

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 83 (1999)

**Artikel:** Deflection monitoring of prestressed concrete bridges retrofitted by external post-tensioning  
**Autor:** Burdet, Olivier / Badoux, Marc  
**DOI:** <https://doi.org/10.5169/seals-62855>

### **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:** 02.04.2026

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



## Deflection Monitoring of Prestressed Concrete Bridges Retrofitted by External Post-Tensioning

### Olivier BURDET

Dr

Swiss Fed. Inst. of Techn.  
Lausanne, Switzerland

Olivier Burdet, born 1960, is a lecturer in reinforced and prestressed concrete. His research interests include serviceability, bridge design and monitoring techniques.

He is a member of the Publication Committee of IABSE SEI Journal.



### Marc BADOUX

Prof. Dr

Swiss Fed. Inst. of Techn.  
Lausanne, Switzerland

Marc Badoux, born 1961, is an assistant-professor of Structural Engineering. His research interests include the serviceability behaviour of concrete structures, high performance concrete applications and the seismic protection of existing buildings



**Keywords:** prestressed concrete, in situ measurements, bridge monitoring, long-term deflections, bridge retrofiting, external post-tensioning

### Abstract

Additional post-tensioning has become one of the leading techniques for the retrofiting of bridges, in particular prestressed concrete box girder bridges. This paper describes the use of external post-tensioning for the retrofiting of three Swiss highway bridges. These bridges are variable depth prestressed concrete box girder bridges built between twenty and thirty years ago by the balanced cantilever method. Monitoring of these bridges long-term deflections showed that the downward girder deflections were large and did not stabilise as expected. In all three cases, the decision to retrofit was governed by serviceability considerations, namely deflection control, rather than structural safety considerations. External post-tensioning has proven well suited for this type of intervention. Findings of the long term monitoring of the bridge deflections are presented, with an emphasis on the effect of the additional post-tensioning on the bridge behaviour in the years following the retrofit. The situation of the Fégire Bridge is described briefly in this abstract.

### Example: Fégire Bridge

Construction of the cast-in-place Fégire bridge was completed by the balanced cantilever method in 1979. The bridge is 512 m long, its three main spans are about 107 m long, and it does not feature intermediate joints. The bridge was retrofitted in 1995 with additional post-tensioning to counter excessive vertical deflections that were not stabilising as expected. The additional post-tensioning is parabolic (fig. 1) and consists of 2x4 cables with an initial prestressing force of 28'000 kN. The additional cables are unusually long since they are anchored at both abutments. The massive anchorage blocks were designed for the case that a future retrofit would double the additional post-tensioning installed to date.

The long-term deflections of the girder of the bridges reported in this paper are monitored with a hydrostatic levelling system. This simple and robust system was developed by IBAP and is operational in over 10 bridges. The measurements of the vertical mid-span deflection of the central span of the Fégire Bridge are presented in fig. 2. They show the instantaneous upward deflection at mid-span (middle span) caused by the post-tensioning is just under 30 mm. The previous downward tendency clearly observable in fig. 2 appears to have been reversed by the additional post-tensioning.

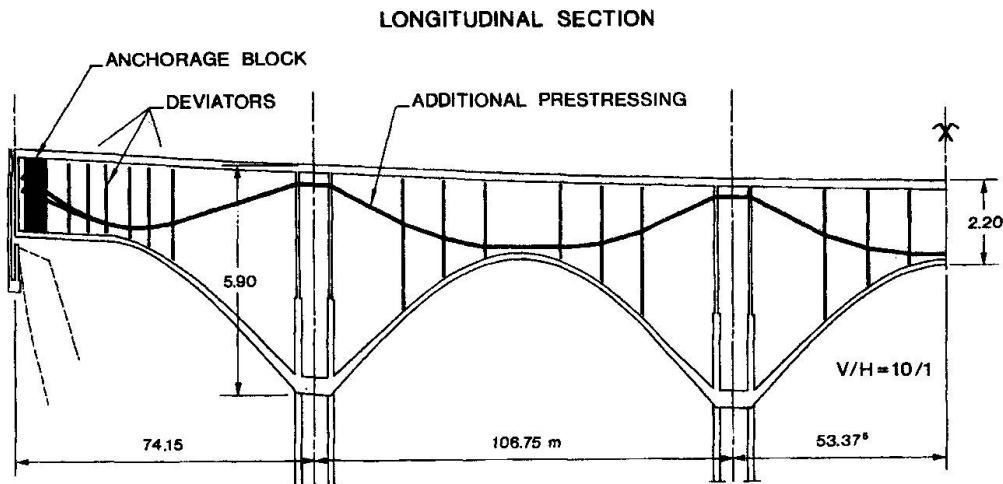


Figure 1: Additional post-tensioning for the Féglise bridge

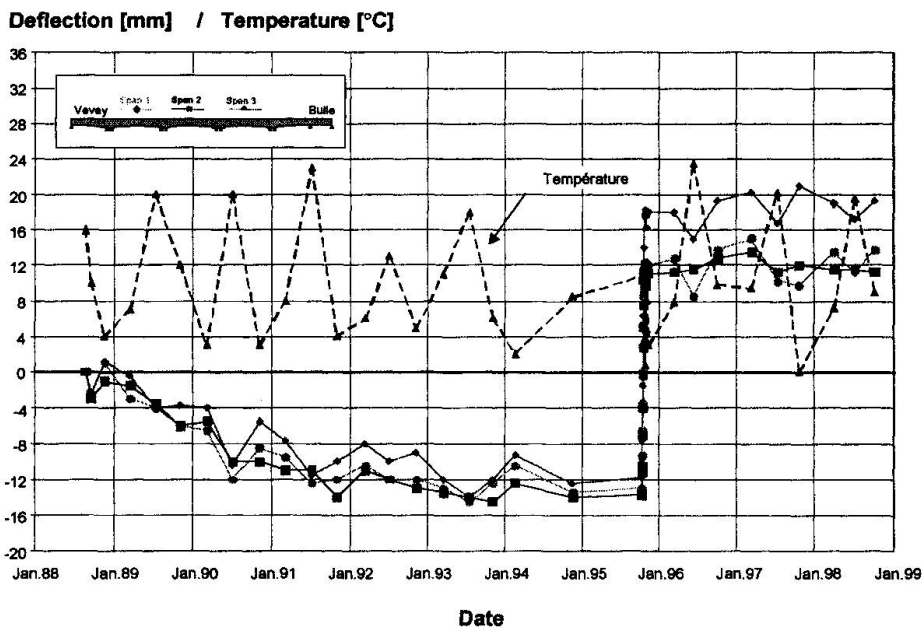


Figure 2: Long-term deflections at mid-span of span 2 of the Féglise bridge

## Conclusions

The Lutrive, Chillon and Féglise bridges were retrofitted with additional post-tensioning to counter excessive long-term deflections. on the basis of these examples, it appears that:

- The addition of external post-tensioning can be a successful retrofitting technique for structures with serviceability limit state problems, such as excessive long-term deflections. It is a relatively flexible technique which can be fine-tuned to achieve the required results. It is for example possible to reverse a downward deflection trend, as shown in the case of the Féglise bridge.
- Long-term monitoring of concrete bridges can be very useful. In the examples reported in this paper, the deflection monitoring data proved extremely valuable for the evaluation of the bridge, and for the selection and design of the retrofitting scheme. It also continues to provide valuable feedback on the actual behaviour of the retrofitted bridges.