EFFECT OF ASBESTOS CEMENT SHEET WASTE ON FLEXURAL STRENGTH OF CONCRETE

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Abstract :

Concrete is the leading construction material in the region of the world and used in structural works, including infrastructure, low and high-rise buildings. It is a man-made artifact, essentially consisting of a combination of cement, aggregates, admixture(s) and water. Inert granular materials such as natural sand crushed stone or gravel form the main part of the aggregates. Conventionally aggregates have been available at economic prices as well as of qualities to suit the entire purposes. But, the continued wide withdrawal of aggregates has been questioned as of the depletion of quality main aggregates and greater awareness of environmental safety. In this research, I have replaced the coarse aggregate partially by using asbestos cement sheet waste. Therefore, I have planned to prepared some number of prisms, using asbestos cement sheet waste at various proportions like 0%, 5%, 10% ,15%, 20% and 25% by weight of coarse aggregate The properties for fresh concrete are tested for flexural strength at the age of 7, 14 and 28 days. It is found that with the increase in the percentage replacement of coarse aggregate with AC sheet waste there is increase in Flexural Strength upto 10 % replacement after that there is decrease in Flexural Strength with further replacement of coarse aggregate with AC sheet waste. It can also observed that 28 days Flexural Strength is increased by 3.33%, 5.20% upto 10 % replacement of coarse aggregate with AC sheet waste as compared to conventional concrete.

Keywords: OPC 43 Grade, Coarse Aggregate, Fine Aggregate, CICO superplasticizer, Water, W/C ratio, Concrete, Asbestos Cement Sheet Waste.

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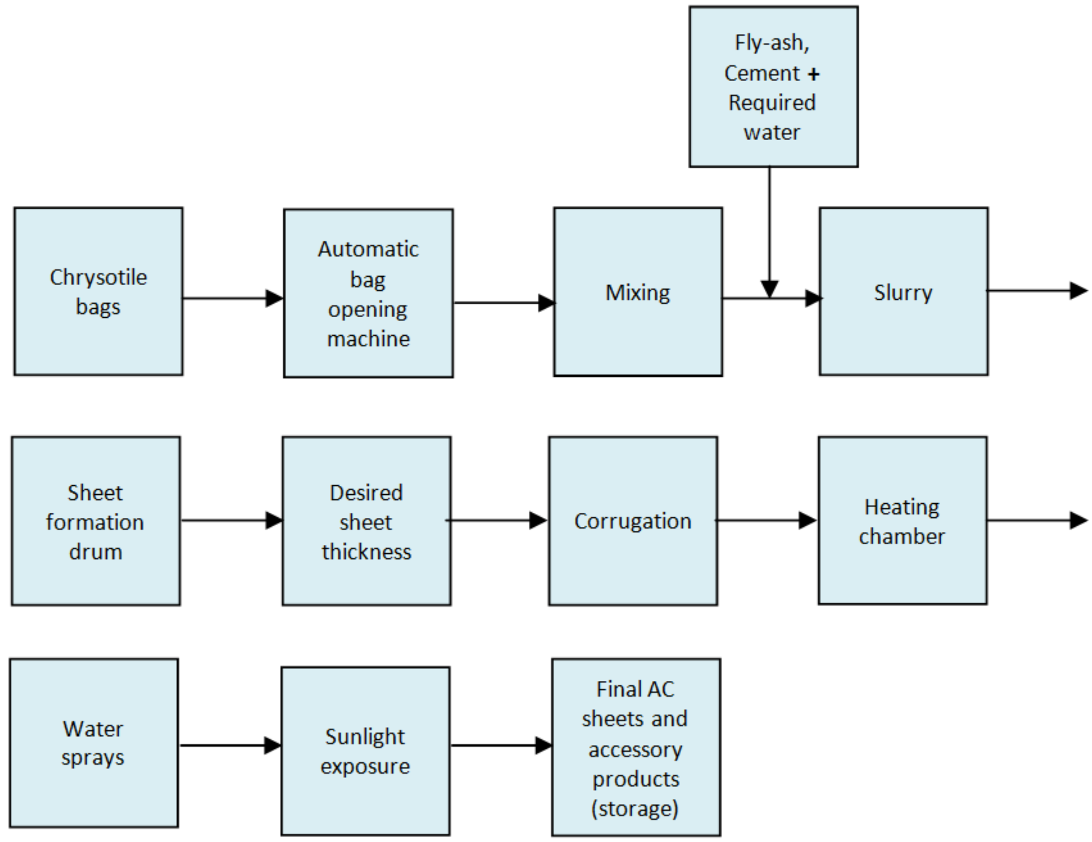
Introduction:

In North America, as well as in Europe, asbestos was used widely as a building material because of its resistance to heat and corrosive chemicals. It was used in roofing materials (flat and corrugated sheets, tiles, building board), cement pipes, roads and apparatus (such as brakes), in high temperature equipment (such as industrial boilers) and in shipbuilding (Virta, 2003). Europe has large natural deposits of asbestos (Coutts, 2005). [1] Currently asbestos is mined in Russia and Canada, as well as in China, Brazil, Zimbabwe and South Africa. In India, chrysotile asbestos is mostly used in the manufacture of asbestos cement (AC) sheets and AC pipes followed by jointing, brake linings, brake shoes, and clutch facings, fireproof suits. Asbestos is however used in over 5000 products worldwide due to its unique properties such as high durability, tensile strength, resistance to chemicals and fire (National Cancer Institute, 2009). Currently, manufacturing of chrysotile‐based products is carried out in more than 100 countries and the annual production is about 27 to 30 million tons.

Manufacturing Process Of Asbestos Cement Sheet [2]:



Source : Ansari et al. – Atmospheric Pollution Research 1 (2010) 128‐131

Fig. 1 Manufacturing Process Of Asbestos Cement Sheet

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Materials Used:

1. **Cement:** The cement used is Portland cement of 43 grade confirming to IS 8112:1989 is used in this study. The specific gravity, initial and final setting time of cement is respectively found as 3.157, 80 minutes and 320 minutes. Fineness Modulus obtained is 8%.[3-7]

2. **Fine Aggregates:** Sand is used as the fine aggregate conforming to grading zone II as per IS 383:1970.The specific gravity, fineness modulus, Water absorption and silt content is respectively found as 2.62, 2.81, 0.32% and 2.604%. [8-9]

3. **Coarse Aggregates:** Coarse aggregate has a maximum size of about 20 mm. The coarse aggregate having a specific gravity 2.71 and fineness modulus of 7.401. Water absorption of coarse aggregate is 0.204 %, Aggregate Crushing value is 15.46% and Aggregate Impact Value is 11.23%. [8-10]

4. **Asbestos Cement Sheet Waste Material:** Asbestos cement sheet waste are taken from upal ltd. near Gorakhnath, Gorakhpur, U.P. They were crushed into required sizes of 4.75 mm to 20 mm by manually operating a hammer. The specific gravity of AC Sheet waste material is 1.61 and fineness modulus of 7.347. Water absorption of AC Sheet waste material is 4.4 %, Aggregate Crushing value is 14.53% and Aggregate Impact Value is 9.84%.

5. **Water:** Water used for curing and producing of concrete should be practically clean and free from toxic substances such as oil, acid, sugar, silt, alkali, salt, organic matter and other elements which are harmful to the concrete. potable tap water is used in this study for mixing of ingredients and curing of concrete.

6. **Admixture: Admixture:** Super plasticizers (CICO Plast super HS) are used as water reducing admixture.

Mix design for M-30 Grade Concrete:

The mix design is produced for maximum size of aggregate is 20mm conventional aggregate and asbestos cement sheet waste aggregate. The variation in strength of concrete by using asbestos cement sheet waste as partial replacement of coarse aggregate is analysed by casting 3 prism for each and every replacement. The concrete is prepared in the Madan Mohan Malaviya University Of Technology laboratory. The cement, fine aggregate, coarse aggregate

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and asbestos cement sheet wastes are mixed in dry state and then the required quantity of water is added and the whole concrete is mixed for 3 minutes. Thereafter concrete is poured in the prismoidal moulds which are screwed tightly and oiling is done in the mould. The concrete is poured into the moulds in 3 layers by compacted with tamping rod for beams of 700X150X150 mm size is tested for flexural strengths. The specimens which are cast is removed after 24 hours and then these are immersed in a water tank. After a curing period of 7, 14 and 28 days the specimens are removed and these are tested for flexural strengths and the results are compared with conventional concrete.

Now the actual quantity of material required in Mix Proportion-

Sl. No.	Replacement of C.A. by AC waste	Cement (kg/m^3)	F.A (kg/m^3)	C.A (kg/m^3)	AC Sheet Waste (kg/m^3)	w/c ratio	Admixture (kg/m^3)	Water (kg/m^3)
1.	0%	398.7	669.87	1175.24	-	0.45	3.98	179.41
2.	5%	398.7	669.87	1116.65	35.045	0.45	3.98	179.41
3.	10%	398.7	669.87	1059.22	70.09	0.45	3.98	179.41
4.	15%	398.7	669.87	999.111	105.35	0.45	3.98	179.41
5.	20%	398.7	669.87	940.34	140.18	0.45	3.98	179.41
6.	25%	398.7	669.87	881.56	175.225	0.45	3.98	179.41

Results And Discussions:

Flexural Strength Test - For Flexural Test beams of 700×150×150 mm size were adopted. Three- point load method was used to measure the flexural strength of Asbestos Cement Sheet Aggregate Concrete.

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Table 3 Flexural Strength of A.C. Sheet Waste Concrete

Sl. No.	% Replacement of Coarse Aggregate	Flexural Strength Test (N/mm^2)		
		7 days	14 days	28 days
1.	0% (C.M)	3.752	3.956	4.424
2.	5%	3.791	4.10	4.473
3.	**10%**	**3.856**	**4.256**	**4.654**
4.	15%	3.714	3.850	4.204
5.	20%	3.641	3.781	4.150
6.	25%	3.530	3.610	3.984

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Fig. 2 Flexural Strength Testing Of Prism

Fig.3 Graph between Flexural Strength of Concrete and %age A.C. Sheet Waste

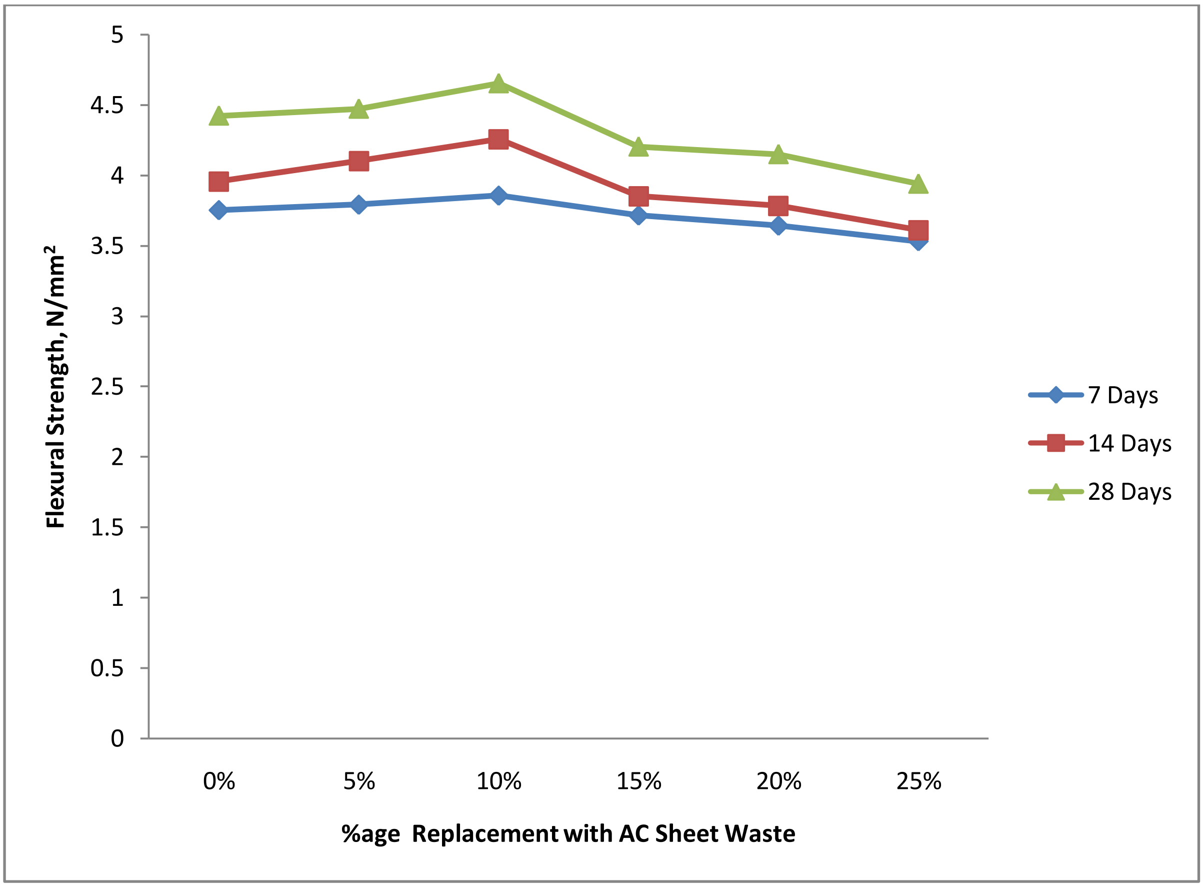

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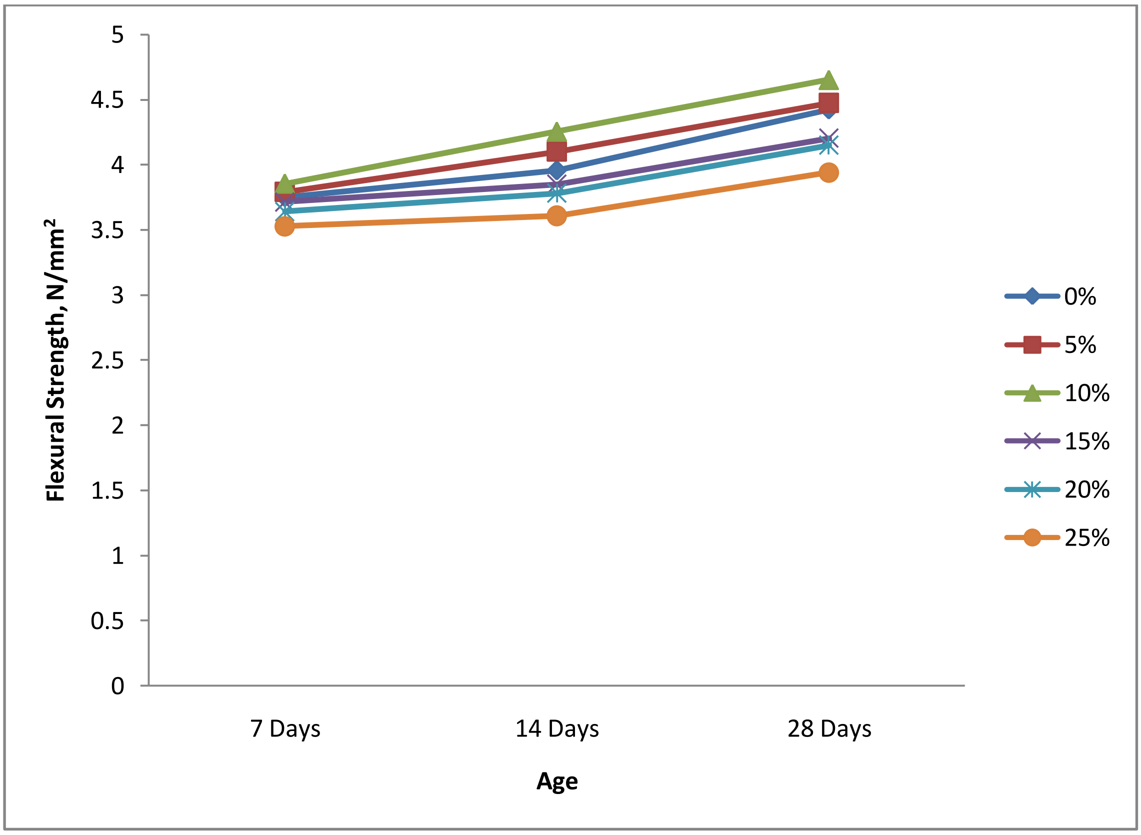
Fig. 4 Graph between Flexural Strength of Concrete and %age A.C. Sheet Waste



With the increase in the percentage replacement of coarse aggregate with AC sheet waste there is increase in Flexural Strength upto 10 % replacement after that there is decrease in Flexural Strength with further replacement of coarse aggregate with AC sheet waste.

The maximum Flexural Strength of 4.654 N/mm^2 is attained at 10% replacement, while the minimum Flexural Strength of 3.984 N/mm^2 was attained at 25% replacement. Till 10% replacement, concrete Flexural Strength increases gradually but after 10% it reduces. The strength increased as the percentage of replacement increased to a certain limit and beyond that strength decreases. So it is beneficial to use AC sheet waste in place of coarse aggregate upto 10%. Beyond that it is not beneficial as strength decreases.

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Conclusion:

It is observed from the experimental results and its analysis, that the flexural strength of concrete initially increases with replacement of coarse aggregate with AC sheet waste and after that there is decrease in Flexural Strength with further replacement of coarse aggregate with AC sheet waste.

From the Experimental test result we can concluded that –

1. In case of replacement of coarse aggregate, 10% asbestos cement sheet waste content can be taken as the optimum dosage for flexural strength, which can be used for giving maximum possible flexural strength at any age for Asbestos cement sheet waste aggregate concrete.

2. In case of replacement of coarse aggregate, the percentage increase of flexural strength of Asbestos cement sheet waste aggregate concrete compared with flexural strength of control mix is observed from 1.039 % to 2.77% at 7 days. The percentage increase of flexural strength of Asbestos cement sheet waste aggregate concrete compared with compressive strength of control mix is observed from 3.64% to 7.58% at 14 days. The percentage increase of flexural strength of Asbestos cement sheet waste aggregate concrete compared with flexural strength of control mix is observed from 1.10% to 5.20% at 28 days.

3. Waste material is utilised in effective manner so by using asbestos cement sheet waste, one can reduce the effective cost of the concrete and it is also helpful for the environmental point of view.

4. Asbestos cement sheet waste aggregate concrete may be an alternative to the conventional concrete.

Suggestions For Future Work:

1. Split Tensile Strength Test can also be studied to determine the effect of Asbestos Cement Sheet Waste on strength parameter of concrete.
2. The effect of different types of cement such as rapid hardening cement, sulphate resisting cement etc can also be studied. Thus we can find which cement is more suitable with asbestos cement sheet waste aggregate concrete.

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Refrences:

1. United States Geological Survey Mineral Resource Program.
2. Ansari et al. – Atmospheric Pollution Research 1 (2010) 128 ‐ 131.
3. IS 8112: 1989, Specification for 43 grade OPC, reaffirmed 1997.
4. IS 4031: 1988, Part 1, Method of Physical Test for Hydraulic Cement, Determination of Fineness by Dry Sieving, reaffirmed 1995.
5. IS 4031: 1988, Part 4, Method of Physical Test for Hydraulic Cement, Determination of Consistency of Standard Cement Paste, reaffirmed 1995.
6. IS 4031: 1988, Part 5, Method of Physical Test for Hydraulic Cement, Determination of Initial and Final Setting Times, reaffirmed 2000.
7. IS 4031: 1988, Part 6 Method of Physical Test for Hydraulic Cement, Determination of Compressive Strength of Hydraulic Cement other than masonry Cement,reaffirmed 2000.
8. IS 383: 1970, Specification for coarse and fine aggregates from natural sources for concrete (second revision), reaffirmed Feb-97.
9. IS 2386: 1963, Part 1, Indian Standard Methods Of Test For Aggregates For Concrete, Particle Size And Shape reaffirmed 2002.

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