Evaluation of Internal Curing in Roller Compacted Concrete Using Brick Waste as a Partial Aggregate Replacement

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Abstract

Even though there are some countries manufacturing internal curing aggregates, they are a bit expensive to utilize in industry. The reason is that the scarcity of raw materials and some amount of processing have to be done before using the material. Therefore, scientists and research enthusiasts are experimenting to seek the best alternative substances for internal curing aggregates using industrial waste. In this study, brick waste is taken to check whether there is a possibility to be used as a partial aggregate replacement for roller-compacted concrete using an internal curing approach. Quantifying internal curing characteristics of brick waste, behavior of microstructure of concrete matrix during water desorption, and determining the suitability of brick waste as partial aggregate replacement are aims to accomplish in this study. Generally, concrete takes its strength from hydrating reactions. Therefore, supplying water to the concrete continuously is a must. In the presence of water in concrete, it will reach its maximum strength. This chemical phenomenon is known as curing. Curing can be categorized in two ways. They are conventional curing and internal curing. Ponding, sprinkling, and wet gunny bags are some practical approaches for conventional curing. Depending on the situation, these curing techniques will be utilized according to our desire, but the problem behind that is water will be able to travel a couple of inches into concrete since the concrete shows less permeability as a result of that cracking; spalling can occur in concrete. On the other hand, internal curing is a process by which the cement paste will be hydrated in the presence of internal reservoirs that assist in providing water to the cement paste, but this water is not a component of mixing water. Thus, normal aggregates are replaced with aggregates that consist of pores that are considered as internal reservoirs that allow water to release into the concrete for curing. Since there are two possible outcomes, brick waste can be used as a partial replacement for fine aggregate or coarse aggregates. Therefore, this investigation will run along two different paths to quantify the physical properties of aggregates and chemical properties of internal curing aggregates with a couple of mixture proportions until we catch up to what is the optimum mix proportion that suits brick waste. Meanwhile, the finite element analysis (FEM) will be developed to make a computational model to see whether the pattern of water absorption and water desorption into the concrete by using ABACUS or ANYSIS software. In order to assess and compare the compressive strength of internal curing concrete cubes and conventional curing concrete cubes, they are taken out in 7 days, 14 days, and 28 days, respectively, according to the ASTM standards. After that, the cube strength values will be taken to draft a graph with time to understand the strength development with time. Not only compressive strength but also water absorption and desorption capacities, pore sizes, the arrangement of pore structure, and splitting tensile strength will be evaluated after the testing process, and then these data will be taken to tabulate finally to conclude whether this material can be utilized as a partial aggregate replacement or not. Under this research study, it reveals that the quality of internal curing of

concrete and suitability of brick waste as partial aggregate replacement address sustainable construction practices.

Keywords: *internal curing, finite element analysis, roller compacted concrete, sustainable construction, brick waste*

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