

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 71 (1994)

**Artikel:** Long-span girder using pre-cast concrete beams  
**Autor:** Sera, Kohsaku / Hitomi, Yasuyoshi  
**DOI:** <https://doi.org/10.5169/seals-54145>

### **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>**

## Long-Span Girder Using Pre-cast Concrete Beams

Poutres à grande portée constituées d'éléments préfabriqués en béton

Entwurf weitgespannter Träger aus Betonfertigteilbalken

**Kohsaku SERA**  
Director  
Nihon Sekkei, Inc.  
Tokyo, Japan

**Yasuyoshi HITOMI**  
Structural Engineer  
Nihon Sekkei, Inc.  
Tokyo, Japan

### 1. INTRODUCTION

This report presents the design of the roof of Matsuyama Community Center. It also includes the results of the research performed for the deflection due to time of the long span girder used in this roof during and after construction. The roof is placed in an area of 32 x 32 m and, is composed of pre-casted concrete members that are connected and then post-tensioned.

### 2. OUTLINE OF THE STRUCTURE

Fig. 1 shows the two types of pre-casted girder members used. This roof is composed of 48 pieces of pre-casted elements which consist basically of two crossed beams connected to each other. Post-tension is applied in both, X and Y directions. Concrete strength is 450 kg/cm<sup>2</sup>.

### 3. TEST MEASUREMENTS

#### 3.1 Strain-Time story

Fig. 2 shows the variation of strain when post-tensioning, after taking off the roof supports (jack down) and, 1.5 month after jack down. Here, it is possible to observe that the concrete compressive strain due to tension in the cable, the flexural strain after jack down and, the flexural strain due to creeping increase with the time. The compressive strain when post-tensioning is 179  $\mu$  (average of M-1, M-2 curves) and is 205  $\mu$  (average of M-3, M-4 curves) from test results. And the compressive stress is 54 - 62 kg/cm<sup>2</sup>. The compressive stress is 57.4 kg/cm<sup>2</sup> from analytical calculations. Bending occurs at jack down and the strain produced at the lowest part of the center of the roof is 130  $\mu$ . The compressive stress condition remains after jack down. And tension does not occur even if load is applied, thus having excellent post-tensioning conditions.

#### 3.2 Deflection-Time Story

Fig. 3 & 4 show the deflection when applying post-tension, at jack down, and after creeping. The vertical deflection of the central part is zero before applying tension and is 2 mm when applying it. The deflection of the central part is 12 mm after jack down, and the deflection due to creeping is 32 mm three months after jack down, which is approximately 2.5 times the deflection at jack down. The span-deflection ratio is 1/750. And the final maximum deflection due to creeping is 40 mm, remaining almost constant from then on.

#### 3.3 Horizontal Displacement and Rotation

Horizontal displacements are produced as shrinkage occurs after post-tensioning. These are 4.14 mm for X direction and 4.37 for Y direction. The horizontal displacement calculated analytically is 5.2 mm. Considering a 10 % of losses due to friction. The external girders rotated about 1/400 after jack down.



4. CONCLUSIONS

The test results permitted us to have a clear understanding of the processes of post-tensioning, jack down and creeping.

- (1) The concrete compressive stress calculated analytically is close to the value obtained from the tests.
- (2) There is an excellent post-tensioning condition as tension is not produced at the lowest part of the center of the roof girder.
- (3) There is no problem due to deflections, including creeping effects, as the span-deflection ratio is 1/750.

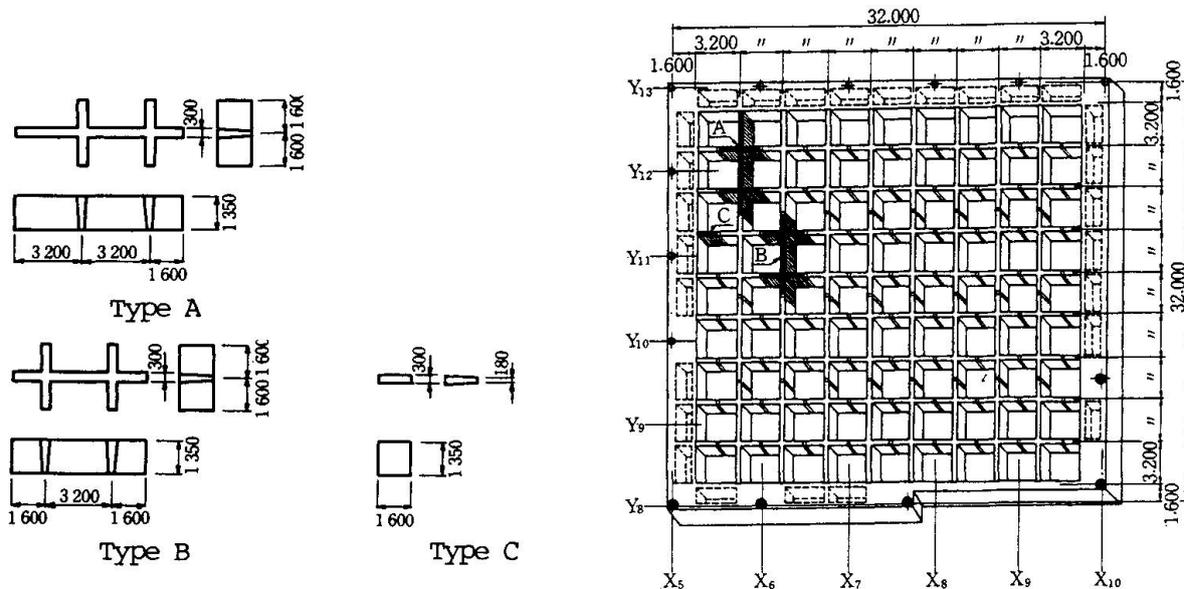


Fig. 1 Types of Pre-casted members and plan of the roof

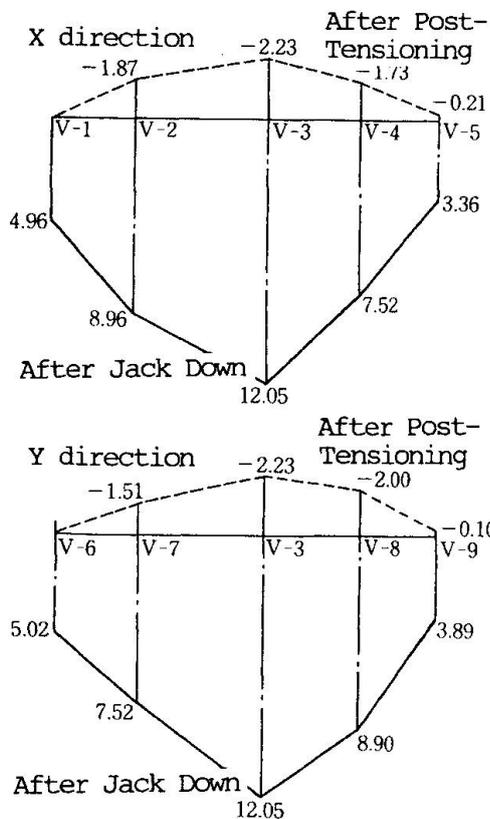


Fig. 3 Deformation of the long span girder

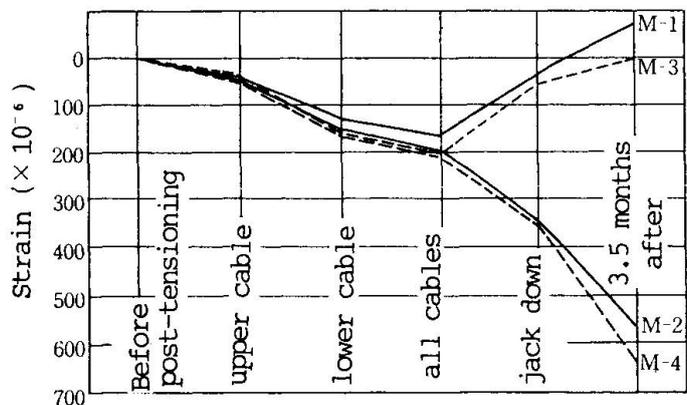


Fig. 2 Strain Time-Story

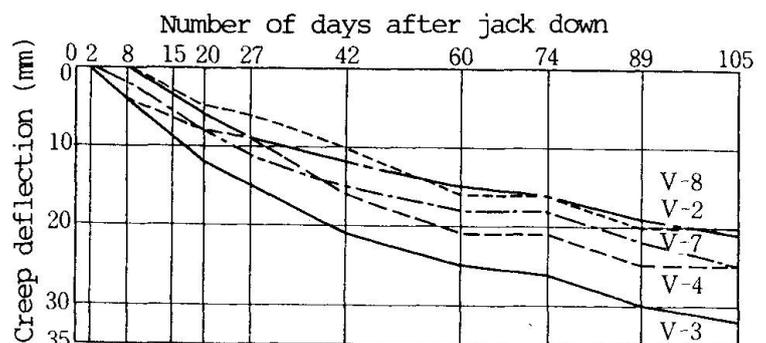


Fig. 4 Creep deflection after jack down