Sustainable Concrete Alternative Construction Material

Abhinandan R.Gupta[#1], Dr.S.K.Deshmukh[*2]

[#](M.E , MBA, Masters in Adv. Const. Mgmt) Asst. Prof., Civil Engg. Department
College Of Engg. & Tech, Akola (MS), India
gupta.abhinandan@gmail.com

[*](PhD: Civil Engg., M.E- Structural Engg.)Principal
College Of Engg. & Tech, Akola (MS), India
[2]principalcoeta@gmail.com

***Abstract*— The word waste is basically given to material when its useful period is over. Waste includes various scrap or by-products. This waste material can be successfully utilized for creation and making of new useful product . This concept of re using waste defiantly leads to decrease in demand of resources as well as help to recycle such un useful materials in proper way. Construction Industry being one of the major resource consumption sector, the thought for reusing various waste so as to be applied successfully in construction process makes valid reason for this research work. As per sources it is revel that approximately 50 % of resources are utilized in construction industry and 40 % of energy is consumed by it.**

Such huge demand of materials is lading to various serious problems like depletion, pollution, green house effect and many more. Thus with the view of sustainable growth , the experimental work is performed in this paper and results of such work highlights the potential use of waste material and total material saving in terms of money and quantity can be achieved. In this paper the study is done for various concrete to achieve 28 days characteristic strength upto 25 N/mm2. On that basis application of sustainable concrete is suggested.

***Keywords*— Sustainable concrete, construction resources, waste.**

I. INTRODUCTION

With the ever increasing economic growth our biodiversity is facing tremendous challenges to meet the demands of rising population. Destruction of ecosystem with increasing economic growth can be seen all over the world with the extinction of thousands of species, degradation of agriculture land, extreme climatic changes that alarm shrinking of biodiversity of planet Earth. UNESCO in the year 2002 set a goal as the United Nations decade of education for sustainable Development (2005-2014) and enhanced its efforts to compel government to observe all aspects of sustainable development in order to create awareness that can certainly be a great step for a sustainable future with equitable growth without causing much damage to the natural environment. However, this mission so far has not seen much positive out comes as far as India is concerned.

It is very clear from the research survey done for demand and supply of resources, forecasting the future conditions makes this study prime important.

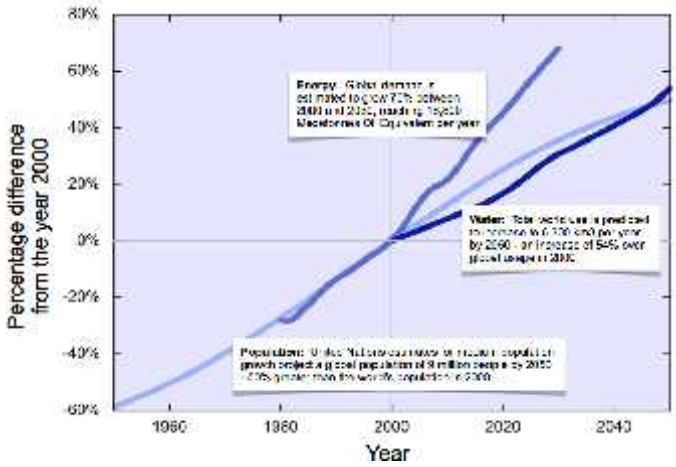

Fig. 1. Demand and Supply Relationship between Global population and Resources with forecasting (Source : Wikipedia)

Along with demolish and construction waste , there are various other types of waste that can be use in construction materials as an element so that wastage can be reuse, reduction can be achieved in resources and economy can be achieved. Thus, the experimental work over here concerns considering one such major resource 'Concrete'. And elements of concete are substituted with waste materials in specific proportion and analysis is done for same. The substitute sustainable material is checked for its strength and suitability as compared to standard specimens.

II. METHODOLOGY

- Initially the standard specimen of desired strength is to be casted as per directions in IS 456.
- This specimen is to be tested for 7 day and 28 days compressive strength.
- The substitute material is sorted and is checked for its physical and chemical properties.
- Over here the study is done over waste material rubber, coconut shell and brick bat.
- These materials are substituted in desired proportion with aggregate and are casted with same mould size and durations.

- All the specimens is to be tested for their 7 day and 28 days compressive strength. The deviations are marked and physical changes are to be noted.
- Depending upon the results of experimental work the suitability on its potential use is to be done.

III. EXPERIMENTAL WORK

A. Standard Reference parameters.

The Concrete mix based on the 28 days cube strength. The following grades of concrete are made (I.S. Code 456: 2000).

The I.S. 456: 2000 code has recommended that the minimum grade of concrete for plain and reinforced concrete work is M20. In above table characteristic strength means the strength of material below which not more than 5% of the test results are expected to fail.

TABLE I
GRADE AND CORRESPONDING STRENGTH OF CONCRETE

Group	Grade of designation	Specified characteristic compressive strength of 150 mm cube at 28 days (N/mm²)
Ordinary Concrete	M10 (1:3:6) approx. M15 (1:2:4) M20 (1:1½:3)	10 15 20
Standard Concrete	M25 (1:1:2) M30 Mix Design M35 Mix Design M40 Mix Design M45 Mix Design M50 Mix Design M55 Mix Design	25 30 35 40 45 50 55
High strength Concrete	M60 Mix Design M65 Mix Design M70 Mix Design M75 Mix Design M80 Mix Design	Mix Design Mix Design Mix Design Mix Design Mix Design

Reference concrete cube strength

Constituents of mix

- Cement: 53 Grade, PPC
- Sand: Local fine sand
- Water: 0.40%
- Aggregate: passing from 20mm IS sieve
- Room temperature:27°C

TABLE III
GRADE AND CORRESPONDING STRENGTH OF CONCRETE

Specimen	7 days Compressive strength (N/mm²)	Mean 7 days Compressive strength (N/mm²)	28 days compressive strength (N/mm²)	Mean 28 days compressive strength (N/mm²)
1	16.77	16.875		
2	16.98			
3			25.30	25.185
4			25.07	

Observation

- Area :- 22500mm²
- Integrity after failure:- Normal
- Density of concrete:-
- For 7days:-0.380 gm/mm²
- 28 days:-0.386 gm/mm²

B. Coconut shell concrete cubes.

Constituents of mix

- Cement – 53 grade, PPC
- Sand – Local fine
- Aggregate – 20mm
- W/C Ratio – 0.40% (3.25 liters)
- Proportion - 1:1:3
- Date of casting – 15/02/2013

TABLE IIIII
RESULTS FOR COMPRESSIVE STRENGTH OF CONCRETE WITH COCONUT SHELL

Sp. No.	Replacement %	7 days comp. strength (N/mm²)	Mean	Std . Comp. strength	28 days comp. strength (N/mm²)	Mean	Std Comp. strength
1	10%	16.12	16.05				
				16.875			
2	10%	15.98					
3	10%				24.33	24.17	
							25.185
4	10%				24.01		

Observation

- Area :- 22500mm²
- Integrity after failure :- Maintained

- Density of concrete:-
- For 7days:-0.386 gm/mm³
- 28 days:-0.391 gm/mm³

C. Rubber concrete cube

Constituents of mix

- Cement – 53 grade, PPC
- Sand – Local fine
- Aggregate – 20mm
- W/C Ratio – 0.40% (3.25 liters)
- Proportion - 1:1:3
- Date of casting – 21/02/2013

TABLE IVV
RESULTS FOR COMPRESSIVE STRENGTH OF RUBBER MIXED CONCRETE CUBES

Sp	Replacement %	7 days comp. strength (N/mm²)	Mean	Std sp. Comp. strength	28 days comp. strength (N/mm²)	Mean	Std Comp. strength
1	10%	17.23					
			17.1	16.875			
2	10%	17.02					
3	10%				24.87		
						24.33	25.185
4	10%				23.70		

Observation

- Area :- 22500mm²
- Integrity after failure :- Maintained
- Density of concrete:-
- For 7days:-0.391 gm/mm³
- 28 days:-0.373 gm/mm³

D. Demolished Concrete cube

Constituents of mix

- Cement – 53 grade, PPC
- Sand – Local fine
- Aggregate – 20mm
- W/C Ratio – 0.40% (3.25 liters)
- Proportion - 1:1:3
- Date of casting – 12/02/2013

TABLE V
RESULTS FOR COMPRESSIVE STRENGTH OF DEMOLISHED CONCRETE MIX CUBES

Sp	Replace-ment %	7 days comp. strength (N/mm²)	Mean	Std Comp. strength	28 days comp. strength (N/mm²)	Mean	Std Comp. strength
1	10%	15.12					
			15.00	16.875			
2	10%	14.89					
3	10%				22.73		
						22.64	25.185
4	10%				22.52		

Observation

- Area :- 22500mm²
- Integrity after failure :- Normal
- Density of concrete:-
- For 7days:-0.382 gm/mm³
- 28 days:-0.391 gm/mm³

IV. CONCLUSIONS

The experimental work done using various waste materials highlights the satisfactory results as tabulated above. The results of such test may vary with local material quality and climatically condition of the casting and testing area. The cracking and crushing strength of concrete for compression is important parameter while considering designing of RCC structure. As various grades of concrete can be applied at various locations depending upon design strength, it can be satisfactorily said that the use of coconut shell, Rubber give result with deviation value of – 05 % approximately. The testing of demolished concrete cubes shows compressive strength comparatively less still can be utilized for the locations where loading is not in excess like staircase landing area etc. Such concrete can be use for PCC application like for footing bed, flooring bed/layer or DPC layer etc. Rubber mix concrete can also be applied for RCC work like for lintels and chajjas, staircase etc.

REFERENCES

- Mohd. Nadeem, (2010) Alternative Building Material and techniques , Sustainable development of Urban Infrastructure 2010.
- Niyaz Ahmed Bhat (2010) Utilization of waste from construction Industry- Recycling, Sustainable development of Urban Infrastructure 2010.
- V.M.Galande, (2010) Sustainable Construction, sustainable development of Urban Infrastructure 2010
- V.L.Manekar,(2010) water conservation for better tomorrow, sustainable development of Urban Infrastructure 2010
- Dr.S.K.Deshmukh, A.R.Gupta (2012) Sustainable Building Design Technique, Role OF Infrastructure for sustainable Development ,IIT Roorke(2012)