UNDERSLUNG MOVABLE SCAFFOLDING SYSTEM FOR CONSTRUCTION OF THE TALBRUCKE EISERN, GERMANY

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Figure 1: Front View of the MSS

INTRODUCTION

The bridge Talbrücke Eisern is located on the A45 motorway in the state of Nord-Rhein-Westfalen in Germany.

This project is part of a restructuring/requalification of the 274 km motorway. The A45 connects Dortmund, a Northern Germany city, to the city of Zellhausen in Bavaria.

This new Talbrücke Eisern bridge project consists of the replacement of two superstructures and associated infrastructure of the former Talbrücke Eisern, dating back to 1967.

Figures 2 and 3: Aerial View of the construction site

THE BRIDGE

The bridge project involves the construction of two parallel viaducts each comprising a concrete box girder section superstructure.

Each viaduct has 7 spans, with a typical span of 53 m, resulting in a total length of 684 m.

The maximum height of the piers is 45.28 m. The width of each superstructure is 17.72 m.

The construction of the viaducts was carried out using an underslung movable scaffolding system M53-I which was designed and supplied by BERD, see Figure 4.

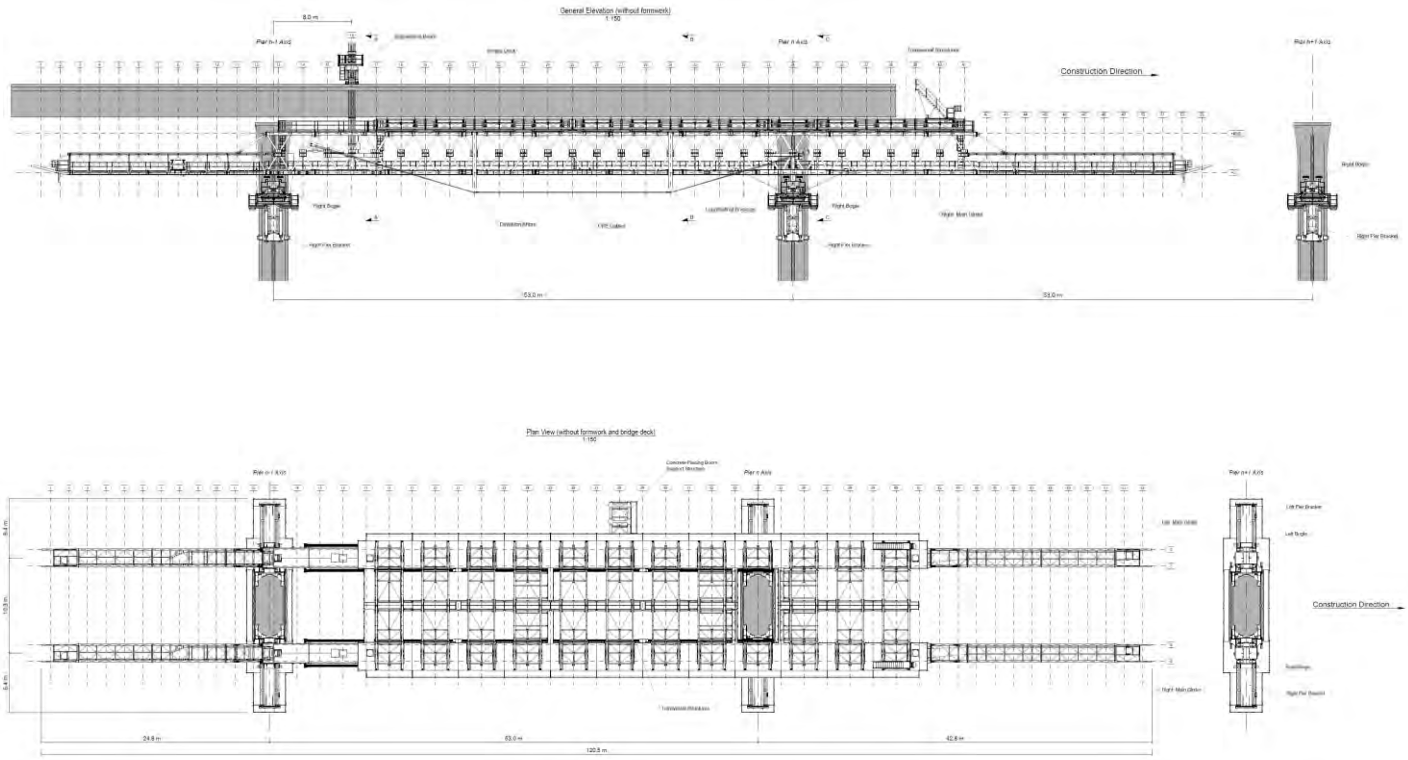


Figure 4: Elevation and plan of the M53-I underslung MSS

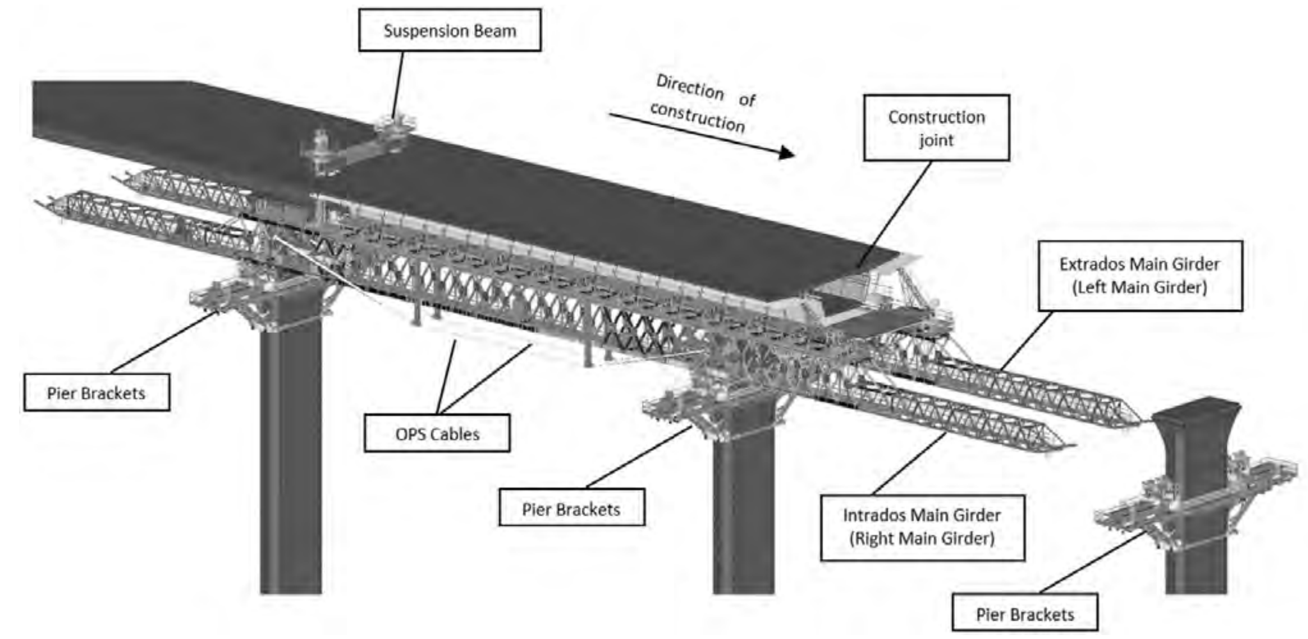


Figure 5: M53-I structure

MSS M53-I

The M53-I is an underslung self-launched Movable Scaffolding System (MSS), conceived for span-by-span construction of concrete bridge decks with span lengths up to 53 m.

The MSS is capable of limiting its own deflection by means of the Organic Prestressing System (OPS), see Figures 5 and 6.

The M53-I has a total length of 120.5 m and a weight of about 550 tonnes (including all metallic structure, formwork, hydraulic equipment and other components).

The main load carrying structure comprises two steel truss girders, the main girders, each equipped with two sets of prestressing cables actively controlled by an Organic Prestressing System (OPS) during the concrete pouring stage.

Both main girders are connected by transverse structures, except in the launching stage when each main girder travels independently from the other.

The launching of the MSS is performed by two hydraulic winches, one on each girder.

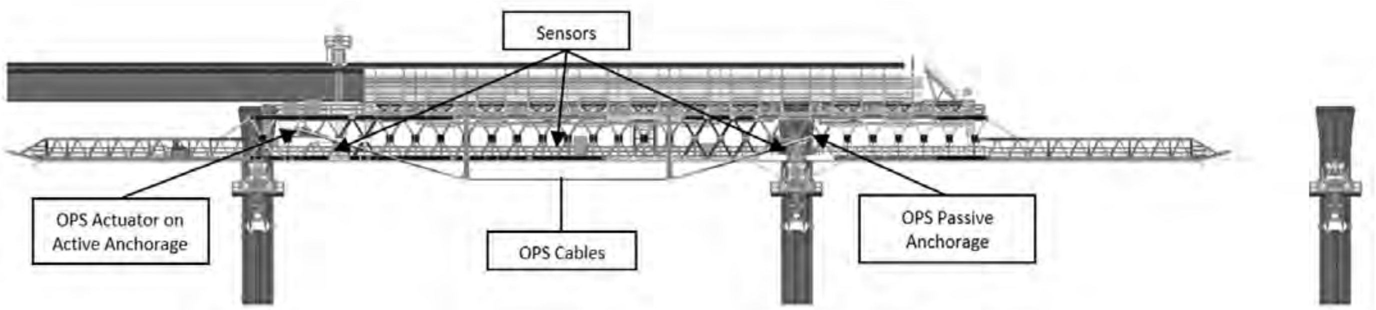


Figure 6: M53-I structure with OPS


Figures 7 and 8: View of the MSS during operation

The pier brackets, see Figures 5 and 9, are the support of the main girders, which must be connected to the pier.

The transverse structures are connected and supported by the two main girders. The formwork panels are placed on top of the transverse structures, see Figure 9.

In order to allow the MSS to pass the pier section without any interference, the central part of the transverse structures is rotated out of the way by hydraulic jacks.

The OPS, worldwide patented and used exclusively by BERD, is a deflection control system that allows the achievement of a lighter, safer and more functional scaffolding support system.

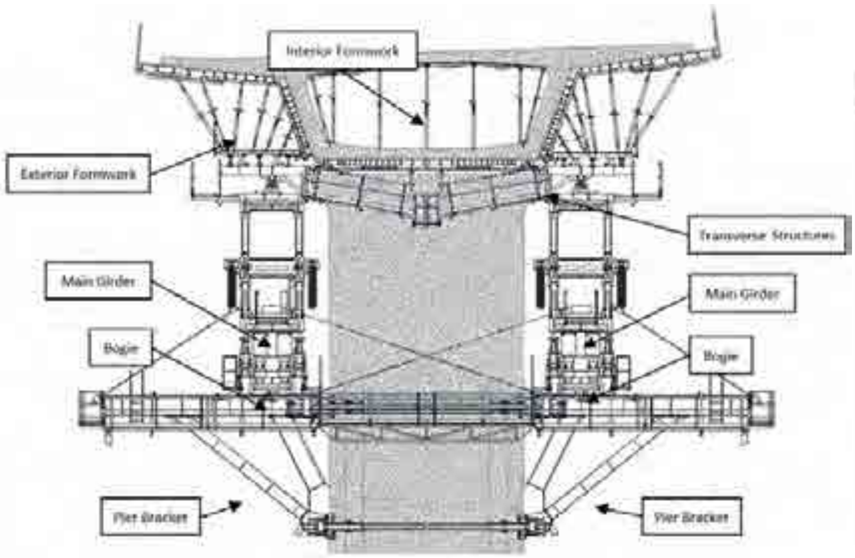
The OPS is an adaptative prestressing system, in which the forces applied are automatically adjusted to compensate the deflection.

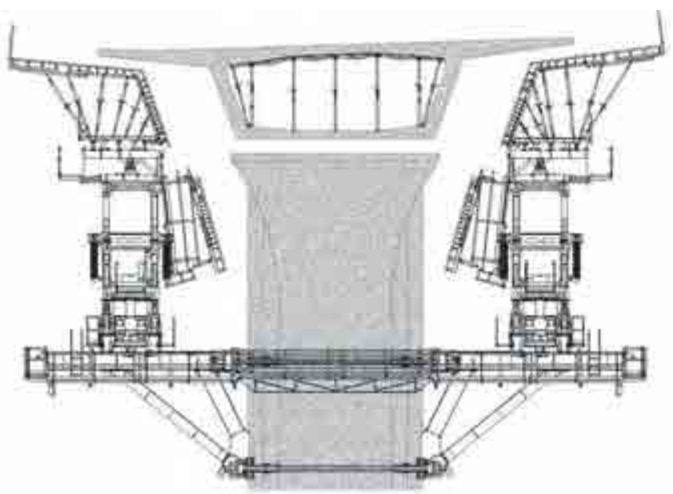
This system also includes several safety redundant components, monitoring system and alarm warnings, Figure 6.

During the launching stage, the prestressing cables are unloaded and the OPS system is inactive.

CONSTRUCTION PROCESS

The typical steps of the construction process using the MSS M53-I are as follows. First, the pier brackets and bogies are disassembled from the Pier N-2 and then reassembled on Pier N+1, see Figures 2 and 9.





Figures 9 and 10: Cross section of the M53-I in casting (left) and launching (right) stages

Then, external formwork is stripped, the main girders lowered and the central joint of transverse structures disconnected.

The main girders are moved transversely out from the pier and transverse structures rotated out to allow MSS passing through the piers, Figure 10.

Following this, the MSS is launched.

After main girders are transversely moved in and transverse structures rotated inwards, its central joint is then reconnected and the main girders raised. External formwork is then raised and adjusted.

Rear support is provided from the rear suspension beam.

The 1st phase of the bridge construction including concrete pouring, curing and application of intermediate post-tensioning of box's U section is followed by the 2nd phase of the bridge deck construction (pouring and curing of the box's top slab) with subsequent post-tensioning of the deck, see Figures 11 and 12 below.

CHALLENGES

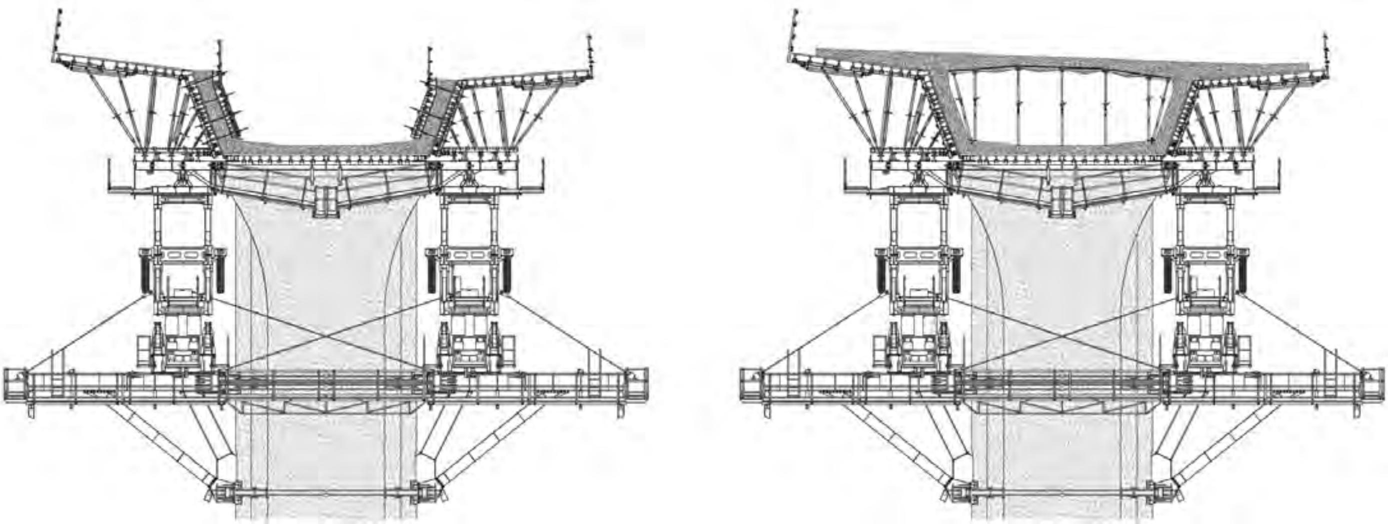
There were a number of challenges associated with the site, but the most demanding was the work from the ground because of the poor accessibility.

For the assembly of the MSS, there was only limited space and difficult access.

Both the MSS assembly and disassembly required an engineered and detailed planning, especially the latter made from under the already built deck with small clearance which was harsh.

It was also necessary to supply material along the previously built deck and provide the client with a solution which allowed the installation of a concrete placing boom over the MSS main girder in order to simplify the concrete pouring task (installed during all operations, see Figures 1, 7, and 8).

Last but not least, from the beginning the client required a technical solution that would guarantee quality deck construction and deformations control.



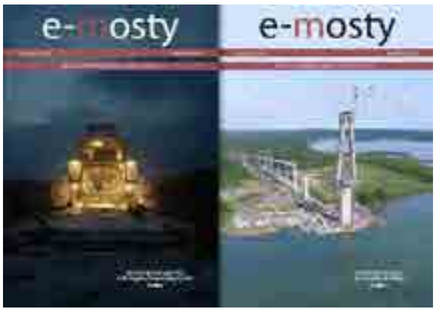
Figures 11 and 12: 1st phase on the left and 2nd phase on the right

Figures 13 and 14: Aerial views of the bridge under construction and when completed

Video 1: Project Overview   *Click on the image to play the video*

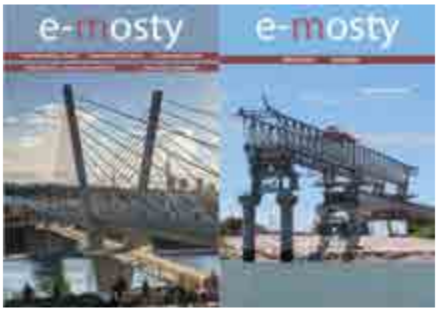
Project images and Video Credit: Construgomes

You can read about BERD's previous projects and equipment in the e-mosty magazine:



BOWSTRING MSS WITH OPS

M1-70-S MSS FOR THE D4R7 THE DANUBE BRIDGE



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OVERHEAD MSS

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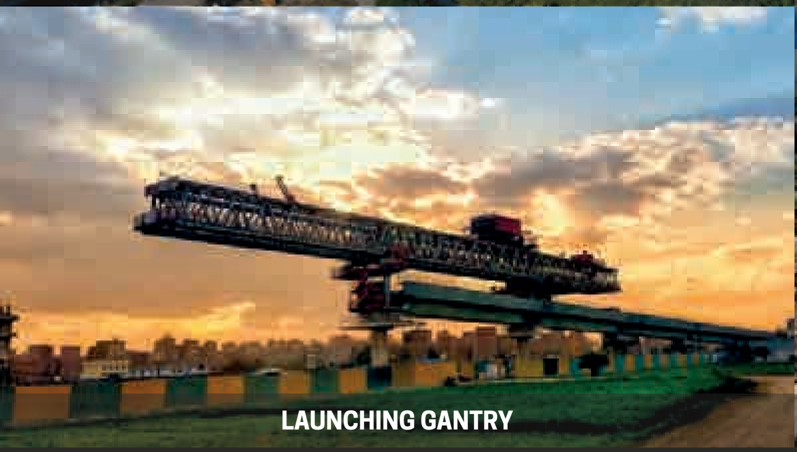
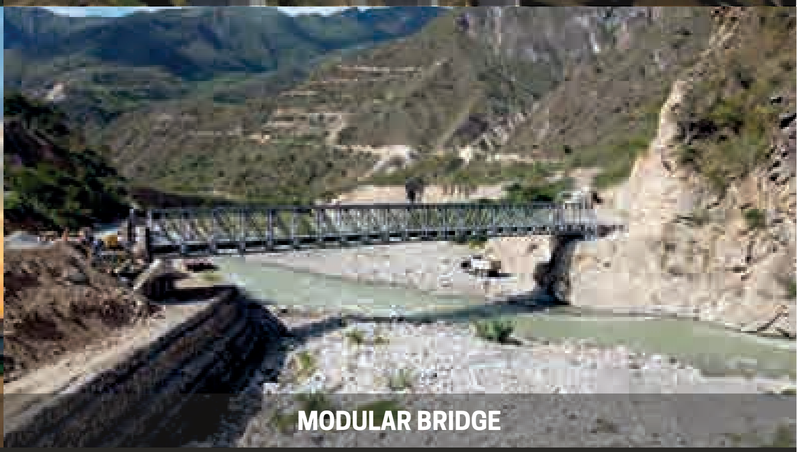


LAUNCHING GANTRY



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