AN EXPERIMENTAL INVESTIGATION ON CONCRETEBY PARTIAL REPLACEMENT OF CEMENT AND COARSE AGGREEGATE USING FLY ASH AND EOF STEEL SLAG

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ABSTRACT: An experimental work was carried out to study the effect of concrete on partial replacement of cement by fly ash and coarse aggregate by EOF Steel Slag. EOF Steel Slag was obtained locally from Jindal steel limited-salem works. Fly ash was obtained locally from NLC –Neyveli works. The rough surface texture of EOF steel slag enhances the strength of the concrete. Fly ash is capable of reducing the heat of hydration which there by reduces the shrinkage in the concrete. For the investigation M20Grade of concrete is used and the concrete mix ratio(1:2.2:3.6) were evaluated to determine the Compressive strength and Spilt tensile strength. Different proportions of EOF Steel slag (0% , 15%, 25%, 35%) as a partial replacement of coarse aggregate in addition with fly ash (20% of replacement of cement) shows noteworthy effects in the strength of the concrete. Thus, in the investigation it was found that the compressive strength and split tensile strength the found to increase.

KEYWORDS: FLY ASH, EOF STEEL SLAG,MIX PRPPORTIONS, COMPRESSIVE STRENGTH,SPLIT TENSILE STRENGTH.

1. Introduction:

The cement and aggregate becomes indispensable material in making concrete. To provide alternative for construction materials, cement can be replaced by **fly ash** and coarse aggregate can be replaced by **EOF steel slag**.

1.1 Fly ash:

Fly ash is a by product of pulverized coal or coal dust in power generating plants. It improves the concrete performance in both the fresh and hardened state. It is used in concrete improves the workability of plastic concrete, strength and durability of hardened concrete. Fly ash is capable of reducing the heat of hydration which there by reduces the shrinkage in the concrete. Fly ash requires less water than Portland cement and is easier to use in cold weather.

1.2 EOF Steel Slag:

EOF **(Energy optimizing furnace**) steel slag reduces the need of natural aggregate which helps to preserve our natural resources. The rough surface texture of EOF steel slag enhances the strength of the concrete. It was observed that it contains 36.96% of CaO which presence of water undergoes hydration to calcium hydroxide resulting in volume expansion leading to cracking. EOF Steel Slag is volumetrically unstable as compared to the blast furnance slag due to the presence of expansive oxides. Fly ash is capable of reducing the heat of hydration which there by reduces the shrinkage in the concrete.

In this work, different proportions of EOF Steel slag (0%, 15%, 25%, 35%) as a partial replacement of coarse aggregate in addition with fly ash (20% of replacement of cement) is used to determine the Compressive strength test and Split tensile strength test.

2. PRELIMINARY STUDY :

Specific gravity of cement :

Specific gravity of fine aggregate is to be the ratio of the given volume of aggregates to the weight of equal volume of water. The value specific gravity of fine aggregate is 2.78.

Flakiness index :

Flakiness index of aggregate is to identified the percentage of weight by aggregate particles and with least dimension is to be less than 0.6 of mean dimensions.

The percentage of flakiness index of coarse aggregate is 11.7%

Elongation index :

Elongation index of aggregate is to identified the percentage of weight by aggregate particles and with least dimension is to be less than 1.8 of mean dimensions.

The percentage of flakiness index of coarse aggregate is 11.7%

Consistency of cement :

The consistency of cement is to be tested with 250g of cement and water to form a paste with 28% of water added in vicat apparatus.

The consistency of cement for 28% water it has penetration of 32mm is safe.

2.1 Mix design:

From the mix design table represents,

Total volume	1 m^3
Mass of cement	248 Kg
Mass of fly ash	62 Kg
Mass of fine sggregate	739.65 Kg
Mass of coarse aggregate	1005.805 Kg
Mass of EOF steel slag	177.495 Kg
Water cement ratio	0.6

2.2 Casting and Curing :

In this work, standard cubes of dimension 150×150×150mm and standard cylinder of dimension150×300 mm were cast and tested. Tests were carried out to evaluate the compressive strengths and spilt tensile strengths at the end of 7 days, 14 days and 28 days. 12 cubes and 12 cylinders were cast in 4 batches by partially replacing cement by fly ash and coarse aggregate by EOF steel slag. The specimens were tested for its 7,14 and 21 days strength to evaluate the Compressive and Spilt tensile strength after subjected to curing.

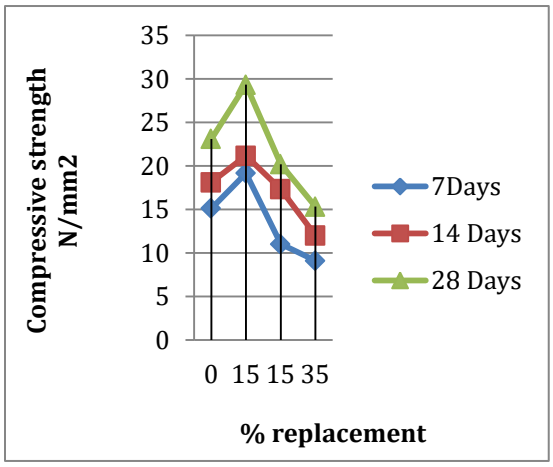
Fig 1 casted cubes and cylinder

3 .Hardened test:

3.1 Compressive strength test:

Compression test conducted for hardened concrete, because it is easy test to give accurate result of the characteristic strength of concrete. A concrete cube test is generally carried out to assess the strength of concrete after 7 days, 14 days and 21 days. The Compressive strength test result was found to 15% increases the strength as partial replacement of coarse aggregate by EOF steel slag in addition with fly ash (20% replacementof cement).

Fig 2 Compressive strength test by UTM Machine



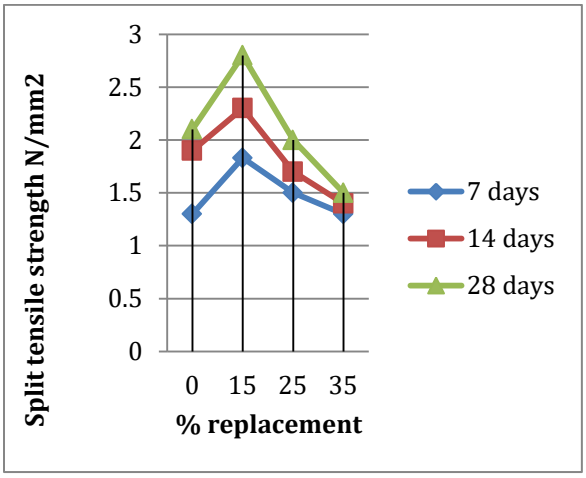
Chat1 Compressive strength test results graph

3.2 Split tensile strength test:

The Split tensile is the indirect method for testing tensile strength of concrete. The stress induced due to grip for specimens to break at its ends. Tensile strength is one of important property for a concrete. A concrete cylinders test is generally carried out to assess the strength of concrete after 7 days, 14 days and 21 days. The Split tensile strength test result was found to 15%

increases the strength as partial replacement of coarse aggregate by EOF Steel slag in addition with fly ash (20% replacement of cement).

Figure 4 Split tensile strength test by UTM Machine



Chat 2 Split tensile strength test results graph

4. CONCLUSIONS:

4.1 Summary:

The "Experimental behavior on concrete by partial replacement cement using fly ash and coarse aggregate using EOF Steel Slag" has been studied .The literature relavent to the EOF steel slag and fly ash were studied and found that EOF steel slag was observed that it contains 36.96% of CaO under the presence of water undergoes hydration to calcium hydroxide resulting in volume expansion leading to cracking. Fly ash is capable of reducing the heat of hydration which there by reduces the shrinkage in the concrete. For this study, two replacement material, Viz., EOF Steel Slag and fly ash were chosen. M20 grade of concrete is designed using Codal provisions IS456:2000 and IS10262:2019. The hardened property of concrete like Compressive and Split tensile strength for partial replacement cement by fly ash and coarse aggregate by EOF steel slag were evaluated by testing in Universal Testing Machine and its strength is compared with the conventional concrete of M20 grade.

4.2 Conclusions:

From the investigation following conclusion were given.

- The performance of concrete using fly ash and EOF Steel Slag as partial replacement in cement and coarse aggregate increases the strength.
- The increase in compressive strength of concrete for higher percentage replacement of EOF steel slag was found to be less significant.
- It was found that the compressive strength and split tensile strength is increased when 15% of EOF steel slag is mixed 20% replacement of cement.
- EOF Steel Slag and Fly ash combination gives better workability and strength in the concrete.

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