# Faster, cheaper and more sustainable: modular bridge construction with carbon concrete

## About this project

### PAMB

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**Markets:**

**Material:** Textile-reinforced concrete

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## About this project

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

## Context

Around 7,400 bridges on German motorways and federal roads are part of the BMDV's modernisation network and are to be renovated or replaced by 2030. To minimise disruption to traffic, short construction times are essential. Modular construction with non-metallic reinforcement offers an innovative solution here: the various components for the bridge are completely prefabricated in the factory, delivered to the construction site and then connected on site.

The advantages of modular bridge construction with non-metallic reinforcement are manifold: industrially manufactured components are more precise and slimmer. In combination with corrosion-resistant reinforcement, this saves concrete and emits less CO# during production and transport. The scope and size of construction sites as well as the construction time on site - and thus congestion times caused by construction - can be significantly reduced. As the pollutant emissions of a construction project correlate directly with the construction time, the impact on the climate and environment is further reduced.

As the connection of the individual modules is designed to be reversible, they can be replaced or removed in the event of damage without having to completely rebuild the structure. When dismantling, the individual elements could be reused or recycled more easily in future to make the entire life cycle more sustainable.

## Purpose

In an international comparison, modular construction methods are not yet very widespread in Germany. This is less due to its feasibility than to the narrowly defined standardisation. The project team is therefore developing and testing a pilot system. The researchers are building the prototype for a road bridge on a true-to-original one-to-one scale and are liaising closely with the approval authorities.

The findings from bridge construction can be transferred to many sectors of the construction industry - from building construction to the energy industry.

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### Procedure

The researchers manufacture the prototype completely in the factory and then join the individual carbon concrete components together on the construction site. The project team wants to achieve this so-called joining by means of pre-stressed dry joints. This means that the prefabricated parts must be manufactured very precisely so that they fit together exactly and static friction is activated. This prevents the individual elements from sliding apart. The outstanding advantage is that the assembly time for the superstructure on the construction site can be reduced to just one working day. Afterwards, the structure is immediately fully load-bearing, as no in-situ concrete has to harden. - This extremely short construction time was demonstrated during the project.

The project partners from industry and science are testing the system under real conditions on a federal highway: they are integrating the bridge prototype into a temporary bypass at a bridge construction site near Freiberg in Saxony. They are exposing the system to the stress of real road traffic for around a year. On 19 September 2023, the structure was put into operation following a load test. With the accompanying metrological monitoring, they want to prove the reliability of the modular design and thus initiate normative adjustments. At the end of its service life, the project partners will examine the bridge in the laboratory and check whether it can be reused at another location.

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## About this project

**Funding duration:**

| | | | |
|---|---|---|---|
| **Funding sign:** | 03LB2031 | **Funding amount:** | EUR 826 thousand |

**Final report**

**Further websites**

www.htw-dresden.de/hochschule/fakultaeten/bauingenieurwesen/labore/labor-konstruktiver-ingenieurbau/bruecke-mit-vorgespannten-trockenfugen - Website with information about the project

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2031A - PAMB in the federal funding catalogue

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## Project coordination

### Contact:

Mr Prof. Dr.-Ing. Holger Flederer

+49 351 462 2435

holger.flederer@htw-dresden.de

### Organisation:

Dresden University of Applied Sciences

Friedrich-List-Platz 1
01069 Dresden
Saxony
Germany

www.htw-dresden.de

## English (EN){{ Projektpartner }}

## Lightweighting classification

| | Realisation |
|---|---|
| **Offer** | |
| **Products**<br>Parts and components | ✓ |
| **Services & consulting**<br>Testing and trials, Validation, Simulation | ✓ |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Field of technology** | |
| **Design & layout**<br>Lightweight manufacturing | ✓ |
| **Functional integration**<br>Sensor technology | ✓ |
| *Measuring and testing technology* | |
| *Modelling and simulation* | |
| *Plant construction & automation* | |
| *Recycling technologies* | |
| **Manufacturing process** | |
| *Additive manufacturing* | |
| *Coating (surface engineering)* | |
| **Fibre composite technology**<br>Casting (concrete) | ✓ |
| *Forming* | |
| *Joining* | |
| *Material property alteration* | |
| *Primary forming* | |
| *Processing and separating* | |
| *Textile technology* | |

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## Lightweighting classification

| | Realisation |
|---|---|
| **Material** | |
| *Biogenic materials* | |
| *Cellular materials (foam materials)* | |
| **Composites**<br>Textile-reinforced concrete | ✓ |
| *Fibres* | |
| *Functional materials* | |
| *Metals* | |
| *Plastics* | |
| *Structural ceramics* | |
| *(Technical) textiles* | |