A STUDY ON EFFECT OF SUGA RCANE ASH AND MARBLE GRANUALS IN MORTAR

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Abstract - Sugarcane ash is a by-product of sugar production. In the present age the waste generated from industries such as sugarcane ash and marble waste is the huge concern for the environment, health, and cause for land filling. Recycling of such wastes and using them in construction materials appears to be viable solution not only to the pollution problem but also the economical option in construction. Incorporation of supplementary cementitous materials in mortar is necessary for sustainability. Supplementary cementitous materials are not only sustainable but also mechanical and durability properties of mortar. In this study sugarcane bagasse ash is incorporated as replacement of cement and granular marble as a replacement of fine aggregate in mortar.

Keywords:-Sugarcane ash, natural sand, water marble granuals, compressive strength.

I. INTRODUCTION:-

Mortar is a masonry product which is matrix of Mortar. Mortar is a blend of cement, sand, fine aggregate and water. Mortar exists as an indispensable construction material in modern world. Portland cement is used primarily as binder for mortar. Production of cement poses major environmental threats. Bagasse is the fibrous residue of sugarcane after crushing and extraction of juice. In sugarcane bagasse it made up of water (about 50 percent), fiber (above 48 percent) and also some small amount of soluble solids. Mostly, bagasse produced is burnt for energy needed for sugar processing The use of sugarcane bagasse ash (SCBA) as cement replacement material to improves quality and reduce the cost of construction material such as mortar .Sugar cane bagasse ash is agricultural and industrial by-products which have pozzolanic properties. Portland cement releases the calcium hydroxide as a by-product when reacts with water. Pozzolanic materials utilize this calcium hydroxide. Thus these pozzolanic materials not only save the cement but also utilize the lime which is generated during hydration reaction and increase the mechanical and durability properties of mortar. The utilization of these supplementary materials saves the cement and decreases the pollution. The aim of this study is to compare the compressive strength of normal mortar, sugar bagasse ash, and Granuals granular marble blended mortar as a partial replacement of cement and fine aggregate.

Marble has been commonly used as a building material since the ancient times. During the cutting process about 25% the original marble mass is lost in the form of Granuals. The marble sludge was obtained in wet form as an inGranualsrial by product directly from the deposits of marble factories, which forms during the sawing, shaping and polishing processes of marble in factories region. The wet marble sludge was dried up prior to the preparation of the samples. The dried material was sieved through a 4.75 mm sieve and finally the marble Granuals was obtained to be used in the experiments as fine sand aggregate.

The use of sugarcane ash as a substitute for cement and marble Granuals for fine aggregates in Mortar mix is one option that can alleviate disposal problem and has been studied widely in recent years. Despite of the wide recent studies, there are still many unknowns with the use of sugarcane ash. Study is needed to determine the contribution of sugarcane ash and marble Granuals to the performance of hardened Mortar. There are great concerns on the strength and durability of the Mortar being produce with replacement material when used as construction materials. If it is proven that the Mortar is durable and strong, this will lead to the use of sugarcane ash and marble Granuals to replace part of the cement and fine aggregate respectively in Mortar. Finally, this study also aims to determine the most suitable mix proportion that can produce Mortar of desirable strength without compromising engineering performance and quality.

II. LITERATURE REVIEW:-

Dr.S.Sundararaman1, S.Azhagarsamy[1] –This work evaluates the performance of Sugarcane Bagasse Ash (BA) as a mineral admixture in mortar having the w/c ratio of 0.39. Mortar was produced with 5% of BA and also replaced with M-Sand for fine aggregate with 10%, 20% and 30%. Similarly the BA percentage is increase to 10% and 15% with different replacement of M-sand. The strength properties are compared with the above varying percentage and found that the mix of 10% BA and 20% M-Sand was comparably shown a better performance than the conventional mortar. [1]

Ravi Bhushan kumar, Ashraf Hussain[2] –In this study sugarcane bagasse ash, rice husk ash and marble dust are incorporated in mortar as replacement of cement. The levels of replacement of cement by sugarcane bagasse ash, rice husk ash and marble dust are 5%, 10%, 15% and 20%. The properties which are determined and compared in this study are workability, 7 days compressive strength and 28 days compressive strength. It is found in study that optimum replacement level of cement by sugarcane bagasse ash and rice husk ash is 15% and compressive strength of mortar is significantly increased. The marble dust can be incorporated as replacement of cement upto 5%.[2]

J.Ragapriyan (2015)[3] -*"Experimental Studies on Partial Replacement of Fine aggregate by using Marble Waste Powder in Mortar"* In this experimental study, the effects of using waste marble powder (WMP) as a fine material on the mechanical properties of the mortar has been investigated. For this purpose four different series of mortar mixtures were prepared by replacing the fine sand (passing 4.75 mm sieve) with waste marble at proportions of 0%, 10%, 20%, 30%, 40%, and 50% by weight. In order to determine the effect of the WMP on the workability was found from slump test. Tests for compressive strength were carried out on specimens at the age of 1, 7, 14, 28, 56 and 90 days. The split

tensile strength and bond strength tests were also carried out at the age of 28 days. The test results were compared with the results of specimen prepared after control mix. The result is that the mass which is 40% of total marble quarried has reached as high as millions of tons. From this study it was concluded that 50% replacement of cement by fly ash contribute reasonable strength along with 20% of silica fume.[3]

Prof. Dhiraj Agrawal (2014)[4] -This paper said that, *2014, "Utilization of industrial waste in construction material"* The various methodologies for the use of industrial waste products by partial replacements of cement and fine aggregates in mortar and mortar have been reviewed. Various physico-mechanical and chemical properties of the mortar and mortar incorporating different waste materials are studied in accordance with the reviewed literature and the standards. It is seen that waste materials like fly ash, rice husk ash, Paper pulp, GGBF, marble waste were used extensively and sufficient research have been done on them. The study in turn is useful for various resource persons involved in using industrial or agricultural waste material to develop sustainable construction material.[4]

Alok D. Sakalkale (2014)[5] -*October 2014 "Experimental Study on Use of Waste Marble Waste in Mortar".* This paper concludes that, Mortar is the most important component used in the construction industry throughout the world, where the fine aggregate is generally natural sand. The use of sand in construction activities results in the excessive mining. Due to unnecessary mining, natural resources are getting exhausted; results in increase in scour depth and sometimes flood possibility. Thus, it is becoming inevitable to use alternative material in mortar. Marble is one of the important materials used in the construction industry. Marble powder is produced from processing plants during the sawing and polishing of marble blocks and about 20 - 25% of the processed marble is turn into powder form. Disposal of the marble powder material from the marble industry is one of the environmental problems worldwide today. The present study is aimed at utilizing Waste marble powder construction industry itself as fine aggregate in mortar, replacing natural sand. The replacement is done partially and fully in the proportion 0%, 25%, 50% and 100% and its effect on properties of mortar were investigated.[5]

III. MATERIAL USE:-

Under this experimental investigation, following materials are using which are given as below:-

- Cement
- Sand
- Sugarcane Ash (Bagasse Ash)
- Marble Granuals

A.Cement:-

Grade: 43

Type: Ordinary Portland Cement.

Table 1 Properties of Cement

Sr.No.	Physical Properties	Value
1	Specific Gravity	3.14
2	Initial Setting Time	155
3	Final Setting Time	270
4	Final Consistency	33%

B. Aggregate:-

Aggregates are those chemically inert materials which when bonded by cement paste form mortar. Aggregates constitute the bulk of the total volume of mortar and hence they influence the strength of mortar to great extent.

1) *Fine Aggregates:* The material which passed through I.S. Sieve No. 480 (4.75mm)is termed as fine aggregates. The source for fine aggregate used is from natural river bed. The fine aggregate used which have fineness modulus of 3.1, specific gravity of 2.62.

2*) Marble Granuals:*

Table 2 Properties of Marble Granuals

Oxides	CaO	SiO2	Al2O3	Fe2O3	MgO
Oxides Present In Marble Granuals	40.45	28.35	0.42	9.7	16.25

3) Chemical properties of SBA :

Table 3 Properties Of Sugarcane Bagasse Ash

Oxide	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	LOI	SO_3	K_2O	Na_2O_3
SBA	67.81	19.41	3.85	4.03	1.11	1	0.66	1.69	0.25

IV. RESULT AND DISCUSSION:-

A. Compressive Strength For Control Mix Mortar

Table 4.A. Properties Of Sugarcane Bagasse Ash

Sr.No.	Control Mix	Average Strength N/mm2		
		7 Days	*14 Days*	*28 Days*
1	1:3	15.31	19.48	26.01

B. Compressive Strength For Replacement Of SBA & Marble Granuals For 1:3 Proportion :-

In this below tables & graphs we can see that the compressive strength after replacement of 5%,10%, 15%, 20%, 25% Sugarcane Bagasse Ash and 10%, 20%, 30%, 40%, 50% Marble Granuals.

Table No.4.B.1 : Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 5% SBA

Sr. No.	Replacement Of Material		7 Days Test	14 Days Test	28 Days Test
	SBA	*Marble Granuals*	*Comp Strength N/Mm2*	*Comp Strength N/Mm2*	*Comp Strength In N/Mm2*
1	5%	10%	18.06	23.27	27.29
		20%	15.45	23.67	27.69
		30%	17.45	23.87	28.09
		40%	16.25	24.28	29.49
		50%	16.65	24.28	28.49

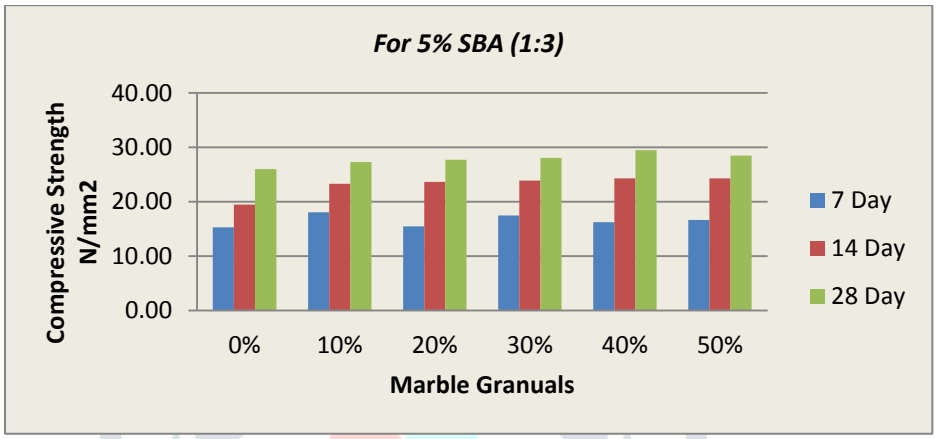

Figure 1 : Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 5% SBA

Observation:

In this graph we can see that the compressive strength after addition of 5% Sugarcane Bagasse Ash and 40%, Marble Granuals the strength is occur maximum

The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced.

Table No. 4.B.2 : Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 10% SBA

Sr. No.	Replacement Of Material		7 Days Test	14 Days Test	28 Days Test
	SBA	*Marble Granuals*	*Comp Strength N/mm2*	*Comp Strength N/mm2*	*Comp Strength In N/mm2*
2	10%	10%	15.25	23.27	27.49
		20%	15.45	23.67	27.89
		30%	16.05	24.08	28.69
		40%	16.25	24.88	29.69
		50%	15.85	24.68	28.89

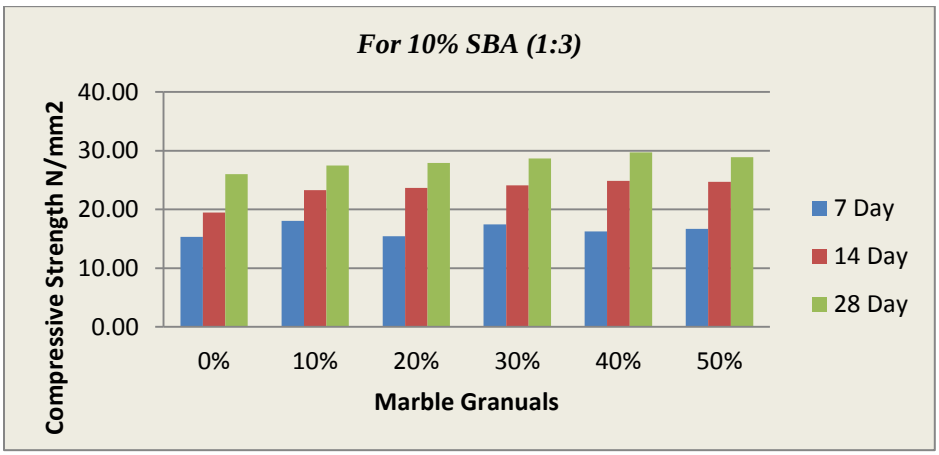

Figure 2. Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 10% SBA

Observation:

In this graph we can see that the compressive strength after addition of 10% Sugarcane Bagasse Ash and 40%, Marble Granuals the strength is occur maximum

The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced.

Table No. 4.B.3 : Comp. Strength of Mortar For Replacement Of 15% SBA

Sr. No.	Replacement Of Material		7 Days Test	14 Days Test	28 Days Test
	SBA	*Marble Granuals*	*Comp Strength N/mm2*	*Comp Strength N/mm2*	*Comp Strength In N/mm2*
3	15%	10%	17.66	23.27	26.88
		20%	17.86	23.27	27.29
		30%	18.06	24.28	27.49
		40%	18.26	24.68	28.09
		50%	18.06	24.48	27.89

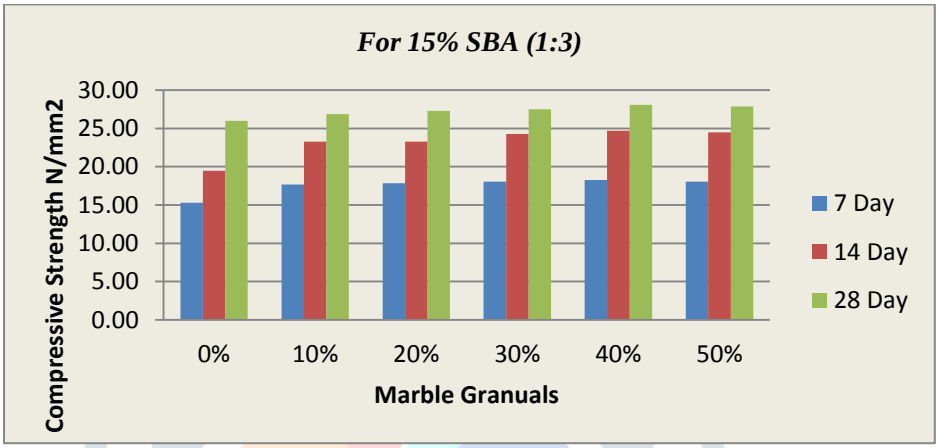

Figure 3: Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 15% SBA

Observation :

In this graph we can see that the compressive strength after addition of 15% Sugarcane Bagasse Ash and 40%, Marble Granuals the strength is occur maximum

The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced.

Table No. 4.B.4: Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 20% SBA

Sr. No.	Replacement Of Material		7 Days Test	14 Days Test	28 Days Test
	SBA	*Marble Granuals*	*Comp Strength N/mm2*	*Comp Strength N/mm2*	*Comp Strength In N/mm2*
4	20%	10%	13.44	20.87	24.48
		20%	13.24	21.27	24.88
		30%	14.24	21.67	25.48
		40%	14.24	22.27	25.68
		50%	14.04	21.47	25.28

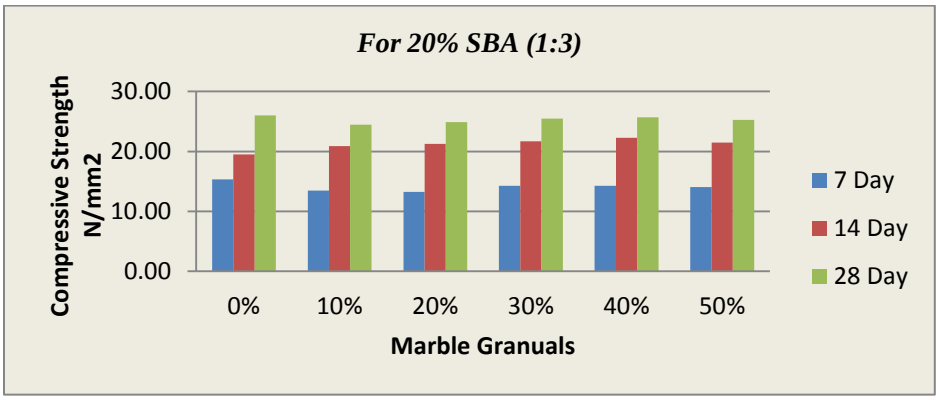

Figure 4: Comp. Strength of Mortar For1:3 Proportion After Replacement Of 20% SBA

Observation :

In this graph we can see that the compressive strength after addition of 20% Sugarcane Bagasse Ash and 40%, Marble Granuals the strength is occur maximum

The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced.

Table No. 4.B.5 : Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 25% SBA

Sr. No.	Replacement Of Material		7 Days Test	14 Days Test	28 Days Test
	SBA	*Marble Granuals*	*Comp Strength N/mm2*	*Comp Strength N/mm2*	*Comp Strength In N/mm2*
5	25%	10%	12.44	18.26	20.87
		20%	13.84	18.86	21.27
		30%	14.65	18.26	21.67
		40%	14.85	19.86	22.07
		50%	14.45	18.66	21.07

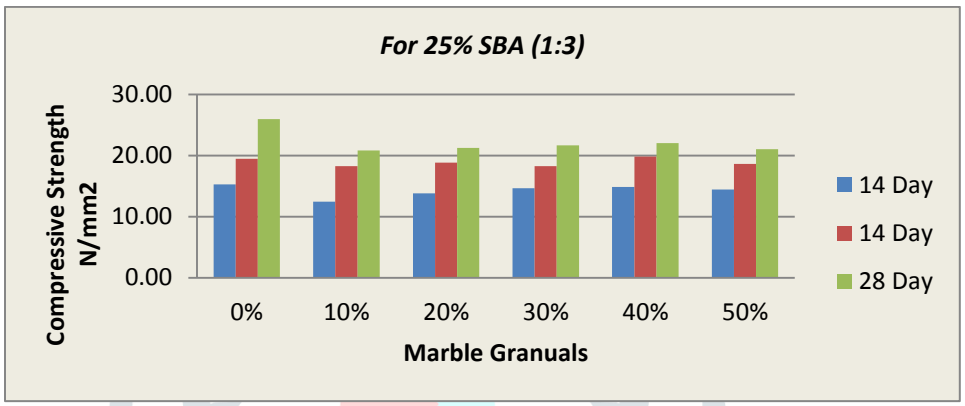

Figure 5: Comp. Strength of Mortar For 1:3 Proportion After Replacement Of 25% SBA

Observation:

In this graph we can see that the compressive strength after addition of 25% Sugarcane Bagasse Ash and 40%, Marble Granuals the strength is occur maximum

The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced.

V. CONCLUSION:-

From this present study it is observed that in this researchers used industrial wastes sugarcane bagasse ash and marble Granuals this material used in mortar with different proportion.

- **i.** The strength is increased in 10% to 40% Marble Granuals and it is maximum at 40% Marble Granuals and also more than control mix. In last mix proportion i.e. 50% Marble Granuals the strength is again reduced and The strength is increased in 5% to 15% Marble Sugarcane bagasse ash and it is maximum at 10% Sugarcane bagasse ash and also more than control mix.
- **ii.** From above result it is concluded that maximum strength of mortar is occur at 10% sugarcane Bagasse ash and 40% marble Granuals.
- **iii.** Due to marble Granuals and sugarcane bagasse ash partial replacement of fine aggregate and cement respectively gives economical product.
- **iv.** This provides us the low cost, light weight and eco-friendly construction products. The use of marble Granuals and sugarcane bagasse ash in construction might be cost effective because this waste is available free of cost.
- **v.** Used of marble Granuals and sugarcane bagasse ash in mortar will solve disposal problem of waste. Recycling of such waste materials

VI. REFERANCES:-

[1] Jayminkumar A. Patel & Dr. D. B. Raijiwala(2015),” Use of Sugar Cane Bagasse Ash as Partial Replacement ofCement in Mortar” Global Journal of Researches in Engineering: JGeneral Engineering.

[2] T. S. Abdulkadir, D. O. Oyejobi,. A. A. Lawal(2013),”Evaluation Of Sugarcanebagasse Ash As A ReplacementFor Cement In Mortar Works.”

[3] T.Subramani , M.Prabhakaran,”Experimental Study On Bagasse Ash InMortar” International Journal of Application or Innovation in Engineering & Management

[4] Dr.S.Sundararaman1, S.Azhagarsamy,” Experimental Study on Partial Replacement of Cement by Bagasse Ash and M-Sand in Mortar”International Journal of Application or Innovation in Engineering & Management (IJAIEM).

[5] Ravi Bhushan kumar, Ashraf Hussain,”A Comprehensive Study on Partial Replacement of Cement with Sugarcane Bagasse Ash, Rice Husk Ash & Marble Dust”IJSRD - International Journal for Scientific Research & Development.

[6] J.Ragapriyan , Dr. K. Sivalingam, T.Ramasamy, "Experimental Studies on Partial Replacement of Fine aggregate by using Marble Waste Powder in Mortar" ,International Journal on Applications in Civil and EnviornmentalEngineeringVolume 1: Issue 2: February 2015,

[7] Rishi, Dr. VanitaAggarwal, "Effect on Partial Replacement of Fine Aggregate and Cement by Waste Marble Powder/ Granules on Flexural and Split Tensile Strength" ,IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),p-ISSN: 2320-334X, Volume 11, Issue 4 Ver. II (Jul- Aug. 2014),

[8] Animesh Mishra, Abhishek Pandey, PrateekMaheshwari, "Green Cement For Sustainable Mortar Using Marble Dust" , International Journal of ChemTech Research CODEN(USA): IJCRGG ISSN : 0974-4290 Vol.5, No.2, pp 616-622, April-June 2013

[9] Noha M. Soliman, "Effect of using Marble Powder in Mortar Mixes on the Behavior and Strength of R.C. Slabs" , International Journal of Current Engineering and Technology ISSN 2277 – 4106, Vol.3, No.5 (December 2013)

[10] V. M. Shelke, "Effect of marble powder with and without silica fume on mechanical properties of mortar", IOSR Journal of Mechanical and Civil Engineering (IOSRJMCE) ISSN:2278-1684 Volume 1, Issue 1 (May-June 2012), PP 40-4.

[11] ABRAR AWOL, "Using Marble Waste Powder In Cement And Mortar Production" , March 2011

[12] M. ShahulHameed and A. S. S. Sekar, "Properties Of Green Mortar Containing Quarry Rock Dust And Marble Sludge Powder As Fine Aggregate" , ARPN Journal of Engineering and Applied Sciences, VOL. 4, NO. 4, JUNE 2009

[13] Aalok D. Sakalkale, G. D. Dhawale, R. S. Kedar, "Experimental Study on Use of Waste Marble Waste in Mortar".Mr. Aalok D. Sakalkale Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 4, Issue 10(Part- 6), October 2014,

[14] RitzawatybintiMohamadShukeri and A. Naser Abdul Ghani, "mortar mix with wastepaper" 2nd international conference on built environment in developing countries (ICBEDC 2008)

[15] Prof.Veena G. Pathan, Prof. Md. GulfamPathan,"Feasibility and Need of use of Waste Marble Powder in Mortar Production"IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 23-26. *(ICAET-2014)*

[16] Ms. Monica C. Dhoka , "Green Mortar: Using Industrial Waste of Marble Powder, Quarry Dust and Paper Pulp" International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org Volume 2 Issue 10‖ October 2013 ‖ PP.67-70

[17] IS: 383-1970, Specification for Coarse and Fine Aggregate from Natural Sources for Mortar, Bureau of Indian Standards, New Delhi.