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## Discrete Element Models applied to Aggregate Properties in Pavement Design

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**Abstract content <br> &nbsp; (Max 300 words)<br><a href="http://events.saip.org.za/getFile.py/a" target="\_blank">Formatting &<br>Special chars</a>**

The shape of rock particles in gravel affects the bulk properties of aggregate material, and the effects are in the process of being well quantified for South African materials. Current practice in pavement and rail engineering is to discard quarry output or recycled material which does not conform to angularity, elongation ratios, and surface texture specifications which are relatively conservative. The proof of the dependence of bulk properties on angularity, in particular, may allow better use to be made of recycled material and mined material.

In previous work (Gledhill, Greben and de Villiers, SAIP Annual Conference 2013) a physics engine was adapted to perform uniaxial testing, and the resulting stress-strain curves were presented for a set of regular shapes. It was demonstrated, within the applicability of this model, that the elastic modulus of the aggregate increases with the angularity index for regular polyhedra, with the exception of cubes, in which the strain reaches a maximum value after which the particle packing is fixed. The method has the advantage that it is faster than Discrete Element Methods (DEM), but the disadvantage that stress within the particles is not modelled.

The Combined Finite-Discrete Element method (Munjiza, Computational Mechanics of Discontinua, Wiley, 2011) offers the significant advantage of providing a Finite Element model of internal elements within each particle. A Combined Finite-Discrete Element model of particles of different angularity has been constructed and the results, in the form of stress-strain curves, are presented here. The simulation is extended to particle models based on laser-scanned surfaces of particle aggregate samples. Laboratory testing of compression has been performed (Anochie-Boateng, Komba and Mvelase, Int. Road Congress 2011) and comparisons with these experimental results will be shown.

**Apply to be<br> considered for a student <br> &nbsp; award (Yes / No)?**

No

**Level for award<br>&nbsp;(Hons, MSc, <br> &nbsp; PhD)?**

none

**Would you like to <br> submit a short paper <br> for the Conference <br> Pro-ceedings (Yes / No)?**

Yes

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