Fig. 1: Large pool floor being placed with a line pump system and 4 in. (100 mm) concrete line on an indoor pool

The Advantages of Completing the Pool Floor First

A HYBRID CONSTRUCTION METHOD FOR LARGE COMMERCIAL SHOTCRETE POOLS

By Mason Guarino

As commercial swimming pools continue to increase in size and complexity, contractors are continually looking for ways to improve production without compromising quality. While some projects are ideally suited for an all-shotcrete approach and others are designed entirely as cast-in-place concrete structures, many large commercial pools can benefit from combining both methods.

At South Shore Gunite, we have found that placing the pool floor with conventional cast-in-place before shooting the walls can significantly reduce construction time, improve jobsite safety, and make better use of valuable shotcrete resources. This approach allows each construction method to do what it does best — conventional concrete casting for large horizontal slabs and shotcrete placement for complex vertical structures.

HOW COMMERCIAL POOLS HAVE CHANGED

When South Shore Gunite began constructing commercial pools in the late 1980s, most projects shared similar structural characteristics. Wall and floor thicknesses generally ranged from 8 to 12 in. (200 to 300 mm), and the majority of pools were less than 5000 ft^2 (460 m^2). These projects were ideal candidates for an all-shotcrete construction.

With two dry-mix shotcrete (gunite) crews working together, it was common to place between 300 and 600 yd^3 (230 and 460 m^3) during a commercial pool shoot. At that scale and with a manageable shotcrete workload, shooting the entire structure was both practical and efficient.

Around 2009, however, commercial pool construction began to change. Universities started replacing aging facilities with larger 50 m (160 ft) competition pools, municipalities expanded aquatic centers, and more pools were being constructed on sites with poor soil conditions that required substantially thicker floor slabs.

These changes resulted in projects with dramatically larger floor placements. Brown University's competition pool required approximately 14,000 ft^2 (1300 m^2) of floor area

and nearly 400 yd^3 (300 m^3) of concrete. Another project at Worcester Polytechnic Institute included floor thicknesses ranging from 12 to 24 in. (300 to 600 mm) and required more than 400 yd^3 of concrete.

Both projects were designed by a nationally recognized aquatic designer and detailed as cast-in-place structures. Rather than convert the entire project to shotcrete, we looked at where each construction method provided the greatest advantage. The solution was simple: Pour the floor conventionally and shotcrete the walls.

Since adopting this sequence, we have completed numerous commercial pool floors ranging from 300 to over 500 yd^3 (230 to 380 m^3) in a single working shift. Attempting to shotcrete the same volume would likely require several days, even with two experienced crews. During that time, our shotcrete crews can remain productive on other projects until the walls are ready for placement.

WHY COMPLETE THE FLOOR FIRST?

The most obvious advantage is production. An experienced flatwork contractor equipped with a boom pump can routinely place more than 400 yd^3 of concrete in a single shift with a crew of 12 to 18 workers. Placing the same volume with a traditional shotcrete crew of seven to ten people could require four to eight working days, depending on floor thickness and geometry.

For large floor slabs exceeding approximately 3000 ft^2 (280 m^2) or greater than 12 in. thick, conventional casting is simply the more efficient method (Fig. 1).

The schedule benefits extend beyond the floor placement itself. Contractors operating a single shotcrete crew often find that the crew becomes the bottleneck on multiple commercial projects. Qualified flatwork crews are generally much easier to schedule than experienced shotcrete crews. Having a flatwork contractor complete the slab allows the shotcrete crew to continue working elsewhere while the project progresses.

Another major benefit is the elimination of rebound management across the floor slab. While rebound is a normal part of shotcrete placement, removing it from under the reinforcement grid of thousands of square feet of flooring takes time. Rebound removal with the slab in place is much more efficient and allows the shotcrete crew to focus exclusively on the walls, where shotcrete offers its greatest advantages.

A BETTER WORKING PLATFORM

One often-overlooked benefit is how much easier every trade's work becomes after the floor is completed. Large commercial pools frequently require extensive scaffolding for wall construction. Setting scaffolding on finished concrete is significantly faster, safer, and more stable than working over crushed stone, excavated soil, or a completed reinforcing grid.

Once the slab is in place, carpenters can install wall forms from a solid surface. Ironworkers can tie reinforcing without balancing on floor reinforcing bar. Plumbers and electricians have a clean working platform for installing penetrations and embedded items. Inspectors have easier access throughout the project, and shotcrete crews work from stable footing rather than walking on top of reinforcing steel.

Simply put, every trade benefits from having a finished concrete floor beneath them.

ADDITIONAL ADVANTAGES

Completing the floor first also simplifies curing operations during periods of extreme weather. Whether thermal blankets are required during cold weather or evaporation control measures are necessary during hot weather, protecting one large concrete placement is considerably easier than continuously adjusting curing systems while portions of the structure are being shot over multiple days.

Quality control also becomes more efficient. Grade verification, reinforcing inspections, embedded items, and wall layout can all be completed from a finished concrete surface before wall placement begins.

IMPORTANT CONSIDERATIONS

Like any construction method, this approach requires planning and experienced crews. The flatwork contractor must understand how to place concrete on sloped surfaces. Without proper placement techniques, concrete naturally follows gravity, creating low areas near the top of the transition and excessive buildup near the bottom of the slope. Contractors unfamiliar with aquatic work can unintentionally create bellies that require correction later.

Placement sequencing is equally important. Concrete should be placed continuously to minimize potential cold joints, particularly near future wall locations. Using a concrete flatwork company with a good rapport with the local ready-mix company is highly beneficial.

The floor-to-wall construction joint also requires proper preparation before shotcrete placement. Although this adds an additional day to the schedule, the benefits gained during floor casting typically outweigh this minor delay.

Waterstops are another topic that frequently arises when discussing this construction sequence (Fig. 2). Over the years, we have successfully completed projects using PVC bulb waterstops, hydrophilic swelling waterstops,

Fig. 2: Core sample from a pool that had the floor cast-in-place and the walls shotcreted

Fig. 3: Roughened finish at the floor-wall joint to receive shotcrete

Fig. 4: Slurry blasting to clean a future wall joint location

and projects where no waterstop was specified. In our experience, leaks in commercial pools are far more likely to occur around penetrations than through properly prepared structural construction joints.

Regardless of the waterstop selected, careful surface preparation and proper shotcrete placement remain the most important factors in producing a watertight joint. PVC bulb waterstops can pose a rebound entrapment risk, as they can be difficult to shoot around. If you are forced to shoot in PVC waterstops, you can help ensure proper encapsulation by utilizing a helper with a small concrete vibrator adjacent to the shotcreter, lightly vibrating the concrete as it is placed immediately around the waterstop.

Embedded floor components also deserve special attention during concrete placement. Main drain pots and other large penetrations can float if surrounding concrete is placed too aggressively while still in a fluid state. We typically initially cast concrete halfway around these components (allowing the concrete to reach a stiff plastic state as opposed to a liquid state) before completing the placement around the penetration later. This minimizes buoyancy while maintaining a monolithic placement, avoiding cold joints.

OUR CONSTRUCTION SEQUENCE

The exact sequence depends on the size and depth of the pool. For larger pools with deep ends requiring significant scaffolding, we typically construct only the slab forms initially. If the floor slab is especially thick, additional bracing is installed to resist the lateral pressure created by the fresh concrete.

Concrete is generally placed using a boom pump with a 4 in. (100 mm) delivery line, although interior projects have also been completed successfully using both 3 and 4 in. (75 and 100 mm) line systems.

Whenever possible, we place concrete from the shallow end toward the deep end. Managing concrete downhill is considerably easier than pushing material uphill on sloped floor sections. Concrete slump is adjusted as necessary, depending on floor pitch to maintain placement control.

To maintain slab thickness, grade stakes are installed on approximately 10 to 14 ft (3 to 4.3 m) centers. Finishers establish grade around each stake, remove it during placement, and hand screed the surrounding area before bull floating the slab. The floor is then finished with an aggressive broom texture in preparation for the future finishes.

One field technique that has worked exceptionally well for us is using a manual lawn aerator hand tool to roughen the concrete along future surfaces while the concrete is still plastic. Unlike a rake, which tends to drag concrete across the surface, the aerator punches hundreds of small holes into the fresh concrete, increasing surface roughness without disturbing the overall profile (Fig. 3).

The following day, the construction joint is slurry blasted to remove laitance and expose clean, angular aggregate for optimal shotcrete bond. If specified, a hydrophilic

Fig. 5: ACI-certified shotcreter Mason Guarino working with a blow pipe operator to ensure a monolithic floor-wall joint is shotcreted

waterstop is then installed and mechanically fastened before shotcreting begins (Fig. 4).

During wall placement, the blow pipe operator continuously cleans the receiving surface ahead of the shotcreter. Rather than immediately building the wall to full thickness, the shotcreter first establishes a deliberate 1 to 2 in. (25 to 50 mm) bond layer by spraying directly into the prepared joint while advancing approximately 15 to 20 ft (4.6 to 6.1 m) along the wall. Once this initial layer has been placed, the shotcreter returns to the starting point and builds the wall to full thickness (Fig. 5).

This intentional first pass serves two important purposes: It establishes an excellent bond with the prepared floor joint while also creating a surface that directs rebound away from the construction joint as wall thickness increases. By concentrating on creating the bond first, subsequent wall placement becomes faster, cleaner, and more consistent.

CONCLUSION

This hybrid construction method is certainly not intended to replace all shotcrete construction. For many commercial pools — and for most residential pools — shooting the entire structure remains the most efficient approach. However, as commercial aquatic facilities continue to grow in size, floor placements exceeding several hundred cubic yards are becoming increasingly common. In these situations, completing the floor conventionally before shooting the walls allows each construction method to be used where it performs best.

The result is a faster schedule, improved crew utilization, safer working conditions, simpler quality control, and a finished product that maintains all of the structural and performance advantages expected from a properly constructed shotcrete pool.

Sometimes the most efficient solution isn't choosing one construction method over another — it's knowing when to combine both.

Mason Guarino *is the General Manager of South Shore Gunite Pools & Spas in Massachusetts, where he oversees the company's residential pool construction and shotcrete operations. He earned a Bachelor of Science in Construction Management from Wentworth Institute of Technology and has worked in the construction industry since 2000. Throughout his career, Mason has managed a wide range of shotcrete and concrete construction projects, from custom residential and commercial swimming pools to large-scale infrastructure and heavy civil work throughout New England. His experience includes overseeing shotcrete operations on major aquatic facilities, as well as managing high-volume structural concrete projects outside of the pool industry. He is passionate about improving construction methods, increasing jobsite efficiency and safety, and sharing practical field experience that helps advance the shotcrete industry.*