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EXPERIMENTAL STUDY OF PARTIAL REPLACEMENT OF FINE AGGREGATES WITH COAL BOTTOM ASH IN CONCRETE

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ABSTRACT
Cloud computing is associate degree Internet-based computing pattern through that shared resources area unit provided to devices on- demand. Its associate degree rising however promising paradigm to group action mobile devices into cloud computing, and therefore the integration performs within the cloud primarily based gradable multi-user data-shared surroundings. With group action into cloud computing, security problems like knowledge confidentiality and user authority could arise within the mobile cloud computing system, and it's involved because the main constraints to the developments of mobile cloud computing. so as to give safe and secure operation, a gradable access management methodology exploitation changed gradable attribute-based coding and a changed three-layer structure is projected during this paper. during a specific mobile cloud computing model, monumental knowledge which can be from every kind of mobile devices, like good phones, functioned phones and PDAs so on will be controlled and monitored by the system, and therefore the knowledge will be sensitive to unauthorized third party and constraint to legal users additionally. The novel theme primarily focuses on the knowledge process, storing and accessing, that is meant to guarantee the users with legal authorities to induce corresponding classified knowledge and to limit criminal users and unauthorized legal users get access to the info, that makes it extraordinarily appropriate for the mobile cloud computing paradigms.

1. INTRODUCTION

Concrete is a composite material containing hydraulic cement, water, coarse aggregate and fine aggregate. The resulting material is a stone like structure which is formed by the chemical reaction of the cement and water. This stone like material is a brittle material which is strong in compression but very weak in tension. This weakness in the concrete makes it to crack under small loads, at the tensile end. These cracks gradually propagate to the compression end of the member and finally, the member breaks. The formation of cracks in the concrete may also occur due to the drying shrinkage. These cracks are basically micro cracks. These cracks increase in size and magnitude as the time elapses and the finally makes the concrete to fail. Concrete is the most vital material for the construction of high rise buildings and various infrastructures. Infrastructure development in such areas particularly in developing countries like India is more. Concrete is a mixture of cement, fine aggregate, coarse aggregate and water and river sand is the main raw material used as fine aggregate in the production of concrete. The natural sources of river sand are getting depleted gradually. The demand for the protection of the natural environment and the ban on mining in some areas is further aggravating the problem of availability of river sand. At present, the construction industry is plagued with the scarcity of this essential constituent material of concrete. Therefore, in the present circumstances of scant sources of river sand and boom in infrastructure development, it becomes essential and more significant to find out its substitute material in concrete. Coal bottom ash is a coarse granular and incombustible byproduct from coal burning furnaces. It is composed of mainly silica, alumina and iron with small amounts of calcium, magnesium sulfate, etc. The appearance and particle size distribution of coal bottom ash is similar to that of river sand. These properties of coal bottom ash make it attractive to be used as fine aggregate in the production of concrete.

2. CONSTITUENT MATERIALS USED

The constituent materials used are cement, fine aggregate, coarse aggregate, stone dust and water. The recommended materials have been described below.

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Cement
Various types of cement can be used in concrete with stone dust. The cement should be fresh, free from foreign matters and of uniform consistency. Usually ordinary Portland cement is used in normal conditions.

Fine Aggregate
The most common fine aggregate used in concrete is sand. The sand should be clean, hard, strong and free from organic impurities and deleterious substances. It should be capable of producing a sufficiently workable mix with a minimum water-cement ratio.

Coarse Aggregate
The aggregates are formed due to natural disintegration of rocks or by artificial crushing of the rock or gravels. The properties of coarse aggregate are chemical and mineral composition, spectrographic description, specific gravity, hardness, strength, physical and chemical stability, pore structure and color. Some other properties of the aggregate not possessed by the parent rocks are particle size and shape, surface texture and absorption etc. All these properties may have a considerable effect on the quality of concrete in fresh and hardened states.

Coal Bottom Ash
Bottom ash obtained from thermal power plant at Panipat, Haryana in India was used in the investigation. The specific gravity of bottom ash was 1.92.

Water
Mixing water should be fresh, clean and potable. Water should be free from impurities like clay, loam, soluble salts which lead to deterioration in the properties of concrete. Potable water is fit for mixing or curing of concrete.

3. MIX DESIGN

Mix design is made according to the IS specifications [BIS 10262-1982 and BIS 456-2000]. The sand used is of zone II obtained from Panchkula, Haryana. Moulds are made on the basis of mix design and various tests are done on these moulds in order to check the strength parameters. The mix design is as follows:

Mix design by Indian standard method:

28 day Compressive strength = 30 N/mm2
Degree of quality control = Good
Maximum size of coarse aggregate = 20 mm
Degree of workability (Compaction Factor) = 0.9
Value of statistical coefficient (K) =2 (Refer IS 456-2000 clause 9.2.2)
Value of standard deviation (S) =4.00 (refer IS 456-2000 Table 8)
Type of Exposure = Mild
Test data of materials:

- Cement used = OPC 43 grade
- Specific gravity of cement =3.12
- Specific gravity of fine aggregate =2.64
- Specific gravity of coarse aggregate =2.72

Target strength for mix design:

$Ft=fck + K \times S$

$Fck = N/mm^2$

$K = 2$

$S = 4.00$

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Ft = 30 + (2×4.0) =38 N/mm²

Table 1 Mix Designation

Mix designation	Sand confirming to zone	Water	Cement	Fine aggregate	Coarse aggregate
M	II	180 lt/m³	450 kg/m³	663.651 kg/m³	1173.130 kg/m³
			1	1.5	2.6

4. NOMENCLATURE OF TEST SPECIMENS

Table 2 Mix Proportion And Nomenclature

S. No	Mix designation	%age of coal bottom ash	Water kg/m³	Cement kg/m³	Fine aggregate kg/m³	Coarse aggregate kg/m³	Coal bottom ash kg/m³
1.	M-0	0.0	180	450	663.651	1173.130	0.0
2.	M -1	10	180	450	597.2859	1173.130	66.3651
3.	M –2	20	180	450	530.9208	1173.130	132.7302
4.	M-3	30	180	450	464.5557	1173.130	199.0953
5.	M-4	40	180	450	398.1906	1173.130	265.4604

5. TESTING OF SPECIMENS

The cubes were tested in compression testing machine after 7 and 28 days with uniformly increasing loads capacity compression testing machine. The loading was transmitted from loading machine to the specimen by rigid steel plates placed on both above and below the specimen. The load was applied until needle started deflecting backward after crushing of the specimen and the last reading was noted.

The beams were tested in a frame having varying capacity with two point load test. The specimens were divided in three parts equally and two point loads were kept at the end of middle third part of specimen and the load was applied through cylindrical iron piece kept below the dial gauge.

The cylinders were tested in compression testing machine with uniformly increasing capacity compression testing machine. The test consists of applying a compressive line load along the opposite generators of a concrete cylinder placed with its axis horizontal between the compressive platens

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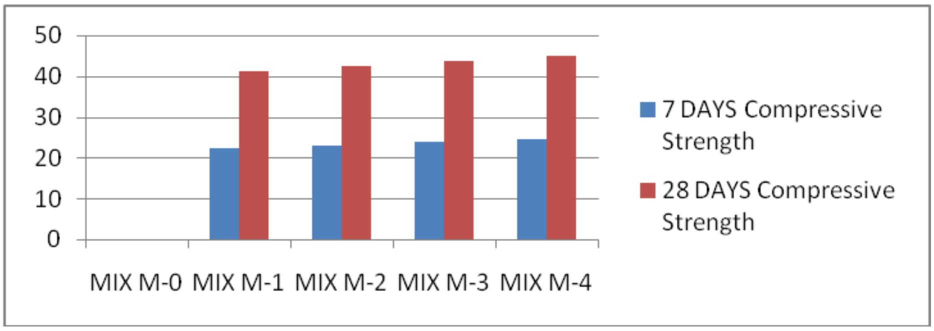
6. RESULT ANAYLSIS

7 and 28 Days Compressive Strength of Concrete

MIX DESIGNATION	7 DAYS Compressive Strength (N/mm^2)	28 DAYS Compressive Strength (N/mm^2)
MIX M-0	22.16	37.85
MIX M-1	22.45	41.244
MIX M-2	23.04	42.47
MIX M-3	23.98	43.76
MIX M-4	24.57	45.08



Compression Testing Machine

7 Days and 28 Days Flexural Strength of Concrete

MIX DESIGNATION	7 Days Flexural strength	28 Days Flexural Strength
MIX M-0	3.67	5.07
MIX M-1	3.73	5.44
MIX M-2	3.87	5.83
MIX M-3	4.04	5.76
MIX M-4	4.17	5.86

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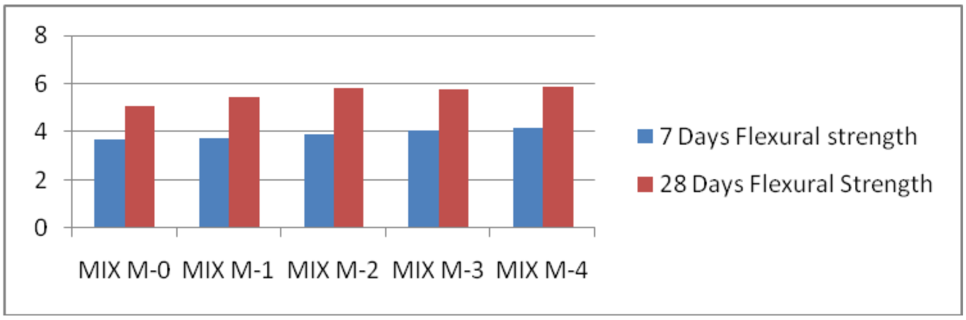
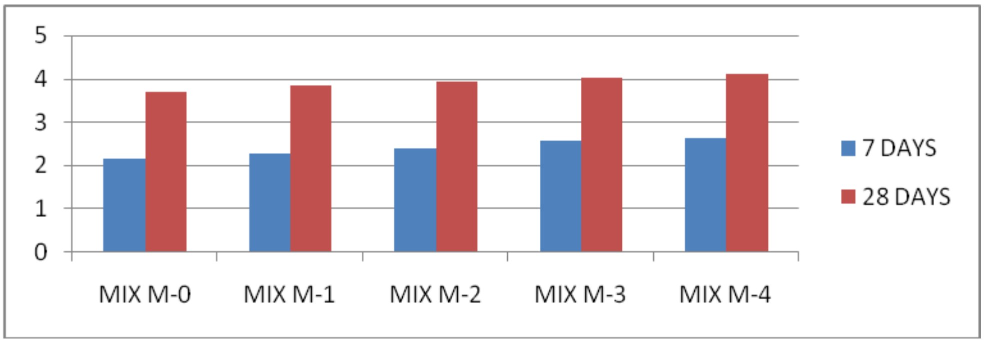


Flexural Strength Testing

7 Days and 28 Days Split Tensile Strength of Concrete

MIX DESIGNATION	7 DAYS	28 DAYS
MIX M-0	2.15	3.7
MIX M-1	2.29	3.84
MIX M-2	2.39	3.94
MIX M-3	2.57	4.03
MIX M-4	2.62	4.12



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Split Tensile Strength Testing

Water absorption after 28 days

MIX DESIGNATION	28 DAYS
MIX M-0	3.37
MIX M-1	2.13
MIX M-2	1.54
MIX M-3	1.74
MIX M-4	2.07

7. CONCLUSIONS

- **Compressive Strength After 7 Days**
  The experimental investigations show that by the partial replacement of sand (10%) the compressive strength increases by 3% also when partially replaced sand (20%) it increased up to 4.3% also when the sand is partially replaced by 30 % it increases the compressive strength by 6%, when sand is replaced by 40% the compressive strength increases by 4% .
- **Compressive Strength After 28 Days**
  The experimental investigations show that by the partial replacement of sand (10%), the compressive strength increases by 5% also when partially replaced sand (20 it increased up to 6% also when the sand is partially replaced by 30 it increases the compressive strength by 7.5%, when sand is replaced by 40% the compressive strength increases by 4.8.
- **Flexural Strength After 7 Days**
  The experimental investigations show that by the partial replacement of sand (10%), the flexural strength increases by 4.5% also when partially replaced sand (20%), it increased up to 7.5% also when the sand is partially replaced by 30 it increases the flexural strength by 5.5%, when sand is replaced by 40% the flexural strength increases by 6.5%.
- **Flexural Strength After 28 Days**
  The experimental investigations show that by the partial replacement of sand (10%) , the flexural strength increases by 8% also when partially replaced sand (20%) it increased up to 10.5% also when the sand is partially replaced by 30 % it increases the flexural strength by 11%, when sand is replaced by 40% the flexural strength increases by 40%.
- **Split Tensile Strength After 7 Days**
  The experimental investigations show that by the partial replacement of sand (10%), the split tensile strength increases by 3% also when partially replaced sand (20%), it increased up to 4.6% also when the sand is partially replaced by 30 % it increases the split tensile strength by 6.5%, when sand is replaced by 40% the split tensile strength increases by 4.6
- **Split Tensile Strength After 28 Days**
  The experimental investigations show that by the partial replacement of sand (10%), the split tensile strength increases by 1.5% also when partially replaced sand (20%), it increased up to

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3.5% also when the sand is partially replaced by 30 % it increases the split tensile strength by 4.5%, when sand is replaced by 40% the split tensile strength increases by 3%

- **Water Absorption**
  All the mixes containing coal bottom ash absorbs less water than the standard mix. Hence it proves the concrete is durable.

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