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No. 62 – Plzeň – bridge of Miroslav Tyrš

road arch bridge	
Plzeň Region	
Plzeň-City district	
cad. territory Doudlevce	
cultural monument	49°43'04.83"N 13°22'55.06"E

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History

The bridge is located in the southern part of the city of Plzeň. It carries the 3rd class road over the River Radbuza and the so-called Czech Valley. This route was of great importance after the completion of the neighbouring reinforced concrete bridge, as it connected the state roads outside the town to Klatovy and Nepomuk. At the time of its construction, it was the first welded public bridge in the country and the first all-welded arch bridge in the world.

Originally, the bridge had five spans. In the outermost two spans on each side, the load-bearing structures were continuous plate girders made of reinforced concrete, and in the middle span, two welded full-wall arch girders were supported by butt joints on concrete piers. The span of the arch beams was 50.6 m and the arch camber was 10.5 m. The columns supporting the bridge deck formed transverse frames with the crossbeams, which transferred part of the horizontal load of the bridge deck to the arch girders. The stringers supported a reinforced concrete bridge deck. The superstructure had two bracing systems – one in the plane of the bridge deck and the other between the arch girders. The arches were modelled as double-jointed arch girders, loaded by the bridge deck through the columns, which, together with the crossbeams were analysed as frames. All components were made of C38 steel, only the joints were of cast steel.

Bridge after assembly in 1933

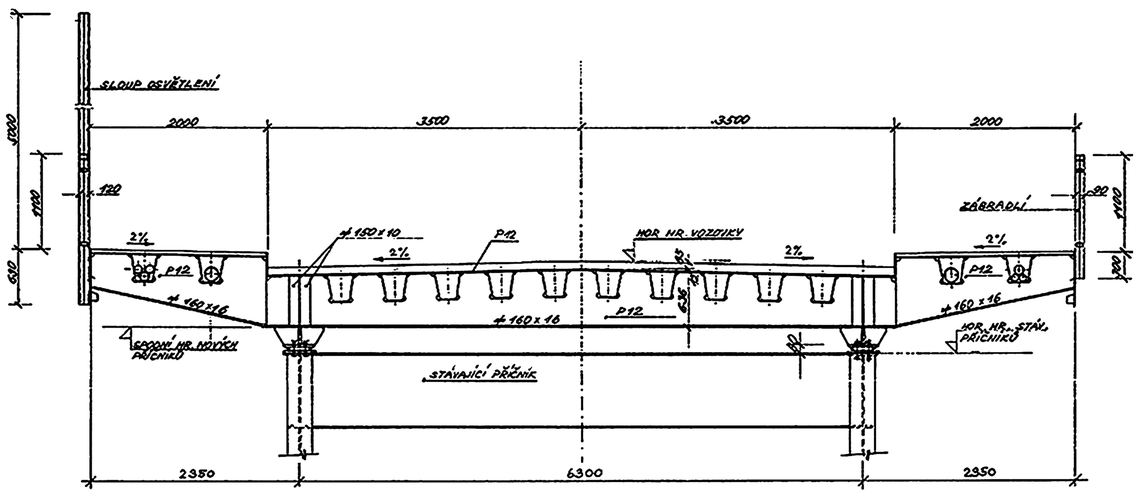
Welding and assembly

For welding, "Böhler-Elite" electrodes from the Böghler brothers, Kapfenberg (Austria) were used. The assembly joints were welded with "Arcos Stabitend" clad electrodes from La soudure Autogéne Areos, Brussels (Belgium). The electrodes had a diameter of 4–6 mm. The welding was carried out with a low voltage but high intensity electric current, which was produced on site using two units.

The steel structure weighing 111 t was manufactured and assembled on site in 1933 by Škoda Plzeň according to the project of Dr. Ing. František Faltus. The original project envisaged an all-steel construction, but later a reinforced concrete bridgehead was chosen.

Defects, repairs, and declaration cultural monument

In the 1980s, a technical inspection of the bridge revealed that unlike the steel structure, the reinforced concrete part (the bridgehead) was in good condition. The situation was satisfactory for the arch girders, but critical weakening due to progressive corrosion was particularly present in the stringers, and at joints with the crossbeams. The defect was attributed to the leaky waterproofing of the bridge deck and its inadequate drainage. This was why traffic was severely restricted in 1986 and the reconstruction or replacement of the bridge were considered. In the end, the Plzeň Municipality decided to repair the bridge by replacing the corroded parts, reinforcing the steel columns and strengthening the reinforced concrete bridgehead. In the following years, the provision of the necessary finance was repeatedly delayed.



Original drawings: Cross section through an orthotropic bridge deck

In 1995, the bridge was declared a cultural monument. Before that, however, the Administration of the Public Farm in Plzeň started preparations for the reconstruction without informing the heritage protection authorities. The implementation of the reconstruction failed to respect the original structural and architectural design. Thus, only the steel arch and columns remained of the original bridge, over which a new steel orthotropic bridge deck was constructed – it provided the required roadway widening and did not strain the existing steel arches. The subdivision into a central arch section and the outermost two full-rail abutments was not respected. The latter were also completely removed and replaced by a new structure. The reconstruction was completed in July 1995.

View from the west in 2021

Crack in the weld

Sheared bolt

Bolt defect

Local deformation of bracing

Corrosion weakening

Local corrosion of bridge deck

Assessment of the bridge condition

The bridge was surveyed in 2019. The main focus of the survey was on the original 1932 steel structure. The global defect is the pitting corrosion of the arch beams. However, the corrosion weakening is small and does not affect the load-bearing capacity of the bridge. The corrosion protection of the arch girders is in good condition and therefore no further development of pitting corrosion is expected provided that the corrosion protection of the arches is regularly checked and maintained.

Identified local defects include:

- Crack in the weld between the vertical stiffener of the crossbeam and the top flange of the arch beam
- Sheared bolt in the joint between the crossbeam and the bridge deck
- Defect of the bolt at the swinging strut
- Local deformation of some members
- Local corrosion of the bridge deck
- Recommendations for monitoring or local repairs were provided within the project activities.

In general, the inspection found the bridge to be in good condition. The detected defects have an insignificant effect on the load-bearing capacity and reliability of the superstructure.