Experimental Investigation on Concrete by Partial Replacement of Waste Asbestos Sheet as Course Aggregate

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Abstract – The waste asbestos sheet used in concrete making leads to greener Eco-Friendly environment. Use of waste asbestos sheet in concrete is an interesting possibility for economy on waste disposal sites and for conservation of natural resources. This project examines the possibility of using waste asbestos sheet as a replacement in coarse aggregate for a new concrete preparation. Natural coarse aggregate partially replaced (0%,5%, 10%, and 15%) with waste asbestos sheet. Compressive strength and flexural strength up to age of 28 days are compared with those age of concrete made with natural coarse aggregates. Fineness modulus, specific gravity, moisture content, water absorption for aggregate are studied. The test results indicate that it is possible to manufacture concrete containing waste asbestos sheet with characteristics similar to those of natural coarse aggregate concrete provided that the percentage of waste asbestos sheet as coarse aggregate is limited to 10-15%, respectively.

Index Terms – WAS (Waste Asbestos sheet), Density, Compressive Strength, Flexural Strength.

1. INTRODUCTION

Concrete is widely used in construction of buildings, bridges and other structures.(1). Great demand for building materials like sand and blue metal due to cost, scarcity has made the civil brains to find alternatives with the use of waste materials, by-products and recyclables.(6). In this paper, silica fumes which is a by-products of silicon alloy manufacture, disposed ceramic tiles and unused waste asbestos sheets are chosen to partially replace the basic materials of concrete. Concrete mix for M30 grade is prepared with a water cement ratio of 0.40 and placed in mould s for cubes of size 150mm, cylinders of diameter 150mm & height 285 mm and beams of size 50cm×10cm×10cm .In fresh state ,slump cone test and compaction factor test have been conducted(10). Test for compression, flexural and split tensile have been done in hardened state on 7 Days, 14 Days and 28 Days(10).

A asbestos was used widely as a building material because of its resistance to heat and corrosive chemicals(1).

In North America, as well as in Europe In North America, as well as in Europe 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 Europe has large natural deposits of asbestos (2).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(1). 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)(2).

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(3).

2. EXPERIMENTAL PROGRAM

2.1. DISCUSSION ON MATERIALS

Cement in general adhesive substances of all kinds, it is the binding materials used in building and civil engineering. Cement was bought in same source throughout our project. While storing cement, all possible contact with moisture was avoided. Specific gravity of cement are found as 3.15 . In the present work the concrete mixes were prepared using locally available river sand. The sand used was confirming to zone 3. Fineness modulus and specific gravity of the sand were found to be 6.59 and 2.6 respectively.

Hard broken granite stones were used as a coarse aggregate in concrete. Size of the coarse aggregate used in the investigation was 10mm. the specific gravity of the coarse aggregate was found to be 2.65.

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement.

In general water fit for drinking is suitable for mixing concrete. Impurities in the water may affect setting time strength, shrinkage of concrete or promote corrosion of reinforcement. Locally available drinking water was used in the present work.

The Waste asbestos sheet aggregate was manually crushed in the size 16 or more. Shape of the WAS aggregate are shown in figure. WAS aggregate having the specific gravity of 1.61.

Being organic in nature, the properties of WAS aggregate highly differ from the conventional aggregates. The physical properties of WAS aggregate and normal coarse aggregates used in the study are presented in Table-1 for compresive purposes. However, the high water absorption of WAS aggregate can be beneficial to the resulting hardened concrete.

2.2 MIX DESIGN OF CONVENTIONAL CONCRETE

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economical as possible. The Bureau of Indian standards recommended a set of procedure for design of concrete mix mainly based on the work done in national laboratories.

Cement (kg)	Fine Aggregate (kg)	Coarse Aggregate (kg)	Water (Litre)
533	533	1189	213
1	1	2.23	0.4

2.3 CURING OF WASTE ASBESTOS CONCRETE

After casting the specimens, they were kept in rest period for five days and then they were demoulded.

The term 'Rest Period' was coined to indicate the time taken from the completion of casting of test specimens to the start of curing at an elevated temperature. This may be important in certain practical applications.

3. RESULTS AND DISCUSSION

3.1 DENSITY OF ASBESTOS CONCRETE

DAYS	WASTE ASBESTOS SHEET (0%)	WASTE ASBESTOS SHEET (5%)	WASTE ASBESTOS SHEET (10%)	WASTE ASBESTOS SHEET (15%)
7	20.62	21.73	22.80	13.47
14	24.53	25.60	28.08	16.17
28	29.70	30.08	30.80	26.40

Variation of density of Asbestos concrete after 7 and 28 days of curing is presented. The density of Asbestos concrete was found approximately equivalent to that of conventional concrete. As the age of concrete increases, there is a slight increase in density. Variation of density is not much significant with respect to age of concrete and type of curing.

4. COMPRESSIVE STRENGTH

The compressive strength after 7 and 28 days of curing is presented. which shows a graphical representation of variation of compressive strength for 7 days and 28 days of curing.

Sl.no	% of replacement	Ultimate load (kN)	Ultimate strength N/mm^2
1	0	668	29.70
2	5	677	30.08
3	10	693	30.80
4	15	594	26.40

Compressive strength of hot cured specimens is more than that of ambient cured specimens both for 7 and 28 days. 28 days compressive strength of hot cured specimens was about 2 times more than that of ambient cured specimens. 7 days compressive strength of hot cured specimens was around 7 times more than that of ambient cured specimens. In ambient curing the 28 days compressive strength is about 4.5 times the 7 days compressive strength. In hot curing the 28 days compressive strength is about 1.2 times the 7 days compressive strength.

5. CONCLUSION

From the results, the following conclusions can be drawn.

- Partially (above 15%) are not achieved the conventional results. The optimum replacement level in coarse aggregate with waste asbestos sheet is 5% and 10%.
- But the partial replacement of waste asbestos sheet in concrete showed better results than that of the conventional concrete at 28 days.
- The better strength had achieved in replacement level 5% and 10% of waste asbestos sheet in coarse aggregate in concrete.
- By applying this waste asbestos sheet in fine aggregate by partially, the cost can be controlled. The waste asbestos sheet are effectively used and the waste has been minimized.
- The comparison of compressive strength test results between conventional and cast mix ratio shows that gives better compressive strength.

- Partially replacement of waste asbestos sheet in concrete has been increased the conventional

  compressive strength results in 28 days but later the day the results are going to be decreased.

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