MYRTHA POOLS®

Comparison

A comparative analysis of the best available technologies for commercial and public pools

Imagine… you have to select the best available technologies to build a perfect swimming pool.

Where would you start?
What would be the most important aspects to consider?
How would you evaluate what is available on the market?

The following document is a comprehensive analysis of the solutions available on the world market **for commercial and public pools**, focusing on the most important aspects that should be taken into consideration for a relevant comparison.
This particular analysis focuses on the **commercial pool market**, where the number of available technologies is limited compared to residential pools. In fact, because of the large volume of water and the heavy use of public pools, special solutions are necessary for commercial pools requiring technologies specifically developed for this type of usage. In contrast most of the residential pool technologies are very simple and not reliable enough for commercial use.
During the last century, the only material used for commercial pools has been reinforced **concrete**, either poured and formed or gunite. Then, from the early 1970s, other solutions have appeared on the market – mainly steel and plastic based technologies – and they have slowly but surely gained a larger share of the world market.

The technologies available **today** for commercial pools can be divided into three main categories:

- **Concrete pools,** including two main solutions: poured and formed concrete and shotcrete/gunite.
- **Fiberglass pools**, that for commercial use can only be reinforced polyester panels.
- **Metal pools,** including three main families: steel panels with a loose membrane, welded steel and the **Myrtha Technology**.

Fiberglass pools have only been successful in Japan in commercial installations due to limitation in size and shape because of the necessity to mould each component and to the limited lifetime they can guarantee. The gel-coat protective layer does not last very long and it is very difficult to replace, so this comparison will essentially **focus its analysis on the comparison between concrete and steel pools**, which represent the only solutions with relevant market shares.

The **parameters** that will be compared are:

1. Structural resistance
2. Waterproofing guarantee
3. Appearance - Finishing
4. Time of construction
5. Overall site engineering
6. Costs
7. Life cycle - maintenance
8. Environmental impact
9. Others

1 Structural **resistance**

The first aspect that should be taking into consideration is structural resistance; a swimming pool has to withstand pressures from both inside the tank (water) and outside (for backfilled pools).

These forces are very different on the walls and on the bottom. The walls have to be resistant so as to counterbalance the side pressure of water (or backfill when the pool is empty), while the floor of the pool has only to withstand a pressure that is very, very low: 0,2 Kg/cm2 for a 2 m deep pool: most soils bear ten times this pressure!

Concrete Pools

Is concrete still the best material to construct a pool? Let's examine the advantages and disadvantages.

To be resistant to a force, **concrete has to be reinforced**: it's a composite material where the strength is provided by the reinforcing **iron bars or mesh. The cement**, mixed with sand or gravel, provides the thickness and the surface, protecting the internal reinforcements that are normally **black steel**.

Needs waterproofing

Yes a concrete pool is solid, **but it's also brittle!** Pools have to be resistant over time and in a concrete pool this resistance is provided by iron bars. To avoid corrosion by the aggressive pool water the pool must be waterproofed. Concrete is porus, therefore it is important that the concrete surface is waterproofed so that the iron bars do not come in contact with the pool water. To obtain this result and avoid even the smallest crack in which water would infiltrate, a concrete pool has to be designed and constructed in very professional manner. This is quite difficult to obtain today, where the majority of the jobs in construction are sub-contracted to non-skilled people.

Easily cracks with movement

Cement is also brittle, and does not like micro-movements (unstable soils, seismic areas) as it could be easily cracked by movement.

Needs comprehensive reinforcement

It is **not efficient** from a **structural** point of view. The fact that a concrete pool tank needs to be a monolithic structure with equal (or similar) reinforcements in the floor and in the walls, and a thick layer of cement is necessary to protect to the reinforcing iron bars from corrosion, make it necessary that a concrete pool needs to have a **thick and heavily reinforced floor, even if this is not necessary from a static point of view**.

Furthermore, there are very critical areas, like the connection between the walls and the floor, that need special reinforcements. This is a very relevant inefficiency: if you imagine that a 50m pool has a floor slab that is 1,250 m^2, you can easily understand how much "unnecessary" reinforced concrete is wasted in this construction.

Difficult to repair

In case of leakages or structural problems, concrete pools are very difficult to repair, first of all because it is not easy to locate the leakage point and also because many times the solution requires a structural intervention that requires relevant costs and time.

Difficult to obtain precise distances

Very **precise dimensions** are also **difficult** to obtain (particularly for gunite pools): the concrete shrinks during maturing time, the precision has to be obtained increasing the plaster depth where necessary, but this may create too thick areas, easy to crack and detach. In a poured and formed pool this precision is much easier but relies on good supervision of trades.

> *I came across to Myrtha Pool and I was very impressed with the quality and the durability. Ultimately I was intrigued by a pool that looked so well after 20 years.*
>
> ***Doug Whiteaker – Water Technology***

Steel Pools

Steel pools rely on the structural integrity of the metal components that are either welded or bolted together.
The relevant advantages of steel pools from a structural point of view are:

- **No need to protect the steel elements with a thick layer of cement**: the steel pools use separate protection systems (ex: vinyl membrane) or a non-corrosive grade of stainless steel

- From a structural point of view the floor is much less relevant (as it does not need a cross reinforcement with the walls) and can therefore be thinner with light (or no) reinforcement.
- The structure is **solid yet flexible** and can easily absorb micro-movements
- Steel pools are much lighter, that make them ideal for construction on suspended slabs.

For a more detailed analysis, it is necessary to distinguish the three main technologies on the market:

A - Steel panels with loose PVC membrane:

- They use either galvanized or stainless steel panels that are bolted together to provide the integrity.
- They can be used also for deep pools, as long as they are designed correctly.
- Mostly used for rectangular shapes.
- Some of the components are welded (ex. reinforcing buttresses), and these could be potentially weak points if installed in a corrosive soil.

B - Welded steel pools:

- They use nickel-based stainless steel sheets that are welded together to make up the pool tank.
- They can be used also for freeform pools.
- The extensive welded joints, exposed to the aggressive pool water, are a potential weak point for corrosion, especially if the water chemistry is not perfectly balanced. In fact, during the welding process, the heat is changing the chemical nature of the stainless steel, making it less resistant to corrosion.
- The floor is made also of stainless steel, with some limitations due to the necessity to create distribution channels on the floor for the water circulation.

C - Myrtha Pools:

- Myrtha uses chrome-based stainless steel panels. In fact, because the wall panels and gutters are completely bolted together and there is no single welding, Myrtha pools can use chrome-based stainless steel (400 series) that is stronger from a mechanical point of view and is very resistant to stress corrosion.
- The stainless steel is protected - through a hot lamination process - on the internal face with a very hard pvc and on the backside with a transparent film that will protect he panels also in the most aggressive soil conditions.
- In a Myrtha pool the connection between the wall structure and the concrete floor (much thinner and much less reinforced than in a concrete pool) is made with a steel base frame, connected to the concrete by means of strong chemical anchors. The result is a very resilient self-standing pool tank, anchored to the concrete but structurally independent.

2 Waterproofing **guarantee**

A good construction of the pool tank has to guarantee perfect waterproofing. This is not so simple because the contained water has a **relevant pressure** (stronger for deeper pools) and as a liquid it tends to find **any possible small way to "escape"** from the pool tank. Furthermore, **modern pools have many perforations** through the walls, gutters and floor for many type of different fittings (inlets, drains, drop-outs, anchors, water features, water toys, moveable floors, etc.) and these can easily become very weak points in terms of waterproofing, unless they are not sealed with a mechanical system.

Concrete Pools

Concrete itself it is not waterproof: it is a porous substrate prone to water penetration, therefore it needs a waterproofing layer to protect it from leakages. Most of the concrete pools rely for waterproofing on a mixture of cement, resin, glue and additives to obtain a **plaster** to spread on the concrete surface. It is not easy, anyway, to control this process, because of the difficulty to have a constant thickness and because of all the problems related to concrete curing time and good bonding.

A better method for waterproofing concrete would be to use specific **waterproofing "membranes"** applied as liquid rubber polymers, but because they are more expensive and require specialists for the installation they are not used very often. The most evident **weak point** for concrete pools is how to guarantee waterproofing in all the **perforation points**: the resin based adhesive mortars normally used are too much subjected to "casual" conditions (skills and attention of the installers, weather conditions, mixing and curing, etc.) to be considered a safe solution, and in fact these are very often the first leaking points in concrete pools.

> *The benefits of the Myrtha pool is that we do not have to drain the pool to repaint, resurface, we can just continue through. So the sustainability of that pool is right on top.*
>
> ***Sue Nelson - USA Swimming***

Steel Pools

Steel pools, in general, can guarantee very safe waterproofing methods. Let's see more in detail:

A - Steel panels with loose PVC membrane:

- The general waterproofing on the pool tank and gutters is guaranteed by the membrane, that is normally reinforced in commercial pools applications.
- The waterproofing of the perforations are guaranteed by mean of flange and counterflange systems.

B - Welded steel pools:

- The tank and pool perforations are welded steel and so waterproofing is simple, and can certainly be considered safe. The only risk is again related to the potential corrosion of the welding points.

C - Myrtha Pools:

- Myrtha Pools use a number of PVC-based proprietary techniques for the waterproofing of the (laminated) panel joints and in general for the pool tank. Most of these techniques rely on a combination of mechanical (bolting and hot gun welding of reinforced membranes) + chemical (liquid pvc) bonding, that provide double safety.
  Please refer to"The Myrtha Technology" and to the Myrtha web site for specific analysis of these techniques.
- Every perforation in the walls/gutters/floor of the pool is waterproofed with a flange + counterflange + sandwich gasket system, sometimes doubled with a chemical bonding or PVC welding.
- The pool floor is waterproofed with a specially designed double/triple thickness reinforced membrane, as of today the safest waterproofing material available on the market.

3 Appearance **and finishing**

The appearance - and particularly the possibility to have different materials, colours, etc. for finishes - is very important for commercial pools, that are often designed by an architect and that in many cases need to be well integrated into a context (hotels, spa, clubs, etc.) where the image/look is fundamental. In swimming pools appearance always has to be well co-ordinated with the functional aspects of the construction, as there are several norms - mostly safety related - that dictate some characteristics of the materials (ex. antislip) and design (ex. presence of a gutter on the perimeter).

Concrete Pools

One of the most significant advantages of concrete pools is that they have a **very wide range** - practically unlimited - of finishing materials that can be applied. Concrete is in fact a rigid surface that can accept either painting (although less and less common due to limited resistance), application of a PVC membrane or gluing of any type of tiles, mosaic, etc. The choice is more limited for gunite pools, that cannot guarantee precise and regular surfaces and that are therefore often finished with renders or pebble finishes.

Steel Pools

For steel pools the appearance really depends on the specific technology considered:

A - Steel panels with loose PVC membrane:

One of the weakest points of this technology is in the limited alternative finishing that can be applied. In fact, having to work on a loose membrane instead of a rigid surface, the application of finishing materials becomes very complicated. Although single skin membrane offers a choice of design these are not suitable for commercial applications.

B - Welded steel pools:

The look of welded steel pools is very specific and it has limited (mainly to central Europe) the success of this type of pools. It is in fact a “steel tank look” that

can appear very clean in some applications, but that in general is not very popular especially in situations (ex: indoor pools) where the natural light is limited and these pools tend to be dark and unattractive. Some doubts have also been raised concerning safety for larger and deeper pools, as the colour might not be consider "contrasting" for the detection of drowning bodies.

> *Once you start looking at Myrtha Technology you really can't go back.*
>
> ***Stephanie Morasky – Harvard Westlake School, Los Angeles***

The application of finishing products (ex. tiles) is possible but technically difficult because of the fact that it is not simple to glue materials directly on stainless steel and the flexible nature of the steel sheets can limit the products used.

C - Myrtha Pools:

The range of finishing products that can be used on a Myrtha pool is **very wide**, similar to concrete pools.

In fact, because Myrtha uses hard-PVC laminated surfaces, it is easy to glue any type of material (tiles, mosaic, natural stone, glass, etc.) without the above mentioned limitations of gluing directly on stainless steel. Furthermore, in the industrial process panels and gutters are manufactured with a specific recess in order to obtain a flush surface with the cladding and with the advantage to make the tile (or other materials) installation much easier and more precise.

4 Time of construction

The time for construction is a very relevant parameter when deciding on technology and it should be considered not only for the pool building time, but also for the impact of the whole site construction time which is particularly important for indoor pools.

Needless to say that a shorter installation time means a substantial savings in direct cost, not to mention the indirect costs such as overhead, energy, insurance, etc.

Concrete Pools

Concrete pools need lengthy construction time if properly built: not only do they need several teams of specialists (for framework and pouring, waterproofing, fittings installation, tiling, etc.) to intervene in sequence, but also they need precise maturing time that need to be respected in order to limit risk. Furthermore, for an indoor facility the concrete shell needs to be started in early stages of the project, with a great impact on the logistics for the rest of the construction and risk of abuse and misuse. For gunite pools the installation time can be shorter, although still subjected to the weather conditions.

> *The Myrtha Technology has multiple benefits over traditional construction, one of which is the expedited time that you can install a Myrtha pool. You are very flexible with the timing of the installation: (…).*
>
> ***Matt Ruzicka - The Pool Company***

Steel Pools

Because the installation is mechanical, not only is the installation time shorter than traditional construction, but the installation can be speeded up if needed. Also, for indoor facilities steel pools are normally installed during the later phases of the overall construction and the pool floor can remain available for stocking materials, cranes, etc, for most of the job and there are no concrete walls to limit movement in the building during that time.

Myrtha Pools:

Myrtha technology, not having any welded point on the pool walls, but only bolted, ensures a even more quick time of installation.

5 Overall site **engineering**

The choice of the building technology for the pool tank is often influencing the overall site engineering, particularly in case of unstable soils or high water table.

> *Is fascinating the way it's put together. Myrtha's technology has just revolutionized the entire pool space.*
>
> ***Rob Butcher – U.S. Masters***

Concrete Pools

Concrete pools need a very stable base because their rigidity cannot accept earth movements, which would end up in micro cracks and leakages. This means that on unstable soils they need extensive piling on the whole surface of the floor slab, that represents a very relevant added cost. In a similar way, high water table concrete pools need to be oversized, many times with very thick and strongly reinforced floors and walls, in order to counterbalance the eventual lifting pressure of water (in case the pool is emptied).

Steel Pools

Steel pools are generally much lighter than concrete pools for the wall construction and they normally require a much thinner floor.

They rely on the strong mechanical resistance of the steel structure that is non brittle and therefore it can resist micro movements much better. This is particularly true for steel pools with a reinforced membrane on the floor, that can guarantee perfect waterproofing even if micro cracks would appear (typical the case in high seismic regions).

In case of unstable soils steel pools with a floor membrane only require piling on the perimeter of the floor slab, while the central slab can be considered a separate element: even if micro movements might happen and micro cracks appear, the PVC membrane will not show them and certainly the waterproofing would not be affected.

For high water table it is possible to use a mix of dewatering and/or hydrostatic relief valves but it is not necessary to cast a thick floor, as again micro movements due to variable water table would not affect the tank integrity.

6 Costs

The following considerations only deal with the construction costs while the maintenance and life cycle costs will be discussed at point #7.

Concrete Pools

It is important to distinguish between poured and formed (normally tiled) concrete and shotcrete/gunite.

Construction costs for **cast in place concrete pools** can vary substantially, depending on the location, site conditions, accessibility, the construction company and project specifications. If the construction company is serious and meticulous, they normally have a much higher cost than when building with the other building technologies.

Shotcrete/gunite pools have traditionally lower costs than poured and formed concrete but again these costs can vary considerably. The choice of the plaster/render can have a substantial impact on the overall cost, but the selection of a cheaper product often results in a very short lifetime of the finish.

Concrete pools are notoriously subjected to “change orders” during the construction phases, that result in higher final costs when compared to the original budgets.

Steel Pools

Also for steel pools we need to distinguish between the different families of products:

A - Steel panels with loose PVC membrane:

It is possibly the cheapest solution among the ones considered. There are many variables, from the type of steel (galvanized or stainless) to the choice of the membrane, but in general it is not an expensive solution, also because from an engineering point of view these are quite basic structures.

B - Welded steel pools:

These are possibly the most expensive solution among the ones considered. The necessity to use stainless steel on the whole floor of the pool (although not structurally necessary) makes this technology very expensive especially for larger pools. The workmanship need to be very specialized - as the specific welding process is complex - and this also has a reflection on costs.

C - Myrtha Pools:

Myrtha is not sold on price and in fact it is a relatively expensive solution.

The relative price comparison with the other technologies depends on the size and design of the project, but in general terms the Myrtha cost should be in between gunite and tiled concrete pools, and certainly less expensive than welded steel. The savings on the overall engineering, shorter construction time and maintenance costs, make Myrtha a very cost effective solution if considered in the bigger picture.

Steel pools, as pre-engineered solutions, very rarely have “change orders” during the construction phases and therefore the final costs are normally in line with the original budgets.

7 Life cycle **maintenance**

The cost comparison between two or more different technologies should take into consideration also the projected costs for the maintenance during the whole life cycle.

Concrete Pools

Also in this respect it is important to distinguish between tiled concrete pools and shotcrete/gunite.

The maintenance costs for **cast in place concrete pools** depend on the quality of the original construction. Even in the case of a good original construction quality, regular re-grouting is a necessity to avoid re-tiling of the pool which otherwise has to be considered as a normal operation every 10-15 years. Both alternatives are quite a relevant cost and mean that the pool is shut down for several weeks.

The maintenance costs for **shotcrete/gunite pools** are very high – higher than those for poured and formed concrete – because the re-plastering has to be considered normally every 5-8 years at the maximum and it is an expensive operation that requires a long shut down of the pool.

Steel Pools

Also for steel pools we need to distinguish between the different families of products:

A - Steel panels with loose PVC membrane:

The life cycle costs are limited. Anyway, because with this technology the PVC membrane is often covering the walls also above the water level, the aging of the PVC itself could be accelerated by the direct UV action. The membrane would normally be replaced every 15-20 years.

B - Welded steel pools:

The maintenance costs for this technology are normally quite limited, although they are very much related to the water chemical parameters. If this is not kept under strict control it could lead to corrosion problems and therefore higher life cycle costs.

C - Myrtha Pools:

The combination of the materials (hot laminated stainless steel for the walls, specially designed membrane on the floor) used in a Myrtha Pool guarantee the lowest maintenance cost and the longest life cycle on the market. In a Myrtha Pool, every component that is above the water level is covered with tiles (or mosaic, or other finishing materials) and the membrane therefore avoids any direct exposure to UV.

8 Environmental **impact**

The environmental impact is becoming a pertinent aspect in many countries where more and more projects need to be LEED certified, to quantify the greenhouse gas emission level. Such comparisons should take into consideration the whole life cycle of the swimming pool, including the installation procedures, the expected lifetime and the number of interventions/refurbishment necessary during the life of the project. However, because some of the aspects listed above are not easy to measure, a more limited but certainly more “scientific” approach is to list the quantities of each single material necessary for the construction of the pool in the different technologies and to transform them into “equivalent greenhouse gas (CO2) emissions". This should be done on the bases of conversion charts, according to international standards. Myrtha commissioned to a specialized engineering firm, Acor Consultants (Sydney, Australia), to do a detailed comparative analysis. The resulting report demonstrated that building a 50m x 25m **Myrtha pool can save about 45% of the greenhouse gas (CO_2) when compared to a traditional tiled concrete construction and more than 30% if compared to a welded steel pool**.

Please refer to the specific Myrtha document for the CO2 emission comparisons and to the Myrtha LEED pre-approval booklet

9 Others

There are further aspects to consider for the choice of the most appropriate swimming pool technology.

A very important consideration concerns **the overall responsibility of the pool builder**.

With traditional construction (poured and formed concrete or gunite) the responsibility (and consequent guarantees) is typically distributed among the several different companies/crews (form and pour, waterproofing, tile finish, fitting positioning, etc.) and this makes it very difficult to consider one trade responsible for any problem that might arise after the job completion. Engineered pools are on the contrary normally installed by the same manufacturer or by an authorized distributor that is taking care of the whole pool tank and fittings (and also filtration if requested) and therefore it will remain the long-term reference for any relevant issues and after sales work.

Another important aspect is that **engineered pools come as a complete package** that includes grating, markings, anchors, treads, etc., while for traditional construction there has to be a competent person in charge of verifying that the supply is complete and all the items are well integrated. This is particularly important if the pool includes complex systems like moveable floors, bulkheads, special water features and playgrounds, etc., that require specific experience in the integration and waterproofing process.

> *As accredited engineers for the design and certification of swimming pools in Australia, we only utilise the exclusive Myrtha technology to design new or renovate existing pools to meet RLSA or FINA specifications.*
>
> ***Livio Chiarot, Acor Consultants***

Conclusions

The comparative analysis of the main technologies available on the market for commercial pools is giving evidence that the **traditional concrete-based systems that have been used for many years are not any more the most indicated choice**.

Steel has now a proven record for structural integrity and watertightness that clearly outperforms concrete, and Myrtha technology is ideal for the exacting build of competitive pools.

In the family of "Steel Pools" Myrtha is universally recognized to be the most engineered, versatile, long lasting and high performance solution.

The advantages in terms of overall costs, speed of construction, quality control and long term low maintenance **have made Myrtha the choice of preference of many architects, aquatic consultants, swimming federations and clients. Because of this, Myrtha is the only pre-engineered solution with thousands of commercial installations in more than 60 countries of the world, in the most different site conditions and for the most varied applications**.

> *This is a Lamborghini of swimming pools.*
>
> ***Gary Hall Jr., Olympic Gold medalist swimmer***

In today's market Myrtha is simply the most modern and reliable technology to build a swimming pool.

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