Experimental Probe on Thirsty Concrete Using Recycled Aggregate

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***Abstract*- Worldwide a great research is currently being conducted on the storm water management in concrete. Concrete is an artificial stone-like material used for various structural purposes. The binding material cement and various aggregates are made by through mixing of stone chips, recycled aggregate, etc… with water and allowing the mixture to harden by hydration. Number of research has been done to find an alternate material in concrete. The thirsty concrete is also called as pervious concrete, Permeable concrete, No fines concrete and Porous pavement. This concrete is mainly used in the places where the water is stagnant. The Main use of the thirsty concrete is to transfer the stagnant water from the top surface to the ground surface (Soil). During rainy seasons the water is stagnant at one place. Sometimes, there is no proper management practice available. To overcome these defects the thirsty concrete is used. This concrete is used as a paving material due to its efficient to the water is allowed to pass through itself to maintain groundwater level and storm water runoff is minimized. It will help to increase the low ground water level and agricultural problems. In this thirsty concrete we are planned to use the recycled aggregates instead of the normal aggregates and we are going to do the probe on the thirsty concrete with normal aggregate and the thirsty concrete with recycled aggregates. A concrete mix ratio of 1:3 was obtained as per BIS method for our experimental work. Water cement ratio 0.35 has been adopted and performance of concrete with treated normal and recycled aggregate is investigated.**

Index Terms- Thirsty concrete, Pervious Concrete, Recycled Aggregate

I. INTRODUCTION

Worldwide the groundwater level is been minimizing. To maintain the water level number of research has been carried out based on sending the water to ground surface. So, there are been various research carried on pavement areas in that thirsty concrete plays an important role in sending water to ground. During rainy seasons the water is stagnant at one place. Sometimes, there are no proper management practices available. To overcome these defects the thirsty concrete is used. This concrete is used as a paving material due to its efficient to the water is allowed to pass through itself to maintain groundwater level and storm water runoff is minimized. It will help to increase the low ground water level and agricultural problems. In this project, we compare of ordinary aggregate & recycled aggregate in thirsty concrete. The thirsty concrete is used for pavements. So, don't require a separate draining chamber along the roads. The various applications of previous concrete are listed as follows residential road, alleys and driveways, Low volume pavements, Sidewalks and pathways, Parking areas, Tennis courts, Sub base for conventional concrete pavements, Well lining, Swimming pool decks.

II. PROJECT SCOPE

The scope of this thirsty concrete is to reduce the water logging in road surface this concrete can be used for the purpose of constructing the sports court, animal shelter, Pavement. By use of recycled aggregate in this concrete, In future we can reduce the usage of raw material. This concrete having the characteristics of high porosity, so it is thermally insulating and it can be used as a sound barrier walls.

III. OBJECTIVES

The main objective of the pervious concrete is to allow the water to flow through itself and transfer the water to the ground. This concrete can be used as Low-volume pavements, Residential roads, Sidewalks, Pathways. It can also be used as water

drain structure in the sides of highways. It increases the ground water level by allowing water through itself. Another significant advantage in India is low cost when compared to western countries, much of the pervious concrete is laid manually without any machinery , so this can be placed in lower costs even in rural areas. The main objective of this concrete is reducing the aggregates. Because we use the recycled coarse aggregate by replacing the ordinary coarse aggregate and also avoid fine aggregate.

IV. MATERIALS

A. Cement

Cement, is an adhesive substances used as a binding materials in civil engineering construction. Cements in the form of finely ground powders, when its get mix with water, it goes to harden state form like solid mass substance. The cement is most widely used of all construction materials in the world today, the manufacture of cement is widespread. Each year almost one ton of concrete is poured per capita in the developed countries. The result of material test of cement is been listed in table below

S. No	PROPERTY	VALUE
1	Initial setting	28min
2	Final setting time	540min
3	Specific gravity	3.15

B. Coarse Aggregate

Aggregates are crystalline or granular rocks used for construction industry. Aggregate are termed which are sized more than 4.75mm. The crushed stone of Gravels are used majorly in concrete works. The angular aggregates are used for proper bonding. Here the primary aggregates (withdrawn from quarries) are used to find the strength of thirsty concrete. Aggregates plays important in strength factor of the structures it is an essentially needed material in construction of all major works. The result of material test of Normal coarse aggregate is been listed in table below

S. No	PROPERTY	VALUE
1	Impact test	11.18%
2	Water absorption	0.5
3	Specific gravity	2.72

C. Recycled Coarse Aggregate

The secondary aggregates are termed normally as recycled coarse aggregate. The recycled coarse aggregate which are broken pieces of waste comes from construction works. The density of recycled aggregate varies slightly from normal aggregate. In this project the pre used concrete cylinders and cubes are reused in the form of recycled coarse aggregate. It Conserves landfill space, reduces the need for new landfills and hence saving more costs. The result of material test of recycled coarse aggregate is been listed in table below

S. No	PROPERTY	VALUE
1	Impact test	10.55%
2	Water absorption	0.56
3	Specific gravity	2.31

V. MIX PROPORTION

Based on the results obtained from the material test the ratio is been determined. The mix ratio of the probe is been listed in table below

WATER	CEMENT	COARSE AGGREGATE
0.35	1	3.1

VI. EXPERIMENTAL PROGRESS

It includes all the experimental work carried out in this probe. The recycled coarse aggregate are been broken in to crystals, casting of fresh concrete in cube and cylinder concrete moulds, curing of hardened concrete for 7,14,28 days to determine the strength parameters of thirsty concrete.

A. Recycled Coarse Aggregate

The Recycled Coarse Aggregate are been taken from waste samples of pre used concrete cube and cylinder specimens. These are been broken and passed through IS sieves of 10mm. The retained aggregates are been taken for further material test and casting. The hammers are been used for breaking the wastes samples.

B. Casting

The mixing of cement and coarse aggregate (normal and recycled) done by correct volumetric calculations. After preparing of fresh concrete it is filled in concrete and cube moulds layer by layer for compaction (or vibrator should be used for proper

compaction). Then the concrete filled moulds are been kept separately.

Figure 1- Casted specimens

C. Curing

The casted specimen(with moulds) are been kept outside at room temperature. After 24 hours, the casted cube and cylinder concrete specimens are kept in curing tank of 7, 14, 28 days respectively.

VII. EXPERIMENTAL TEST

A. Slump Cone

The slump cone value is determined for various water cement ratio's and the result are listed in table below

SPECIMEN NAME	0.35 W/C	0.4 W/C	0.5 W/C
Normal Aggregate(mm)	300	290	270
Recycled Aggregate(mm)	300	300	290

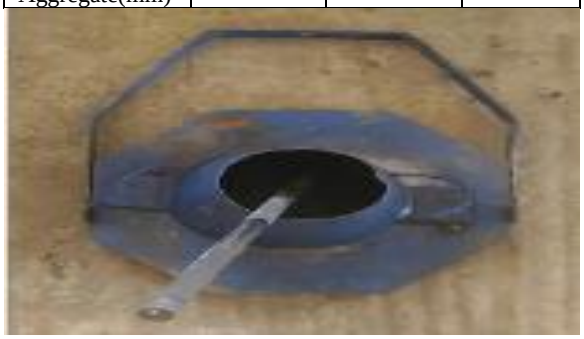

Figure 2- Slump cone

B. Compaction Factor

The compaction factor value is determined for various water cement ratio's and the result are listed in table below

SPECIMEN NAME	0.35 W/C	0.4 W/C	0.5 W/C
Normal Aggregate	0.76	0.70	0.64
Recycled Aggregate	0.85	0.74	0.68

C. Flow Table

The flow table value is determined for various water cement ratio's and the result are listed in table below

SPECIMEN NAME	0.35 W/C	0.4 W/C	0.5 W/C
Normal Aggregate	76	84	92
Recycled Aggregate	68	76	84

Figure 3- Flow table

D. Compressive Strength

The test is carried out on cube specimens of size (150x150x150mm). For normal and recycled aggregate each three specimens are been tested for 7, 14 and 28 days respectively. The compressive strength of thirsty concrete (Normal Aggregate and Recycled Aggregate) are tabled below

SPECIMEN NAME	7 DAYS (N/mm^2)	14 DAYS (N/mm^2)	28 DAYS (N/mm^2)
Normal Aggregate	17.06	25.60	27.77
Recycled Aggregate	15.73	23.60	25.07

E. Split Tensile Strength

The test is carried out on cylinder specimens of size (150x300 mm). For normal and recycled aggregate each three specimens are been tested for 7, 14 and 28 days respectively. The split tensile strength of thirsty concrete (Normal Aggregate and Recycled Aggregate) are tabled below

SPECIMEN NAME	7 DAYS (N/mm^2)	14 DAYS (N/mm^2)	28 DAYS (N/mm^2)
Normal Aggregate	4.29	5.92	6.57

Recycled Aggregate	3.66	5.57	6.1

Figure 4- Testing of specimens

VIII. LIMITATION

- In this investigation, only the construction demolition & pre used specimen wastes are used.
- While this thirsty pavement is an good option for certain situations, but it is not possible choice. It has a honeycombed surface, rough-textured, the surface of concrete will be raveled.
- The main reason pervious concrete is not used for high-traffic pavements, such as highways. This can be used mainly as sidewalks to drain the stagnant water.

IX. CONCLUSION

From this experimental probe the followings are been concluded

- Using the Recycled aggregates instead of normal aggregates in Thirsty concrete we can reduce the construction demolition waste.
- The Normal aggregates are fully replaced by the Recycled aggregates which results in more or less equal compressive strength.
- Water absorption of the Recycled aggregates are 9-10% higher than the Normal aggregates.
- The Compressive and Split Tensile strength of the thirsty concrete using Recycled aggregates is slightly lesser than the Normal aggregate thirsty concrete.
- From this investigation it is clear the thirsty concrete is very useful to our environment to reduce the stagnant water.

REFERENCES

[1] Anandh Babu Malayali and Ramesh Babu Chokkalingam, "Replacing cement with Geopolymer in pervious concrete" (2018).
[2] V.Shivaprakash, "Effects of material proportions on the engineering properties of pervious concrete", (2017).
[3] Er. Rajan Vinayak, Er. Gurprit Singh Bath,Er. Vineet Garg, "Comparison of properties between Natural & recycled aggregates", volume 4,Issue 2, (2017).
[4] R.Vinodhini, Pervious Concrete as a Paving Material: A Review ISBN: 978-0-6482502-2-7 (2017).
[5] Darshan S. Shah, Prof. Jayesh kumar Pitroda, Prof.J.J.Bhavsar "Pervious Concrete: New Era For Rural Road Pavement"ISSN: 2231-5381 (2016).
[6] Mr.V. R. Patil , Prof. A. K. Gupta , Prof. D. B. Desai "Use Of Pervious Concrete In Construction Of Pavement For Improving Their Performance" ISSN: 2278-1684, PP: 54-56 (2016).
[7] S.Aadhavan, R.Kayalvizhi, "Replacement of coarse aggregate using scrap rubber" (2016).
[8] Sherif yehi,Kareem Helal, Anaam Abusharkh, Amani Zaher, and Hiba Istaitiyeh, "Strength and Durability Evaluation of Recycled Aggregate Concrete", volume 9, No.2, pp.219-239, June (2015).
[9] Maniarasan S. K., Nandhini V., Kavin G. and Kavin Kumar T. R., "Study on characterization of pervious concrete for pavement", International journal of research in engineering and applied science, vol. 5, issue 4, pp 81-81-97 (April 2015).
[10] Ruizhong, kaywille, "Material design and characterization of high performance pervious concrete", construction and building materials, Elsevier, (Aug 2015).
[11] Jitender Sharma, Sandeep Singla and Gobindgarh, "Study of Recycled Concrete Aggregates", volume 13,number 3,July 2014.
[12] IS 383-1970 Specification for coarse and fine aggregates from natural sources for concrete.
[13] IS 10262-2009 Guidelines for concrete mix design proportioning.
[14] IS 12269-1987 Specification for 53 grade ordinaryPortland cement.