Zeitschrift:	IABSE reports = Rapports AIPC = IVBH Berichte	
Band:	64 (1991)	
Artikel:	Design and constrcution of Shinkawaotogawa bridge	
Autor:	Kimura, Hideo / Kuroiwa, Tadashi / Hanada, Tadaomi	
DOI:	https://doi.org/10.5169/seals-49319	

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. <u>Mehr erfahren</u>

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. <u>En savoir plus</u>

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. <u>Find out more</u>

Download PDF: 10.08.2025

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

Projet et construction du pont de Shinkawaotogawa

Entwurf und Bau der Shinkawaotogawa-Brücke

Hideo KIMURA	Tadashi KUROIWA	Tadaomi HANADA	Hideyuki NAKAJIMA	Hiroshi SHINKAWA
Civil Engineer	Civil Engineer	Civil Engineer	Civil Engineer	Civil Engineer
Japan Highway Public Corporation		Fuji PS Concrete Co. Ltd.		PC Bridge co. Ltd.
Tokyo, Japan		Tokyo, Japan		Tokyo, Japan

1. General

Sinkawaotogawa Bridge is a 7-span continuous frame structure of span length approximately 90 m long showing in Fig. 1. It locates between oimatsuda and Gotenba on the reconstructed route of the Tohmei Expressway. This bridge does not require bearinge at bridge piers. On such point of view, it becomes economical. Also the improvement in drivability is trafical because of less expansion and contraction devices.

Since the bridge is statically indeterminate stracture of high order, the cracking may occur in unforessen seismic actions. However, the reinforced and prestressed concrete with multi-fixed-pier can possess enough toughness. This system is excelling in a seismic resistance compared with continuous-girder type and T-frame bridge with single pier.

Consequently in recent years, prestressed concrete continuous-frame bridges have been planned and constructed in large number in Japan.



Fig. 1 Side view of Shinkawaotogawa Bridge

For a multi-span continuous-frame bridge, excessive section forces may be produced at fixed piers at the ends because of deformation due to creep, drying shrinkage, secondary prestress, temperature variation, etc. Therefore this type of structure had been considered to be unsuitable in the past for a bridge such as this one with short piers of 31.0 to 34.5 m in relation to fixed span length of 366 m. However designing was made possible by alleyiating restraining forces using a flexible structure with pier width 3.0 m which is thin compared with conventional bridges. By making the pier cross section small, excessively large tensile stresses are produced in the concrete. The occurrence of cracking cannot be avoided. Further, extremely high stresses are produced during earthquakes. It will be necessary to consider that behaviors will extend into the elastoplastic range. For this reason, the strengths and deformation capacities of the bridge piers were calculated by elasto-plastic analyses. It had been confirmed was ascertained that there was ample allowance in a seismic safety.

2. ELASTO-PLASTIC SEISMIC RESPONSE ANALYSIS OF BRIDGE PIER

The strength possessed by the bridge pier cross section against cyclic loads exceeding the yield point was analytically evaluated from the composition law of concrete and steel. In performing this analysis the restrained and unrestrained concrete and reinforcing bars comprising the bridge pier cross section were divided into a large number of fiber elements, and bending momentcurvature relationships under cyclic loads in the elastoplastic range were calculated based on the stress-strain relationship hypothesized for each element.

As a result of examining by load simulation the cyclic amplitude increasing load of inelastic behavior of the bridge pier cross section under action of axial force corresponding to actual load, yield strength $M_y = 42,000$ tm and ultimate strength $M_u = 49,000$ tm were calculated.

On examining the bending moment-curvature ratio shown in Fig. 3, in spite of the fact that a considerable cyclic load is sustained in the plastic range, the maximum strength in the hysteresis loop having dropped almost none at all indicated that this bridge pier cross section had much deformation capability. It was judged from this analysis that this bridge pier had ample allowance in a seismic stability according to both strength and deformation capabilities.



Fig. 2 Bridge pier cross section arrangement

Table 1Design section force, stressintensity of bridge pier

Dead load + seismic	+ cemperature		
	Section	Section	
	1	2	
Bending moment (tm)	30,992	31,591	
Axial force (ton)	5,023	6,447	
Reinforcing bar stress intensity (kg/cm ²)	2,696	2,664	
Concrete stress (kg/cm ²)	144	142	



Fig. 3 Moment(M)-curvature(ϕ) relationship, (0-30 sec) N=6,447 ton, cyclic amplitude incremental load