International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 3 Issue 5, August 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Effects of Waste Asbestos Cement Sheet on Compressive Strength and Flexural Strength of Concrete

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How to cite this paper: Varun Yadav | Sudhansu Kumar | Dr. Bharat Nagar "Effects of Waste Asbestos Cement Sheet on Compressive Strength and Flexural Strength of Concrete" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-5, August 2019, pp.866-870, **https://doi.org/10.31142/ijtsrd26490**

IJTSRD26490

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 and crushed stone or gravel form the main part of the aggregates. Conventionally aggregates have been available at economical 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 cubes and beams, using asbestos cement sheet waste at various proportions like 0%, 5%, 10% and 15%by weight of coarse aggregate The properties for fresh concrete are tested for Compressive Strength and 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 Asbestos sheet waste there is increase in Compressive Strength and Flexural Strength upto5 % replacement after that there is a decrease in Compressive Strength and Flexural Strength with the further replacement of coarse aggregate with Asbestos sheet waste. It can also observe that 28 days Compressive Strength and Flexural Strength are increased by replacement of coarse aggregate with Asbestos sheet waste as compared to conventional concrete.

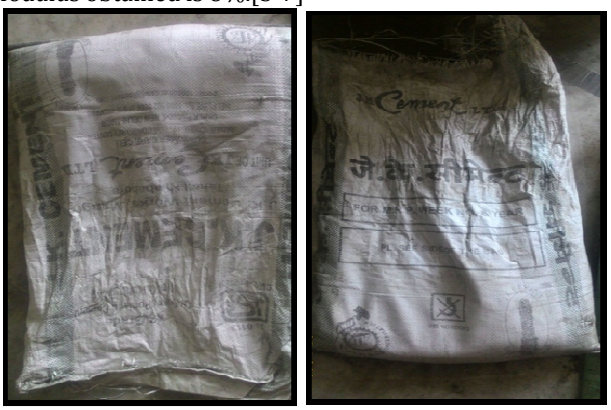
KEYWORDS*: OPC 43 Grade, Coarse Aggregate, Fine Aggregate, CICO super plasticizer, Water, W/C ratio, Concrete, Asbestos Cement Sheet Waste*

INTRODUCTION:

Concrete is an essential building material is widely used in the construction of infrastructures such as buildings, bridges, highways, dams, and many other facilities. Most concretes used are lime-based concretes such as Portland cement concrete or concretes made with other hydraulic cement. However, road surfaces are also a type of concrete, asphalt concrete, where the cement material is bitumen, and polymer concretes are sometimes used where the cementing material is a polymer. Almost in all the countries in the world, various experiments are done at reducing the use of primary aggregates and escalating reuse and recycling have been introducing, which is economically technical or environmentally acceptable. As a result in developing countries like India, the informal sector and secondary industries recycle 15-20 % of solid wastes in various building materials and components. Asbestos sheet waste also a solid waste used as a coarse aggregate in the concrete mixes. Asbestos products manufacturing industries are located in fifteen industrial states of India strategically important from raw materials and energy availability viewpoint and also from the consumption pattern viewpoint. It is understood that Tamil Nadu, Andhra Pradesh, Haryana, Maharashtra, Madhya Pradesh and Gujarat consume more than 75 % of the asbestos in India

Materials Used:

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]

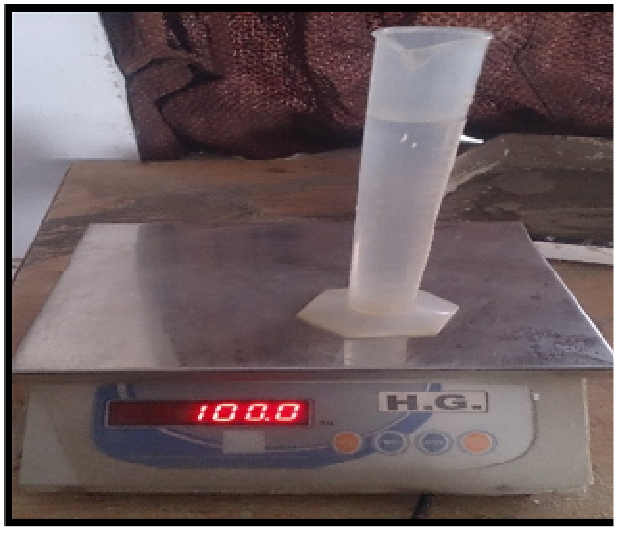


Fine Aggregates: Sand is used as the fine aggregate conforming to grading zone II as per IS 383:1970. The specific gravity, fineness modulus, Water absorption, and silt content is respectively found as 2.62, 2.81, 0.32% and 2.604%. [8-9]

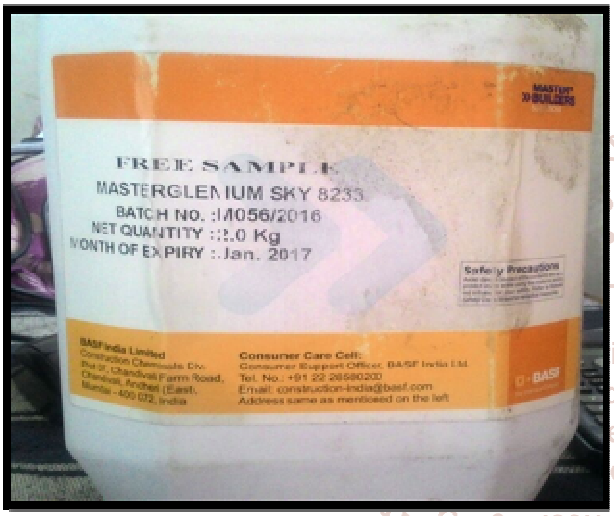
Coarse Aggregates: Coarse aggregate has a maximum size of about 10mm and 20 mm . The coarse aggregate having a specific gravity 2.71 and fineness modulus of 7.401. Water absorption of coarse aggregate is 0.204 %, Aggregate Crushing value is 15.46% and Aggregate Impact Value is 11.23%.

Asbestos Cement Sheet Waste Material: Asbestos cement sheet waste were crushed into required sizes of 10 mm to 20 mm by manually operating a hammer. The specific gravity of Asbestos sheet waste material is 1.61 and fineness modulus of 7.347. Water absorption of Asbestos sheet waste material is 4.4 %, Aggregate Crushing value is 14.53% and Aggregate Impact Value is 9.84%

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



Admixture: Admixture: Superplasticizers (CICO Plast super HS) are used as water reducing admixture.



METHODOLOGY:

This study was focused firstly to determine whether Asbestos Sheet Waste and its subordinate can be used as coarse aggregate for M20 and M25 grade of concrete. Scope of this project is to check the Compressive Strength at M20 and Flexural Strength at M25 grade of concrete for three different proportion of Asbestos Sheet Waste, each proportion of Asbestos Sheet Waste Concrete M20 and M25 is suitable for footing, Residential and Highway application. The ingredient of the concrete consisted of cement; coarse aggregate (10mm to 20mm) Asbestos Sheet Waste, fine aggregate and water.

Mix Design:

Concrete is a versatile building material and its mix design may be defined as the art of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing of concrete of certain minimum strength and durability as economically as possible

It can be designed for strength ranging from M10 (10MPa) to M100 (100MPa) and workability ranging from 0 mm slump to 150mm slump. In all these cases the ingredients of concrete are same, but it is their relative proportioning that makes the difference. Following tests are conducted to determine the workability, strength and durability indicators of the concrete.

Mix design for M-20 and M-25 Grade Concrete:

The mix design is produced for the maximum size of aggregate is 20mm conventional aggregate and asbestos cement sheet waste aggregate. The variation in the strength of concrete by using asbestos cement sheet waste as partial replacement of coarse aggregate is analyses by casting 3 cubes and 3 beams for each and every replacement. The concrete is prepared in the Maharishi Arvind Institute of Engineering And Technology laboratory. The cement, fine aggregate, coarse aggregate and asbestos cement sheet wastes are mixed in a 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 molds 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 cubes 150X150X150 mm size is tested for Compressive Strength and beams of 700X150X150 mm size is tested for Flexural Strengths. The specimens which are cast 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 Compressive Strength and Flexural Strengths and the results are compared with conventional concrete.

The actual quantity of material required in M-20 grade concrete for Compressive Strength

SI.NO.	Replacement of C.A by A.C Waste	Cement(kg)	F.A(kg)	C.A(kg)	Asbestos sheet Waste(kg)	W/C Ratio	Admixture(kg)	Water(L)
1	0%	5.07	6.60	13.26	-	0.45	0.101	2.28
2	5%	5.07	6.60	12.59	0.663	0.45	0.101	2.28
3	10%	5.07	6.60	11.93	1.33	0.45	0.101	2.28
4	15%	5.07	6.60	11.27	1.99	0.45	0.101	2.28

The actual quantity of material required in M-25 grade concrete for Flexural Strength

SI.NO.	Replacement of C.A by A.C Waste	Cement(kg)	F.A(kg)	C.A(kg)	Asbestos sheet Waste(kg)	W/C Ratio	Admixture(kg)	Water(L)
1	0%	32.60	28.35	56.70	-	0.45	0.652	14.67
2	5%	32.60	28.35	53.86	2.83	0.45	0.652	14.67
3	10%	32.60	28.35	51.03	5.67	0.45	0.652	14.67
4	15%	32.60	28.35	48.19	8.50	0.45	0.652	14.67

Results and Discussions:

Compressive Strength

For each mix, specimens were tested for compressive strength after 7, 14 and 28 days after casting. The average of three cubes was taken as the mean compressive strength.

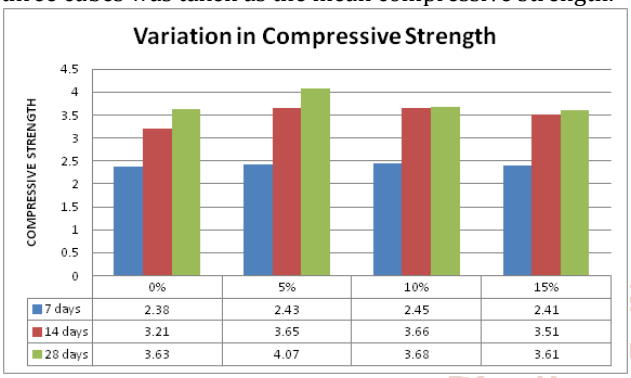


Figure: Comparison of Compressive Strength for various mix

Flexural Strength Test:

For Flexural Test beams of 700×150×150 mm size were adopted. Four-point load method was used to measure the flexural strength of Asbestos Cement Sheet Aggregate Concrete. For each mix, specimens were tested for Flexural Strength after 7, 14 and 28 days after casting. The average of three Beams was taken as the mean Flexural Strength.

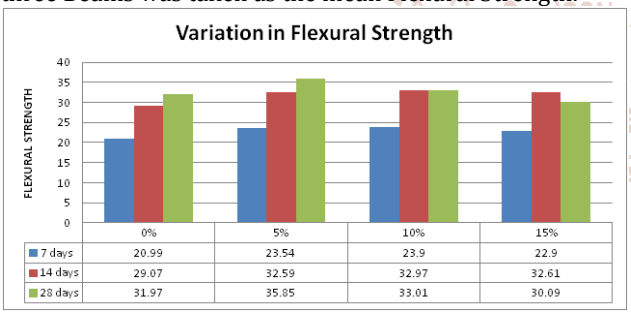


Figure: Comparison of Flexural Strength for various mixes

Conclusion:

This experimental study sought to identify the effects of implementing Asbestos as a partial replacement for fine aggregate in structural grade concrete. The results obtained demonstrate that doing so can in fact "add value", and in conjunction with environmental legislation focusing on sustainable building development, may act as an incentive for the construction industry to incorporate this waste material into their practices. This would result in a twofold benefit for the environment, reducing the consumption of raw materials and diverting additional waste. The main findings of the study can be summarized as follows:

1. While I am observing from the experimental results and its analysis, that the Compressive Strength and Flexural Strength of concrete initially increase with the replacement of coarse aggregate with Asbestos sheet waste and after that there is a decrease in Flexural Strength with further replacement of coarse aggregate with Asbestos sheet waste.
2. While I am replacing of coarse aggregate, 5% asbestos cement sheet waste content can be taken as the optimum dosage for Compressive Strength and Flexural Strength, which can be used for giving maximum possible Compressive Strength and flexural strength at any age for Asbestos cement sheet waste aggregate concrete.
3. Waste material is utilized in an 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.
   Asbestos cement sheet waste aggregate concrete may be an alternative to the conventional concrete.
4. Asbestos cement sheet waste can effectively be used as coarse aggregate replacement.
5. The construction industry presents an attractive market for the use of Asbestos cement sheet. One of the principal components of construction is concrete, due to its high compressive strength, durability and ease of construction.
6. With natural aggregates within Indian being present in limited quantities, producing aggregate for use in the construction industry is costly. It can, therefore, be seen that incorporating asbestos cement sheet as an aggregate in structural concrete has the potential to not only produce environmental benefits and the consumption of raw materials but to also reduce costs for industry costs.

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APPENDIX