

NEW PROPOSALS FOR A MORE EFFICIENT CONCRETE THAT MEETS THE NEEDS OF THE MARKET.

Hello, dear reader.

It is with great satisfaction that Tecnosil announces more big news, in this seventh edition of the Tecnosil Newsletter.

After all, supporting each stage of the development process of high-performance concrete is our most important purpose.

We highlight the Madeira complex in Alphaville, where it was possible to unite timeless and functional architecture in a unique and impressive design, putting into practice the essence of concrete technology. For this, we invited everyone involved in the creation of the project to show you how you can prepare and deliver more efficient designs, with improved productivity and cost-effectiveness, while meeting the construction requirements.

You will see here the solutions offered by architects, designers, builders, engineers and different specialists and professionals who have overcome the challenges of a bold project, which is already drawing everybody's attention.

I hope that reading this will be useful and show you the new opportunities ahead of us. All the best!

Eng. João Paulo F. Guimarães

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Technical Director

WOOD BUILDING. INNOVATION IS THE SOLUTION TO DIFFERENT APPLICATIONS AND REQUIREMENTS.

With the scarcity of fine aggregates for high performance concrete and a higher demand for these special concretes, we study new alternatives for their preparation.

The possibility of using materials that are easily found and theoretically "discarded" for not having the specific features to satisfy the design specifications is a good example of how solutions can be found to produce economically feasible and sustainable concrete.

In 2002 the NATIONAL ECONOMY AND ENVIRONMENT COUNCIL was created, establishing guidelines, criteria and procedures for the management of construction waste. With this important regulatory body, we are even more encouraged to pursue options for the preparation of concrete and to comply with the regulatory requirements and the technical requirements of structural designers, with new solutions.

In the works on the Madeira Complex in Barueri (São Paulo), MIXDESIGN had the opportunity to use the latest technology to meet the specifications of the work. The construction company requested that the concrete should meet the following conditions:

- n High resistance to compression at early stages, to enable the reshoring within the work deadline;
- n High modulus of elasticity of the concrete, specified by the structural design in compliance with Brazilian regulations;
- n Concrete with low hydraulic shrinkage rate;
- n And the economic viability of the features prepared, meeting the resistance and modulus requirements.

At first we faced a big challenge to make a concrete foundation base

with a volume of approximately 900 m³ in one single step. For this special concrete, we used the union of two materials, Active Silica and an Additive based on stabilized nanosilica, which helped in reducing the heat of hydration of the concrete, so that it didn't need to be cooled.

The use of Active Silica and Nanosilica helped in reducing the water/cement (w/c) ratio, in controlling the hydraulic shrinkage and reducing the heat of hydration, making it possible to make this base without interruption and meeting the project specification.

In the structure (beams, columns and slabs) we faced the challenge of high initial resistances to facilitate the deformation and we still needed to meet the elasticity modulus at the ages of 7 and 28 days. We obtained a very interesting growth curve for the modulus and resistance of the concrete, as to reduce the shoring time in the period of the works. This meant less time and lower costs.

Another optimization was the gain of resistance and modulus mentioned above without changing the value of the concrete, previously budgeted, with the addition and replacement of new materials, whilst still complying with the performances established in the project design. The technology of the concrete used in this project will be a milestone for the construction industry with regard to durability and performance.

When we look at the increasing difficulties in acquiring the finest materials, we believe that the use of Nanotechnology is the way forward. An innovation that will be a great ally for special concretes, with bolder features, and that motivates MIXDESIGN to increasingly invest in technology and to excel.

NANOSILICA WITH ACTIVE SILICA. A MORE THAN EFFICIENT COMBINATION.

One of the biggest construction sites in SP, the Madeira Building is located in the city of Barueri and consists of 26 floors, intended for mixed, commercial and residential use. Approximate concrete volume: 23,000 m³.

This project required special attention because, due to the schedule, it required concrete with high resistance at early stages, something like 40.0 MPa at the age of 5 days, even with the use of CP II or CP III cement.

In the tests performed on the concrete, resistances at 28 days in the region of 70.0 MPa can be observed in some cases, and a deformation modulus of up to 50.0 GPa, a number very difficult to achieve with conventional materials used by concrete producers.

The technological control conducted by Qualitec required high technical competence, because the latest equipment and trained professionals were instrumental to achieving numbers of this magnitude and to alerting to any possible disruption in the processes.

REGARDING THE NUMBERS ACHIEVED IN THE CONCRETE, THEY WERE ONLY POSSIBLE THANKS TO THE NANOSILICA PRESENT IN THE ADDITIVE USED IN CONJUNCTION WITH ACTIVE SILICA, WHICH WORK IN THE FOLLOWING MANNER:

In the concrete, microsilica acts in two ways:

n The chemical effect: the pozzolanic reaction of the silica with the calcium hydroxide forms more CSH-gel until the final evolution of the mechanical properties.

n The physical effect: the Active Silica is 100 times smaller than the cement. The Active Silica fills the gaps and participates in the

hydration of the cement paste, giving a lower porosity and higher packing (compactness), which results in a denser concrete and higher modulus of elasticity.

WITH NANOSILICA THESE ACTIONS CAN BE ENHANCED, WHETHER IN MECHANICAL PROPERTIES OR IN THE DURABILITY OF THE CONCRETE.

And that is because of the high specific surface that works in the nucleation of the CSH-gel precipitation. Thus, higher early resistance is obtained. With the characteristics presented, there is a higher need for the amount of water, which should be avoided through the use of an additive with highly dispersed ultrafine particles.

Furthermore, nanosilica provides a strong contribution in the paste-aggregate transition zone, which provides high performance in resistance to compression and flexion.

When using nanosilica it is important to check the compatibility of the mechanical properties of the constituent materials of the concrete, including the mechanical resistance and porosity of the coarse aggregate.

Concrete with nanosilica has a more uniform and compact microstructure. The nanosilica reacts with the CaOH_2 crystals, causing a reduction thereof.

A PROJECT FULL OF STRUCTURAL CHALLENGES, WHICH REQUIRED SPECIAL PRECAUTIONS.

THE GREAT CHALLENGE OF THIS PROJECT WAS WITHOUT DOUBT THE DEFINITION AND IMPLEMENTATION OF THE FOUNDATIONS AND DIAPHRAGM WALLS. THE BUILDING HAS THREE BASEMENTS AND THREE BUILDINGS AS REAR NEIGHBORS, SUPPORTED ON THE DIRECT FOUNDATION, EXERCISING ADDITIONAL UNBALANCED PRESSURE THAT WAS ABSORBED BY THE STRUCTURE AS A WHOLE AND BY THE CABLE-STAYED WALLS.

For this project, various structural analyzes were performed in finite elements, using programs like the QST and Plaxis to evaluate stress and strain:

n Several structural analyzes with use of unbalanced thrusts of 13,000 tf to 6000 tf, due to the unevenness of the neighbors of the rear neighbors where three buildings with direct foundation are situated. n Structural analysis for the definition of the shoes, taking into account different tensions on the ground, settlements and misalignments of the tower.

Settlement pins were installed in the neighboring buildings in order to monitor any settlements caused by the work. The photo to the side shows the unevenness of the rear neighboring buildings and the large size of the building support shoes, the cable-stayed walls and the boulders. The concrete for the shoes also created great difficulties because of the large volume of concrete for each piece.

Focusing our delivery on a solution customized to the characteristics of this project, we were able to provide for the complexity of the works, a project that involves garages, stores, a swimming pool, hotel rooms and offices, a double height convention center, with large spans, supported with pre-stressed beams.

Area constructed - City Council: 55,718.57 m² Structural area:
61635.10m² Volume of concrete for shoes: 3,600 m³

Volume of concrete for the structure: 14,500 m³

MADEIRA COMPLEX

3 IN 1 CONCEPT REACHES ALPHAVILLE, SURPRISING EVERYONE.

Tecnosil technology is now present in one of the most impressive developments of the Barueri region, the Madeira Complex. A venture from developer ALPHAPAR and TIVOLI, in an area of more than 6,500 m² and high visibility near the entrance of Alphaville, the Madeira Complex is designed to facilitate the day-to-day professional who works in the region.

The office of architect Ricardo Julião designed the project, comprising two towers and a large Convention Center and Boulevard. The horizontal tower will house the Blue Tree Premium Alphaville hotel and the vertical tower will unite corporate spaces. The biggest challenge was to keep the same architectural language between the two towers, elegantly.

FUNCTIONALITY AND INNOVATION IN TIMELESS ARCHITECTURE.

The facade prioritizes balance between the towers above all else. They will use glass and cement slabs to generate a horizontal feeling and movement. The structure, called the "glass candle" (glazing), will join the two towers, providing unity to the project and making it even more beautiful.

Executives and entrepreneurs in the region can celebrate the arrival of another beautiful architectural complex, with great comfort, modernity and everything they need close by.

Project Structure

3 basements. 1 900 m² double height Convention Centre. 1 floor



with leisure area for hotel guests. 1 floor with a boulevard for use by all users of the complex. Terrace. 2 entrances. Around 760 parking spaces. 105 m long front facade. Over 90 m in height. Completion scheduled for end of 2014.

Horizontal tower

6 floors. About 320 apartments. Suites up to 52 m².

Vertical tower

18 floors. Each floor is 1100 m² of private area.

Totaling 324 hotel units; 279 commercial rooms and 18 boulevard stores.

DATA SHEET:

Developer: **Alphapar - Tivoli** Construction Company: **Afonso França** Architecture: Ricardo Julião Architecture and Location Urbanism: Alphaville, Barueri, SP Land Area: 6.720 m² Total Constructed: 55.000 m² Parking Spaces: 757 Foundation: Damasco Penna Engenharia Geotechnical Structure: Statura Engenharia Concrete Supplier: Concrevit Concrete Technology Consulting: Eduardo Tartuce - Mixdesign Technological Control: Laerte Brandioni – Qualitec

"To maintain a timeless architecture in harmony with contemporary aspects, adding value to the location of the enterprise while respecting the environment, was one of our big challenges."

Arc. Ricardo Julião

SYNERGY PROVIDING EFFICIENT SOLUTIONS FOR THE MARKET AND AGENTS OF THE CHAIN.

Tecnosil's objective is to optimize the use of materials that increase the lifetime of concrete constructions, offering sustainable products with even more technical efficiency.

How to innovate is part of our DNA, Tecnosil joined ABECE (Brazilian Association of Structural Engineering and Consulting) to help designers to get the best out of new technologies and to deliver the best economic results to the developer and user.

FOLLOW TECNOSIL'S GOALS AND ACHIEVEMENTS FOR THE EVOLUTION OF THE CONCRETE CHAIN.

We constantly develop and work intensely in the pursuit of concrete with low permeability, high mechanical resistance and durability.

We have enabled the application of over 10 million m³ of high performance concrete with the introduction of the first Active Silica in Brazil.

We created the Silicon brand, concrete additives based on stabilized nanosilica, allowing greater physical and chemical stability and mechanical resistance, particularly against flexion and tension and with a high modulus of elasticity.

We are helping to transform the entire concrete chain, to adapt technically and economically to the new NBR-6118 standard, which values durability, mechanical resistance and the modulus as one of the most important requirements.

The stabilized nanosilica synergy plus active silica provides better efficiency for the concrete base and offers different properties to

products made with them separately. Both types and additions may be incorporated together to produce a durable concrete for any environment.

SOLUTIONS THAT BEST MEET THE REQUIREMENTS OF THE PROJECT AND ARE MORE ECONOMICAL.

For the design: it provides the best cost-benefit ratio, exceeding the requirements of mechanical stress and durability established by NBR 6118.

For the construction: increased productivity, with better operating levels than a fresh concrete, more elasticity and resistance to compression.

THE STIMULUS FOR THE SUCCESS OF THE WORKS:

EFFECTIVE IDEAS WITHIN AN ESTABLISHED DEADLINE.

WHAT WERE THE GENERAL CHALLENGES OF THE WORKS AND THE SOLUTIONS EMPLOYED FOR EACH CASE?

One of the major challenge was starting the execution of the foundation and the concrete structure, because of the rocks in the soil. The removal of these rocks was part of the customer's scope and they were removed in stages.

A decision that improved productivity in the field was the division of implementation of the concrete structure of the Commercial Tower between two companies. This attitude created a healthy competition for the works, which picked up speed, meeting the deadline for completion of the concrete structure.

WHAT SOLUTIONS WERE EMPLOYED REGARDING CONCRETE THAT USED ACTIVE SILICA AND SILICON ADDITIVES BASED ON STABILIZED NANOSILICA?

Because of the deadlines and blasting of rocks that prevented the full onset of the foundations, it was necessary to organize a plan of attack that, in addition to phasing the steps and meeting the project requirements (elasticity modulus greater than 37GPa, 45MPa

resistance), required resources for obtaining the execution speed by means of metal pieces in the shoes, ensuring fast assembly and eliminating the need to disassemble.

Another resource was the improvement of the concrete mix with additives. The use of active silica improved the resistance of the concrete in its early stages, ensuring the rapid deformation of the slabs and beams and thus optimizing the use of the materials. The AD200 plasticizer applied in the shoes (most of them with 900m³ concrete) helped reduce a/c consumption and secured a high resistance, combined with the required elasticity.

WHAT ARE THE MAIN FEATURES OF THE PROJECT?

It is a tower with 26 floors and three basements that will house a hotel, stores and commercial offices. The construction system uses reinforced concrete throughout, molded in place with mixed seals (concrete and dry wall blocks). The project included technological reengineering improvements such as the use of ACM coatings to replace the cement slabs in the vertical elements, the use of metal shapes in the shoes, high internal floors in granite, use of PEX systems for water supply, glass with high reflective technology and thermal comfort, among others. n

NANOTECHNOLOGY FAVORS AN EVEN MORE DURABLE AND RESISTANT CONCRETE.

Concrevit provided the concrete that was used in this innovative development, the works on the Madeira Complex, in partnership with construction company Afonso França, successfully using nanotechnology.

In recent years, we realized that the application of nanotechnology in building materials has grown significantly, with special emphasis on the use of nanosilica in the production of concrete, which increases its

resistance and durability.

Nanosilica used as an additive in concrete is more effective than Active Silica or fly ash because it has smaller particles and consequently a higher specific surface, reacting faster and enabling it to be applied in smaller quantities. It is obtained by a chemical process, and its chemical composition is similar to that of quartz. Its particles have a diameter between 3 nm and 200 nm (1 nm = 10^{-9} m).

ITS USE, ASSOCIATED WITH POLYCARBOXYLATES BASED ADDITIVES, PROVIDES THE CONCRETE WITH FEATURES SUCH AS:

- Greater cohesion and less segregation.
- Lower water/cement ratio.
- Maintenance of plasticity for up to 4 hours at 20°C.
- Lower exudation. n Reduced permeability.
- Lower heat of hydration.
- Increased modulus of elasticity.
- Increased resistance to initial and final compression and flexion.
- Less shrinkage

BETTER UNDERSTAND THE CHARACTERISTICS OF THE CONCRETE USED.

Due to the modern design and challenging construction system, the concrete requested is also special: we have an fck 45MPa B1 ST 120 + 20 mm mix with 37 GPa modulus of elasticity. After making some concrete, we achieved values of resistance to compression of 41.6 MPa at three days, 60.9 MPa at seven days and 75 MPa at 28 days of age for the concrete. The elasticity modulus reached an incredible 50 GPa, proving that the solution found for this work is the most efficient.

LIQUID VERSION: EASIER TO USE AND WITH BETTER DISPERSION IN THE CONCRETE.

The nanosilica is provided in liquid form, dispersed in superplasticizing additives based on the latest generation of polycarboxylates.

WHAT HAPPENED:

Io Luso-Brazilian Meeting on Degradation in Reinforced Concrete Structures

August 6-9, 2014 - Fiesta Convention Center Salvador, Bahia.

Eng. João Paulo F. Guimarães from Tecnosil and Silicon gave a presentation on the Synergy between Active Silica and Nanosilica: Permanent action. **Topics covered:** Corrosion of Reinforcements: Carbonation, Alkali-Aggregate Reaction (AAR), Methods of Monitoring and Recovery, Durability and Characterization of Materials with Historical Interest, Other Degradative Processes.

New Tecnosil and Silicon websites. Check it out!

Our other channel now has a new look!