

Development of low-cost seismic isolators using scarp rubber tyre pads for sustainable disaster mitigation

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Abstract

This research aims to develop low-cost and environmentally sustainable seismic isolator using scrap tyre rubber pads (STRPs), as an alternative to conventional elastomeric seismic isolators, which can be implemented at mass scale to safeguard remote rural communities, dense urban settlements, associated industries and infrastructure vulnerable to seismic events. The STRP bearings are manufactured through die-mould vulcanization of STRP pads and steel shims to achieve mechanical properties suitable for seismic isolation. The green and environment friendly approach is achieved by using the industry leftover such as scrap rubber tyre pads. The STRP seismic isolators would especially be beneficial to communities at high seismic risks which do not have access to advanced and costly seismic retrofit measures.

Keywords: conventional isolators; low-cost seismic isolators; scrap rubber tyre pads; sustainable disaster mitigation; green environment friendly approach.

1 Introduction

Seismic resiliency of remote and rural communities in developing countries require an economic and sustainable solution that can be implemented at mass scale. More than 50% of the land area in India is subject to moderate to high seismic activity. Seismic isolation, which has been shown to significantly reduce earthquake disaster risk, may be utilized at mass scale to remote rural communities, dense urban settlements, associated industries and infrastructure vulnerable to seismic events.

However, the application of conventional seismic isolation devices is cost prohibitive and restricted due to complexity and proprietary issues. The STRP seismic isolators proposed in this research fabricated using vulcanization-based die-mould fabrication technology which has been developed in collaboration with industry partners for reliable manufacturing and high capacity. The developed

technology can provide two-dimensional and three-dimensional isolation thus catering to wide range of structures and systems. Scrap Tyres Rubber Pad (STRP) isolators provide an environmentally sustainable disaster mitigation way to protect small structures and buildings from damaging effects of earthquakes.

Turer et al.,2008 [1] conducted research to develop low-cost seismic base isolation pads using scrap automobile tyres, stacking the pads one on top of another without applying adhesive. The mechanical and dynamic properties of STRP specimens made from different tyre brands, with different number of layers and orientations were evaluated experimentally. The results of these STRP tests were compared among themselves and against a commercially available Laminated Rubber Bearing (LRB) specimen. Static and dynamic tests conducted on STRP samples showed similarities between STRP and conventional lead rubber bearing response.