In 2003, the Ontario Cast-In-Place Concrete Development Council (OCCDC) was formed to aid the owner/developer, architect/engineer and design-build contractor in the decision-making process of choosing the best construction material for the framing system of new cast-in-place structures.

OCCDC promotes the use of reinforced concrete as the construction material of choice based upon the following advantages:
- Fast-track construction
- Cost savings
- Structural advantages
- Environmental considerations
- Local economy

The Members of the OCCDC include (alphabetical order):
- Aluma Systems Inc.
- Carpenters District Council of Ontario
- Concrete Forming Association of Ontario
- Ironworkers District Council of Ontario
- LIUNA—Ontario Provincial District Council
- Ontario Formwork Association
- PERI Formwork Systems Inc.
- Ready Mixed Concrete Association of Ontario
- Reinforcing Steel Institute of Ontario

While addressed some of the structural concerns, the concrete was still required to meet functionality considerations and ensure formability and final finish of the flooring. This represented the second major challenge. The concrete supplier, Innocon, had to identify a product that could meet Dominus’ need for high volume, accurate consistency, accommodation of a tight construction schedule; reliability in a full cycle of seasons; and functional workability on floor slabs. Innocon recommended the use of their self-consolidating concrete Agilia. This product was capable of meeting all our requirements for the columns and walls and could be used in a special mix for the slabs. The product also offered the added benefit of increased efficiency by requiring fewer workers and minimizing the risk of worker crowding. The construction schedule spanned over a full cycle of seasons and special methods were utilized to ensure sufficient heating in the winter and cooling in the summer to allow the concrete to properly cure.

For the columns and walls the Agilia concrete performed exceptionally well. The specified mix designs called for an ultimate strength of 70 MPa in 90 days. Testing demonstrated that these levels were achieved in only 28 days. The concrete performed at rates and strengths much higher than expected.

The product’s superior performance also required the concrete finishers to achieve greater efficiency and adapt to an accelerated schedule because the concrete reached a finished state more rapidly than traditionally expected.

In order to increase the benefit of using Agilia, Dominus opted for the use of concrete pumps to alleviate unnecessary crane usage and hoisted concrete with the traditional bucket method. For the columns, Premform prefabricated many of the column supports in a staging area and then hoisted them into place. These techniques contributed to speed and efficiency.

Summary

The Absolute World represents a visionary architectural design that required innovation and creative problem solving in its construction. Inventive approaches to managing thermal transfer; versatile formwork; a customized RCS system; and innovative concrete products; all contributed to building this vision. Working with its partners, Dominus met the construction challenges head-on with creative cost effective solutions and strong project management skills to keep the development on schedule and on budget from its inception. Without the support of our partners, this project would never have succeeded. Premform delivered innovative new systems to increase productivity; Sigmund Soudack’s commitment to value engineering provided functional solutions; and Innocon’s extraordinary product all contributed to this amazing achievement. The Absolute World has changed the face of downtown Mississauga and has pushed the boundaries for innovation in design and construction.

The Absolute World is an iconic architectural innovation constructed by Dominus that has redefined downtown Mississauga. The S6 and S0 storey landmark towers represent a major breakthrough in conventional tower design. Eschewing straight lines, fixed points and vertices, the tower is a curved and rotating form that is unlike anything seen before in Canada or the world. The objective was to provide Mississauga’s “Four Corners” with an architectural landmark that redefined the area and its skyline. This inspired Fernbrook Homes and Cityzen Development Group to launch the first worldwide architectural and design competition in 40 years in the GTA.

The Absolute World is part of a master-planned community of five towers. With over 1.7 million square feet, the Absolute community contains 1,850 residential units, a three-storey 35,000 square foot recreation facility and retail facilities.

The Absolute World’s creative architectural design resulted in a number of construction challenges and opportunities for innovation. The construction partners were not constrained by traditional approaches when addressing complex issues involving thermal transfer, forming, and concrete usage. Innovative construction solutions and engineering design were able to realize the vision and achieve results within budget and on schedule.

CASE STUDY

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www.occdc.org
Thermal Transfer
A key feature of the building’s design is the presence of continuous wrapping balconies on every floor. The balconies are also an integrated part of the curved and rotating design of the overall structure. This ground-breaking design presented unique challenges relating to the transfer of cold/heat both horizontally and vertically. While balconies can create thermal challenges in traditionally shaped structures, in the Absolute World, the curved and rotating design of the building compounded the challenges.

The horizontal thermal transfer concerns required a break in the concrete slabs that would still accommodate the unique design features. The rotating floor plates also caused additional vertical thermal transfer issues. As the floor plates rotated, the window lines did not align as in traditional building structures and this created another unique set of transfer issues.

A number of potential solutions were considered but dismissed for being excessively costly or risking construction delays. The owners also not prepared to consider a solution that would compromise the balcony feature for any of the suites.

The team responded by developing an innovative two-pronged approach: They utilized thermal breaks to minimize the horizontal thermal transfer and an internal bulkhead with external insulated sofit to minimize the vertical thermal transfer. The thermal breaks were formed in such a way that it allowed for sections in the slab up to 50 mm in width and varying lengths up to 1200 mm. The void that resulted from this approach was later finished with fire stopping, smoke seal and waterproofing.

In implementing these solutions, the team developed a new and innovative proprietary process. Not only were thermal transfer issues minimized to within acceptable levels, but they also were able to protect the integrity of the original design and keep the project on time and on budget.

Forming
The unique design properties of the building also required an innovative concrete forming method that was both practical and safe. Traditional fly tables were not appropriate for this construction because they would have resulted in large unsupported panels when the rotation of the floor plate was more than two degrees. The formwork partner, Premform, was required to innovate a new forming method that would allow for configuration changes while maintaining structural integrity. This had to be accomplished without compromising safety.

Premform’s solution teamed together two main features - an EFCo climbing elevator formwork system; and a modified Peri’s SKYDECK drop head system with a modified rail climbing RCS system.

The EFCo climbing elevator formwork system contributed to project efficiency and allowed for faster turnaround on the main central core of the building. Schedule delays were avoided with this system.

The modified SKYDECK and RCS system represented an innovation for Peri as they had never before designed a system that was required to climb and also move in relation to a varying rotation. The modified SKYDECK provided the ability to form the constantly changing floor plate by allowing panels to be carried out immediately after the slab concrete reached the required strength. This revolving process permitted panels to be used immediately for the next cycle and created efficiencies.

Since the SKYDECK system is not traditionally used above grade, a specialized enclosure system was required around the formwork to ensure safety. Peri adopted a modified RCS system that worked in conjunction with the SKYDECK system. These modifications created a safe environment that also provided efficiency benefits. The enclosure simplified the heating requirements for the concrete slabs during winter pours as it enclosed two floors below the current deck being completed. The result was greater efficiency and less lost days due to weather constraints.

Through these innovations, Dominus was able to achieve a cycle time from floor to floor that could match those of traditional systems for conventional building designs.

Concrete
The last major innovation in the construction of this building related to the use of the concrete itself. Although the building was unique in its design, it was still required to meet all structural requirements for a residential condominium. This presented a number of unique challenges.

Firstly, the traditional concentric loading of columns was not appropriate for the unique design of the building. The structural engineer, Sigmund Soudack and Associates, was presented with the challenge of finding an alternative that utilized sufficient rebar and concrete while still allowing for livable spaces. Their final design included heavy reinforcement at the bottom half of the tower using 35M bars. However, this design did not allow for use of traditional methods to consolidate the concrete. The final concrete specification called for 70 MPa columns, walls and beams and 50 MPa slabs.