



Panoramic view of the development.

Delivering five precast villas per day

Governmental authorities in the United Arab Emirates are developing vast housing communities in the Emirate of Abu Dhabi, to cater for the needs of the national population. The main requirements for these projects are speed of execution, quality, durability and reliability. Precast manufacturing is an optimal solution. One recent contract saw the construction of five precast villas per day as part of a development of more than 2000 such buildings.

Daniele Pfeffer Seraphim, Gulf Precast Concrete Company, Abu Dhabi, UAE

In January 2010, Gulf Precast was selected as a precast contractor for 2069 villas of various designs in the Al Falah area, Emirate of Abu Dhabi. The main pre-requisite was to hand over five villas per day, with heavy penalties in case of delay.

The scope of work included precast wall panels, hollowcore slabs and glass-fibre-reinforced concrete (GRC) decorative elements. Gulf Precast was able to cater for the needs of the Al Barari development due to its seven production facilities, technical design teams and its product range.

An additional challenge was soon added to the original scope of work – the production and erection of more than 220km of surrounding boundary walls as well as the superstructure works for numerous electrical substations within the development.

Project description

Although precast manufacturing is the best option for such a large development both from economy of scale and time frame perspectives, the project is far from being entirely repetitive in its nature. It includes three-, four- and five-bedroom villas.

For each villa size there are three different styles and each style includes a mirrored option. Thus there are 18 different types of villas in the development, with different types of precast elements per villa varying between 40 and 100, excluding the hollow-

core slabs and the GRC decorative elements.

The project is divided into three phases, with Phase I comprising 320 villas to be delivered by December 2010, Phase II having 739 villas to be completed by September 2011 and the remaining 1010 villas to be handed over by June 2012.

Design specifics

Most of the precast projects in the UAE are pre-engineered before production.

Once the concept design and structural integrity of the 18 types of villas was

approved by the client, the engineering team proceeded to detail each of the 3085 different types of elements, including all connection details and electromechanical inserts.

Approved drawings were sent in a phased manner to the factory floor over several months, to allow production to start while the engineering team continued to co-ordinate with the consultant, MEP subcontractor and architect.

The engineering department soon identified that the boundary wall design could



Development overview.



Completed villa with boundary wall and GRC decorative elements.

benefit from substantial cost saving by modifying the column footings from eccentric as originally intended, to concentric. However, this design modification would require Governmental approval.

Although the approval would take time and the tight production schedule did not allow waiting for it, Gulf Precast decided to quote based on concentric footing to secure the boundary wall variation works. One month after the start of the eccentric footing production, the concentric footing option was approved and a second set of drawings was implemented for further production.

Production challenges

The original plan was to start producing one month in advance and build up a stock of villas in the factories in order to deliver according to site requirements.

However, because of the high number of different elements, the cumbersome process of obtaining approvals on all of them and the stringent time constraint of the



Factory production.

project, the factories started production as soon as the approval of any element was received, even if the full set for a villa or a floor was not yet available.

To minimise the delivery logistic difficulties, it was decided that one factory would specialise in the wall panel production of the five-bedroom villas, a second one in the four-bedroom and a third one in the three-bedroom villas. Each of these three plants took over the production of six different

types of villas, and thus a high number of different types of wall panels. The remaining factories specialised in hollowcore slab production, GRC production and panels for the boundary wall. Thus all Gulf Precast's production plants were handling different parts of the project.

A major challenge for the production of wall panels was to determine the optimal production cycle. Although the three factories involved are able to produce more than one villa per day, they cannot produce all six different types at the same time.

Switching from one type of villa to another requires mould changes that necessitate up to five days of modifications, during which no casting can take place. It would therefore have been optimal, from a production point of view, to complete all villas of a given type before starting the production of the next type. However, this is not possible, as the site has to be supplied in zones in which all 18 types of villas are mixed. Thus, the cycle of mould changes had to be studied carefully in order to minimise the number of changes, while still meeting the requirements of site erection.

In addition, a semi-mobile production plant was set up directly on-site, to manufacture columns and footings for the boundary wall, which are cast as one element, thus offering a significant increase in production and storage capacity. The plant is fitted with



Precast wall panel storage.

“One of the key lessons learnt on this specific project is the critical importance of regular planning meetings.”

the required quality control laboratory and equipment to monitor and control the product quality.

An original plan was devised in order to store the elements on the factory grounds according to their site delivery sequence. However, as partial drawing approvals were received, production for the approved elements needed to start right away due to the stringent time line. This led to the number of elements cast for those drawings received first exceeding those received later.

At the onset of the project the carefully planned storage system had to be discarded in order to store a large number of panels that were not part of a full set, creating storage engorgements, additional loading time and immobilisation of high-cost inventory. Over time, double-casting of the elements lagged behind enabling Gulf Precast to catch-up with full sets of deliverable elements.

On-site erection challenges

On-site the erection team, subject to a stringent time schedule, was sometimes obliged to receive partial floors of panels, knowing that the few remaining ones would be delivered a few days later. This of course entailed additional costs of double handling and crane usage. This condition persisted throughout Phase 1, with 320 villas to be delivered by December 2010.

By the time Phase 2 started, in January 2011, the production had caught up with elements whose design had been received late, and full floors were routinely delivered. The current objective for Gulf Precast erection team is to achieve erection directly from the trailer, avoid any site storage and maximise use of the cranes.

Due to the stringent time schedule of this project, the developer has decided that the infrastructure contractor responsible for all deep services and roads shall work in parallel with villa contractors. One of the current main challenges faced on-site is the co-ordination and interfacing with these other contractors.

Lessons learnt

One of the key lessons learnt on this specific project is the critical importance of regular planning meetings between the factory



Storage area in the hollowcore factory.



On-site semi-mobile factory.

operations team, the site erection team, the transport team and of course the planning department. Through weekly planning meetings, during which constraints faced are discussed and understood, the delivery plan for the next week is elaborated, taking into consideration the constraints of each process.

As developments of this size are not frequent, it is of critical importance to gather the expertise, knowledge and learning to be able to reuse them in forthcoming projects, even if they occur after a significant time lag. Formal documentation of that additional knowledge is therefore critical for future references. Gulf Precast implemented quarterly inter-disciplinary meetings to discuss and document the key lessons learnt.

Although the size and stringent time schedule of the development triggered a number of difficulties, it should be noted that these were all overcome, sometimes at a cost, and that the project is ahead of schedule and the target of handing over an average of five villas per day is being suc-

cessfully achieved. This demonstrates that precast was the right solution for the project, provided that the precast manufacturer holds both sufficient production capability and expertise. ■



Site erection.