

Quality of precast facades in landmark developments in the United Arab Emirates

The use of glass reinforced concrete in architectural exigent construction components

The United Arab Emirates (UAE) has positioned itself on the International Architecture Map through its landmark developments. The façade of such buildings is of critical importance, as above and beyond its functionalities, it is a statement about the development itself and the values that it represents. In order to achieve distinctive beauty and elegance, Precast Manufacturers are requested to reach new standards in terms of product quality to meet the expectations of their demanding Clients. Using the example of the Dubai Mall, the world's largest shopping centre, and the Palazzo Versace, the new ultra-luxury hotel by the Versace brand, the challenges faced and overcome by Gulf Precast in such endeavours are evaluated.

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The Dubai Mall and the Palazzo Versace: Two landmark developments in Dubai

The façade of the Dubai Mall was completed in 2008, while that of the Palazzo Versace is under final stage of installation. If some of the challenges were common to both projects, Gulf Precast had to overcome specific difficulties on both developments, during Engineering, Production, Delivery and Installation of the elements. Gulf Precast is a UAE leader in precast manufacturing and installation. It operates since 1984, implements a strict Quality system, and has gained a sound reputation for the quality of its works, and in particular its façade works.

For both Projects, a mixture of traditional Precast and Glass Reinforced Concrete (GRC) was adopted. The production cost of a traditional precast element is lower than that of GRC, but the versatility of GRC is higher and is therefore preferred for all



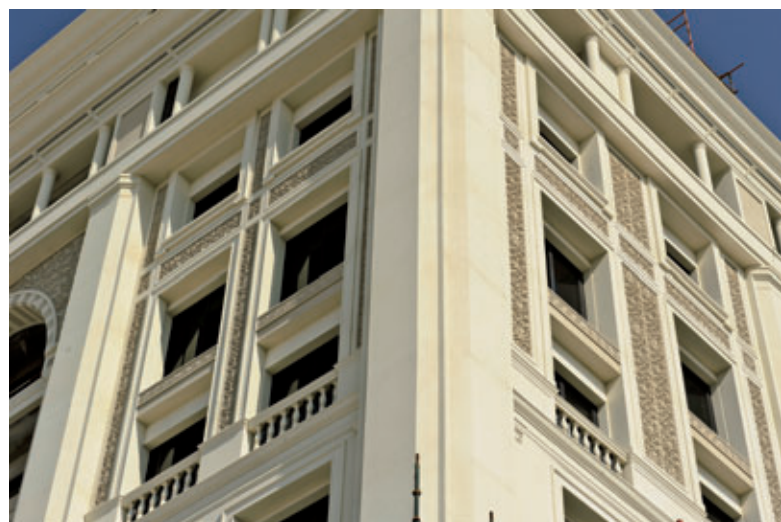
Large size panels hanged on the structure of the Dubai Mall

complex forms. It can be moulded into thin, lightweight panels with a wide variety of shapes and surface finished. The percentage of GRC components is of 80 % in the Dubai Mall and 83 % in the Palazzo Versace. In the Dubai Mall, quality expect-

tations were clearly identified in project specifications: A safety factor of 2.8 and a deflection limit not exceeding 1/1000. In the Palazzo Versace, visual perfection was the criteria used for quality acceptance.



The Dubai Mall



The Palazzo Versace - Dubai

Quality Assurance through sound Engineering

The starting point of a high quality and safe product is the Engineering process. Any mistake in the design entails defects and rework at the best or even unsuitable quality in the project if the defective product is not identified through Quality Assessment and Control. Gulf Precast's team of 60 specialized engineers have been designing precast developments since 1984, following a strict quality system. They are experts in both structural calculations and detailing works, and are often asked to undertake connect engineering design, such as primary or secondary steel fixing system, as was the case in both projects. The proposed design is formally approved by the Client and Governmental Authorities to ensure that the design intent is met and that the Quality of the end-product will match international standards.

From an Engineering point of view, Gulf Precast had to overcome the difficulty of large size precast and GRC elements connected up to 7 meters away from the structural support in the Dubai Mall. Both steel and concrete had to be designed together to allow for perfect cladding of the patterned panels on the irregular shape of the steel and concrete frames. In addition to very strict structural requirements and stringent low tolerances, special waterproofing, flashing and air sealing details were required.

In the Palazzo Versace, the façade is of such complexity that the design of more than 17,000 different types of elements was



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required for the 23,000 components. The buildings were not detailed to receive such challenging façade, and Gulf Precast had to undertake the engineering of the secondary steel support to ensure a perfect fit. The intricate shapes of the GRC elements with deep design patterns feature different finishes within the same panel. Fitting them together seamlessly to create big patterned areas was an additional challenge.

Quality Assessment and Control throughout the production process

Throughout the production and installation processes, quality assessment and control is routinely performed to ensure that the project design is complied with. In Gulf Precast, laboratory facilities are available in the seven production plants, and the production and quality control teams are verifying each production step to ensure compliance with the strict quality system. For challenging projects, third party assessments are



The Dubai Mall: Pigmented elements with different shade of colour within the same panel



Mould carving for the Palazzo Versace



Rubber moulds

performed in addition to internal assessments and controls. Not a single element can leave the production ground without undertaking a strict final inspection. Client representatives are often present in the plants to witness the production process and approve the products in collaboration with the in-house teams.

For the Dubai Mall, the mix Design included marble chips aggregates, and poly car-

boxylic ether based admixtures to produce a very rich, dense and consistent concrete. Cores were taken and assessed by international Test Laboratories such as Bodycote-UK and experts from Mott MacDonalds were invited in UAE to collect cores and study them in England. The tests performed included the assessment of chloride free mix, high durability, high strength, as well as petro-graphic tests of the mix ingredients.

While the elements of the Palazzo Versace were produced in natural grey concrete to be later painted at site, the Dubai Mall ones were of pigmented concrete following shades of coloured patterns sometimes with two different tones on the same panel. Ensuring the uniformity of the colour was highly challenging, particularly so when the quarry from which the dune sand was procured closed its doors. Extensive tests and adjustments were performed to maintain the consistency of the colour scheme. To ensure that the panels would not be affected over time by pollution and weather, samples were tested in an accelerating weathering tester chamber during 3000 hours, simulating cycles of high temperatures, UV and humidity, assessing that the original colour would remain unchanged.

If mould manufacturing was complex for the Dubai Mall, the challenge was even greater for the Palazzo Versace, which required extensive artistic skills in addition to perfect technical skills. Only a handful of Gulf Precast's specialized carving carpenters were able to sculpt the large quantity of wooden moulds required for the production of concrete elements with intricate, curved and deep patterns. The incorporation of different types of texture within the same panel was an additional challenge in the production process.

On-site installation and handing over

In both projects, the size of some of the elements was a difficulty. Many GRC cornices of the Palazzo Versace were of 4 meters length by 1.5 meters width and height. Numerous Dubai Mall panels were of 3 meters per 10 meters, which required a special support system during transport and



GRC elements in the manufacturing plant



Lifting of a GRC cornice in the Palazzo Versace



Details of the façade of the Palazzo Versace

erection, to tilt the vast panels from horizontal to vertical positions.

The site installation on steel structure was a challenge in both developments as there is no possibility of adjustment in the fixing, and all panels must be perfectly aligned to ensure that the pattern flows from one element to another in a seamless manner. In the Dubai Mall a rubber Baffle was used as water stopper in the vertical joints in addition to the low modulus high expansion silicon based sealants between the precast panels. From inside, the joints were sealed by high quality air seals which are 100% water proof and 100% un-inflammable.

Prior to the submission of inspection requests to the Client, Gulf Precast's quality control inspectors perform a final verification of the product. Client snagging and final approval, which is generally a lengthy process in the case of cast-in-place projects, is straight forward in case of precast developments, as product quality is assessed and validated at every step, and on-site installation represents only 26% of the overall project deployment, according to the average over the last three years data of Gulf Precast.

Concrete and beauty

In the Dubai Mall the colour selection represents the different shades of the sand of the United Arab Emirates, and the open sunscreens and mousharabyas are of distinct Arabic Architecture inspiration. They are a statement of belonging. The intricate see-through patterns are providing lightness and elegance to the sheer size of the world's largest shopping centre.

The patterns on the Palazzo Versace hotel are distinctive of the Versace brand. The complex, varied and unique design represent the luxury and beauty that the Versace brand stands for, a cast in concrete statement in the heart of Dubai.

For such prestigious developments, the Clients are requesting increasingly challenging façade works and are not ready for any compromise in terms of Quality. Gulf Precast was able to meet their expectations based on the in-depth experience of its employees, a mature quality system, and stringent quality assurance, assessment and control over each step of the processes. The

Dubai Mall as well as the Palazzo Versace are perfect examples of this achievement.

FURTHER INFORMATION



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