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Adobe Geocomposite: A Sustainable Geomaterial Perspective

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Abstract

Adobe is a wide range of naturally occurring clay rich soils broadly inclusive of weathered and heavily weathered residual soils that are reconstituted, moulded, compacted, air dried or fired to blocks and bricks for sustainable infrastructure support and development. In Tropical and Subtropical parts of Africa, laterites, lateritic soils, and ferricretes underlying vast portions of the continent, readily provide a sustainable resource for adobe production. Mud, Red Mud, Lateritic Earthen materials, Compressed Earth Blocks walls Mud Houses and sections of Earth dams are sustainable infrastructure and materials built up with adobe. Some of the major clay mud based infrastructure in the continent are fired brick Bell Tower in Cape Town, built between 1666 and 1684 and the Sun dried Timbuktu Library in Mali 1545 – 1560 Clay rich earthen structures improved by different degrees of reinforcements and stabilization predominate the Africa landscape. However, despite the sustainable, recycle potential and cost effectiveness of clay mud based infrastructure, conventional sundried houses suffer from many structural durability and serviceability limit problems. Some of the major problems of sun dried Adobe Infrastructure are variability of particle size constitution and mineralogy, moisture and cyclic moisture induced desiccation, reduction in strength and stability and bearing capacity of earthen walls, shrinkage cracking of adobe masonry walls, significant reduction in stability due to shock load, tremor and cyclic loading, mass Loss and erosion of adobe foundations. Traditional sustainable and non-sustainable improvement methods have been implemented and have mostly required the use of plant / bio fibre reinforcement. However, this method has required the management of moisture adsorption and degradation of ultimate tensile strength and durability, that are related to materials biochemical composition and properties that are controlled mainly by cellulose and Lignin content. The more common readily deployed improvement method are reinforcement by conventional synthetic fibers ie Polypropylene Fibers In the past 10 years, series of investigations have been conducted to improve the properties of sundried clay rich infrastructure materials. These include: the use of natural fibre Inclusion and precompresion on the strength properties of Lime-Fly ash stabilized adobe soil, improvement of adobe masonry ductility by optimized strand fibre inclusions, improvement of compressive and tensile strength properties of pre-compressed and soaked natural fiber reinforced lime—fly ash stabilised adobe soil, effect of natural fibre inclusion and precompresion on the strength properties of Lime-Fly ash stabilized soil, desiccation characteristics and desiccation induced compressive strength of natural fiber reinforced soil, density control method for compression test of compacted lime-fly ash stabilised fiber-soil mixtures Title of Journal, effect of fibre surface coating on the mechanical properties of natural fibre reinforced soil, improvement of cyclic and post-cyclic shear behavior of natural fibre reinforced soil, benefits of fiber inclusion in adobe masonry construction in relation to elemental matrix i.e. unreinforced and fibre reinforced brick and mortar, combinations in wallets and adobe panels. Adobe material for sustainable material development and applications To SDG 9 (Industry, Innovation and Infrastructure) and SDG 11 (Sustainable Cities and Communities) would require the integration of the following research imperatives : The performance of Adobe at low firing Temperature in Relation to Recycle Potential; Biopolymers Stabilization, Durability and Degradation in UV and acid mine environment; BioFibres and improved coating Methods , Macro and strand reinforcement of load bearing Adobe Members with Bamboo and strands (i.e. Sisal).