Schöck Bauteile GmbH

Schöckstrasse 1

76534 Baden-Baden, Germany

Tel.: +49 (0) 7223 9670

Email: presse-de@schoeck.com

Case study.

**Building the future with Combar**

**Schöck products made of glass fibre composite: building the CUBE using non-metallic reinforcement**

**Baden-Baden, April 23- innovative material for a futuristic look: the CUBE, the world's first carbon concrete building, opened on the TU Dresden campus in September 2022. It has a visually striking, boldly curved roof/wall construction arching over a simple cube. Only non-metallic reinforcement was used in the CUBE to provide the necessary structural strength. Schöck Isolink and Schöck Combar made of glass fibre composite take on the task of reliable load transmission in the composite walls, sandwich walls, foundation and roof.**

The CUBE is the brainchild of the Institute for Solid Construction at the Dresden University of Technology, represented by Manfred Curbach, chair of the board of the association C³ - Carbon Concrete Composite. Since it was founded in 2014, the association has been dedicated to the development of carbon concrete - an umbrella term for concrete with non-metallic reinforcement, considered to be the building material of the future. The CUBE was conceived by Gunter Henn. The design by the prolific architect combined a rectilinear BOX with a roof/wall construction consisting of carbon concrete shells with multiple curves known as the TWIST. These two heavily contrasting elements effectively demonstrate the versatility of non-metallic reinforcement.

**Less volume, high tensile strength**

Carbon concrete is a composite material consisting of concrete reinforced with non-metallic material, such as a carbon-fibre mat or fibreglass rods. Schöck has been using fibreglass rods as reinforcement and as a component of various products for over 25 years. Under the product name Combar, they have been approved by the building authorities since 2008, the only fibre composite material with this distinction. Combar is also economical compared to other non-metallic reinforcement. The bars can be straight or curved, which offers flexibility in terms of component geometries. Furthermore, the glass-fibre reinforcement has a high load-bearing capacity and is 100 percent corrosion-resistant. This property makes the material much more durable than conventional reinforced concrete. It also has a higher tensile strength and lower density than steel, so less material is required. Much slimmer and lighter concrete walls can be created without any loss of stability.

**Schöck Combar: essential modular element of the CUBE**

The planners selected Schöck Combar to make the reinforcement cages, wall corners, stirrups, ring beams and the foundation connection reinforcement for the BOX and TWIST modules. Glass fibre composite bars and stirrups were used as reinforcement in the edge beams of the TWIST module. The range of different bar shapes lent the load-bearing structure of the unusually shaped building stability.

**Combar does the TWIST**

During construction, it became apparent that the qualities of Combar open up an entirely new spectrum of design. The double-curved, twisted shell in exposed concrete segues from the horizontal to the vertical in a continuous twirl of roof and wall. Formwork for the seamless structure consisted of a specially made wooden base. Layers of concrete were applied on top of this using the shotcrete method while incorporating the carbon fibre reinforcement mesh.

First, a load-bearing shell 25 centimetres thick was fabricated in multiple layers. Next, a carbon concrete solid shell 3 to 4 centimetres thick was constructed. This was followed by polystyrene blocks as void formers to reduce the volume of concrete used, the amount of thermal insulation needed and the overall weight. This was topped by another carbon concrete solid shell 3 to 4 centimetres thick. The two shells were connected by vertical concrete bars.

Both TWIST shells rest on a steel structure and are supported on the ground by a foundation. The glass-fibre composite material Combar was incorporated as the connecting reinforcement and encased in concrete to produce the supporting shell.

Combar is much lighter than conventional reinforcement, weighing only approx. 30% as much as steel. This also makes it easier to handle during installation. Structural engineer Hans-Hendrik Ritter from Assmann Beraten + Planen remarked "During the construction of the CUBE, we gained a great deal of experience that we can apply in future projects".

**Innovative roof/wall construction**

The load-bearing and weather shells were connected using Schöck Isolink elements. The glass fibre bars were glued into the pre-drilled holes according to the structural requirements. Then, the 14-centimetre-thick thermal insulation elements were pushed on to these and bonded over their entire surface. The protruding ends of the Schöck Isolink units provide a reliable hold for the 4-centimetre-thick, carbon concrete weather shell. In total, this innovative roof/wall construction is 27 centimetres thick.

**Schöck Isolink secures core-insulated concrete façade**

The rectangular, two-storey BOX is testimony to the potential uses of non-metallic reinforcement for economic construction methods suitable for mass production. The composite walls and sandwich walls were prefabricated using the usual process in a precast concrete plant and delivered to the construction site on schedule. The innovative insulation and slim concrete shells only 4 centimetres thick made it possible to construct walls only 27 centimetres thick in total – as a rule, walls of reinforced concrete buildings are usually 44 centimetres thick. Schöck Isolink provides reliable fixing for core-insulated concrete façades.

**Reliable thermal insulation, highly flexible design**

Isolink is used as a connecting element that reduces thermal bridges due to the low thermal conductivity of the material. It also allows light filigree concrete components to be used, as shown by the slender walls of the CUBE. The bars also act as spacers in the cavity that is filled on site using the in-situ concrete method as is customary.

Almost 170 square metres of wall and ceiling were built in this way. Approximately 3 Isolink units were used per square metre, amounting to around 500 units for the entire BOX.

**Paving the way for imitators**

Thanks to the commitment and expertise of the companies involved, the example of the BOX shows the huge potential of non-metallic reinforcement for structural engineering and design. Construction is complete – now it is time to put it to the test in everyday life. Over the next few months, special sensors installed in the concrete will provide important data on aspects such as moisture, deformation or cracking. At the same time, the partners of the C³ association are developing processes to increase the level of automation in production to make construction with non-metallic reinforcement even more attractive to the general public.

6822 characters (including spaces)

[www.schoeck.com](http://www.schoeck.com)

**Project information**

**Construction period:** January 2021 to September 2022

**Principal:** Manfred Curbach

**Architectural design:** Gunter Henn, HENN GmbH, Berlin, Germany

**General planning:** AIB GmbH Architekten Ingenieure Bautzen, Bautzen, Germany

**Structural engineering:** Assmann Beraten + Planen GmbH, Dresden branch, Germany

**Prefabricated part production:** Betonwerk Oschatz GmbH, Oschatz, Germany

**Joint venture:** Bendl Hoch- und Tiefbau Sebnitz GmbH & Co. KG, Hohnstein; Hentschke Bau GmbH, Bautzen, Germany

**Products:** Schöck Combar, Schöck Isolink, Schöck Isokorb

**Info box**

**Combar integrated in FRILO and RIB design software**

Combar by Schöck is the first fibre composite reinforcement to be building regulations approved and has now been integrated into FRILO and RIB. The means that the unusual reinforcement element can now be sized in the familiar software environment as longitudinal reinforcement or as stirrup reinforcement. A wide variety of cross-sections (rectangular, circular and T-beam cross-sections) is available for straightforward dimensioning of Combar in various structural and civil engineering applications.

For more information, go to: www.schoeck.com/en/combar

**Graphic**

Ein Bild, das Mobiliar, Tisch, Bett, Arbeitstisch enthält.

Automatisch generierte Beschreibung

*Copyright: © Iurii Vakaliuk, Institute for solid construction, TU Dresden*

**Sectional drawing**

Ein Bild, das Diagramm enthält.

Automatisch generierte Beschreibung

*Copyright: Assmann Beraten + Planen GmbH*

**Images**

**[Schoeck\_The-Cube-Dresden\_1]**

**Ein Bild, das draußen, Gras, Himmel, Saftig enthält.

Automatisch generierte Beschreibung**

*The CUBE in Dresden, the world's first building made of carbon concrete, was constructed entirely without steel reinforcement.*

*Photo: © Moritz Bernoully*

**[Schoeck\_The-Cube-Dresden\_2]**

Ein Bild, das Himmel, draußen enthält.

Automatisch generierte Beschreibung

*With the different bar shapes of Combar®, the load-bearing structure of the unusual building geometry could be secured.*

*Photo: © Moritz Bernoully*

**[Schoeck\_The-Cube-Dresden\_3]**

*Ein Bild, das Gras, Himmel, draußen, Segelschiff enthält.

Automatisch generierte Beschreibung*

*The CUBE, consisting of the two building parts TWIST and BOX, is an experimental building and at the same time a test stand in which the long-term suitability of carbon concrete is researched in terms of structural design, statics and building physics.*

*Photo: © Moritz Bernoully*

**[Schoeck\_The-Cube-Dresden\_4]**

**

*Schöck Combar is used as connection reinforcement in the foundation of the BOX, and absorbs the load of the external walls.*

*Photo: Marén Kupke*

**[Schoeck\_The-Cube-Dresden\_5]**



*The energy efficiency of the roof is ensured by 14 centimetres of thermal insulation and Schöck Isolink façade fasteners, which minimise thermal bridges.*

*Photo: Marén Kupke*

**[Schoeck\_The-Cube-Dresden\_6]**

****

*To use Schöck Combar to reinforce walls at the corners, the required bending radii had to be adapted to the requirements of the slender wall structures.*

*Photo: Marén Kupke*

**[Schoeck\_The-Cube-Dresden\_7]**

****

*The arrangement of the composite walls is clearly visible here. The cavity is filled on site with in-situ concrete.*

*Photo: Marén Kupke*

**[Schoeck\_The-Cube-Dresden\_8]**

**Ein Bild, das schmutzig enthält.

Automatisch generierte Beschreibung**

*Edge beams were formed in the roof area of the TWIST. Schöck Combar reinforcement cages also guarantee reliable load transfer here.*

*Photo: Marén Kupke*

**[Schoeck\_The-Cube-Dresden\_9]**



*Schöck Combar has been approved by the building authorities since 2008 as the only fibre composite material. The bars are available in both straight and curved form - this enables the realisation of flexible component geometries, as in The CUBE Dresden.*

*Rendering: Schöck Bauteile GmbH*

**[Schoeck\_The-Cube-Dresden\_10]**

*Ein Bild, das Metallwaren, Schraube enthält.

Automatisch generierte Beschreibung*

*Schöck Isolink type C is the façade fastening made of glass fibre composite and an energy-efficient alternative to conventional stainless steel solutions for connecting the concrete shells of core-insulated sandwich and element walls.*

*Rendering: Schöck Bauteile GmbH*

**About Schöck:**

Schöck Bauteile GmbH is a company of the international Schöck Group that has more than 1100 employees and is active in over 40 markets. It has its headquarters in Baden-Baden at the feet of the Black Forest where the company's success story began in 1962. Company founder Eberhard Schöck used his knowledge and experience of building sites to develop products that simplify the construction process and solve the physical problems of construction work. This mission has remained the foundation of the company’s philosophy to this day, a philosophy that has allowed Schöck to become the leading provider of reliable and innovative solutions to reduce thermal bridges and impact sound, for thermally insulating façade connections and reinforcement technology. Schöck products facilitate a more rational approach to construction and safeguard the construction quality in the long term. Our focus is on the building-physical benefits and energy efficiency. Schöck is driving the digitalisation of the work flow from planning to the building site to support the construction work of tomorrow.

**For any questions, please contact:**

**Ansel & Möllers GmbH**

Christine Schams

König-Karl-Strasse 10

70372 Stuttgart

Tel.: +49 (0) 711 92545 284

Email: [c.schams@anselmoellers.de](mailto:c.schams@anselmoellers.de)