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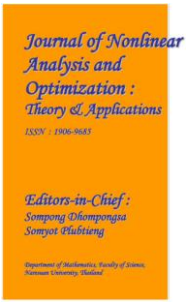

IDENTIFICATION OF THE ALTERNATIVE MATERIALS FOR RIVER SAND FOR BRICK MASONARY CONSTRUCTION

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Abstract

The construction industry is a key sector that provides a basic human need, such as shelter or building infrastructure. The public sector construction industry constructs constructions such as roads, dams, bridges, and health care facilities. Building materials, which constitute the backbone of construction operations, are in high demand due to the requirement for numerous activities. River sand is a common building material used in construction. River sand is used in many forms for various construction activities. Masonry mortar, concrete manufacture, plastering work, road construction, and many other key construction operations. Because construction activity has grown so quickly during the past ten years, the demand for river sand has multiplied many times over. Traditional sources of natural sand include rivers, where fine aggregates are created over time by physically and chemically altering rock particles. River sand is now scarce due to both legal and illicit mining, which has had negative effects on natural sources of fine aggregate. Since river sand cannot be replenished, it must be preserved for the future. Hence, alternatives that can replace the usage of fine aggregates partially or entirely are required. To substitute natural sand in various construction projects, many alternative materials were investigated for their qualities. M-sand (manufactured sand) from aggregate manufacturing plant, slag sand (waste produced from steel industry), Construction & Demolition waste(waste generated after demolition of buildings) are bi-products of their respective industries. All these alternatives were considered to be waste product and were dumped in landfills. According to literature reviews, these wastes' characteristics are comparable to those of fine aggregate. Numerous alternative research programmes have advised using the substitutes as fine aggregate in a set replacement percentage. Since these substitute materials are less expensive to produce or process, they can economically replace the fine aggregate. Because to the decrease in transportation to landfills and subsequent reduction in CO2 emissions, using such alternatives is a practise that is environmentally benign. Effective alternatives will aid in reducing the issues with landfills. It is sustainable to use these substitutes in place of fine aggregates. Thus, government should promote and support the adoption of alternatives. It is best to replace these alternatives in construction activities. Strength behaviour of brick masonry specimens made with alternatives is examined i.e. compression, tensile and flexural behaviour of brick masonry. Based on the experimental results, best suitable alternative is recommended as an approach towards sustainability.

Keywords : River sand, M sand , Slag sand ,C & D Waste

Introduction

Rapid growth of population in urban areas demands for proper infrastructure in terms of residential and public structures. Construction industry is the main source to fulfill the need for infrastructure. Hence there is a requirement for construction materials in various applications of construction. River sand is one of the important construction material used as fine aggregate in mortar, concrete, plastering and other various means of construction. River sand is becoming scares due to its enormous

requirement and use. Main source of natural sand are rivers, which are being emptied or erosion of river is taking place. Aquatic life is also affected by the rivers which are being eroded. In present scenario there is a requisition of alternatives which can replace the natural sand, partially or by full replacement. There is a need for alternatives which can solve the land fill problems, can be used as a recycle material and which are socially acceptable. There are several investigations on such alternatives being carried out all round the world by different research programmes. Hence there are number of alternatives which can replace river sand, as suggested from experimental investigations. In the present investigation three alternatives i.e. manufactured sand, slag sand, construction & demolition waste are identified. All the three alternatives are from different sources, detailed analysis of each alternative is carried out in further chapters. The present investigation on alternatives to river sand aims towards sustainable approach. All these alternatives identified are being the waste from different industries which will minimize the land fill problems and replace the natural aggregates. These alternatives are by- products, which can be used in construction activities economically. Adverse effects on environment are also reduced by these alternative materials hence are socially acceptable. Sustainable advantages of alternatives to river sand are as follows:

1. Reduce the ill-effects on sources of river sand Decreases the landfill problems
2. Reduce the demand of non-renewable materials like gravel, rock and river sand.
3. Reduces the emission of carbon dioxide gas by reducing the transport distance for landfilling.
4. Acts as a sustainable material which is good for environment, economical and socially acceptable

Objectives

1. To determine the physical properties of the three alternatives identified to river sand.
2. To determine the properties of masonry mortar mix of proportion 1:6 using the alternatives.

To determine the properties of brick masonry constructed with the alternatives selected in the presence study. To determine the physical properties of different alternatives for river sand.

Methodology

Methodology with respect to each objective is briefly given below

1. To determine the physical properties of different alternatives for river sand.

For achieving this object, the process applies as like the determination of physical properties and test results will be compared with natural sand. For that purpose, the test
will be used like

- Sieve analysis
- Specific gravity
- Water absorption
- Bulk density
- Bulking of fine aggregate

2.To determine the properties of masonry mortar with various alternatives for river sand.

For achieving this object, the process apply as like the determination of fresh and hardened properties of masonry mortar. For that purpose, mortar mix design will be used to carry out the experiments and the results are compare to river sand.

3.To determine the properties of brick masonry constructed with the alternatives selected in the present study.

For achieving this object, the present study mainly concentrates the behavior of brick masonry made with three alternatives in masonry mortar. For that purpose, the tests as like compressive strength, water absorption, flexural strength and shear strength on brick masonry will be carried out.

4.To determine the economic comparison of alternatives with river sand.

For achieving this objective cost comparison of all the alternatives and river sand will have to be done to get the economy comparison. The construction industry is facing problems due to scarcity of river sand. Several investigation have revealed the need for alternatives to river sand. There are about eleven alternatives identified so far. The present investigation is on three alternative materials. The three alternatives are M-sand, Slag sand and C&D waste obtained from distinct sources. This chapter deals with the experiments on alternatives and mode of procurement.
The present chapter is mainly divided in two parts as follows:
I Characterization of alternatives to river sand, based on their physical properties.
II Examining the alternatives by replacing river sand in mortar mix of 1:6 at 25%, 50%, 75% and 100%.

Alternatives to river sand
The three alternatives considered in present study were brought and processed to obtain fine aggregates. These include;
M-sand:
Manufactured sand or artificial sand is produced by crushing the rocks to the required size in aggregate manufacturing plant. Special crushers are employed to obtain the desired size of aggregates. The dust particles generated during the crushing process are washed to get fine aggregates of good quality. In the present investigation the required quantity of manufactured sand is procured from RMC India, Aggregate manufacturing plant, Bangalore. The sample is sieved i.e. materials retained on 4.75mm and passing through 150µ sieves are neglected. Further the sample is examined to know its various properties. A typical scene observed in an aggregate manufacturing plant where heaps of M-sand can be found is shown in Fig.

Fig.Heap of M-sand in aggregate manufacturing plant

Fig.Manufacturing plant

Slag sand:

Slag sand or blast furnace slag is a by-product of steel manufacturing plant formed during the smelting process of steel production. It is non-metallic in nature, with glass particles having silicates and alumino silicates of lime. This by-product of steel is commonly stored outside the production unit in heaps and according to its end use is crushed to the required size and send to the consumer In the present study, slag sand is procured from JSW steel limited, Hospet. The sample was packed in bags and brought by truck (Fig 4.4) to the college laboratory, each bagapproximately weighing 50 kg. The slag sand was already in fine size i.e. finer than 4.75mm in size hence the sand is sieved only with 150µ sieve and used in experimental programme.

Physical properties of fine aggregates

Sieve analysis:

Fineness modulus = sum of percentage cumulative weight retained / 100

Sieve size(mm)	**Wt. retained(gm)**	**Wt. retained in (%)**	**Per. Cumulative wt. retained (%)**	**Cumulative percentage passing (%)**
4.75	10	0	0	100
2.36	18	1.2	1.2	98.8
1.18	237	15.8	17	83
600µ	446	29.73	46.73	53.27
300µ	661	44.06	90.89	9.21
150µ	119	7.93	98.72	1.28

Weight of river sand sample considered for sieve analysis = 1500gm

Fineness modulus = 2.54

Compressive strength of masonry mortar with alternatives is done according to IS: 2250-1981 standards. To carry out the test, mould of size 70.6×70.6×70.6 mm are used. Cement mortar is mixed with known quantity of water as determined by flow test for respective % replacements. The mould is filled in two layers by tamping 25 times for each layer. Care must be taken for uniform tamping so as to avoid the segregation of mortar mix, excess ofmortar is struck off and mortar is levelled with a trowel. Once the specimen are cast, they are kept for curing in a place which is free from vibration and at temperature of 27 +/- 20C.

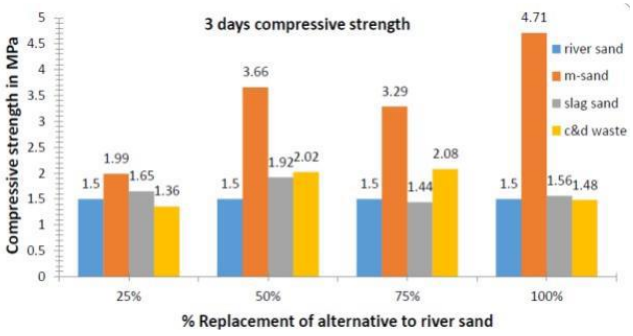

Fig. Compressive strength at 3 days

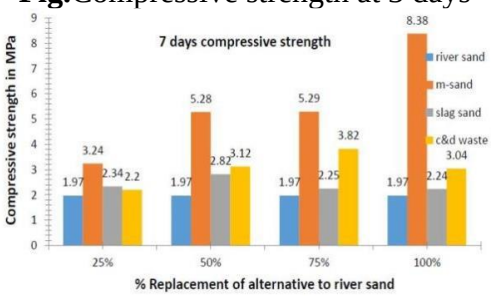

Fig. Compressive strength at 7 days

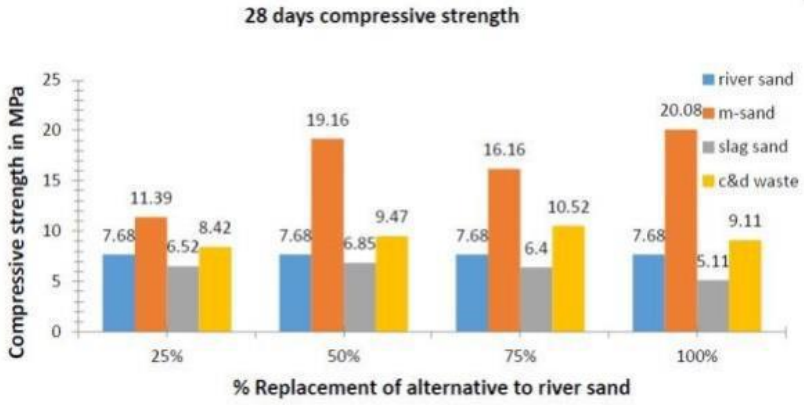

Fig. Compressive strength at 28 days

Conclusions :

Sieve analysis on all the three alternatives has shown that it can be categorized under zone-2 sand as per IS codal provisions.

Specific gravity of all the three alternatives are lower than natural sand. Water absorption exhibited by m-sand and slag sand is around 2%. However C&D waste has shown 6% similar to past research findings. This being due to the presence of adhered mortar around the particles.

Mortar mix of 1:6 with OPC was maintained for all mortars. Varying percentage of replacement was attempted from 25% to 100% or full replacement.

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