A SUCCESSFUL OPERATION

A complete line of high-tech products specified in the ambitious design of a new hospital in Camaiore, Italy, resulted in fast, high quality construction.

by Natasha Calandrino

Photo 1
Patients in the 121,770 sq m hospital breathe the healthful air of the surrounding pine forest.

Plans had been in the works for ten years to build a large hospital in the Versilia region on the coast of Tuscany in Italy to replace four smaller ones in nearby communities. A study by the University of Venice determined that the town of Camaiore would be the best location for the hospital. As this large building was to be constructed in an environmentally sensitive area, the architects had to pay special attention to its environmental impact, especially the increased traffic the hospital would generate. A site was chosen in a pine forest off the Via Aurelia. The hospital would be housed in a low-rise building so it would be hidden by the surrounding vegetation.

The foundations

For the building to rise no higher than its surroundings, two floors of it had to be built underground. As a result the foundations had to be dug 7.50 meters (24.5 ft) deep, necessitating removal of a considerable amount of earth, 300 m (984 ft) long and 90 m (295 ft.) wide. A steel cofferdam with one or two rows of tension bars was erected to hold back the loose earth. Since the water table is 1.5 meters below the surface of the site and

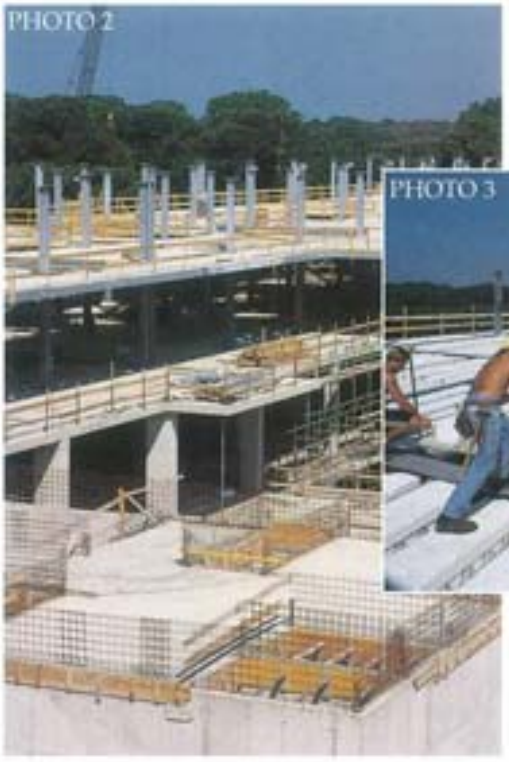


Photo 2
The reinforced concrete building consists of a grid of projecting columns and beams that support concrete planks.

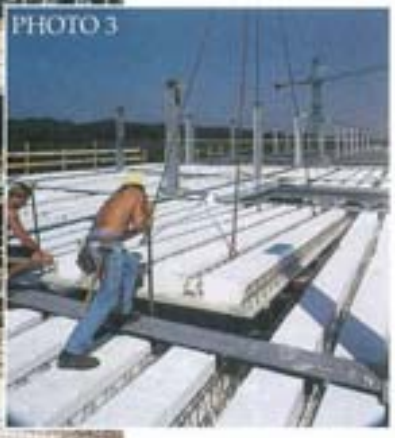
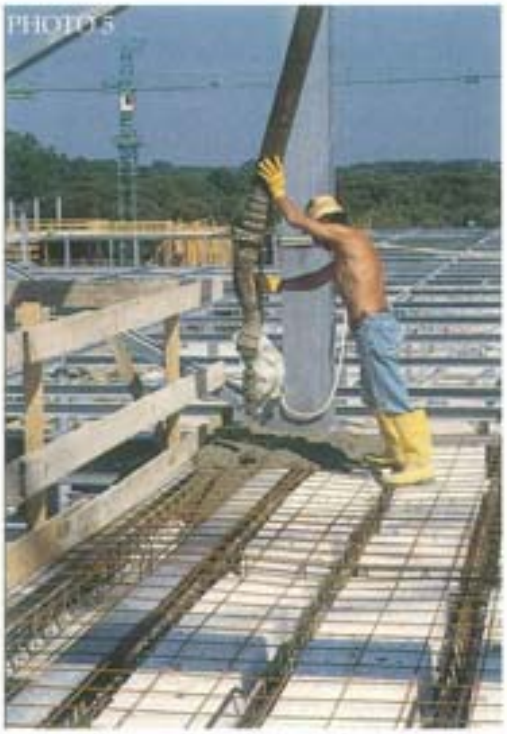


Photo 3
Placing the concrete planks on the galvanized steel beams.

Photo 4
Here we can see the hospital's repetitive structural design. A welded grid of reinforcement was laid over the concrete planks before pouring the concrete.

Photo 5
Using MAPEFLUID R104 set-retarding superplasticizer made it possible to cast 70,000 sq m of concrete in the 12 months scheduled.

Photo 6
The concrete was vibrated to prevent voids from forming.



the anchor blocks 18 meters subgrade, the entire foundation is immersed in water. For this reason a drainage system had to be installed to keep the water at bay. When the foundation was completely excavated a horizontal drainage system was installed composed of a Wellpoint pump system connected to pipes with pinhole perforations. These are encased in chases filled with special gravel to prevent the pipes from getting clogged. Over the chases lies a layer of sand one meter thick, over which a waterproofing layer of PVC was installed. A thin bed of concrete was then poured over the PVC, followed by a concrete raft 115 cm thick stiffened with a pin 2.50 meters (8 ft) thick. These precautions were taken to prevent rising damp from causing damage that would compromise the structure's durability.

The reinforced concrete building

The completed hospital has 617 beds and the latest equipment for its multiple health services on 121,670 square meters (1,309,500 square feet) of surface, making it one of the largest and best equipped in Tuscany. The building consists of a square structural grid of galvanized steel columns and beams supporting concrete plank floors, and is clad with terracotta tile.

A retaining wall was erected around the edge of the excavation as a permanent replacement for the temporary cofferdam. Even though the building is very big, it is constructed of elements that are constantly repeated, which led the concrete contractor to schedule the work in such a way as to maximize productivity. Considering the large number of beams and columns, and the 58,000 sq m (624,000 sq ft) of concrete floors in the design, the casting of the concrete and the transportation time had to be well coordinated to achieve high weekly productivity. 1,500 sq m (16,145 sq ft) of concrete was cast each week. Great attention was paid to the quality of the concrete, casting procedures and the installation of the reinforcement. These operations were managed by the project manager, following procedures agreed upon with the contractor.

Operational procedures

Before work began, two batching plants in the area were chosen for the project that continued to provide specimens of each casting later on. The quality control procedure specified that the measurements of the concrete covering be checked before casting and that these be recorded by the project manager along with the analyses of specimens taken from the concrete. The project manager, the contractor and the Mapei technicians jointly established quotas and procedures for the casting in order to maximize the performance of the concrete. From this pool of information a work schedule was drawn up with detailed instructions for mixing and placing. The final mixes designed by the technicians to meet the construction specifications were Rck30 N/mm^2 and Rck 40 N/mm^2 with 15/20 slump in elevation and Rck25 N/mm^2 with 10/15 slump in foundation. To enhance performance the concrete was admixed

with MAPEFLUID R104, a superplasticising set-retarding admixture that substantially reduces the amount of water needed in the mix. The product prolongs workability, thus reducing the amount of water added on the job site to a minimum. Less water means concrete with higher performance characteristics, and increased mechanical strength and durability.

The mix had to have extended workability even when construction continued through hot summer weather when high temperatures and the longer transportation times caused by the heavy summer beach traffic made slump loss even more of a problem. Five mixers were always on hand and additional mixers brought in as needed. At one point a total of eleven mixers were at work on the site. Two pump trucks with hoses 33 meters (110 ft) long were used to pump the mixes.

Finishing

Once the skeleton was completed work began on covering the more that 10,000 square meters (107, 600 sq ft) of the hospital facade. Just over half of the facade was covered with ventilated surfaces. The rest was clad with 25x25x1 cm (10x10x4") terracotta tiles. Here, too, Mapei supplied its technology and experience with setting materials and on-site technical assistance. The terracotta was bonded to the concrete with the KERAFLOOR+ISOLASTIC flexible adhesive system. This system was developed in the Mapei Research and Development Laboratories to provide the flexibility needed when installing tiles and slabs on substrates subject to movement, as in this case. Using KERAFLOOR+ISOLASTIC also enabled the terracotta to be installed in one go, without having to use a leveling compound over the concrete, which saved a considerable amount of time. The terracotta was grouted with KERACOLOR LARGE GRAIN, a premixed cementitious grout composed of special aggregate, synthetic resins and water-repellent additives. KERACOLOR LARGE GRAIN's easy cleanability allowed the entire facade to be grouted without staining. However, for removing traces of grout and deep cleaning of the surface, KERANET liquid was used, an acid cleaner for ceramic floor and wall tiles. KERANET was applied after wetting the surface thoroughly. The hospital's design features exterior stairways in architectural concrete. To obtain a better quality finish, the reinforced concrete was leveled with MAPEFINISH, a two-component cementitious mortar containing high strength cement, with excellent adhesion on all concrete surfaces. Once hardened, MAPEFINISH forms a compact surface with high bond strength that is impermeable to water and aggressive atmospheric gases (CO_2-SO_2, nitric oxide) and resistant to freeze/thaw cycles.


PHOTO 9


PHOTO 7


PHOTO 8

Photo 7
The surface of the pour was smoothed manually.

Photo 8
A detail of the structural system of columns, beams, planks, reinforcement and poured concrete.


PHOTO 11

Photo 9
Once the skeleton was finished, the facade was clad with terracotta tiles installed directly over the concrete with KERAFLOR+ISOLASTIC, grouted with KERACOLOR LARGE GRAIN and cleaned with KERANET liquid.

Photo 10
Detail of the exterior staircases leveled with MAPEFINISH, a cementitious mortar that forms a protective finish with high bond strength.

Photo 11
The impressive building is now ready to receive patients.

On the job site, from start to finish

The enormous size of the hospital and its sensitive location caused the project to be followed very closely both by the authorities and the public. As a result the contractors and project managers had to maintain the highest standards of quality in construction materials and methods. Mapei contributed a wide range of products that met the design's specifications from the foundation to the final covering.

TECHNICAL DATA

Project: The New Versilia Hospital in Camaiore (Lucca), Italy

Architect: Ettore Zambelli

Design and engineering of the reinforced concrete: Oreste Pedroni Ingegnieri Associati, Florence, Italy

Project Manager: Giovanni Gallo

Built: 1997-1999

Contractors: Impreglio S.p.A., Milan, Italy
CMB Carpi, (Modena) Italy
CTC (Cooperativa Costruttori Toscani), Florence, Italy

Mapei products for concrete: *
MAPEFLUID R404 admixture
MAPEFINISH finishing mortar

Supplier: General Sabbia, Viareggio, Italy

Cladding: 25x25x2 cm Il Palagio terracotta tiles

Mapei products used to install the terracotta: *
KERAFLOOR+ISOLASTIC
KERACOLOR LARGE GRAIN
KERANET liquid

Mapei Coordinators: Gianluca Bianchin, Paolo Lombardi, Nicola Sbrana

*These products are manufacture by Mapei in Europe.

The Technical Data Sheets for the products mentioned in this article are contained in Mapei binder No. 4, "Mapei Admixtures", No. 3, "Building Specialty Line", and No. 1 "Ceramic Tile Installation Products".