Bringing structures to life

The Yas Hotel

Client: ALDAR Properties
Contractor: Al Futtaim Carillion
Location: Abu Dhabi, UAE
Products: Megashor / Superslim

Case Study

Designed using specially developed 3D software, the heavy-duty Megashor system was used to support 911 node points required for the installation of a landmark steel ladder and glass paneled shroud structure covering The Yas Hotel. When RMD Kwikform Middle East was awarded the contract to support a new 217-metre grid-shell shroud - an expanse of sweeping, curvilinear forms, constructed of steel and 5,096 pivoting diamond-shaped glass panels - the business took on one of the most innovative and exciting structures in the world.

For primary contractor Al Futtaim Carillion, working for developer ALDAR Properties, the requirement for a formwork and falsework based temporary works system that could safely support no fewer than 911 different node points throughout the grid-shell shroud design was essential to the project delivery.

For RMD Kwikform, the design and practical execution of the temporary works support were the two most challenging elements to the project. Darren Ellwood, General Manager, UAE explains: “The end goal of the project that has now been completed was to have a steel and glass shroud that would cover The Yas Hotel, a two tower 499 room structure that was built on either side of the Abu Dhabi Formula One race track. “With very few companies able to take on a job of a scale and complexity, never before seen in the heat of the Middle East, we recognised the only way we would be able to make it a success was to base the whole system design around our Megashor heavy-duty shoring product.”

Once RMD Kwikform’s design team saw the 3D models of the Waagner Biro designed grid-shell, the team began the design process in July 2008. Working closely with Al Futtaim Carillion they presented several solutions to supporting grid shell while ensuring there was as much access as possible along the bottom of the structure.

Darren: “This was made more difficult due to the grid-shell’s location, connecting to the hotel which also incorporated a man-made marina. This meant some of the grid-shell had to be supported on dry land and other parts from the much deeper marina. It was this factor that determined the only product we could use was Megashor, as we had to come up as high as 40 metres.

“The next challenge to overcome was how to get the equipment in such volumes to the site. Logistically this meant sourcing a massive amount of material with more than 2,600 tonnes of product required in total. To meet

these needs we shipped in Megashor from other RMD Kwikform group companies across the globe”

Due to the varying height and nature of the grid-shell shroud, Megashor towers were erected on jacks with varying leg section lengths from 90mm to 5400mm used to meet the very precise levels required. At any one time, up to 64 Megashor towers were in use on the site, erected and dismantled to be moved onto the next section in modules.

Commenting on the design of the Megashor towers, Harprit Dogra, RMD Kwikform Middle East Project Manager said: “Thanks to Megashor’s capability to withstand leg loads of 1000kN per leg, we were able to space the towers far enough apart. This meant the client could bring in various equipment and modules/pods for the hotel, while we were still assembling the temporary works above, making best use of space”

Once erected, each Megashor tower weighing up to 8 tonnes was capable of supporting at least 1000kN. With each steel ladder making up the shroud, weighing up to 30 tonnes, the challenge for RMD Kwikform engineers was to design a solution that would ensure the millimetre accurate positioning (zero tolerance) and installation of each of the 217 steel ladders. With each ladder having at least 4 multiple node points, no fewer than 911 individual node points had to be safely secured in position.

Harprit Dogra: “Because each node point support required a zero tolerance approach, which is virtually impossible on a building site, the key to the success of the formwork and falsework system was the use of our new 3D modeling software called Locus. This allowed us to model and perfect the whole design approach before equipment even arrived on site (all clashes were cleareddue to 3D modeling prior to erection).

“For the off slab support, we came up with a simple ‘A Frame’ design. The ‘A Frame’ was built out of Superslim Soldiers using left and right hand jacks and a special node point, which allowed us to pick up the relevant points on the grid-shell.

“When we moved onto the connection point between the hotels the client wanted to be able to have access to as much of the site as possible. Therefore, instead of erecting towers between the two hotels, we were able to keep the bridging space open by designing a Megatruss and R700 girder arrangement across the span.

“Made up of lengths of Megashor, the truss, supported by Megashor towers was able to span the 27 metre gap, whilst giving support to the Rapidshor ‘birdcage’ above. In a similar fashion R700 girders were used to create support platforms on top of the Megashor towers and Megatrusses. “Fixed on top of the Megashor was a Rapidshor shoring ‘birdcage’ arrangement, designed to support and incorporate the node point used to help position the steel ladder sections into place. The ‘birdcage’ structure was inherently strong and capable of dispersing the load evenly from the all important node point, through to the Megashor towers.

“With each node point representing a different angle and position, due to the complexity of the grid-shell, each individual node point required its own bespoke shoring support. Therefore each node point had an individual drawing and plan for erection identified in 3D relative to the overall structure.

“The node point was the main load bearing connection, where the grid-shell members came together. Each of the 271 steel ladders has up to 7 node points to support, which are later removed after loose members are welded between ladders. “For this part of the project, our engineering team used our 3D software to design the node point, ensuring once manufactured it could cope with the environmental and practical challenges of the job at hand.”

For primary contractor Al Futtaim Carillion, getting The Yas Hotel’s two towers ready to the tight timescale, was a challenge in itself. Adding the grid-shell shroud to the overall build made the project delivery even more complex as Martin Reeve, Project Design Director for Al Futtaim Carillion explains: “We were awarded the project in December 2007 on a very fast track nature, to build the hotel with its aesthetic iconic type grid-shell cloak, which posed in itself huge engineering challenges.

“Our requirements were so complex that there were not many companies who would have had the capability to design the works, let alone the ability to provide the proven materials and resources required to meet the timescales. It was for these reasons that we chose to work with RMD Kwikform, as they were able to prove they had the experience, design capabilities and most importantly access to the equipment we needed to make the project a reality.”

Having lit up the Formula One Etihad Airways Abu Dhabi Grand Prix in 2009 the hotel continues to be enjoyed by thousands of F1 enthusiasts and visitors to the region.