

2014/15 Undergraduate Research Grant Scheme

Project title: Dynamic performance of rubberised concrete beams

University: Loughborough University

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Aims of research:

Rubberised concrete is a composite obtained by using recycled rubber crumbs as partial aggregate replacement in concrete. The mechanical properties of the material have been widely investigated and it is well known that the rubber improves toughness and ductility but reduces strength. While some studies demonstrate the ability of the material to absorb vibrations and sound waves, very few investigations deal with the dynamic characteristic of rubberized concrete structural members. Aim of this project is to explore the enhanced energy dissipation capability of the rubberised concrete for structural applications where also strength is important, like for example in seismic applications.

Description of method:

The work will investigate the effect of rubber ratio on the dynamic behaviour of the rubberised concrete beams. To do so, the project will mainly entail experimental work and numerical analysis will be used to design the structures to be tested. Two sets of small-scale beam models will be fabricated: the first set will be made of traditional concrete to be used for comparison and the second set will be done replacing coarse aggregates with rubber crumb at different volumetric ratio. Silica fume will be also added to the mix in order to improve bonding between rubber crumbs and cement paste which in turn will increase the compressive strength of the material. The mechanical properties of concrete specimens will be also evaluated from standard tests on the rubberised/normal concrete specimens. Experiments (free vibration tests) will be performed in order to assess the damping capacity of the beams and the seismic performance will be experimentally assessed through shaking table tests.

Benefits to structural engineering:

Rubberised concrete is already used by for paving purposes and in a number of non-load bearing applications thanks to its improved sound insulation properties (sound barriers along railways, noise reduction barriers, interior construction and facades, etc). Moreover, due to the material's ability to damp vibrations, it has the potential to improve the dynamic performances of structures subjected to dynamic actions (railway sleepers, structures subjected to earthquake/wind/moving vehicles). The proposed work will produce new practical recommendations in the use of rubberised concrete as a material for structural dynamic applications where the load-bearing strength of the concrete cannot be sacrificed.

Proposed finish date: May 2015