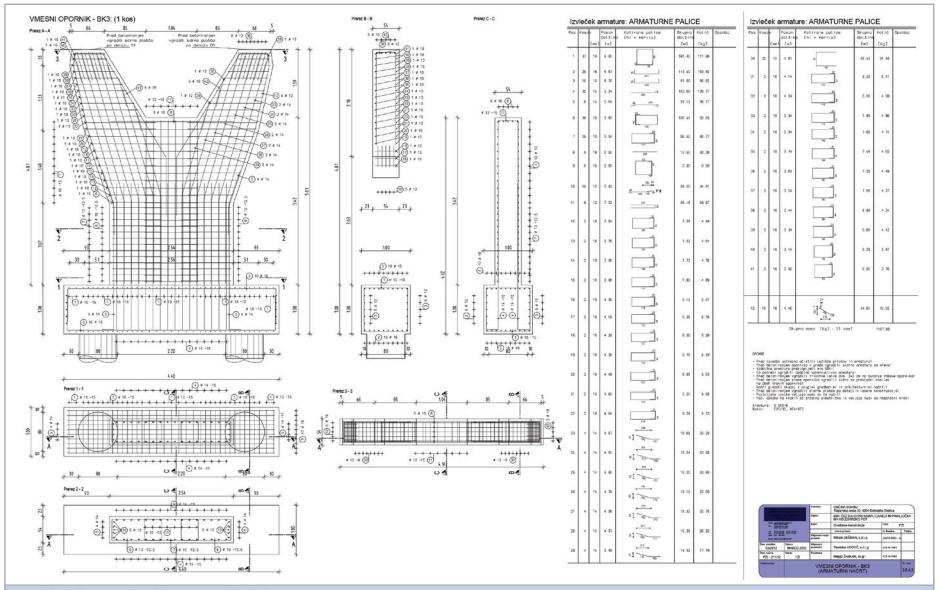
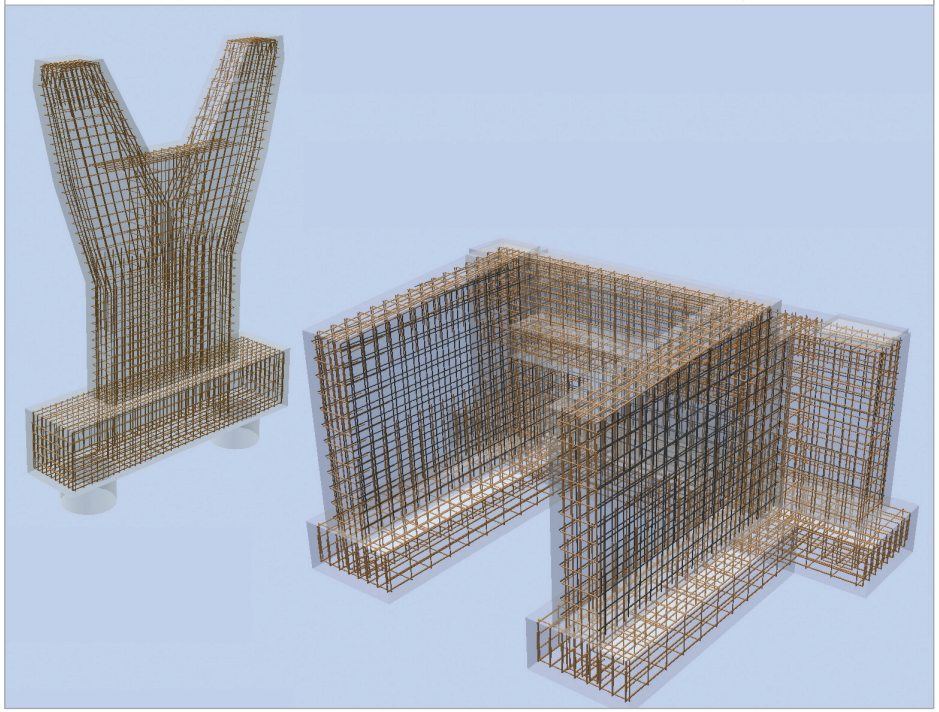
# Wooden Footbridge with a Cycling Track Across the River “Sava” - Bohinjska Bistrica, Slovenia





The footbridge is composed of three different structural materials. The main bearing structure and secondary bearing structure are designed as glue-laminated timber beams. Connecting members, anchoring seats and stability bracings are designed with structural steel. The complete supporting structure with foundations and pilots are designed as massive concrete structures.

**Architectural design**

The architectural design is based on a smooth curved structure with a natural look to fit in a natural environment. Terrain at each end will be raised to prevent the flooding of the cycling track and pedestrian walkway. Both end foundation blocks will be partially filled with earth to form a new embankment raised to a new flood protection height. The main span is divided into three smaller spans with two middle support pillars. These pillars will be placed beyond the main river stream on dry river bed. The bridge structure is designed as a U-type channel with two large main beams connected with smaller cross beams at the bottom and longitudinal secondary beams for attaching walking boards.

**Design of the structure and technical data**

**Timber bearing structure**

Two main beams are used to bridge across all three spans. The cross-section dimensions of these beams are 24 x 160 cm. The middle span beams are curved beams because of the curved bridge design. Span sections are connected together with steel plates and a large number of bolts to assure a rigid connection. Hinge connections are used to attach the beams to concrete supports and steel sockets will be used because of the large height of the cross-sections, in order to gain stability and prevent overturning.

The main beams are connected with smaller cross-beam dimensions of 20 x 22 cm and are placed approximately every 5.0 m. The connections of these beams are rigid. This is achieved with the usage of steel plates and a large number of bolts in each connection. These beams also provide stability that counters overturning. Secondary beams with dimensions of 16 x 16 cm are then placed on top of the cross beams at an 83 - 84 cm distance to ensure the bearing of the final walking surface. The secondary beams are attached with hinge connections. All the beams are made as glue-laminated beams with GI28h grade quality.

**Steel elements of the structure**

Besides the steel plates for all the connections and anchoring seats, steel bracing diagonals were used to achieve the global stability of the structure. These diagonal bracings are placed in intersections of cross beams and main beams and are attached through steel plates on the socket connections of the cross beams. All the diagonals have a strain link to gain the correct tension of the elements. Some diagonal bracing elements must be anchored to concrete supports to assure the global stability of the structure.

**Concrete foundations and pillars**

Both end foundation blocks are designed as concrete U-wall element blocks on strip foundations. The walls of the foundation blocks are 50 - 60 cm thick. On each front wall there are two raised concrete seats for the timber beams of the main bearing structure. Both rebar and mesh reinforcement were used for the adequate reinforcement of cross-sections. The middle pillars are slightly different, being made as walls with two inclined arms. Each inclined arm has a seat for the main timber beam on top. The walls of the middle pillars are anchored to a massive concrete girder on two pilots, which are drilled 5 - 6 m deep in bedrock.

**Software and calculation model**

Scia Engineer 2012 was chosen for the complete 3D-Modeling and for the calculation because there were three different structural materials in interaction. Some calculations were also “handmade”, such as for the timber section design because of complex vertical and horizontal frequencies that had to be calculated to prevent uncomfortable vibrations.

The concrete design and reinforcement was carried out in cooperation with another engineering bureau with Nemetschek Allplan software. Some details for connections were also “handmade” and transferred into the computer design.

**Software: Allplan Engineering, Scia Engineer**

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**Personal information**: Matjaž Žabkar was born in 1979 in Novo mesto, Slovenia. From 1997-2002, he attended to a Diploma study of Civil Engineering at the University of Ljubljana, specialising in "Steel structures". In the period 2002-2007, he worked on Architectural and Civil Structure projects, and in 2008 he became a certified engineer in the Slovenian Chamber of Engineers, IZS. Since 2007, he has worked on planning and the optimisation of steel and membrane structures, foundations and other concrete structures, and earthquake resistant structures.

**Company information**: The company develops, manufactures and erects Office and Manufacturing facilities, Storage halls, Functional constructions, Sports facilities and Mobile halls, Canopies and other structures. The firm cooperates with many Slovenian and foreign partners, developing new products and improving existing programmes and services. In Slovenia, LoGing is one of the leading companies in the field of buildings with inflatable thermal membrane roofs with ETFE, PTFE or LOWE coatings. The production capacity for steel structures is limited to 500 t per month.

## Project information

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| Owner | Dipl.-Ing. Matjaž Žabkar |
| Architect | Dans arhitects |
| General Contractor | ProTehno d.o.o. Ulica pod Gozdom 19, 4264 Bohinjska Bistrica |
| Engineering Office | Loging d.o.o., Biro Udovč s.p. |
| Location | Bohinjska Bistrica, Slovenia |
| Construction Period | 04/2013 to 07/2013 |

## Short description | Wooden Footbridge with a Cycling Track

The wooden footbridge with a cycling track is a future project in terms of offering safety to cyclists and pedestrians as the cycling track on the other side of the river is currently accessed with difficultly from the main road. The wooden bridge will be 53.6 m long and 3.40 m wide with a curved vertical course. The vertical radius of curvature is ~181.6 m in the middle span. Both ends of the bridge are linear and ~12.35 m in length. The highest point of the walking surface is ~1.56 m higher than the surface at the beginning or end.

The bearing wooden structure sits on two end foundation blocks and two middle supporting pillars with pile foundations. The complete wooden structure is connected with steel plate sockets and bolts. Many connections are strengthened with steel plate ribs. The structure stability is based on diagonal steel bracings which are anchored to concrete supports. Both fences are part of the bearing structure. From the aesthetic point of view, the complete fence is decorated with shingle plates.