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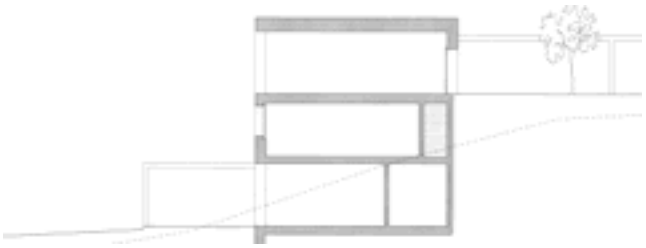
Modern architecture in Switzerland

Monolithic with

For Patrick Gartmann, concrete has a special fascination. The Swiss engineer and architect's dedication and creativity in the handling of this material becomes clear from a visit to his own house near Chur in the canton of Graubünden. The monolithic design of the building conveys an impressive sense of modern aesthetics. To make this "poured-in-place" concept a reality, Patrick Gartmann chose Liapor's innovative insulating concrete which is manufactured by combining the lightweight aggregates Liapor expanded clay and Liaver expanded glass.

"Living rough": The untreated construction materials used in the building give a primitive, unadorned impression.



Patrick Gartmann's house sets new standards thanks to the use of Liapor insulating concrete.

Liapor insulating concrete

The Böschenstraße, a street in Chur, passes alongside the eastern foot of the Hochwang mountain (2,532 m) and offers a fascinating panorama. The view plummets from on high down to the Rhine valley below: to the left, the city of Chur and, to the right, on the opposite bank of the river, the slopes of Mount Calanda (2,697 m). This is the site for the house where Patrick Gartmann, of the engineering firm Conzett, Bronzini, Gartmann AG, Chur, now lives. For his residence, the architect designed a three-storey dwelling conceived as a monolithic concrete construction which stands between two similar buildings on the slopes of the Hochwang.

A tour of the construction

When you step off the Böschenstraße and into the courtyard, the first thing you find is a flat-roofed building similar to a bungalow. This third, topmost floor is the entry point and provides access to the other storeys. However, it also accommodates the living room and adjacent bedroom which is separated from the stylish bathroom by an opaque, sand-blasted sliding glass partition. The living room contains a number of special features: The two large windows that face one another on the eastern and western sides of the room provide interesting inward and outward views. The fact that Patrick Gartmann feels at home on a building site has contributed much to the design of the house. The visitor soon discovers where the charm of `living rough' lies. The untreated construction materials used in the building give a primitive, unadorned impression. This is why the living room with its ground though unpolished concrete floor which incorporates an underfloor heating system feels unusual. Walking over the raw concrete, it is easy to feel its deliberate roughness. The walls, too, are made of concrete and were again left untreated after the removal of the formwork – just like the ceiling which simultaneously acts as the flat roof. Here, Liapor's insulating concrete with its above-average thermal insulation properties plays a particularly important role.

Above the EXPO

After the visitor has passed through the entrance area, a staircase branches off to the two lower floors. This is precisely aligned with the building's North/South axis and the interesting play of light it lets in causes the concrete to glow in a range of different shades. The middle floor houses a large workshop with three amply-sized windows and an incomparable view over Chur and Mount Calanda. This storey again reflects the architect's desire to achieve something pure, untainted and natural. Thus, the radiators have a natural steel finish and are neither painted nor enameled. Another interesting detail: On several occasions, Patrick Gartmann has worked with the Swiss urban architect Peter Zumthor and, as a consequence, was involved in the planning and realization of the Swiss Pavilion at the EXPO 2000 in Hanover. From this greatly admired, harmonious Swiss ➔

construction in the form of a spatial structure measuring 50 by 60 meters of overlaid Scots and Douglas pine, Patrick Gartmann secured a small number of wooden planks which he then converted to create a wooden floor. Descending the stairs once again, the visitor finds the generously-sized kitchen/living room which measures approximately 5.5 x 13.5 meters. The openings on the western side consist exclusively of sliding glass doors. These provide access to the 100 m² veranda and a garden measuring 350 m².

This modern building offers impressive internal and external views.

Architect profile

Patrick Gartmann

- Born in 1968, Engineering diploma (FH) and architecture diploma (FH/STV).
- Studied as a structural engineer at the Chur Academy of Technology and Economics (HTW). Graduated 1994.
- Studied architecture at Chur HTW. Graduated 1998.
- 1998 – 2000 Assistant to Valerio Olgiati at Zurich's Technical University (ETH).
- Since 2001 Lecturer in IT and Construction Principles at Chur HTW.

Alongside many surface constructions, the engineering firm Conzett, Bronzini, Gartmann AG, Chur, has constructed more than 20 bridges in the canton of Graubünden, including the award-winning Pùnt da Suransuns Viamala.

Conzett, Bronzini, Gartmann AG
Dipl.-Ingenieure ETH/FH/SIA,
Bahnhofstraße 3, 7000 Chur
www.cbg-ing.ch

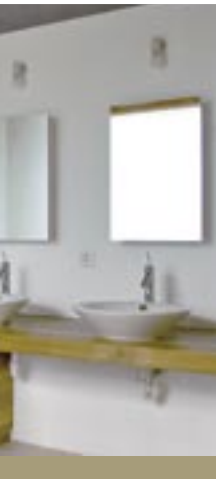
Monolithic construction

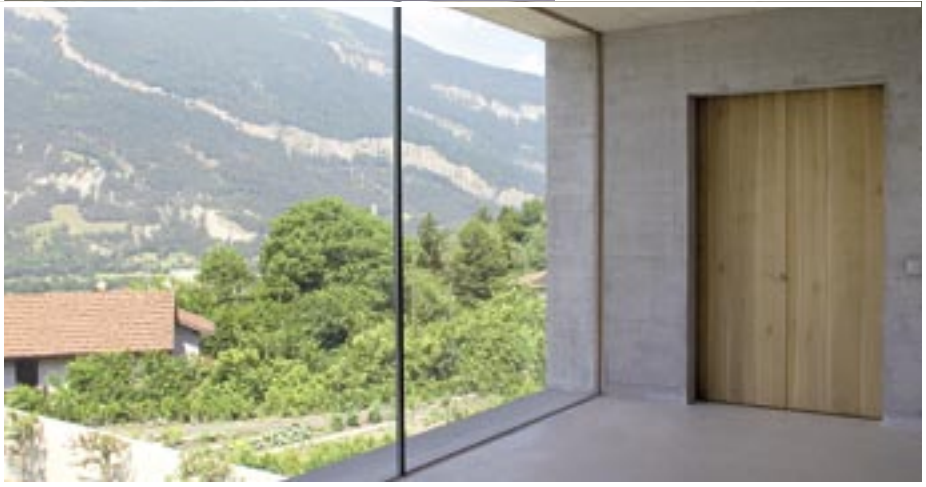
Monolithic constructions are characterized by the fact that the walls and ceilings consist of only a single layer. Concrete products such as the Liapor insulating concrete mentioned above provide not only the required stability but also the desired insulating properties. There are no vapor barriers, insulation layers or plaster. Consequently, the construction phase consisted simply of removing the formwork and drying the resulting structure. This monolithic construction method not only reduces the effort and time required for building. The concrete surfaces that are produced are so uniform and finely structured that no additional treatment or finishing is required. The aesthetic impact they make has a contemporary feel in all respects. In Gartmann's creation, the walls and ceilings are constructed from concrete or Liapor insulating concrete depending on the static requirements and desired insulation values. Liapor insulating concrete is the ideal material for modern, monolithic constructions. Thanks to its above-average thermal insulating properties, it ensures long-term energy savings even when used in monolithic constructions. The thermal insulation values can be modified slightly by adapting the concrete mix as required.

Liapor expanded clay and Liaver expanded glass

Liapor's innovative insulating concrete (patent applied for) represents an intelligent mixture of cement and the lightweight aggregates Liapor expanded clay and Liaver expanded glass. Both expanded clay and expanded glass are manufactured using a similar granulation and burning process. After careful preparation, the raw clay used for Liapor is fired in a rotary oven at a temperature of approximately 1,200 °C. This operation burns off the evenly and finely distributed organic components in the clay. The clay spheres expand, resulting in the air-entrained ceramic expanded clay. Liapor expanded clay possesses a somewhat rough, closed surface coupled with a uniform, fine internal pore structure. Liaver, a member of the Liapor Group, produces its identically named expanded glass granulates using a patented procedure with high-quality recycled glass as the raw material. Liaver is a mineral-based, fiber-free, ecological material with a uniform, fine-pored structure and a broadly closed surface. Both Liapor expanded clay and Liaver expanded glass are characterized by low unit weights which form the basis for their outstanding thermal insulation properties. Consequently, Liapor insulating concrete can be manufactured at a low specific gravity of less than 1,000 kg/m³. Liapor's optimum particle strength and the high compressive strength of the expanded glass granulates pro-

The concrete walls were left unadorned after the removal of the formwork.





Outstanding
The architectural journal "Hochparterre", the Swiss television program "Kulturplatz" (broadcast by DRS) and Zurich's famous Design Museum combine to form a highly-respected Swiss committee that awards prizes every year for outstanding achievements in the field of architecture, landscape design and design.
Patrick Garmann's house in Chur was awarded the architectural award "Silberner Hase für Bestleistung Architektur 2004" for the overall creation consisting of the underlying architectural idea and the innovative Liapor insulating concrete used to realize it.

vide the perfect basis for a wide range of applications in the construction sector: from lightweight aggregates for lightweight concrete, mortar and plaster products through to formwork.

Special formula

The air inclusions that characterize Liapor expanded clay and Liaver expanded glass ensure an excellent level of thermal insulation. Thermal bridges are particularly rare in monolithic constructions. The special formula used for Liapor insulating concrete makes it possible to adapt the structure that is to be created to the specific requirements in terms of compressive strength and thermal insulation. During the design and construction of his house, Patrick Gartmann benefited from the cooperation of Daniel Meyer and Walter Capatt. Daniel Meyer, Managing Director of Liapor Switzerland, launched a series of laboratory tests designed to identify the ideal insulating concrete. The preferred cast concrete prototypes were then subjected to stringent EMPA tests. Walter Capatt, technical director of Calanda-Beton AG in Chur, was responsible for ensuring that the ratios resulting from the laboratory work were perfectly replicated on site. The Calanda concrete works delivered the concrete mixes to the site on a just-in-time basis precisely as specified. The Liapor insulating concrete used for the construction possesses a lambda value of 0.32 W/(mK) thus making it possible to achieve a heat transmission coefficient of 0.53 W/(m^2K).

Concrete and glass

Patrick Gartmann's modern, monolithic house is not impressive because of its architectural design alone. It sets new standards thanks to the use of Liapor insulating concrete. The beautiful, even surface of Liapor insulating concrete meets exacting aesthetic demands and points the way toward the use of exposed concrete. The second design element featuring in Gartmann's structure is glass which is perfectly complemented by the exposed concrete. The structure contains approximately 90 m^2 of glass in the form of windows, sliding windows and sliding doors. And one more special feature: the glass/concrete joint is realized using an invisible technique which means that there is no need for wooden frames. ●

Further information:

Liapor Schweiz Vertriebs GmbH
Phone ++41 (0)62 / 206 91-20
info@liapor.ch
www.liapor.ch

Frankfurt/Oder district and local court

Liapor lightweight concrete for Brandenburg's court house

The new district and local court in Frankfurt/Oder has a monolithic design achieved using Liapor LB 15 lightweight concrete which boasts the qualities required of exposed concrete. The concreting activities were completed in September 2004 and the legal departments' employees are now in full possession of their new building.

The newly constructed district and local court in Frankfurt/Oder forms part of a building program undertaken by the State of Brandenburg to accommodate its courtrooms and District Attorney's office. The Berlin-based architects Bumiller & Junkers decided to realize all the elements of the facade using Liapor lightweight concrete.

Lightweight concrete chosen for design reasons

The new complex of buildings on the Müllroser Chaussee is enclosed in a square space which results in a rectangular internal courtyard. A rectangular annex at the rear of the complex reaches through to the atrium. The compact overall design is emphasized by the monolithic appearance of the new court buildings. Only by using lightweight concrete was it possible to satisfy the architectural demands placed on the facade. Lightweight concrete gives the buildings a sculptural quality while simultaneously providing the necessary thermal insulation qualities. "The sculpted design of the walls was only possible by using a single-skin construction in exposed concrete quality," says Georg Bumiller to explain the architectural concept. "We could never have achieved this compact, monolithic impression by employing a multilayered cladding technique. Since the design of the surface plays a crucial role, the wall could not have any inclusions or uneven areas." The choice of material was also prompted by the customer's functional requirements. For example, the way the facade has been designed using lightweight concrete also meets the requirement for flexible room sizes. As the architect explains, "the facade had to be equipped with numerous connection points for the partitions. "Apart from an aesthetically less pleasing grid facade, the only option was to construct a lightweight concrete facade." A total of approximately 3,500 cubic meters of densely textured Liapor LB 15 lightweight concrete was used for the facade of the court building which measures between 60 and 90 centimeters in thickness. This external wall was constructed as a pilot project during which a number of institutes provided scientific support. The employed lightweight concrete consisted of Liapor expanded clay spheres with a grain size of 2 to 8 millimeters, Liapor K sand of 0 to 2 millimeters, fly ash, additives and water. This formula resulted in a low thermal conductance level of $\lambda = 0.45$ W/(mK) coupled with a bulk density of only 1.2 kg/dm^3. Thanks to this special composition, Liapor lightweight concrete is able to achieve strength class 15 despite its low weight. This means that it is just as strong as normal concrete.

Exposed concrete quality

The Liapor lightweight concrete was supplied by the company Lichtner Beton GmbH & Co.

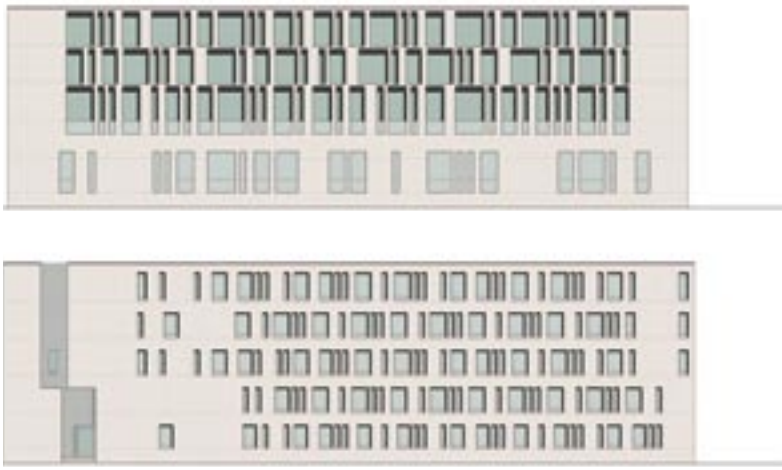
Construction details

- Client: Frankfurt/Oder state planning department
- Design: Bumiller & Junkers Architekten, Berlin www.bumillerarchitekten.de
- Planning of the substructure: Pichler Ingenieur, Berlin
- Gross volume: 20,000 cubic meters
- Usable surface area: 6,600 square meters
- Building costs: 19.6 million euros
- Construction period: two years, nine months
- Concrete supplier: Lichtner Beton, Berlin

The multi-level foyer (left), galleries providing access and waiting areas (right) .

All the facade elements of the Frankfurt/Oder district and local court are made from Liapor lightweight concrete.

Betriebs KG Berlin from its site in Frankfurt/Oder. "This was the first time we had worked together with Liapor and we are very happy with the end result," explains Thomas Crimmann from Lichtner Beton. "Using Liapor as an additive proved to be the best way of meeting the exacting requirements concerning the uniformity of the material." Stationary tower cranes delivered the material directly to the formwork structure via movable containers and flexible hoses. This was then compacted by means of needle vibrators. Thanks to its excellent flowability and low level of shrinkage, Liapor lightweight concrete can be compacted quickly and forms a uniform surface structure with no blisters or rough areas. This was the reason for choosing it for use as exposed concrete for the construction of the Frankfurt/Oder district and local court. "At the same time, a construction using Liapor lightweight concrete was attractive because it is such a cost-effective material," says Georg Bumiller.



The design makes a compact, monolithic impression.

A rectangular construction

This new five-floor building constructed at the edge of the city of Frankfurt/Oder is located close to a group of former barracks. The layout of the Frankfurt/Oder district and local court radiates outwards in all directions. This has made it possible to delineate clearly between the judiciary and the executive and create a potent symbol for the city and the surrounding countryside. The rectangular construction whose sides measure approximately 60 meters in length has two office wings and a set of public chambers. After crossing a small inside courtyard, visitors reach the multi-level foyer that provides access to the chambers which are also arranged on a number of different storeys: on the one side, a public space within the building and, on the other, a link providing access to the courtrooms. The courts of criminal justice occupy the two lower levels of public chambers while civil cases are heard in the smaller courtrooms on the upper floors. The galleries which converge on the central hall serve provide both access and waiting space. In the newly constructed district and local court in Frankfurt/Oder, Liapor lightweight concrete has been able to prove its versatility, its aesthetic potential and its many construction-related capabilities. Liapor lightweight concrete can be supplied in individually tailored settled and bulk densities as well as with a variety of grain sizes. This gives architects great freedom during their design work. ●

Further information:

Liapor GmbH & Co. KG
Phone ++49 (0) 95 45 / 448-0
info@liapor.com
www.liapor.com

The building was intended to be unadorned and natural, conceived as a concrete foundling in the forest. That is how architect Rüdiger Trager designed his house which he had constructed in a monolithic design from Liapor insulating concrete. With its clean, pure lines, the house fits like an inhabited cave into the slopes that border the city of Heidelberg. The unfinished feeling of the construction with its rough concrete surfaces and the limited use of other natural materials such as oak and glass emphasize the building's striking, natural look.

A monolithic construction using Liapor insulating concrete

Total aesthetics

Northern view

in Heidelberg

Western view

The "inhabited cave" burrows deep into the hillside.

When designing the house in which he wished to live, Rüdiger Trager was inspired by the building land itself which is located on a steep, wooded slope in a long, narrow valley in Heidelberg. Another factor was his love for concrete as a building material. As a result, Rüdiger Trager, a partner in the Heidelberg company ap88 Architekten, found out everything he could about monolithic construction techniques and Liapor as a building material. It did not take long for him to decide to use a monolithic approach to the design of his own home.

Constructed on the slope

The three-floor house constructed from Liapor insulating concrete is set back from the double garage and burrows far into the slope. A steep outside stairway leads from the garages to the lower floor which is entered through an imposing oak door and gives access to the office space. A concrete stairway rises to the ground floor with its centrally located kitchen/living room. This room, which the Trager family planned to be at the center of their house, combines the functions of a passage way and living room. It is here that the family meets to talk and enjoy one another's company – in particular, the bench made out of a single piece of oak in the corner of the room is a popular meeting place. Here, the large panoramic window provides a wonderful view of the surrounding countryside.

From the kitchen, it is possible to access all the private rooms in the ground and first floor along a narrow corridor. These private spaces follow one another like a string of pearls. One of these is the amply-sized ground floor living area, a polygon with walls that meet at oblique angles and a sloping ceiling whose height of 5.5 meters gives the visitor the feeling of being in a cathedral. It is the diagonal that determines the feeling of space since the rooms are accessed from the corner of this area. As a result, most of the windows are located in the opposite corner and offer a view of the luxuriant natural environment outside. The staircase leading up from the living area leads to the top floor which accommodates the bedrooms, children's rooms and bathroom.

Natural building materials

The client and the architect chose to use simple, shuttered concrete for the walls, ceilings and staircases as well as for the gable roof with its mixture of inclines. The floors are also characterized by a simple, natural design. Here, Rüdiger Trager chose smoothed screed except in the private rooms where oak boards are used. All the fixed installations are manufactured from MDF wood panels. "As a result, the design and crafting have an immediate, authentic impact," explains Rüdiger Trager who decided to employ only the three natural building materials: concrete, wood and glass. This natural impression is further supported by the vegetation which is typical of the building's location at the edge of the forest. The land, which covers approximately

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Deliberate simplicity: untreated lightweight concrete surfaces.

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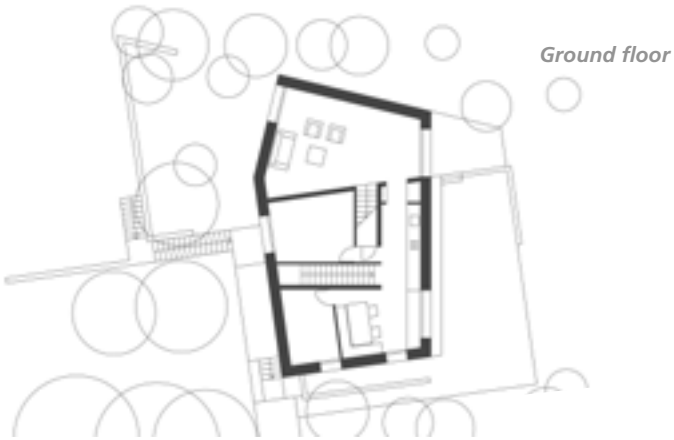
760 m², was planted with large trees, shrubs and fruit trees. Gravel is used for the paths and relaxation areas. The owner decided to use no ornamental plants since he wants nature to reclaim the land.

Monolithic construction

To ensure that all the external walls and roof coverings complied with the requirements of the German energy savings regulations and were manufactured from locally sourced concrete, all the external elements were cast in one piece to a thickness of fifty centimeters using Liapor insulating concrete. All the internal walls and ceilings are made of normal concrete. The surfaces of the various elements were either left unfinished or oiled. The monolithic construction is impressive not only due to its striking visual impact, rough surface structure and outstanding thermal insulation properties thanks to the use of lightweight concrete, but also due to the considerable reduction in construction time resulting from this technique.

The Trager family was able to move into their new house in November 2006, just two months after the carcass work had been completed. However, a certain amount of preliminary work was required in order to identify the right formula for the concrete used in the external walls and the ceiling. In Adrian Wolf, sales adviser at Liapor GmbH & Co. KG, Rüdiger Trager found a skilled partner who, in cooperation with the local concrete supplier Kurpfalzbeton GmbH, was able to develop the perfect mix for the task. First of all, sample panels were manufactured, followed by a trial wall using a number of different formwork variants. As an architect, Rüdiger Trager decided for a simple and no longer totally new steel shuttering system which met the needs of the divisions provided for by the floor plan. As a result, the rough surfaces of the walls seem to be bursting with vitality despite the simplicity of the employed material. The marks left by the shuttering, clamp marks, nail holes and scratches were all a part of the architect's vision.



Straight lines, untrammeled aesthetics: the house belonging to architect Rüdiger Trager in Heidelberg

Liapor expanded clay

Liapor insulating concrete is the ideal building material for monolithic constructions since, in most cases, it meets all the requirements relating to bearing strength, safety, resistance to heat and damp as well as fire resistance and acoustic insulation much better than conventional concrete. This is due to the use of Liapor expanded clay spheres as a lightweight aggregate together with a formula versatile enough to cope with any construction project. Ceramic Liapor expanded clay possesses a somewhat rough,

Architect profile

Rüdiger Trager

Born in 1969
Engineering graduate
Independent architect and member of the German Architects' Association (BDA)
Studied architecture at Kaiserslautern Technical Academy
Graduated 1994.
Since 1997: ap88 Partnership of architects and member of the BDA 2002

His work focuses on multistory residential and commercial buildings and he regularly takes part in national and international competitions at which he is able to attract new customers and put his own achievements and innovative prowess to the test

ap88 Architektenpartnerschaft
Bellm, Löffel, Lubs, Trager
Freie Architekten BDA
Sickingenstr. 39
69126 Heidelberg
www.ap88.de

The structure shows just what goes into Liapor lightweight concrete: top-quality expanded clay for optimum thermal insulation.

closed surface coupled with a uniform, fine internal pore structure. Though low-weight, Liapor provides optimum particle strength and therefore constitutes an excellent building material. Liapor expanded clay is characterized by low unit weights which form the basis for its outstanding thermal insulation properties. The lightweight concrete made of Liapor expanded clay and CEM III cement used for the external skeleton of the Trager family house belongs to strength class LC8/9 and possesses a bulk density of 1000 kg/m^3. Thanks to its low weight, this lightweight concrete is able to achieve extremely good insulating values. Liapor insulating concrete possesses a lambda value of 0.36 W/(mK) thus making it possible to achieve a heat transmission coefficient of 0.6 W/(m^{2}K) in the walls. The roof was also constructed using lightweight concrete. However, concrete of strength class LC 12/13 with a bulk density of 1200 kg/m^3 was used for this application. The heat transmission coefficient of the roof is also 0.6 W/(m^{2}K).

A versatile visual impact

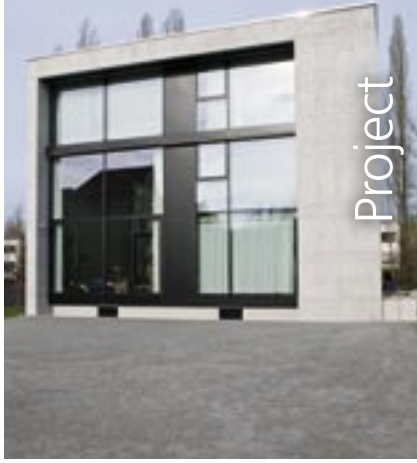
The composition of the concrete would normally have meant that extensive form removal times were required after casting. However, because the client's requirements in terms of the concrete surface were not exacting, it was possible to reduce these times to only three to four days. Shortly after the removal of the formwork, the concrete surface on the outside of the building was treated with a water-repellent agent to prevent any moisture penetration. All the internal walls were left with their natural appearance unchanged. "The walls in our house should radiate with their pure beauty. There are no images to disturb the visual impression, the versatility of the concrete makes its own impact," explains Rüdiger Trager as he describes the aesthetics of the striking concrete surfaces. The client and his family were also able to experience the climatic benefits of Liapor insulating concrete during the past summer. "The internal ambience is considerably better than with normal concrete and offers excellent protection against heat in the summer," says the building's owner whose thermometer never climbs above 23 °C in the living areas even on hot summer days. The house possesses geothermal heating.
The Trager building in Heidelberg is a further illustration of the versatility of Liapor lightweight concrete and the ease with which it can reconcile designers' ambitions with the applicable legislation, building regulations and technologies. It is the natural look of Liapor insulating concrete that opens up new outlooks and creative alternatives in the field of architectural design. Thanks to its beautiful, even surface, Liapor insulating concrete is ideally suited for exposed concrete applications in striking residential buildings, as architect Rüdiger Trager has shown in the design of his own house. Back to nature and humanity's roots is the owner's credo – and it is precisely this that he has achieved with his "inhabited cave" on the hilly slopes near Heidelberg. ●

Further information:

Liapor GmbH & Co. KG,
Phone ++49 (0) 95 45 / 448-0
info@liapor.com
www.liapor.com

Monolithic construction with

There is nothing unusual about an architect designing his own house. However, if the construction also has a scientific use then the building becomes something special. Like the house which Professor Mike Schlaich designed as a monolithic construction made from superlightweight concrete and in which he now lives. The Managing Director of the renowned engineering firm Schlaich, Bergermann and Partners has made his family home in the east of Berlin available to science almost as if it were a test center. Together with his team and in close cooperation with Liapor, Schlaich, working at Berlin's Technical University, has developed a superlightweight concrete which exhibits outstanding thermal insulating properties coupled with a dry unit weight of less than 800 kg/m³ thanks to the use of Liapor expanded clay as a lightweight aggregate.

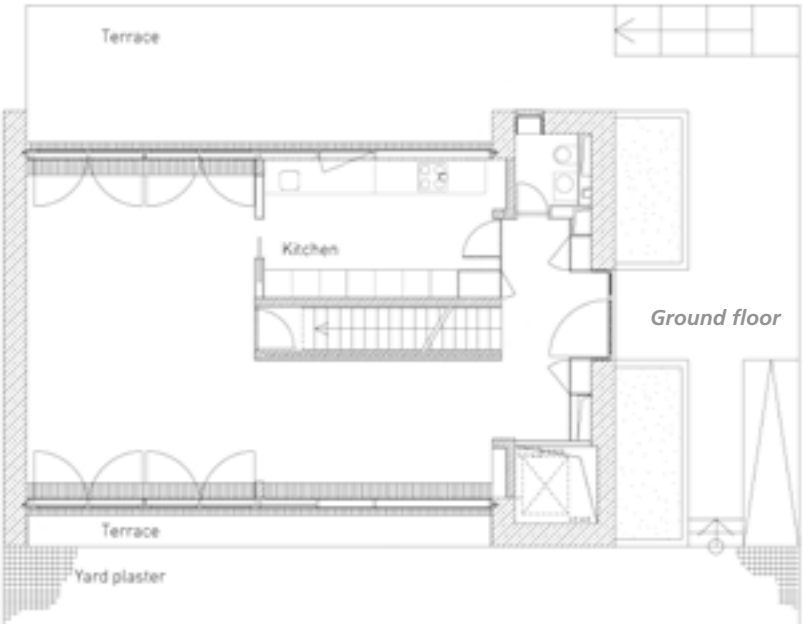


Material developed in the university lab: The Schlaich building.

A residential building in Berlin's Prenzlauer Berg district

superlightweight concrete

In recent years, architects have rediscovered the art of using lightweight concrete as an exposed material. As a result, a number of monolithic exposed concrete constructions made of lightweight concrete with its excellent thermal insulation properties have been built in Switzerland and Germany. On the one hand, exposed concrete is fascinating due to its exceptional architectural qualities. On the other, monolithic, single-skin concrete substructures are particularly long-lived. The fact that there is no plastering or cladding work means that costs can be reduced and materials are easier to recycle. "Our house was inspired, among other sources, by the Gartmann building in Switzerland which is also constructed using a monolithic design with exposed concrete walls. However, my idea was to develop an even more lightweight concrete with a lower bulk density. As a result, the principles underpinning our house were initially developed in the laboratory,"explains Mike Schlaich, head of the department responsible for solid construction at Berlin Technical University's Construction Engineering Institute. During the summer of 2006, Mike Schlaich worked together with his colleagues at Berlin's Technical University and with Liapor's Maik Dostmann to develop a formula for a particularly lightweight concrete with outstanding thermal insulating properties and a dry unit weight of less than 800 kg/m^3. The resulting formula, which consisted of water, cement, Liapor expanded clay and air-entraining agents, perfectly satisfied the defined objectives. The fact that this innovative superlightweight concrete is also ideally suited to practical use is convincingly demonstrated by the Schlaich family house whose external walls are constructed from this material.



Liapor as a lightweight additive

The superlight concrete, in which Liapor expanded clay is used as a lightweight aggregate, is the ideal building material for monolithic constructions since, alongside its outstanding thermal insulating properties, it usually meets all the requirements relating to bearing strength, resistance to heat and damp as well as fire resistance and acoustic insulation better than conventional concrete. Liapor expanded clay possesses a somewhat rough, closed surface coupled with a uniform, fine internal pore structure Though low-weight, Liapor provides optimum particle strength and therefore constitutes an excellent building material. The cho- ➔

For a number of reasons, exposed concrete is again one of today's trends.

A monolithic construction using superlightweight concrete: At a dry unit weight of just 760 kg/m³, the coefficient of thermal transmission calculated for the walls is 0.34 W/(m²K).

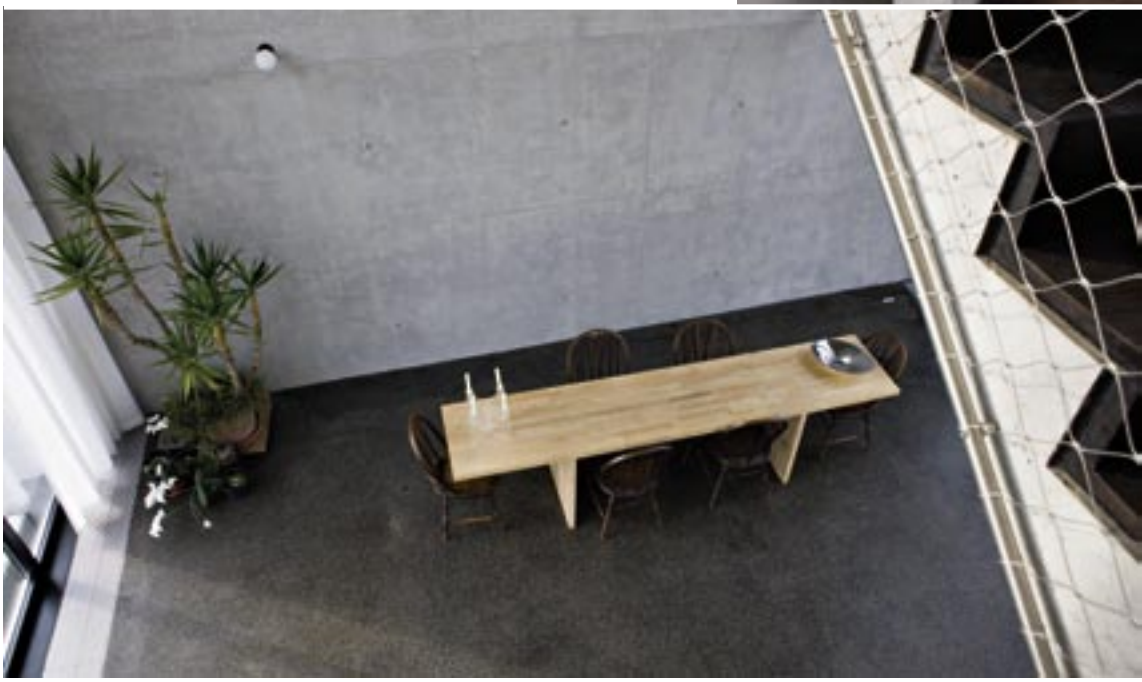
➔
sen materials were Liapor 1-4 round granules and Liapor F 2.9 together with Liapor's sand product "Liapor L Sand 0/2" which further enhances the concrete's thermal properties. Cement of CEM III-A 32.5 quality, water and air-entraining agents were also used in the superlightweight concrete formula. Thanks to this combination, it was possible to limit the dry unit weight of the monolithic exposed concrete walls to just 760 kg/m³. As a result, the superlightweight concrete is able to achieve excellent thermal insulation values. The measured lambda value is 0.18 W/(mK) and the resulting coefficient of thermal transmission for the walls is 0.34 W/(m²K).

Glass fiber rod reinforcement

This superlightweight concrete achieves a level of strength comparable to that of LC8/9 lightweight concrete. One of the key interests of the project lay in the need to adapt the constructional and physical details to the properties of the material and explore possibilities not usually considered when steel-reinforced concrete is used. To reduce the otherwise unavoidable formation of cracks due to shrinkage, glass fiber rods were used as reinforcement. This made it possible to both solve the problem of corrosion and avoid thermal bridges. Simple concrete shuttering without any partitioning was used for the formwork of this exposed concrete building. The lightweight concrete was transported to the site in buckets and compacted using conventional vibrators. A period of one week was required to remove the formwork. Nevertheless, this trial use of superlightweight concrete resulted in a significant amount of cavitation. Fortunately, a little touching up with a mortar produced from CEM III-A and expanded glass granules coupled with some facing work performed by the owners themselves and the application of a water repellent resulted in an interesting and stimulating but also smooth concrete surface achieved with comparatively little work. Inside the building, the exposed concrete walls were left with their natural appearance unchanged.

A modern architecturally designed house

In the summer of 2007, after a construction period lasting almost exactly one year, the Schlaich family was able to take up residence in its modern, architecturally designed house in the Prenzlauer Berg district, the diplomatic center of the former GDR. The building was designed by the architects Amanda Schlaich and Clemens Bonnen. On established wooded land measuring approximately 1,500 square meters, the modern building with its pure rectangular forms (9.75 x 13.42 meters) blends perfectly with its environment. The building's eastern and western sides consist entirely of exposed concrete walls, while the



Architect profile

Professor Mike Schlaich (doctor of technology and science)

1960 born in Cleveland, Ohio, USA

• Academic history: 1979 – 81 Studied engineering at Stuttgart University to primary level
1981 – 85 Swiss Technical Academy (ETH) Zürich (ETH/SIA certified engineer), In-depth study of building construction and materials technology with professors Menn, Dubas and Rössli
1985 – 89 Assistant to Professor Anderheggen in the Engineering IT department (co-lecturer: Professor Thürlimann)

• Professional experience:
1990 – 93 Engineer at FHECOR, consulting engineer in Madrid, Spain
1993 Engineer at Schlaich, Bergermann and partners
since 1999 Partner
since 2005 Test engineer for building statics specializing in solid construction

• Teaching responsibilities:
2000 – 2004 Teaching responsibilities at Stuttgart University: "Building with ropes"
since 2004 Professor of solid construction at Berlin Technical University's Construction Engineering Institute

A modern architecturally designed house: Exposed concrete is the dominant design element.

northern and southern facades are characterized by a post-and-mullion construction, striking glazed areas and anodized aluminum panels and a narrow exposed concrete wall. In total, the house provides a living space of approximately 190 square meters distributed across three floors. Due to the high groundwater level, the cellar was constructed using waterproof concrete. The ground floor accommodates a spacious hallway, a kitchen, a large living/dining room which opens onto the first of the upper storeys, together with a guest bathroom and WC. A staircase made from concrete cast in-situ, which has also been left unadorned, rises to the first floor which houses two children's bedrooms and bathrooms. The second floor contains the bedrooms, workshop and bathroom as well as an additional workshop which also serves as a guestroom. All the bathroom installations and the lift are located on the side of the house that has been finished with exposed concrete walls. The remaining rooms possess generous glazed facades manufactured from triple-layered safety glass. In the inside of the house, the owners, Amanda and Mike Schlaich also placed great emphasis on the use of natural materials. The floors on the ground floor and in the bathrooms are made from poured asphalt which was finely polished to create an exclusive, elegant terrazzo finish. Oak flooring was laid in the children's bedrooms and the other room on the second of the upper floors. The house possesses geothermal heating. In addition, a mechanical ventilation system ensures that cool air is continuously supplied to the house while the stale air is removed.

Further annexes planned

However, building work at the Schlaich family house is not yet complete. Two wooden terraces – one on the northern and one on the southern side – and two small annexes to the South (a garden building and a garage space) are planned in the future to finish off this striking residence. "Since our house is 20 meters away from the road, we want to create a dry indoor courtyard on the southern side. In contrast, the Northern side is intended to be a restful, natural area," says Amanda Schlaich describing the planned construction activities. While Mike Schlaich has handed over most of the architectural responsibilities to his wife, he himself has continued to concentrate on structural concerns. "Our experience so far has shown that superlightweight concrete makes it possible to produce exposed concrete structures with good thermal insulation properties and has the potential to play a far from negligible role in the construction industry of the future." ●

Further information:

Architects: Clemens Bonnen, Amanda Schlaich
Construction engineers: Mike Schlaich, Lars Werner
Mix/formula: Jointly developed by the materials and materials testing and solid construction departments at Berlin's Technical University
Construction company: Kasimir Bau, Berlin
Concrete plant: Lichtner Beton, Berlin
Glass fiber reinforcement: Schöck, Baden-Baden
Testing engineer: Hartmut Kalleja, Berlin

Liapor specialist consulting:
Liapor GmbH & Co. KG
Phone ++49 (0) 95 45 / 448-0
info@liapor.com
www.liapor.com

Gebrüder Meier AG and AquaPura AG company headquarters, Birrhard

A Swiss construction jewel

Simplicity and efficiency were the watchwords behind the construction of the new company headquarters and factory site commissioned in Birrhard by the Swiss company Gebrüder Meier AG to celebrate its 100th anniversary. After 14 months of construction work, the result was a striking architectural highlight which combines aesthetics and functionality within an exceptional complex of buildings.

For Gebrüder Meier AG 2007 was a special year. The Swiss civil and highway engineering company not only celebrated its 100th anniversary but also commissioned the construction of a new factory site at its premises in Birrhard in Switzerland's Aargau. The main aim behind the creation of the new company headquarters was to concentrate the various functions in a single location. "We had reached the limits at our old site in Windisch and the type of expansion required for the future was no longer possible," explains Richard Fischer, Vice President of the Gebrüder Meier AG Board of Directors. The old company premises were sold to provide the finance necessary for the 10.5 million CHF new construction in Birrhard where the company's management had identified the necessary potential for growth.

Eastern view

Northern view

Western view

Functional aesthetics

The owners' wishes for the new company headquarters were very clear. The building that was to be erected was to serve as a workshop, vehicle bay, warehouse and office complex simultaneously and combine all the company's premises and departments. The resulting synergisms have given rise to a new, creative working approach in spacious premises. "Our guidelines to the architects consisted of three Es," says Fischer. "Easy – extendable – electrifying. We wanted to implement simple, efficient workflows in our office and factory activities. At the same time, we wanted the new location to have an extendable, forward-looking architectural design. An electrifying appearance for a building characterized by its quality features was also important to us." On the basis of these instructions, Daniel Kündig and Manuel Alberati from the Zürich-based firm of architects UC'NA created an impressive building design which met the requirements for a functional factory site as well as for a versatile office space. With this new company headquarters, Gebrüder Meier AG and its subsidiary AquaPura AG were able to offer their customers an even more extensive range of services in the fields of highway and civil engineering. This is because by concentrating their resources at a single site, the companies are now able to perfectly harmonize their solutions for complex construction projects.

Three characteristic key elements

With their spectacular design, the architects were able to integrate the new company premises perfectly into Birrhard's residential and industrial environment. This was no easy task given the varied nature of the immediate surroundings which include a tennis center, a wine merchant and a residential district. "The form of the new company premises is inspired by three interrelated key elements. The wall which encloses three sides of the site forms a distinct, massive base for the complex, says architect Manuel Alberati to explain the structure of the building. The warehouse and workshops, reception and rest areas as well as the main entrance ➔

Both the inside and outside of the new company headquarters impress through their functionality and aesthetics.

The overhanging hollow body is one of the highlights of the building.

➔

are integrated and interlinked within this striking, unbroken wall element with its serrated openings.
The second key element is the elongated structure that extends far beyond the base and accommodates the office areas with their room-height openings.
"The office space is structured by the rhythm of the pillars and the two massive centerpieces," says Alberati. The self-supporting factory roof forms the complex's third key element. Huge Y-shaped pillars bear the weight of the steel construction which tapers to form a narrow edge strip at both ends and thus opens up a view from the offices down onto the storage areas below. "In many different ways, the resulting complex creates spaces, tensions and relationships and enables the civil engineering company to optimize its workflows," says Alberarti, emphasizing the functionality of this striking construction.

Liapor's structure revealed

High-performance Liapor insulating concrete was used to construct the ground floor which houses office spaces, the workshop and storage areas. The specially developed mix consisted of Liapor 3, 4–8 mm and Liaver 1–4 mm together with air-entraining agents, stabilizing agents and other additives. To ensure an optimum result, preliminary tests were performed in Liapor Switzerland's own company laboratories while, at the same time, two reference walls were constructed in concrete for test purposes. The facade walls of a height of up to 5 meters and a thickness of 50 centimeters were raised to the required height in a single step. After the skeleton structure had been completed, approximately one centimeter of the external concrete skin was removed using high pressure water jets operating at 500 bar to reveal the open structure of the expanded clay and expanded glass aggregates. This structure was then waterproofed.

Architect profile

Prof. Daniel Kündig, certified architect ETH/SIA/BSA

1956 born in Zürich

• Academic history:
1978 – 1983 Architectural studies at Zürich's Technical University

• Professional activities:
Since 2003 UC'NA Architekten ETH SIA BSA, with Manuel Alberati
Since 2001 President of the Swiss Engineers' and Architects' Association SIA
1984 – 2001 Architekturbüro Kündig . Bickel Architekten

• Teaching activities:
1986 – 1990 Graduate design assistant for Prof. Franz Oswald, ETH Zürich
Since 2000 Professorship at the Technical College of North-West Switzerland

Manuel Alberati, certified architect ETH/SIA

1973 born in Zürich

• Academic history:
1994 – 2001 Architectural studies at Zürich's Technical University

• Professional activities:
Since 2003 UC'NA Architekten ETH SIA BSA, with Prof. Daniel Kündig
2001 – 2003 Self-employed architect
1996 – 2001 Employed at Kündig . Bickel Architekten

• Teaching activities:
2001 – 2006 Assistant to Prof. Daniel Kündig, Technical College of North West Switzerland

From the office spaces, the large glass elements provide provide a view of the storage areas below the self-supporting factory roof.

Another spectacular feature of this new construction is the roofing over the 22.5 meter wide site approach. This is suspended by six pre-tensioned tie rods located in the top floor from two pre-stressed upstand beams stretching across the floor of the top floor ceiling. The formwork for the ceilings therefore had to be designed in a way that could support the entire weight of the two coverings, the bearing construction in the top floor and the suspender beams.

Equipped for the future

Since May 2008, the new building has been the workplace for up to 150 employees – and has been a success right from the start. "This is not just a building construction. It is a construction jewel," proclaimed Erich Erne, President of the Board of Directors of the Erne Group to which Gebrüder Meier AG has belonged since 2007, at the inauguration ceremony. Richard Fischer is equally enthusiastic: "The results have exceeded our expectations. Our instructions were followed to the letter and the costs have been kept within the budgeted framework." The new building is a unique, exquisite design which makes a powerful aesthetic impact and forcefully underlines Gebrüder Meier AG and AquaPura AG's claim to be progressive, innovative companies. The aesthetic impression of the whole, the harmony in the interaction of the individual elements and the choice of the employed materials and colors give the company headquarters a genuine "face" with an unmistakable profile. It means that the company is optimally equipped for future tasks. "At present, we are witnessing an exciting period of transition to a future in which we can push forward with our developments. Our new headquarters with its spacious, functional areas will naturally help us greatly with our forward-looking plans." ●

Zigzag wall apertures are the dominant element of the ground floor.

Further information:

Architects: UC'NA Architekten ETH SIA BSA, Zürich
Construction engineers: Gerber + Partner, Bauingenieure und Planer AG, Windisch
Construction supervision/ management: Xaver Meyer AG, Villmergen
Planning of sanitary fittings: PGMM Schweiz AG, Winterthur
Electrical planning: Herzog Kull Group, Schlieren
Construction physics: Kopitsis Bauphysik AG, Wohlen
Planning of retention/drainage: Gerber + Partner, Bauingenieure und Planer AG, Windisch
Concrete plant: Beton Baden-Brugg, Werk Müllingen

Liapor specialist consulting:
Liapor Schweiz Vertriebs GmbH
Phone ++41 (0)62 / 206 91-20
info@liapor.ch
www.liapor.ch

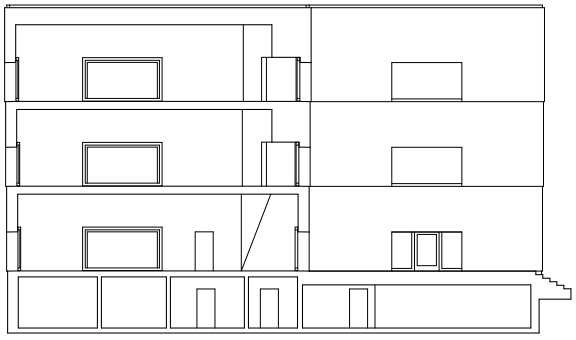
National Park Center

A monolithic white building

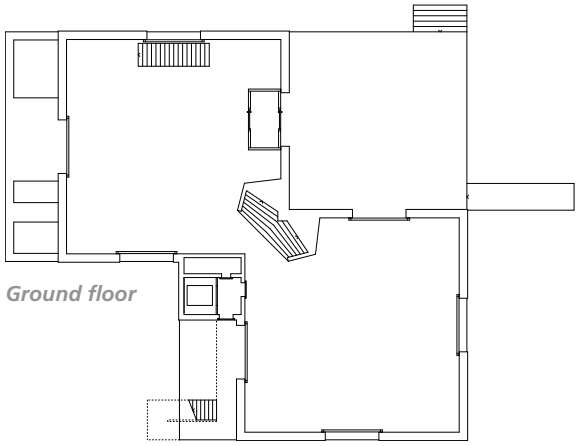
Striking, unusual but not intrusive – the Visitor Center at the Swiss National Park is a true symbol of the village of Zernez in the canton of Graubünden. The pure lines of this monolithic construction fit harmoniously into the surroundings. The entire facade and the indoor rooms have been created from Liapor insulating concrete.

Narrow wall projections slightly offset the individual storeys of the three-floor building.

The Swiss National Park in Zernez (in the canton of Graubünden) is the largest protected natural area in Switzerland. Its alpine landscape and many varieties of animal and plant life are free to develop unconstrained and protected from human activity. At the same time, the National Park is a site for scientific research into flora and fauna. It also acts as an educational establishment. The information it provides is intended to increase its visitors' understanding of nature. This is the task entrusted to the Visitor Center, one of the architectural highlights of Zernez. The building's monolithic design is the brainchild of renowned architect Valerio Olgiati whose uncluttered conception won the competition launched to select the best design.



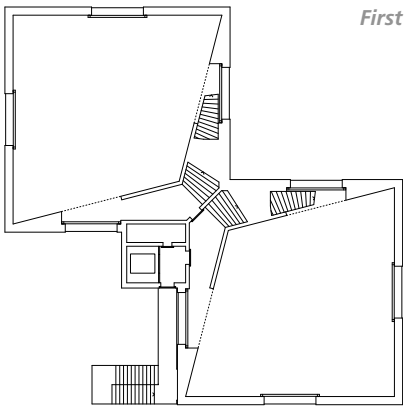
North-South cross-section



Ground floor

Exposed concrete ensures a memorable impression

The construction consists of two imposing intersecting cubes. The projections on the walls slightly offset each of the storeys of the three-floor building. The symmetrical panoramic windows set back in the center of each floor are particularly striking. Thanks to the use of so-called trim-strips around the windows which differ in their structure and color and counteract the formation of cracks in the concrete – the individual concrete sections are clearly distinguished. First of all the corners of the building were constructed followed by the center section with its window recesses. The achieved effect ensures that the result is unmistakably individual and extremely memorable.
The interior of the two white cubes is striking due to its sophisticated room layout. Six halls sharing the same floor plan are distributed across the three storeys of the National Park Center. The lower floor is dominated by a spacious reception area from which a twin staircase, characterized by its interesting perspective, rises to ➔



First of the upper floors

The National Park Center rises against the backdrop of its surroundings without being intrusive.

➔

the upper floors. These contain the permanent exhibitions. Visitors can then descend a second twin staircase to another room which is intended for temporary exhibitions. Finally, the tour of the exhibition rooms ends at the foot of the same set of stairs from which it began.

Architect profile

Valerio Olgiati, certified architect ETH

1958 born in Chur

• Academic history:
1980 – 1986 Studied architecture at Zürich's Technical University (ETH)

• Professional activities:
1993 – 1995 Architecture company in Los Angeles
1996 Opened a firm of architects in Zürich
2008 Company relocated to Flims

• Teaching activities:
1998 – 2000 Guest lecturer at Zürich's Technical University
2002 Guest lecturer at the Architectural Association School of Architecture in London
2005 Guest lecturer at Cornell University in Ithaca/NY
since 2002 Teaching activities at the Universitá della Svizzera italiana in Mendrisio

Careful planning and reliable partners

Aldo Duelli from the Olgiati firm of architects explains just what it is that makes monolithic architecture so special: "One particular feature of monolithic constructions is the fact that the traces of the production process, the craftwork, remain visible." The entire building is made from the same material and characterized by purity and simplicity. At the same time, the light exposed concrete gives the building an elegant quality. This type of monolithic technique demands very precise planning. There is hardly any room for improvisation. Consequently, Aldo Duelli was full of praise for the trouble-free cooperation between the involved parties: "The Zernez-based concrete plant Sosa Gera SA invested in new factory technology in order to manufacture the concrete used for the building; the local building companies, Foffa & Conrad and Lazzarini AG, constructed a very precise carcass and worked extremely carefully and professionally in accordance with the specified logistics." The success of this cooperation can also be seen from the fact that only two years elapsed between the start of the work and the Center's public inauguration. Just as important as the careful planning and reliability of the partners for the construction of the Visitor Center was the use of the ideal concrete formula. Liapor Switzerland which supplied the lightweight aggregates performed extensive tests to develop the mixture used in Zernez. The composition of the lightweight concrete was first fine-tuned in the laboratory before being employed in a series of test constructions. "It was clear that only Liapor expanded clay and Liaver expanded glass could be considered as lightweight aggregates due to their particular thermal insulating properties. The task was to develop the correct mixture to be used in combination with the carefully prepared white cement," explains engineer Daniel Meyer of Liapor Switzerland when looking back at the challenges involved in finding the suitable concrete formula.

Outstanding thermal insulation

Adding expanded clay and expanded glass to concrete brings a number of advantages. The expanded clay spheres are resistant to humidity, heat and chemicals. They also offer a high level of compressive strength. Due to the addition of air-entrained pores,

A staircase opens the way to the upper rooms which contain the permanent exhibitions.

The inside of the building is dominated by the bright exposed concrete and the wide, symmetrical, recessed panoramic windows.

lightweight concrete has a low dry unit weight. Its very high insulating properties ensure excellent energy efficiency. Only very little heating is needed in the winter while only minimal indoor cooling is required in the summer. Thanks to Liapor expanded clay and Liaver expanded glass, it was also possible to meet the strict requirements concerning the external appearance of the building. "Both materials are completely neutral in terms of color. As a result, we were able to achieve both the desired insulating qualities and fidelity to the color design," says Daniel Meyer. With its white appearance, the Visitor Center blends perfectly as part of the historical triad that covers the National Park which also includes the Park's administrative headquarters in Planta-Wildenberg castle and the 150-seat auditorium in the former Stall castle. "White emphasizes the identity of the building as an individual object and gives it a pure and abstract appearance," says Duelli. The brightness of the construction shines with a constant presence without ever being intrusive. Different shades of color can even be distinguished depending on the weather conditions and angle of the sun. With its new Visitor Center, the Swiss National Park in Zernez possesses an architectural highlight that fits effortlessly into the impressive mountain scenery of the Engadine. ●

Further information:

Architect: Valerio Olgiati, Certified architect ETH
www.olgiati.net

Engineering firm:
Jon Andrea Könz, 7530 Zernez

Site management:
Architectura DC SA and Castellani & Bulfoni, Scuol

Planning of bathroom installations: S. Collenberg & Co., St. Moritz

Electrical planning:
Kurt Buchegger AG, Pontresina

Construction physics:
mKB, Chur

Masonry, gravel and concrete:
Sosa Gera SA, 7530 Zernez

Liapor specialist consulting:
Liapor Schweiz Vertriebs GmbH
Phone ++41 (0)62/206 91-20
info@liapor.ch
www.liapor.ch

Dead weight calculation values

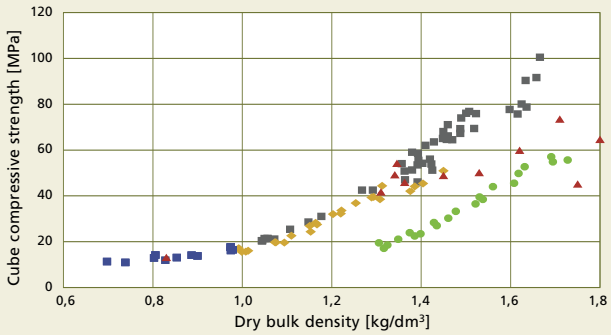
Bulk density class	Thresholds of the mean value of the dry concrete bulk density ρ_d	Dead weight calculation values	
		Lightweight Concrete kg/dm³	**Reinforced light wight concrete** kN/m³
1,0	0,80 – 1,00	10,5	11,5
1,2	1,01 – 1,20	12,5	13,5
1,4	1,21 – 1,40	14,5	15,5
1,6	1,41 – 1,60	16,5	17,5
1,8	1,61 – 1,80	18,5	19,5
2,0	1,81 – 2,00	20,5	21,5

Reference values for assigning strength and bulk density classes

Strength class	Minimum required concrete bulk density [kg/m³]		Modulus of elasticity [kN/mm²]	
	Lightweight sand	**Natural sand**	**Lightweight sand**	**Natural sand**
LC8/9	1,0	1,2	4,9	7,1
LC12/13	1,1	1,3	5,4	9,0
LC16/18	1,2	1,4	8,2	11,1
LC20/22	1,2	1,4	8,6	11,7
LC25/28	1,3	1,5	10,6	14,2
LC30/33	1,3	1,5	11,1	14,8
LC35/38	1,3	1,6	11,6	17,6
LC40/44	1,4	1,6	14,0	18,2
LC45/50	1,4	1,6	14,5	18,9
LC50/55	1,5	1,7	17,1	22,0
LC55/60	1,5	1,7	17,6	22,6
LC60/66	1,6	1,8	20,5	25,3
LC70/77	1,6	1,9	21,5	30,3
LC80/88	1,7	2,0	25,2	34,9

Compressive strength/ bulk density

- Lightweight concrete with natural sand
- Lightweight concrete with lightweight sand
- High-performance lightweight concrete
- Lightweight concrete with expanded glass
- Buildings



Liapor GmbH & Co. KG
Liapor – Werk Pautzfeld
D-91352 Hallerndorf
Phone ++49 (0) 95 45/4 48-0
Fax ++49 (0) 95 45/4 48-80
www.liapor.com
info@liapor.com

Lias Österreich GesmbH.
A-8350 Fehring
Phone ++43 (0) 31 55/23 68-0
Fax ++43 (0) 31 55/23 68-20
www.liapor.at
info@liapor.at

Liapor Schweiz Vertriebs GmbH
CH-4603 Olten
Phone ++41 (0) 62/2 06 91-20
Fax ++41 (0) 62/2 06 91-10
www.liapor.ch
info@liapor.ch

www.liapor.com