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AN EXPERIMENTAL STUDY ON CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH FLY ASH AND BENTONITE POWDER

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ABSTRACT :- Moment's environmental problems are more and more important. The artificial area produces lost of waste accoutrements . One of the most useful ways to break these problems is the consumption of these waste accoutrements in concrete. Conventional concrete is the most considerably used construction material world wide, both in moderate and strong aggressive surroundings. The main ideal of the work is to find out the effectiveness of Fly ash and Bentonite inclusively on the concrete strength. In this work cement is incompletely replaced with Fly ash and Bentonite greasepaint. By replacing recycled accoutrements we can minimize the environmental hazards and safe guarding the natural coffers. Major problem associated with cover ash is its disposal a large area of land needed for disposal and toxin associated with heavy essence percolated to ground water. Strength characteristics are studied by varying of Fly ash- Bentonite blend as a relief of cement in M40 grade concrete. Cement is replaced incompletely with Bentonite by 0, 10, 20 and 30 and Fly ash by 0, 5, 10 and 15. Compressive strength and Split tensile strength were conducted as per Indian Standard law of procedure. samples were casted and tests were conducted after 7 and 28 days of curing in water. Test results for each variation are tabled and bandied in details and some important conclusions are made.

Key words: Cement, Bentonite, Fly ash, Compressive Strength, Split tensile.

I INTRODUCTION

The entire growth of a country depends on the production value of power and consequently its consumption as energy. Our country, needs huge power resources to meet the prospect of its occupant as well as its aim to be a develop nation. Fossil fuel plays an essential part in meeting the demand for power generation .Coal is considered to be one of the world's richest and broadly distributed fossil fuel. India has the third largest production of coal and fourth largest coal reserves approx. (197 Billion Tons). Approx 75% of India's installed power is thermal, coal shares about 90% of it. Almost about 600 Million tons of coal is produced worldwide every year, with Fly ash production is about 500 MT at (60-78 %) of whole ash produced. In India, the generation of Fly Ash is nearly about 180 Million tons/year. Indian coal has high ash content and low heat value. In order to meet up the rising demands, many coal based thermal power plants have been constructed. As a result of which enormous amount of combusted residue in the form of Fly ash 80 %, and Bottom ash 20% has been formed. The finely dispersed particle from the burnt coal is discharge out through the flue gases which are separated mechanically through electrostatic precipitators and separators which are then composed together in the field of hoppers.

The rate of manufacturing of FA is high and it goes on increasing year after year. The annual production of FA in China, India and US is approximated about 275 MMT (million metric tons). But less than half of this is consumed in different areas. The greatest challenge before handing out and manufacturing industries is the removal of the residual waste products. The harmful impact on the surroundings suggests the necessity for appropriate discarding of fly ash and justifies full utilization of FA when feasible. Waste products that are generally toxic, reactive have harmful environmental consequences. This important issue requires an efficient, economic and eco- friendly method to tackle with the dumping of industrial waste products. The problem with safe disposal of ash is it requires large storage area and it disturbs the environment and ecological balance.

Objective of the work:

- To Main Objective of this project work is to find Compressive Strength and Split Tensile strength of Concrete by partially replacing cement with Fly ash and Bentonite powder.

- To find the Optimum % of Bentonite-Fly ash mixture that can replace cement.

Need for the work:

A properly cured Fly ash and Bentonite concrete has a good compressive strength. Earlier researches attempted to study the effect of strength properties of concrete by replacing fly ash and bentonite at various proportions. In this work attempt is made to study the effect of strength of concrete formed by replacing cement collectively with 5%, 10% and 15% fly ash and 10%, 20% and 30% bentonite so as to reduce cost production of concrete and also to increase its strength.

II METHODOLOGY

The experimental program is to determine the feasibility of using fly ash-bentonite concrete and its effects on mechanical properties of concrete in comparison with conventional concrete. This program was carried out in many steps. After proper determination of various properties of materials involved, a mix design for M40 grade was prepared.

1. Fly ash replaces cement by 0%, 5%, 10% and 15% proportions and casting is done

2. Bentonite powder replaces cement by 0%, 10%, 20%, and 30% proportions and casting is done.

3. Fly ash + bentonite powder replaces cement by F5B10, F5B20, F5B30, F10B10, F10B20, F10B30, F15B10, F15B20, F15B30 and casting of specimen is done.

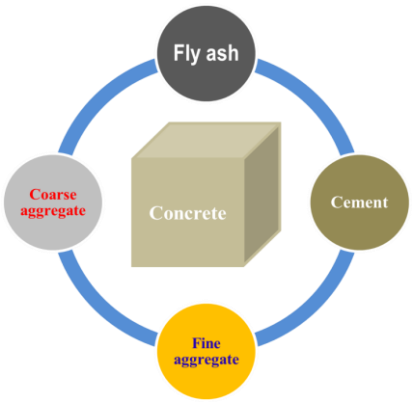


Fig 1 Ingredients used in formation of concrete

In the First phase Fly ash is replaced with cement by 5%, 10% and 15% proportions and casting is done. A total no of 18 cubes were casted and compressive test is done after 7days and 28 days of curing in water.

In the Second phase Bentonite powder is replaced with cement by 0%, 10%, 20%, and 30% proportions and casting is done. A total no of 18 cubes were casted and compressive test is done after 7days and 28days of curing in water.

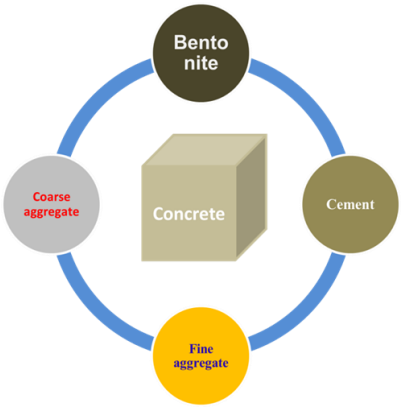


Fig 2 Ingredients used in formation of concrete

In the Final phase both the materials (Fly ash + Bentonite powder) is replaced with cement by F5B10, F5B20, F5B30, F10B10, F10B20, F10B30, F15B10, F15B20, F15B30 and casting of specimen is done. A total no of 54 cubes were casted and compressive test and Split Tensile strength is done after 7days and 28days of curing in water.

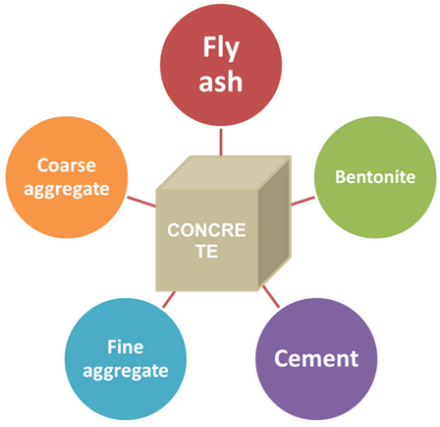


Fig 3 Ingredients used in formation of concrete

Materials:-

Cement:

Ordinary Portland cement Ultra-tech 53 grade conforming to IS: 12269 were used. Physical properties of cement are evaluated from laboratory. Consistency testing has been done as per IS code 8112-1976 and the consistency was found to be 30% with 6mm reading in the Vicat apparatus. Specific gravity of cement is found to be 3.15 and this test has been done as per the test procedure mentioned in the IS code 269-1989. Fineness of cement by sieve analysis is found to be 6.

FINE AGGREGATE:

Locally available natural sand is used. Tests have been conducted in laboratory regarding the properties of sand. Specific gravity of fine aggregate is 2.69 Fineness modulus was found based on sieve analysis results for fine aggregate. Weight of the sample taken was 1000 grams.

COARSE AGGREGATE:

Crushed stone aggregate of size 20mm has been used. Laboratory tests are conducted for the properties of concrete. The physical properties of the coarse aggregate like specific gravity, bulk density, gradation and fineness modulus were found in accordance with IS238.

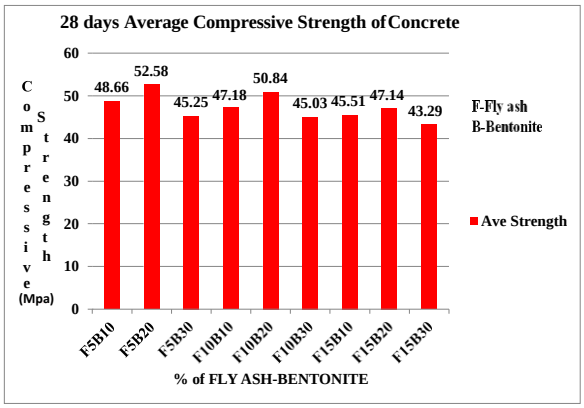
Fly ash: In the present experimental work, dry fly ash obtained from National Thermal Power Corporation Ramagundam, Telangana, was used as the base material. Based on the chemical composition the fly ash was found to be of type ASTM-Class F (low Calcium) fly ash as the percentage of CaO was less than 10% Specific Gravity of FLY ASH is 2.3 and Colour: Grey (Blakish).

BENTONITE POWDER: Bentonite powder was brought from local dealer in Hyderabad. It is dark brown in colour having specific gravity 2.81.

IV Results and Discussions

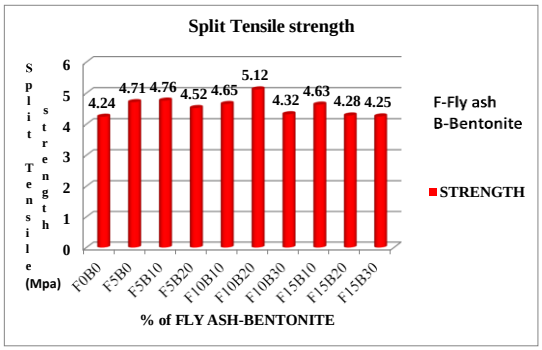
Compressive strength of Conventional concrete at 28 days.

In this project the cement is replaced partially with Fly ash and Bentonite Powder and concrete is formed. Compression strength test is done on it according to the results discussions is done. In phase-1 a 5%, 10% and 15% of cement is replaced with Fly ash and concrete is made and test is performed. 5% cement replacement with fly ash gives higher compressive strength than 10% and 15%. As the % of fly ash mixture increases in concrete there is a gradual decrease in strength. From 5% to15% there was decrease in strength up to 8%. In phase-2 a 10%, 20% and 30% of cement is replaced with Bentonite powder and concrete is made. It is observed that as the % of bentonite mixture increases in concrete the compressive strength also increases. Maximum compressive strength achieved was 49.29mpa at 20% bentonite mix with cement. However a 30% bentonite mix gave higher compressive strength when compared to 10% bentonite mix. In phase-3 collectively cement is replaced with both fly ash and bentonite concrete is made. 30% replacement of cement with Fly ash and Bentonite give good tensile strength. It is observed that a 25-30% fly ash-bentonite mixture gave good results.



The above graph Shows Average compressive strength of concrete after 28 days of water curing. Maximum strength obtained was 52.58 Mpa at 25% replacement of cement with 20% Bentonite and 5% Fly ash. Results show good compression strength when compared to conventional concrete i.e. 43.87 Mpa.

Split Tensile Strength Test Results:



The above Shows Split Tensile strength of concrete after 28 days of curing in water. Maximum tensile strength was achieved at 30% of Fly ash-Bentonite mixture i.e. 5.12Mpa. Results also show that tensile strength of all the specimens is higher when compared to conventional concrete.

V CONCLUSIONS

1. The following conclusions are made based on the test results of this study. After conducting compressive test on all the specimens, it has been observed that replacement of cement partially with fly ash and Bentonite proved to be good in compression.

2. The results shows that as the when fly ash content is increased from 0% to 10% in concrete, it achieves higher compressive strength when compared to 15% fly ash replacement of cement in concrete.

3. The 10% replacement of cement with Bentonite shows lower strength than 20% and 30% replacement of Bentonite, it concludes that as the proportion of Bentonite increases compressive strength also increases.

4. When cement is replaced with 25%, 30% and 35% of Fly ash-Bentonite mix concrete attained its optimum strength of 52.58Mpa, 50.84Mpa and 47.14Mpa.

5. 30% Replacement of cement with Fly ash-Bentonite mixture gives good Tensile strength.

6. From the results obtained it can be concluded that 25-30% of Fly ash-Bentonite mixture is an optimum mix that can be easily used as Partial replacement of cement.

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