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Petro-chemical investigation as a tool for quality control in the production of recycled aggregates for concrete

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Disposal of Construction and Demolition (C&D) debris and its treatment for re-use and recycling has gained importance in EU policy as clearly shown by the introduction of waste legislation and directives aiming to provide the industry with incentives towards a more sustainable management of waste. At present British standards (BS) and European Normatives (EN) are contributing to the solution of the environmental impact, induced by the demand of large quantities of natural resources (aggregates such as gravel and sand). The standards allow and set quality requirements for the use of two types of recycled aggregates in concrete production, namely, recycled aggregate (RA), mainly consisting of masonry, and recycled concrete aggregate (RCA), mainly consisting of concrete. This study demonstrated that a petro-chemical characterisation of natural and recycled coarse aggregates for concrete is a suitable approach to complement the established engineering methodologies, as described in BS 8500:Part 1 & 2 and EN 12620 for aggregates for concrete. A petrochemical mineralogical assessment, involving XRF, XRD and ICP-AES techniques, was carried out on materials from three different commercially produced coarse RCAs and natural aggregates (NA), in order to define their chemical and mineralogical features and their suitability for use as replacement of coarse NA in concrete production, without compromising durability (i.e. alkali-silica reaction, sulphate attack, chloride attack, etc.) performance. The results have shown that RCA from three distinct sources had very similar characteristics comparable to the natural aggregates and all aggregates conformed to current standards for use in concrete. Petro-chemical and mineralogical characteristics of all RCA sources were similar and compared well with the natural aggregate results. This part of the study did not reveal any concerns regarding durability of concrete, however, water and acid soluble chloride contents were significantly

higher (although well within standard requirements) compared to NA and it would be necessary to monitor this closely during production. Overall, this work have shown that the traditional characterisation regimes for aggregates for concrete, can be enhanced through the application of chemical-mineralogical techniques primarily used on geological materials, establishing an integrated quality control method. On site adaptation of this multidisciplinary approach, will provide the necessary quality control of recycled construction materials.