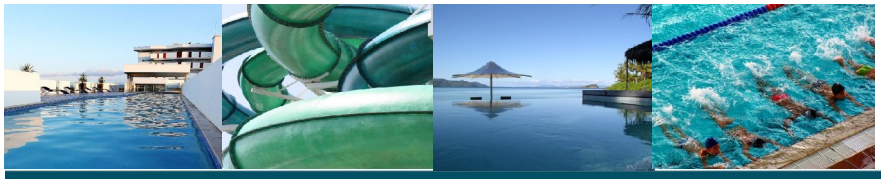
BROWN
Smart Consulting

Structural Review

Wonthaggi Indoor 25m Pool

08 March, 2013
Aquatic Structures

Prepared for Bass Coast Shire Council



1. PREAMBLE

The indoor pool facility at Wonthaggi was constructed in 1980 and the aquatic component of it comprises two fully tiled reinforced concrete pools that were constructed using the sprayed concrete system.

The main pool is a 25m x 12.5m 6 lane pool with depths of 0.8 metres to 1.6 metres and a small, 4m x 4m shallow toddler's pool 0.6 metres deep is located nearby.

Both pols are skimmer box style pools with an exposed aggregate finish to the perimeter beam.

Filtered water is introduced to the main pool through 7 No. floor inlets located along the centre of the pool floor and soiled water is taken out of the pool for processing via 7 No. skimmer boxes.

Stair access is provided at one shallow end corner for the main pool while the toddler pool has a small triangular set of steps in one corner.

The main pool has two recessed climb-outs, one in each deep end corner. Handrails are provided at each point of access.

The pools were originally tiled with mosaic tiles but the interior tiling was replaced with KlinkerSire 250x 125 module swimming pool tiles in early 2005.

Lane lines and target lines are provided in the main pool tiling although the wall target lines are unusual. Deck sockets for false start and backstroke indicators are located in the concourse outside the pool pediment.

2. POOL LAYOUT AND FUTURE USE

The purpose of the inspection was to allow us to form an opinion on the potential remaining life of the 25m pool as Council are considering future renovations and extensions to this facility.

In 2011 a Leisure Centre Feasibility Study was prepared by InSynch Consulting and within this study two preliminary pool layout options were prepared showing suggested extensions of the pool hall.

Both layouts show the complete removal of the old toddler's pool as it is to be replaced with a leisure pool/splash deck arrangement. A new 25 metre pool is shown in differing locations in each of the options. From what we can see, the preferred layout, or option 1, has the orientation of the leisure water and the lap pool with the leisure water close to the amenities which avoids having small children walking past deep water to access their play features. This layout however, requires the demolition of the existing 25m pool as part of the first stage works.

The second option allows the 25m pool to be retained as it is until stage 2 works commence this will give a layout that may not suit council needs because of the location of the leisure water in relation to change facilities.

InSynch have obviously recognised the problems with that second layout and this is why they have recommended removal of the old 25m pool in stage 1 to allow the preferred layout to be adopted.

These matters are relevant to our commentary on the life expectancy of the existing 25m pool as there is not only the matter of structural integrity to consider. We should also look at the potential of the pool, if any, to continue to give good service and perform in a way that conforms to current regulations and industry guidelines.

We will not be commenting on the filtration system in this report as it is beyond the scope of our brief but we will say that the plant room is in an excellent state and it is a credit to those responsible. The equipment has been progressively upgraded over the years since the initial installation and the equipment is generally of good quality apart from the chemistry control system which is of domestic quality.

There has been a new U.V system installed recently and the filters and pumps are of reasonable quality and in good condition. Most of the big ticket items in the pool plant room can be re-used in any new version of the pool facility.

3. POOL STRUCTURE

The 25m pool only is being discussed here as the toddler pool is to be demolished in any version of future works.

This 25m concrete pool shell is typical of any commercially sprayed concrete pool of that era.

Walls and floor will be 150 thick and reinforced with Y12 reinforcing bar at 300 centres each way placed centrally. Higher yield 'N' grade bar is used these days for reinforcing but the use of lower yield 'Y' grade steel in this pool would not significantly impact on its durability.

As with many such pools, the concrete would have been sprayed against the excavated earth face with only perimeter edge boards used to form the outline of the pool perimeter beam. There is the possibility at times with this construction technique for there to be a lack of reinforcing cover on the earth face as often there are minor cave-ins of the excavation during construction and these would fall to the bottom of the excavation or hang up on the reinforcing. In both cases, the fallen earth takes the place of concrete.

In such circumstances an excellent path is created for moisture to attack the reinforcing.

There is no sign of rusting of any significance on the interior surface of the pool and there wasn't any rusting evident on the internal concrete surface when the pool was re-tiled in 2005. We cannot say however, if there is rusting showing on the outside face of the pool walls.

Typically, this type of pool has a life expectancy in the order of 50 to 60 years. These sprayed pools are not built to comply the water retaining structures code known as AS 3735 – 1991 and this is one of the reasons for reduced durability compared to a pool structure built in compliance with this code.

Pools built to AS 3735 should have a lifespan well in excess of 80 years because of the strict requirements in the code to minimise crack width and to distribute shrinkage stresses evenly over the structure. The code also requires concrete of greater compressive strength than used in this pool and this increases the density of the concrete. More dense concrete inhibits or slows down carbonation and pH change and as both of these contribute to degradation of the reinforcing any impediment to their movement towards the reinforcing assists with structure longevity.

The life of a concrete structure is generally determined by the life of the reinforcing in it.

Obviously, the pool doesn't collapse at the end of 50 or 60 years when it reaches the end of it 's life. The reinforcing degradation takes time to be seen at the surface even though the pool can be well beyond it structurally adequate life. It may take a further 15 or more years for the rusting to show but by that time the pool would no longer be viable.

In our opinion the Wonthaggi 25m pool can offer a further 20 to 30 years useful structural life but that won't be the determining issue that brings the overall useful life of the pool to an end and this is where the proposed development plans become relevant.

There are a number of other issues that will determine the remaining useful life of the pool and these are listed below.

3.1. Pool Stability

The pool is constructed on a layer of 20mm screenings approximately 100 thick and this 'flexible base' can become unstable. There is no guarantee that the pool will remain level or at the same height over time and this would be detrimental to adjacent finishes and concourses where slab movement can reverse falls and lead to additional pool support issues.

This pool at Wonthaggi has a history of instability of the sub-grade and of water finding its way into the substrate.

The original design included a pipework system to carry sub-pool water away from the pool base to a point of discharge however that discharge point was not clearly identified at that time. From what we know of it; there was never a sub pool drainage line installed or if there was, no one can find it.

Possibly a lack of natural falls to a suitable point of discharge caused the idea of a sub-pool drain to be abandoned.

In 1994 the pool lifted significantly off its sub-base with the highest point being in the north west corner. This occurred while the pool was being emptied for maintenance.

We should note here that if the pool sub-base drainage system was open with a natural fall to a point of discharge, the pool would not have lifted and this further supports our view that there is no sub-pool drainage system.

The pool dropped partly back into position when the water below it was pumped-out but during the upheaval there was evidence of significant stress cracking in the pool walls adjacent to the north west corner and this cracking, unless it healed, would have allowed moisture penetration towards the reinforcing. This would lead to more rapid reinforcing deterioration.

Reinforcing in concrete is protected by the highly alkaline nature of new concrete but over time that alkalinity changes as a result of external factors and in doing so, the reinforcing protection is progressively reduced until the pH of the concrete is such that corrosion commences.

A crack in the structure however, can allow direct access by moisture and this will allow reinforcing degradation to commence immediately depending on the crack width.

On this basis there may already be significant deterioration of reinforcing in the north west corner. This can't be determined unless we undertake intrusive testing but we don't recommend that level of testing at this stage as the cost of it may not be justified. Other factors may determine that the pool should not be retained and this would make intrusive testing unnecessary.

The signs of the 1994 stress cracking have been hidden behind the new tiling and the slight out-of-level that remained when the pool settled back into place was also corrected in the re-tiling.

In 2004 the concourse slabs adjacent to the pool north west corner dropped well below adjacent paving levels.

The damaged slab was demolished to make way for a new section of concourse which was installed after the area was re-filled to bring it back up to level. The concourse drainage was damaged during this event and significant amounts of water made its way into the pool sub-drain system. It was not possible at that time to assess the extent of the damage, if any, to the pool base.

In 2004 there was evidence of sub surface water travelling below ground from the north and arriving against the building footings and in some cases passing under the footings into the area in and around the pools. The site was found to be boggy in places along the north side of the building and this suggests that some measures will be required to deal with this ground water in any refurbishment or upgrade of the facility. No doubt there will be geotechnical investigations as part of any further development of the site.

From the history of the pool it is not unreasonable to say that the pool is founded on a potentially unsatisfactory sub-base. It has lifted at least once already and it cracked as a consequence. We expect that these incidents will contribute to a reduced ultimate life for the pool.

3.2. Pool Design

We don't believe that the 25m pool can be retained as a permanent part of any future redevelopment of the site without significant modifications. The modifications would be costly and they therefore would not be viable. It makes no sense to spend large sums of money on a pool that is fundamentally flawed and of limited life expectancy.

Some of the necessary modifications are listed below:

(a) The pool has only seven skimmer boxes and seven adjustable filtered water inlets and they limit the ability to adequately turn over the pool contents for processing by the water treatment system.

The skimmer boxes discharge by gravity to a common soiled water pit from which the filtration circulation pumps draw water for processing.

The filters and pumps installed have the capacity to turn the pool contents over once every 4.5 hours but for a modern indoor pool the rate should be 2.5 hours. The problem is however; the three filtration pumps overpower the ability of the skimmer boxes to deliver water to the pump pit and only two of the three can be operated at the one time. A consequence of this is that the normal turnover rate for the pool with the two filters functioning is almost 7 hours and this is far from satisfactory.

This can only be remedied by installing additional filtered water inlets and substantially modifying the soiled water collection system by turning the pool into a wet deck style pool. This would also require the installation of a balance tank as the present soiled water pit is too small to serve this purpose.

We would not recommend that level of expenditure on a pool that has limited structural adequacy and is half-way through its expected life. In addition; we doubt that the existing wall design would be adequate to carry the load the wet deck gutter would impose.

(b) The wall to floor and wall to wall radiuses inhibit the ability to provide a good tile finish to the pool. This cannot be rectified if the pool is retained.

(c) The pool depths are too shallow. A shallow end water depth of 0.8 metres is only marginally safe for tumble turns by inexperienced swimmers and the deep end of 1.6 metres is also less that would be adopted if a new pool was to be installed.

(d) The original design intended the pool edge to have a corbel on it to support the adjacent edge of the concourse to maintain affixed relationship between the pool and the concourse. This does not appear to have been provided and would be difficult to add to the existing structure. It could however, be provided as part of the work described in item (a) except that the existing wall design would not be able to carry the load of the concourse.

4. CONCLUSION

The pool is of unsuitable design by modern standards and has only a limited remaining life expectancy and in our opinion it should not be retained as a permanent part of any redevelopment of this facility. The construction and design of this pool does not lend itself to modernisation.

The design of the pool structurally and hydraulically is such that significant modifications would be required to bring it up to an acceptable standard to meet future needs. The cost of those modifications cannot be justified as there would be little difference in cost between modifying this pool and building a new pool.

We also advise against allowing this pool to remain in place as part of a multi-staged development. To do so, would leave Council with no option other than to adopt a less than satisfactory pool hall layout.

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