AN AIRPORT IN RECORD TIME

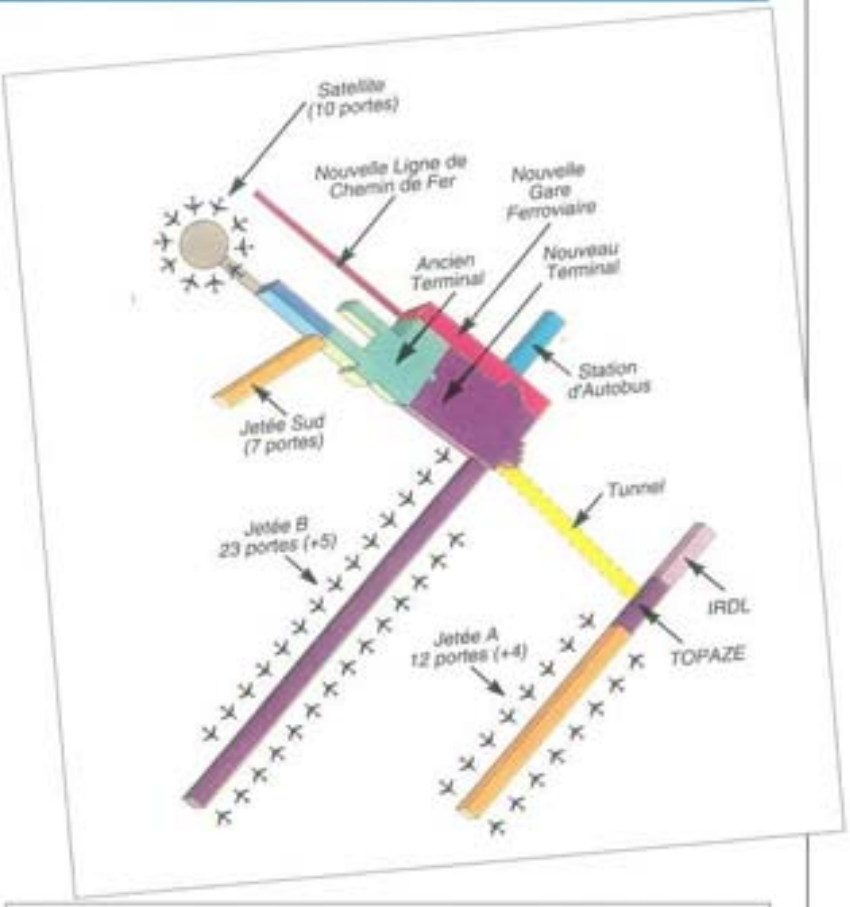
SEVERAL TOP ARCHITECTS, ENGINEERS, SPECIALISTS AND COMPANIES FROM DIFFERENT COUNTRIES COOPERATED TO RENOVATE AND EXTEND THE ZAVENTEM AIRPORT IN BRUSSELS. THANKS TO INNOVATIVE PRODUCTS THE SHORT TIME SCHEDULE WAS HONORED.

by Aristide Mariotti and Francesco Stronati

Imagine 500.000 m³ (17657,4 c.ft.) of excavations, 240.000 m³ (8475,5 c.ft.) of concrete, 27.000 tons of steel, 80.000 sq.m (861.110 sq.ft) of granite : this should give you an idea of the magnitude of the extension and renovation work at the Zaventem National Airport in Brussels.
The goal of this project was to provide faster and more updated service to the airport due to the ever growing number of passengers. While the current structure is indeed capable of handling 20 million passengers per year, the new framework is expected to achieve a capacity of 30 million travellers per year.
The Zaventem project started in 1990 with the cooperation of several top architects and large companies from different countries.
In order for the airport to remain fully functional, the project was divided into three stages. During the first stage, the new terminal was constructed, in the second stage, the existing area was integrated into the new structure, and in the final stage (which has yet to be completed) a temporary building, which was erected during the initial construction phase, is replaced by a permanent one.

An Invaluable Terminal

The new terminal is the key element of the project. It starts from the left side of the existing building and consists of 125.000 sq.m of usable space on eight levels, three of which are accessible to the public. The first level is assigned to the Arrivals, the second one to the Departures and the third to the Mezzanine. The Mezzanine is the main area in the terminal and it is built around a vast entrance covered by a cupola. The Administrative headquarters is located on higher levels while the automated baggage area is on the Arrival floor. Two main passageways called



•••• THE ZAVENTEM AIRPORT IN THE YEAR 2000 ••••
1st STAGE : FACTS AND NUMBERS

A HUGE JOB-SITE :
500.000 m³ of excavations
240.000 m³ of concrete
80.000 sq.m of granite
27.000 tons of steel
20.900 sq.m of glass

AN AIRPORT IN RECORD TIME
285.000 sq.m with one building consisting of 104,000 sq.m usable space distributed on 8 levels
A 215X115 m surface, the equivalent of 4 soccer fields for each floor
4.850 sq.m of commercial surface reserved for sale
1.900 sq.m of surface reserved for service
1.990 sq.m reserved for the restaurants
850 sq.m of surface reserved for the passengers' comfort
1.923.000 cube m of air conditioning every hour
40 approach gates with a total of 68 doors

ZAVENTEM 2000
A new 125.000 sq.m airport

Construction of the airport began in 1990. On June 14th 1994 the first section of the new airport in Brussels was opened to the public. In the future the old airport, built in 1958, will be renovated and integrated into the new project. Construction is expected to be finished in 2010.

Diamant and Saphir connect the two floors. The first passage way, Diamant, is the most important one and it is characterized by an octagonal construction which allows the passengers to enter the airport at the Departure level or leave through the Arrival level.
The Saphir passage way connects the Departure area and the Arrival area ; moreover, it permits easy access to the two restaurants located on the Mezzanine level. Seven sets of elevators, two of which are equipped with a special system for the handling of over-weight baggage, form a secondary communication system.
Structure B is composed of 5 levels; two levels are for the technicians, one level is for the arrivals and another one, which was built perpendicular to the terminal, is for the VIP. While waiting to erect Structure A similar to B, another building called Topaze was built in order to create a vertical communication route.

The underground tunnel, which connects the check in areas with the gates, was paved with marble. Two walk ways run the entire length of the tunnel.

Topaze is linked to the terminal through an underground tunnel consisting of two moving walkways which span the entire length of the tunnel and a corridor for baggage transportation. In order to complete such a large project within the required time of 26 months, the structure was pre-fabricated with a post-tension technique.
Only the pillars were built on the job-site in their entirety.
This construction technique provided remarkable savings in time and prevented climactic conditions from affecting the job-site schedule.

Fast And Resistant Screeds

Before installing the floors in the different areas of the airport it was necessary to set the screed. The thickness of the screed varied from 6 cm (2.3") to 12 cm (4.6") and was composed of sand and cement.
For nearly 10.000 sq.m (107.640') the screed was composed of a cement-based mixture including MAPEFLUID N200, a naphtalene sulfonate based superplasticizer for concrete. When added to the cement-based screed mixture with a 1% to 1.5% by weight cement dose, MAPEFLUID N200 allowed a 17% to 25% water reduction depending on the concentration of additive.
MAPEFLUID N200 improves the mortar's workability while in a plastic state, increases its compressive strength and reduces its shrinkage while curing.
In order to maintain the short time period required by the installer, the remaining 3.000 sq.m (32.30') of substrate was completed by using MAPECEM in the cement screed. MAPECEM is a special fast-setting hydraulic binder for the preparation of shrinkage controlled screeds. When mixed with graded aggregates and water, MAPECEM has the extraordinary capacity to dry and harden in just a few hours.
These characteristics and its very high mechanical strength allow the substrate to be ready for installation within only 24 hours. MAPECEM also saved considerable time in the organization and management of the job site while eliminating the long curing time usually required before installing the flooring over a traditional cement-based substrate.
All the substrates were installed with expansion joints every 6x6 cm (2.36") in order to weaken the substrate section. This also prevented possible crazing and damage to the screed caused by the dry shrinkage of the mud bed.
The installation was done after the screeds were ready for traffic and was completed by cutting 1/3 of the depth into the substrate.

Mapefluid N 200

Mapecem

Setting the MAPECEM screed created a substrate which was ready for floor installation in a very short time. Cement-based screeds were initially added with the MAPEFLUID N200 superplasticizer.

An image of the check-in hall. The marble flooring makes these heavily trafficked rooms elegant and cozy.

Ultraplan

Leveling with ULTRAPLAN. A pump was used for the application.

Leveling The Substrate In Less Time

Despite the professional skills of the construction firm, in some areas of the substrate, particularly in the Arrival, Departure and restaurant areas, the difference in the substrate level was greater than the 2mm (0.08") measured with a 2m (6.56') straight edge as specified by the construction manager. To even out the differences between the levels, which in some cases reached a maximum thickness of 7mm (0.275"), an easy-to-apply, rapid-setting material was required. ULTRAPLAN, the fast-hardening, self-leveling compound, was chosen. Its fluid nature enabled 15.000 sq.m to be leveled in record time. The new surface was ready to be installed after only 4-5 hours. The perfect flatness of the substrates made it possible to install materials with a minimum quantity of adhesive.

Floor And Wall Coverings

Groupe 2000, the interior design firm in charge of the project, wanted to create an environment which was extremely functional, pleasant and comfortable. Special care was devoted to the interior decoration : the flooring in the Departure and Arrival areas and in the vertical communication passageways, Diamant and Saphir, were installed with a chamfered and calibrated red granite (60X60X2 cm) from Madagascar over a 40.000 sq.m surface. This granite is manufactured by Technostone. The flooring, with dimensions of 30X30X1 cm, was also installed over a 15.000 sq.m surface in the passageway connecting the main building with the boarding lounges.
10.000 square meters of Marbralys marble was installed inside the tunnel connecting the new terminal with the Topaze building. The heavy traffic and delicate marble required a special adhesive. This adhesive had to meet specific standards such as : high shear resistance, rapid drying and hardening to avoid slab deformations and a floor ready for foot traffic in the shortest time possible.
GRANIRAPID, a fast-setting adhesive system with rapid hydration, was chosen since it allows floors to be ready for grouting after three hours and is open to heavy traffic after 24 hours.
The 2mm wide grout joints were filled with ULTRACOLOR n°10, a rapid setting and hardening cement grout for use with 2 to 20 mm ceramic tile joints. ULTRACOLOR was used since it is an easy to clean, color fast grout that will not promote efflorescence. In addition, floors can be ready for traffic three hours after installation. Finally, a green and violet carpet was installed in the

Granirapid

Adesilex P25

Keralbond+Isolastic

Three project stages : here below, mixing the two components of GRANIRAPID. At the center, installing the red granite from Madagascar (60X60X2 cm) with GRANIRAPID.
At the bottom, after positioning, the granite slabs are tamped to achieve a proper adhesion of the back.

mezzanine and the waiting area in the Departure area .
Particular care was devoted to the floor and wall coverings in the rest rooms. A 20X20 cm single-fired tile manufactured by Appiani was installed on the walls with ADESILEX P25, a ready to use paste adhesive. The floors were set with GRANIRAPID and the grout joints were grouted with KERACOLOR, a Portland cement based grout.
An agglomerate marble by Silestone was used for the wall base boards. These base boards were installed with KERABOND+ISOLASTIC (KERALASTIC system in North America), a dry-set mortar system composed of a cement based adhesive for ceramic tiles modified with a latex additive to elasticize cement based adhesives.

Only 26 Months To Fly

Despite a demanding time schedule, the airport was completed in just 26 months. Excellent results were obtained thanks to the team work of an experienced and trained crew. In addition, selection of the best installation products for the designated setting materials resulted in a remarkable saving of time and outstanding final results.

The technical data sheets for the products mentioned in this article are contained in Mapei binder No. 1 "Ceramic Tiles Adhesives" and No. 3 "Building Speciality Line"

Ultracolor

Keracolor

Several adhesives have been used to bond the ceramic tiles to the rest room floor and wall coverings : ADESILEX P25 and KERABOND+ISOLASTIC (KERALASTIC system in North America), ULTRACOLOR and KERACOLOR were used to grout the marble and the ceramic tiles

A detail of the hall connecting the departure area with the bus and train station

Below, a detail of the departure area

TECHNICAL DATA

PROJECT: Zaventem national airport in Brussels, Belgium - 1° stage

CONSTRUCTION PERIOD: 1990-1994

CONTRACTOR: BATC (Brussels Airport Terminal Company), Zaventem

INTERIOR DESIGNERS: Groupe 2000 (Dirk Bontinck, Michel Jaspers, Henri Montois, W. Van Campenhout and L. Willox)

CONSTRUCTION FIRM: A.M.I.A.C. (Association Momentanée International Airport Contractors), Zaventem

INDUSTRIAL SCREED AND COVERING COMPANY: Miot & Bresciani, Brussels

INSTALLER: Technostone, La Spezia, Italy

TOTAL COVERING SURFACE: 125.000 sq.m.

INSTALLATION MATERIAL: red granite from Madagascar by Technostone ; reconstructed marble by Marbralys and Silestone ; Single-fired tiles by Appiani

INSTALLATION PRODUCTS:
Substrates: MAPEFLUID N200 additive for concrete MAPECEM screed
leveling : ULTRAPLAN
adhesives : GRANIRAPID, ADESILEX P25 and KERABOND With ISOLASTIC
grout : ULTRACOLOR n°10, KERACOLOR