CONCRETE FACTS ABOUT COOLING TOWERS

What type of cooling tower is better – FRP or concrete towers? Aslan Barazi weighs their comparative merits to facilitate an informed choice.

Since the beginning of the district cooling era in the Gulf region, which began in the UAE over a decade ago, FRP (fibre reinforced polymer) cooling towers have taken the lead. This is because of the material's ability to withstand harsh climatic conditions of the region, which include factors, such as high ambient temperature, high humidity and high sea air salinity in this area. However, concrete cooling towers are a tried and tested option. There are many concrete cooling towers still in operation in the region that are more than 35 years old, thanks to their inherent efficiency and longevity. This article addresses some of the key features and differences between the two types of cooling towers – concrete and FRP towers.

It is worth mentioning here

Single FRP, Palm Island

that each country seems to have its own preference in cooling towers. For example, the UAE appears to be partial to FRP cooling towers, while Kuwait seems to prefer concrete cooling towers. It is interesting to note that there are many examples of old and new towers that use ceramic tile file with a 25 year standard warranty on the fill, for both plant room size projects and small scale projects.

Both concrete and FRP towers have their advantages. An FRP cooling tower comes with a single FRP body, with either a stainless steel construction or an FRP pultruded structure.

On the other hand, a concrete cooling tower is made of 100% corrosion free material. This is because manufacturers take into account the fact that even SS316 in the cooling towers has been shown to oxidise and turn brown, requiring regular cleaning.

An FRP tower is lighter in weight and has a higher stress/strain ratio, especially when made by reputable cooling tower manufacturers, who use an FRP pultruded structure.

Some cooling tower manufacturers offer the option of a double FRP wall, which gives it a life span comparable to a concrete cooling tower, provided it is correctly specified at the time of listing quality specifications. With minimal alterations, it also becomes an FM approved fire rated cooling tower. This is an important factor from a safety point of view. In case of a fire, the fire can be safely contained within the cooling tower cell, without the possibility of it spreading to the neighbouring cell.

Another advantage in the case of the double FRP wall is that it substantially reduces noise levels, since the air medium between the two FRP walls acts as a sound insulator. In addition, a double wall FRP cooling tower looks better.

The point to be noted here is that there is an additional cost for a double FRP cooling tower compared to the single wall corrugated FRP structure – normally in the range of a 1.15 multiplier. It can be argued that the additional cost is justifiable, if we factor in the fire safety aspect, lower noise level, longer life and higher tower stability, compared to a single wall FRP tower. Its visual appeal, of course, is an added advantage.

At this juncture, it is also important to remember that a material density of FRP/glass composite of no less than 12 oz to 16 oz per square foot FRP ingredient is required for the long life and structural integrity of a cooling tower. There are numerous instances of cooling towers either failing or, worse, collapsing, when cooling tower manufacturers have compromised on the quality of material and have supplied cooling ▶

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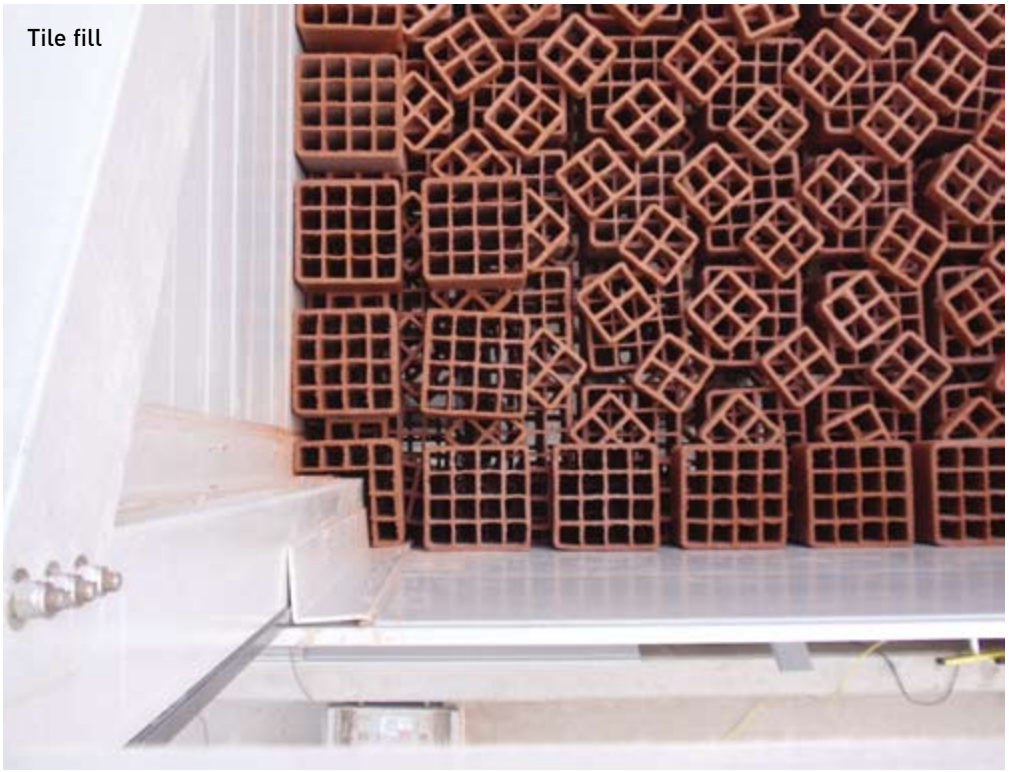
Dobule FRP

towers using material with thickness of lesser density, for example six oz per square foot or eight oz per square foot thickness.

Concrete cooling towers, on the other hand, have a long history, globally, and in the region, thanks to their longevity, compared to FRP cooling towers. Interestingly, what makes them a more economical option in the region is the lower cost of pouring concrete, when compared to Europe or the United States. Having said that, it can be argued that the concrete needs to be competitively priced, when taking into account the overall pricing of the tower. Which means, the total concrete scope of the cooling towers should be part of the civil contractor's total scope, including procurement and labour cost, for better economies of scale.

When we compare the life cycle cost (LCC) between a concrete and an FRP cooling tower, a concrete cooling tower seems to emerge as the clear winner in the long run, particularly in the region. If they are manufactured by a reputable company, and are properly maintained, concrete cooling towers can be expected to last for about 50 years – the same longevity as that of a building. This criterion could also be applied, in all probability, to the ceramic tile fill (25 years warranty) that comes along with the tower. Comparatively speaking, a standard quality FRP tower has an average life span of about 20 to 25 years by industry standards, and therefore, needs to be replaced twice during the life of a building. Lower in the rung is the tower with a PVC fill, with an average life



Tile fill

of seven to nine years, and would, therefore, need to be replaced five to six times over the average life of a project.

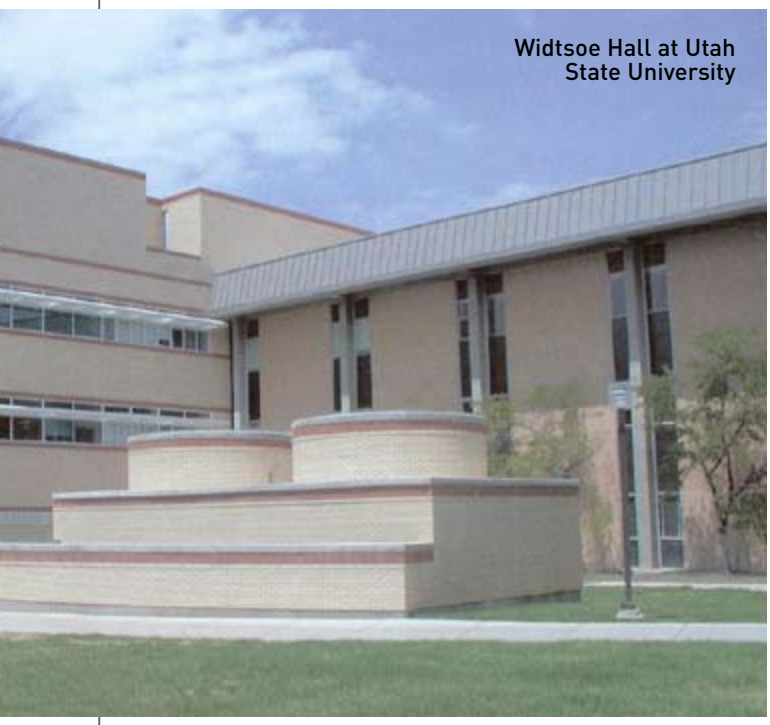
It needs to be noted that a PVC fill is more efficient and occupies less space than the tile-fill variety. Normally, a tile-fill tower may take15% to 25% more space than an FRP or a PVC-fill tower. A tile-fill tower, however, has the advantage of longer life, and is clog free and maintenance-free, allowing practically any kind of water quality to pass through it, without any worry about the effect of heat transfer on the fill medium, as it happens in the case of the more sensitive PVC-fill tower.

In the case of a PVC-fill tower, a slight nudge or tilt may alter the effect of water trickling over the fill, making the water take the path of least resistance. This would, in turn, reduce the overall cooling tower's heat transfer performance. Additionally, concrete cooling towers have lower noise levels than conventional FRP (single wall) cooling towers, due to the inherent properties of concrete.

Another feature of concrete cooling towers is that they can be constructed as part of the architectural design and, therefore, have aesthetic appeal. This also makes the cooling towers more flexible, as far as space is concerned. The client or consultant, therefore, can allocate a separate space for the towers, instead of installing them in the plant room. This is an added advantage, especially if space in the plant room is a constraint.

A caveat: though concrete cooling towers offer a wide range of innovative possibilities, clients who want to opt for them need to factor them in at the project's design stage itself and work in tandem with the architect and the mechanical engineer.

In conclusion, it can be said that both FRP and concrete cooling towers are feasible options for a client to consider. The choice depends upon design factors, LCC cost analysis, available project time scales, space considerations, noise levels, safety, tower fire rating and issues of operation and maintenance. ■



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