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### 23. Grenzbrücke of Motorway N2, Basle

*Client: Department of Public Works, Basle City (Switzerland) together with Motorways Department, Baden-Württemberg (German Federal Republic)*

*Design and Supervision: Joint venture formed by Dr. Walther and Mory with Aschwanden & Speck, Dipl.Ing. ETH/SIA Ltd.*

*Contractor: Consortium formed by Preiswerk & Cie AG  
G. Stumpf  
Ed. Züblin & Cie AG  
Stamm Bauunternehmung AG*

*Posttensioning: Stahlton AG*

*Main dimensions*

*Total length:  $L = 1476,50$  m*

*Normal width:  $B = 22,00$  m*

*Normal span:  $l = 35,40$  m*

*Depth of superstructure:  $h = 2,00$  m*

*Quantities (at typical superstructure cross-section)*

*Concrete:  $0,48$  m<sup>3</sup>/m<sup>2</sup>*

*Steel (Grade III 42/50):  $63$  kg/m<sup>3</sup>*

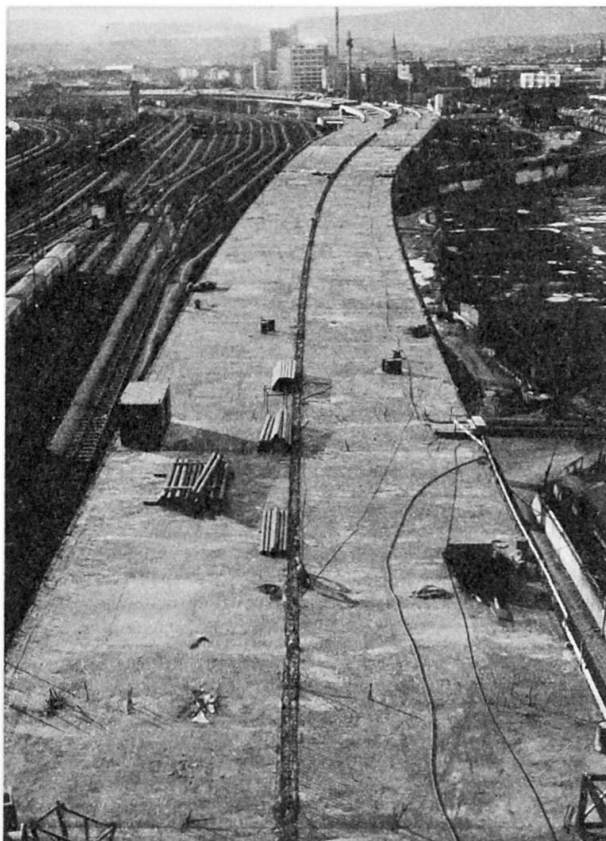
*Prestressing steel (grade 170):  $10$  kg/m<sup>2</sup>*

*Execution Period: 1976 – 1978*

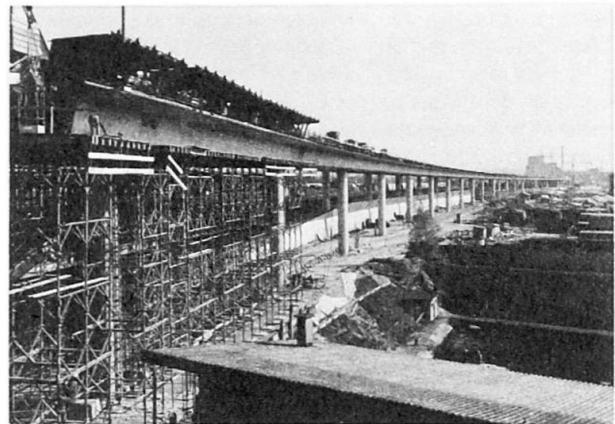
*Opening to traffic 1980*

Nearly one third of the bridge runs through West German territory, while the remaining part lies in Switzerland. The client was represented by the National Motorways Office of Basle City. The design and construction of the bridge was carried out in accordance with Swiss regulations and SIA Codes of practice.

The bridge has an average height above ground level of about 10 m. Over a length of approx. 1140 m the superstructure has a constant width of 22.0 m; approaching the south abutment, the width increases in order to accommodate an exit and an entry ramp bridge.



This 1,5 km long bridge connects the Swiss National Motorway N2 with the German Hafraba Motorway, linking Hamburg with Basle (E4). Starting at the joint customs facilities located on German territory, the bridge crosses the territorial boundary, following the embankment of the German Federal Railway (DB) until it reaches the large, common abutment of the bridge over the river Wiesen.



The load bearing subsoil strata of Rhein gravel lies at varying depths up to 10 m below ground level and is overlain by a strata with a very poor bearing capacity. Pad or piles foundations were used, depending on the depth at which the gravel was found. In case of piling, bored piles with a dia. of 116 cm were chosen.

Part of the bridge lies above a series of railway tracks. With acute shortage of space available in this zone, round columns were best suited to be adapted to the alignment of existing railway lines and of planned extensions. The 7,0 – 12,0 m long columns for the main bridge have been designed with a constant circular cross-section of 160 cm diameter.

The standard span length is 35,4 m, while the end spans measure 29,4 m.

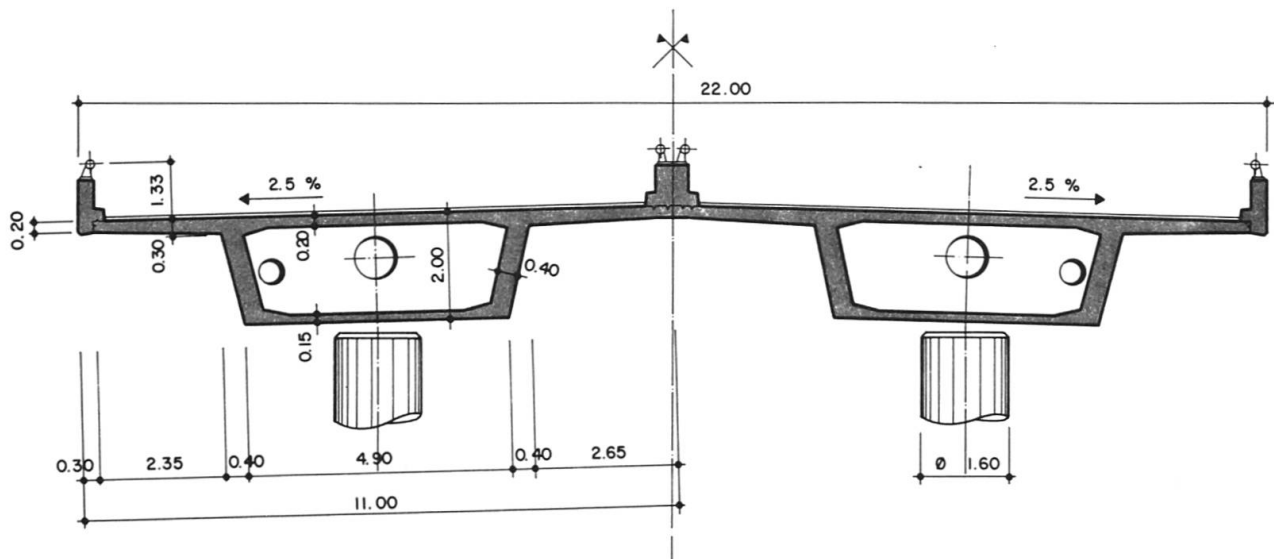
Three Gerber hinges divide the total bridge length into 4 continuous sections of approx. 350 m each. In each section, 2 lines of supports adjacent to the zero movement point are joined monolithically to the bridge deck, followed by 1 or 2 lines of supports with concrete hinges. All other bearing points, including the dilatation joints and the supports at the abutments, are provided with sliding bearings.

On the 1140m long constant width, the superstructure consists of 2 hollow box girders connected by the deck slab. A through cross beam at every alternate line of column support connects the 2 boxes and is intended to resist torsional loading.

Additional through cross girders had to be provided when columns are located eccentrically, because of railway lines or roads below the bridge.

The 2 access ramp bridges consist of single hollow box girders with the deck and bottom slab suitably strengthened to resist high torsional loads.

# NORMALQUERSCHNITT



At its widest point, the cross-section of the superstructure is transformed into a multi-cellular hollow section with the addition of 2 webs and by closing the bottom slab over the whole width. Of course, the outer profile of the consoles is maintained. The continuation of the webs coming from the standard section had to be maintained in a skew position inside the multi-cell section for constructional reasons.

The arrangement of the tendons is dictated, to a large extent, by the sequence of construction, which consisted of a span by span execution of the superstructure from one coupling point to the next. This coupling point lies at approx. 8,0 m from the line of support. At the coupling point, only the tendons, which needed to be stressed for carrying the newly concreted span, have been coupled, while the remaining tendons run through over the next span. The design is based on the principle of a partially prestressed structure in accordance with the Swiss Code of practice SIA 162.

The scaffolding consisted of towers (3,0 x 4,0 m in plan) resting on precast foundation pads, which were reused for successive construction stages. A stationary crane on the already completed bridge deck and a pneumatic-tyred crane were used for moving precast pads, scaffold towers and formwork from one span to the next. In spite of the rather simple scaffolding system, a very high speed was obtained, enabling the execution of a span of 35,4 m length and 22,0 m width in 2 weeks (390 m<sup>2</sup> of bridge per week).

(A. Aschwanden)

