



## Small-strain Shear Stiffness and Strain-dependent Dynamic Properties of Gravel-rubber Mixtures

Gabriele Chiaro<sup>1</sup>, Ali Tasalloti<sup>2</sup>, Alessandro Palermo<sup>1</sup>, Laura Banasiak<sup>3</sup>

<sup>1</sup>Department of Civil and Natural Resources Engineering, University of Canterbury, Christ-church, New Zealand

<sup>2</sup>Beca, Auckland, New Zealand

<sup>3</sup>Environmental Science and Research Institute, Christchurch, New Zealand

### Abstract

The purpose of this study was to investigate the small-strain shear stiffness and strain-dependent dynamic properties (i.e., shear modulus degradation curve) of mixtures of gravel and recycled granulated tire rubber for use in geotechnical applications, including geotechnical seismic isolation foundation systems for buildings. Therefore, bender element and small-strain cyclic triaxial tests were carried out on dried specimens of pure gravel and gravel-rubber mixtures with 10%, 25%, and 40% rubber content by volume. In this paper, the small-strain shear stiffness ( $G_{\max}$ ) characteristics as well as shear modulus ( $G$ ) vs. shear strain ( $\gamma$ ) amplitude curves are presented, and the effects of stress level and rubber content are discussed. Hence, an analytical hyperbolic model for estimating  $G$  as a function of the rubber content, stress level and shear strain amplitude is proposed for gravel-rubber mixtures (GRMs).

**Keywords:** Gravel-tire rubber, Bender element, Shear modulus, Damping ratio, Small strain, Cyclic triaxial tests