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Performance Evaluation Of Waste AAC Block Fine Aggregate Partially And Fully Replaced In Cement Mortor.

(Potential of waste AAC block use as fine aggregate, partially and fully replaced in cement mortor)

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Abstract: Autoclaved aerated concrete (AAC) blocks are widely used everywhere in present-day building construction. They are known for their lightweight nature and excellent thermal insulation properties. It's made of quartz sand, calcined gypsum, lime, Portland cement, water, and aluminum powder. They are also available in different sizes for various applications and can be easily shaped or cut to fit specific requirements. During the construction of the wall, many times, a part of the AAC block (called the bat) remains behind, and this bat will not be used in further work if it is not suitable or does not fit at that place. Instead, it will be discarded, and it is waste material. Also, during transportation as well as in the handling process, AAC blocks are getting wasted. They are not being utilized efficiently, resulting in unnecessary waste. The waste AAC blocks may not be suitable for land filling purposes due to their relatively low load-bearing capacity. It also has a significant negative impact on the environment due to its high energy consumption during the manufacturing process and waste generation. Therefore, it is important to find ways to the utilization of waste AAC blocks.

In this present research work, we discuss the potential methods and strategies for maximizing the use of waste AAC blocks and promoting recycling or repurposing of unused materials. Specifically, we explore various techniques for reusing waste AAC blocks in construction projects and investigate the feasibility of incorporating them into new building construction material. A study was conducted on AAC block waste as sand replacement material in mortar mix with replacement percentages of 25%, 50%, and 100%. The compressive strength test was conducted in this study on the specimens.

Index Terms **-** AAC Block, fine aggregate, mortor, compressive strength.

I. INTRODUCTION

Materials and methods make construction techniques efficient and precise. The importance of selecting appropriate materials for construction projects to ensure durability and longevity. The role of technology and innovative tools in improving construction methods and streamlining processes. In the present era, the construction industry is the largest industry, providing employment opportunities and contributing significantly to the growth of the economy. Modern construction techniques use modern materials, but these modern materials have a significant impact on the environment. It is seen that everywhere, during construction activities, there is a large amount of waste generated, like unused materials, waste brick pieces, waste AAC block pieces, packaging waste, and demolition waste. Due to improper handling and a lack of technical skills, this excessive waste material contributes to environmental degradation and resource depletion. It is a call for researchers to find innovative solutions for waste management and develop sustainable practices. Explore the benefits of implementing sustainable methods in the construction industry to reduce its environmental impact. Also, finding the solution to how using renewable materials, minimizing waste generation, and adopting energy-efficient techniques can contribute to a greener future. Additionally, incorporating sustainable practices can also lead to cost savings and improved long-term durability of buildings.

In Construction, concrete is the primary material when making mortar & Concrete. Fine aggregate is important component & has a significant impact on mix design. River sand is now prohibited in many places, so finding natural sand at good price it is difficult. The Construction industry will be affected by shortage of fine aggregate or a lack of availability. That is why to find out various alternatives do control these problems such as recycling of construction demolition waste.

II. PROBLEM STATEMENT

With the help of this project, we are trying to explore the use of recycled materials, such as waste AAC blocks, in construction. Discuss how recycling construction demolition waste can be a viable solution to address the shortage of fine aggregate. Explore different methods and techniques for reusing these materials in mortar and concrete mix designs. Investigating the properties of alternative aggregates: Highlight various alternatives to river sand, such as crushed rock, manufactured sand, or even industrial by-products like fly ash or slag. Examine their qualities and determine whether they can be used in place of fine aggregate in construction.

Investigating the feasibility of using waste AAC block fine aggregate as a partial or complete replacement for fine aggregate in mortor mixtures, considering factors such as compressive strength, durability, and workability. Conducting a comparative study to evaluate the performance of mortor made with waste AAC block fine aggregate compared to conventional mortor mixes.

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III. LITERATURE REVIEW

The main purpose of literature Review is to idea about the research work conducted in the world. this forms the basis on which one can carry out the work techniques that can be used for conducting experiments .The following literature elaborates the research studies made on different construction waste as a Replacement of fire aggregate.

a) Partial Replacement of fine aggregate by using timber waste, G. Vinoth Kanna, Assistant Professor, Department of Civil Engineering, Chennai. International Journal of Engineering & Technology. - In this research timber waste concrete was made at 3 different mix proportions of cement. to timber of fit, 1:1,1:2 and 1:3 by Volume .The Increase in the amount of timber waste, the Workability decreased however, concrete with higher amount of timber waste performed Very well it also found that heat transfer of timber waste concrete decreased. Concrete Samples were casted with mix proportion of M50 grade concrete The test were carried out after 7, 14 and 28 days Normal concrete is also tabulated for comparative study, Based on limited study carried out strength behavior of sow dust Increase in the percentage replacement of timber waste, the strength compressive strength. increase. The test Result indicate that it is Possible to manufacture concrete, containing timber waste.

b) Study on Performance of Quarry Dust as fire Aggregate, M.M. Rahman, M.H. Rashid. MA Hossain, M.T.Hasan and M.K. Hasan International Journal of Engineering & Technology- This study presents the use of Quarry dust as Replacement of fine aggregate for production of concrete. The suitability of quarry dust as alternative material for sand in concrete manufacturing is studied M25 grade concrete prepared was 0 %, 20 %, 40 %, 60 %, 80 % with partial replacement of sand with quarry dust. This was followed compression,

split tensile and bending tests on cubes, cylinders and RC beams, respectively to study the strength. The Result showed that with increasing proportion of quarry dust, the strength increase to peak Valve (at 40%). The better Flexural performance of beams with quarry dust is observed, the study suggest that quarry dust has potential to provide alternative to fine aggregate.

IV. MATERIALS

Materials play a vital role in preparing any kind of concrete and mortor. Because the ultimate properties of mortor or concrete mainly depend on the properties of the materials used to prepare them. Materials used for the current work were plaster sand, waste AAC block fine aggregate, and cement, which are common materials for the preparation of any kind of mortor in general, except waste AAC fine aggregate. The following materials were used in this project:

4.1Cement

Cement is a binder, a substance used for construction that sets, hardens, and adheres to materials to bind them together. The cement used in this study is ordinary portland cement (OPC) produced by 'Ultratech Company'. The various properties of cement are also studied before using it, and these properties are mentioned in the following chapter.

4.2 Fine Aggregate / Crushed Sand (Plaster sand)

In the present day, crushed sand is a good substitute for natural sands. It is manufactured from quarried rock, by bringing down its particle size in the range of 4.75 mm to 150 microns. Crushed sand is quite different from stone dust, which is waste from stone crushers. Crushed sand has two important features: one is its gradation, and the second is its particle size. Crushed sands are successfully used for various grades of concrete, from M15 to M40, as well as in mortors.

4.3 Fine Aggregate (Waste AAC Block)

The preparation of fine aggregate from waste AAC blocks, which are gathered from construction sites, is the crucial task in the present work. We prepared fine aggregate by manual process. The properties of waste AAC block fine aggregate are determined and mentioned in the following section.

4.4 Water

The mixing water should be fresh, clean and potable. It should be free from organic matter, silt, oil, sugar, chlorides and acidic materials. The value of pH should be close to 7.0.

V. EXPERIMENTAL WORK, RESULTS AND DISCUSSION

The experimental work focused on testing the properties of the fine aggregate obtained from waste AAC blocks. Various tests were conducted to determine the gradation, particle size, and other important characteristics of the material. The results of these tests will provide valuable information on the suitability of using waste AAC block fine aggregate in motor, concrete, and other construction applications. This research aims to find sustainable solutions for utilizing construction waste and reducing the environmental impact of the construction industry. Also, the determination of the properties of other materials is necessary for further experimental work.

5.1Testing of Materials

Testing of materials such as cement, plaster sand, and waste AAC block fine aggregate will also be conducted to ensure compatibility with the waste AAC block fine aggregate. By understanding the properties of all materials involved, we can optimize the mix design for maximum strength and durability.

5.1.1 Cement

Testing will involve examining factors such as fineness, standard consistency, and compressive strength. The testing of cement was done according to the IS code for PPC, and the results are summarized below in Table 1.

Table 1: Physical properties of cement

Property	Result
Fineness	2 %
Consistency strength	32%
Compressive strength	N/mm^2
3 days	36 N/mm^2
7 days	43 N/mm^2
28 days	52.87 N/mm^2

5.1.2 Fine Aggregate

Tests on crushed sand (plaster sand) are done using IS 383:1970. In this study, we conducted various important tests such as fineness modulus, water absorption, and bulk density of fine aggregate. The same test was conducted on both crushed sand (plaster sand) and waste AAC block fine aggregate, and the results are summarized below in Table 2.

Table 2: Physical properties of Fine Aggregate

Property	Results crushed sand (plaster sand)	Results waste AAC block fine aggregate
Fineness Modulus	2.455	1.655
Water Absorption	Nil	30 % (by wt.)
Bulk Density	1.745 kg/lit	0.83 kg/lit

5.2 Testing of Specimens

Testing of specimens involved subjecting them to mechanical test to determine their strength. The specimens were prepared according to the specified dimensions and curing conditions. The test included compressive strength. The results of this test were then compared to the standard requirements to assess the quality of the specimens.

5.2.1 Compressive Strength of Cement Mortor

5.2.1.1 Proportioning of cement mortar

Normally, the preparation of cement mortar is a very simple task for everyone if we have to know the proportion of materials and water-cement ratio. In the present study, we had to see that in the case of waste AAC block fine aggregate, it has a high water absorption tendency. It will affect the water requirement for preparing a consistent cement mortar mix. Ultimately, for a given proportion of motor mix prepared by using waste AAC block fine aggregate, we have to make the correction in the water-cement ratio. For the present study, the following mix proportion was used:

Table 3: Properties of cement mortor mix

Property	Cement mortor *crushed sand (plaster sand)*	Cement mortor *waste AAC block fine aggregate*
Mix proportion	1 : 3	1 : 3
Water-cement ratio	0.60	0.60
Correction in water-cement ratio	Nil	Add extra water 30% of wt. FA

We prepared four types of test specimens for this research purpose on the basis of the amount of waste AAC block fine aggregate in the mix proportion. Test Specimens M1, M2, M3, and M4 have 0 %, 25 %, 50 %, and 100 % of waste AAC block fine aggregate of the total amount of fine aggregate in the mix proportion.

5.2.1.2 Preparation & testing of cement mortar specimens

This test is considered as one of the most important properties of concrete and it is often used as an index of the overall quality of concrete. The compressive strength of cement mortar prepared by using plaster sand and AAC block fine aggregate was determined from a cube of 100 mm and 70.7 mm in size tested in accordance with I.S. 516-1959.

Fig. 1: Proportioning, preparing and testing of specimens

There were four different kinds of specimens prepared, and their compressive strength was examined for a period of 7 days and 28 days in the current project work. Table No. 4 lists the type of specimen, its designation, and the testing age of the specimen.

Table 4: Compressive strength of Test Specimens

Specimen Designation	**Specimen Description** *(% of waste AAC FA)*	**Compressive Strength (N/mm^2)**			
		100 mm Size Mould		**70.7 mm Size Mould**	
		7 Day	***28 Day***	***7 Day***	***28 Day***
M1	0 %	7.989	12.956	10.36	12.920
M2	25 %	6.641	9.917	8.199	10.680
M3	50 %	4.277	7.161	6.345	7.939
M4	100 %	3.064	4.166	3.763	4.825

Three cubes of 100 mm and three cubes of 70.7 mm from each specimen were cured and tested for 7 days and 28 days and the average compressive strength was obtained. The results are shown in the Table 4. It seen that, the compressive strength of specimens decreased with an increase in the percentage of waste AAC fine aggregate in the mix. This trend was consistent for both the 7-day and 28-day testing periods. It is clear from the results that the use of waste AAC fine aggregate negatively impacted the compressive strength of the specimens.

VI. CONCLUSION

These findings suggest that the inclusion of waste AAC fine aggregate in the mix may not be ideal for achieving high compressive strength in concrete. From the above results, there is no doubt to say that fine aggregate prepared by using waste AAC block fine aggregate will definitely be used partially along with conventional fine aggregate for masonry work, plastering work, etc.

Further research and testing may be needed to explore ways to mitigate the negative impact of waste AAC fine aggregate on the strength of cement mortor specimens. Overall, these results highlight the importance of carefully considering the materials used in mortor or concrete mixes to ensure optimal performance and durability.

REFERENCES

[1] Vinoth Kanna, "PARTIAL REPALCEMENT OF FINE AGGREGATE BY USING TIMBER WASTE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04.

[2] Biswarparkashd Das and MahendraGattu "STUDY ON PERFORMANCE OF QUARRY DUST AS FINE AGGREGTE" International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04.

[3] Madhu. K. S. Darshan. K. b, Harshita G"REPLACEMENT OF FINE AGGREGATE BY BUILDING DEMOLISHED WASTE FOR ESTABLISHING SUSTANABLE CONCRETE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04.

[4] RajuSuram,T.Srinivas and Vegiraju Naresh kumar Varma31M. Tech Scholar, GRIET, Hyderabad, India Professor, GRIET, Hyderabad, India, AssistantProfessor, GRIET, Hyderabad, India "PLASTIC AS SUBSTITUENT MATERIAL FOR FINE AGGREGATE IN CONCRETE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04 .

[5] Ahmed SerajFraide, lecture, faculty of engineering and Taher.A.Tawfig "THE EXPLOITATION OF BLAST FURNANCE SLAG AS SAND REPLACEMENT IN CONCRETE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04.

[6] Gowhar Aziz, Ms.PayalBakshi, Rahul Chaudhary "COMPARATIVE STUDY ON NATURAL SAND AND CRUSHED STONE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04 .

[7] Akshay Lad', Nikhil Shirode, BalajiShivpuje' Prof. B.R.Waravte "AUTOCLAVED AERATED CONCRTE", International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 04.

[8] Schnitzler S. (2016), "AUTOCLAVED AERATED CONCRETE AS A GREEN BUILDING MATERIAl", UC Davis Extension, Switzerland.

[9] Reunka S M, Alagukumaran P, Mohamed wasim khan S, Sabarigirivasan A R, Vijayavendhaan P, "A REVIEW PAPER ON PARTIALLY REPLACEMENT OF FINE AGGREGATE BY CONSTRUCTION AND DEMOLITION WASTE IN PLAIN CEMENT CONCRETE"

[10] Kulbhushan K., Kumar S., Chaudhary R., Ahmad S., Gupta S., &Chaurasia R. (2018). "A CONTEXTUAL ANALYSIS OF THE ADVANTAGES BY USING LIGHTWEIGHT CONCRETE BLOCKS AS SUBSTITUTION OF BRICKS" International Research Journal of Engineering and Technology (IRJET), 5(2), 926-931.

[11] Erdog˘anÖzbay, Mustafa Erdemir, and Halil _Ibrahim Durum's,"UTILIZATION AND EFFICIENCY OF GROUND GRANULATED BLAST FURNACE SLAGON CONCRETE PROPERTIES A REVIEW". Journal of Construction and Building Materials, Vol. 105 (2016) pp.423–434.

[12] O. PAVEZ, O.RIVERA, TOLEDO, A.NAZER, "USE OF COPPER SLAG AS FINE AGGREGATE AND PARTIAL REPLACEMENT OF CEMENT".

[13] R. Veerakumar, R. Saravanakumar, "A DETAILED STUDY ON PARTIAL REPLACEMENT OF FINE AGGREGATE WITH BRICK DEBRIS".