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Impact of clay brick dust on durability parameters of bituminous concrete

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Abstract

Bituminous Concrete (BC) is widely used as wearing surface in flexible pavement. BC as a construction material mainly consists of coarse and fine aggregates in defined proportions and bitumen as binding agent. After compaction, it offers smooth compacted surface for the road users.

In the present study, effect of replacement of sand to brick dust on properties of Bituminous Concrete (BC) is studied in this research. Aggregates of size 20mm, 10mm, sand and VG-30 grade bitumen were used in this research. To check the feasibility of raw materials to be used in pavement, all physical tests on aggregates and bitumen were performed as per relevant IS codes. To design Bituminous Concrete (BC), Grading 1, proportioning of aggregates was carried out. Marshall method was used for determining of Optimum Binder Content (OBC). Average of bitumen content corresponding to maximum stability, maximum bulk density and 4% air voids was taken as OBC of BC mix. At OBC, three durability tests were performed i. e., Marshall Quotient, Tensile Strength Ratio (TSR) test and Permeability tests were conducted for all the replacements. Based on above study, it was concluded that brick dust in the range of 5% – 10% can be used as partial replacement of sand in BC mixes. In the range of 5% – 10% replacement, durability parameters conducted in this research were within the permissible limits specified by MoRTH. On exceeding replacement more than 10%, there was drastic change in the properties of the mix.

Introduction

India has the second largest road network in the world after the USA with 4.69 million kilometers of road network [1]. Indian government is also spending a very high budget on road infrastructure development of our country. In the union budget 2021, the Government of India sanctioned around Rs. 1.18 lakh crores to the Ministry of road transport and highways (MoRTH) for road infrastructure development in India [2]. High infrastructure development al brings increased demand for natural resources. The primary raw materials used in the construction of flexible pavement are coarse aggregates, fine aggregates and sand. There is a massive demand for road aggregates for the construction and maintenance of roads. The annual need for natural sand in India is 750 million tons and is estimated to reach 1350 million tons by 2025 [3], [4]. This will create a severe burden on the environment and there is a high need to look for alternative materials in place of natural resources. The utilization of waste materials in the construction of highways is a good solution for sustainability.

India is the world's second-largest clay brick producer, having a total of 0.14 million brick kilns [5], [6]. Small-scale industries dominate brick kilns in India with minimum economic, technical, and organizational capability. Although alternative of clay bricks are available in the market