

FEATURE

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A New Facade for Cairo's Television Tower

Cairo's summer temperatures often soar above 45°C. Such extreme conditions are hard on inhabitants and structures alike. The more than 60-year-old Cairo Tower, a landmark of this Nile city, recently underwent extensive renovations – WACKER specialists contributed innovative materials and substantial construction-chemicals expertise.

Antique and modern architectural masterpieces – in Cairo you'll find both

This metropolis on the Nile is among the world's most densely populated: a quarter of all Egyptians live in or near Cairo. More than 16 million people are estimated to live here. But no one knows for sure, since the residents of this pulsating megacity are not required to register. What is certain is that Cairo is Africa's largest city, has Africa's only subway, and hosts a wealth of monumental edifices such as the over 4,500 year-old pyramids at Giza. In addition to the ancient works of the pharaohs, the Egyptian capital also has fascinating modern architectural gems.

The Cairo Tower is a city landmark ...

One such masterpiece is the Cairo Tower, or El Borg as it is known by the locals. Situated on the Nile's Gezira Island (which is also Cairo's 'green lung'), the tower soars 187 meters high and has a diameter of 14 m. The world's tallest all-concrete tower, it contains no steel frames or other reinforcement. Erected in 1961 by order of then-President Gamal Abdel Nasser, the structure serves as a television tower and even surpasses the height of the pyramids by some 45 m. Its design resembles a lotus blossom, which (along with papyrus) is one of the most

...and the world's tallest all-concrete tower

revered plants in ancient Egyptian history. The tower exterior's lattice structure is made of granite and ornamented with approximately eight million tiny porcelain mosaic tiles.

Exhaust fumes, heat and dryness leave their mark.

Unfortunately, urban life is constantly assaulting the one-of-a-kind tower. Large metropolises such as Cairo must contend with very heavy traffic, and the emissions from exhausts etch away at noble city buildings. Furthermore, Cairo's subtropical climate places high demands on building materials. At summer temperatures above 45 °C, exterior facades can heat up to 80 °C.

The exterior surface area exceeds 6,000 m²

Therefore, the Egyptian government decided to renovate the tower's exterior – a surface area exceeding 6,000 m². The contract was awarded to the Arabian Construction Company (ACC) and included replacing the existing mosaic with new ceramic tiles, repairing the plaster, cleaning the granite, and examining the tower's structural integrity.

Exceptional challenges – exceptional materials

In light of the considerable challenges involved, ACC sought out specialized suppliers for the necessary construction chemicals. These all had to satisfy European standards. One supplier ACC chose was the Turkish company Eczacibasi Koramic Yapi Kimyasallari – EKY, for short – which has collaborated with WACKER for years. "Many EKY employees have attended WACKER technical seminars and have been trained by us," says Ece Doker, sales manager for Construction Polymers at WACKER Turkey in Istanbul. EKY's construction experts again teamed up with WACKER's materials specialists because extensive preliminary tests were necessitated by the

**WACKER experts
develop customized
formulations**

high demands made on additives for plasters, mortars, adhesives and grouts. “We carried out numerous tests and experiments at our Burghausen labs,” recalls WACKER’s Dr. Hardy Herold, responsible at the time for technical marketing in Central and Eastern Europe as well as Turkey. This was the only way to adapt the preparations and their polymer additives to best withstand the extreme conditions they would encounter.

**Formulations optimized
with dispersible polymer
powders**

Modern construction methods geared to high quality and reliability need a combination of inorganic and polymer binders in dry-mix mortars. To meet this need, VINNAPAS® dispersible polymer powders are added to tile adhesives, grouts or mineral plasters to improve such important qualities as adhesion, cohesion, flexibility and bending tensile strength, water resistance and workability.

**Millions of mosaic tiles
in thin-bed mortar**

Together with their Istanbul colleagues, WACKER chemists used VINNAPAS® polymer powders to optimize the Turkish thin-bed mortar formulations, since the millions of mosaic tiles were to be laid via the thin-bed method. Tile adhesives must be perfectly tailored to the tiles and substrate. When working with difficult materials such as natural stone, the potentially weakest point is clearly the bond between tile and substrate. “But a tailor-made VINNAPAS® polymer powder enabled us to address the problem and strengthen the adhesive bond,” explains Herold.

Critical: high winds ...

This was absolutely necessary if the porcelain tiles are to remain firmly in place. After all, at its summit the tower sways back and forth as much as one meter. “Even on calm days, the top of the tower is exposed to strong winds that exert huge forces on the mosaic tiles,” adds Herold. This creates enormous tension on

... and extreme

temperatures ...**... require precisely
tailored formulations****Complications at 35 °C****Mortar adapted to
withstand Cairo's
climate****VINNAPAS® modified tile
adhesive for the
facade's mosaic**

the facade and, of course, the tile adhesive. Thus, the adhesive bond had to be highly flexible. The extreme summer temperatures on the facade created their own demands on the chemicals used in its construction. WACKER's experts and their EKY colleagues met this challenge, too, by optimizing the appropriate VINNAPAS® polymer powder.

Yet before construction specialists could lay a new mosaic of porcelain tiles, the tower's plaster work had to be renewed. "Due to the heat, this activity could be done only in the early morning or late in the evening, and only on the side away from the sun," recounts Herold. In addition, workers had to suspend operations every time the temperature rose above 35 °C. Last but not least, a sunshade of sorts was erected around the entire tower to prevent its surface from overheating and the mortar from setting too quickly. Here too, the WACKER specialists shared their expertise with Turkish colleagues. "In cooperation with EKY, we optimized the dry-mix mortar formulation in our labs and adapted it to the unusual processing conditions in Cairo," explains Herold.

Once the mortar bed was ready, the new mosaic of porcelain tiles was applied to the tower's exterior using a special technique known as "mesh mounting." To accelerate the laying of the mosaic creations and simplify color combinations, the individual porcelain tiles (each 2.5 x 2.5 cm) were first bound together to create ceramic mats before being applied to the tower's surface. To this end, the sides of the tiny tiles were spot-bonded with plastic, rendering the tiles water-resistant and extremely durable. Mesh mounted tiling not only offers superior

Rigorous grout requirements

water resistance but also improved bonding with the substrate.

At first, ACC hoped to fill the joints in the mosaic with epoxy resin. “Ultimately, however, the costs would have been too high and processing conditions less than ideal for this type of grout,” explains Herold. In need of an alternative, EKY opted for a grout similarly optimized with VINNAPAS® to reflect the climatic and processing conditions specific to Cairo. These modified grouts can better accommodate stresses in gaps between tiles while protecting the substrate against water ingress. In addition, the polymer powders improve adhesion to the joint flanks, increase deformability, and greatly optimize abrasion resistance.

Better adhesion and flexibility ...

Furthermore, specific VINNAPAS® polymer powders convey hydrophobicity to the grout: they reduce water absorption and reliably protect against the accumulation of dirt and discoloration.

... and protection from water and discoloration**Renovation cost more than eight million euros**

In total, the Egyptian government spent more than eight million euros on the high-tech renovation. Cairo’s landmark is now well protected from heat, dryness and wind, thanks to VINNAPAS® polymer powders from WACKER. The Cairo Tower now shines with renewed splendor and attracts visitors from all over the world. After all, the tower offers one of the best bird’s-eye views of Cairo, sometimes referred to as the Paris on the Nile due to the influence of French and British architects. And like the Eiffel Tower, the Cairo Tower is bathed in bright spotlights at night – indeed, innovation ought to be seen.

Renewed splendor with VINNAPAS®

Background Information on VINNAPAS®

With its VINNAPAS® dispersible polymer powders, WACKER has been the global market and technology leader for over fifty years in the field of polymeric binders for modifying cementitious systems. More than a million metric tons of VINNAPAS® polymer powders have been sold worldwide since they were first launched. The main applications of polymer-modified premixed mortars are construction and tile adhesives, exterior insulation and finish systems, self-leveling mortars and grouts, as well as plasters and repair mortars.

WACKER pioneered polymeric binders in powder form for the construction industry as early as 1957. This technology revolutionized working methods in the sector, providing the first ever one-pack polymer-modified cementitious system. It only required water to be added on site. To this day, the system still represents a much simpler way of working, with substantial cost advantages.

The benefits that dispersible polymer powders bestow on the end product include easier processing, excellent anchorage to all substrates, increased flexibility and flexural strength, and enhanced weathering resistance. Another advantage is that VINNAPAS® dispersible polymer powders do not contain plasticizers or film-forming aids, and therefore have low emissions levels.



The extensive renovation of the Cairo Tower demanded the highest standards of quality for plaster, mortar, adhesive and grout additives. WACKER experts helped to develop formulations containing specialized VINNAPAS® polymer powders that now protect the television tower from heat, dryness and wind (photo: EKY).

Extensive tests and experiments were carried out in WACKER's labs in Burghausen in order to optimize the formulations and their polymer additives for the conditions they would be subjected to in Cairo (photo: Wacker Chemie AG).





The high-tech renovation of the world's tallest all-concrete tower was carried out using VINNAPAS® polymer powders from WACKER. The Cairo Tower now shines with renewed splendor (Foto: EKY).

Note:

This pictures are available for download at
<http://www.wacker.com/pressreleases>

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The company in brief:

WACKER is a globally-active chemical company with some 15,000 employees and annual sales of around €3.78 billion (2007). WACKER has 27 production sites and over 100 sales offices worldwide.

WACKER SILICONES

Silicone fluids, emulsions, rubber and resins; silanes; pyrogenic silicas; thermoplastic silicone elastomers

WACKER POLYMERS

Polyvinyl acetate and vinyl acetate copolymers in the form of dispersible polymer powders, dispersions and solid resins used as binders for construction chemicals, coatings, adhesives, paints, plasters and nonwovens

WACKER FINE CHEMICALS

Fine chemicals, biologics and other biotech products, such as cyclodextrins and cysteine

WACKER POLYSILICON

Polysilicon for the semiconductor and photovoltaics industries; solar wafers

Siltronic

Hyperpure silicon wafers and monocrystals for semiconductor devices