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CHANGE IN CHARACTERISTICS OF BLENDED CEMENT CONCRETE WITH AGGREGATES

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ABSTRACT

Aggregate is a combined term for the mineral materials such as sand, gravel, and crushed stone that are used with a binding medium such as water, bitumen, Portland cement, lime, etc. to form compound materials such as bituminous concrete and Portland cement concrete. By volume, aggregate generally accounts for 92 to 96 percent of Bituminous concrete and about 70 to 80 percent of Portland cement concrete. It is well known that different types of aggregate produce different degrees of workability when used in concrete of given mix proportions and water/cement ratio. Flaky is the term applied to aggregates that are flat and thin with respect to their width and length. Aggregates which are flaky and/or elongated will often lower the workability of a concrete mix and may also affect long term durability. Here, in the present work effect of flaky aggregates over the behavior of cement concrete in comparison with normal aggregates has been investigated.

Keywords: Flaky Aggregates And Fly Ash.

I. INTRODUCTION

Presently India has taken a chief initiative on increasing the public utility structures which are express highways, power projects and industrial structures etc. For providing all these utility structures construction materials such as aggregates and cement are having important roles and big quantity of concrete is being consumed (Kandekar et al. 2012). By quantity, aggregate generally accounts for almost 70 to 80 percent of Portland cement concrete. Aggregate is also utilized for base and sub-base courses for both flexible and rigid pavements. Aggregates can either be natural or manufactured. Natural aggregates are usually taken out from bigger rock formations through an open mine (quarry). Removed rock is typically reduced to utilizable sizes through mechanical crushing. Manufactured aggregate is often a bye product of other manufacturing industries.

II. METHODOLOGY

Coarse aggregate is a major component of concrete as it takes a high percentage of either the mass or volume of concrete based on any standard mix design. The increased use of the traditional normal aggregates calls for the use of new shape aggregates. This has led to work by several researchers on either the mechanical properties of plain concrete or the bending/shear strengths of beams made from non-traditional shape aggregates.

In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock-like mass known as concrete. Within this process lies the key to a remarkable trait of concrete: it's plastic and malleable when newly mixed, strong and durable when hardened.

Effect of the grading of river sand particles has been investigated by Agarwal et al. (2007) for a good Concrete mix. Sand has been sorted in three categories i.e. Fine, Medium, and Coarse. These were mixed with coarse aggregate in different proportions so as to keep the combined Fineness Modulus (all-in aggregate) more or less the same.

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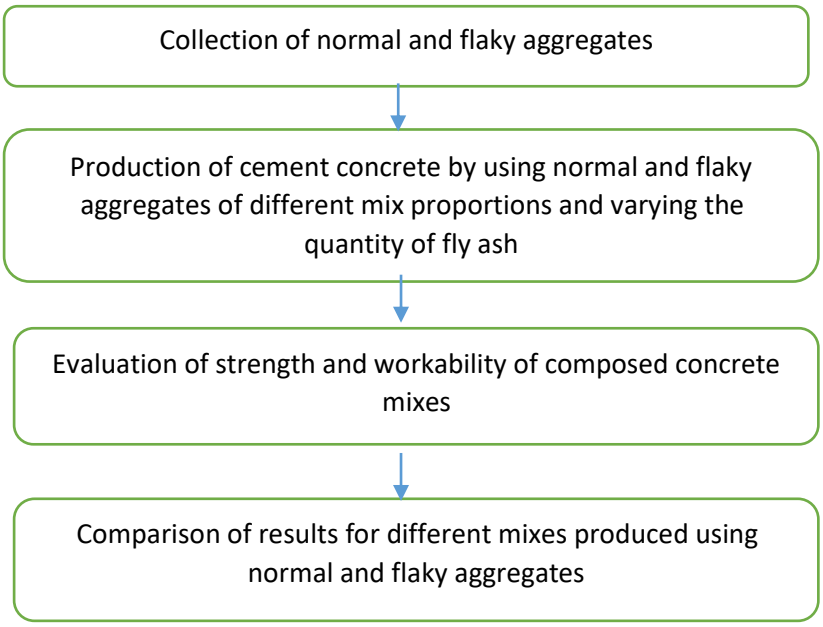
Methodology adopted in present research



CLASSIFICATION BASED ON SOURCE:

Fig 1: Manufactured and natural aggregates.

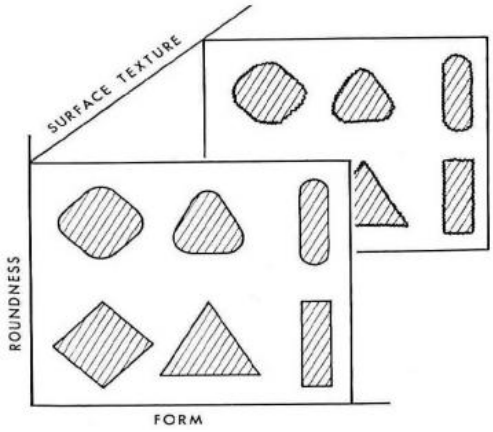


Fig 2: Different Properties of aggregates

III. MODELING AND ANALYSIS

CLASSIFICATION	EXAMPLES
Glassy	Black flint
Smooth	Gravel, Marble
Granular	Sandstone
Rough	Basalt
Crystalline	Granite
Honeycombed & Porous	Brick, slag

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Surface texture is a measure of the smoothness and roughness of aggregate. The grouping of aggregate is broad and is based on visual examination of the specimen. As per IS:383-1970 the aggregates are classified into five groups, namely, Glassy, Smooth, Granular, Crystalline, Honeycombed and Porous .

HARDNESS

The hardness of the minerals that make up the aggregate particles and the firmness with which the individual grains are cemented or interlocked control the resistance of the aggregate to abrasion and degradation. Soft aggregate particles are composed of minerals with a low degree of hardness. Weak particles have poor cementation. Neither type is acceptable. The Mohs Hardness Scale is frequently used for determination of mineral hardness (Figure 2). Although there is no recognizable INDOT specification or requirement which pertains to Mohs Hardness Scale, the interpretation, concept, and use of this scale is useful for the field identification of potentially inferior aggregates.

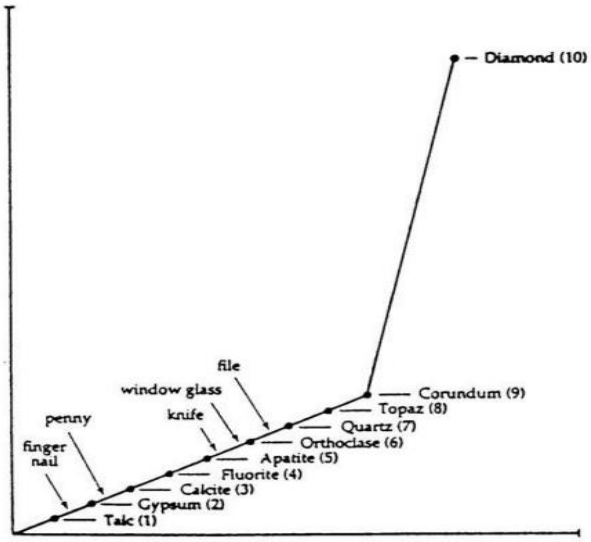

Fig 3: Relative Hardness of Minerals in Mohs Scale

(Numbers in parentheses)

IV. RESULTS AND DISCUSSION

Type of aggregate flaky or normal affects the several physical and chemical properties of the concrete and mortar. Here in the present work, several properties of concrete such as compressive strength and workability are identified and evaluated for investigating the effect of aggregates on the structural behavior and performance of concrete. Following table , will presents theses parameters along with testing techniques.

Table 1: Comparison of displacement of all 4 cases

PARAMETERS	SIGNIFICANCE	TESTING	REFRENCES
Compressive Strength (3 Days)	In 3 days concrete can gain almost 40% of the 28 days compressive strength.	Compression testing machine	ASTM C 31, C 39, C 617, C 1077, C 1231
Compressive Strength (7 Days)	7-day test may be help to detect potential problem with concrete or testing procedure at the lab. In 7 days compressive strength is almost 65% of the 28 days strength	Compression testing machine	ASTM C 31, C 39, C 617, C 1077, C 1231
Compressive Strength (28	To evaluate quality and characteristics of concrete. Concrete mixes are	Compression testing machine	ASTM C 31, C 39, C 617, C 1077, C 1231

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Days)	recognized by their respective 28 days strength.		
Workability	Workability represents the amount of which is to be done to compact the compact the concrete in a given module	Slump Test	IS: 1199-1959 BS 188 I part 105 of 1984

Result table

Table 2: Results of Compressive strength and slump cone tests

S. No.	Mixes with variation in Fly ash	% of Fly Ash in Cement	Flaky/ Normal Aggregate	Compressive strength	Slump
1	M11	5	0	29.1	97
2	M12	10		29. 3	95
3	M13	15		29.8	94
4	M21	5	0.17	28.6	90
5	M22	10		28.9	87
6	M23	15		29.4	86
7	M31	5	0.42	27.4	84
8	M32	10		27.7	83
9	M33	15		28.3	81

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10	M41	5	0.8	27.1	76
11	M42	10		27.4	75
12	M43	15		28.1	72
13	M51	5	1.46	25.7	69
14	M52	10		25.9	66
15	M53	15		26.6	64
16	M61	5	0	39.4	93
17	M62	10		39.7	91
18	M63	15		39.9	88
19	M71	5	0.18	38.9	89
20	M72	10		39.2	87
21	M73	15		39.7	84
22	M81	5	0.45	37.4	82
23	M82	10		37.8	79
24	M83	15		38.4	77
25	M91	5	0.86	36.6	75
26	M92	10		36.9	72

V. CONCLUSION

A study has been performed to evaluate the combined effect of using partially Flaky aggregates and Fly ash over the compressive strength and workability of concrete. Following conclusions are revealed from the present work –

1. It has been observed from that concrete mix formed by only using 15% with flaky aggregates, with flaky to normal aggregate ratio 0.17, is almost comparable with the values of 100% normal aggregate.

2. With the increase in percentage of flaky aggregate values of compressive strength and slump cone reduces.

3. Additional effect of fly ash variation over the effect of flaky aggregates has been determined by replacing cement by fly ash in different proportions such as 5%, 10% and 15% for each variation of flaky aggregate.

4. Increase in percentage of fly ash increases the compressive strength for a flaky aggregate proportion.

5. Increase in percentage of fly ash reduces the slump value for a flaky aggregate proportion.

6. For both M30 and M40 concrete grades maximum saving of cement with good compressive strength has been observed at 15% and 30% replacement of normal aggregate with flaky aggregate along with 15% of fly ash content

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