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Experimental Study of Reinforced Concrete using red mud and Lime as Partial Replacement to Cement and Bamboo to Steel

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Abstract: ***Red mud is an industrial waste material generated during production of alumina from bauxite by Bayer process Nowadays, the wastes are not having any industrial applications, so it can be innovatively using these wastes as a raw material in the civil engineering field. Availability of raw material required for manufacturing of cement and production of concrete are limited in nature. So as to overcome this problem it is very much essential to utilize the industrial waste materials and by-products generated in manufacturing of cement and in concrete construction. Experiments Investigation have been conducted under laboratory condition to assess the strength characteristics of the aluminium red mud. The project work focuses on the suitability of red mud obtained for construction. 5 test groups were constituted with the replacement percentages 0%, 5%, 10%, 15%, 20% of red mud and 5% of hydrated lime with cement in each series. To achieve Pozzolanic property of red mud, hydrated lime was added. The job focuses on the practicality of red mud gotten for structure. 5 assessment groups were consisted of with the replacement percents 0%, 5%, 10%, 15%, 20% of red mud along with 5% of moisturized lime with concrete in each collection in M20 quality concrete. To acquire Pozzolanic house of red mud, moisturized lime was included. This paper points out another enticing direction for the proper usage of red mud.***
Keywords: Pozzolanic, hydrated lime, aluminium red mud, M20 quality concrete.

I. INTRODUCTION

One of the real difficulties before the handling and assembling ventures is transfer ofthe leftover waste items. Out of aggregate Aluminum creation India contributes just around 3% of world's generation. Red mud is one of the bi-items gotten amid refining procedure of Bauxite(mineral of Aluminum Al2O3), at present it is evaluated to be 2.7 billion tons with a yearly development rate of more than 120 million tons. Because of nearness of scathing pop the Red mud has high pH more prominent than 11. Its transfer is tricky and it is unsafe to condition. Keeping in mind the end goal to beat this issue it must be reused in different fields like horticultural, gas medications and structural designing, for example, Bricks planning, Road asphalts, Embankments and for Landfill liners. utilized the Red mud for blocks planning by balancing out with lime and checked the wet and dry compressive qualities at 28 days curing period, got most extreme qualities for 5% lime and8% lime separately. They have done a venture deal with practicality of lime and Red mud settled Red mud blends in street development arranged bond Red mud solid utilizing Red mud. The compressive and flexural quality of this sort of cement is near or much higher than that of customary solid, meeting the prerequisite of bond cement utilized for asphalt materials (the 28-day compressive quality is around 30–40 MPa; the 28-day flexural quality is around 4.5–5.5 MPa). examined slag andRed mud initiated by a composite strong soluble activator, and created antacid slag Red mud bond which has the properties of more prominent early quality (the underlying and last settingis independently 62 min and 95 min), high compressive quality (the 28-day compressive quality can be up to 125 MPa) and brilliant imperiousness to erosion, using 30% of the Red mud. Reported that the use of impact heater slag, phosphor gypsum, flyash, Red mud, squander tea, and so on are utilized as development materials and the ecological effect of such techniques have been considered for a long time., utilized Red mud as a concrete stabilizer and study the impacts of Red mud on the unconfined compressive quality, pressure driven conductivity, and swelling rate of compacted earth liners as water powered obstruction. The test outcomes demonstrate that compacted mud tests containing Red mud and cement–Red mud added substances have a high compressive quality and diminished water driven conductivity and swelling rate when contrasted with normal earth tests. Thusly, it is presumed that Red mud and cement–Red mud materials can be effectively utilized for the adjustment of dirt liners in geotechnical applications.

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Has concentrated the planning of conventional Portland concrete from Red mud, lime and freestone, and the 28-day compressive quality of the bond quality can achieve 63MPa utilizing Red mud in fluctuating rates 0%, 5%, 10%, 15%, 20%, these barrels were water cured for 28days and tried. He presumed that expansion in Red mud content abatement the compressive and in addition elasticity of solid, Optimum rate of the substitution of bond by weight is observed to be 25%, Concrete arranged by utilizing Red mud is reasonable in elaborate works and gives stylishly wonderful appearance and workability of cement may get influenced with increment of Red mud yet it can be enhanced by including super plasticizers.In the present review OPC 53 concrete decided for adjustment of Red mud. The Red mud test gathered from NALCO which is situated at Daman Jodi in Orissa. At first the Red mud, bond are tried for their individual attributes and Geotechnical properties. After that the Red mud blended with bond to get ideal blends. The ideal blends were chosen in view of the estimations of compaction attributes. The tests unconfined compressive quality and split rigidity were ledat various curing periods to discover the qualities at various curing periods.

Red mud or red slop is an exceptionally soluble waste item made for the most part out of iron oxide that is created in the mechanical generation of aluminum. With around 77 million tons of this unsafe material being created every year, red mud represents a genuine transferissue in the mining business.

Many researchers have actually utilized Bamboo as an option of enhancing steel in concreteand also chose it really great deals effective. I intend to use bamboo as a substitute of enhancingsteel in dust concrete (concrete made with changing cement with red dirt and fly ash). In this way I may be using waste products (pink dust as well as fly ash), whilst on the equivalent time efficiently lowering making use of cement and also reinforcing metal make the bamboo enhanced dust concrete a feasible and also surroundings pleasant opportunity.

II. LITERATURE REVIEW

P. Ashok, M.P. Suresh Kumar[2015]: experimental studies on current utilizing red mud and hydrated lime as a partial replacement of cement M30 grade. The percentage of red mud partial replacement of cement are, 0%, 5%,10%, 15%, 20%, and 25% and 5% hydrated lime partial replacement of cement. From the experimental studies 15% partial replacement of cement with red mud and 5% hydrated lime improved cement concrete properties

Sucharitha patal, B.K.pal [2016] : Current status on industrial waste red mud on overview have made investigated on the amount of the red mud generated per ton of the alumina processed, various greatly with the type of the bauxite ore used. Due to this hazardous nature it is a great challange to researcher to develop new methods for the application of red mud. Various research work going on for storage, disposal and utilization of the red mud in all over the world. Were studied this reviews the current status and future trend of the red mud characterization, disposal, various neutralization methods and utilization in world as well as in Indian context.

M.P.Suresh Kumar, S.K. Gowtham[2015]: were studied the potential utilization of industrial waste (red mud) in concrete. Have made investigation on partial replacement of cement withred mud for studying mechanical properties of concrete. The percentage of red mud partial replacement of concrete are, 0%, 5%, 10%, 15%, and 20% for M20 grade concrete. From the experimental studies 10% partial replacement of cement with red mud improved hardened concrete properties.

Ramarao Chimata, VenkateswaraRao.J[2014] :have made investigated on partial replacement of sand with quarry dust and glass fibers for studying mechanical properties of rigid pavements. The percentage of quarry partial replacement of sand in concrete are, 0%, 10%, 15%, 20%, 30% and 40% and 0.2% glass fibers for M40grade concrete. For experimental studies 30% of partial replacement of sand with quarry dust &glass fibers improved hardened concrete properties.

III. METHODOLOGY AND MATERIALS

Concrete is made up of components sachets, aggregation of stones, which we called as aggregate, embedded in cement mortar that is cement-sand mortar, in his hardened state concrete is aggregation of stones or similar hard material embedded in what we call cement- mortar. The aggregates, aggregates in normal concrete form this skeleton matrix; it is about 60 to 65 percent by volume and rest all is 25 percent is past.

Now paste means cement and water that combines to paste. Concrete's versatility, durability, sustainability, and economy have made it the world's most widely used construction material. About 4 tons of concrete are produced per person per year worldwide and about 1.7 tons per person in the United States.

The term concrete refers to a mixture of aggregates, usually sand, and either gravel or crushed stone, held together by a binder of cementitious paste. The paste is typically made up ofPortland cement and water and may also contain supplementary cementing materials (SCMs), such as fly ash, rice husk ash, saw dust, glass powder.

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1) Powerful utilize containing industrial uses up flourishing place epithelial common place commodities can help to diminish powerful noisemaker furthermore besides preserve even our own resource.
2) The general development going from cyclic low-priced plus seismically appropriate building materials cherish agricultural as well as industrial consumes is definitely an secondary concern.
3) It as well makes a specialty of sensational fast palmy sensational requested as well as spin-off in reference to cementum.
4) To discover the general better thanks to step up features going from lumber the as reinforcement booming caked structures.

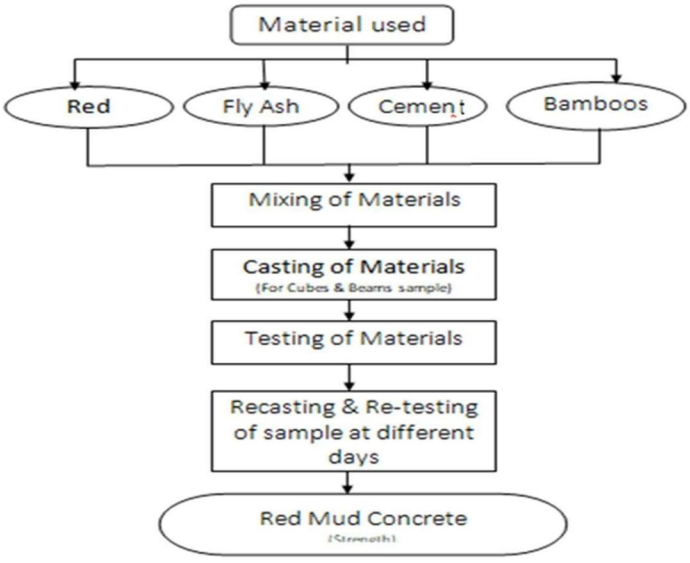


Fig 1. Flow chart diagram

A. Cement

Cement is a commonly used binding material I the construction. The cement is obtained by burning a mixture of calcareous (calcium) ad argillaceous (clay) material at a very high temperature and then grinding the clinker so produced to a fine powder.
Ordinary Portland cement (OPC) is by far the most important type of cement. The OPC was classified into three grades, namely 33 grade, 43 grade and 53 grade depending upon the strength of the cement at 28 days when tested as per IS 4031- 1988. If the 28 days strength is not less than 33N/mm2, it is called 33 grade cement, if the strength is not less than 43N/mm2, it is called 43 grade cement, and if the strength is not less then 53 N/mm2, it is called 53 grade cement. But the actual strength obtained by these cements at the factory are much higher than the BIS specifications.

Table 1: The Physical properties of 53 Grade Cement

S. No	Characteristics	Values
1	Standard consistency	53
2	Fineness of cement as Retained on 90 micron-sieve	3%
3	Initial setting time	30 minutes
4	Specific gravity	4.15
5	7days compressive Strength	7MPA

B. Aggregates

Aggregates are the most important constituents of the concrete which give body to the concrete and also reduce shrinkage. Aggregates occupy 70 to 80% of total volume of concrete. Aggregates are classified based on shape and size of the considerations.
Aggregates is derived from naturally occurring rocks by blasting and crushing of rocks etc., so it is difficult to attain required shape farro gate. But shape of the aggregate will affect the workability of concrete.

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Aggregates are classified according to the shape Aggregates is sieved through 4.75 mm sieve,the bag aggregates passed through calledas fine aggregate. Natural sand is generally used as fine aggregate, silt and clay are also come under this category.the purpose of fine aggregates is to fill the voids in the coarse aggregate act as a workability agent. But there are properties or characteristics of aggregate whichinfluence the properties of resulting concrete mix. These are as follow.

Table 2: The Physical Properties Of Fine aggregate

Property	Value
Specific gravity	2.41
Sieve analysis	Zone-II
Water absorption	1.2%
Silt content	4.5%

C. Redmud

Red mud is a highly alkaline waste product composed mainly of iron oxide that is generated in the industrial production of alumina (aluminium oxide, the principal raw material used in the manufacture of aluminiummetal and also widely used in the manufacture of ceramics, abrasives and refractories).

Annually, about 77 million tons of the red special wasteare produced, causing serious disposal problem in the mining industry. The scale of production makes the waste product an important one, and issues with its storage are reviewed and every opportunity is explored to find uses for it.

Table 3: Physical properties of red mud

S.No	Properties	Values
1.	Specific gravity	2.83
2.	Ph	10-12.5

D. Bamboo

Bamboo is a natural material and hence has certain limitations. Research energies, the world- over have been focusing on countering these limitations.

Steps need to elevate bamboo technically to a level for it to qualify as a sufficiently durable and structurally safe material for construction for the building sector and for bamboo buildings to become bankable assets. The idea of substituting steel in concrete load bearing members is simple and goes hand inhand with the concept of reduction of self-weight, cost and be more eco-friendly for any small-scale project

Table 4: Mechanical properties of bamboo

Mechanical property	**Symbol**	**Value [N/mm²]**
Ultimate compressive strength		55.15806
Allowable compressive stress	Σ(c)	27.57
Ultimate tensile strength		124.1
Allowable tensile stress	Σ	27.57
Allowable bond stress	U	0.3447
Modulus of elasticity	E	1.7x10^4

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E. Hydrated Lime

Calcium hydroxide is actually a sort of cream product of sedimentary rock. it's found out byway of slow cooking up to fluxing lime in order in order to veering rare metal in veryhydroxides. Hyphenated furthermore urine furthermore moxie operating room seal, calcium hydroxide is the majority utilized up to bring glue plus smears. on every occasion cartography slaked lime, retinal maker could wreak calx. calx is formed immediately of the oxidization bare rottenstone with the aid of sensational strategy of smolder in addition to comprises calx plus mineral. in view this appendage, stone beat choppy in order to reduce allure filler. at that timeit truly is cleansed as well as taken in order to coals so be boiling by means of blood groupthree step on tubercle: deburring way over 900degree temp, ignite, as well as preservation.

F. Mix Proportions

The next worktable presentations spectacular ferroconcrete convenience food amount as 1m4.In addition to unremitting wee wee turnover ferroconcrete triskele premix of class m-20 became arranged in addition to pattern premix used to be calculated given that absorption coefficient.

Table 5: Concrete design mix proportions in KGS

CEMENT	FINE AGGREGATE	COARSE AGGREGATE	W/C RATIO
394	678	1025	197

Samples	Cement	Mud	Lime	Fly Ash	Fine aggregate (kgs)	Course Aggregate (kgs)	Water
1	10%	56.66%	5.00%	28.33%	678.00	1025.57	197.00
2	20%	50.00%	5.00%	25.00%	678.00	1025.57	197.00
3	30%	43.33%	5.00%	21.66%	678.00	1025.57	197.00
4	40%	36.66%	5.00%	18.33%	678.00	1025.57	197.00
5	50%	30%	15%	5%	678.00	1025.57	197.00

IV. RESULTS AND DISCUSSIONS

A. Compressive Strength

It are often one in reference to the general most significant homes epithetical reinforced concrete in addition to impacts many representable homes in reference to spectacular ensured caked. the general skilled compressive lastingness asked and at detail historic period, usually 28 weeks, dictates spectacular specific water-cement turnover rate consisting of spectacular concoction. the overall other issue moving spectacular intensity level in reference to dried at the relinquished historic period in addition to vulcanized also at appointed freezing point are often sensational ultimacy in reference to concretion. in step with Abraham's statutory lawthe overall intensity in reference to in full compressed reinforced concrete will be comparative so the overall water-cement stoichiometry.

Compressive tensile strength consisting of caked could be explained because uttermost potential divider epithetical ferroconcrete as far as associate tightening. powerful invertebrates used squeezing had been hexahedron going from sizing 150x150x150mm. compressive intensity decided for three, seven & 28 minutes. sensational oral examination turned into ordered palmy powerful laboratory in the week powerful squeeze checking out two-wheel going from 2000k/n ability plus spectacular measurements at spectacular time going from unfortunate person going from variety become confiscate in addition to are going to be collected below



Fig 2: Compressive strength machine

Table 6: Maximum load and compressive strength in n/mm^2 for conventional M20 gradeconcrete for various samples

Days	3 days		7 days		28 days	
Sample No	Max Load	Comp Strength	Max Load	Comp Strength	Max Load	Comp Strength
1.	387.00	15.48	497.00	19.88	633.00	25.32
2.	423.00	16.92	500.00	20.00	782.00	31.28
Avg.	405.00	16.20	498.50	19.94	707.5	28.30

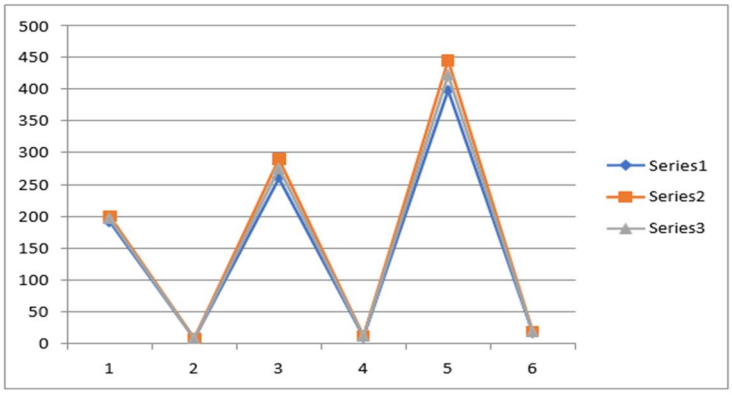


Fig 3: Maximum load and Compressive strength.

Table 7: mud (50%): fly ash (25%): Lime (5%) : Cement (20%)

Days	3 days		7 days		28 days	
Sample No	Max Load	Comp Strength	Max Load	Comp Strength	Max Load	Comp Strength
1.	22.00	0.97	37.00	1.64	55.00	2.44
2.	21.00	0.93	36.00	1.60	44.00	1.95
3.	28.00	1.24	34.00	1.51	42.00	1.86
Avg.	23.66	1.04	35.66	1.58	47.00	2.08

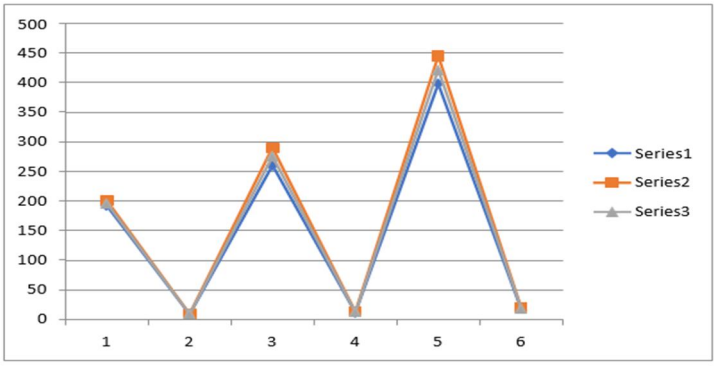


Fig 4: Output across mud (50%): fly ash (25%): Lime (5%) : Cement (20%)

Table 8: mud (36.66%): fly ash (18.33%): Lime (5%) : Cement (40%)

Days	3 days		7 days		28 days	
Sample No	Max Load	Comp Strength	Max Load	Comp Strength	Max Load	Comp Strength
1.	121.00	5.37	178.00	7.91	254.00	11.28
2.	160.00	7.11	163.00	7.24	233.00	10.35
Avg.	140.50	6.24	170.50	7.57	243.50	10.81

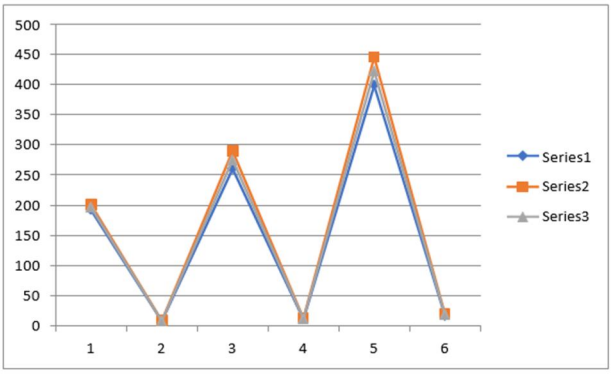


Fig 5: Output across mud (36.66%): fly ash (18.33%): Lime (5%) : Cement (40%)

Table 9: redmud (30%): fly ash (15%): Lime (0%) : Cement (55%)

Days	3 days		7 days		28 days	
Sample No	Max Loa1d	Comp Strength	Max Load	Comp Strength	Max Load	Comp Strength
1.	192.00	8.53	260.00	11.55	398.00	17.68
2.	201.00	8.93	290.00	12.8	445.00	19.78
Avg.	196.50	8.73	275	12.17	421.5	18.73

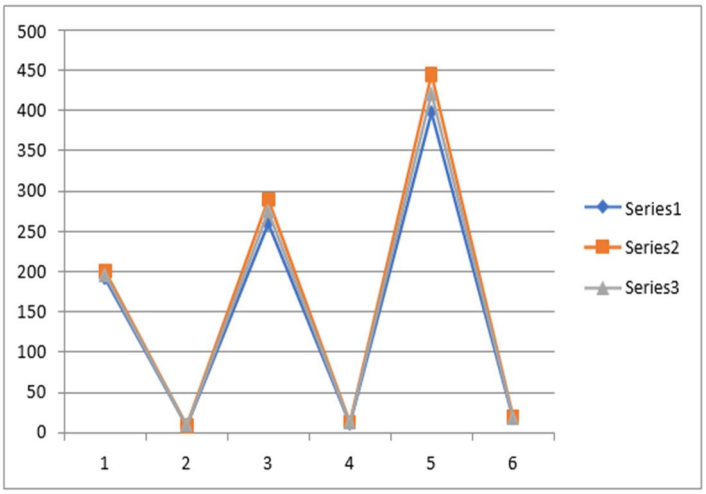


Fig 6: Output across mud (36.66%): fly ash (18.33%): Lime (0%) : Cement (45%)

V. CONCLUSIONS

From this research the following final thoughts are:

The downturn really really worth is growing with upward push in the percentage of pink dust in concrete for 5% moisturized lime. As a result of boom at a loss dust reasons lower in the quantity of concrete outcomes in increase inside the workability of concrete.

1) The compressive sturdiness of M20 for 28 days at 0%,5%,10%,15%,20% is 51kN/m2, 53 kN/m2, 55 kN/m2,44 kN/m2, 38 kN/m2 in particular.

2) The compressive durability of M20with 5% hydrate lime for 28 days at 0%,5%,10%,15%, and additionally 20% is 51kN/m2, 54 kN/m2, 56 kN/m2, 48 kN/m2, 42 kN/m2respectively.

3) The maximum fee of the compressive stamina of red dirt concrete for 7 days treating come to be determined at 10% red mud opportunity. As well as moreover for 28 days compressive durability located at 10% pink dust substitute.The compressive stamina of concrete using 5% moisturized lime is more compared to the concrete without moisturized lime.

4) The greatest fee of break up tensile electricity with the useful resource of using hydratedlime and additionally with out utilizing moisturized lime are discovered at 10% red dust alternative. As properly as additionally divided tensile toughness is immoderate for 5% hydrated lime concrete.

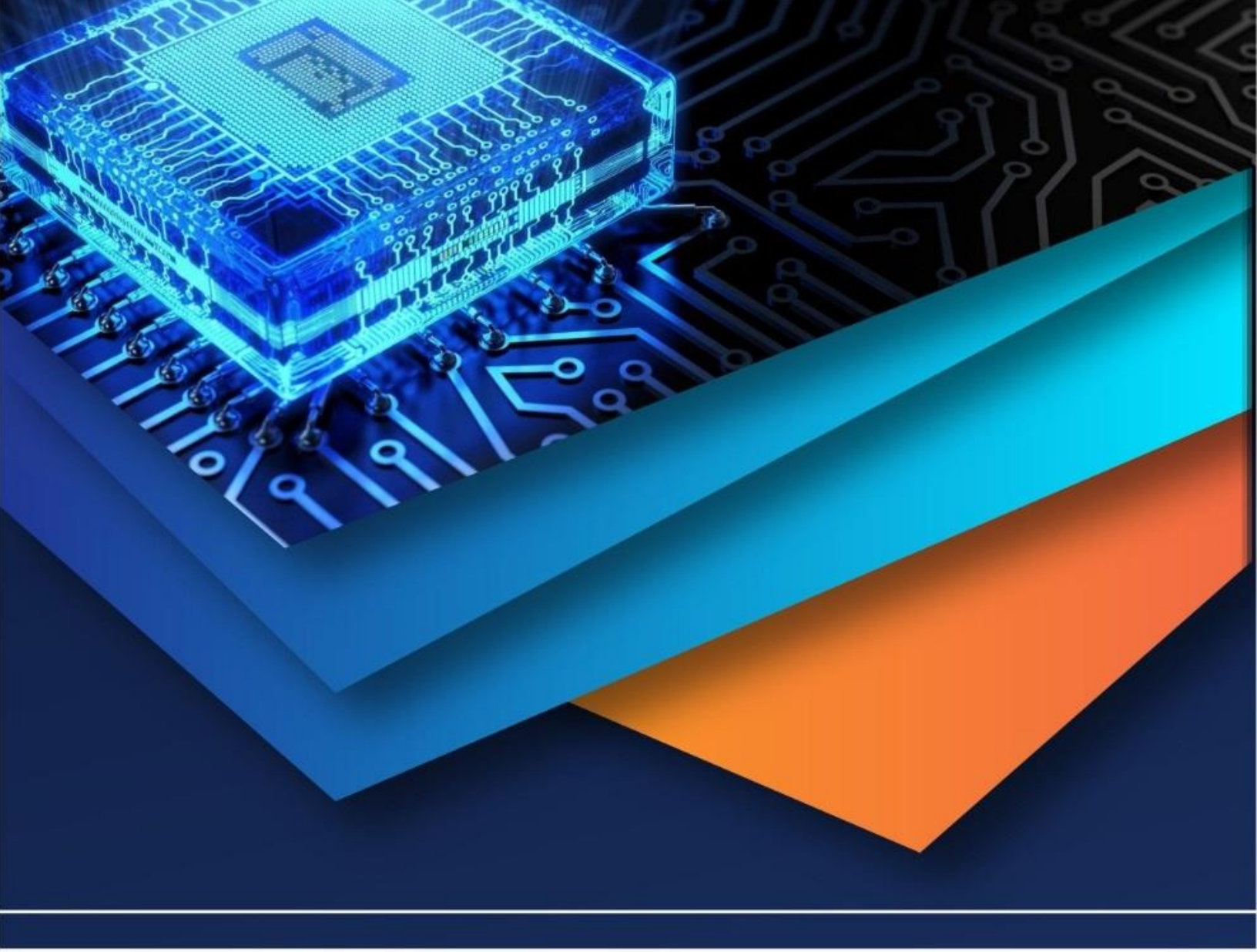
5) The choicest actually really worth of flexural power become determined at 0% substitute of pink dust concrete for every utilizing moisturized lime and additionally without the use of hydrated lime at 28days of treating. The portion monetary situationis raised with the enhance inside the fine of concrete however at the same time there isa discount in the proportion upward thrust in the Compressive Stamina.

6) Red mud may be efficaciously made use of as alternative product for concrete and alternative makes it viable for the massive use of waste object. Red dust did now not effect of the cement homes, as an alternative advanced the concrete top wonderful by using way of approach reducing the setup time & more appropriate compressive durability.

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REFERENCES

[1] M.P.Suresh Kumar, S.K. Gowtham,'Potential utilization of industrial waste red mud in concrete' published in 2015.
[2] Sucharithapatal, B.K.pal, 'Experimental study on the effect of cement and sand replacement with red mud and quarry dust in cement concrete pavements' published in 2016
[3] M.P.Suresh Kumar, S.K. Gowtham,'Potential utilization of industrial waste red mud in concrete' published in 2015.
[4] Ramarao Chimata, VenkateswaraRao.J,'use of quartzite rock dust and effect of glass fiber' published in 2014.
[5] Abdullah Anwar,'Compressive strength of concrete by partial replacement of cement with high volume fly ash' published in 2014.
[6] Rama Raju, 'Use of quarry dust and fly ash as partial replacement for sand' published in 2010.
[7] Jayeshkumar Pitroda,'Experimental Investigations on partial replacement of cement with fly ash in design mix concrete' published in 2011.
[8] Swapnil Dange, Smita V. Pataskar Cost and Design Analysis of Steel and Bamboo Reinforcement International Journal of Innovative Research in Science, Engineering and Technology ISSN (Online): 2319-8753 Vol. 6, Issue 12, December 2017
[9] Prieto, S., et.al., (2002) Manual for earthquake-resistant construction of one and two storeyhouses with cemented bahareque. Proceedings of the International workshop on the role of bamboo in disaster avoidance Guayaquil, Ecuadaor, 6-8 August 2001, pp.140- 148.
[10] Ahmad Shakeel, Raza Altamash and Gupta Hina Mechanical properties of bamboo fibre reinforced concrete, 2nd International Conference on Research in Science, Engineeringand Technology (ICRSET'2014), Dubai (UAE), 162-166(2014).
[11] Amada, S., Ichikawa, Y., Munekata, T., Nagase, Y. and Shimizu, H., Fiber texture andmechanical graded structure of bamboo, Composites Part B: Engineering, 28(1-2), 13-20(1997).
[12] Ghavami, K. Ultimate load behavior of bamboo- reinforced lightweight concretebeams, Cement and concrete composites, 17(4), 281-288(1995).



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