Comparative Study on Cost Analysis of Natural & Manufacture Sand in Residential Building

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***Abstract*-**The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced by using natural sand obtained from riverbeds as fine aggregate. The cheapest and the easiest way of getting substitute for natural sand is by crushing natural stone to get manufactured sand which would be free from all impurities. Manufactured sand is a term used for aggregate materials less than 4.75mm and which are processed from crushed rock or gravel. The concrete mixes having different mix proportions for both natural and manufactured sand (i.e. 100%NS+0%MS, 70%NS+30%MS, 40%NS+60%MS, and 0%Ns+100%MS) were prepared for M30 grade of concrete for cubes. Then there were 2 case studies is taken in which slab concrete cost of building by done construction and concrete cost of same quantity by my trial mix variation is compared. And this cost comparison of trial mix is done with cost of Natural sand & Manufactured Sand obtained from 3 different cities

Index Terms*—Natural Sand, Manufactured Sand, Trial Mix, Cost Comparison, Quantity.*

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I. INTRODUCTION

Manufactured sand is a term which has small size than 4.75mm on base of fine aggregate and which is processed from crushed rock or gravel. To study the manufactured sand the suitable replacement of natural sand firstly its compressive strength should be checked and secondly its cost comparison is studied. Initially, different natural and manufactured sand samples to be used in the concrete mixes were collected and their physical properties were studied. Then the quantity Of M30 grade used in residential building of 2 Case study were obtained. Then the trial mix were prepared of different proportion & Cost analysis is done between concrete cost of the construction done and the cost of my trial mix of different proportion of the natural sand and manufactured sand in concrete.

Manufactured sand is a substitute of river for construction purposes sand produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges. Washed and graded to as a construction material.The scarcity of natural sand due to such heavy demands in growing construction activities have forced to find the suitable substitute. One of the cheapest and the easiest ways of getting substitute for natural sand is by crushing natural stone to get MS of desired size and grade.

II. LITRATURE REVIEW

1. *Vinayak R.Supekar & Popat D.Kumbhar "Properties of Concrete by Replacement of Natural Sand with Artificial Sand" in International Journal of Engineering Research & Technology Vol. 1 Issue 7, September – 2012* - In the present an attempt has been made to discuss the properties such as workability and compressive strength of concrete prepared by replacing natural sand with artificial sand at different replacement levels (0%, 20%, 40%, 60% and 100%). The development of cracks and their measurement is also studied. The results have shown that the natural sand can be replaced with artificial sand up to a maximum replacement level of 60% in order to produce concrete of satisfactory workability and compressive strength and also with cracks of lesser areas.

Chirag D Magnani & Vatsal N Patel "A Review on Need of Manufactured Sand in Concrete constructions as a Replacement to River Sand" in Indian Journal of Research Volume : 3 Issue :

5 May 2014- The reduced availability of natural sands, particularly along the east coast of India, and the need to better utilise sand-size material generated in the aggregate crushing process, has combined to encourage the development of 'Manufactured Sand'. . With manufactured sand marketed as a material complying with certain recognized specifications, it is then up to the design engineers or concrete producers to specify ordinary crushed rock fine, which is cheaper and should be good enough for normal concrete, or manufactured sand, which is more expensive but should be a better choice for high strength concrete. This paper describes different issues related with manufactured sand.

III. AIM

- Primary Aim is that to low the cost of the construction by use of manufactured sand.
- Secondary Aim is to replace successful Natural Sand by Manufacturing Sand.
- To get the optimal compression strength of the concrete by the used of varied proportion of Natural sand & Manufacturing Sand.

Also with the use of Manufacturing Sand there will be less wastage of the quarry as th wastage of quarried rock product is replaced by processed and Manufacturing Sand is obtained.OBJECTIVES

1. Due to presence of silt and clay in natural sand. If the natural sand is not properly processed then there will be damage in concrete at early stage.
2. Primary Objective is to reduce the cost of the building by reducing cost of concrete
3. MS is more cost effective then the Natural sand.
4. Due to Growing demand for fine-aggregates in construction MS was introduced.
5. MS will reduce the wastage of low-value by-products in the quarries.
6. Secondary Objective to show that a manufactured sand can be made to replace natural sand

IV. EXPERIMENTATION

TABLE I
SIEVE ANALYSIS OF AGGREGATE

IS Sieve Designation(mm)	% Passing for Graded Aggregates of Nominal Size(By Weight)			
	Weight Retained(Kg)	%Weight Retained	%Cumulative Weight Retained	%Passing
	X	(X/W1) x 100	Y	100 -Y
20	0.012	0.24	0.24	99.76
12.5	3.945	78.9	79.14	20.86
10	0.548	10.96	90.1	9.9
6.3	0.466	9.32	99.42	0.58
4.75	0.014	0.28	99.7	0.3
Pan	0.021	0.48	100	00
Total (W1)	5.006≈5 kg	100.18	468.6	131.4

Above is the experiment work done for the aggregate which were used in the trial mix concrete M30. From, the sieve analysis we get to know the Finess Modulus of the aggregate is 4.68. Angular shape aggregate of size of 20 mm was used. It has a specific gravity of 2.935.

TABLE II
SIEVE ANALYSIS OF NATURAL SAND

IS Sieve Designation(mm)	Percentage Passing for Graded Aggregates of Nominal Size(By Weight)			
	Weight Retained (Kg)	%Weight Retained	%Cumulative Weight Retained	%Passing
4.75	0.011	1.1	1.1	98.9
2.36	0.021	2.1	3.2	96.8
1.1-8	0.43	43	46.2	53.8
600	0.257	25.7	71.9	28.1
300	0.196	19.6	91.5	8.5
150	0.061	6.1	97.6	2.4
75	0.006	0.6	98.2	1.8
Pan	0.01	1.1	99.3	0.7
			509	

Above is the experiment work done for the Natural Sand which were used in the trial mix concrete M30. From, the sieve analysis we get to know the Finess Modulus of the Natural Sand is 5.09.

TABLE III
SIEVE ANALYSIS MANUFACTURED SAND

IS Sieve	% of passing (Manufactured Sand)	Zone II (As per IS:383)
4.75mm	100	90-100
2.36mm	90.7	75-100
1.18mm	61.2	55-90
600micron	40.8	35-59
300micron	26.5	8-30
75micron	Max 15	Max 15
	Zone II	

Above is the experiment work done for the Manufactured sand Sand which were used in the trial mix concrete M30. From, the sieve analysis we get to know the Finess Modulus of the Manufactured Sand and it is found out that it is of Zone II

Most concrete is poured with reinforcing materials (such as rebar) embedded to provide tensile strength, yielding reinforced concrete. Concrete gains compressive strength progressively with time. The strength achieved at the end of 28 Days is called characteristics compressive strength of concrete and is designed rounded as a result of weathering. Over the time some investigations have shown that angular particles, rough surface of MS influences the workability and finish ability in fresh concrete

Manufactured sands with levels of micro fines (material less than 75-micron) exceeding 10% can be used in the production of Portland cement concrete. It is clear from the definition for manufactured sand that it was never acceptable for quarries to produce a crusher dust that results from the fine screenings of all quarry crushing and call this material manufactured sand.

TABLE IV
MATERIAL REQUIREMENT AS PER DESIGN

Material	Unit	% REPLACEMENT NS BY MS			
		0%	30%	60%	100%
Cement	Kg/m³	492.5	492.5	492.5	492.5
Fine aggregate	Kg/m³	772.12	540.48	308.84	0
MS	Kg/m³	0	231.63	463.27	772.12
Coarse aggregate	Kg/m³	1010.87	1010.87	1010.87	1010.87
Water	Liter	197	197	197	197
W/C	Kg/m³	0.40	0.40	0.40	0.40

TABLE V
CASE STUDY 1
QUANTITY

Sr no.	Description	Grade	Concrete quantity (cum)	Rate
1	Slab	M30	73.82	5865
2	Beams	M30	68.76	5865
3	Staircase	M30	4.88	5865

TABLE VI
CASE STUDY 2
QUANTITY

Sr no.	Description	Grade	Concrete quantity (cum)	Rate
1	Slab	M30	72.915	4897
2	Beams	M30	72.039	4897
3	Staircase	M30	5.00	4897

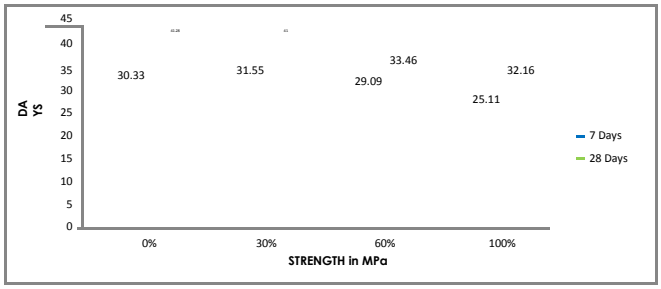
In this paper firstly the experimentation work of Partial Replacement of Natural Sand by Manufacturing Sand and the results are obtained. Secondly then after there were 2 case studies are considered 1 is the site of Pune & 2 site is of Mumbai. From these 2 case studies I obtained the concrete quantity of M30. Then I calculated the total cost of concrete of M30 at site as per contractor and cost obtained by my trial mix and then I compared results.

V. RESULT & DISCUSSION

TABLE VII
COMPRESSIVE STRENGTH FOR DIFFERENT % REPLACEMENT OF NATURAL SAND BY MANUFACTURED SAND

Cube No.	0%		30%		60%		100%	
	7 Days	28 Days	7 Days	28 Days	7 Days	28 Days	7 Days	28 Days
1	28.35	40.24	30.28	42.02	28.11	32.91	27.02	33.48
2	31.77	42.20	32.12	39.26	29.80	33.91	22.46	32.00
3	30.87	41.40	32.25	41.73	29.37	33.57	25.86	31.00
Avg	30.33	41.28	31.55	41.00	29.09	33.46	25.11	32.16

GRAPH I
BAR CHART OF COMPRESSIVE STRENGTH BY UTM



GRAPH II
BAR CHART OF COMPRESSIVE STRENGTH BY REBOUND HAMMER
TEST

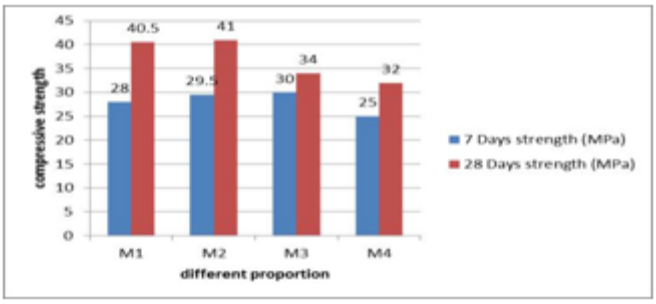


TABLE VIII
COST CALCULATED FOR SLAB, BEAMS & STAIRCASE AS PER CONTRACTOR RATE OF CASE STUDY 1

Sr No.	Description	Grade	qt	no of flo ors	Rate	Total cost
1	Slab +Beams +Staircase	M30	149.9	12	4897	8811870

TABLE IX
COST CALCULATED FOR SLAB, BEAMS & STAIRCASE AS PER EXPERIMENT WORK OF CASE STUDY 1

Sr No	City	Description	% Replace	qt 149.95* 12	Rate	Total cost
1	Mumbai	Slab +Beams +Staircase	0 %	1800	4607.87	8294166
			30 %	1800	4547.22	8184996
			60 %	1800	4459.25	8026650
			100 %	1800	4366.67	7860006
2	Pune	Slab +Beams +Staircase	0 %	1800	4413.00	7943400
			30 %	1800	4297.22	7734996
			60 %	1800	4227.77	7609986
			100 %	1800	4204.60	7568280
3	Surat	Slab +Beams +Staircase	0 %	1800	4170.00	7506000
			30 %	1800	4135.00	7443000
			60 %	1800	4098.14	7376652
			100 %	1800	4065.74	7318332

Above is the 1 case study a site of Pune. World pride city a Project of the Pride group. It is a 12 floors building with a MIVAN construction.

The project is mainly divided intp 3 phases. In which the construction work of 2 phases was going on they are Brooklyn, Long Island.

TABLE X
COST CALCULATED FOR SLAB, BEAMS & STAIRCASE AS PER CONTRACTOR RATE OF CASE STUDY 2

Sr No	Description	Grade	Qt	no of floors	Rate	Total cost
1	Slab +Beams +Staircase	M30	147.5	12	5865	10378938

TABLE XI
COST CALCULATED FOR SLAB, BEAMS & STAIRCASE AS PER EXPERIMENT WORK OF CASE STUDY 2

Sr No	City	Description	% Replace	Qt= 147.47 *12	Rate	Total cost
1	Mumbai	Slab +Beams +Staircase	0 %	1770	4607.87	8155930
			30 %	1770	4547.22	8048580
			60 %	1770	4459.25	7892872
			100 %	1770	4366.67	7729006
2	Pune	Slab +Beams +Staircase	0 %	1770	4413.00	7811010
			30 %	1770	4297.22	7606080
			60 %	1770	4227.77	7483153
			100 %	1770	4204.60	7442142
3	Surat	Slab +Beams +Staircase	0 %	1770	4170.00	7380900
			30 %	1770	4135.00	7318950
			60 %	1770	4098.14	7253708
			100 %	1770	4065.74	7196360

The Builder Riddhi Siddhi corporation Rehabilitation 2 building. It is of 12 floors storey building and has a 180000 sq feet area. It has 15 flats per floor of 1 bhk flat.

VI. CONCLUSION

Major Outcome from study

- If there will be application of the Manufactured Sand all over the world there will be low depletion of the riverbed as Natural Sand cause depletion of riverbed.
- Due to introduction of manufactured Sand in concrete it will lower the cost of the construction & can be replaced.
- From the 2 case studies it is concluded that the concrete used with a 60% manufactured sand and 40 % Natural sand have the optimum results also the optimum cost of the construction.
- Also MS will reduce the wastage of low-value by-products in the quarries.
- The MS satisfied the technical requisites such as workability, strength and durability of concrete and hence it has become necessary to study these properties.
- In order to check the suitability and appropriate replacement level of MS in comparison with the natural sand for producing concretes in an economical way.

MS is lesser impurities and good working properties.

Above is the 2 case study a site of Pune. It is a 12 floors building with a wood shuttering construction. It is a SRA site located near mulund Railway station , BMC colony.

VII. REFERENCES

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[4] Guidance from the document of “world pride city “site at lohegaon, Pune.

[5] IS 456:2000 [PLAIN AND REINFORCED CONCRETE- CODE OF PRACTICE (*Fourth Revision)*]

[6] IS: 516:1959 –“Method of test for strength of concrete”.

[7] IS: 13311:1992 part 2)-“Methods of non-destructive testing of concrete”.