

## Seismic Protection of Automated Stocker System by Customized Viscous Fluid Dampers

**Authors :** Y. P. Wang, J. K. Chen, C. H. Lee, G. H. Huang, M. C. Wang, S. W. Chen, Y. T. Kuan, H. C. Lin, C. Y. Huang, W. H. Liang, W. C. Lin, H. C. Yu

**Abstract :** The hi-tech industries in the Science Park at southern Taiwan were heavily damaged by a strong earthquake early 2016. The financial loss in this event was attributed primarily to the automated stocker system handling fully processed products, and recovery of the automated stocker system from the aftermath proved to contribute major lead time. Therefore, development of effective means for protection of stockers against earthquakes has become the highest priority for risk minimization and business continuity. This study proposes to mitigate the seismic response of the stockers by introducing viscous fluid dampers in between the ceiling and the top of the stockers. The stocker is expected to vibrate less violently with a passive control force on top. Linear damper is considered in this application with an optimal damping coefficient determined from a preliminary parametric study. The damper is small in size in comparison with those adopted for building or bridge applications. Component test of the dampers has been carried out to make sure they meet the design requirement. Shake table tests have been further conducted to verify the proposed scheme under realistic earthquake conditions. Encouraging results have been achieved by effectively reducing the seismic responses of up to 60% and preventing the FOUPs from falling off the shelves that would otherwise be the case if left unprotected. Effectiveness of adopting a viscous fluid damper for seismic control of the stocker on top against the ceiling has been confirmed. This technique has been adopted by Macronix International Co., LTD for seismic retrofit of existing stockers. Demonstrative projects on the application of the proposed technique are planned underway for other companies in the display industry as well.

**Keywords :** hi-tech industries, seismic protection, automated stocker system, viscous fluid damper

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