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Briefing. Gypsum: prospects for recycling

P. A. Claisse and E. Ganjian

Proceedings of the Institution of Civil Engineers, Construction Materials, **159**, No. 1, February, 3–4

The term gypsum is used to refer to three main compounds of calcium sulphate: anhydrite, hemihydrate and dihydrate; but it is most often used for the dihydrate. The two main industrial uses of these compounds are in cement and in plaster products. Cement producers use a blend of gypsum and anhydrite as a set controller. Plaster is made with hemihydrate. This material is used both for bagged plaster and also to feed the plasterboard production lines. The materials are available from both primary and secondary sources. Waste plasterboard is an increasingly important secondary source but there are a number of problems which limit the proportion of this material that can be used in plasterboard production. Research is therefore in progress to find other uses for it, such as low strength concrete mixes.

Development of bitumen-bound waste aggregate building blocks

J.-P. Forth, S. E. Zoorob and I. N. A. Thanaya

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The paper describes the optimisation of several mixes for the development of a new range of construction units (Bitublock) composed entirely of recycled and waste aggregates. The development of this new range of building units is driven by the issue of sustainability, both nationally and globally, and this complete replacement of traditional aggregates is possible because Bitublock uses bitumen as the binder. Five main waste materials are considered in this optimisation: crushed glass, pulverised fuel ash (PFA), incinerated bottom ash (IBA), incinerated sewage sludge ash (ISSA) and steel slag. In addition two types of bitumen were also considered: 50 penetration bitumen and harder H 80/90 bitumen. Several properties of the Bitublock were measured to assess their performance in relation to concrete block masonry products found in the UK. These

were: shape, density, water absorption, compressive strength, elastic modulus and time-dependent properties. It is shown that all these properties are dependent on the types of aggregate and the binder used, as well as on the compaction pressure and the curing regime. It is clear that Bitublock can be produced with properties that are at least equivalent to those of current concrete block masonry units. The long-term stability of Bitublock is significant in terms of construction, because its use could negate the need for—or at least reduce the frequency of—required movement joints in masonry.

Optimum utilisation of FGD waste in blended binders

P. S. Mangat, J. M. Khatib and L. Wright

Proceedings of the Institution of Civil Engineers, Construction Materials, **159**, No. 3, August, 119–127

The pollution caused by the wastes of semi-dry and dry flue gas desulphurisation (FGD) processes and the increasing cost of disposal make their utilisation imperative. The paper presents the first part of a comprehensive investigation to optimise the use of FGD wastes in concrete manufacture. Batches of FGD materials from actual industrial disposal sites and laboratory simulations based on fly ash and gypsum were investigated, representing the following categories: non-siliceous and deleteriously reactive; non-siliceous and non-reactive; siliceous and pozzolanic active. Generic relationships were derived that emphasise the importance of SO_3 content on concrete properties. There is an exponential relationship between strength and SO_3 content and also between strength and $\text{SiO}_2\text{-Al}_2\text{O}_3$. The results show that $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-CaSO}_4$ -based FGD wastes with $\text{SO}_3 < 15\%$ retard early strength but increase long-term strength. Mortars containing fly ash-gypsum (FA-G) blend (25% replacement) with gypsum contents up to 35% (SO_3 content up to 18.37%) do not suffer long-term strength reduction. An optimum FA-G blend has an SO_3 content less than 10%.

A geotechnical classification system for coal ashes

K. Prakash and A. Sridharan

Proceedings of the Institution of Civil Engineers, Geotechnical Engineering, **159**, No. 2, April, 91–98

Most of the existing soil classification systems make use of the plasticity chart for classifying fine-grained soils and some coarse-grained soils as well. They cannot classify those granular materials that are non-plastic through appropriate group

symbols indicative of their non-plastic nature without any ambiguity. Coal ashes, consisting of fly ash (known as pulverised fuel ash in the UK), bottom ash and pond ash, are produced in large quantities and are occasionally used in geotechnical applications. As they are non-plastic materials, the existing classification systems fail to classify them appropriately. This paper discusses this issue in detail. A classification system for coal ashes that are essentially non-plastic is formulated and proposed in this paper. It is shown through illustrative examples that the coal ashes can be classified easily and without any ambiguity using the proposed system.

Using waste to reduce slope erosion on road embankments

J. de Oña and F. Osorio

Proceedings of the Institution of Civil Engineers, Transport, **159**, No. 1, February, 15–24

Urban waste may be used to reduce slope erosion of highway embankments. Whereas different kinds of compost have been tested in the USA for highway revegetation, sewage sludge has been used only for agricultural purposes. This paper presents the results of research carried out in order to study the viability of the application of sewage sludge compared with compost. Test areas measuring $4\text{ m} \times 5\text{ m}$ were constructed on a new highway embankment with 2:1 and 3:2 side slopes in the south of Spain. Crop cover and erosion were evaluated for plots with application of three dosages of compost and three dosages of sludge. Also, the costs of the proposed application are analysed. This treatment costs, on average, 0.24% of the budget for new roads infrastructure, and reduces soil loss by up to 30% on average. Based on these results, compost and sludge can be successfully used to reduce slope erosion on highway embankments. However, standards and specifications are required for their routine application.