

MINIMIZING SAND CONTENT IN CONCRETE

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Abstract

The experimental results of a research on plain cement concrete with partial or full replacement of natural sand (fine sand) with manufactured sand produced at stone crusher as a byproduct. Designed concrete mix having proportion as 1: 1.5: 3 with specified properties of concrete as per INDIAN STANDARDS (IS) in experimental study. Concrete cube specimens are tested for evaluation of compressive strength. The concrete exhibits excellent strength with 40%, 60%, 70%, 80% and 100% replacement of natural sand by manufactured sand. This project may play a very important role in the further development in the field of civil engineering. It will help to find viable solution to the declining availability of natural sand to make eco-balance.

Keywords: Manufactured Sand (M.S.), Natural Sand (N.S.)

1. INTRODUCTION

The demand of natural sand is quite high in developing countries to satisfy the rapid infrastructure growth due to extensive use of concrete; causing very high global consumption of natural sand. In general the situation of developing country like INDIA is facing shortage in good quality of natural sand. Now-a-days large amount of depletion of natural sand is causing a serious threat to the environment as well as society. Increasing extraction of natural sand from river beds causes many problems like retaining sand strata, deepening of the river courses and causing bank slides, loss of vegetation on the banks of rivers, exposing the intake well of water supply schemes, disturbs the aquatic life and also affecting agriculture due to lowering the underground water table etc are few examples. Properties of aggregate affect the durability and performance of concrete, so fine aggregate is an essential component of concrete. The most commonly used aggregate is natural river or pit sand. Fine and coarse aggregate constitutes about 75% of total volume. It is therefore, important to obtain right type and good quality aggregate at site because the aggregate forms the main matrix of concrete. Now a day's sand is becoming a very scarce material, in this situation research began for inexpensive and easily available alternative material of natural sand. Some alternative materials have already been used as a part of natural sand e.g. fly-ash, slag lime-stone and siliceous stone powder are used in concrete mixtures as a partial replacement of natural sand. However, scarcity in required quality is the major limitation in some of the above materials. Now a day's sustainable infrastructural growth demands the alternative material that should satisfy technical requisites of fine aggregate as well as it should be available abundantly.

2. RESEARCH SIGNIFICANCE

The main objective of the present work is to study the effect of percentage replacement of natural sand by manufactured sand as 40%, 60%, 70%, 80% and 100% respectively experimentally. The M20 mix is used to find compressive strength of the concrete for Comparative study. Manufactured sand can be used as a fine aggregate, but it has to satisfy the technical requisites. On this aspect, research on cement concrete with natural sand is scarce, so this paper investigates the cement concrete produced with manufactured sand.

2.1 Materials

1. Cement
2. Water
3. Coarse Aggregate (C.A.)
4. Natural Sand (N.S.)
5. Manufactured Sand (M.S.)

2.2 Material Properties

The specifications of the constituents required for preparing concrete have been taken into consideration as per the IS: 383:1970.

3. EXPERIMENTAL PROGRAM

The main objective of this experimentation is to find out the effect of replacement of natural sand by manufactured sand in cement concrete. The experimental work includes the casting, curing and testing of specimens. Concrete mix is prepared with proportion 1:1.5:3. Sieve Analysis method is used for removing the dust content from the manufactured sand so as to reduce the water absorption of the mix. Sieves used are IS 106 microns and IS 75 microns respectively. Five trials are carried out for each replacement ratio, where mix 1 is the reference mix with 40% replacement of natural

sand by manufactured sand, mix 2 is with 60% replacement of natural sand by manufactured sand and mix 3 is with 70% replacement of natural sand by manufactured sand, mix 4 is 80% replacement of natural sand by manufactured sand and mix 5 is 100% replacement of natural sand by manufactured sand. All of the experiments are performed in normal room temperature. The concrete ingredients are first mixed in dry state by weight-batching. Manufactured sand is used as a replacement to the natural sand, then calculated amount of water is added and mix it thoroughly to get a homogeneous mix. Concrete is poured in the moulds layer by layer and compacted thoroughly. Cubes are used for compressive strength test having standard size 150 mm x 150 mm x 150mm that are cured in water for 7 days on Compression Testing Machine (C.T. M).

The results observed during this experiment are as follow:

Table.-1: Result Table for M20 concrete mix

| (N.S.:M.S.) | fck in MPa (N.S.) | fck in MPa (N.S.:M.S.) |
|-------------|-------------------|------------------------|
| 100:0 | 14.74 | - |
| 60:40 | - | 18 |
| 40:60 | - | 19.81 |
| 30:70 | - | 26.74 |
| 20:80 | - | 22.88 |
| 0:100 | - | 20.08 |

Where, fck is characteristic strength of concrete.

The below graph represents the readings obtained in this experimental project:-

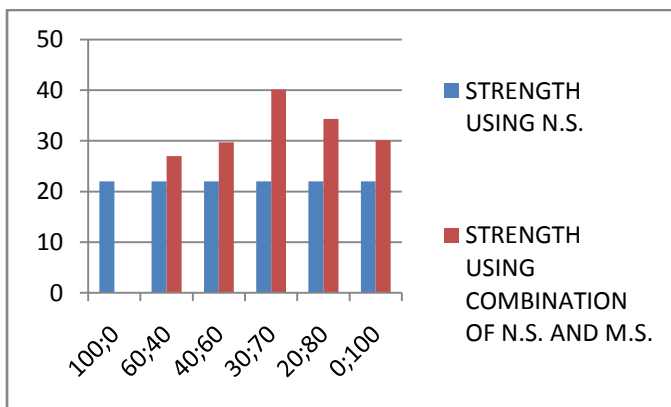


Chart -1: N.S.:M.S. comparison for M20 concrete mix

4. CONCLUSIONS

Manufactured sand has a potential to provide alternative to natural sand and helps in maintaining the environment as well as economical balance. Non-availability of natural sand at reasonable cost, forces to search for alternative material. Manufactured sand qualifies itself as suitable substitute for river sand at reasonable cost. The manufactured sand found to have good gradation and better bonding which is comparatively less in natural sand.

REFERENCES

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