Influences of particle characteristic and compaction degree on the shear response of clinker ash

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ARTICLE INFO

Keywords:
Degree of compaction
Shear behaviour
Particle shape
Single particle crushing strength
Critical state

ABSTRACT

Clinker ash is regarded as a granular waste of coal combustion but potentially employed as a recycled and lightweight backfill material for retaining wall and embankment in recent years. The physical, particle, compaction and mechanical properties of six selected types of clinker ash were thoroughly examined in this experimental investigation. Clinker ash owns very complex and angular shapes and it gives rise to the larger difference between the maximum and minimum void ratios. The single particle crushing strength of clinker ash is around 1/5–1/10 lower than natural sands and it indicates high crushability in nature. With similarity to natural sands, the mean crushing strength of clinker ash displays a decreasing tendency with the increase in grain diameter. A series of triaxial compression tests were performed on different types of clinker ash to examine the influences of particle characteristics, degree of compaction and effective confining pressure on their shear behaviour and deformation characteristics. Test results demonstrate that clinker ash possesses a higher peak friction angle at low effective confining pressures and gradually loses its shear strength with the rise in effective confining pressure. The great shear strength dependence on the stress level for clinker ash is confirmed. The stress-dilatancy behaviour of a given type of clinker ash is minimally affected by the degree of compaction and level of effective confining pressure. The stress ratios at the critical state of clinker ash are well correlated with the mean crushing strengths. A larger N value for clinker ash determined using Nova's rule indicates its higher crushability. The downward shift of critical state line of clinker ash due to grain crushing is identified on the void ratio and logarithm of effective mean stress plane. Additionally, grain crushing was confirmed by the comparison of the variation in grain size distribution curves and the observation of colored particles previously seeded in the tested samples before and after shearing.