RAILWAY BRIDGES OVER THE MOSELLE AND RHINE (1857-1879).

TWENTY YEARS OF BRIDGE CONSTRUCTION HISTORY IN KOBLENZ

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On account of its topographical situation at the confluence of two important, also strategically significant rivers, Koblenz has been a bridge city from earliest recorded history. Two permanent Roman bridges, one across the Rhine (about 50 A.D.), the other across the Moselle (2nd or 3rd century A.D.), with earlier, as yet unproven Moselle ones, were at the beginning. Whereas the former was abandoned with the fall of the limes (about 260 A.D.) and there was no further permanent Rhine bridge for more than 1500 years, the Roman Moselle bridge had a successor in the Baldwin bridge (construction began about 1326) which was for the most part only destroyed in its historical substance by planning mistakes in the 1960's and '70's.

The following four bridges, which all still exist today, admittedly only with the pillar construction or abutments from the original structures, were built within a little more than two decades (1857-1879). All four are railway bridges, with the Pfaffendorf bridge being used exclusively by road traffic since 1895.

Unfortunately, apart from commemorative publications at the time of the opening and mention in specialist literature, there is no thorough account of the structures and certainly no monograph. Even if the iron constructions have had to make way for modern structures in tune with traffic technical requirements, it is nonetheless incomprehensible why the stone components should also be destroyed and why these remains - imposing enough - still have not been protected as ancient monuments.

It is interesting to observe the very rapid changes in attitude towards the Koblenz bridges. In 1875, the art historian Wilhelm Lübke (1826-1893) listed the "lattice bridges in Düsseldorf, Marienburg, Cologne and Koblenz" as being equally important and adds that they would rank "on a par with the greatest works of wonder of all times". However, in his "History of German Art" (1890), the same author does not mention a single bridge structure, and F. Hasck, who compiled "The Art of the Nineteenth Century" edited by W. Lübke, does not mention the bridges at all (1912/18). On the other hand, the in its time widely used "Illustrated Building Lexicon" by O. Mothes (1974) praises the Pfaffendorf bridge and reproduces two drawings of it. F.M. Feldhaus expresses similar praise in his lexicon "Technologien" (1921). In more recent times, G. Drebusch accorded the Pfaffendorf bridge an appropriate place in his work "Industrial Architecture" (1976). If one disregards the brief mention in Lübke's work, the aesthetic-art historical dimension is never brought to the fore, just the technical one. But both should be taken into account if justice is to be done to the bridges.

The Koblenz bridges came into being as a result of the rapid expansion of the Prussian railway network; apart from economic aspects, it was the strategic ones which were decisive. The Moselle bridge was built in the course of the construction of the main north-south trunk route, as part of the section from Rolandsaek to Bingerbrück. At the same time, however, a Rhine bridge was planned in order to be able to provide the link to the line running along the right bank of the Rhine. The two other bridges, the Moselle bridge at Gillen and the Rhine bridge at Horchheim, were planned as part of the Berlin-Metz route. In this case it was solely strategic reasons which played a decisive role, something which was also clearly observed in
 structural sides. In order to attain greater rigidity at the sides, there were three instead of two main trusses in each span and wrought iron was selected as building material.

In the case of the Hohenzollern bridge, the following broad principles were applied: The greatest loading of the wrought iron should not be more than 720 kg per sqm or that with a maximum load of 3200 kg per square meter. The greatest angle of angles of the track height was determined by the height of the driving wheel of a locomotive taken to be 8250 kg. The modulus of elasticity was presumed to be 1,510,000 kg.

The ribs of the main girders were composed of plates and angles set together in upper and lower members. The arches were 3.14 m in height and their pier height was 9.10 m. The supports on the abutments of the land-based piers were 1.24 m above ground level and 3.14 m above the tow path. The underside of the arch at the centre was 15 m above normal water level, while the railway track was 62 cm higher, so that a considerable part of the curve of the arches extended above the railway tracks.

The upper and lower members were connected by a system of double-diagonal t-girders and vertical plates reinforced with angle irons. The divisions in this system coincided with the divisions of the cross girders so that in each case the connection with the cross girders, where they were within the ribs, was made by such a plate. On the other hand, where the cross girders with the track bed lay above the upper beam, vertical plates of similar construction formed the supports for the transverse girders and track beds. Vertical, horizontal and diagonal cross girders served to safeguard against lateral sway.

The track bed was formed by iron transverse sleepers supporting longitudinal sleepers on which the rails were laid and which were placed in transverse girders. The width of the transverse girders was such that it was possible to attain as low a height as possible for the track bed above the lower member at its apex.

The arch ribs had very powerful wrought iron plates, reinforced by angle irons. At their ends, they rested on steel wedges on the cast plates mounted onto the abutments. By tightening up the central wedges, the arches were supposed to retain an elastic flexibility.

The plan for this magnificent structure came from the senior government architect Hartwich and the former Prussian state architect Steinecke, government architect in Baden and professor at the Baden Polytechnic in Karlsruhe. The construction work itself was under the direction of the departmental architect Schierz. The construction time was again remarkably short: The first track was laid into three summer months, the foundation stone was laid on the 11.11.1862, the opening - celebrated at enormous expense for the ceremonials - was on the 9.5.1864.

For its time the bridge represented a work of technology which by virtue of the boldness of the project as also its execution outshone all other Rhine bridges, both the Cologne truss bridge and the Mainz bridge constructed with so-called fish-belly girders. Above all it excelled by its architectural beauty.

The foundations at the bridge heads were considerable, culminating in 10 m high bomb-proof towers, closing gates and extending roller bridges. The design of the towers was similar to that for the Moselle bridge.

The Pfeffendorf bridge was rebuilt in 1932/34 and in 1955/56; like all other Koblenz bridges it too was destroyed in 1944/45.
Chronologically, the next bridge is the Elsässer railway bridge over the Moselle, it was built as part of the Berlin-Metz railway between April 1877 and October 1878. The Moselle was not crossed at right angles by the railway, but at an angle of 80°, with roughly the same period of construction and employing the same building material - namely iron - as factors linking them together. If one disregards the varying nature of the construction, they do share in common the successful synthesis of functional technology and aesthetic desire to create and incorporate into the landscape by means of employing forms related to the landscape. Their successors, constructed between the 1950's and 1970's are, for all their praiseworthy functionalism, soulless alien bodies in a delightful landscape.

Notes
3. P. Hinkel: Die Kunstdekmäler der Stadt Koblenz. Die profan Denkmäler und die Vororte (= Vol. 1 Kunstdekmäler von Rheinland-Pfalz) Munich, Berlin 1924, pp. 165/6. - H. Bellinghausen: Alte und neue Rhein- und Monselbrücken bei Koblenz. In: Festbeschreibung zur Einweihung der Pfaffendorfer Brücke, Koblenz 1935. - E. Franke: Geschichte der Ballindbrücke. In: Koblenz Stadt der Brücken, pp. 16-55. - By far the best survey is provided by the festchrift published by the City of Koblenz on the occasion of the completion of the Adolf-Hitler-Brücke and the reconstruction of the Pfaffendorf bridge, Koblenz 1934. In this work the chief City Architect, Neumann and City Architect Kohaupt write about the four Koblenz railway bridges on pp. 29-52. All dates and construction descriptions quoted here have been taken from this work unless otherwise stated.
12. ibid. p. 46.
15. Neumann/Kohaupt pp. 34/35.
16. ibid. p. 38. The "bridge which is so characterised by its light and pleasing form" was praised by contemporaries, cf. J. Wegeler; Beiträge zur Geschichte der Stadt Koblenz, Koblenz, 2. edition, 1862, p. 193.
17. ibid. p. 49.
19. The only photograph showing the towers is to be found in: K. Mühlig: Der Alt-Koblenzer Östereiseraflug. In: Mitteilungen des Heimatkundlichen Arbeitskreises Gülis/Mosel 4, Gülis 1969, Illustration on p. 13.
20. As Note 10.
22. As Note 10.

IRON FURNITURE

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Surrounded by all those giants of iron architecture to which the papers in this colloquium are primarily devoted, pieces of furniture do not only appear small and modest, but perhaps also out of place. However, I am very pleased to have the opportunity here of pursuing this subject further, because iron time immemorial, the art of furniture construction has been very closely linked with architecture. Perhaps this symposium may help to throw light on the extent to which this opinion of mine is also indeed applicable in the case of iron furniture - assuming that it is possible for any conclusions at all to be drawn at the present stage of investigations, because I must admit that my own research in this field is still very new. My comments are in effect a commissioned work without any preliminary work, either by other researchers or by me myself. In the extensive range of literature on iron - including also what has been appearing recently and has also been dealing increasingly with the decorative parts of iron architecture - furniture is never touched.

I can thus only give a preliminary survey, which means that I can also not just restrict myself to the second half of the nineteenth century - although the greater part of the furniture to be covered dates from this second half.

Firstly the question arises: Why is there such a thing as iron furniture? How did the manufacture of iron furniture come about? A decisive incentive for the manufacture of iron furniture is fear, namely fear in three forms:
1. fear of theft and fire,
2. fear of bugs and
3. fear of bad weather.

That is, of course, just one aspect which leaves out other motives, such as questions of skill, craftsman's pride, the pleasure in strange things which also induces the artist-craftsman to produce iron furniture. Nevertheless, I should like to keep to the three "categories of fear", because they do permit a certain degree of classification of the material. Fear of fire and theft led to the production of iron receptacles as items of furniture, starting out from the iron chests of the Middle Ages down to modern safes. Fear of bugs led to the production of iron beds which - something we tend to forget nowadays - were so widely spread and in general use in the nineteenth century, that the reintroduction of wooden bedssteads was only achieved with difficulty. Finally, fear of bad weather led to the manufacture of iron garden furniture, the most extensive and widely spread form of iron furniture.

The first pieces of iron furniture we know of were, admittedly, produced for artistic reasons, for the sheer pleasure of using an unusual material for furniture. One of the most magnificent pieces of iron furniture in existence was produced in Augsburg in 1574 by the master cutler and instrument-maker Thomas Rucker, and was intended as a gift by the City of Augsburg to Emperor Maximilian II. (1) This elaborate piece of furniture is, of course, itself part of a tradition. Its cross members forming the seat proper and continuing up to form the back and arms are a development of the