

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 55 (1987)

**Artikel:** Tension member prestressing  
**Autor:** Sparowitz, Lutz / Kernbichler, Karl / Zillich, Herbert  
**DOI:** <https://doi.org/10.5169/seals-42806>

### **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:** 01.04.2026

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

### Tension Member Prestressing

Zugbandvorspannung

Précontrainte par tirants

**Lutz SPAROWITZ**  
Dipl. - Ing., Dr. techn.  
Zivilingenieur  
Graz, Austria

**Karl KERNBICHLER**  
Dipl. - Ing., Dr. techn.  
Univ. - Doz., Techn. Univ. Graz  
Graz, Austria

**Herbert ZILLICH**  
Dipl. - Ing.  
Graz, Austria

#### 1. PRINCIPLE

A special disposition of the cables for the longitudinal prestressing is suggested concerning continuous prestressed concrete bridges with usual spans and depths. The longitudinal prestressing consists of straight tension members which can only be found in the support zones whereas the normal reinforcement is used in the midspan zones (Fig. 1b and 1c). Since there is no turning round of the tension members problems of durability and fatigue strength are avoided.

The effect of this system can be compared to stay-cable bridges used for wide spans (Fig. 1a). In figure 1 both structures are compared in scale. The figure shows that the cable can be placed within the cross section of the structure of bridges with tension members due to the sufficient overall depth of the structure respectively due to the variable depth (cleat).

The structure can be designed with tension members which are either unbonded or with subsequent bonding. In the latter case the cables are built into a deck slab of a greater depth. In the case of unbonded prestress the tension members can be run within the box girder section. Since the tension members run outside the webs there smaller webs are possible and the construction is also easier.

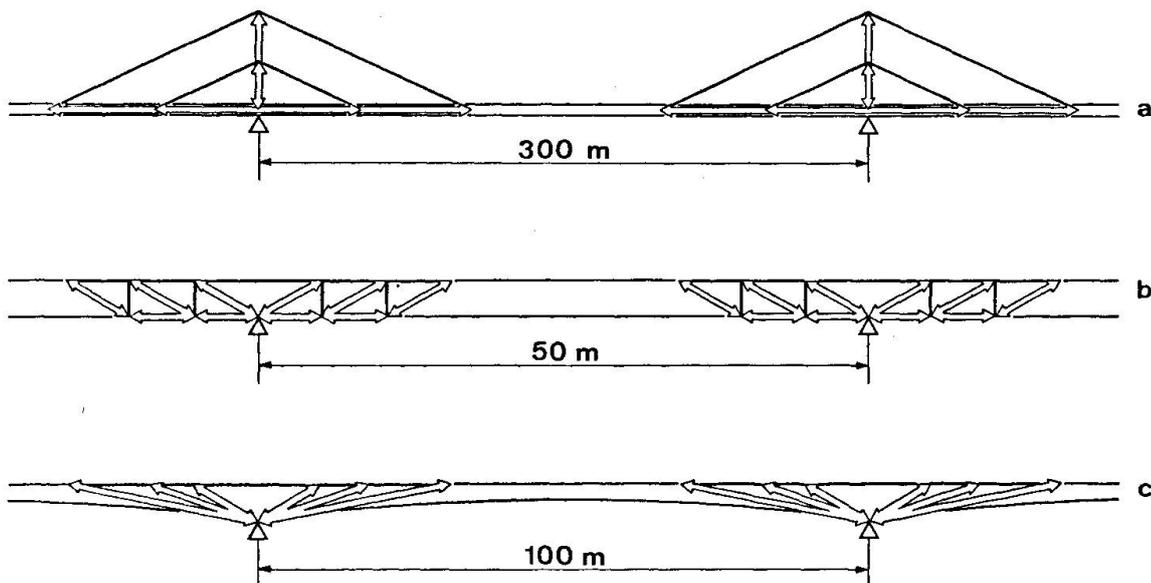


Fig.1: Strut and tie models



## 2. THE STATICAL BEHAVIOUR AND ECONOMY

The bending effect of a normally reinforced beam is superimposed by the effect of the strut frame within the zone of the tension member (Fig. 1b and 1c). The strut frame strengthens the bending beam in the support zones. The share of the support-moment carried by the strut frame can be controlled by the size of the force in the tension members. Our experience shows that it is economical and recommendable concerning the design to choose the degree of prestress of the tension members in such a way that the strut frame carries the dead load. For the share of the bending beam normal reinforcement is arranged not only in the midspan zones but also in the support zones.

A comparison of the required amount of steel (amount of normal steel plus amount of prestressing steel multiplied by the yield stress ratio) concerning the conventional disposition of prestressing cables with the tension member prestressing shows that the recommendable design requires 20 % less steel, even in the case of the unfavourable effect of unbonded prestressing. This reduction, mentioned above, is a result of short tension members in the support zones only.

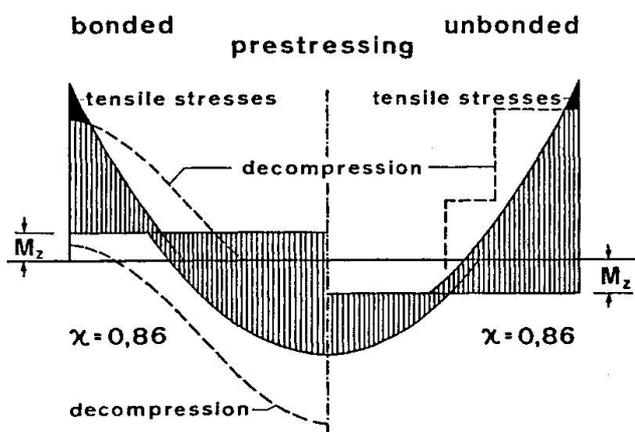


Fig. 2: Partial prestressing – tension member prestressing

Consequently there is a considerable shift of bending moments under working load (Fig. 2). Within the conventional disposition of the cables the prestressing produces positive secondary moments. Owing to that fact the midspan moment increases (Fig. 2, left). On the other hand the tension member prestressing produces negative secondary moments (Fig. 2, right). Consequently the midspan moment considerable decreases.

The normal reinforcement takes care of the cracking control. The prestressing controls the deformation and is required for some methods of construction (e.g. for construction joints with couplings).

## 3. PROBLEMS OF THE UNBONDED PRESTRESSING

It is generally known that the unbonded prestressing causes extra cost for the cover of corrosion and for the feeding-in of the forces of prestressing. But this higher amount is compensated by the economy of the recommended disposition of the cables. Concerning the costs of maintenance the unbonded prestressing compares favourably to the bonded one. That is proved by the following advantages:

- Since there is no danger of corrosion the degree of prestress can be decreased. The greater amount of normal reinforcement improves the cracking behaviour, the ductility and the durability of the structure.
- Since there are no frictional losses prestress can exactly be adjusted and easily measured.
- Since there is no grouting there are no risks and there are no restrictions concerning weather conditions.
- The cables can easily be checked and can be exchanged without obstruction of traffic.

## 4. REFERENCES

- /1/ Kernbichler K., Gedanken zur Anwendung der verbundlosen Vorspannung im Brückenbau. Schriftenreihe des Österreichischen Betonvereins, Heft 7, 1987
- /2/ Zillich H., Sparowitz L., Kernbichler K., Vorspannung ohne Verbund im Straßenbrückenbau. Bundesministerium für Bauten und Technik, Straßenforschung, 1987