There's Betonsafe ... and the water stays out forever!

BETONSAFE®

SLEEP WELL

www.betonsafe.it

ADVANTAGES

- Ease of use and installation of the components of the method
- Elimination of traditional waterproofing works
- Usable even in adverse weather conditions
- Backfilling with any type of fill material
- Dramatically reduces the final costs of underground work

MICROSILICA REACTION

FIBRE ECOMICS 180 or STRUCS 540

Prodotti per l'impermeabilizzazione e l'ermetizzazione delle opere edili • Products for sealing and waterproofing buildings •

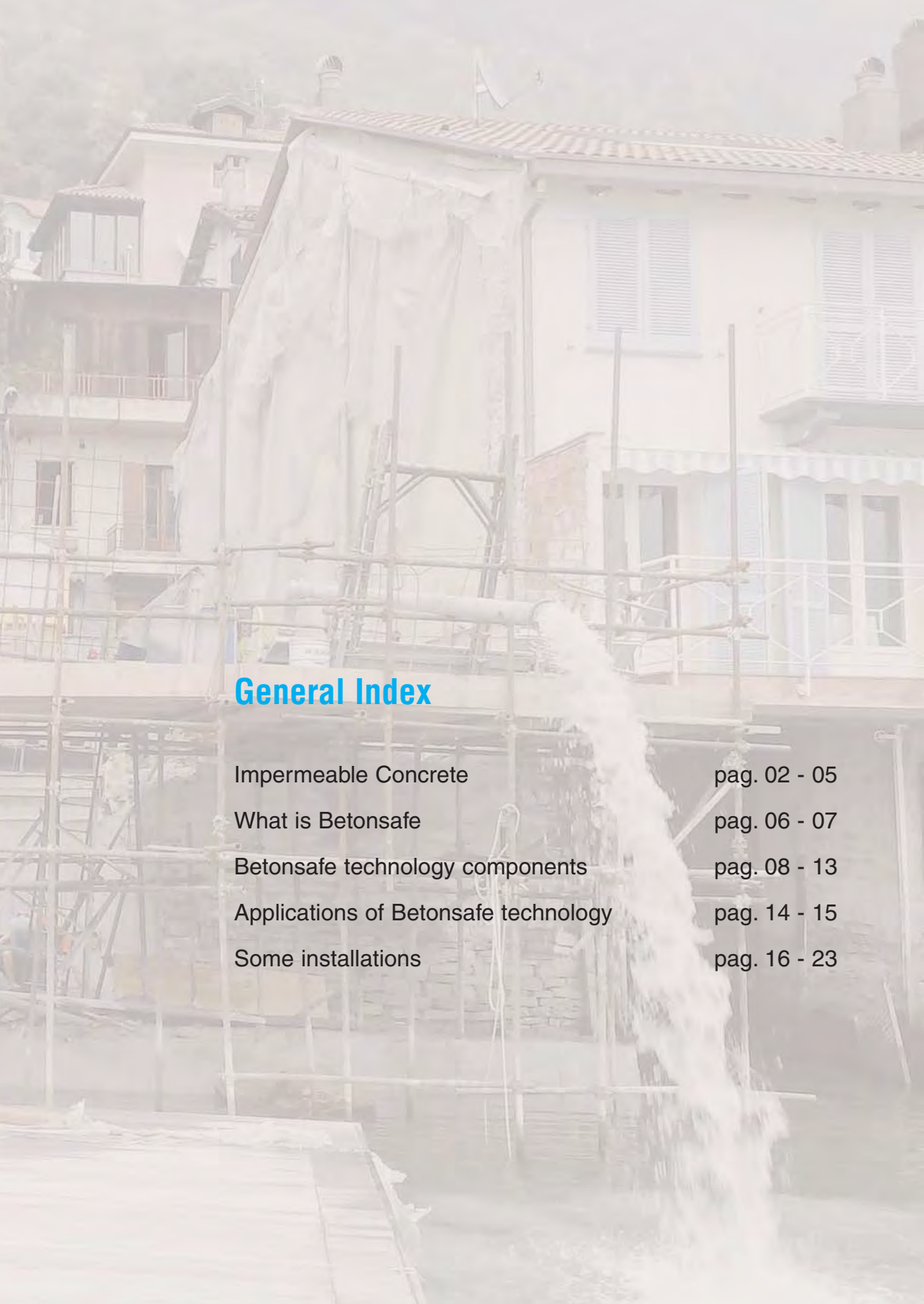
STOP all'Acqua

TECHNOLOGY FOR MAKING **CONCRETE WITH VERY HIGH WATER RESISTANCE** FOR THE CONSTRUCTION OF HERMETICALLY SEALED STRUCTURES BELOW THE WATER TABLE

TECNOB

PRODOTTI E SOLUZIONI PER L'EDILIZIA SPECIALIZZATA

dal 1988



General Index

BETONSAFE

TECHNOLOGY FOR MAKING **HIGHLY IMPERMEABLE CONCRETE**
FOR THE CONSTRUCTION OF HERMETICALLY SEALED
STRUCTURES BELOW THE WATER TABLE

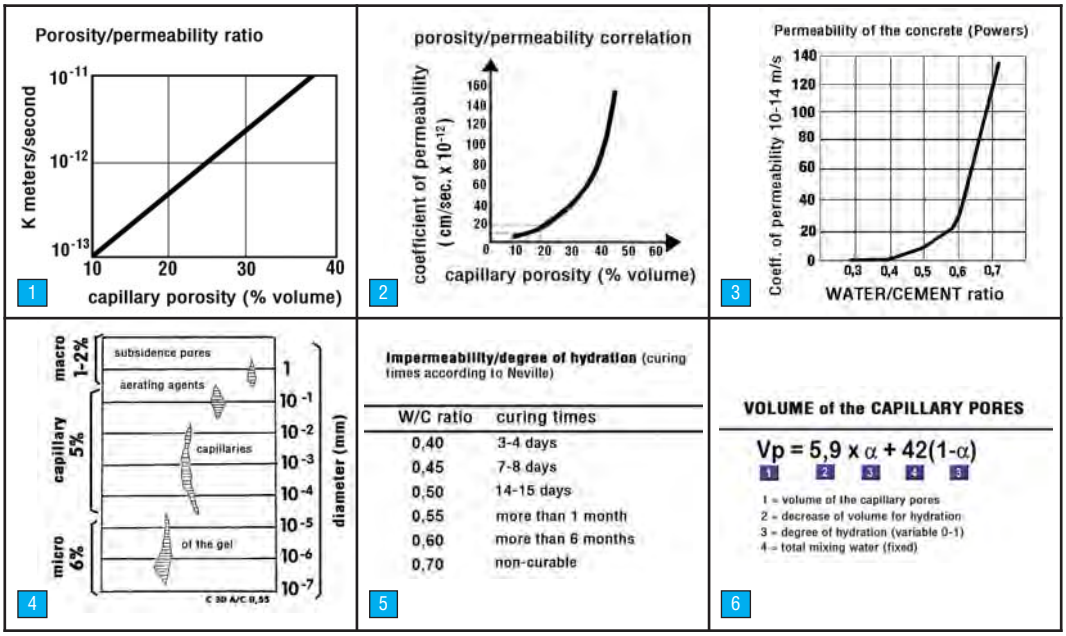
There's Betonsafe ... and the water stays out forever!

1.0 PERMEABILITY AND IMPERMEABILITY

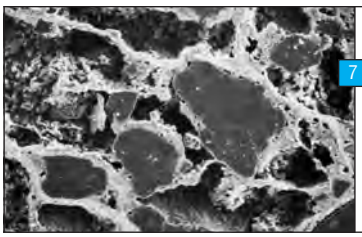
In general, permeability is the property of materials that allows the passage of fluids (liquids, in the case in question) without altering their own structure. Permeable materials are those that allow the passage of relatively high quantities of liquid, while impermeable materials are those through which the flow of liquid is negligible. The rapidity with which a fluid passes through a solid body depends on the type of substance the body is made of, the pressure of the fluid and the temperature. To be permeable, a material must be porous, i.e., it must have empty spaces, pores, capable of absorbing liquid. In addition, the pores must be connected by a network of interstices, which allow the fluid to pass through the solid substances. On the contrary, an impermeable material must have a dense, compact structure without interstices that communicate with each other.

2.0 THE PERMEABILITY AND IMPERMEABILITY OF CONCRETE

The impermeability of concrete is one of the essential requirements for the durability of structures over time. The cement conglomerate, or stone, is similar to a natural compact stone for which the impermeability to water of compact marble, for example, cor-



responds to cement with W/C ratio = 0.48. After curing, the water added to the concrete mix for hydration and the workability required for pouring leaves a dense network of passages in the matrix of the concrete, consisting of gel pores and capillary pores that determine the porosity of the cement mixture. (Figure 4). The “capillary porosity”, which controls a large part of the “intrinsic” permeability of the conglomerate, is dependent on the water/cement ratio (Figure 3) and the degree of hydration (Figure 5) and can vary from zero up to 40% in volume with respect to the volume of the cement mixture. With a water/cement ratio greater than 0.38, the creation of capillary pores, even after complete hydration, is practically unavoidable, except for specific interventions involving the addition of “reactive fillers”. Capillary pores are only visible with an electron microscope, their diameter is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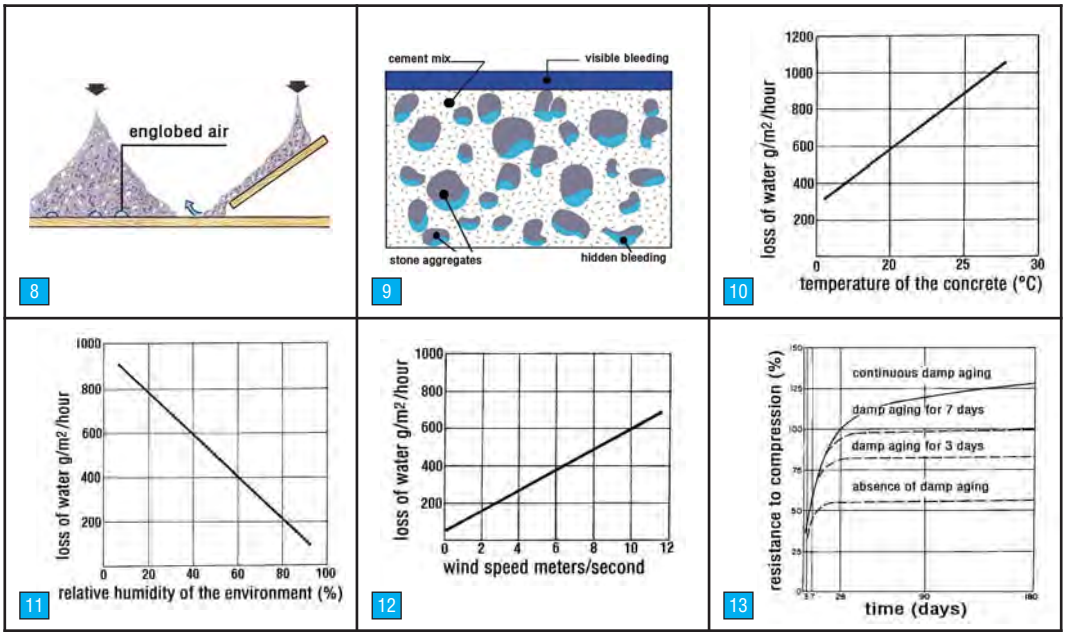
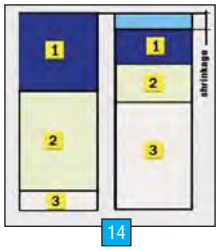
Concrete: porosity (influence on degradation processes)

Type	Dimensions	Effects
POROSITY OF THE GEL	(approx.)	does not allow motility of the liquids
CAPILLARY POROSITY	several µ	slow degradation
INTERSTITIAL POROSITY	tenths of a mm	medium/fast degradation
MICRO-CRACKS	tenths of a mm	medium/fast degradation
MACRO-CRACKS	millimeter	fast degradation

on the order of microns (from 0.1 to 10 microns), have a variable structure and form a continuous, interconnected channel in the matrix; So, the permeability of concrete is not simply a function of its porosity but also depends on the size, distribution, physical properties and continuity of the pores. The empirical formula to the side (Figure 6) provides criteria for assessing the volumetric entity of the capillary pores as a function of the degree of hydration and fixed total water in the mix. Figure 7 lists the different porosities of concrete and their relative influence on the most common processes of degradation of the cement conglomerate. By way of example, the "porosity of the gel" inside the solid particles that form the cement mix, can account for up to 28% of the volume of the particles themselves, with dimensions of 1/100 micron, but because it does not allow the "motility" of the liquids, has absolutely no effect. In general, in terms of the interconnections between pores, in addition to capillary porosity, there is the widespread presence of "englobed or trapped air" in fresh concrete, which must be expelled by correct compacting and that creates macro-voids (of about 1 mm to several tenths of a mm). Another variable, which is capable of increasing both the porosity and the interconnections between pores, is the "transition zone", i.e., that part of the cement mix (often several microns or up to 10 microns) that is in direct contact with the stone aggregate; The transition zone can be significantly more porous than the adja-



cent cement matrix as a function of the "bleeding" water (pooling of water on the surface of the concrete) that, during its rise, remains partially trapped under the larger stone aggregate. The permeability of concrete depends on the greater or lesser presence of voids (capillaries) communicating between opposed casting surfaces in which water can flow due to a difference of hydrostatic pressure and, as already noted, also depends as much on the characteristics of the concrete as much as, the correctness, or lack of it, of the skill employed in pouring it, its damp curing (Figures 10, 11, 12 and 13) in addition to any occurrence of micro and macro-cracking due to plastic and hygroscopic shrinkage (Figure 14). During the hardening of the concrete, climatic conditions such as the temperature (Figure 10), the relative humidity (Figure 11) and ventilation (Figure 12) can lead to the more or less sudden loss of the mixing water. In the absence of adequate care and damp curing, significant quality drops can occur that also involve permeability. Figure 13 shows the qualitative and performance differences between samples of the same concrete depending on whether it was damp cured or not. The values in play can reach values on the order of 50%. The volumetric dimension of the plastic and hygroscopic shrinkage shown in Figure 14, allows one to easily understand how the resulting tensions can be translated into micro and macro-cracking that is extremely damaging for the proper impermeability of the concrete. The left side of the figure shows the condition of the concrete at the beginning of hardening; the right side, on the other hand, shows the condition of the concrete after hardening. Number (1) defines the volumetric evolution of the mixing water, number (2) that of the cement and (3) that of the hydrated cement.



3.0 PERMEABILITY AND STANDARDS

The most recent standard for concrete: UNI EN 206-1:2001 makes only a passing mention of impermeability (5.5.3) as "Resistance to penetration by water", without defining parameters and limits. Standard UNI 9858 "Concrete: Performance, production, pouring and conformity criteria" provides the values referenced in the table shown below.

UNI 9858	CONCRETE: Performance, production, pouring and conformity criteria
IMPERMEABLE CONCRETE: RESISTANCE TO PENETRATION BY WATER 7.3.1.5SA mixture is considered suitable for making impermeable concrete if its resistance to penetration by water, determined according to UNI 7699, is a maximum penetration value of 50 mm and average values less than 20 mm. The w/c ratio must not exceed 0.55.	

The Ministerial Decree of September 14, 2005: "Norme Techniche per le Costruzioni" (NTC - Technical Standards for Construction) deals with the subject of structural durability and, as a consequence, also aspects inherent to the "permeability" of concrete and leaves it to the designer specify the life expectancy of the structure, together with the client, as a function of 2 main classes: Class 1, for a life expectancy of up to 50 years, Class 2, for a life expectancy of up to 100 years. In addition, the same decree assigns the designer the responsibility of establishing and prescribing in the design the pouring, compaction and curing methods for the selected concrete.

4.0 OBTAINING IMPERMEABLE CONCRETE

As already mentioned, the permeability of concrete is strictly related to the porous microstructure of hardened cement, in its turn strictly related to the water/cement ratio. It follows that concrete can have different degrees of impermeability, depending on how it is mixed and poured. The factors that influence this characteristic are the same as those that determine its other properties: composition, processing and subsequent treatment. In theory, there are no particular difficulties in obtaining impermeable concrete but, in practice, one should keep in mind that "really" impermeable concrete requires effort and attention that are different from normal job site habits. On a technical-design level, it is essential to remember that this impermeability must be considered relative and not absolute. In fact, obtaining impermeable concrete requires careful design, mixing and adequate pouring, without forgetting the indispensable treatments of curing and aging, which must be effective, unlike the entirely apparent procedures that are "often" adopted on many job sites. In practical terms, it is, first of all, necessary to reduce the water/cement ratio to the minimum compatible with adequate workability; aggregates of a suitable nature and granularity must be used; the poured concrete must be prevented from drying too rapidly to avoid the formation of external and internal cracks due to shrinkage; during pouring, it is necessary to avoid the sedimentation of the concrete, i.e., the loss of homogeneity that is obtained with mixing. Since, even after complete hydration, the formation of capillary pores is practically inevitable with water/cement ratios greater than 0.38, the addition of "reactive fillers" may be required.

5.0 INNOVATIVE MATERIALS AND THE UNI EN 206-1:2001 STANDARD

In point 3.1.23, the UNI EN 206-1:2001 standard "Calcestruzzo, Specificazione, Prestazioni, Produzione e Conformità" (Concrete, Specification, Performance, Production and Conformity) introduces the concept of "additives", defined as finely divided materials used in concrete for the purpose of improving certain properties or obtaining special properties. This standard considers two types of inorganic additives: practically inert additives (Type I) and pozzolanic or latent hydraulic activity additives (Type II).

Point 5.2.1 of the same standard similarly adds the concept of k value (not to be confused with the permeability parameter of the same name). The k concept, referring to additives, allows Type II additives to be taken in consideration by substituting the term "water/cement ratio + k additive" for the term "water/cement ratio" (defined in 3.1.31), in the requirement for the minimum dosage of cement (see 5.3.2). The effective value of k depends on the specific additive. For "pozzolanic additives" (comparable to MICROPLUS), point 5.2.3 specifies that the maximum quantity of silica fume, or similar additives, that can be considered for the revaluation of the water/cement ratio and the cement content, can be derived based on the following parameters:

• for a prescribed water/cement ratio ≤0.45 k = 2.0
• for a prescribed water/cement ratio >0.45 k = 2.0 except
• for exposure classes XC and XF, for a prescribed water/cement ratio >0.45. k = 1.0

The availability of "proprietary" additives with high technological content, such as the "pozzolanic" additives is, therefore, recognized as technologically and terotechnologically conforming for constructing impermeable works through the combined use of "intrinsically impermeable concretes", specific protections and conforming construction techniques.

6.0 MEASUREMENTS OF PERMEABILITY

According to Darcy's Law, which was developed for rocks, the coefficient of permeability K (in meters per second) is the parameter that also fully expresses the permeability of concrete, indicating, with the unitary speed of the water, the entity of its passage through the concrete. In the case of high water/cement ratios (greater than 0.7), the coefficient of permeability is on the order of 10^{-10} m/s, a value representing high-permeability concrete. For more favorable water/cement ratios (less than 0.40), the coefficient achievable, with suitable added pozzolanic reactive fillers and super-lubricating agents capable of providing the necessary consistency in the context of the water/cement ratio values considered, can be on the order of 10^{-11} m/s, or less. Keeping in mind the variables alluded to and the operational complexity, the generallyassumed design value is:

$K = 1 \times 10^{-11}$

coefficient of permeability K (Darcy)

- Darcy's Law is valid for Newtonian fluids. The coefficient of filtration depends on the viscosity and specific weight of the fluid.
- One can introduce the coefficient of intrinsic permeability k

$$K = \frac{Q \times L}{A \times H}$$

- The coefficient of intrinsic permeability is only a function of the characteristics of the porous means

K = Coefficient of permeability (cm/sec)
Q = Flow of water through the sample (cm^3/sec)
L = Thickness of the sample crossed by the flow (cm)
A = Section of the sample (cm^2)
H = Water head (cm)

Bibliography
Luigi Massidda: "Analisi delle cause di degrado del calcestruzzo e delle opere in cemento armato".
Adam M. Neville: "Properties of Concrete".
T.C. Powers: "The Physical Structure of Portland Cement Paste".
Mario Collepardi: Z come zona di transizione".
NRMCA: "Concrete in Pratice".
ACI: "Manual of Concrete Practices".

WHAT IS BETONSAFE®

BETONSAFE SLEEP WELL

BETONSAFE® technology is simple to implement and control, for making concrete with very high intrinsic water resistance and constructing hermetically sealed structures below the water table.

The method, successfully tested in America and Scandinavia beginning in the early 1970s and introduced in Italy in the early 1980s, for the construction of civil, industrial and hydraulic structures, sea works, concrete pavements, pools, tanks, aqueducts, etc., is based on a thorough understanding of the nature of concrete and the causes of water infiltration in buildings.

On the one hand, the components of the **BETONSAFE®** method cause a profound transformation of the concrete, from "normal" concrete to "impermeable" concrete and, on the other, ensure the absence of infiltrations in the key connection points of the buried structure (both horizontal and vertical connections, blade and tube form spacers, pass-through tubes, etc.) using specific sealing techniques (betonite and PVC waterstops, water-tight sealants of the form spacers, osmotic cement mortars, etc.).

The profound transformation of the concrete, prepared with a suitable mix-design, is made through the addition of a polyvalent, composite super-lubricant powder waterproofing additive based on thickened and selected micro-silicates, plastifying agents, micro-fibres of calcium metasilicate, alkaline-resistant fibre-glass and specific **MICROSTANDARD** or **MICROPLUS** agents and, with the purpose of providing anticrack protection and reducing the absorption of water, **FIBRE ECOMICS 180 polypropylene fibres.**
(Note: With the addition of structural fibres made of Fibre Strucs 540, ordinary concrete is transformed into Fibre Reinforced Concrete (FRC), which allows the construction of waterproof pavements, foundations and walls with the total, or partial, replacement of steel rein-forcements. The technical and economic advantages and increased durability are particularly significant).

The absence of infiltrations at the key joints of the buried structure is assured with the help of **WATERSTOP B/25.20**, **WATERSTOP G/20.10** or **G/20.20** and **RING GASKET (L-19 or T-21)** and **CORK GASKET T-21** gasket seals for the form spacers.

The result is a dense, composite (fibre-reinforced) concrete structure with a drastic reduction of "weak points" (free lime) and a significant increase of intrinsic impermeability. Any water seepage that should somehow occur during the construction of underground structures (differentiated subsidence cracks, unsuitable connections, loose foundations from poor vibration, etc.) will be sealed simply and safely with the application of **SYNTECH HAG (Eco and/or Flex)** hydroexpansive polyurethane resins.

The profound modifications to the matrix and structure of the concrete, condensed in the BETONSAFE® method, are based on the assumptions of ACI 116 R (°), SFA documents (°°), Eurocodes EC2 and documents and standards related to FIBRE-REINFORCED CONCRETE (FRC).

ADVANTAGES OF BETONSAFE® TECHNOLOGY

EASE OF USE:
The waterproofing of the buried space is directly in the concrete mixer. By simply adding MICROSTANDARD or MICROPLUS and FIBRE, suitably prepared, reactive components are introduced that profoundly transform the concrete from normal concrete to waterproof.

ELIMINATION OF TRADITIONAL WATERPROOFING WORKS:
At the same time that you're pouring the concrete, you are also waterproofing. No more stressing waits to allow the waterproofers to begin working. The costs of storing waterproofing materials at the job site and energy costs, etc., are eliminated.

USABLE EVEN IN ADVERSE WEATHER CONDITIONS:
Cold, frost, rain and high temperatures, etc., at the job site will no longer be considered obstacles to waterproofing.

BACKFILLING WITH ANY TYPE OF FILL MATERIAL:
The waterproofing protection systems (ashlars of various types, TNT, etc.) all disappear; backfilling can be done immediately after removing the forms using any type of material (sand, rocks, crushed inerts, recovered inerts, rocks, etc..).

REDUCTION OF THE FINAL COST OF UNDERGROUND WORK AND FULL CUSTOMER SATISFACTION:
Hundreds of construction sites throughout Italy, with great customers satisfaction both as regards the time to do the work and the final result, a secure hermetic seal and a drastic reduction of the overall final costs, are the calling card of BETONSAFE® technology.

BETONSAFE®: sleep well !

MICROSILICA REACTION

FIBRE ECOMICS 180 or STRUCS 540

INDUCED PERFORMANCES

- SHARP INCREASE IN MECHANICAL RESISTANCE.
- INCREASE IN THE COHESION AND STABILITY OF THE MIX (INHIBITION OF SEGREGATION AND SURFACE BLEEDING).
- MARKED RESISTANCE TO BEING WASHED AWAY.
- SHARP INCREASE IN INTRINSIC WATER-RESISTANCE.
- SHARP INCREASE OF RESISTANCE TO ABRASION AND CAVITATION.
- SHARP INCREASE IN CHEMICAL RESISTANCE.
- INHIBITION OF PERNICIOUS ALKALINE-AGGREGATE REACTIONS.
- DRASTIC REDUCTION OF EFFLORESCENCE.
- SHARP INCREASE IN OVERALL DURABILITY.

Main Component

MICROSTANDARD

MICROSTANDARD is a special “additive”, compound, multifunctions (UNI EN 206-1.2006, 3.1.23,type II: pozzolana additives) able to product interesting transformations in cement pasta, in structure and concrete performance. MICROSTANDARD is most made by thickened reactive micro-silicates, selectioned sands of very thin granules, as well as a special mix of polypropylene multifilament fibers and minerals microfibres (Wollastonite) with a contribution of matrix expressible, for the usual dosages, by reason of 800/1000 microfibers, mineral granule of cement. The reactive fillers present in MICROSTANDARD determine a high effect of cohesive thickening of conglomerate and great linking increasing of concrete, in a mix able to maximize the functions of fibres dissolved in it. For this reason, the concrete with Microstandard, can be considered a compound material, fibro-reinforced of elevated quality.

MICROPLUS

Consisting of thickened and selected micro-silicates, reactive kaolinic microfillers, stabilizing agents, alkaline-resistant fibreglass and calcium metasilicate micro-fibres, MICROPLUS the base product of the "Betonsafe Method", is a special multi-functional additive (UNI EN 206-1:2006, point 3.1.23, type II: pozzolanic additives), able to perform profound transformations in the cement mix and the structure and performance of the concrete. MICROPLUS must simply be added to properly prepared concrete, consistent with current standards. In any case, MICROPLUS can be added either in the mixing plant by gradually distributing it on the aggregate conveyor belt, or directly in the concrete mixer truck at the job site.

By varying the dose from case to case, the peculiar properties of MICROSTANDARD or MICROPLUS allow defining various categories of finished concrete, which can be schematized as follow:

MICROSTANDARD: **1)3)4)6)8)** - MICROPLUS: **1)2)3)4)5)6)7)8**

Mixing waterproof concrete for works in direct contact with fresh or salt water

	1) Waterproof concretes for underground structure with or without the presence of ground water.		**2)** Waterproof under water, anti-washout concretes to be poured directly in water.		**3)** Concretes with increased chemical resistance for structures in urban, industrial, marine or mountain environments.

Packaging of other types of special concrete designed

	4) Mechanically-projected bentonite concretes and mortar: gunites and shotcrete.		**5)** Concretes with very high mechanical resistance, even short-term (> 100 N/mm^2).		**6)** Light structural concretes with expanded clay: light concretes with high-performance polystyrene.
	7) Refractory concretes with high thermal resistance for works and structures in critical industrial areas.		**8)** Concretes resistant to abrasion and cavitation for pavements and areas to high mechanical stresses and wear.		

HOW IT IS USED

MICROPLUS and MICROSTANDARD should simply be added to properly mixed concrete, consistent with the current standards, as a function of its specific use, the atmosphere of exposure and the consistency values determined by the method of application. The addition of MICROPLUS or MICROSTANDARD results in significant increases the cohesion of the mixture. It follows that the basic concrete for the use of the additive must be designed and/or ordered from the plant, with a consistency class of a higher grade than originally anticipated. The correct mixing and homogeneous distribution of MICROPLUS or MICROSTANDARD, with the components of concrete are essential prerequisites. Particular attention must therefore be paid to prolonged, protracted mixing until the sure elimination of lumps. In any case, MICROPLUS and MICROSTANDARD can be added either in the mixing plant by gradually distributing it on the aggregate conveyor belt, or directly in the concrete mixer truck at the job site. In the second case, you can use the following rule of thumb: 1' of mixing, at the maximum speed of rotation of the drum of the concrete mixer, for every cubic meter of concrete. Concrete with MICROPLUS and MICROSTANDARD is to be considered a high-quality concrete, for all effects. As such it requires the usual techniques of good practice during preparation, mixing, transporting, placing and curing. The latter must be particularly accurate and prolonged in time.
Concrete with MICROPLUS or MICROSTANDARD, can not only be easily transported and poured with a pump, but in most cases, the addition of MICROPLUS OR MICROSTANDARD even the most difficult concretes easy to transport with a pump .

Polypropylene and polyolefin reinforcing fibres

FIBRE ECOMICS 180

FIBRE ECOMICS 180 is an auxiliary poly-propylene multifilament micro-fibre, with a length of 18 mm., suitable for the addiction of concrete conglomerates. The addiction of FIBRE ECOMICS 180 to the mixture allows to contrast the phenomenon of plastic retreat split of the concrete, in addiction to having positive effects on the ductility of the mixture, frost- defrost resistance, push resistance and the whole waterproofing.
Ecomics 180 fibres can be added up the concrete as during the making up as to the mixture prepared before. The special sacks in degradable paper in alkaline background allow the direct inlet in the mixer. In this case it is possible to use the following rule: 1' of mixture at the maximum speed of rotation of the mixing drum, each m3 of concrete. Packaging: Boxes of 12 kg with 12 sacks 1 kg each Consumer 1 kg./m3 of concrete (n.1 sack)

FIBRE STRUCS 540

Fiber Strucs 540 is a structural polyolefin macro-fiber , at high performance, better adherence, 54 mm. length, specific for the realization of industrial floors and concrete surfaces, usable in replacement of traditional steel reinforcement too (only under approval of the structural engineer).

Fibre ECOMICS 180 Fibre STRUCS 540

MODEL	TYPE	LENGTH	MATERIAL	APPLICATION
ECOMICS 180	Auxiliary	18,0 mm	Polypropylene	Concrete in general
STRUCS 540	Structural	54,0 mm	Polyolefinic Mixture	Industrial floors, foundations, civil engineering in general, prefabrication, structural application in general

Hydroexpansive waterstop made of sodium bentonite and rubber

WATERSTOP B/25.20

Preformed hydroexpansive joint sealer for the hermetic sealing of casts in structures, walls and foundations, made with a mixture of sodium bentonite and special aggregating polymers, it is normally fixed in the work, preliminary to pouring the concrete, by riveting. Potential expansion = up to 4-5 times (volume). Dimensions = 25x20 mm in 5-meter rolls. - Packaging = boxes with 6 rolls (30 m) - Appearance: Cord - Colour: black - Packaging: 30-m box.

WATERSTOP G/20.20

Waterstop sealant based on a special mixture of natural and synthetic rubbers and hydrophilic and hydroexpansive agents: in contact with water increases its volume to more than 3 times its original size. Field of use: Construction of connections with a secure and permanent hydraulic seal. Packaging: boxes with 4/10-ml rolls for a total of 40 linear meters/box.

WATERSTOP G/20.10

Preformed hydroexpansive joint sealant, for joints and hermetically-sealed connections in structures, walls and foundations, etc.; made of special rubber hydro-reactive. Installed by riveting or with the aid of GASKET FLEX water-reactive sealant. Expansion potential: up to 3 times (volume).
Packaging: boxes with 4/10-ml rolls for a total of 40 linear meters/box.

FLEX GASKET

A hydroexpansive sealant in a thixotropic paste, pre-packaged in an extrudable 300-cc cartridge. With normal dosing pistols for the creation of hermetic seals at connections, holes, cavities, cracks, formwork blades, etc.

Waterproof PVC waterstop

PVC GASKET - RG 250

The PVC GASKET - RG 250 waterstop is an impermeable PVC profile with high elasticity; it is used in horizontal (large slabs) or vertical (elevation walls) connection joints in concrete structures in a central position in the casting. Due to its special composition, it can be cut with a knife and welded with simple heat-sealing tools, thus making easy to make connections during the course of the work. Width of the waterstop: 25 cm - Minimum package: 25-m roll.

PVC GASKET - RGF 250

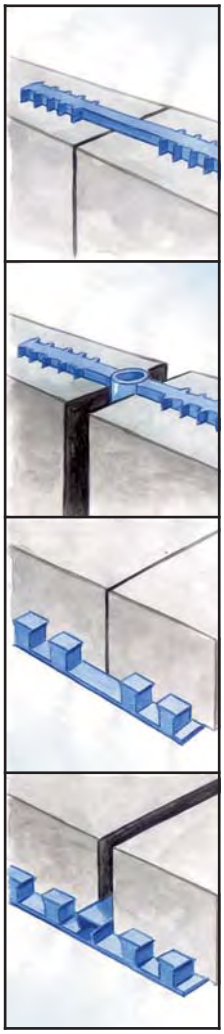
The PVC GASKET - RGF 250 waterstop is an impermeable PVC profile with high elasticity; equipped with a centre bulb, it is used in structural joints (movement), horizontal joints (large slabs) or vertical joints (elevation walls) in concrete structures, in a central position in the cast. Due to its special composition, it can be cut with a knife and welded with simple heat-sealing tools, thus making easy to make connections during the course of the work. Width of the waterstop: 25 cm - Minimum package: 25-m roll.

PVC GASKET - 4TV 240

The PVC GASKET - 4TV 240 waterstop is an impermeable PVC profile with high elasticity; it is used in construction horizontal casting joints (large slabs) or vertical joints (elevation walls), in concrete structures, supported on substrates under the reinforcement. Due to its special composition, it can be cut with a knife and welded with simple heat-sealing tools, thus making easy to make connections during the course of the work. Width of the waterstop: 24 cm - Minimum package: 25-m roll.

PVC GASKET - 4TB 240

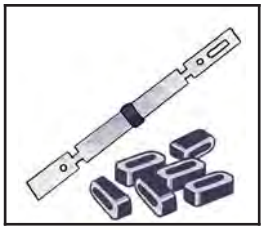
The PVC GASKET - 4TB 240 waterstop is an impermeable PVC profile with high elasticity; equipped with a centre bulb, it is used in structural joints (movement), horizontal joints (large slabs) or vertical joints (elevation walls) in concrete structures, supported on substrates under the reinforcement. Due to its special composition, it can be cut with a knife and welded with simple heat-sealing tools, thus making easy to make connections during the course of the work. Width of the waterstop: 24 cm
Minimum package: 25-m roll.



Hydroexpansive gaskets and plugs for waterproofing formwork spacers

RING GASKET L 19

Hydroexpansive gasket for hermetically sealing with panels and formwork with metal blade spacers, which is applied in a central position with respect to the pacers with a special “three-nose pincer". Consumption per formwork blade = no. 6-8/m^2 of formwork. Appearance: Ring gasket - Packaging: Box 200 pieces.



RING GASKET T 21

Hydroexpansive gasket for the hermetic sealing of panels and formwork with tubular PVC spacers, which are applied in a central position with respect to the spacers. Consumption per tubular = no. 1-2/m^2 of formwork. Appearance: Ring gasket - Packaging: Box of 100 pieces.

CORK GASKET T 21

Hermetic closing device for tubular formwork spacers consisting of a rigid core of polyamide plastic and a corrugated, hydroexpansive rubber cap; applied with hammer and riveter. Consumption per tubular = no. 1-2/m^2 of formwork.
Appearance: Plug - Colour: blue - Packaging: Box of 100 pieces.

Complementary products

FLUID ENTER

This is a mono-component impregnating protectant based on modified waterglass. A waterproofer and consolidator, it gives concrete extraordinary protection against degrading agents such as acids, salts and sulphates. Applied with a low-pressure manual or electric (airless) pump, FLUID ENTER is a permanent treatment that deep-seals the pores of the cement matrix, making the concrete resistant over time to the penetration of water, chemical attack and freezing-thawing. Consumption: the product's yield per square meter varies as a function of the absorption capacity of the surface treated. In general, it is good practice to treat concrete to saturation. In our experience, the typical dosage ranges from 2 to 4 m²/liter. Conservability: 12 months in an unopened and protected package.

TECNO LATEX

A flexibilizing, reactive latex adhesive based on acrylic resins in aqueous dispersion, for improving the adhesion, deformability, and performance of mortars and plasters. The methods and quantities of use vary depending on the needs of use, based on the indicative mixtures shown on the product data sheet. Packaging: 5, 10 and 25-kg drums.

UNDERGROUND STRUCTURES, BELOW THE WATER TABLE, IN WATERPROOF CONCRETE

BETONSAFE
SLEEP WELL

HOW IT IS MADE (Specification information)

1. Mixing and pouring concrete with high intrinsic impermeability:
- The characteristics of the concrete must be consistent with UNI EN 206-1;
- The minimum dosage of PTL 32.5 or 42.5 R cement to use for its preparation must not be less than 300-350 kg/m^3 (Rc 25-30 N/mm^2)
- The aggregates selected should be of suitable diameter, clean and on a continuous particle size curve;
- To improve the characteristics of intrinsic impermeability and resistance to sulphates, chlorides and washing away and reduce the water/cement ratio while maintaining workability, the polyvalent MICROSTANDARD or MICROPLUS powder additive of the BETONSAFE method must be added with dosages variable with the type of use.

2. In order to achieve the necessary crack-resistance, three-dimensionally-diffused reinforcement must be obtained through the addition of the special mix of fibrillated polypropylene fibres and multifilament mesh, FIBRE ECOMICS 180 of the BETONSAFEmethod of a length of 18 mm, in the ratio of 1kg/m^3 (no. 1 bag/m^3).

3. Hermitically sealing the connections and joints through the preparation, during installation, of hydroexpansive waterstops: Preparation of seals at connection points, both horizontal and vertical, through the installation of waterstops made of sodium bentonite and aggregating polymers such as, WATERSTOP B/25.20 of the BETONSAFE method, with a section 25 x 20 mm and an expansive capacity of about 4-5 times its initial volume.

4. Construction of suitable formwork, connected through spacers fitted with sealing devices: The containment formwork must be adequate to supporting the hydrostatic pressures of fresh concrete without moving or being deformed. The formwork in question must have sealing devices installed consisting of hydroexpansive rubber spacers:
- RING GASKET L-19 of the BETONSAFE method for blade formwork spacers of section of about 19 mm.
- RING GASKET T-21 and CORK GASKET T-21 of the BETONSAFE method for PVC tube formwork spacers, with an inner diameter of about 21-22 mm.

APPLICATIONS OF “BETONSAFE TECHNOLOGY”
WHY YOU SHOULD SELECT THE "GUARANTEED TURNKEY" OPTION

The fear that the requirements of the project will not be accurately constructed by normal workers, sometimes exacerbated by the memory of past failures caused by blatantly ineffective, though often widely publicized, waterproofing methods are the basis for the increasingly frequent need **to have mathematical certainty that expectations will be respected.** Indeed, the construction and performance of underground structures below the water table are often characterized by absolutely unacceptable results to the point that the consequences deriving from them in terms of infiltrations, flooding, subsidence, etc., the most common reasons for disputes in civil, industrial and hydraulic construction.

The solution to this problem is to totally rely on the experience of an organization, backed by the knowledge gained in over twenty years of construction, both small and large, that manages workers and supplies of special materials need for the "professional" execution of the "waterproof" work in a coordinated way, allowing customers **to award the work in the reassuring formula of "turnkey-guaranteed".**

The savings of time, expense and energy by the designer and customer resulting from this approach to the problem are entirely obvious. Moreover, the security of the "turnkey-guaranteed" system is also concretely formalized at the end of the work through the drafting of an insurance policy to guarantee the works.

APPLICATIONS	UNDERGROUND STRUCTURES - SQUARE, RECTANGULAR AND CIRCULAR TANKS WATER CHANNELS - BIOGAS PLANTS - POOLS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1) Pavia
2) Morazzone (VA)
3) Novara
4) Brienno (CO)
5) Lecco - Via Quarto
6) Galbiate (LC)
7) Carate Urio (CO)
8) Menaggio (CO)
9) Lecco - Via Valsecchi
10) Pallanza (VB)
11) Casnate con Bernate (CO)

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12) Melano (Svizzera)
13) Busto Arsizio (VA)
14) Montalcino - loc. Castelgiocondo (SI)
15) Piacenza
16) Semogo (SO)
17) Pian del Vino (SO)
18) Cantù
19) Livigno (SO)
20) Pognana Lario (CO)
21) Abbiategrasso (MI)
22) Melano (Svizzera)

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23) Gornate Olona (VA)
24) Verbania
25) Olgiate Comasco (CO)
26) Bormio (SO)
27) Bisuschio (VA)
28) Olgiate Molgora (CO)
29) Milano (Muggiano)
30) Portichetto (CO)
31) Fiordalpe (SO)
32) Laglio (CO)
33) Campione d'Italia (Svizzera)


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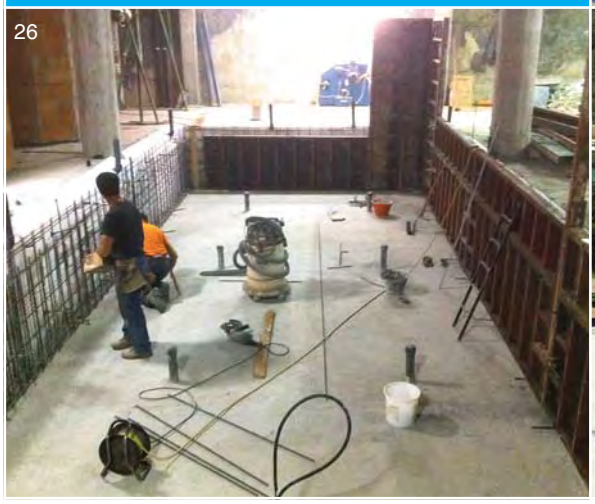
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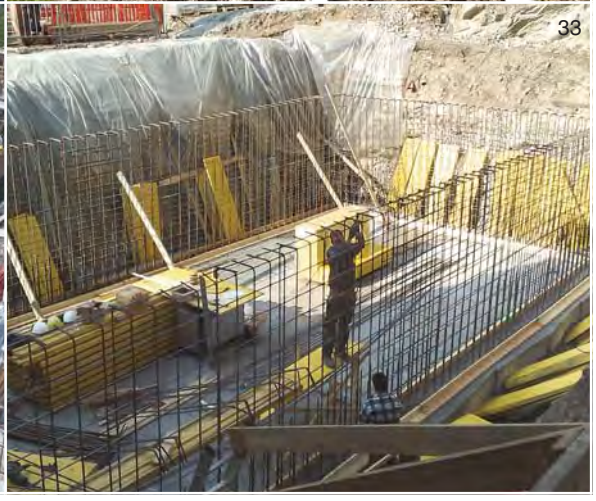
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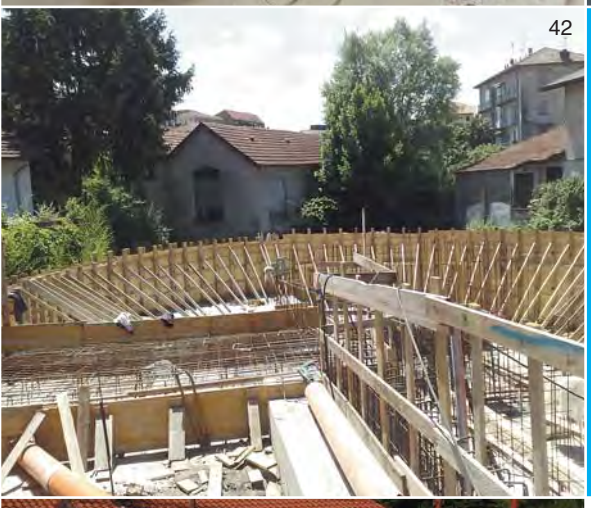
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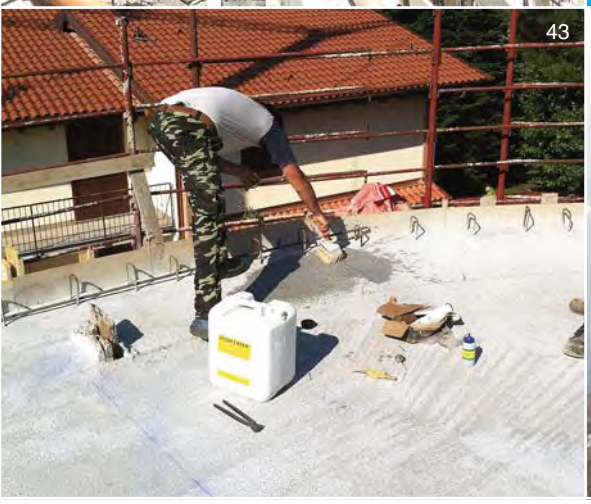
34) Gazzada Schianno (VA)
35) Bergamo
36) Porlezza (CO)
37) Sousse (Tunisia)
38) Binago (CO)
39) Carugo (CO)
40) Sumirago (VA)
41) Gorgonzola (MI)
42) Arona (NO)
43) Varese
44) Torno (CO)

....See more references on www.betonsafe.it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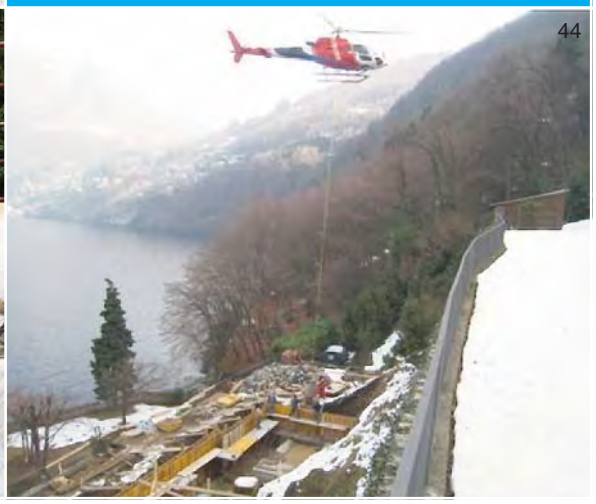
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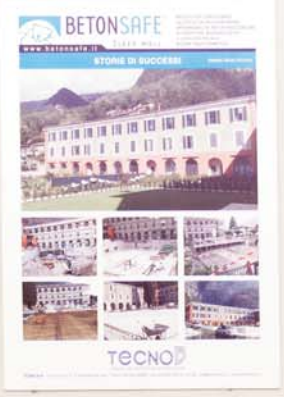

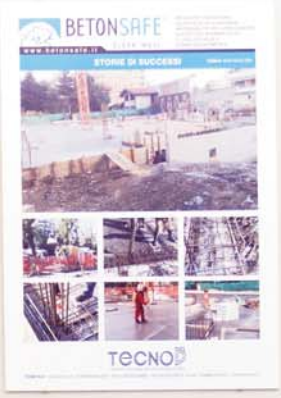

TECNO B srl is a firm constantly undertaken in the research and development of solutions and technologies in specialized building.
It intervenes with high qualified technicians in the resolution of complex problems as block of seepage water, masonry restoration, realization of structural reinforces and concrete waterproofing structures, giving a full service from the specific analysis of the situation to solve, to the after sales assistance.
The enthusiasm and the will to undertake in this important market sector about the waterproofing of the groundwater structures are the power to grow and since 1999 TECNO B srl has produced the main components of the Betonsafe method in the plant in Goito (Mantova - Italy), 16/a Giovanni Gentile road.

Additional information
on this subject can be found on our website

www.betonsafe.it

BETONSAFE
SLEEP WELL

TECNOB
PRODOTTI E SOLUZIONI PER L'EDILIZIA SPECIALIZZATA

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