



Mechanical characterization of recycled tire rubber to be used as seismic isolation of the structure

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Summary

This paper discusses the results obtained by an experimental investigation aimed to the development of an innovative low-cost seismic base isolation pads using scrap car tires. The main idea consists in realizing a new layer, by means of the recycled car tires, that replace large areas of the surrounding soil underneath the structure, or special elastomer based isolator between the soil and the basements. To this aim several tests have been conducted on specimens properly prepared from tires, in order to investigate the behavior of proposed system under compression and shear forces. The results reported here are related to the compression test and they were compared to the ones of common elastomer bearings (SREI). They show that at same strain levels, the instantaneous compression modulus values of RTP specimens are higher than that of the SREI values. The slope changes of RTP specimens start earlier and fail at much lower strains compared to SREI specimen. The high vertical stiffness of RTP layers combined with relatively low amount of steel content makes RTP layers stiffer and lower strength compared to SREI. Test results have shown that the friction between tire layers is sufficient to keep layers intact. RTP application so presents advantages such as low-technology no-cost pad, weight reduction, ease of handling, simple shear stiffness adjustment by changing the number of layers, and environmental benefits by recycling tires.

Keywords: Seismic Protection. Low cost technology, recycling materials,; rubber; soil; developing countries, damping

1. Introduction

Seismic base isolation[1] is a well-defined building protection system against earthquakes, on which numerous studies have been conducted. It consists in the placement of a laterally flexible system between the footing (ground) and upper structure to isolate earthquake induced seismic forces. The natural vibration periods of the suspended building or structure shifts towards larger values in the response spectrum causing reduction in the forces and accelerations in the suspended building. Elastomer-based isolators have been heavily studied and used for the last 25 years. Steel or fiber reinforcement inside the elastomer isolators provides high vertical stiffness, whereas rubber segments between reinforcement layers provide low horizontal stiffness for the seismic base isolation. This study aims at cost reduction of seismic base isolation system by recycling material: scrap tires [2]. Scrap tires are old used car tires and their existence on rubbish areas is an earnest threat for the health of both community and environment. The automotive tires are made of synthetic rubber which is obtained from petroleum. The development of tires was based on improving the performance of natural rubber which is obtained from the liquid latex secreted by certain plants. During the 19th century, Charles Goodyear studied on making rubber more resistant