Improving Recyclability of Construction & Demolition Waste in Brazil

Background

CDW generation rate is high. The city of São Paulo alone generates 8.5 million tonnes/year.

Fly tipping is intensely done. Local authorities have significant expense for the management of CDW. The council of São Paulo spends around US$11 million/year.

CDW recycling is crucial for both environmental and social sustainable construction.

Objective

To improve the recyclability of Brazilian CDW coarse aggregate by introducing new, reliable, cost effective and fast characterization techniques that give relevant technical information to the selection of the best application for the CDW aggregate in concrete.

Methodology

Complete aggregate characterization

- Representative samples
- Density separation by heavy media
- Phase separation by hand sorting
- More detailed, integrated and complete characterization than required by standards
- Mineralogical analysis (DRX)
- Chemical analysis (FRX)
- HCl 20% acid leaching assay
- Aggregate bulk specific gravity
- Aggregate water absorption

Modeling of aggregate characteristics influences on concrete performance

\[ f(x, y, z, \ldots) = \text{CDW aggregate}, w/c, \ldots \]

- Concrete compressive strength
- Water/cement relation
- Different aggregate compositions varying phase content and density particles

Fast characterization methods

- Aggregate porosity
- Image analysis
  - Particle size distribution
  - Phase composition
  - Cement paste attached to rock
  - Rocks

Conama Resolution (307) for CDW in Brazil

- Promotion of recycling
- Actual recycling rate is less than 5%

Composition of CDW: concrete + masonry +...

Pure concrete or masonry waste is not common. Segregation at recycling plants is very difficult.

Downcycling as road base aggregate is the major market for recycled aggregates.

Preliminary results

The three studied samples of CDW coarse recycled aggregates from Brazil are composed of different porosity particles. When divided in heavy media classes, the mass distributions can be different.

Heavy media classes are constituted by different mineral phases and different amount of binders attached to natural rocks.

Particles separated by hand sorting have similar mineral phase composition but high variability of bulk specific gravity and water absorption results.

New characterization procedures

- Critical cement paste content attached to rock particles
- No mineral particles
- Red ceramic
- Cement (concrete or mortar)
- Rocks

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