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EXPERIMENTAL EVALUATION OF M35 GRADE CONVENTIONAL CONCRETE BY SUPPLEMENTING NATURAL FIBERS, FOUNDRY SAND AND SEA SAND AS PARTIAL REPLACEMENTS

Mohammed Shafan Ahmed, M.tech Student, Kallam Haranadhareddy Institute of Technology, India.
Dr. B. Sarath Chandra Kumar, Professor, Kallam Haranadhareddy Institute of Technology, India.
Dr. M. Satish Kumar, Professor & HOD, Kallam Haranadhareddy Institute of Technology, India.

Abstract-Present urbanization required a huge variety of concretes and minimized effects of newly developed composite materials. This development leads to adverse effects on the surrounding environment. As a part of environmental concern, we have to minimize the negative effects. The use of fine aggregate in the construction industry is more. Therefore, the use of river sand can be replaced with other materials to protect the environment of the river as well as prevent erosion and flood, in My present research paper is similar to this, based on the recycling technique I used to do materials replacements of natural fibers and waste foundry sand & sea sand are the major partial replacements of fine aggregate and grade of concrete are M-35.After the preparation of M-35 Grade concrete, it should be validated with conventional concrete. The major tests are conducted on M-35 grade hardened concrete, which are Concrete cube tests, Cylinder Test & flexural tests. After the test results are verified with referenced documents and satisfactory results are obtained, the complete discussions and results are listed separately in further chapters.

Keywords: Recycled Materials, Natural fibers, M-35grade, Foundry waste, Foundry sand.

1. INTRODUCTION

By volume, aggregate accounts for about 80% of the total weight of concrete. In the manufacturing of concrete, both fine and coarse aggregates are used. With startling rapidity, the use of sand as a fine aggregate in the building sector has risen to unprecedented heights. Natural river sand is in short supply in the sector, which is making it difficult to meet the growing demand for the material. In order to address this dilemma, the building industry has developed alternatives such as synthetic sand, robo sand, rock dust, and other materials such as gravel. Another option to this is the utilisation of waste material in the construction of concrete structures. Sedimentary sand and waste foundry sand are two types of waste materials produced by the ferrous and non-ferrous metal casting industries, respectively. It is possible that the use of such a material in concrete will help to reduce the environmental problems associated with waste foundry sand and other resources, as well as make concrete manufacturing more cost-effective. Sand is essential in the building sector on a large scale. It is a significant ingredient in the manufacture of mortar and concrete, and it plays an important role in the design of concrete mixes. River sand is in low supply these days as a result of erosion and other environmental concerns. The building sector would be adversely affected by the lack of river sand, and as a result, it is necessary to develop innovative alternative materials to replace river sand. Many researchers are working to develop alternative materials to sand, with sea sand being one of the most commonly used substitutes for sand. The M35 grade of concrete was used in the current investigation. Natural sand was largely replaced by sea sand in quantities ranging from 0 to 40%.

A natural fibre is one that is neither synthetic nor manufactured, and this is the simplest meaning of the term. They may be derived from either plants or animals as sources. The utilisation of natural fibres

derived from both renewable and non-renewable resources, such as oil palm, sisal, flax, and jute, to manufacture composite materials has received a great deal of interest in recent decades, particularly in the field of composite materials. Base fibres (jute, flax, ramie, hemp, and kenaf), seed fibres (cotton), leaf fibres (sisal, pineapple, banana, and abaca), grass and reed fibres (rice, corn, and wheat), and core fibres (hemp, kenaf, and coir), as well as all other kinds of cellulose fibres, are produced by plants that produce cellulose fibres (wood and roots).

2. LITERATURE REVIEW

Naik et al. (1987) He performed research on using waste foundry sands in concrete, that is, concrete that makes use of discarded foundry sands in lieu of a fine mixture. The proportions of a manipulated concrete blend have been adjusted to attain a compressive energy of 38 MPa after 28 days. Other concrete mixes have been balanced such that clean/new foundry sand and used foundry sand have been substituted for 25 percent and 35 percent, respectively, of the same old concrete sand weight. The compressive strength, tensile power, and modulus of elasticity of the concrete have been measured and analysed to determine its overall performance. At 28 days, used foundry sand-containing concrete had values that were 20-30% lower than non-used foundry sand-containing concrete.Clean/new foundry sand became utilised in 25 percent and 35 percent of the concrete mixes, respectively, and the compressive electricity became almost equal to that of the control blend.

Reddietal.(1995):The compressive energy of stabilized foundry sands diminishes because the replacement percentage of foundry sand inside the mixes grows, and the strength is attained significantly faster with fly ash than with cement, consistent with his findings. Cement and fly ash mixes were created by substituting foundry sand for silica sand at numerous probabilities (zero percent, 25 percent, 50 percent, seventy-five percent, and a hundred percent) of the original amount of silica sand. As a result of the failure of the first studies using class F fly ash, which lacked the cementitious qualities important to making a solid mix, the next trials were restricted to magnificence C fly ash by myself. It was determined that the water-to-cementitious-binder ratio needed to be one in the case of Portland cement and one-third in the case of fly ash in this observe. The samples were constructed using PVC pipes measuring 2.85 cm in diameter and 5.72 cm in length. The sand and binder combos have been poured into those pipes, which were then vibrated on a vibrating desk to eliminate any air pockets that may have formed. Compressive strengths were measured after 3, 7, 14, 28, and 56 days for each of the replacement tiers to be able to assess the impact of curing time at the very last compressive strength. The clay-bonded foundry sand had an extra effect on the strength of the stabilised combinations than the resin-bonded foundry sands did on them. A similar finding has been made in the area of fly ash stabilisation. In each of the examples of fly ash and cement, the large drop of strength that happens with the growth of clay in a certain foundry sand substitute is readily apparent. The electricity of cement-stabilized mixtures develops at a far slower rate than that of fly ash-stabilized mixes. Although it took just seven days to complete therapy, the cement-stabilized RBS only executed 30% of its peak energy, but its fly ash counterpart obtained 80% of its peak power.

3. PROPERTIESOFMATERIALS

Properties of Foundry Sand:

Various environmental issues are caused by the trash created by the industrial sector. As a result, the importance of reusing this waste material may be underlined. Foundry sand is a high-quality silica sand that is produced as a by-product of the manufacture of both ferrous and nonferrous metal casting

industries, and it is used in a variety of applications. Because of its excellent heat conductivity, foundry sand has been used as a moulding and casting medium for hundreds of years now. For foundry sand to have certain physical and chemical qualities, the kind of casting process used and the industrial sector from which it comes are important considerations to bear in mind. Sands from the moulding process are recycled and reused numerous times throughout the casting process. It is inevitable that recycled sand will deteriorate to the point that it can no longer be utilised in the casting process at some time in the future. Upon reaching this phase, the old sand is removed from the cycle as a by-product, and fresh sand is injected, resulting in the cycle starting again from the beginning.

There are two primary kinds of binder systems used in metal casting, and the foundry sands are divided into two categories based on the type of binder system employed: clay-bound systems (green sand) and chemically-bonded systems. They are both suited for beneficial use, yet they have distinct physical and environmental properties that distinguish them from one another. During the past several decades, a great deal of investigation has been undertaken into the mechanical, chemical, and durability characteristics of foundry sand. However, the investigation of the strength and durability features of foundry sand concrete receives little attention in the literature.

PHYSICAL PROPERTIES OFFOUNDRYSAND

Characteristics	**Values**
BulkRelativeDensity	2592kg/m3
Absorption	0.43 %
MoistureContent	0.1 – 9.8
ClayLumpsandFriableParticles	1 – 42
Coefficientofpermeability	10-3–10-6cm/s
PlasticLimit	Non-Plastic
Specificgravity	2.49

TABLE:1PHYSICALPROPERTIESOFFOUNDRYSAND

CHEMICALPROPERTIESOFFOUNDRYSAND

Constituents	Value	Constituents	Value
Sio2	67.21	Na_2O	0.48
Al2O3	4.28	K_2O	0.46
Fe2O3	7.32	P_2O_5	0.00
CaO	0.15	Mn_2O_3	0.12
MgO	0.23	SrO	0.19
S03	0.89	Tio2	0.48
		Lossofignition	16.25

TABLE:2CHEMICALPROPERTIESOFFOUNDRYSAND

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4. TESTS ON MATERIALS

Current paper deals with the used materials and conducted laboratory tests on cement, Fine aggregate, coarse aggregate, Replacement Materials

CEMENT:

Generally speaking, cement is a binder, which means it is a substance that sets and hardens on its own and may be used to bind other materials together as a binding agent. Cement is generally composed of components in the form of limestone, chalk, and marl, as well as argillaceous minerals, as well as other additives. It is necessary to use standard Portland cement grade 53.

FINENESS OFCEMENT:

This test gives the percentage amount of course material present in the cement.
If content of coarse material greaterthan10%, the cement should not be used.

- **Procedure and observation:**
  - Takenthe100grams(W1) of ordinary Portal and cement in a basin and spread it on the 90µm sieve.
  - Shakenitaround10-15minutes.
  - The weight residue on the sieve (W2) was measured
  - Percentage ratio of W2 to W1gives the residue of the cement.
  - Result

CONSISTENCY OF CEMENT:

This test is performed to know the amount of water required to form a cement paste of standard consistency. Standard consistency is about 30% for OPC.

- **Procedure and observation:**
- 400grams of cement was taken and 25% of water was added to it.
- The cement paste was placed in the mould and placed it under the needle of vicat apparatus.
- Then the plunger released slowly, so needle is penetrated in to the paste.
- Reading on the vicat apparatus was noted.
- Another mix was prepared by increasing the percentage of water and the above procedure was repeated for the different mould shaving different water percentages.
- The penetration value was tabulated below for the different percentages of water.
- The water content at which reading will shows the penetration of 5 to 7mm on vacate apparatus is the
- normal consistency of cement.

INITIAL AND FINAL SETTING TIME OFCEMENT:

Initial setting time:

This is the time period between the time water is introduced to the cement and the time when partial loss of plasticity occurs, which is measured by the depth to which a standard test needle penetrates the block (5 mm from the bottom). The first setup time should be no less than 30 minutes.

Final setting time:

The time of interval between the time when water is added to the cement and time of complete loss of plasticity i.e., in standard test needle can't penetrates the block since paste hardened.

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Final setting time should not be more than 600min.

- **Procedure and observation:**

- 400grams of cement was taken,0.85times the normal consistency of water was added to the cement and starts the stop watch.
- Cementpastewasplacedinthemouldanditwasplacedundertheneedleofvicatapparatus.
- Plunger was released slowly, so needle is penetrated in to the paste.
- Reading on the vicat apparatus was noted and the needle lifted up and needle was released after sometime.
- The time at which reading will shows the penetration of 5mm from bottom on vacat apparatus was noted.
- Another mix was prepared and starts the stopwatch. Needle of vicat apparatus was changed for final setting time.
- Same procedure was repeated and measured the time at which needle can't able to enter ateinto the paste.

SPECIFIC GRAVITY OF CEMENT:

Specifically, specific gravity may be defined as the relationship between the weight of a given volume of material at a standard temperature and the weight of an identical amount of distilled water at the same specified temperature.

- **Procedure and observation:**

- Pycnometer is used to measure the specific gravity of the Cement.
- Empty weight of the pycnometer(W1) was measured.
- Measured the weight of the pycnometer after1/4th of its volume is filled with Cement(W2).
- Measured the weight of pycnometer which contain 1/4th volume of cement and kerosene up to mark (W3).
- Pycnometer was filled with water up to the mark and measured its weight (W4).

5. TEST REPORTS

After casting of cube specimens, I conducted tests on hardened concrete and correlated with Indian standard limits and interpreted

TEST: 1

COMPRESSIVESTRENGTHONCONCRETECUBES:

The uniaxial compressive strength of a material is defined as the value of uniaxial compressive stress attained by the material when it totally fails. As part of this research, cube specimens with dimensions of 150 millimetres by 150 millimetres by 150 millimetres are examined in line with IS: 516 – 1969 [Method of test for concrete strength]. The compression testing was carried out using compression testing equipment with a capacity of 300 KN. The machine is equipped with a control valve that allows the operator to regulate the pace of loading. The quipment has been calibrated in accordance with the established norms. The plates have been cleaned, the oil level has been checked, and the machine has been prepared in every way for testing.

After 28 days of curing, the cube specimens were taken from the curing tank and thoroughly cleaned to eliminate any remaining surface water. The specimens were placed on the swivelling

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head of the machine in such a way that the weight was applied at the centre of the specimens. The bearing surfaces are put on the specimen's flat surfaces, which act as bearing surfaces. By spinning the handle, the top plate was brought into contact with the specimen on the bottom plate. The oil pressure valve was closed, and the machine was turned on for the first time. It was possible to maintain a constant loading rate of 140 kg/cm2/min. It was determined what the maximum load to failure was at which the specimen broke and the pointer began to move back. The test was repeated for each of the three specimens, and the mean of the three values was selected to represent the average strength. The compressive strength test on concrete containing various sizes of coarse aggregate has been carried out in the current inquiry. The M35 grade was examined on the 7th and 28th days

TEST REPORT FOR SEVEN DAYS SPECIMENS

- Compressive strength of normal concrete mix[M-35grade] for7days
- **Compressive strength Graph of normal concrete mix [M-35grade] for7days**

S.NO	CUBEID	%OFREPLACEMNT (%)	7 DAYS N/mm^2
1	N-MIX	0%	26.01
2	N-MIX	0%	25.97
3	N-MIX	0%	25.98
4	N-MIX	0%	25.90
5	N-MIX	0%	26.00

TABLE 20: COMPRESSIVE STRENGTH 28 DAYS NORMAL MIX

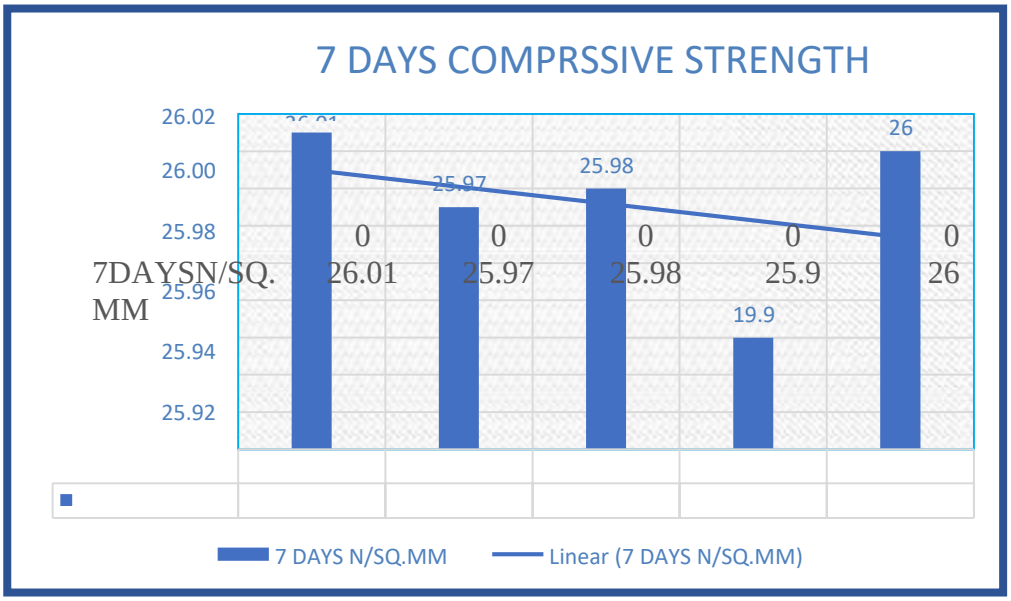

FIG 5: COMPRESSIVE STRENGTH GRAPH OF NORMAL MIX

PROPERTIESOFSEASAND:

In this work, sea sand is used to partially replace fine aggregate as a fine aggregate replacement. It was obtained from Bapatla beach, which is located inside Zone IV. The following are the specific gravity, fineness modulus, and sieve analysis results for sea sand:

S.no	Property	Testresults
1	**SpecificGravity**	**2.16**
2	**Finenessmodulus**	**0.90**
3	**Zone**	**4**
4	**pHvalue**	**8.2**

TABLE:3PHYSICALPROPERTIESOFSEASAND

CHEMICAL PROPERTIESOFSEASAND

Chlorides are a kind of soluble mineral component that is dissolved by water as it passes through the earth's surface. Chlorides are often found in sea sand, and they are toxic. As recommended by the World Health Organization, the maximum permissible chloride content in drinking water ranges between 250 and 1000 mg/l. Sea water may be tested for chloride concentration by titrating it with a standard silver nitrate solution, which is made using potassium dichromate.

Watersamples	**River sand inMg/Lit**	**Sea Sand without wasin mg/lit**	**Seasandwithwasinmg/lit**
Amountofchloridecontent	238	419	269

TABLE:4CHEMICALPROPERTIESOFSEASAND

PHVALUE: The pH of water is a measure of how acidic or basic it is. The numbers range from 0 to 14, with 7 representing neutrality. Having a pH of less than 7 denotes acidity, whereas having a pH of greater than 7 suggests baseness. The pH of water is really a measure of the relative number of free hydrogen and hydroxyl ions present in the solution. A pH metre is an electronic device that consists of a particular bulb that is sensitive to zero. The light from the bulb is amplified and fed to an electronic metre that is attached to the bulb and measures and displays the pH value. In comparison to the pH sheets, it provides more exact readings.

HARDNESS: Hardness is a feature of water that hinders the creation of lather or foam when the water is combined with soap and other ingredients. It is most often induced by the presence of divalent metallic ions such as calcium and magnesium. Hardness is commonly described as the calcium carbonate equivalent of the presence of calcium and magnesium ions in water, and it is represented in milligrammes per litre of water. Hardness may be classified into two categories.

CONCLUSIONS

To obtain the mechanical properties we run two tests on concrete cubes. A total of 106 Concrete cubes were casted and obtained reports for 7 &28 days conducted tests are compressive strength and UPV tests.

- For normal concrete mix seven days ‟strength achieve dissimulative of 61% which is accurate based on Indian standards
- For twenty-eight days ‟concrete mix strength achieves dissimulative of 99%which is also accurate based on Indian standards

- Finally conducted UPV test on Concrete Test cubes8 cubes are Obtained result of,, GOOD "Quality of concrete
- further replacements up to 15%-25% was not defined by past reviewers and researchers,
- My present research work is limited up to 12 % of replacements of Foundry sand /Sea sand/Natural fibers.

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