Full PSD Rejects Shear Strength Testing for Co-disposal and Assisted Tailings Dewatering Technique Selection

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ABSTRACT
Daunia and Caval Ridge are two of the BHP coal mines having been co-disposing rejects and dewatered tailings within spoil dumps from the beginning of their operations in 2013 and 2014, for the purpose of minimising environmental impact and geotechnical risk. Through its Coal Tailings Program, BHP plans to transition all other coal mines to deliver “dry” tailings to produce mixed plant rejects (MPR) for in-pit co-disposal, to materially reduce its future tailings dam risk exposure, following the recent large failures of tailings dams in Brazil. Previous laboratory shear strength testing was conducted on reject particles scalped to -20 mm or less, with the limitation that the results might not represent the mechanical properties of the actual full Particle Size Distribution (PSD) rejects. In addition to the scalping, BHP were aware that using different techniques to dewater the tailings, such as belt press filters (BPF) and solid bowl centrifuge (SBC) could produce thickened tailings which could significantly modify the physical behaviours of the MPRs, particularly the bonding between particles. Therefore, laboratory testing on both coarse rejects and mixtures of the coarse rejects and dewatered tailings (MPRs), with full particle size distributions, was carried out. Testing was performed using the large direct shear machine developed by the Australian Coal Association Research Program (ACARP) project C20019 in 2017, as well as a 300 mm diameter triaxial compression testing machine at the University of Newcastle. This paper presents details of the laboratory testing program and results for the rejects from the first studied mine of the BHP Coal Tailings Program. It compares the shear strengths measured at full scale with those tested on scalped specimens in the past; and discusses the tailings dewatering technique selection from geotechnical aspects based on the testing results on rejects with the full particle size distributions.

Key Words: Rejects co-disposal, shear strengths, large scale testing, dewatering system selection