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RECYCLING OF DEMOLISHED WASTE MATERIAL AS A COARSE AGGREGATE IN CONCRETE & THEIR EFFECT

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ABSTRACT

Disposal has emerged as a problem in World. India is presently generating construction & demolition waste to the tone of 23.75 million tone. Construction industries is having major role in the development & growth of a country. In future its share will be increased to 70-80%. Construction industry holds total 14% of total gross domestic product. Yet no disposal method is being practiced in 70% of the industry because of the easy availability of the raw material. Hence in future, it plays a major role in the growth of country. By replacing natural aggregate to demolished waste upto 10%,20%,30%,40% & performed test on 7,14,21 & 28 days

Keywords ***Cement, Sand, Lime, Recycled Aggregates, Recycled Aggregate Concrete (RAC), Natural Aggregate Concrete (NAC), Compressive Strength, etc.***

I. INTRODUCTION

Demolished waste is waste debris from destruction of building. Certain component of demolition waste such as brick, timber, steel, concrete are hazardous ones landfill as it is broken down in land fill. condition releasing hydrogen sulphide , toxic gas. Best solution would be to recycle & reuse the demolition waste which would not only help in protecting the environment. But it also help in reducing the construction cost of the product. In the project, we are replacing the natural aggregate partially by demolished waste up to 40% without affecting the compressive strength of the member. Demolition of old and deteriorated buildings and traffic infrastructure, and their substitution with new ones, is a frequent phenomenon today in a large part of the world. The main reasons for this situation are changes of purpose, structural deterioration, rearrangement of a city, expansion of traffic directions and increasing traffic load, natural disasters (earthquake, fire and flood), etc. For example, about 850 millions tones of construction and demolition waste are generated in the EU per year, which represent 31% of the total waste generation. In the USA, the construction waste produced from building demolition alone is estimated to be 123 million tons per year. The most common method of managing this material has been through its disposal in landfills. In this way, huge deposits of construction waste are created, consequently becoming a special problem of human environment pollution. For this reason, in developed countries, laws have been brought into practice to restrict this waste: in the form of prohibitions or special taxes existing for creating waste areas. On the other hand, production and utilization of concrete is rapidly increasing, which results in increased consumption of natural aggregate as the largest concrete component. For example, two billion tons of aggregate are produced each year in the United States. Production is expected to increase to

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more than 2.5 billion tons per year by the year 2020. This situation leads to a question about the preservation of natural aggregates sources; many European countries have placed taxes on the use of virgin aggregates. A possible solution to these problems is to recycle demolished concrete and produce an alternative aggregate for structural concrete in this way. Recycled concrete aggregate (RCA) is generally produced by two-stage crushing of demolished concrete, and screening and removal of contaminants such as reinforcement, paper, wood, plastics and gypsum. Concrete made with such recycled concrete aggregate is called recycled aggregate concrete (RAC). The main purpose of this work is to determine the basic properties of RAC depending on the coarse recycled aggregate content, and to compare them to the properties of concrete made with natural aggregate (NAC)—control concrete. Fine recycled aggregate was not considered for RAC production because its application in structural concrete is generally not recommended.

The main reasons for increase of volume of demolition concrete / masonry waste are as follows:-

- Many old buildings, concrete pavements, bridges and other structures have overcome their age and limit of use due to structural deterioration beyond repairs and need to be demolished;
- The structures, even adequate to use are under demolition because they are not serving the needs in present scenario;
- New construction for better economic growth and job opportunities;
- Structures are turned into debris resulting from natural disasters like earthquake, cyclone and floods etc.
- Creation of building waste resulting from manmade disaster/war.

II. HEADINGS

The process of manufacture of cement concrete hollow blocks involves the following 5 stages; (1) Proportioning (2) Mixing (3) Compacting (4) Curing (5) Drying

The purpose of compacting is to fill all air pockets with concrete as a whole without My by volume of Portland cement. If this ratio is taken in terms of weight basis this may average approximately at 1:7 (cement : aggregate). However, there have been instances of employing a lean mix of as high as 1:9 by manufacturers where hollow blocks are compacted by power operated vibrating machines. The water cement ratio of 0.62 by weight basis can be used for concrete hollow blocks.

(2) Mixing

The objective of thorough mixing of aggregates, cement and water is to ensure that the cement-water paste completely covers the surface of the aggregates. All the raw materials including water are collected in a concrete mixer, which is rotated for about 1 ½ minutes. The prepared mix is discharged from the mixer and consumed within 30 minutes.

(3) Compacting

movement of free water through the concrete. Excessive compaction would result in formation of water pockets or layers with higher water content and poor quality of the product.

Semi-automatic vibrating table type machines are widely used for making cement concrete hollow blocks. The machine consists of an automatic vibrating unit, a lever operated up and down metallic mould box and a stripper head contained in a frame work.

5

Wooden pallet is kept on the vibrating platform of the machine. The mould box is lowered on to the pallet. Concrete mix is poured into the mould and evenly levelled. The motorised vibrating causes the concrete to settle down the mould by approximately 1 ½ to 1 ¾ inches. More of concrete is then raked across the mould level. The stripper head is placed over the mould to bear on the levelled material. Vibration causes the concrete come down to its limit position. Then the mould box is lifted by the lever.

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The moulded hollow blocks resting on the pallet is removed and a new pallet is placed and the process repeated. The machine can accommodate interchangeable mould for producing blocks of different sizes of hollow or solid blocks.

(4) Curing

Hollow blocks removed from the mould are protected until they are sufficiently hardened to permit handling without damage. This may take about 24 hours in a shelter away from sun and winds. The hollow blocks thus hardened are cured in a curing yard to permit complete moisturisation for atleast 21 days. When the hollow blocks are cured by immersing them in a water tank, water should be changed atleast every four days.

The greatest strength benefits occur during the first three days and valuable effects are secured up to 10 or 14 days. The longer the curing time permitted the better the product.

(5) Drying

Concrete shrinks slightly with loss of moisture. It is therefore essential that after curing is over, the blocks should be allowed to dry out gradually in shade so that the initial drying shrinkage of the blocks is completed before they are used in the construction work. Hollow blocks are stacked with their cavities horizontal to facilitate thorough passage of air.

Generally a period of 7 to 15 days of drying will bring the blocks to the desired degree of dryness to complete their initial shrinkage. After this the blocks are ready for use in construction work

III. INDENTATIONS AND EQUATIONS

Demolished Waste Consists of –

- Brick and Masonry - 30%
- Timber-2%
- Soil , sand , Gravel-35%
- Glass less than 1%
- Steel- *5%*
- Concrete-25%
- Bitumen-2%

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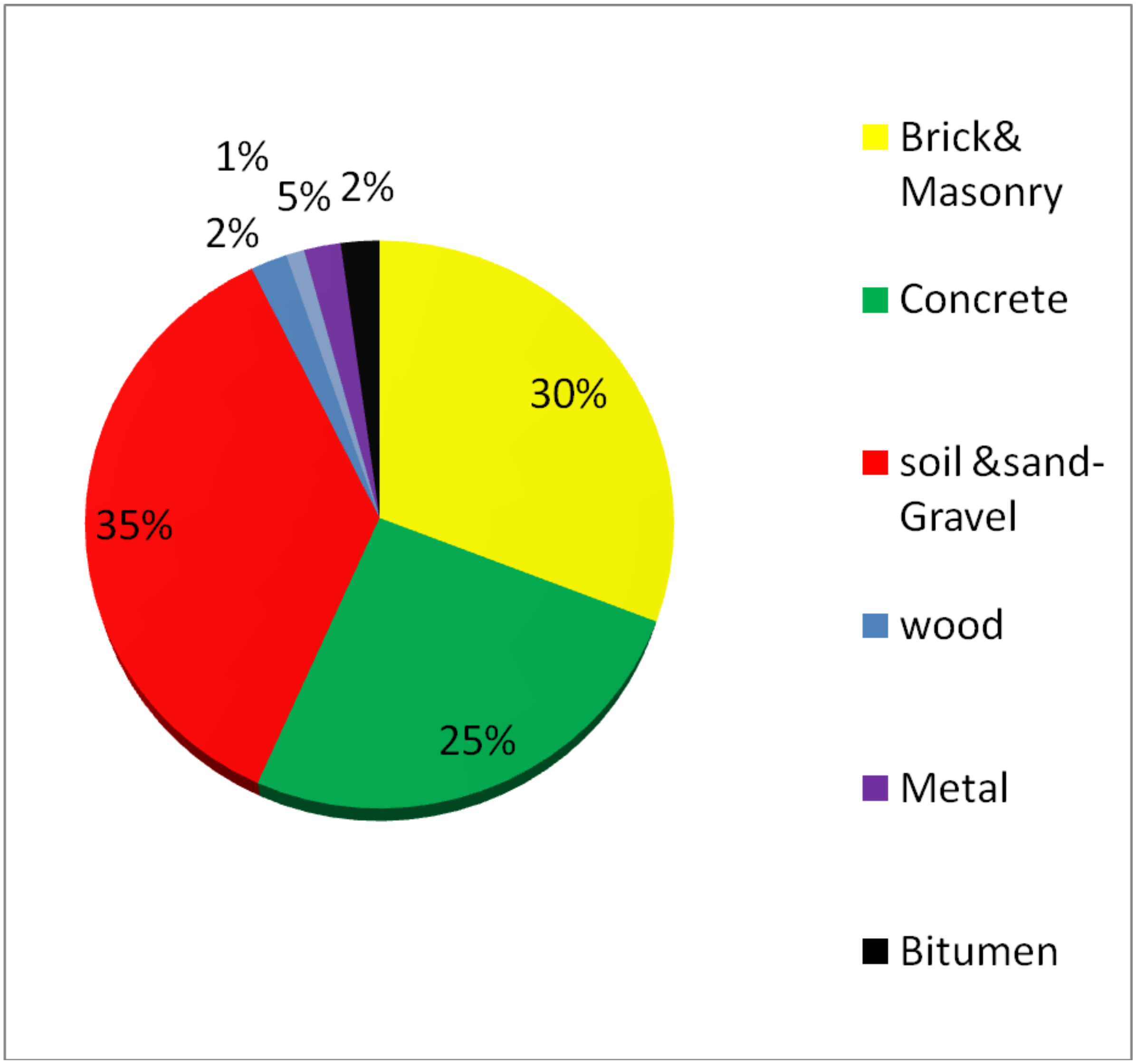

Ordinary Portland Cement 43 grade hydraulic cement was used in the present investigation. It was tested as per IS: 4031-1968 and IS: 8112-1989 recommendations for the hydraulic cement.

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DESCRIPTION OF TEST	EXPECTED VALUE	OBSERVED VALUE	Average value
Fineness test	LESS THAN 5%	2.8%	2.5%
		2.5%	
		2.2%	
Consistency test	---	30%	30%
Initial setting time	30 Min.	32 Min.	32 Min.
Final setting time	10 hours	9.5 hours	9.5 Hrs.
Soundness test	NOT MORE THAN 10mm	3mm	2mm
		2mm	
		1mm	

AGGREGATE

Description	Expected value	Observed value	Average value
Flakiness index	Not more than 10-15%	0.78%	0.89%
		1.0%	
Elongation index	Not more than 4 to 5 times of the above	2.1%	2.0%
		1.9%	

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Water absorption test	Not more than6%	2.6%	2.6%
		2.5%	
		2.7%	
Impact value test	---	9.20%	9.23%
		9.26%	

IV. FIGURES AND TABLES

The main aim of this research project is to utilize recycled concrete as coarse aggregate for the production of concrete. It is essential to know whether the replacement of RCA in concrete is inappropriate or acceptable. The recycled aggregates were crushed and soaked in water for 24 hours for water treatment then kept for drying. Similarly the recycled aggregate soaked with diluted sulphuric, hydrochloric and nitric acids separately and then those aggregates were used for casting of concrete cubes.
The graph will show the result of compressive strength after 7 days, at varying percentage of D.Waste.
The test is conducted for M20 grade of concrete. The 30 percent replacement of D.Waste gives better result for construction purpose

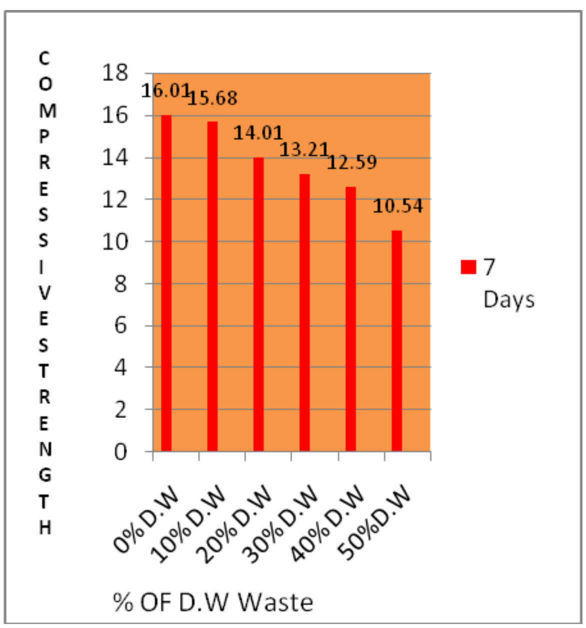

FIG: 1. Compressive Strength of Demolished Waste after 7 days

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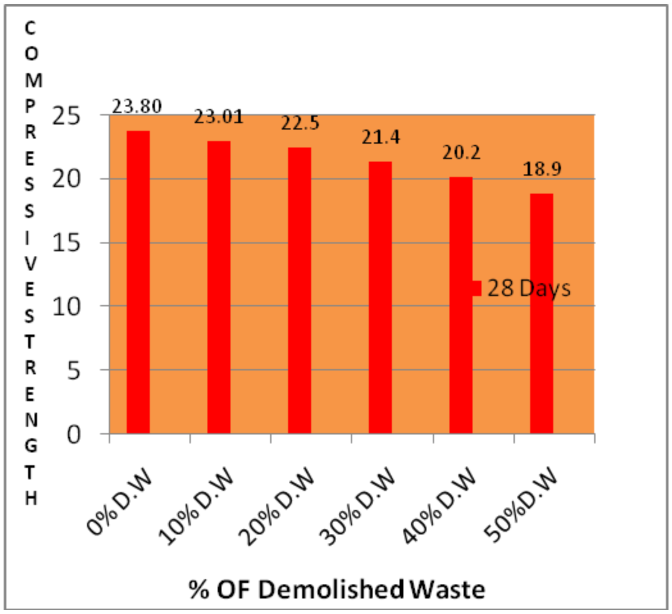

FIG: 2. Compressive Strength of Demolished Waste after 28 days

V. CONCLUSION

Research on recycling and reuse of construction and demolition wastes is very important because with the increase in modernization and urbanization there is an increased demand on natural resources while on the other hand the existing demolished wastes have no proper means of disposal. Hence to use these wastes in new concrete production is not only a promising solution to both the problems, but also that these demolished wastes are easy to obtain and are available at cheaper prices than the virgin aggregates.

The following conclusions can be drawn from the above experimental studies:

- The specific gravity and bulk density of recycled aggregates is lower than that of conventional aggregates. This is because of the attached mortar present on the aggregate surface.
- The water absorption of recycled aggregates is higher than the natural aggregates. The range may vary based on the type of aggregates and in this case it is 6% higher. This is also because of the attached mortar present on the aggregate surface which has a tendency to absorb more water.
- The aggregate crushing and impact values of recycled aggregates are higher than the natural aggregates. This is because the recycled aggregates have already been subjected to fatigue once during the previous use.
- From the workability results it can be concluded that as the concrete in question is high strength concrete.
- The compaction factor results indicate that the workability of the concrete is moderate. Though with increase in the replacement ratios, the value of compaction factor reduces, the least value of compaction factor for the maximum replacement ratio of concrete is still above the value for low workability. Hence the concrete is moderately workable.
- From the compressive strength results of recycled aggregate concrete it can be concluded that the recycled aggregate concrete give slower strength development than the conventional concrete, it can still be used in construction by electing the optimum replacement ratio.

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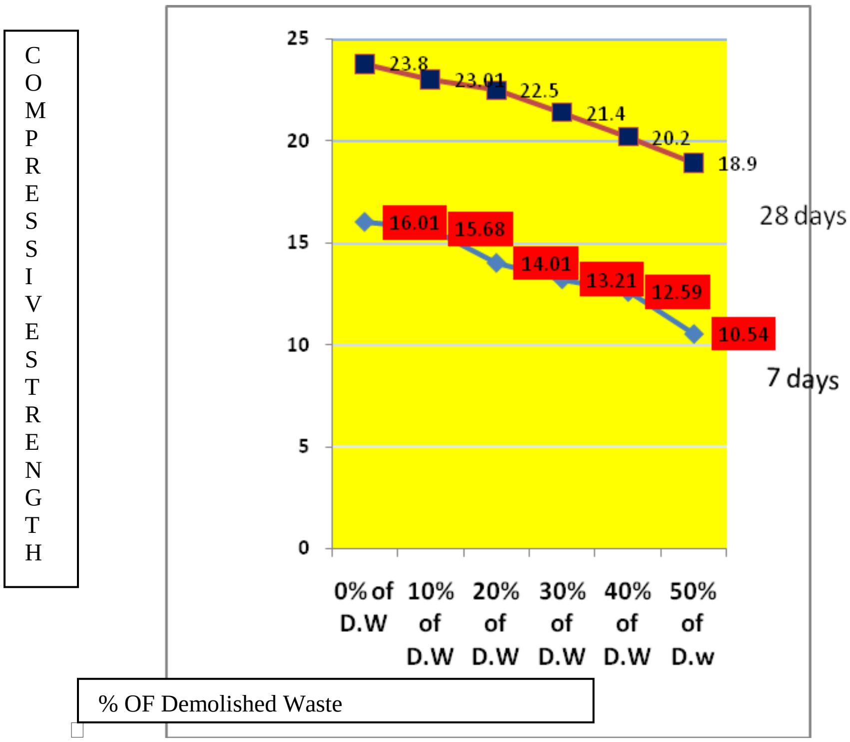
- In this investigation it is found that up to 30% replacement of natural coarse aggregates by coarse aggregate



ADVANTAGE-

- Reduction in construction cost (Reduction in dead load) and cost of building.
- Eco-friendly
- Durability
- Conserves landfill space
- Creates more employment opportunities in recycling industry
- Versatility APPLICATION
- Can be used for constructing gutters, pavements etc
- Large pieces of crushed aggregate can be used for building revetments which in turn is very useful in controlling soil erosion
- Recycled concrete rubbles can be used as coarse aggregate in concrete
- Production of RAC also results in generation of many by-product having many uses such as a ground improvement material, a concrete addition, an asphalt filler etc

BARRIERS USE IN PROMOTING RECYCLED AGGREGATE Lack of appropriately located recycling facility Lack of awareness Lack of government support Lack of proper standards

VI. ACKNOWLEDGEMENTS

I have made this Paper. I have tried my best to elucidate all the relevant detail to the topic to be included in the Paper. While in the beginning I have tried to give a general view about this topic. My efforts and whole hearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to who assisting me throughout the prepration of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

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Journal Papers:

[1] Limbachiya and Leelawat (2000) found that recycled concrete aggregate had 7 to 9% lower relative density and 2 times higher water absorption than natural aggregate. According to their test results, it shown that there was no effect with the replacement of 30% coarse recycled concrete aggregate used on

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the ceiling strength of concrete. It also mentioned that recycled concrete aggregate could be used in high strength concrete mixes with the recycled concrete aggregate content in the concrete. Sagoe, Brown and Taylor (2002) stated that the difference between the characteristic of fresh and hardened recycled aggregate concrete and natural aggregate concrete is relatively narrower than reported for laboratory crush recycled aggregate concrete mixes. There was no difference at the 5% significance level in concrete compressive and tensile strength of recycled.

[2] In the same year, Poon (2002) reported that there were not much effect of the compressive strength of brick specimens with the replacement of 25% and 50% of recycled aggregate. But when the percentage of recycled aggregate replacement increased, the compressive strength of the specimens was reducing. Mandal, Chakarborty and Gupta (2002) also found that there will no effects on the concrete strength with the replacement of 30% of recycled aggregate. But the compressive strength was gradually decreasing when the amount replacement of recycled increased. They concluded that the properties and the strength characteristic of recycled aggregate concrete were deficiency when compared to the specimens that made by the natural aggregate.