

Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH
Kongressbericht

Band: 2 (1936)

Artikel: Examples of the application of high tensile steel in reinforced concrete
slabs

Autor: Olsen, H.

DOI: <https://doi.org/10.5169/seals-3266>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 14.01.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

IIc 1

Examples of the Application of High Tensile Steel in Reinforced Concrete Slabs.

Beispiele für die Anwendung von hochwertigem Baustahl bei Plattenträgern aus Eisenbeton.

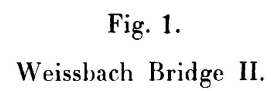
Exemples d'application de l'acier à haute résistance dans les systèmes en dalles de béton armé.

Dr. Ing. H. Olsen,
München.

Hitherto the development of reinforced concrete construction in bridges has been concerned almost exclusively with the design of arch and beam bridges, but in view of the great improvement attained in the mechanical properties of concrete, the production of a structural steel of high yield point, and the endeavours now being made to utilise these two high-grade materials consistently, further constructional development of the slab girder is to be anticipated. This is a type of structure with the merit of clear and simple statical conditions, because as a rule the bending moments are in one direction only, while moreover the shuttering work, the arrangement of the reinforcement, and the placing of the concrete are all notably simplified. Again, slab shaped members, in consequence of the great width of the concrete in the tension zone, show much greater freedom from cracking than is the case with the shallow ribs of T-beams.

The structural possibilities of slab girders when account is taken of the increased permissible stresses will be illustrated here in a few practical examples. The bridges in question were designed by the author and were completed as part of the work on the eastern section of the German Alpine Road in the spring and summer of 1936.

Fig. 1 shows a reinforced concrete slab designed as a *Gerber* girder over three openings of 12.4 m span each, with a roadway width of 8.5 m. The piers and abutments make a wide angle with the axis of the road. The thickness of the slab, only 0.60 m at the side and 0.68 m at the axis of the road, shows the extent that the constructional depth can be reduced through the use of high-grade materials. In the present case the proportion of the mix was 300 kg of ordinary Portland cement per cubic metre, and at 28 days the cube strength of the concrete was 405 and 513 kg/cm², allowing a permissible compressive stress in the concrete up to 70 kg/cm², while the permissible stress in the steel in the round bars of St. 62 was taken as 1500 kg/cm². Loading was assumed in accordance with the German regulations for Class I bridges, including a 24 tonne steam



roller and a 12 tonne motor lorry uniformly distributed over two lanes of traffic totalling 5.0 m in width, with an impact coefficient of 1.4.

The reinforcement in the direction of the length of the bridge is shown in Fig. 1. With a maximum moment of 51.7 mt/m at the centre of the outside spans and of 60.3 mt/m over the supports, and taking $\sigma = 70/1500 \text{ kg/cm}^2$, the design provides nine round bars of 30 mm diameter in each unit of width over the supports. The suspended slab in the central field, which is 6.4 m long and receives a maximum moment of 20.3 mt/m with $\sigma = 42/1500 \text{ kg/cm}^2$, is reinforced with seven round bars of 22 mm diameter.



Fig. 2.

Fig. 2 shows the flowing lines in which the bridge crosses the river. The adoption of a timber railing on reinforced concrete posts notably improves the architectural unity of the structure, and this railing runs into massive parapets carried on the wing walls.

Fig. 3 shows another reinforced concrete slab built as a *Gerber* girder over three openings, each of 11.5 m span, with a road width of 8.5 metres. In this case again the two piers and the abutments are askew with the axis of the road. The roadway slab is cambered at 1.5 % and is uniformly 60 cm thick.

Here again the slab was reinforced with round bars of St. 62 subject to a stress of 1800 kg/cm^2 . This stress was justified, among other factors, by the conclusion drawn from the Dresden experiments that such slabs possess notably greater safety against cracking than T-beams, and also by adequate safety against breakage. In the Stuttgart fatigue tests on high tensile steel the further conclusion was drawn that a permissible stress in the steel of 1800 kg/cm^2 is suitable in slabs, even under moving loads, in cases where the concrete shows a cube strength of not less than 225 kg/cm^2 .

The reinforcement required to resist the standard loading for Class I bridges is shown in Fig. 3. With a maximum moment of 47 mt at the centre of the outside spans and of 45.5 mt over the supports, seven round bars of 13 mm diameter were adopted, the stresses in the cross sections being then respectively

By making proper use of the mechanical properties peculiar to high-grade concrete, it becomes possible to construct slab bridges even over large spans, and at the same time the amount of steel required can be much reduced by adopting

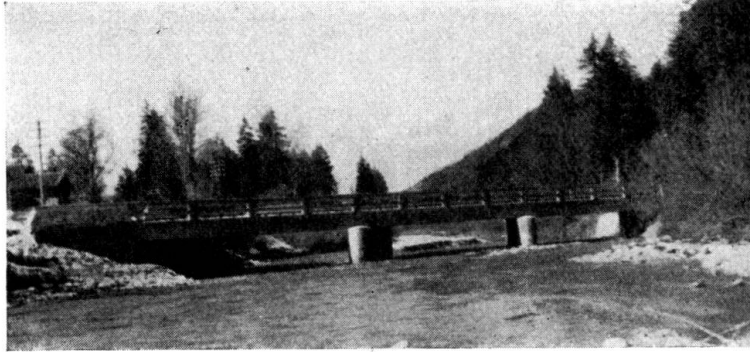


Fig. 4.

high tensile steel and taking advantage of the increased permissible stress therein.

The bridges just described are the first in Germany in which permissible stress in the steel of 1800 kg/cm^2 has been adopted; this figure exceeds what is

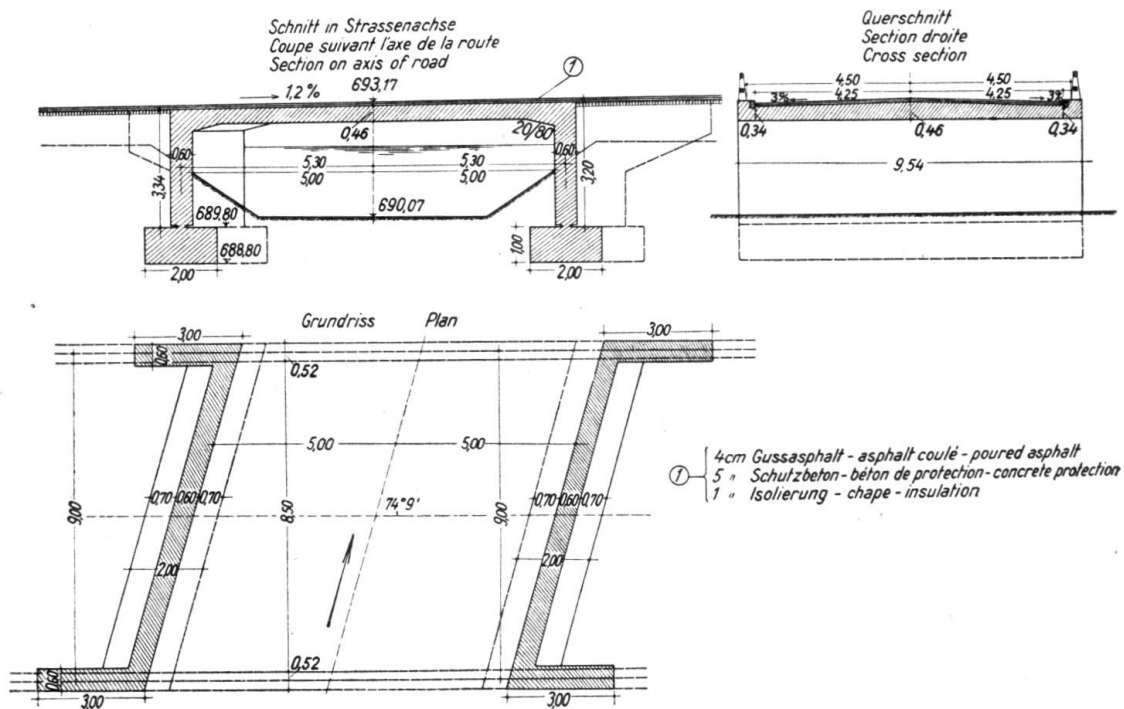


Fig. 5.

Bridge over Grosswaldbach.

allowed by the current regulations, but in view of the knowledge now made available by the testing laboratories its adoption was held to be justified. Moreover the peculiar mechanical properties of high tensile structural steel are

confirmed by practical experience in actual work, particularly by the excellent performance noted after six months service under heavy traffic.

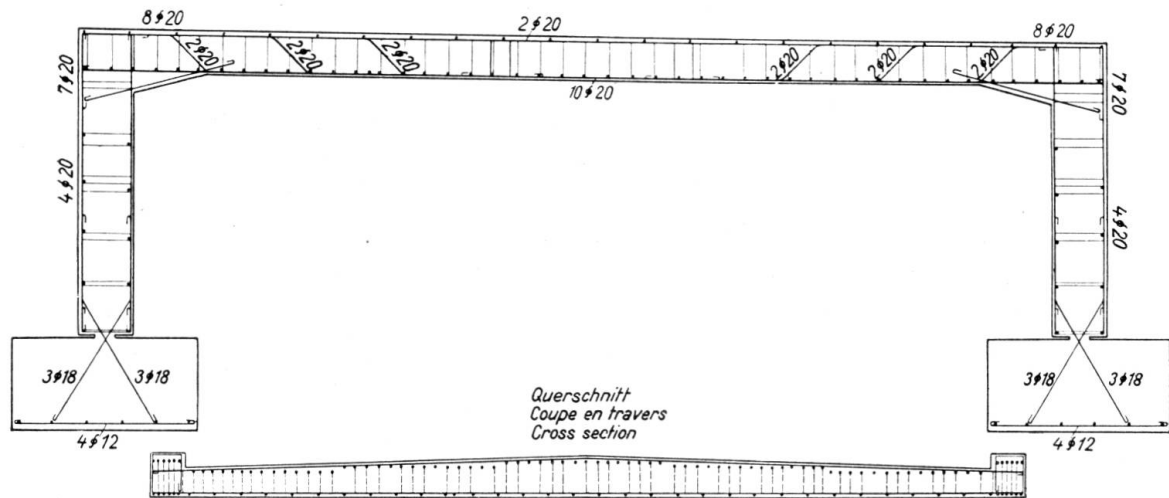


Fig. 6.
Reinforcement of frame.

It may be deduced from these descriptions of structures that slab girders are in fact a method of construction which offers scope for development. Seeing that the scantlings, and therefore the "own weights" of the structure, depend on

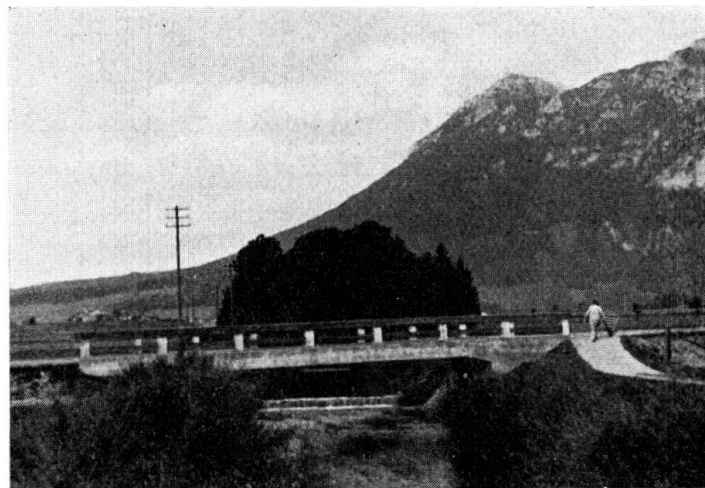


Fig. 7.

the magnitude of the permissible stresses the question arises what is the maximum span to which bridges of this type can be built with constructional and economic advantage; the answer to this depends, above all, on improving the qualities of high-grade concrete and high tensile steel.