will be less.

7. Comparatively less hot reservoir will give ease and comfort to the maintenance workers during hot daytime even in summer.

8. Any leakage or problem will be very easily noticed by people and quick necessary action will be taken by the owner of the building conveniently and economically.

Some guidelines for construction

A simple RCC reservoir may be placed suspended just below the staircase roof as shown in the drawing A-2, keeping accessible clearance from the staircase walls directly exposed to sunlight, rainwater and dewdrops. But if the load of reservoir (with full water) is calculated to be heavier compared to the tensile strength of its four walls, three to four beams (as necessary) may be used under the reservoir to take partial load of it. An inclined lintel parallel to the stairs may be built to take load of the beams more efficiently and safely.

To use GI or plastic compound reservoirs, three or more RCC/wooden/GI beams may be placed across the staircase walls (parallel to the roof) to take the load. Necessary clamps may be used to fix the reservoir at its placing. The size and shape of the reservoir will be such that it can be easily carried from outside to its place of use. In an incomplete/ temporarily completed staircase, GI/ plastic reservoirs may be used in the same way under the temporary shade. With advancing of the building upward, the reservoir will also be replaced/ lifted upward.

If any wall of the staircase is not exposed to sunlight, rainwater and dewdrops, it can be used as the common wall of both the RCC reservoir and staircase (construction cost will be more curtailed for this).

In multi-storied building, where the proposed reservoir can not meet the demand of required water (for greater number of users), extra reservoirs may be made upon the top floor bathrooms as in the staircase. Necessary piping may be made to connect all these reservoirs in a common grid system.

Artificial cooling and heating of reservoir water

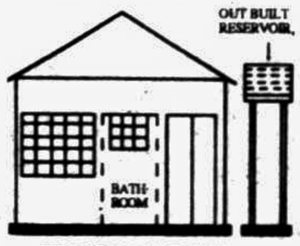
Due to proposed unique placement of the reservoir, cooling and heating of reservoir water to some extent is possible by artificial means.

In summer

We know, if a water jug made of mud is kept under shade and air flows even at a very low speed there, water inside the jug becomes cooler than the air around (having ambient temperature). Similarly, if some ventilators (having easy opening and closing provision manually) are made in the uppermost portion of staircase walls allowing the hot air (heated by wall temperature due to sunshine) to flow out, a low speed air flow will cool the reservoir to some extent. Besides, some GI/ plastic pipes (having U-shaped head) may be kept inserted in the reservoir roof for hot air/ steam produced inside water to flow out of the reservoir. Ventilators used in the staircase wall will be such that, even strong wind cannot push rainwater inside the staircase while kept open. Upper part of the roof directly upon the reservoir may be painted with white colour (just after every winter) to decrease heat radiation by sunshine upon water inside the reservoir.

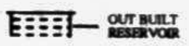
Water in GI or plastic reservoirs cannot be cooled in the above way. For cooling them, a pipeline with very small holes is to be fitted with upper perimeter of the reservoir (just below the earmarked higher limit of water level) and below that line of holes, a thin foam jacket should be wrapped around mid perimeter of the reservoir (about 70% of its height). After every fill up, some amount of water will come out from those holes to swamp the foam jacket which will be dried by the airflow (up to next fill up of water) to cool the reservoir. The excess water falling from the foam jacket may be collected by a small tin/plastic drain made around the lower perimeter of the reservoir and from there that water may go out by a plastic/GI pipe. Connection between the above pipeline and reservoir should be made through a simple water tap for easy closing and opening the water flow towards the pipeline.

DRAWING NO. B-1

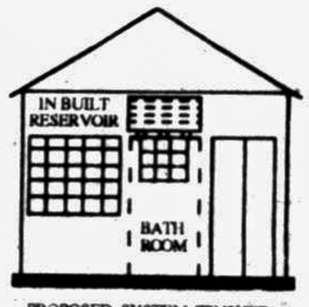


EXISTING SYSTEM (TINSHED)

DRAWING NO. C-1



DRAWING NO. B-2



PROPOSED SYSTEM (TINSHED)

In winter and rains

We know, in a closed space, the hot portion of air is accumulated in the upper region. If the ventilators of staircase walls are kept closed in the winter and rainy seasons, comparatively hot portion of air (heated by wall and roof temperature due to sunshine) of staircase will accumulate at its upper region and will not be able to escape, rather it will heat the reservoir and its water.

In these seasons, natural cooling is unnecessary. Water flow from the reservoir to the aforesaid pipeline should be kept stopped so that the foam jacket does not get water and remains dry to avoid natural cooling of reservoir water. The U-shaped head of the GI/plastic pipes should also be closed at its open end above the reservoir roof.

If RCC reservoir walls are fully water resistant, the above foam jacket and pipeline arrangement is to be applied for natural cooling. In place of foam, any material durable in water air may also be used for the jacket.

Maximum possible use of glass in staircase walls to allow direct sunshine into staircase will make the artificial heating and cooling more efficient.

Building without staircase/ tin shed house

In these kind of houses, if the reservoir is placed upon three to five RCC/GI beams or GI angles above the lintel level and three walls of the bathroom, some problems of the existing system will be solved.

The comparison between the proposed and conventional systems of reservoir placement in these houses will be more or less similar to that in the case of building having staircase. But, in this case, cost involvement of the proposed system will be much lower than that of the existing system due to complete omission of: (1) separate mounting structure (2) three bathroom walls (2 to 3 feet) above the lintel level. Besides, in the proposed system pipe length and security need will be less, heat resistant ceiling over the bathroom will not be required and bathroom will be soundproof.

Guidelines for construction

In these houses, GI or plastic reservoir (of length and width equal to those of bathroom and height according to space available above the bathroom) may be placed upon three to five RCC/GI/wooden beams and three bathroom walls (as shown in drawing B-2 and C-2). Two ends of each beam will be put on slots made upon two opposite walls of bathroom at lintel level or shower level and the reservoir bottom will be just above that level. For higher number of users or more water requirement, reservoirs may be installed upon more than one bathroom with interconnection pipe between them to create a common grid of water source of required capacity.

Industrial premises

Here also, overhead water reservoir may by placed just under the staircase roof of the highest building or under the highest shade to use water conveniently.

Disadvantages of the system and probable remedies

In the proposed system, the reservoir height is a bit lower than that of the existing system, for which water pressure will be a bit less only at shower level of only the top floor bathrooms (while all other water points will have good water pressure). This problem may be minimised and a workable water pressure may be made available at top floor showers, if water level is kept always above that shower height by an automatic water level controller, (or a water level indicator may be used to determine when to start the water lifting pump and when to stop it for keeping water level always above the desired height) and the shower should have holes and their connecting pipes should be of bigger diameter. Due to any fault, if the water pump does not stop at a desired water height, and overflow pipe is to be connected with the reservoir to drain out excess water somewhere outside the house, so that the waterfall is noticed by somebody who will immediately stop the pump.

Tapping the Sun for Clean Energy

by Dieter Dollken

MORE than one hundred residents of Hamburg have received government subsidies to run solar-energy facilities; and many more have filed applications for such assistance.

Jorg Kuhbier, Hamburg's minister for the Environment, touring a model facility operated by the Pulm family, confirmed that even for northern Germany - relatively impoverished when it comes to sunshine - solar energy can provide meaningful amounts of power.

"Tapping the sun to generate electricity is one of the cleanest forms of energy because there are no pollutants whatsoever released into the environment. Power is produced even when conditions of diffuse light prevail," he added.

"Solar power for an ecological house in Germany." The Kraus family in the southern German town of Merkendorf doesn't need power from the municipal utility. A solar reflector nets enough energy to cook a pot of sausages. The European Community awarded its European Environment Prize to the timber-and-clay house with the alternative power facility (Photovoltaic installations by Siemens).

— Photo : INP

"Tapping the sun to generate electricity is one of the cleanest forms of energy because there are no pollutants whatsoever released into the environment. Power is produced even when conditions of diffuse light prevail," he added.

Most such facilities employ an instrument which converts the direct current of the photovoltaic power into alternating current and brings the power directly into the household's wiring. The solar power is thus consumed directly by the household. Possible surpluses enter into the local power mains grid - at a fixed price.

Despite government subsidies covering up to 70 per cent of the installation costs, "rooftop power from the sun" is still prohibitively expensive.

Thus, Hermann Pulm, operator of the facility visited by the Hamburg minister, says that "concern for the environment was the reason we decided to invest." His facility cost 26,000 German Marks.

At present, it covers a third of the household's daily electricity needs. But the price of the "home-made" Kilowatt-hour is still twice the utility's price, all subsidies notwithstanding.

The Hamburg environment authority is convinced that this will change for the better, and that this innovation has be evaluated with an eye for the long term. Rising demand for such solar facilities can be counted on to reduce the per-unit price.

Plans call for the evaluation phase for these innovations to extend into 1994. The aim is to demonstrate that such rooftop units for generating electricity conform to construction and architectural requirements.

Recommendations are given to attune household power use to the rhythm of solar energy generation, and to employ energy-efficient devices. The program also creates expertise in the areas of installation and the practical operation of such facilities. — *IN Press*

Only God Can Make a Tree, But Now ...

by Gamini Seneviratne

SINCE the earliest human settlements, farmers have been changing nature's original plants. All the crops we know today are very different from their wild ancestors.

Much of this was achieved simply by propagating new crops from the best of the previous season. The science of plant breeding speeded things up and made more pronounced changes possible; plants bred to grow faster, need less water, mature together and to have many traits desired by us.

Genetic engineering has opened new frontiers. Specific changes can be made so that plants grown from the altered cells, and generations which follow, will all carry the new trait.

Disease resistance is especially desirable and gene transfer has achieved many successes, but only in short-lived so-called herbaceous plants.

For example, alfalfa, potato, tobacco, tomato and several other important crop plants have been made resistant to diseases caused by the potyvirus family, the largest and most widely distributed group of plant viruses.

But research on tree species, woody plants, has not yet got beyond "marker" genes to see if a possible procedure might work.

Few suitable genes have been identified. And there are no protocols (detailed step-by-step route maps) that show how a given gene is best transferred and how whole plants can be grown from the transformed plants cells to ensure that the introduced gene is carried from generation to generation.

Researchers at Vienna's Agriculture and Forestry University have now achieved a significant breakthrough.

At the University's Institute of Applied Microbiology, a 14-strong team led by Dr Margit Laimet, has transferred a gene into tree-tissue culture and regenerated large numbers of transformed plants.

The target of the work is Sharka disease, which is caused by another member of that infamous potyvirus family, the Plum Pox Virus (PPV).

This is the most damaging pathogen (agent of disease) of stonefruit trees, such as commercially valuable apricot, peach and plum of the species known as Prunus. The virus deforms the fruit and make them ripen unevenly.

As a poet once put it, only God can make a tree. But humans want to make some little changes to the originals. Scientists in Vienna, reports Gemini News Service, have made an important advance in the cultivation of fruit. Their breakthrough opens up big opportunities for developing countries now that their produce is finding a global market.

Sharka, which was described in Bulgaria in 1932, is now widespread in eastern and southern Europe and many Mediterranean countries, with significant economic consequences.

Prunus trees are very sensitive to climate. So plantations use climate-specific cultivars. Many Austrian cultivars are already threatened with extermination, says Laimer. So there was added urgency to her team's work.

The virus is carried by aphids, so its spread is difficult to control. There is no cure. PPV-free countries are fearful of an invasion. In the US, stringent quarantine regulations cover Prunus material and the virus is the only plant pathogen for which there is an emergency plan should it cross the Atlantic.

Laimer's team worked with apricot plant tissue. They cut out the PPV coat protein gene — the gene is responsible for the sub-units that make the protein envelope of the virus — and put it into their apricot culture.

The main difference between a virus and other organisms is that it uses its host's cells to build up its sub-units so it can multiply.

To do this it un-coats itself first. The host would then be induced to produce all its various parts, including its protein coat.

Work on other plants has shown that those given the coat protein gene are resistant to the virus, though how and why is not yet known.

Laimer's team used a selected piece (plasmid) of the genetic structure of an agrobacterium, to transfer the PPV gene to their apricot tissue culture. The bacterium causes tumours in stonefruit trees.

"It does so," Laimer explains, "because in each plasmid, between its left and right borders, it has oncogenes which if transferred to the plant cell, induces the plant cell to start to divide and form a tumor.

"We cut out the oncogenes, replaced them with our coat protein gene, and put it in the agrobacteria to transfer the gene to the plant tissue.

From this plasmid, only the sequence between the two borders, so just our transfer DNA, will be integrated in our plant genome."

Now a large number of transformed apricot saplings, 4-6 inches tall, are growing in pots in the Institute's hothouse. Soon they will be artificially infected with PPV and virus behaviour in them monitored.

Laimer says it would be at least two years before transformed plants are put in the field ,"because these are the first and we want to study them in real depth."

The transferred gene carries no risk to the tree, nor to consumers of its fruit. Stonefruit trees are familiar with the coat protein gene, which they begin to produce as soon as the virus infects them.

Many people would have eaten it in fruit of infected trees. While stonefruit crops would be the immediate beneficiaries of this work, it has wider significance extending to the developing world whose produce now has a global market.

In an environment-conscious world, genetic transformation of woody plants, to protect them against bacterial, fungal and viral diseases, will soon be a major activity. Genetic-resistance hugely reduces dependence on chemical aids.

How a Waterless Town is Drinking its Fog

by Luis Tricot

FIVE hundred kilometres north of Santiago stands Chungungo, a most unusual desert town. Its 400 inhabitants are unique. They are the only people on earth using "fog water."

Incredibly, after a 20-year drought Chungungo has drinkable water for the first time in its history. The water is obtained from camanchaca the thick fog typical along Chile's northern coastline. The system is ancient — the Incas used it — but only since 1987 has the idea became a reality, thanks to funding from Canada's International Development Research Centre (IDRC) .

Like most towns in the region, Chungungo always relied on a water-tank truck to supply it. The truck came twice a week.

It was not always like that. Sergio Espejo, chairman of the Pro-water committee, says: "Back in the Twenties, an American mining company provided us with water and electricity."

This was the Bethlemen Steel Company, which in 1914 began operating the largest steel mine in the world. It eventually left and Chungungo went back to its dry and arid existence.

Then, last May, the town's inhabitants opened their water taps and watched in astonishment as clear, crystalline liquid flowed easily and abundantly.

Their lives were changed. "We were quite sceptical at first," says an elderly, radiant woman. "Once we used to joke ... only fog or smoke will come out of the taps, we said."

Legend has it that the region's original inhabitants used to worship particular trees which they considered sacred because a permanent flow of water sprang from the treetop. They were right.

The thick fog that forms along the coast changes into tiny raindrops which are in turn retained by the tree leaves, producing a constant interior rain.

Canadian and Chilean scientists set about finding out how to take advantage of this natural phenomenon and so help the people of Chungungo.

The solution was to be found only a few kilometres east of the town itself —at el Tofo hill. Scientists discovered that clouds which originated in the Pacific, rose whenever they collided with a hill. Condensation at the higher ground would produce even more fog.

The ancient eucalyptus forest of el Tofo hill, with its eternal interior rain, provided the vital clue that scientists needed to create an ingenious and peculiar water supply system.

They installed 50 "fogcatchers" on the top of the hill. These are huge nets supported by four-metre long eucalyptus pillars, with water containers at their base. At a distance they look rather like giant fly flaps.

About 7,200 litres of water is collected each day and brought into town by a pipe seven kilometres long.

This small-scale technology system is cheap and clean. The nets cost around 17 dollars — slightly more than the average monthly water bill of a city household.

The project's total cost was $ 140,000. This is little indeed, considering the significant improvement in the quality of life of hundreds of poor men and women.

The Chungungo experience is a good example of sustainable development, albeit only applicable to small towns. In Chungungo, average water consumption per person amounts to 14 litres a day , whereas in Santiago it goes up to 300 litres.

Also, the system will work only if no contaminating agents, such as industrial chimneys, are present.

Oman and Peru might import the system, but whether such efforts succeed or not, the people of Chungungo are happy and optimistic about their future, for they know that the fog, unlike the Americans, will never leave them.