

Particles Packing In Ultra-sustainable Concrete With High Scm Content

zhe song¹

Mina Mortazavi¹, Vute Sirivivatnanon²
and Farzad Moghaddam³

¹ School of Civil and Environmental
Engineering, University of Technology
Sydney

² University of Technology Sydney

³ Boral Construction Materials

Keywords: concrete; particle packing;
packing density; mix designs.

With the rapid development of the construction industry, concrete production is expanding. As one of the most popular binder materials, cement manufacturing has produced 8% of the world's total carbon dioxide emissions annually. For environmental protection and economic purposes, reducing cement usage has become one of the essential goals of concrete mix designs. Since aggregates can account for up to 75% of concrete, the application of particle packing theory may prove effective in maximizing aggregate packing density and significantly reduces the usage of binder materials and creating more sustainable concrete. The basic principle of the theory is to reduce the voids among various materials to lower the binder demand at the same water to binder ratio. Therefore, the study of particle packing models has received extensive attention, and the establishment of these models provides a theoretical basis for predicting concrete microstructures. In this paper, a number of established particles packing models are discussed and compared. Interaction effects among particles which are included in these models are listed and reviewed in current study. Along with applications of particle packing theories on concrete mix designs considering aggregates, fillers, and binder materials. The effectiveness of above mentioned of particle packing theories on concrete properties are introduced, and the directions of future studies are further discussed.