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# Experimental Study on the Effect of Partial Replacement with Flyash in Recycle Air Entrained Concrete

R. Suriyakala[a] , A.Jayabal[b]

[a]PG student (structural engineering),department of civil engineering, paavai engineering college , pachal.

[b] assistant professor, department of civil engineering,paavai engineering college, pachal.

## Abstract:

Concrete is one of the most important materials employed in public works and building construction projects. It means that we are utilizing a tremendous amount of concrete and we will continue to use it. On the other hand, sustainable development has become more and more important. The human race is steadily transitioning its socio economic system in an effort to solve its resource, energy and environmental problems. It is obvious that the concrete industry also have to introduce environmental axis in to technologies.

In this project, recycled coarse aggregate was used as coarse aggregate and the fine aggregate composed of 85% of recycled fine aggregate and 15% of natural fine aggregate. Cement was replaced with flyash at 0%,10%,20%,30% & 40%. Concrete was prepared with the above ingredients and also with the air entraining agent. A comparative study was carried out on the properties of plain concrete and air entrained concrete and optimum percentage replacement of cement with flyash was also carried out. Nominal mix mentioned in the IS 456-2000 for M20 grade concrete was used for casting the specimens. Tests were carried out to find the compressive strength, strength and modulus of elasticity. Results of recycled aggregate concrete were compared with the air entrained recycled aggregate concrete. The optimum percentage replacement of cement with flyash is also reported.

***Keywords***: Flyash, Air ntraining Agent.

## 1. Introduction:

Cement concrete has been a popular construction material in the world and has satisfied almost all the requirement of a good building material. Concrete is defined as composite mixture of cement, sand and gravel in definite proportions with water. The workability for placement and strength development with age depend upon the proportion of the constituent materials and their combined action.Concrete is normally produced using alluvial river gravels and sands. These materials are abundantly available and are relativity in expensive to process and hence they are widely used. More ever they produce good concrete due to their physical properties such as shape gradation. The natural process of formation of these deposits occurred many millions of years. These deposits are over exploited. Hence there is a scarcity of aggregates.

  

## 2.1 Cement:

The ordinary Portland pozzolona cement was used for casing the specimens.
Following tests were performed for finding the properties of cement

## 2.2 Water:

Water is the important ingredient of concrete , since it helps in strength development process.Potable drinking water having pH value of 7 was used for making and curing of concrete specimens

## 2.3 Aggregates:

Concrete waste was collected and it was crushed in the jaw crusher and the fragments passing through 4.7mm SI sieve was ash fine aggregate and the fraction retained on the sieve was used as coarse aggregate

## 2.4 Flyash:

Fly ash is finely divided residue from the combustion of ground or powdered coal. They are generally finer cement and consist mainly of glass-spherical particles as well as Residues of hematite and hematite and magnetite, char and some crystalline phases formed During cooling.

## 2.5 Air Entertaining Agents:

Air entraining is the process where by many tiny air bubbles are incorporated into Concrete and become part of the matrix that binds the aggregate together in the hardened Concrete. These air bubbles are dispersed throughout the hardened concrete. These air bubbles Are dispersed throughout the hardened cement paste but are not, by definition, part of the Paste.Air entrainment has now been accepted fact in concrete technology for more than 45 years. Extensive laboratory testing and field investigation concluded that the formation of minute air Bubbles dispersed uniformly thorough the cement paste increased the freeze – thaw durability Of concrete.

Besides the increase in freeze – thaw and scaling resistance, air entrained concrete is more
Workable than non – entrained concrete. Thus use of air entraining agents also reduces
Bleeding and segregation of fresh concrete. With air entering agents additional voids are Produced in till the concrete matrix which will compensate the in volume of water during
Freezing.

It was observed that the entrainment and the satiability of the artificial air voice system
Is influenced by a number of factors regarding concrete technology, transport and environment.
Air – entraining agents are liquid chemicals added during mixing to produce microscopic air

- Improve durability by increasing resistance to freeze – thaw cycles.
- Improves workability.
- Reduce bleeding and segregation of concrete mixtures.

Air entrain is usually specified for outside concrete slabs and it's specified at 24.5% of the mix.

## 3. Methodology:

- Also with air-entraining agein this project,recycled coarse aggregate was used as coarse aggregate and the fine agrregate.
- It is composed of 85% of recycled fine aggregate & 15% of natural aggregate.
- Cement was replaced with flyash at 0%,10%,20%,30% & 40%.
- Concrete was prepared with the above ingredients and nt.

  

- Tests were carried out to find the compressive strength,tensile srength and modulus of elasticity.
- Results of recycled aggregate concrete were compred with air entrained recycled aggregate concrte.
- Nominal mix mentioned in the is 456-2000 for m20 grade concrete used for casting the specimens.

## 4. Flexural Strength Test Apparatus:

The testing machine may be of any reliable type of sufficient capacity, the bed of testing machine is to be provided with steel rollers 38mm in dia on which the specimen is to be supported NUMBER OF SPECIMENS:

specimens for mix M20. Three in each is used for 28 days test.

Procedure:

1. The specimens was tested immediately on removed from the water and while they were still in wet condition.
2. The dimensions of each specimen were noted before testing.
3. Placing the specimens in the testing machine.
4. The bearing surface of the testing machine and surface of the specimens were cleaned. The specimens was placed into the machine in such a manner that the load was applied to the opposite sides of the cubes as cast that was not to the to bottom. The axis of the specimens was carefully aligned with the center of the thrust of the spherically seated plate no packing was used between two faces of the specimen and the steel platen of the testing machine.
5. The movable portion was rotated gently by hand so that uniform seating may be obtained.
6. The load was to be applied without shock and increased continuously at a rate such that the extreme fiber stress increases approximately 7kg/ cm^2/min that was a rate of loading of 180 kg/ min for our 10cm specimens .
7. The load was increase until the specimen fails, and the maximum load applied the specimen during the test was recorded.
8. The appearance of the concrete and any unusual features in the type of failure was noted.

## Calculation:

The flexure strength of specimen was expressed as the modules rupture fb which is equal to the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen in 'cm' was to be calculated to be nearest 0.5 kg /cm^2 as follows.

$$Fb = P\times L/B \times D^2$$

When 'a' is greater than 13.3cm for 10.0 cm specimen.

$$Fb = 3P \times a /B \times D^2$$

When 'a' is than 13.3 cm but greater than for 11.0 cm for 10.0 cm specimen.Where,

B = measured width in 'cm'' of the specimen.

D = measured depth in 'cm' of the specimen.

L = length in 'cm' of the span on which the specimen was supported and

P= maximum load in 'kg' applied to the specimen.

If 'a' is less than 11.0 cm for a 10.0 cm specimen' in the results of the test is to be discarded.

## Load calculation table:

| SI.NI | DEFELECTION IN DIVISION OF 0.002 (MM) | LOAD IN (KN) |
|---|---|---|
| 1 | 0 | 0 |
| 2 | 44 | 5 |
| 3 | 88 | 10 |

  

| | | |
|---|---|---|
| 4 | 131 | 15 |
| 5 | 175 | 20 |

## 5. Flexure Test Results:

| Mix no . | Description of mix in Terms of fly ash | Distance 'X' (mm) | Modulus of rupture (N/mm^2) |
|---|---|---|---|
| 1 | 0% | 157 | 3.53 |
| 2 | 10% | 162 | 3.66 |
| 3 | 20% | 168 | 3.39 |
| 4 | 30% | 175 | 3.21 |
| 5 | 40% | 172 | 3.08 |

**Conclusion:**

Based on the test were conducted both on the fresh and hardened concrete, the following conclusion were drawn. In the sieve analysis, recycled fine aggregate has not met the requirement in the grading limits of zone ll. To obtain specified grading 15% of recycled fine aggregate was replaced by natural sand.

It is concluded that optimum replacement of cement with fly ash is 10% both in washed recycled aggregate concrete and in washed air entrained recycled aggregate concrete.

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