Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 6): pp. 2243-2251
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.06.206

"Experimental Investigation On Paver Block Using Fly Ash, Rice Husk Ash And Plastic"

Satish D. Kene Ph.D Scholar RKDF University, Bhopal – Madhya Pradesh, India, SVPCET ,Nagpur - Maharashtra, India, Department of Civil Engineering satishkene2285@gmail.com

Dr. Arun Patel Department of Civil Engineering, RKDF University, Bhopal – Madhya Pradesh, India. arunpatel123@gmail.com

ABSTRACT—: Paver block have been in use since several years. Due to fast infrastructure development the requirement of cement is increasing day by day and it produces large amount of carbon dioxide which leads to global warming. The main purpose of this research paper is that, prevention from environmental pollution of agricultural and industrial waste. This can be reprocess into making the paver block with cement concrete. Paver block is an attractive engineering and inexpensive alternative to both flexible and rigid pavement in various countries together with India. Interlocking concrete pavements are special dry mix precast piece of concrete commonly used in exterior landscaping pavement applications. For better look, easy laying and finish paver block are supreme material. The strength, durability and aesthetically pleasing surfaces have made paving blocks attractive for many commercial, municipal and industrial applications such as parking areas, pedestrian walks, traffic intersections, container yards and roads. This paper is survey of the use of waste plastic, Fly ash and rice husk ash in concrete paver blocks is aimed at reducing cement content and leading to better economy and durability. The primary objective of this research is to understand the properties, economical, technological and environmental benefits of waste used in paver block.

KEYWORDS: - Paver block, Fly ash, rice husk ash, plastic, Quality control and impact on environment.

1.0 INTRODUCTION — Concrete paver blocks are made with concrete basically consisting of cement, fine aggregates, coarse aggregates (10 mm and below), water, etc. Overall performance of concrete paver blocks used is mainly governed by properties of materials, water cement ratio, mixing process and curing process. To suit the imagination of landscape architectures and natures, pavers are having various shapes, sizes and colors. They are placed in variety of pattern. Natural resources are depleting worldwide, at the same time the generated wastes from the industry, agriculture and residential area are increasing significantly. The sustainable development for construction involves the use of non-conventional and innovative materials. The recycling of waste materials just like plastic, fly ash and rice husk ash in order to compensate the lack of natural resources and to find alternative ways conserving the environment.

The use of waste plastic, Fly ash and rice husk ash in concrete paver blocks is aimed at reducing cement content, aggregate and leading to better frugality and durability. It will also help in safeguarding the environment effects and contribute towards the solution for safe disposal of wastage plastic, Fly ash and Rice husk ash.

Waste material used as supplementary materials of cement in the paver block like plastic, Fly ash and Rice husk ash.

1. Rice husk ash:- Due to 98% silica content, which increases strength, hardness, strength and durability.
2. Fly ash:- Fly ash is with Ca, Si and Al2o3 etc, which provide help in setting and hardening and acts as a workability agent.
3. Plastic:- Crushed, gravelled any type of plastic can give reinforcement to cement block, which provide toughness, strength load bearing capacity lower down the weight of the block and save the quantity of aggregate etc.

In manufacturing of cement paver block resources are required as raw materials are available but in limited quantity. On the other hand imbalance of ecology and habitat occurs during the complete manufacturing processes to manufacture good quality paver block raw materials with necessary properties are required. It is possible to replace up to 30% raw materials by other materials which possess the properties necessary for good quality paver block. Rice husk ash is with 98% silica content which can be used and provides hardness, strength and durability. Rice husk ash is a waste product of industry and available easily. Fly ash is a waste product remains after burning of coal in thermal power plant which can be used as a raw material for paver block material. Fly ash is always with some percentage Ca and Si etc. Fly ash works as a workability agent during manufacturing of paver block. Third very important supplementary raw material is plastic, as we know the plastic is very big environmental problem. It can be remove out from waste and use for manufacturing of paver block or for road construction. Plastic provide reinforcement which increases tensile strength and load bearing capacity. All above three supplementary materials imparts good and necessary properties in paver block. It also helps in saving the impact on environment due to use of the resources of mother earth.

The objectives and scope of present study are

- Replace the resources up to 30% to serve natural resources and environmentalism.
- Utilization of various waste materials and provide economical construction material.
- Investigate the physical properties of plastic, Rice husk ash and fly ash.
- Find the optimum mix design with regards to the amount of plastic, Rice husk ash and fly ash required for making the paver block.
- Analyze the desired compressive strength of paver block with the combination of plastic, Rice husk ash and fly ash and compare with cement concrete block.
- Safeguard the environment by utilizing waste properly.
- Conduct water absorption test and compare with cement concrete block.
-

2.0 Materials and Methods

The work presented in this paper reports an investigation on the behaviour of Paver block produced from blending cement with FA, RHA and plastic. The physical and chemical properties of RHA, FA, OPC and plastic were first investigated. The effect of RHA on concrete properties was studied by means of the fresh properties of concrete and the mechanical properties i.e. compressive strength was studied as the time dependent property.

2.1 Cement

The cement used was Ordinary Portland cement (43 Grade) with a specific gravity of 3.15. Initial and final setting time of the cement was 50 min and 365 min, respectively.

2.2 Rice Husk Ash

Rice husk ash used was obtained from Ellora Paper Plant located in Tumsar Bhandara .The Specific gravity of rice husk ash is 2.10 and bulk density is 0.781 g/cc RHA, produced after burning of Rice husk (RH) has high reactivity and pozzolanic property. Indian Standard code of practice for plain and reinforced concrete, IS 456- 2000, recommends use of RHA in concrete.

2.3 Fly Ash

Fly ash used was obtained Koradi Power Plant Nagpur. Fly ash is one of the residues generated in the combustion of coal. Fly ash is generally captured from the chimneys of power generation facilities, whereas bottom ash is, as the name suggests, removed from the bottom of the furnace. Depending upon the source and makeup of the coal being burned, the components of the fly ash produced vary considerably, but all fly ash includes substantial amounts of silica (silicon dioxide, SiO_2) (both amorphous and crystalline) and lime (calcium oxide, (CaO). Fly ash is commonly used to supplement Portland cement in concrete production, where it can bring both technological and economic benefits, and is increasingly finding use in synthesis of geopolymers and zeolites.

2.4 Plastic

Plastic pollution is currently one of the biggest environmental concerns. It may seem like large amounts of plastic waste are inevitable in the world we live in, but we can help with the plastic pollution issue by being aware of its dangers and taking steps to reduce waste. Crushed, gravelled any type of plastic can give reinforcement to cement block, which provide toughness, strength load bearing capacity lower down the weight of the block and save the quantity of aggregate etc.

2.5 Aggregate

Good quality river sand was used as a fine aggregate. The fineness modulus, specific gravity and dry density are 2.32, 2.68 and 1690 kg/m3. Coarse aggregate passing through 20mm sieve was used. Its specific gravity and dry density was 2.7 and 1550 kg/m3.

2.6 Chemical Admixture

A commercial AC- Green Slump-GS-02 black cat Chemical Limited and Glenium- AG-30 JP – BASF Const. Chemical Limited type hyper plasticizer was used to maintain the workability of fresh concrete. The dosage of hyper plasticizer was kept constant in mass basis; it was 1%-1.6% of cement weight. The aim of keeping the amount of plasticizer constant is to neglect, if any, the influence of plasticizer on the properties of hardened concrete.

3.0. Experimental Programme

Experimental programme covers of test on cement, RHA, FA, Test on concrete, Plastic and paver block with partial replacement of cement with RHA and FA and 10% of replacement aggregate with plastic.

3.1 RICE HUSK ASH

1) Normal Consistency = 17%
2) Initial and Final Setting time = 195min. and 265min.
3) Compressive Strength = 11 N/mm2
4) Specific Gravity = 2.09

3.2 ORDINARY PORTLAND CEMENT

OPC 43 grade cement is used for this whole experimental study. The physical test results on OPC are as follows.

1) Normal consistency = 22%
2) Initial Setting time = 30 min.
3) Final Setting Time = 10 hrs.
4) Specific Gravity = 3.15

3.3 TEST ON CONCRETE

An M25 mix is designed as per guidelines in IS 10262, 1982 based on the preliminary studies conducted in the constituent materials. Tests on fresh concrete are obtained as follows.

1) Slump Test=55mm
2) Vee-Bee = 13sec.
3) Compaction factor =0.95
4) Flow Test =78 %.

3.4 Testing methods

Testing is done as per following IS code. The testing done for compressive strength of cubes as per IS: 516 – 1959.

4.0 Test Result

Experimental investigation is carried out on the paver block test specimens to ascertain the strength related properties namely compressive strength. This paper presented the test results of the experimental investigation carried out on the test specimens to study the optimum percentage of replacement of cement with FA & RHA and aggregate with waste plastic.

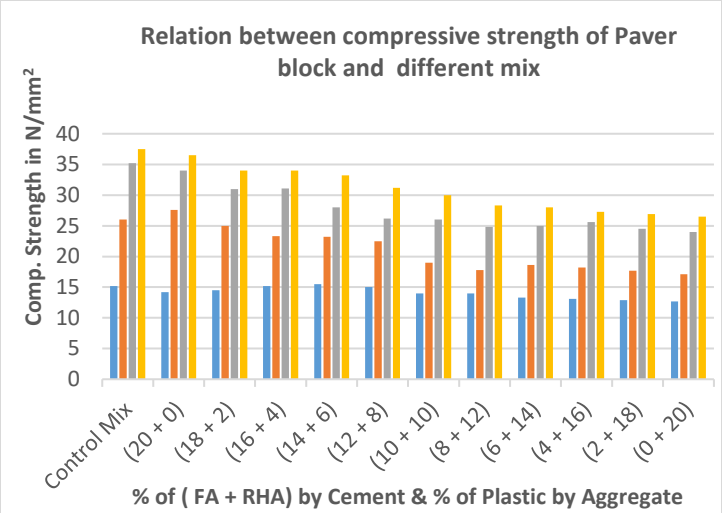
4.1 Testing of Compressive strength

Testing of paver block samplings are tested for 7, 14, 28 and 54 days compressive strength by using compressive testing machine. After conducting compressive strength testing the test results are tabulated.

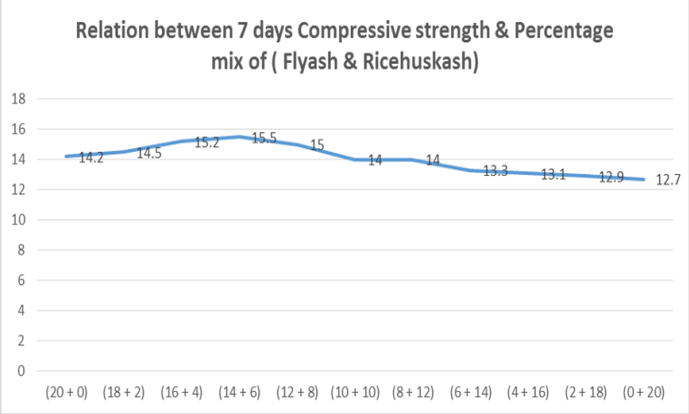
Table No. 1 Table for compressive strength of paver block.

MIX				Strength of Paver Block in N/mm²			
Sr. No.	Flyash by wt. of % cement	Rice huskash by wt. Of % cement	Plastic by wt. of % aggregate	7 Days	14 Days	28 Days	54 Days
1	Control Mix			18.7	26.7	33.2	42.3
2	20	0		14.2	27.6	34	36.5
3	18	2		14.5	25	31	34
4	16	4		15.2	23.2	31.1	34
5	14	6		15.5	23.2	28	33.2
6	12	8		15	22.5	26.2	31.2
7	10	10	10	14	19	26	30
8	8	12		14	17.8	24.8	28.3
9	6	14		13.3	18.6	25	28
10	4	16		13.1	18.2	25.6	27.3
11	2	18		12.9	17.7	24.5	26.9
12	0	20		12.7	17.1	24	26.5

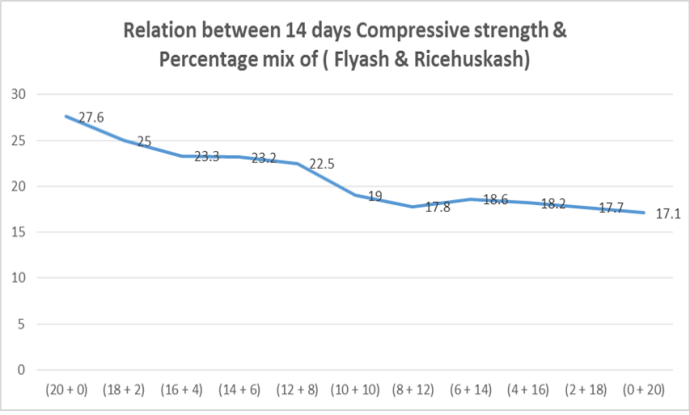
4.1.1 Relation between compressive strength of paver block in days and different mix.



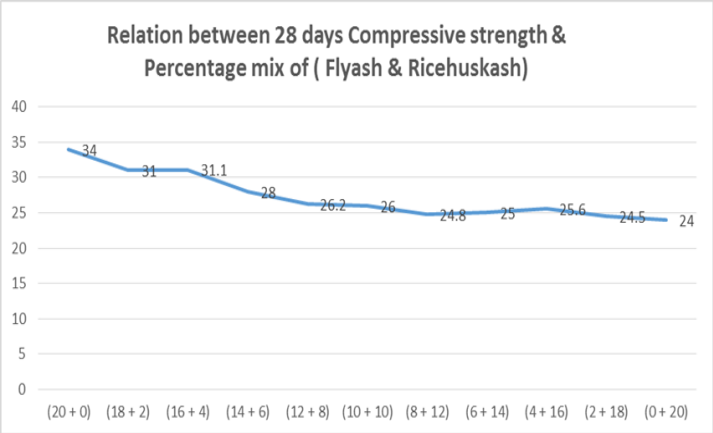
4.1.2 Relation between compressive strength of paver block in 7 days and different mix.



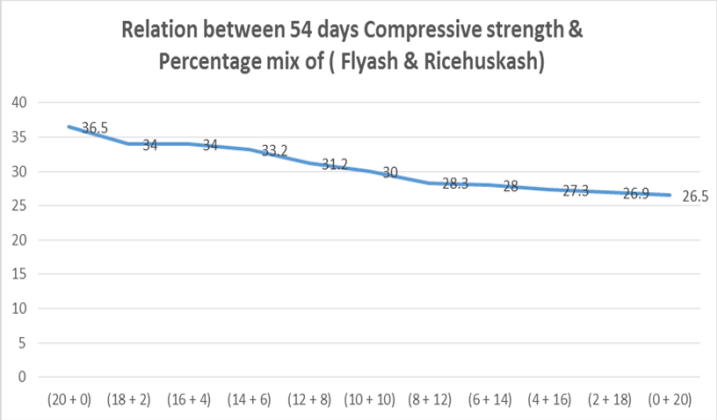
4.1.3 Relation between compressive strength of paver block in 14 days and different mix.



4.1.4 Relation between compressive strength of paver block in 28 days and different mix.



4.1.5 Relation between compressive strength of paver block in 54 days and different mix.



5.0 Conclusion

Based on the results presented above, the following conclusions can be drawn:

1) Compressive strength of paver block increases with the increase in the percentage of Fly ash and Rice Husk Ash up to replacement (14 %FA and 6 % RHA) of Cement and 10 % plastic of aggregate in Concrete for different mix proportions.
2) Paver block concrete requires approximate increase in water cement ratio due to increase in percentage of RHA. Because RHA is highly porous material.
3) The workability of RHA concrete of paver block has been found to decrease with increase in RHA replacement.
4) The water absorption of paver block increases after the addition of percentage increase of rice husk ash as compare to control mix.
5) Rice husk ash contains more silica, and hence we prefer rice husk ash use in concrete paver block than silica fume to increase the strength.
6) Through Rice husk ash is harmful for human being, but the cost of rice husk ash is zero and thus we prefer RHA use in concrete as compared to silica fumes.

7) The workability of RHA concrete has been found to decrease but FA increases the workability of concrete so RHA and FA mix together in concrete paver block to improve the workability of concrete.
8) In paver block Rice Husk Ash can be used with admixtures, plasticizers, and super plasticizers, for increasing the strength with partial replacement of cement.
9) The cost of construction will be reduced and also helps to avoid the general disposal technique of waste plastic.
10) Strongly conclude the use of fly ash, rice husk ash and plastic in a paver block is the best option for the disposal of fly ash, rice husk ash and plastic and ultimately reduces the pollution of environment.

REFERENCES –

a. Satish D. Kene and Dr. Arun Patel (2020),"A Survey Based on Utilization of Fly Ash, Rice Husk Ash and Plastic waste in Paver blocks" In IJERT, Volume 9, Issue 9 , September – 2020.

a. **Sarang Shashikant Pawar and Shubhankar Anant Bujone (2017),** "Use of Fly ash and Plastic in Paver Block". International research journal of Engineering and Technology (IRJET) Volume :04 Issue:11|Nov – 2017.
b. **B. Shanmugavalli, K.Gowtham, P. Jeba Nalwin2 and B. Eswara Moorthy (2017)** "Reuse of Plastic Waste in Paver Blocks". International research journal of Engineering and Technology (IRJET) Volume :06 Issue:02|Feb – 2017.
c. **Mohan D.M.S, Vignesh.J, Iyyappan. P and C.Suresh (2018)** "Utilization of plastic bags in pavement blocks". International journal of pure and applied mathematics. Volume :119 Issue:15|Feb – 2018.
d. **Koli Nishikant, Aiwale Nachiket, Inamdar Avadhut and Abhishek Sangar (2016)** "Manufacturing of concrete paving block by using waste glass material" International journal of Scientific and Research Publications, Volume :06 Issue:06|June – 2016.
e. **Dinesh.S, Dinesh.A and Kirubakaran.K (2016)** "Utilisation of waste plastic in manufacturing of bricks and paver blocks" International journal of applied engineering research , ISSN 0973 – 4562 Vol.11 No. 3 (2016).
f. **A.Panimayam, P.Chinnadurai, Anuradha and K.Pradeesh, A.Umar Jaffer (2017)** "Utilisation of Waste Plastics as a Replacement of Coarse Aggregate in Paver Blocks" International journal of ChemTech Research CODEN (USA) : IJCRGG, ISSN :0974-4290 Vol.10 No.8, pp 211-218 (2017).
g. **Mohammad Jalaluddin (2017) "**Use of Plastic Waste in Civil Constructions and Innovative Decorative Material (Eco- Friendly)" MOJ Civil Engineering, Review Article Volume 3 Issue 5 – 2017.
h. **A.I. Essawy a, A.M.M. Saleh b, Magdy T. Zaky c, Reem K. Farag b, A.A. Ragab b (2013**) "Environmentally friendly road construction" Egyptian journal of Petroleum (2013) 22, 189-198.