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# Bearing capacity of a square model footing on sand reinforced with shredded tire – An experimental investigation

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## HIGHLIGHTS

- Using waste tires in civil applications may be feasible to consume the scrap tires.
- Shredded rubber mixed with soil acts as reinforcing materials beneath the footing.
- The performance of rubber-reinforced soil increases in presence of soil cap.
- Bearing capacity of rubber-reinforced bed obtained 2.68 times of unreinforced bed.
- Findings lead to overall saving in soil material costs and recycling of tires waste.

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## ABSTRACT

Recycling rubber from waste tires has become one of the major challenges worldwide. The use of waste tires in geotechnical applications may be feasible as an alternative way to consume the huge stockpile of scrap tire, with a better understanding of the behavior of rubber–soil mixture. The objective of this study was to investigate the feasibility of using rubber shreds, randomly distributed into the soil, as soil reinforcement beneath the footing. A series of laboratory tests were conducted to obtain the bearing capacity of a square footing rested on shredded rubber-reinforced soil. The results show that the efficiency of rubber reinforcement was increased by addition of rubber content, the thickness of rubber-reinforced soil layer and the soil cap thickness up to the optimum values of these parameters, after that, with a further increase in each of these parameters, the bearing capacity decreases. For the optimum value of rubber content of 5% at footing settlement level of 5%, the maximum improvement in bearing capacity of rubber-reinforced bed was obtained as 2.68 times of the unreinforced bed. This value of improvement was achieved using the optimum thickness of reinforced layer of 0.5 times of footing width and the optimum thickness of soil cap of 0.25 times of footing width. The findings strongly suggest the use of rubber shreds obtained from non-reusable tires as a viable alternative way for improving the soil behavior, particularly when environmental interest is considered.



## 1. Introduction

In the recent decades, hundreds of millions of scrap tires are generated and accumulated in the worldwide, due to the developing industry and growing population [1–3]. Increase in the amount of waste tires makes them harder and more expensive to dispose of safely without threatening human health and environment. For instance, stockpiled waste tires are flammable, prone to fires with toxic fumes and may then cause a major health hazard for both human beings and animals [4].

As a practical point of view, the use of waste rubbers may be offered in geotechnical applications due to four advantages; (1) the re-use of waste materials such as tires and tubes, reduction in environmental health hazard and saving huge spaces and costs to maintenance of wastes, (2) the reduction in consumption of competent natural soil and its cost saving benefit, (3) soil reinforcement, which can demonstrate a substantial increase in shear strength of mixture compared to soil alone, and (4) the exhibition of a higher capacity to absorb and to dissipate energy than soil alone and tend to decrease the stress and shocks transferred into the ground when subjected by dynamic loads.

Reinforced earth technique has been gaining popularity in the field of geotechnical engineering due to its highly versatile and flexible nature. The application of waste tires in various forms, has been recently developed in reinforcing soil for a variety of

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