

Development of a Viscoelastic Tuned Mass Damper for Floor Vibration Applications

I. Saidi¹, A. D. Mohammed², E. F. Gad^{1,3}, J. L. Wilson¹, N. Haritos³

¹ Faculty of Engineering and Industrial Sciences, Swinburne University of Technology

² Department of Mechanical Engineering, University of Technology/Baghdad, Iraq

³ Department of Civil and Environment Engineering, Melbourne University

1. Abstract

In recent years, due to changes in construction methods, human activities such as walking, dancing and aerobics have become major sources of excessive, induced floor vibrations. Excessive vibration in building floors is generally not a safety concern but a cause of annoyance and discomfort. Rectification measures for excessive vibrations in existing floors may include structural modifications to increase the floor stiffness or the addition of damping. While structural stiffening can be easily designed and the corresponding effect be accurately predicted, it is often not practical due to space limitations or associated construction disruptions. The addition of mechanical dampers can be more practical and cost effective for floors with low damping, but there are very limited proprietary systems available and they are difficult to design from first principles. This paper forms part of a research project which aims to develop a new cost effective Tune Mass Damper (TMD) using viscoelastic materials. A TMD consists of a mass, spring, and dashpot which is attached to a floor to form a two-degree of freedom system. TMDs are typically effective over a narrow frequency band and must be tuned to a particular natural frequency. A new innovative prototype of a viscoelastic damper has been developed and used for the retrofitting of a steel simply supported beam. Results for the effectiveness and sensitivity of the viscoelastic damper are presented in detail. The experimental results are validated numerically by an FE model. It is shown that the developed viscoelastic damper is quite efficient in reducing floor vibrations and it is not highly sensitive to changes in the properties of the coupled floor.

Keywords: Floor vibrations, viscoelastic materials, tuned mass dampers.