

Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 79 (1998)

Artikel: Seismic upgrade by base isolation system and visco-elastic damper
Autor: Ohta, Hiroshi / Katagihara, Kenichi / Tanabe, Taichi
DOI: <https://doi.org/10.5169/seals-59954>

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: 26.07.2025

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

Seismic Upgrade by Base Isolation System and Visco-Elastic Damper

Hiroshi OHTA
Senior Eng.
Konoike Constr. Co. Ltd
Osaka, Japan

Kenichi KATAGIHARA
Dir.
Konoike Constr. Co. Ltd
Osaka, Japan

Taichi TANABE
Struct. Eng.
Konoike Constr. Co. Ltd
Osaka, Japan

Tetsuro ONO
Dir.
Konoike Constr. Co. Ltd
Tokyo, Japan

Mitsuo NAKAYAMA
Dir.
Konoike Constr. Co. Ltd
Tokyo, Japan

Summary

After the Hyogo-ken Nanbu earthquake on 17 January, 1995, many existing buildings have been strengthened in Japan for surviving during severe earthquake in the future. In this paper, we introduce two buildings that employed innovative strengthening techniques.

One is the new reinforced concrete building that replaced the existing building suffered serious damage during the Hyogo-ken Nanbu earthquake. We employed a base isolation system in this building for adding high seismic capacity. The other is the historical wooden building in Kyoto that was constructed in the 18th century. We employed visco-elastic dampers in this building.

We used each technique to control and dissipate input energy from ground motion. Both techniques are useful for new and old buildings. We wish structural engineers and researchers further study and widely utilize new structural systems like energy dissipation system and base isolation system.

1. Seismic Upgrade by Base Isolation System

A condominium located in Takarazuka city was steel structure, which suffered severe damage during 1995 Hyogo-ken Nanbu earthquake. For seismic repair of this building, we have studied several methods, as adding new braces or welding steel plates. But it is evident that we can't obtain good habitability and seismic safety by these methods. So we decided to reconstruct this building of reinforced concrete structure with using base isolation system, so that the building doesn't change the original plan and feature (photo 1).

In this project, we have used the laminated natural rubber as isolator under high compressive axial stress over 10N/mm^2 for lengthening natural vibration period, and two different types of damper, namely steel bar damper and lead damper (photo 2). The natural vibration period without damper is about 3.0 second. We could reduce the response of first floor shear coefficient from about 0.3 to 0.14 and maximum story drift angle from more than $1/100$ to $1/800$ in case of 40cm/s maximum ground motion.

2. Seismic Upgrade by Visco-elastic Damper System

The historical wooden building, which was constructed about 250 years ago, is strengthened using visco-elastic dampers (VED). This is one of the buildings in Zen-shu temple "Tenryu-ji" located in Kyoto. Photo 3 shows the appearance of the building. Because this is historical building, we couldn't be allowed to change the appearance. Under this condition, conventional technique couldn't add enough performance to this building, so we put inside the building the steel frame with visco-



elastic dampers in knee-bracing type as shown in photo4. By installing visco-elastic dampers in steel frame (figure 1), we could reduce response story drift angle to smaller than $1/80$ and displacement to about 70 percents of displacement without damper in case of 50cm/s maximum ground motion (figure 2).

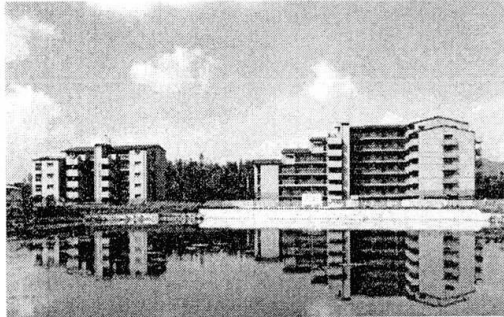


Photo 1. Reconstructed condominium located in Takarazuka city

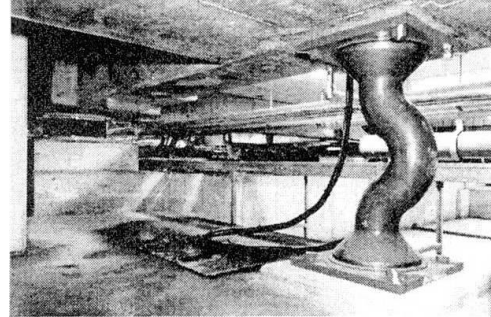


Photo 2. Base Isolation System



Photo 3. Hatto of Tenryuji-temple in Kyoto

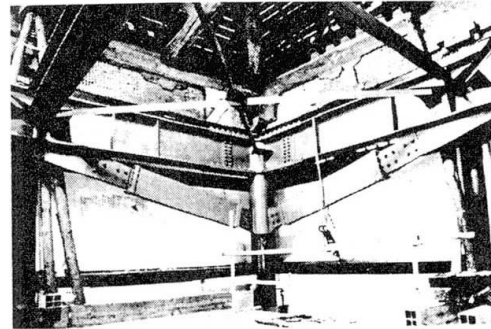


Photo 4. Installed VED in Knee-bracing Type

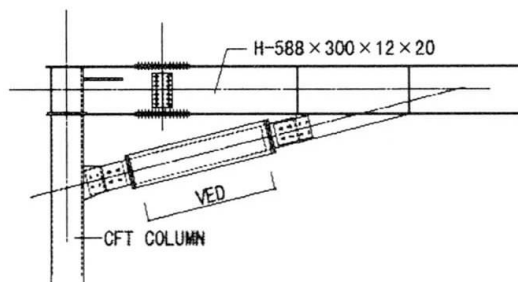


Figure 1. Detail Drawing of VED

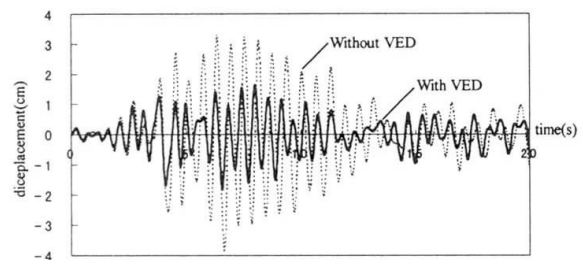


Figure 2. Time-history Diagram of Earthquake Response Analysis

References

- [1] K.Katagihara et al, Seismic Strengthening with Visco-Elastic Dampers for Historic Wooden Architecture, Summaries of Technical Papers of Annual Meeting, AIJ, Sept., 1997, in Japanese.
- [2] S.Soda et al, Study of Visco-Elastic Damper (part 1), Summaries of Technical Papers of Annual Meeting, AIJ, Sept., 1996, in Japanese.
- [3] S.Soda and Y.Takahashi, Application of Visco-Elastic Damper to Seismic Strengthening of RC Buildings, Proceedings of the Japan Concrete Institute, Vol. 18, No. 2, pp. 191-196, in Japanese.
- [4] H. Yamanouchi and S.Soda and K.Katagihara, Seismic Strengthening with Visco-Elastic Dampers, Proceedings of Structural Engineers World Congress, July, 1998, San Francisco.