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16. Reconstruction of Vienna's Reichsbrücke "Johann Nestroy" Project

Commissioned by:	*Federal Ministry of Building and Technology* *Municipality of the City of Vienna*
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Architectural design:	*Architect Dipl. Ing. N. Kotz*
Artistic supervision:	*Architect Heiki Siren*
Construction syndicate:	*Hofman & Maculan – Züblin – Negrelli – Hamberger – Stuag*
Construction periods:	*1978-1981.*

Introduction

Following the collapse of the Vienna Reichsbrücke on 1st August, 1976, the city was faced with the problem of establishing a new traffic route across the Danube. The following important factors had to be taken into consideration in the process:

- town planning
- individual transport (with traffic connections at each end of the bridge)
- underground railway
- energy supplies for the districts north of the Danube (electricity, water, gas, heating)
- high-water protection
- navigation.

These limiting conditions were laid down in the course of an international competition. The "Johann Nestroy" project described below was awarded the first prize by the jury, who recommended that the project be realised.

Foundations

With the exception of the two abutments on the left and right banks, which have raft foundations in the outcropping gravel, all the piers of the new Reichsbrücke have deep foundations. The caisson foundation of Pier XX of the old Reichsbrücke on the right bank of the Danube was reused after pressure grouting had successfully been carried out. The loads of the section of the bridge spanning the river – about 220,000 kN – are taken by a pile foundation via a load-spreading grid raft with a thickness of 3.8 m. The cast-in-situ piles – ∅ 150 cm – are arranged in an elliptical shape around the outside contour of the existing caisson of pier XVIII of the Kronprinz Rudolf bridge.

Based on an angle of internal friction of $\psi=27.5°$ and an assumed skin friction of $\tau=20$ kN/m^2, the permissible loading of a pier anchored 24 m below the river bed was calculated as being N=9370 kN. Static computations took into consideration a possible pool of 6 m. The safety factor of the complete pile caisson is s=3.8.

The foundations of the piers on the left bank of the Danube and in the vicinity of the New Danube are either on closed bored pile or slurry trench wall caissons in the outcropping Vienna marl.

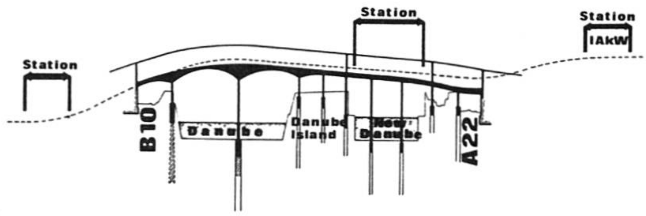


Fig. 1 Bridge Scheme

Planning and design of the bridge

The bridge carries the B 8 federal road and crosses the B 10 federal road along the Handelskai and the Austrian Railways line along the bank of the Danube before crossing the Danube with a main span of 169.41 m. It then passes over the new Danube island at a clear height of about 4.5 m above the top of the projected embankment. It continues on to cross the New Danube and goes over the A 22 Danube motorway unsupported to join the Schüttau junction.

The essential feature about the planning of the bridge is the fact that the various types of traffic are kept strictly separate from one another. The roadway on top of the bridge will handle motor transport, the pavements will be situated along the side of the bridge along the lower deck, and the underground railway will travel through the box girders. The supply lines will be located in the space between the two box girders.

Due to the fact that the design selected is a haunched girder construction, the gradients of the underground railway will be kept as low as possible. In routing the underground railway in ground plan, particular attention has been paid to the transverse frame above the piers which is, for statical and constructional reasons, necessary (profile distortion, bearing replacement). The supporting structure crosses the Danube in spans of 87-169-150-60-60 m as a haunched continuous girder. This then buts onto a prestressed concrete structure with three spans of 60-77-76 m. At this point the New Danube station is integrated into the structure, with stairs going down from the station on either side.

In cross-sectional view the supporting structure consists of two monocellular box girders that are monolithically connected by the deck. The prestressed concrete supporting structure is partially prestressed in a longitudinal direction using the VSL pretensioning system (19 cables of quality St 160/180). The deck is slightly pretensioned in a lateral direction using the ZS 40 pretensioning system. In areas of high principal stress of the webs, the tensions that occur are taken up by angular prestressing.

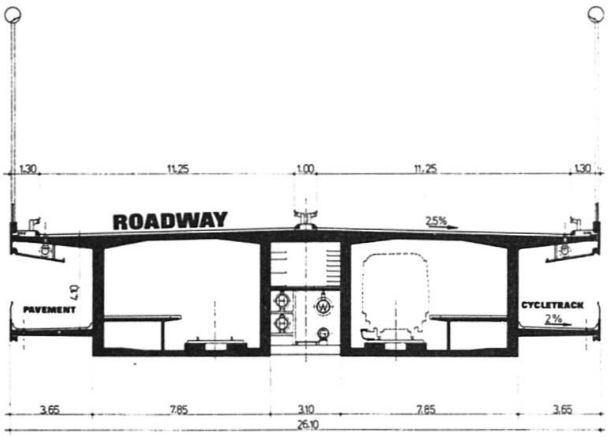


Fig. 2 Cross-section in the station

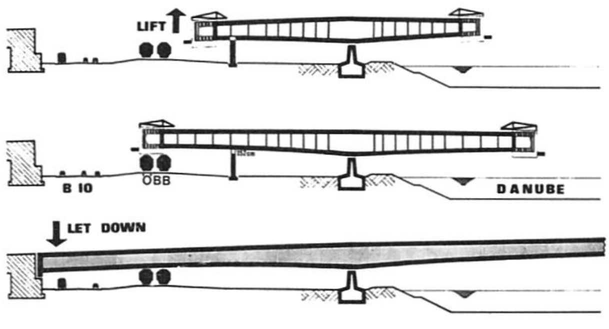


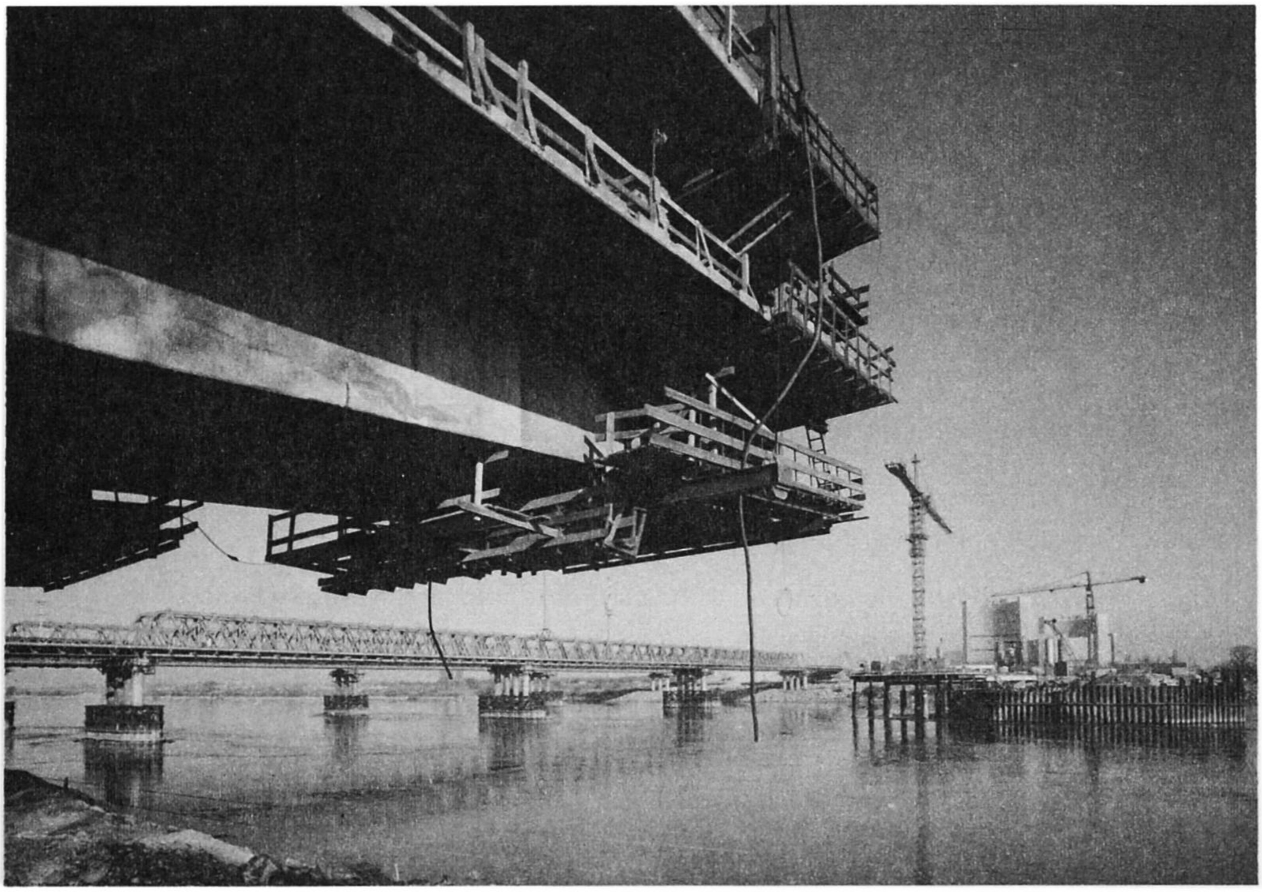
Fig. 3 Scheme of Railway crossing

Construction

Across the river the supporting structure is produced using conventional cantilever construction methods in sections of 3.5-5 m with a cantilever scaffold moving out along the top of the bridge. The two box girders, which are later monolithically connected together, are constructed independently of one another. After completion of the individual construction phases, the deck joining the box girders and the lower cross beams are concreted. The lower pavement platforms are built with the box girders in cantilever construction. Due to the extremely asymmetrical loading during construction, partial pretensioning is carried out before the deck is laid so as to provide a relieving torsional moment.

As a result of the prescribed limiting conditions on the right bank of the Danube, it was necessary to tilt the supporting structure to cross the railway line along the bank of the Danube (see illustration). On the banks the supporting structure is built on staging in the conventional manner with step-by-step construction of sections. The lower half of the box girder is concreted first, to be followed in the second section by the top half. Exact calculation of the combined support of the hardened lower box girder sections and the rigidity of the staging was of vital importance in the dimensioning of the bridge.

(P. Metz)



The Bridge under construction