



Best practice example

for lightweighting in Germany

Prestressed carbon concrete



Installation of a trapezoidal slab made of prestressed carbon concrete for a garage

Sustainable construction using prestressed carbon concrete

Fields of application



Construction sector (newbuilds)

In this example, lightweighting allowed for the following reductions compared to a conventional concrete ceiling:



Weight approx. -60%

Application

A trapezoidal slab made of prestressed carbon concrete was developed and used as a roof element for a garage. The garage roof is made up of five trapezoidal panels placed next to one another. The entire roof system is made of prefabricated parts and can be easily disassembled for recycling later on. The total length of the roof is 8.71 m.

Challenge

In the past, prestressed, thin-walled components made of concrete, folded structures or shell elements would be widely used as prefabricated parts because of their lightness, cost-effectiveness and aesthetics. Today, such load-bearing structures have virtually disappeared from the building industry altogether. One reason for this was the corrosion of reinforcements due to insufficient concrete cover.

Solution

Corrosion-resistant reinforcements made, for example, of carbon fibre reinforced plastic (CFRP) or carbon for short, are needed for the use of thin concrete shells.

Carbon reinforcements are particularly suitable as prestressing elements due to their high tensile strength. This means that carbon concrete can be used to create components that are light, durable and also sustainable due to the low amount of material consumed.

Best-Practice-Beispiel | Prestressed carbon concrete



Trapezoidal folded structure made of prestressed carbon concrete during 4-point bending test



Prototype of a carbon concrete bridge with prestressed CFRP strands

Other potential applications

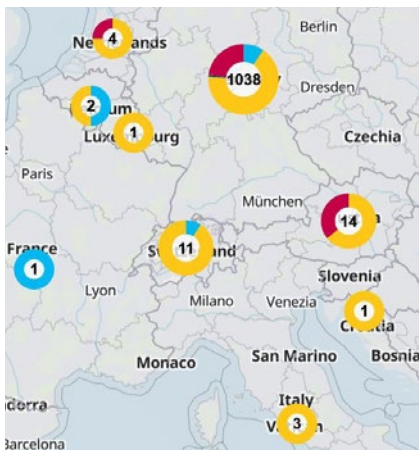


Construction sector (full renovation)

The use of prestressed carbon concrete opens up new ways of employing light-weight construction not only in building construction, but also in bridge construction. Due to the susceptibility to corrosion and low fatigue strength of steel, many bridges in Germany are in a state of disrepair.

As an alternative construction material for this purpose, carbon, is not only corrosion-resistant, but also has a high strength-to-weight ratio and fatigue resistance, making it more efficient. Using a prototype with a scale of 1:2, it was able to be demonstrated that a scaled, semi-finished part could be manufactured and transported. A bridge span of 21 m was used instead of the original 42

m. Compliance with all requirements relevant for the sector is ensured. Research activities are being conducted so as to further improve health and safety, environmental protection and recycling.



Der LIGHTWEIGHTING ATLAS

The LIGHTWEIGHTING ATLAS is an interactive web portal that pools information on those active in lightweighting and their skills across different industries and materials. The atlas is free to use and entries into the atlas are also free. You can find the LIGHTWEIGHTING ATLAS at www.leichtbauatlas.de

The Lightweighting Initiative

Modern lightweighting is of pivotal importance for German industry and its competitiveness. The Federal Ministry for Economic Affairs and Climate Action has established the Lightweighting Initiative to support lightweighting in Germany. The Lightweighting Initiative Coordination Office in Berlin, which is financed as part of the initiative, pools all activities relevant to lightweighting and supports German companies, especially SMEs, as they implement lightweighting.

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