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Review Paper on Experimental Investigation to Check the Application of Various Grades of M-Sand on Properties of Concrete.

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ABSTRACT

The increasing demand for natural river sand in concrete production has led to exploration of alternative materials such as manufactured sand (M-Sand). This study investigates the influence of different grades of M-Sand on the properties of concrete, including workability & compressive strength. Various grades of M-Sand, classified based on particle size distribution, are used in concrete mixes. This experimental investigation was carried out using Mix Design M25 Grade of concrete with mix proportion for grades of M-Sand such as Medium M-sand (particle size 2.36 to 1.18mm) and Coarse M-Sand (particle size 2.36to 4.75mm). The cubes will be tested with varying proportions medium and coarse m sand namely 30%, 40%,50%,and 100% fully M-Sand. The cubes will undergo various tests, including Indian Standard and ASTM, to ensure their quality. Experimental tests, such as slump test and compressive strength tests are conducted to asses the impact of M-Sand on fresh and hardened concrete properties. The results are analyzed to determine the optimal grade of M-Sand that enhances concrete performance while ensuring sustainability.

Keyword- M-Sand, Concrete properties, Workability, Compressive Strength, Particle Size Distribution, Sustainable Construction.

I. INTRODUCTION

Using alternative materials in place of natural river sand in concrete production makes concrete a sustainable and environmental friendly construction materials. M-Sand has similar physical and chemical properties as a river sand and can be utilizes for the construction activities. M-sand is Produced by crushing hard granite rock into fine particles, offering controlled gradation and reduced impurities compared to river sand. its use in concrete can potentially enhance mechanical properties and long term durability while promoting sustainable construction practices. However the quality and performances of concrete depend on the particle size distribution and characteristics of M-sand, which vary based on manufacturing process and parent rock properties. This sand can be readily obtained locally because hard granite rocks can be broken to make it, which lowers the expenses of transporting from distant river sand bed. As a result, using synthetic sand as an alternative building material can reduce construction costs. This study aims to experimentally investigate the effect of different grades of M-Sand on properties of concrete. This research provides valuable insights into the feasibility of M Sand as a suitable alternative to river sand contributing to cost effective and environmentally friendly construction practices.

Manufactured Sand: For construction reasons, manufactured sand, which is made by crushing hard granite stone. Typically, the crushed sand is shaped like a cube with grounded edges. After being cleaned, it is categorized as construction sand with a size (M-Sand) less than 4.75mm. The usage of artificial sand has expanded as a result of the shortages of high-quality river sand used in building. This sand can be readily obtained locally because hard granite rocks can be broken to make it, which lowers the expense of transporting from distant river sand bed. As a result, using synthetics sand as an alternative building materials can reduce construction costs.

Advantages of M-Sand:

i. It is highly economical.
ii. Use of M-Sand is environmentally friendly as the waste materials from industries are effectively being used to create quality building materials.

iii. The concrete mixture generates a very low heat of hydration which prevent thermal cracking.
iv. The shrinkage of M-Sand concrete is very less.
v. The use of M-Sand gives concrete good work ability, durability and finish.

Disadvantages of M-Sand:

i. The quality of M-Sand can affect the quality and strength of cement concrete.
ii. Poor quality M-Sand can increase the permeability of the cause damage to the buildings.

II.MATERIALS USED:

i. Cement
ii. Aggregate
iii. Medium M-Sand
iv. Coarse M-Sand

Cement-Cement, in general, adhesive substance of all kinds, but in a narrower sense, the binding materials used in building materials and civil construction. Cement of this kind are finely ground powders that, when mixed with water, set to hard mass.

Aggregate- Aggregate is a granular materials used in concrete to make it stronger, more compact, and less likely to crack .Aggregate can be made of many different materials, including sand, gravel, crushed stone granite, limestone.it may be categorized as coarse or fine based on their particle size.

Medium M-Sand-Medium grade M-Sand typically has a particle size range of 0.425mm to 2.36mm.This grading is suitable for concrete production and plastering because it provides a balanced mix of coarse and fine particles, which helps improve the workability, strength and finish of the concrete or mortar.

Coarse M-Sand- Coarse M-Sand typically has a particle size range of 2.36 to 4.75mm.This type of M-Sand is coarser than medium grade m sand and is commonly used in concrete mixes for structural application where higher strength and durability are required.

III. LITERATURE REVIEW

i. Characteristics of M-Sand as a partial replacement with fine Aggregate in mix design.
Author: Shreyas. K - Issue year:2017
Manufactured sand, when used in different proportions, enhances the concrete's engineering and physical performance, which is relevant to recent construction innovations. In this study, M-sand replaced fine aggregate by weight in varying amounts from 0% to 40%, and its effects on concrete were analyzed. introduction of manufactured sand in a proper proportion will leads to increase in the compressive strength 15 to 20% for a concrete cubes which are being tested for 7 days, 14 days and 28 days strength.

ii. Experimental Investigation On Properties Of Concrete Produced With Manufactured Sand.
Author: Mane K.M, Kulkarni D. K.-Issue year :2016
This study aimed to investigate the effect of replacing natural sand with manufactured sand at various replacement levels (0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%) on the shear and impact strength characteristics of concrete. M30 grade concrete was used for the study, with a water-cement ratio of 0.45.

iii. Replacement of fine Aggregate by M-Sand.
Author: Halesh Kumar B T, Anusha H S-Issue year:2017
In this paper, the scarcity of good-quality natural sand, due to resource depletion and environmental limitations, is explored, prompting concrete manufacturers to find alternative solutions for fine aggregate. One such alternative is manufactured sand. Concrete properties such as workability, strength, and durability were evaluated with M-sand used as a partial replacement for natural sand at 0%, 5%, 10%, 15%, 20%, and 25%.

The tests were carried out on M20 grade concrete. Slump cone test is conducted to determine workability on fresh concrete. Compressive strength test and spilt tensile strength tests are conducted on hardened concrete by casting cubes and cylinders respectively. Compressive strength and spilt tensile strength tests were conducted to determine strength of concrete. The 15% replacement of natural sand by manufactured sand showed an increase in strength in both compressive strength test and spilt tensile strength tests.

iv. Study on Properties of concrete with Manufactured Sand As Replacement to natural Sand.
Author: Yajurved Reddy M, D.V. Swetha- Issue Year :2015
In this paper to study investigation workability, strength and durability of concrete with manufactured sand as replacement to natural sand in proportion of 0%, 20%,40%, 60%, & 100% is studied. The experiments were conducted on M20 and M30 concrete grade with 450 specimen Concrete workability was determined using the slump cone test, compaction factor test, and Vee-Bee test.. Results showed that as replacement of natural sand by manufactured sand is increased, there is a decreased in the workability. Compressive strength, spilt tensile strength tests were conducted to determine strength of concrete. Strength increased by approximately 20% at 60% replacement, and by no less than 0.93% for all other replacement percentages in both grades.

v. The Impact of Manufactured Sand As Partially and Fully Replacement of fine Aggregate of Concrete.
Author: Siti Aliyyah Masjuki, Siti Asmahri Saad-Issue Year:2020
This research focused on assessing the suitability of M-Sand compared to river sand for use in concrete. M-sand is replaced by river sand 0%,45%,50%,55%,and 100%, in the concrete mix, Mix Design is designed as per IS Standard. In this research a mix 1:2.32:2.82(M20) was considered. The test specimen was casted for 7days, 28days and 90 days. The performance of M-Sand was determined by several experiment such as slump test, impact strength test, flexural strength and compressive strength. The results attained from each test states that as M-Sand increase the slump value decrease. Flexural strength compressive strength and impact test of concrete at 7 days ,28days and 90days is grater at 100% and 50% replacement of M- Sand by river sand.

vi. Experimental Investigation Of M-Sand In Concrete.
Author: Dr. Shankar H. Sanni -Issue Year:2021
The main purpose of this investigation is to replace sand in concrete with M-Sand for both M30 & M40 grades. The test results were compared to that of conventional concrete for 7days and 28days. Based on the experimental investigation carried out, it can be conclude that replacing river sand with that of M- Sand provide most effective result in reduction of dependency on river sand. The workability of M-Sand concrete was low compared with river sand, apart from that when at the mechanical properties these concretes gave higher strength in compression, tensions and flexural also. Hance in todays construction, it can be stated that M-Sand can be effectively used instead.

vii. Experimental Study On Concrete By Using Manufactured Sand.
Author: Boobalan S C, Niketan D, Pradesh – Issue Year :2019
This paper reviews various studies on concrete where natural river sand is replaced with different percentages of manufactured sand. Due to the angularity of manufactured sand particles, a higher water-cement ratio is required to maintain workability in comparison to river sand concrete. The properties addressed in this paper include mechanical characteristics, workability, and durability. In conclusion, the paper suggests that using a suitable proportion of manufactured sand as a replacement in concrete is both feasible and effective.

viii. Replacement of River Sand By M-sand On Concrete.
Author: Dr. M Kannan, Fantin Jesanth- Issue Year:2019
This study was conducted to assess the influence of manufactured sand on the compressive strength and split tensile strength of concrete, as well as to explore the possibility of fully replacing natural river sand with manufactured sand. The samples of fully manufactured sand were collected, and their physical properties were examined. Concrete mixes of M20 and M25 grades were prepared using both natural and manufactured sand, maintaining consistent water-cement ratios and cement content. The results of the hardened concrete properties indicated that mixes with full replacement of manufactured sand and natural sand achieved improved compressive strength and spilt tensile strength at all test ages.

ix. An Experimental Study On Use of Manufactured Sand in Concrete Production.
Author: Anjali Rathore, Pushpendra Kumar – Issue Year: 2018
A study on the behavior of special concrete when fine aggregate is partially replaced by manufactured sand in varying amounts. This will safeguard environment river basin and at the same time unwanted accumulation of crusher dust will put into better use than being used as more filling materials. Experiments conducted on M25,M30 and M40 grade concrete with fine aggregate replacement proportion 25%, 50%, 75% and 100%. The properties such as workability, water absorption, compressive strength ,spilt tensile strength and flexural strength are determined from cubes, beams and cylinders cast with manufactured sand. It will be conclude that, the compressive strength of concrete with manufactured sand has been increased up to 50% and after 50% of the replacement the strength are gradually reduced.

x. Experimental Investigation On Properties Of Concrete Containing Natural Sand By Manufactured Sand.
Author: Akshatha B A, Vikranth H P – Issue Year:2022
This research utilized a conventional mix ratio of 1:2.32:2.82 with a fixed water-to-binder ratio of 0.55. Manufactured sand (M-sand) replaced river sand at varying levels—0%, 45%, 50%, 55%, and 100%. The study focused on assessing the fresh and hardened properties of concrete incorporating M-sand as a natural sand replacement. In this study some investigation on the compressive, tensile, flexural and impact strength by partial and fully replacement of M-Sand by River Sand and result should be compared. Concluded that to the superior gradation of M-Sand gave good plasticity of concrete providing excellent workability. 100% replacement of M - Sand with respect River Sand is decreases with 7 and 28 days strength. Replacement of 100% river sand with m sand is not satisfied the strength compare to conventional concrete. compressive strength of concrete for 7 and 14days with river sand is higher when compered with compressive strength of concrete with m sand is higher than that of with river sand. Tensile strength and flexural strength at 55% replacement of M-Sand by river sand is optimum after 28days strength of concrete. Increased in impact resistance of the concrete was derived from an increased ability of material.

xi. Strength Analysis On Concrete With M-Sand As A Partial Replacement Of Fine Aggregate
Author: K. Suseela, Noorul, Kumar coil, Dr. Baskaran-Issue Year:2017
Concrete is composed of cement, fine aggregates, and coarse aggregates. In recent years, the extraction of natural river sand has posed severe environmental threats, leading to difficulty in obtaining it. Government restrictions on sand mining from riverbeds have also been enforced. As a result, the limited availability of natural river sand and the rising demand for it have become pressing issues. This reasrch intention towards effective utilization of manufactured sand for commercial purpose. This reasrch in cooperates effectiveness of m sand by investigation compressive strength ,spilt tensile strength and durability of concrete with various mix.

xii. An Experimental Investigation On, Effect On The Properties Of Concrete By Partial Replacement With M-Sand.
Author: Rameez Raja, V.S. Sagu-Issue Year:2019
This paper study manufactured sand is also used for making hollow blocks and in light weight concrete in this investigation are mainly concerned with compressive strength, specific gravity, slump value, compaction factor, vee bee time.it will be compare the tests of concrete containing the river sand with the test of concrete containing M-Sand. Therefore the construction engineers and contractors have decided to use manufactured sand in making concrete instead of river sand. The study's results indicate that the materials identified above have potential for partial cement replacement, as confirmed through the evaluation and investigation in the results and ultimately helping the environment.

xiii. Manufactured Sand As Fine Aggregate Replacement In Concrete-Effect On Compressive Strength .
Author: Shilpa Thakur, Yogesh Kr Agrawal, Amit Mittal-Issue Year:2018
In that experimental studied the natural sand of good quality are becoming scarer and costlier due to non accessibility of river during entire year, illegal dredging, rapid growth of construction activities etc. So it is

needed to search an alternative materials to use as natural sand in construction activities. Manufactured sand serves as a viable alternative to natural sand. Therefore, the present study aims to assess its suitability and potential use as fine aggregate in concrete mixes. To accomplish this an experimental programmed was planned for cast specimen cubes at an interval of 16% replacement of fine aggregate with M-Sand in concrete. Results shows natural sand can be effectively replace with m-Sand and maximum strength obtain at 64% replacement of natural sand with M-sand based on compressive strength.

xiv. Experimental Investigation on The Effect of Manufactured Sand In High Performances Concrete.
Author: M. Adams Joe, A. Maria Rajesh
The objective of this study is to investigate the influence of M-Sand as a replacement for river sand in structural concrete, with the goal of producing high-performance concrete. The research proposes to analyze and compare the properties of concrete containing river sand versus M-Sand. It is also proposed to use steel fiber and chemicals admixtures to increases the strength and workability of concrete respectively. The investigation are to be carried out using several test which include workability test, compressive tests, tensile test, flexural test.

xv. Use of Manufactured Sand in Concrete Manufacturing, Mix Design & Quality Expectations from the User Industry.
Author :R. Padmanabhan-Issue Year:2020
Studying the physical characteristics of manufactured sand reveals its influence on workability and strength; concrete made with M-Sand often outperforms that made with natural sand. However, strict quality control during the manufacturing process is essential. Additionally, the use of M-Sand in concrete is more economical. This paper presents use of M-Sand in concrete manufacturing ,mix design and quality expectation from the users industry.

xvi. Manufactured Sand Concrete-A Review.
Author: Batham Geeta, Akhtar Saleem, Rajesh Bhargava-Issue Year:2022
This paper presents a review on performances of cement concrete containing manufacturing sand as an understand the effect of manufactured sand on the fresh, hardened and durability properties of concrete. Several papers have been studied to take an overview of recent admixtures and this paper is aimed to review the application of concrete containing manufactured sand and its performance to set a benchmark for future research work in this field.

xvii. Study on the Effect of M-Sand from Various Sources on the Workability of the Concrete.
Author: Abitha Begam S. U, Abdul Rahim M.I-Issue Year:2018
An experimental investigation into the effect of manufactured sand (M-sand) collected from various sources on the workability of concrete has been conducted. The workability property has been studied for different water cement ratio varying from 0.3,0.35,0.4,0.45,&0.5%.The workability property has been studied from slump cone test and compaction factor test and results determine that there were greater variations based on the varying water cement ratio. To achieved greater workability for lower water cement ratios, the admixtures have been added to improve the performance. Although manufactured sand required more water and had lower air content, it still achieved improved workability.

xviii. Suitability of M-Sand Dust in Civil Engineering Application.
Author: Jency Christy, Jenifer Dharshini Raj. M-Issue Year:2019
The primary aim of this study is to evaluate the suitability of M-Sand silt for civil engineering applications by performing tests such as grain size distribution, specific gravity, and the Standard Proctor test, permeability test, direct shear and CBR test. based on the results, the suitability of M-Sand dust for plastering, concrete, pavement, filter media ,landfilling and reinforced earth wall backfill are discussed.

xix. A Review on use of manufactured sand in concrete production.
Author: Roushan Kumar, Mithun Kumar Rana-Issue Year:2024

This research carried out to study the effect of use of crushed sand on properties of concrete. Hence in this paper review of various operational viz. workability, water absorption, compressive strength, flexural strength, tensile strength is highlighted.

xx. An Experimental Study on Partial Replacement of Fine Aggregate with M-Sand.
Author: Mr. D. Naresh, Ms. N Usha Lakshmi-Issue year:2023
This project was, therefore conducted to study the influence that manufactured sand having compressive strength, split tensile strength of concrete for 7days, 14days, 28days and to access the prospects of using manufactured sand as a replacement of natural sand. The experiments were conducted on M30concrete grade. slump cone test is conducted to determine workability on fresh concrete.it can therefore be concluded from the finding of the study that when the availability of natural sand is scare are in cities where the price of natural sand is as expensive as manufactured one, manufactured sand concrete mix is a viable and better alternative the use of natural sand.

IV. CONCLUSION

1] The characteristics of M-Sand as a partial replacement with fine aggregate in mix design. M-Sand by varying proportion 15 to 20% to increase in compressive strength for concrete cube which are being tested for 7days,14days and 28days strength.

2] Experimental investigation on properties of concrete produced with manufactured sand. This concluded that effect on workability property of concrete, when percentage increase. Higher compressive, flexural, spilt tensile strength for concrete are found at 20% replacement of manufactured sand to E waste sand.

3] The study of replacement of fine aggregate by manufactured sand. Replacement of 15% natural river sand by manufactured sand yielded good compressive strength for M20grade concrete. Hardness and strength better than natural sand.

4]The manufactured sand is a best alternative for natural sand in terms of strength and durability. The 60% replacement of natural sand by manufactured sand yielded good compressive strength. spilt tensile strength for M20 and M30grade concrete compared to other proportions of mixes.

5] Impact of manufactured sand as a partially and fully replacement of fine aggregate in concrete. By 100% and 55% incorporation of m sand by river sand concrete can achieve higher flexural strength and compressive strength of concrete at 7days, 28days and 90days.

6] Based on the experimental investigation carried out, it can be concluded that replacing river sand with m sand provides most effective result in reduction of dependency on river sand. Workability of m sand concrete was low compared with river sand apart from that the mechanical properties these concretes gave higher strength in compression, tension and flexural also.

7] Manufactured sand properties are comparable to that of the natural river sand and values are within the ranges specified by the Indian Standard. To satisfy the workability properties water cement ratio is increased slightly along with cement content.

8] Replacement of river sand by manufactured sand on concrete.it shows that manufactured sand has larger amount of fine materials than the natural sand.

9] In this paper concluded that workability reduces significantly with increase in % of manufactured sand content workability decrease. The compressive strength of concrete with manufactured sand has been increases up to 50% and after 50% of the replacement the strength are gradually reduced .

10] Due to the superior gradation of M Sand gave good plasticity to concrete providing excellent workability.100% replacement of M-Sand with respect to river sand is decrease with 7days and 28days strength.

11] The partial replacement of fine aggregate with M-Sand in the M30 grade mix proportion concrete causes the increase in compressive strength and tensile strength.

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