

How to assemble a 32-metre long bridge in 3 hours?

Double interview on the Mandola river bridge in Calceranica: Tecnostre's technical director Stefano China, and the client Alessandro Trentin

WORKSITE DATA

General information:

1. Worksite name: Bridge Torrente Mandola - Calceranica (TN)
2. Intended use: Road Bridge Use Class II
3. Start and expected end date: 01/07/2022 - 31/07/2022
4. Tecnostre's supply start and end date: 06/06/2021 - 10/06/2021
5. Client: Municipality of Calceranica al Lago (TN)
6. Contractor: Burlon S.r.l
7. Architectural designer: Studio Bombasaro
8. Structural designer: Ing. Bombasaro
9. Architectural Works Management: Ing. Bombasaro
10. Structural Works Management: Ing. Bombasaro
11. Building size (m², m³, no. of floors specifying if underground): Full deck to cover a net span of 27.5m.

THE NEED FOR A NEW, SAFER AND MORE FUNCTIONAL BRIDGE FOR CALCERANICA

The bridge is located in the historical centre of Calceranica in the province of Trento and is the main link in town, as it connects the church with the square in front of the town hall. The old bridge was demolished due to structural and hydraulic deficiencies. It had too narrow a section that risked creating dangerous 'plugs' of material in the event of strong and sudden floods. As

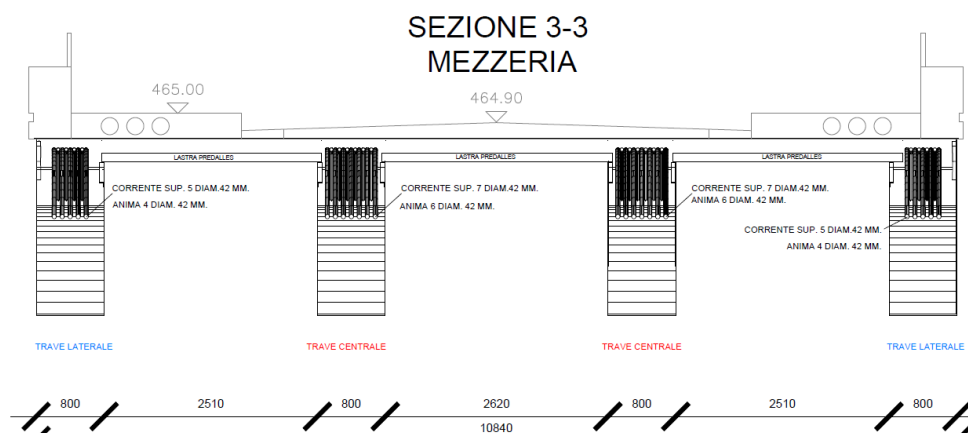
Tecnostrutture’s technical director, Stefano China, also confirmed, “the bridge was no longer suitable for guaranteeing its functions in terms of road safety due to the deterioration and of the concrete structures and the lack of hydraulic clearance between the free surface and the intrados of the load-bearing structures.”

The existing bridge is of the concrete girder type with three stone piers in the riverbed, with a total length of approximately 30 m. The overall thickness of the deck is approximately 1 m and has a slight curvature with approximately 0.4 m of abutment in the middle. The current section of the bridge consists of two lanes with a total width of 6 m and two 2m-wide. On the sides are reinforced concrete walls with steel handrails above them. The paving, both of the pavements and the roadway, is made of porphyry cubes.

THE CHOSEN DESIGN SOLUTION.

BIM AND NPS STRUCTURES TO REDUCE LEAD TIMES

The design solution involved the construction of a bridge with mixed steel-concrete beams in a single span, with a net span of approximately 27 m, 80 cm wide. The structure consists of four NPS beams, two of which are perimeter beams. Between the beams there is approximately 2.5 m of slab cast on top and self-supporting predalles slabs. The bridge section has an overall width of 11 m: it consists of two pavements at the sides each 2 m wide and a two-lane driveway with a total width of 6.5 m.



Drawing of the design solution chosen for the new bridge

The bridge is made of reinforced concrete, according to an ‘integral bridge’ static scheme, i.e. a bridge that is not free from supports, but creates a



Construction of single span bridge, Calceranica (TN)

hyperstatic node with the bridge abutments, capable of transmitting bending moments. The deck consists of four trussed beams with a mixed steel-concrete structure and a 25 cm thick reinforced concrete slab on self-supporting prestressed slabs. The NPS elements used are not visible. The perimeter beams are covered with a precast concrete slab and are made of weathering steel to ensure good durability. In addition, the outer deck rails follow the course of the deck's curvature and serve as a guide for the laying of the outer cladding.

“ The launching of the four beams was completed in just over three hours by a team consisting of one crane operator and two workers on each side. A 250t crane was used for lifting on site. The maximum weight of a beam is 18 tons, and they are 27 metres long ”



The new bridge with a single span of 25.6 metres and an 11-metre-wide section

“For over 10 years, Tecnostrutture’s technical office has been modelling its elements in BIM,” said Stefano China. BIM allows to avoid surprises on the construction site, which could slow it down by months. The topographical control of the built environment in relation to the BIM model makes it possible to notice any errors before they are too difficult to solve. Prefabrication means paying more attention to the design stage so that there are no delays during production and installation.

“The interoperability between the calculation model and BIM software has enabled an acceleration of the timeframe for production and the control of interferences in the construction phase”

“The BIM model, already in its early stages, was constantly shared and updated with the contractor, who was also responsible for the construction of the side piers where the bases of the beams rest. This allowed to anticipate and dissect some issues that were invisible in 2D, such as, for example, checking the positions of the anchor bolts to avoid interference with the reinforcement of the pier, checking the correct position of the holes on the banks for the passage of pipes, verifying the encumbrances to tighten the M30 anchor bolts, and checking the lifting of the elements.”

“By using NPS offsite structures, we have achieved an aesthetically pleasing shape, as the bridge is very slender, and we have respected the hydraulic clearance,” said Stefano China.



NPS beams for the new bridge in Calceranica

THE WORD FROM THE CLIENT TO THE SURVEYOR ALESSANDRO TRENTIN

Is this the first time you are using this type of solution? If yes, what has changed compared to the traditional methodology?

“Yes, this is a first. Definitely a different solution for building bridges, the strong point being the reduced weight and therefore easier launching and laying of beams, perhaps even in places where it is impossible to get to and position large cranes.” NPS solutions allow for more compact and lighter sections, with less environmental impact. The high structural flexibility also allows for easier and faster assembly, while guaranteeing seismic strength and robustness.



The team in Calceranica (TN)

“*In Tecnostruttura I have found qualified technical staff who are willing to listen and accommodate our questions and/or worksite issues.*”