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Assessing the Usage of Barytes Powder and Cuddapah Stone Dust as Supplementary Cementitious Materials in Concrete of Grade M30 and M35

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Abstract: ***This research studied the effects of using Barytes powder and Cuddapah stone waste as substitutes for cement in M30 and M35 grade concrete using OPC. Cement production is known to harm the environment and consume a lot of energy, making the search for alternative materials to replace cement in concrete important.In this study, different amounts of Barytes powder and Cuddapah stone waste were added to concrete mixes as partial replacements for cement. The resulting concrete was tested for compressive strength and compared to normal concrete. The experiment involved making concrete samples with varying percentages of cement replacement, ranging from 0% to 50%, using Barytes powder, Cuddapah stone waste and Combination. The samples underwent standard curing and testing according to Indian standards.The research analysed the results to find the optimum percentage of cement replacement that provided satisfactory mechanical properties. This study determined the feasibility and effectiveness of using Barytes powder and Cuddapah stone waste as partial replacements for cement in concrete production.***

Keywords: Concrete materials-Cement-Supplementary Cementious Materials-Cuddapah stone Polishing waste, Barytes stone powder-cube casting- Determination of Compressive strength-Optimum dosage-study

I. INTRODUCTION

Concrete is one of the oldest and the most widely used construction material in today's world. It is easily obtainable, relatively cheap, strong, and durable. On the other hand, the concrete industry is one of the major consumers of the natural resources. The annual concrete production 11 billion metric tons, of which 70-75% are made up of aggregates (mostly natural rock),15% are water, and 10-15% are cementitious binder. Globalisation, privatization, liberalization, and the development of important infrastructure projects have all contributed to the rise in demand for aggregates.

An ecological imbalance has resulted from increased extraction due to the increased demand for natural aggregates' response, scientists and engineers have looked for fine aggregate substitutes in building. Innovative solutions such as filtered sand, robot silica or sand, treated and sieved silt removed from reservoirs and dams, and sand from other water bodies are among the proposals. The search for substitute materials highlights the importance of both assuring local availability in significant quantities and satisfying the technical specifications of fine aggregates, particularly considering the current need for sustainable infrastructure expansion. This strategy is in line with the main objective of sustainable development, which is to lessen the negative environmental effects of building projects while preserving resources for future generations.

II. SCOPE OF THE STUDY

This study focuses on the environmental impacts of concrete production, with a particular emphasis on substitution materials for cement, the primary binder, which is a significant contributor to CO2 emissions. Barytes stone powder, Cuddapah slab polishing waste powder is used as substitue to cement (ordinary portland cement) in making concrete of Grades M30 and M35. The basic tests on materials were condcted, Conrete Mix Design done as per IS: 10262:2019 and cubes were casted and tested for 07 days and 28 days compressive strength. Futher The optimum dosage in usage of the materials considered as supplementary cementitious is found.

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III. OBJECTIVES OF RESEARCH

1) To examine the suitability of barytes powder and Cuddapah stone dust as Supplementary Cementious material.
2) To design M30 and M35 grades of concrete with OPC and replacing cement with Barytes powder and Cuddapah stone dust as partial replacement
3) To find out the combined optimum dosage of Baryte powder and Cuddapah stone dust for partial replacement of OPC for Grade M30 and M35

IV. MATERIALS USED

Cement-OPC 53 Grade(Zuari Brand), Sand: Papagni River, Aggregate: 20mm and 12mm (crushed Granite,), Water: R.O Plant, Water Reducing Agent: Roof plast PC455

V. MATERIAL TESTS RESULTS

Sr.	Name of the test	Observed Test Value	IS CODE reference
Cement(OPC 53 Grade)			
1	Normal consistency test	28.00%	IS 269:2015; IS 4031:1988
2	Initial setting time test	90 minutes	
3	Final setting time test	310 minutes	
4	Specific gravity test	3.15	
5	Fineness test	5%	
coarse Aggregate: 20mm			
6	Sieve Analysis test	Confirming to Table 7	IS383:2016
7	Specific Gravity test	2.73	IS2386: Part I and 3 1986, IS :2430-1986
8	Water Absorption test	0.10%	
9	Bulk density test	1.753 Kg/Litre	
coarse Aggregate: 12mm			
10	Sieve Analysis test	Confirming to Table 7	IS383:2016
11	Specific Gravity test	2.67	IS2386: Part I and 3 1986, IS :2430-1986
12	Water Absorption test	0.2%	
13	Bulk density test	1.76 Kg/Litre	
Fine Aggregate Sand			
14	Sieve Analysis test	Confirming to Table 9, classified as zone	IS383:2016
15	Specific Gravity test	2.64	IS2386: Part I and 3 1986, IS :2430-1986
16	Water Absorption test	2.04%	
17	Bulk density test	1.64 Kg/Litre	
18	Fineness Modulus test	2.9	
19	silt content test	1%	
20	Bulking of sand test	8.3%	
Water			
21	pH	7	pH strips
22	TDS	30ppm	TDS meter
Admixture (WRA_ROOF PLAT PC455)			
23	Specific gravity of Admixture used	1.08	Density bottle method

Table 1. Summary of tests results

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VI. METHODOLOGY

A. *Experimental Program*

The aim of the experiment was to assess the compressive strength of concrete made with partial replacement of cement with cuddapah slab polishing waste, barytes and its combination for 10%, 20%, 30%, 40% and 50% replacement of cement apart from other raw materials for M30 and M35 Grade of concrete. Initially raw materials procured and tested to determine various properties for analysis and Mix Design of concrete purpose. Further Design mix of concrete is done as per IS: 10262-2019 and cubes casted as per trial mix data, cured for 7 days and 28 days. The compressive strength of cubes consists of variable portion of cement with Cuddapah slab polishing waste, lime stone and its combination is determined and analysed. A total of 128 cubes were casted. Based on the analysis of results regarding compressive strength, the optimum dosage of material used as substitute to cement is arrived.

ID No.	COMBINATION DETAILS	NO. OF SAMPLE CUBES CASTED	
		7 DAYS	28 DAYS
M30NC	Grade M30, Normal Conrete	2	2
M35NC	Grade M35, Normal Conrete	2	2
M30B10	Grade M30, Cement replaced with Barytes Powder by 10% by weight	2	2
M30B20	Grade M30, Cement replaced with Barytes Powder by 20% by weight	2	2
M30B30	Grade M30, Cement replaced with Barytes Powder by 30% by weight	2	2
M30B40	Grade M30, Cement replaced with Barytes Powder by 40% by weight	2	2
M30B50	Grade M30, Cement replaced with Barytes Powder by 50% by weight	2	2
M35B10	Grade M35, Cement replaced with Barytes Powder by 10% by weight	2	2
M35B20	Grade M35, Cement replaced with Barytes Powder by 20% by weight	2	2
M35B30	Grade M35, Cement replaced with Barytes Powder by 30% by weight	2	2
M35B40	Grade M35, Cement replaced with Barytes Powder by 40% by weight	2	2
M35B50	Grade M35, Cement replaced with Barytes Powder by 50% by weight	2	2
M30L10	Grade M30, Cement replaced with Cuddapah slab waste powder by 10% by weight	2	2
M30L20	Grade M30, Cement replaced with Cuddapah slab waste powder by 20% by weight	2	2
M30L30	Grade M30, Cement replaced with Cuddapah slab waste powder by 30% by weight	2	2
M30L40	Grade M30, Cement replaced with Cuddapah slab waste powder by 40% by weight	2	2
M30L50	Grade M30, Cement replaced with Cuddapah slab waste powder by 50% by weight	2	2
M35L10	Grade M35, Cement replaced with Cuddapah slab waste powder by 10% by weight	2	2
M35L20	Grade M35, Cement replaced with Cuddapah slab waste powder by 20% by weight	2	2
M35L30	Grade M35, Cement replaced with Cuddapah slab waste powder by 30% by weight	2	2
M35L40	Grade M35, Cement replaced with Cuddapah slab waste powder by 40% by weight	2	2
M35L50	Grade M35, Cement replaced with Cuddapah slab waste powder by 50% by weight	2	2
M30BL10	Grade M30, Cement replaced with Barytes and Cuddapah slab waste powder by 10% by weight	2	2
M30BL20	Grade M30, Cement replaced with Barytes and Cuddapah slab waste powder by 20% by weight	2	2
M30BL30	Grade M30, Cement replaced with Barytes and Cuddapah slab waste powder by 30% by weight	2	2
M30BL40	Grade M30, Cement replaced with Barytes and Cuddapah slab waste powder by 40% by weight	2	2
M30BL50	Grade M30, Cement replaced with Barytes and Cuddapah slab waste powder by 50% by weight	2	2
M35BL10	Grade M35, Cement replaced with Barytes and Cuddapah slab waste powder by 10% by weight	2	2
M35BL20	Grade M35, Cement replaced with Barytes and Cuddapah slab waste powder by 20% by weight	2	2
M35BL30	Grade M35, Cement replaced with Barytes and Cuddapah slab waste powder by 30% by weight	2	2
M35BL40	Grade M35, Cement replaced with Barytes and Cuddapah slab waste powder by 40% by weight	2	2
M35BL50	Grade M35, Cement replaced with Barytes and Cuddapah slab waste powder by 50% by weight	2	2
		64	64
		128 NO.'S	

Table 2: Details of sample cubes casted

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B. Trial Mix Data

M30Trial Mix Data (per cubic metre)
Cement = 369.19 Kg
Water = 177.21 Kg
Coarse aggregate = 1178.33 Kg;
20 mm@70% = 1178.33* 0.7=824.83 Kg,
12mm@30 % = 1178.33*0.3=353.5 Kg
Fine aggregate = 686.6 Kg
Mass of admixture= 4.10 Kg

M35 Trial Mix Data (per cubic metre)
Cement = 393.81 Kg
Water = 177.21 Kg
Coarse aggregate = 1175.89 Kg;
20 mm@70% = 1175.89*0.7=823.123Kg,
12mm@30 % = 1175.89*0.3=352.76 Kg
Fine aggregate = 667.83 Kg
Mass of admixture= 4.30 Kg

VII. RESULTS AND DISCUSSIONS

ID No.	Percentage of Cement Replacement%	Date of Casting	7 days					
			Date of testing	Sample 1		Sample 2		Average Compressive Strength (N/sq.mm)
				Load at Failure(P), KN	Compressive Strength (N/sq.mm)	Load at Failure(P), KN	Compressive Strength (N/sq.mm)	
M30NC	0	25/4/2024	2/5/2024	550	24.44	560	24.89	24.67
M35NC	0	25/4/2024	2/5/2024	585	26	595	26.44	26.22
M30B10	10	25/4/2024	2/5/2024	500	22.22	510	22.67	22.45
M30B20	20	25/4/2024	2/5/2024	330	14.67	350	15.56	15.12
M30B30	30	25/4/2024	2/5/2024	300	13.33	320	14.22	13.78
M30B40	40	26/4/2024	3/5/2024	250	11.11	200	8.89	10
M30B50	50	26/4/2024	3/5/2024	0	0	0	0	0
M35B10	10	26/4/2024	3/5/2024	510	22.67	520	23.11	22.89
M35B20	20	26/4/2024	3/5/2024	375	16.67	390	17.33	17
M35B30	30	26/4/2024	3/5/2024	300	13.33	330	14.67	14
M35B40	40	27/4/2024	4/5/2024	300	13.33	300	13.33	13.33
M35B50	50	27/4/2024	4/5/2024	0	0		0	0
M30L10	10	27/4/2024	4/5/2024	545	24.22	540	24	24.11
M30L20	20	27/4/2024	4/5/2024	500	22.22	520	23.11	22.67
M30L30	30	27/4/2024	4/5/2024	440	19.56	470	20.89	20.23
M30L40	40	3/5/2024	10/5/2024	350	15.56	320	14.22	14.89
M30L50	50	3/5/2024	10/5/2024	300	13.33	330	14.67	14
M35L10	10	3/5/2024	10/5/2024	580	25.78	600	26.67	26.23
M35L20	20	3/5/2024	10/5/2024	550	24.44	560	24.89	24.67
M35L30	30	3/5/2024	10/5/2024	500	22.22	480	21.33	21.78
M35L40	40	20/05/2024	27/05/2024	400	17.78	380	16.89	17.34
M35L50	50	20/05/2024	27/05/2024	300	13.33	350	15.56	14.45

Table 3: 7 Days Compressive strength Details

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ID No.	Percentage of Cement Replacement%	28 days					
		Date of testing	Sample 1		Sample 2		Average Compressive Strength (N/sq.mm)
			Load at Failure (P), KN	Compressive Strength (N/sq.mm)	Load at Failure (P), KN	Compressive Strength (N/sq.mm)	
M30NC	0	23/5/2024	865	38.44	870	38.67	38.56
M35NC	0	23/5/2024	930	41.33	925	41.11	41.22
M30B10	10	23/5/2024	850	37.78	810	36	36.89
M30B20	20	23/5/2024	650	28.89	640	28.44	28.67
M30B30	30	23/5/2024	600	26.67	600	26.67	26.67
M30B40	40	24/05/2024	400	17.78	420	18.67	18.23
M30B50	50	24/05/2024	0	0	0	0	0
M35B10	10	24/05/2024	840	37.33	820	36.44	36.89
M35B20	20	24/05/2024	660	29.33	700	31.11	30.22
M35B30	30	24/05/2024	650	28.89	600	26.67	27.78
M35B40	40	25/05/2024	450	20	440	19.56	19.78
M35B50	50	25/05/2024	0	0	0	0	0
M30L10	10	25/05/2024	800	35.56	820	36.44	36
M30L20	20	25/05/2024	770	34.22	750	33.33	33.78
M30L30	30	25/05/2024	650	28.89	600	26.67	27.78
M30L40	40	31/05/2024	640	28.44	585	26	27.22
M30L50	50	31/05/2024	550	24.44	530	23.56	24
M35L10	10	31/05/2024	820	36.44	840	37.33	36.89
M35L20	20	31/05/2024	800	35.56	805	35.78	35.67
M35L30	30	31/05/2024	740	32.89	755	33.56	33.23
M35L40	40	17/05/2024	700	31.11	620	27.56	29.34
M35L50	50	17/05/2024	545	24.22	560	24.89	24.56
M30BL10	10	17/05/2024	820	36.44	820	36.44	36.44
M30BL20	20	17/05/2024	810	36	760	33.78	34.89
M30BL30	30	17/05/2024	650	28.89	600	26.67	27.78
M30BL40	40	8/7/2024	450	20	400	17.78	18.89
M30BL50	50	8/7/2024	300	13.33	320	14.22	13.78
M35BL10	10	8/7/2024	840	37.33	815	36.22	36.78
M35BL20	20	8/7/2024	715	31.78	715	31.78	31.78
M35BL30	30	8/7/2024	500	22.22	470	20.89	21.56
M35BL40	40	15/7/2024	410	18.22	420	18.67	18.45
M35BL50	50	15/7/2024	385	17.11	360	16	16.56

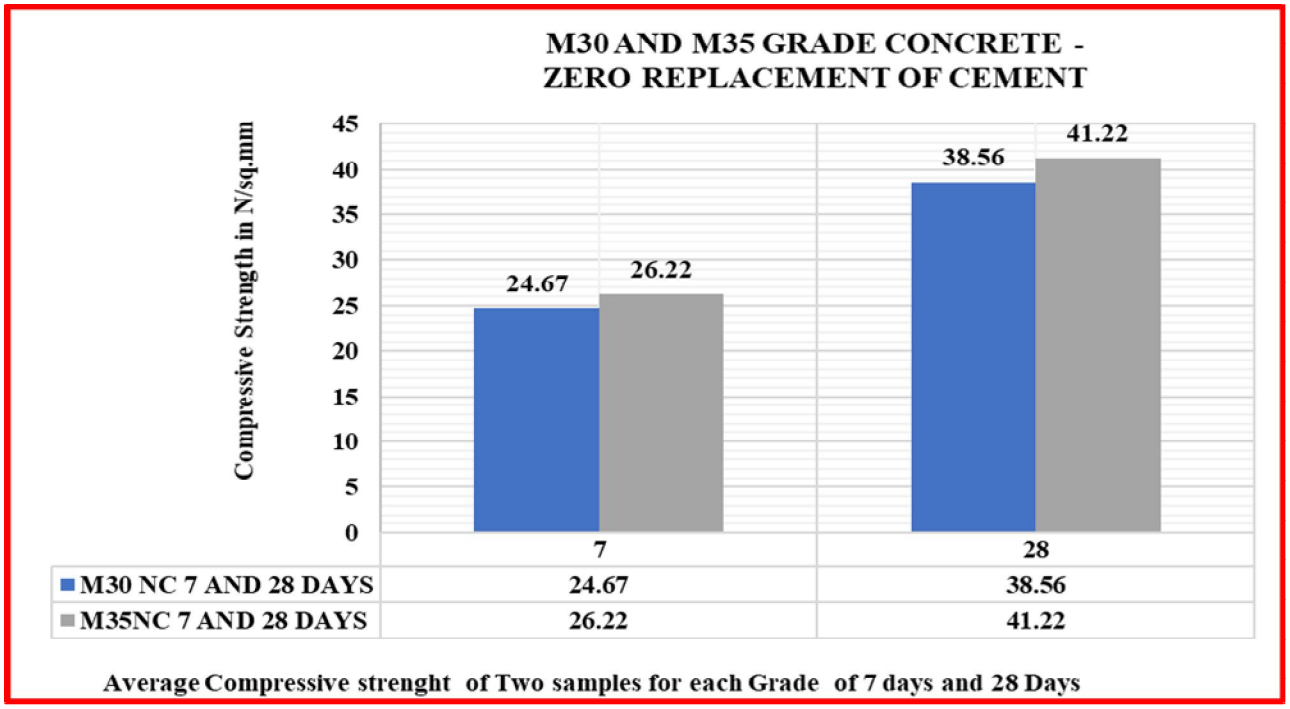
Table 4: 28 Days Compressive strength Details

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A. Graphical Analysis of Results and Inferences Drawn

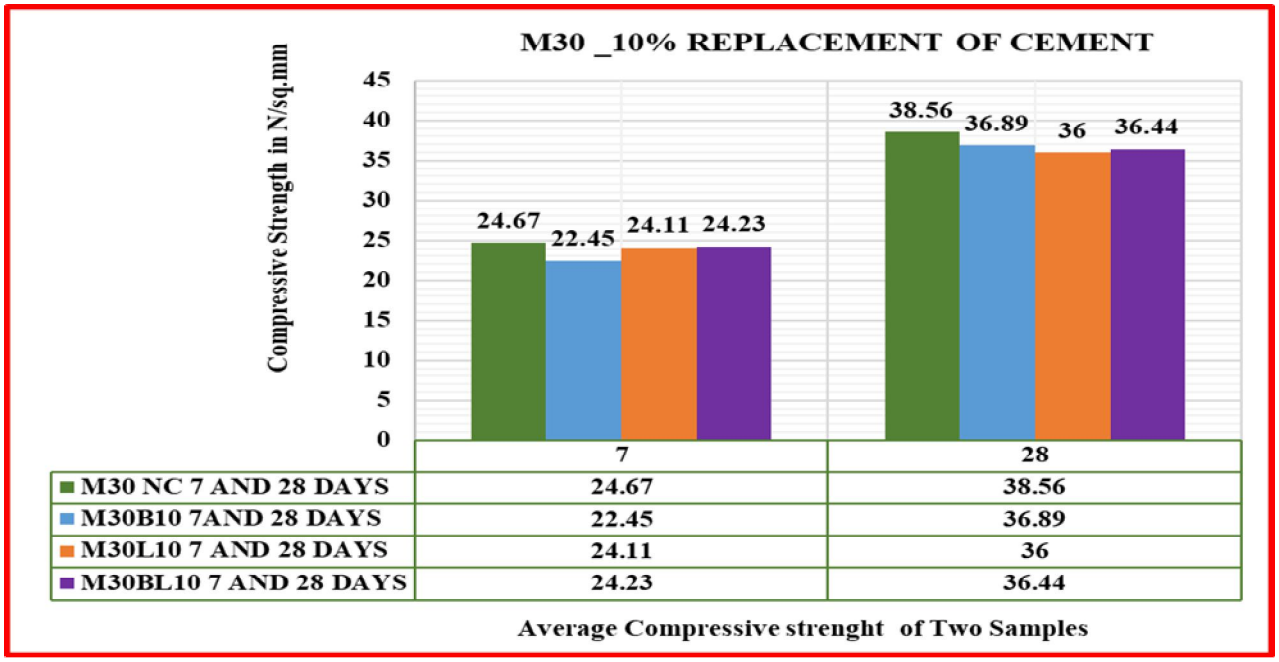
Consists of the graphical analysis of the results obtained and discussions pertaining to compressive strength variation upon cement replacement.



GRAPH 1-Compressive Strength of Normal Concrete of M30 and M35

Inferences drawn

From the above chart, it can be seen that the 28-day strength - M30 and M35 grades of the tested concrete cube for normal concrete are **38.56 N/mm2 and 41.22 N/mm2**, meeting the target average strength level



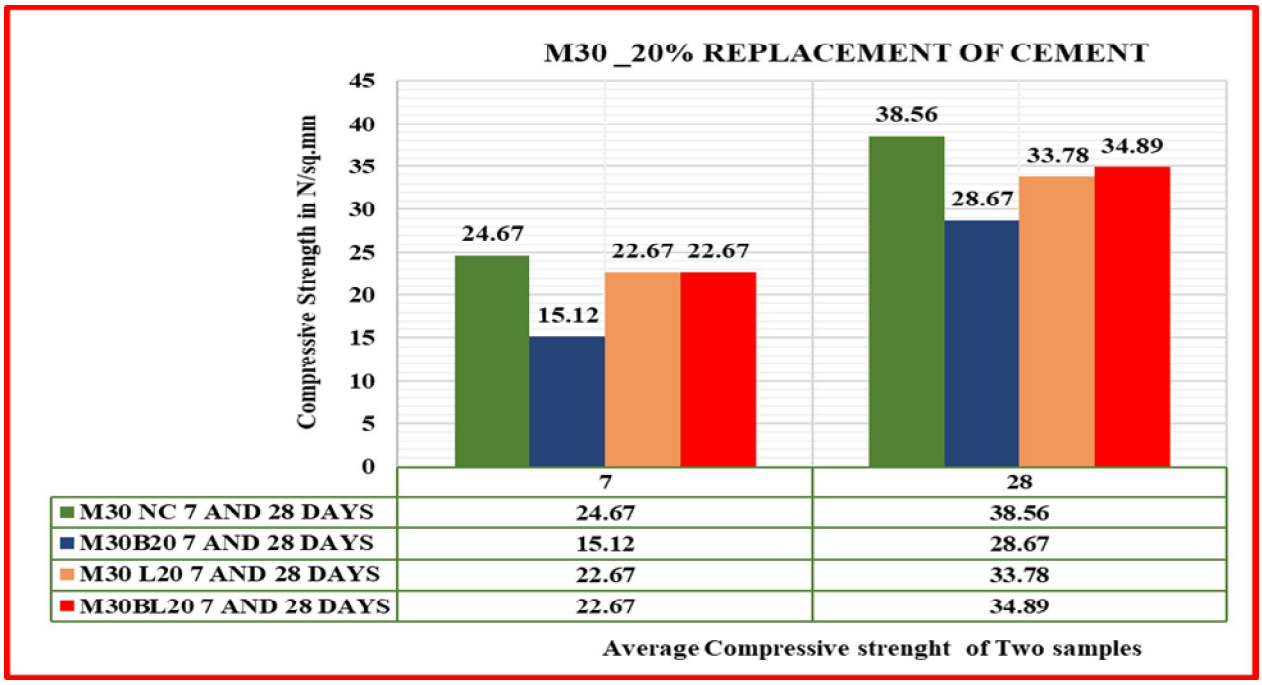
GRAPH 2- Analysis of Compressive strength of M30 Grade concrete-with 10% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

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Inferences Drawn

% of strength gained Vs Strength of Normal M30 Grade			
ID No.	M30B10	M30L10	M30BL10
7 days	91.00	93.11	98.22
28 days	95.67	93.36	94.50

- From the above graph it is seen that on 10 % cement Replacement with Barytes which results 28 days strength as **95.67%** against Targeted Mean Strength of Normal concrete of M30 Grade
- From the above graph it is seen that on 10 % cement Replacement with Limestone which results 28 days strength as **93.36%** against Targeted Mean Strength of Normal concrete of M30 Grade
- From the above graph it is seen that on 10 % cement Replacement with Combination which results 28 days strength as **94.50 %** against Targeted Mean Strength of Normal concrete of M30 Grade



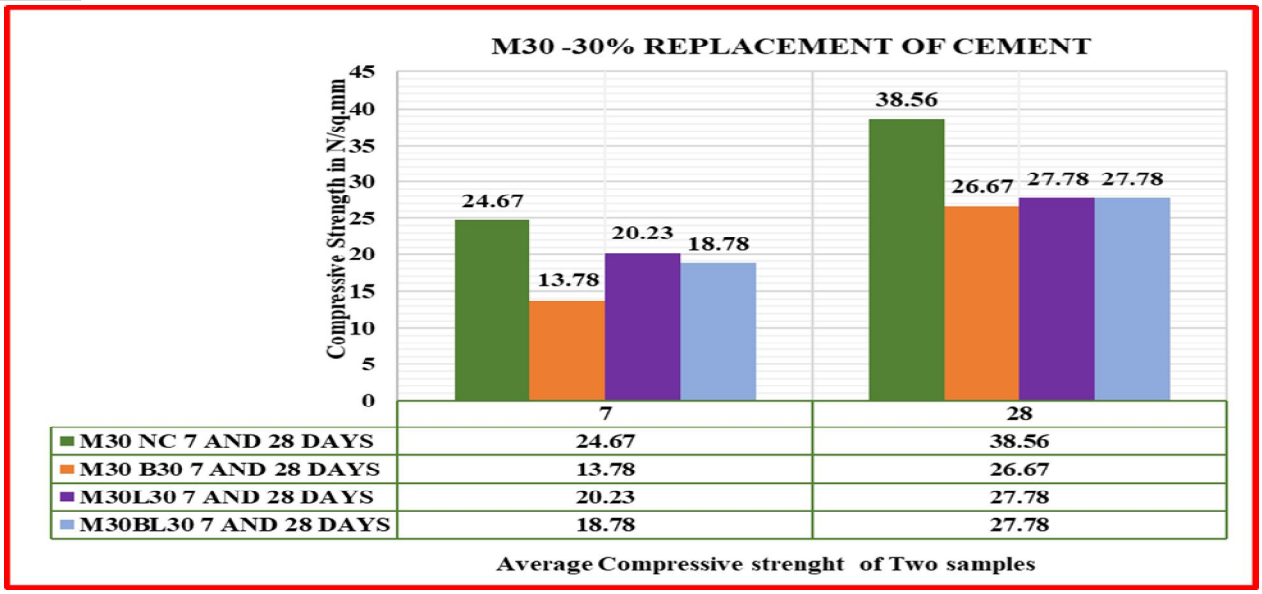
GRAPH 3 Analysis of Compressive strength of M30 Grade concrete with 20% cement replacement 1) Barytes 2) Cuddapah stone polished waste 3) Combination

Inferences drawn

% of strength gained Vs Strength of Normal M30 Grade			
ID No.	M30B20	M30L20	M30BL20
7 days	61.29	94.03	91.89
28 days	74.35	87.60	90.48

- From the above graph it is seen that on 20% cement Replacement with Barytes which results 28 days strength as 74.35% against Targeted Mean Strength of Normal concrete of M30 Grade
- From the above graph it is seen that on 20% cement Replacement with Limestone which results 28 days strength as 87.6% against Targeted Mean Strength of Normal concrete of M30 Grade
- From the above graph it is seen that on 20% cement Replacement with Combination which results 28 days strength as 90.48 % against Targeted Mean Strength of Normal concrete of M30 Grade

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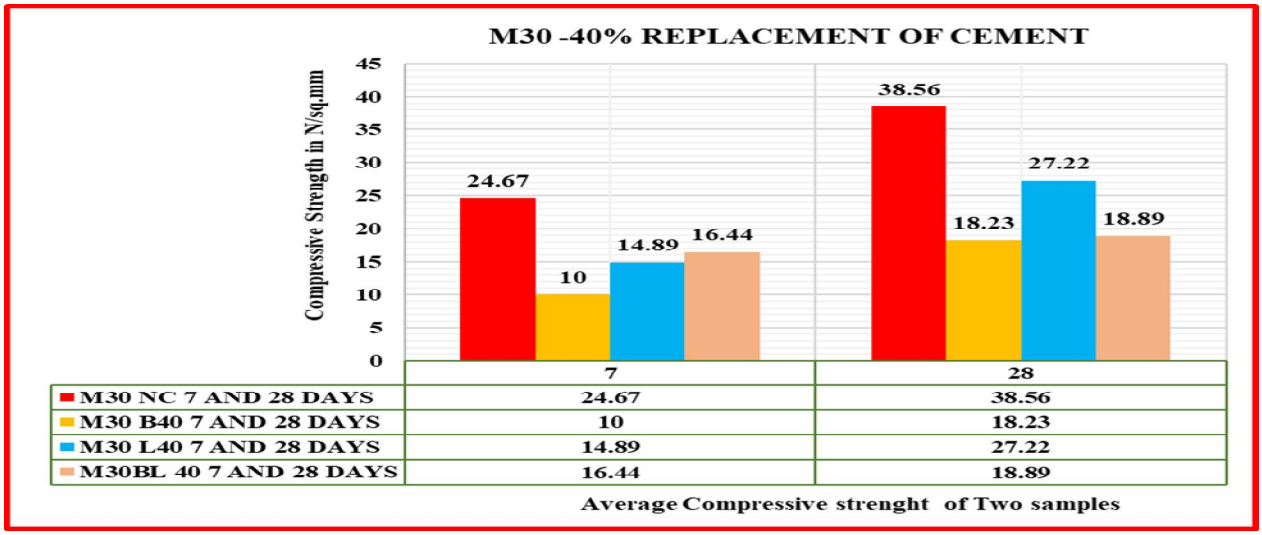


GRAPH 4 - Analysis of Compressive strength of M30 Grade concrete-with 30% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M30 Grade			
ID No.	M30B30	M30L30	M30BL30
7 days	55.86	83.91	76.12
28 days	69.16	72.04	72.04

- From the above graph it is seen that on 30% cement Replacement with Barytes which results 28 days strength as 69.16% against Targeted Mean Strength of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 30% cement Replacement with Limestone which results 28 days strength as 72.04% against Targeted Mean Strength of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 30% cement Replacement with Combination which results 28 days strength as 72.04% against Targeted Mean Strength of Normal concrete of M30 Grade concrete

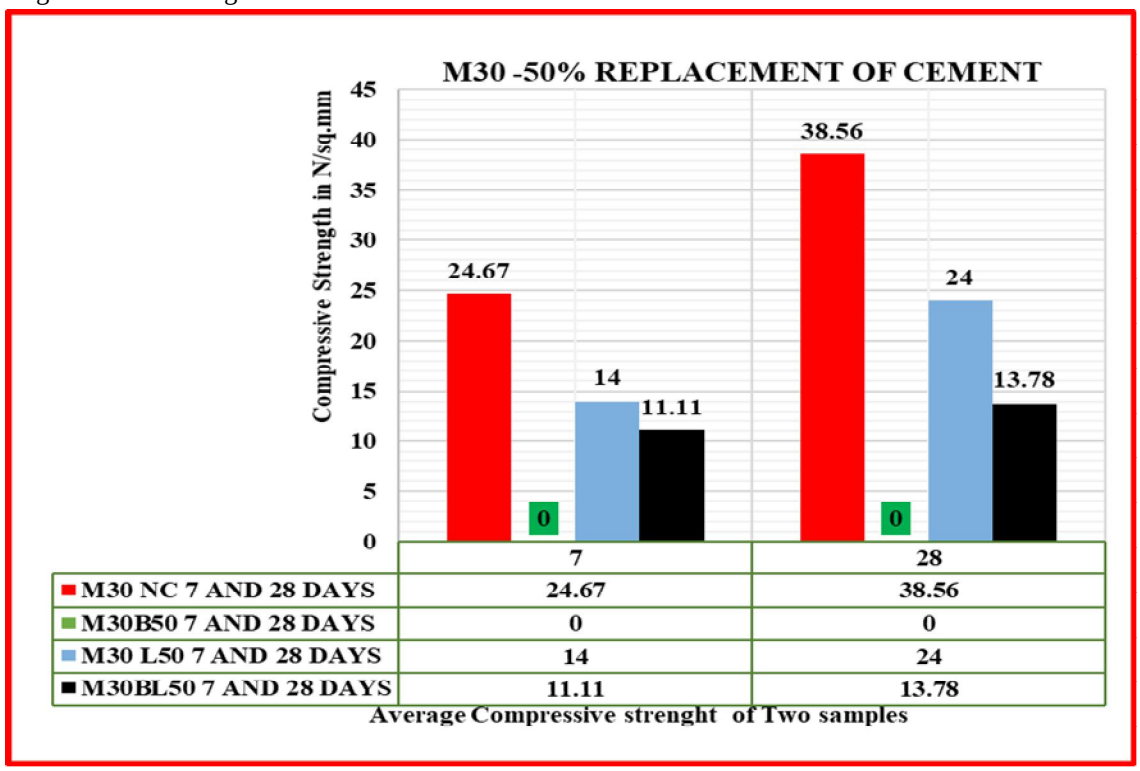


GRAPH 5- Analysis of Compressive strength of M30 Grade concrete-with 40% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M30 Grade			
ID No.	M30B40	M30L40	M30BL40
7 days	40.54	61.76	66.64
28 days	47.28	70.59	48.99

- From the above graph it is seen that on 40% cement Replacement with Barytes which results 28 days strength as 47.28% against Targeted Mean Strength of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 40% cement Replacement with Limestone which results 28 days strength as 70.59% against Targeted Mean Strength of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 40% cement Replacement with Combination which results 28 days strength as 48.99 % against Targeted Mean Strength of Normal concrete of M30 Grade concrete



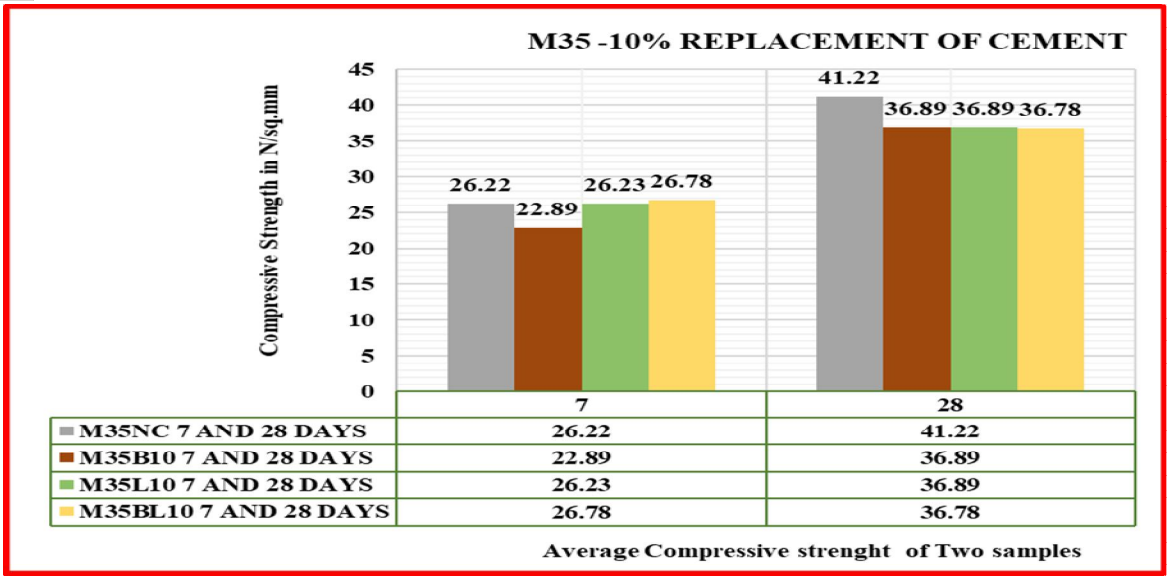
GRAPH 6- Analysis of Compressive strength of M30 Grade concrete-with 50% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3)Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M30 Grade			
ID No.	M30B50	M30L50	M30BL50
7 days	0.00	58.07	45.03
28 days	0.00	62.24	35.74

- From the above graph it is seen that on 50% cement Replacement with Barytes which results 28 days strength as 0.00% against Targeted Mean Strength of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 50% cement Replacement with Limestone which results 28 days strength as 62.24% against Targeted Mean Strenght of Normal concrete of M30 Grade concrete
- From the above graph it is seen that on 50% cement Replacement with Combination which results 28 days strength as 35.74 % against Targeted Mean Strength of Normal concrete of M30 Grade concrete

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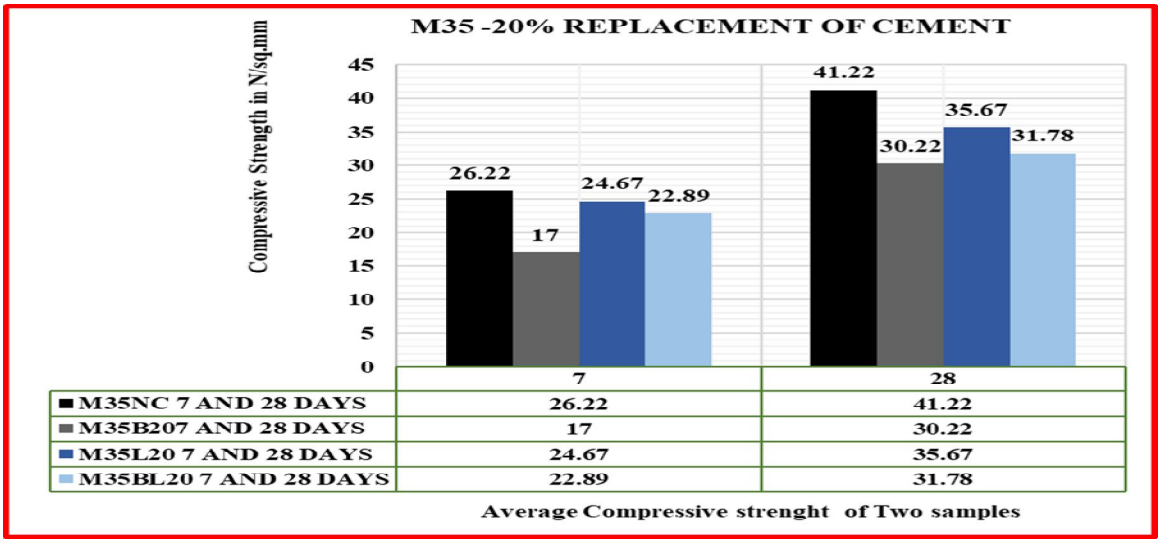


GRAPH 7- Analysis of Compressive strength of M35 Grade concrete-with 10% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3)Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M35 Grade			
ID No.	M35B10	M35L10	M35BL10
7 days	87.30	100.04	102.14
28 days	89.50	89.50	89.23

- From the above graph it is seen that on 10% cement Replacement with Barytes which results 28 days strength as 89.50 against Targeted Mean Strenght of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 10% cement Replacement with Limestone which results 28 days strength as 89.50 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 10% cement Replacement with Combination which results 28 days strength as 89.23 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete

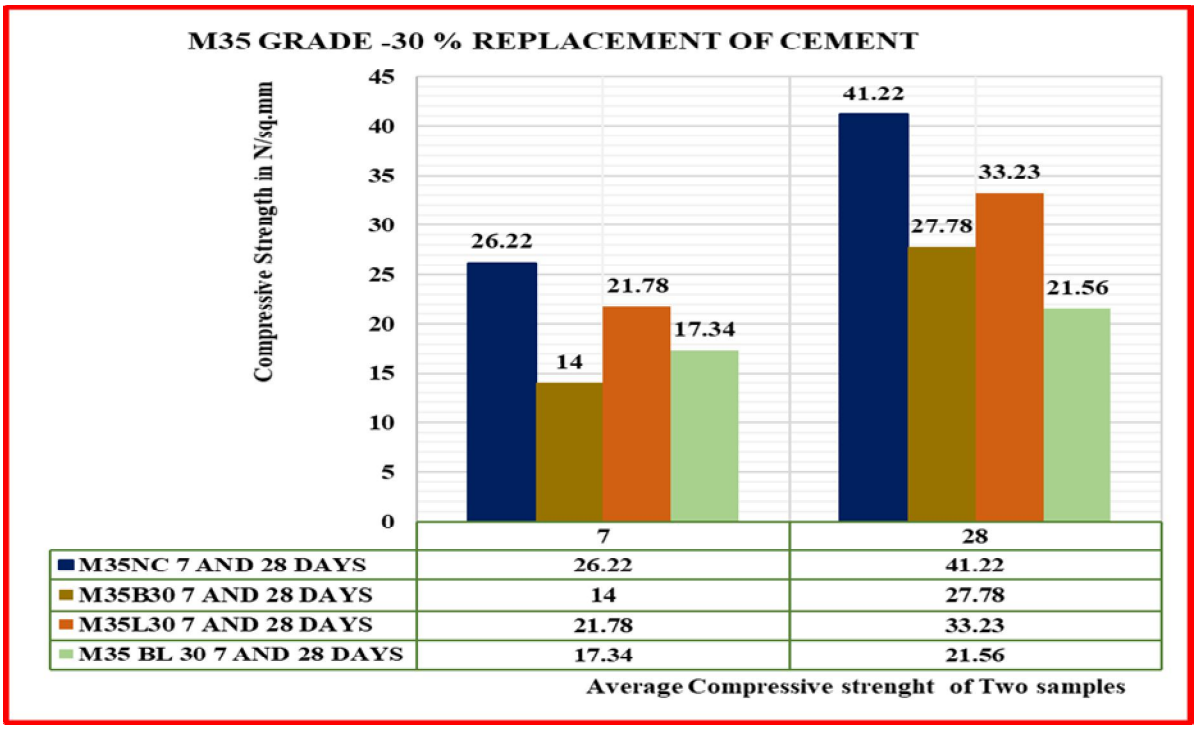


GRAPH 8 -Analysis of Compressive strength of M35 Grade concrete-with 20% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3)Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M35 Grade			
ID No.	M35B20	M35L20	M35BL20
7 days	64.84	94.09	87.30
28 days	73.31	86.54	77.10

- From the above graph it is seen that on 20% cement Replacement with Barytes which results 28 days strength as 73.31 against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 20% cement Replacement with Limestone which results 28 days strength as 86.54 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 20% cement Replacement with Combination which results 28 days strength as 77.10 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete



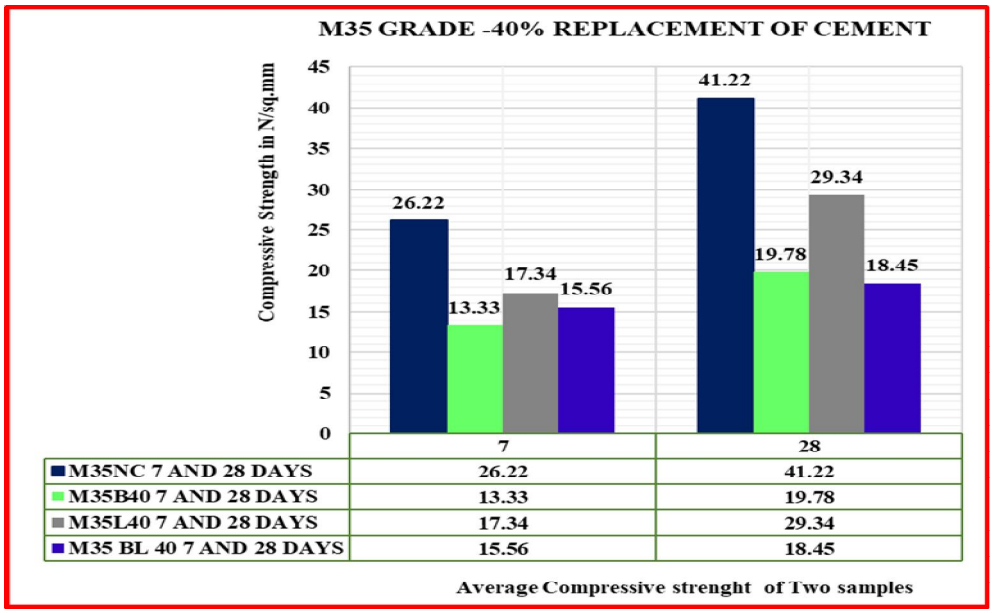
GRAPH 9Analysis of Compressive strength of M35 Grade concrete-with 30% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M35 Grade			
ID No.	M35B30	M35L30	M35BL30
7 days	53.39	83.07	66.13
28 days	67.32	80.62	52.30

- From the above graph it is seen that on 30% cement Replacement with Barytes which results 28 days strength as 67.32 against Targeted Mean Strenght of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 30% cement Replacement with Limestone which results 28 days strength as 80.62 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 30% cement Replacement with Combination which results 28 days strength as 52.30 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete

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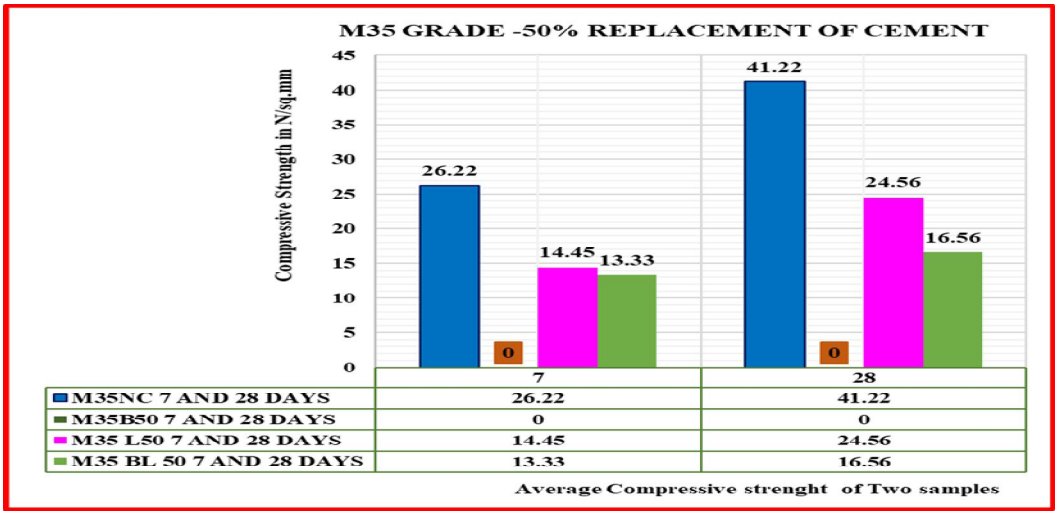


GRAPH 1- Analysis of Compressive strength of M35 Grade concrete-with 40% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M35 Grade			
ID No.	M35B40	M35L40	M35BL40
7 days	50.84	66.13	59.34
28 days	47.99	71.18	44.76

- From the above graph it is seen that on 40% cement Replacement with Barytes which results 28 days strength as 47.99 against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 40% cement Replacement with Limestone which results 28 days strength as 71.18 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 40% cement Replacement with Combination which results 28 days strength as 44.76 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete



GRAPH 11- Analysis of Compressive strength of M35 Grade concrete-with 50% Cement Replacement 1) Barytes 2) Cuddapah Stone polished waste 3) Combination

Inferences Drawn

% of strength gained Vs Strength of Normal M35 Grade			
ID No.	M35B50	M35L50	M35BL50
7 days	0.00	55.11	50.84
28 days	0.00	59.58	40.17

- From the above graph it is seen that on 50% cement Replacement with Barytes which results 28 days strength as 0.00 against Targeted Mean Strenght of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 50% cement Replacement with Limestone which results 28 days strength as 59.58 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete
- From the above graph it is seen that on 50% cement Replacement with Combination which results 28 days strength as 40.17 % against Targeted Mean Strength of Normal concrete of M35 Grade concrete

B. Photographs During the Work



Fig. 1 Bartyes powder collection



Fig. 2 Cuddapah Slab Polishing Waste



Fig. 3 Testing of materials



Fig. 4 Concrete Cube casting

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Fig.5 Failed cube profile



Fig.6 Sample failed during Curing
(50% replacement of cement with Barytes)

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. *Conclusions*

Based on the results and analysis of present experimental work the following conclusions were drawn:

1) Optimum Dosage for M30 Grade Concrete

a) For M30 Grade Concrete , if Barytes powder alone used, the optimum dosage is up to 10% ONLY as cement replacement material in preparation of concrete

b) For M30 Grade Concrete, if Lime stone polished waste powder alone used, the optimum dosage is up to 10% ONLY as cement replacement material in preparation of concrete

c) For M30 Grade Concrete, if both i.e Lime stone polished waste powder and Barytes powder used, the optimum dosage is below 20% ONLY as cement replacement material in preparation of concrete.

d) Further use of barytes powder beyond 10% as replacement of cement, it is noticed that 28 days compressive strength decreases and at 50 % cube loss its shape during curing.

e) Further use of lime stone polished powder beyond 10% as replacement of cement, it is noticed that 28 days compressive strength decreases , but not as much as barytes and at 50 % it is observed that concrete cube loses its strength by 40% to Normal concrete Compressive strength.

f) Further increase use of Lime stone polished waste powder and Barytes powder beyond 20% as replacement of cement, it is noticed that 28 days compressive strength decreases , as much as barytes and at 50 % it is observed that concrete cube loses its strength by 65% to TMS.

2) Optimum Dosage for M35 Grade Concrete

a) For M35 Grade Concrete , if Barytes powder alone used, the optimum dosage is below 10% ONLY as cement replacement material in preparation of concrete

b) For M35 Grade Concrete , if Lime stone polished waste powder alone used, the optimum dosage is below 10% ONLY as cement replacement material in preparation of concrete

c) For M35 Grade Concrete both if both ie Lime stone polished waste powder and Barytes powder used the optimum dosage is below 10% ONLY as cement replacement material in preparation of concrete

d) Further increase use of barytes powder beyond 10% as replacement of cement, it is noticed that 28 days compressive strength decreases and at 50 % cube loss its shape during curing.

e) Further increase use of lime stone polished powder beyond 10% as replacement of cement, it is noticed that 28 days compressive strength decreases , but not as much as barytes and at 50 % it is observed that concrete cube loses its strength by 40% to TMS.

f) Further increase use of Lime stone polished waste powder and Barytes powder beyond 20% as replacement of cement, it is noticed that 28 days compressive strength decreases even below to barytes powder and Lime stone polished waste and at 50 % it is observed that concrete cube loses its strength by 60% to TMS.

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B. Recommendations

1) The optimum dosage of Bartyes powder alone as SCM is upto 10% for M30 and below 10% for M35 Grade of concrete

2) The optimum dosage of Lime stone polished waste alone as SCM is up to 10% for M30 and below 10% for M35 Grade of concrete

3) The optimum dosage of Combined of Bartyes powder and Lime stone polished waste powder as SCM is below 20% for M30 and below 10% for M35 Grade of concrete.

C. Future Scope

1) The Present work can be continued to find exact dosage (i.e in between 5%-20%) to replace cement portion in concrete.

2) The present work can be continued for combination of barytes with fly ash/ other puzzolana material

3) The present work can be adopted for combination of barytes powder and lime stone polished waste to find exact dosage to replace cement portion in concrete for M20 and M25 Grades.

4) The present work can be extended to study the effects of these materials on other properties of concrete like permeability, RCPT, Flexural strength, water absorption etc.

D. Limitations

1) Since the materials chosen in this work as SCM are locally available materials in the region of Kadapa District Andhra Pradesh it is suggested to consider this while estimating the savings towards cement replacement

2) Through this experimental work it is clear that the lime stone polished waste and barytes powder as SCM may be selected for below M30 or M35 grades of concrete.

3) The Concrete is mixed, poured manually in to the cube moulds, Hand tamping using cylindrical tamping rod to remove any air is adopted to make fresh concrete further dense.

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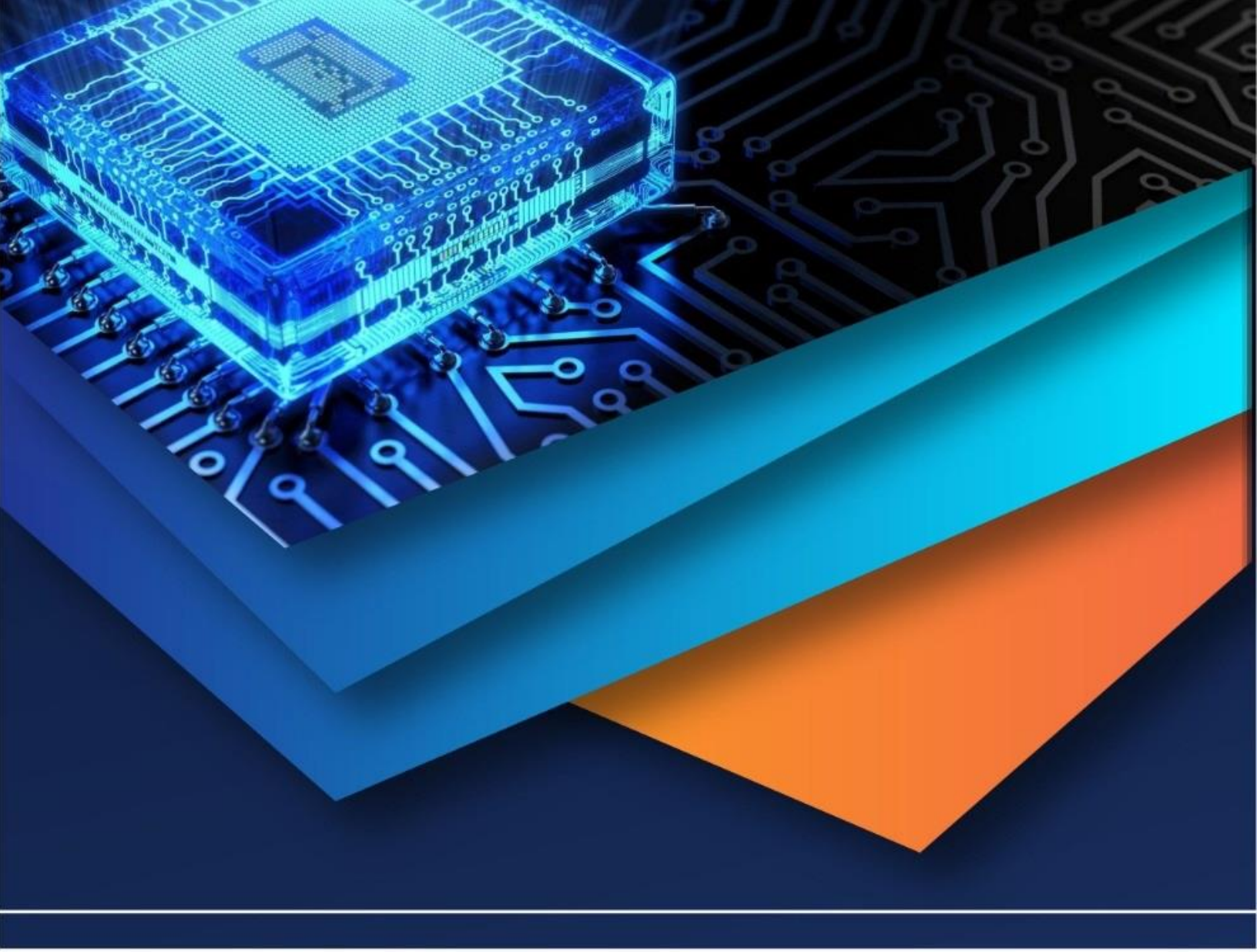
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