Investigation on the Properties of Concrete Using Glass Powder as Partial Replacement of Fine Aggregate for Paver Blocks

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Abstract - Concrete is the most widely used construction material in the world it is a mixture of cement fine aggregate coarse aggregate and water. Storage and safe disposal of waste glass powder is a huge problem everywhere, reuse of these waste reduce the problem. When used glass powder in pre-cast cement paver block found that the strength increases with the replacement of fine aggregate by glass powder beyond 30% workability of concrete is different.

Solid unreinforced pre-cast cement concrete paver blocks may be a versatile, esthetically enticing, functional, worth effective and desires very little or no maintenance if properly factory-made and set. Paver blocks unit generally used for diverse traffic classes i.e. Non-traffic, Light-traffic, Medium-traffic, Heavy-traffic and really important traffic. Concrete block paving is versatile, aesthetically attractive, functional, and price effective. Most concrete block paving's created in country have performed satisfactorily but there are two main areas of concern occasional failure and variability of strength of blocks.

In this study 60 mm thick and paver blocks of M35 concrete grade is casted, in this experiment fine aggregate is replaced 0% to100% of its weight by glass powder in concrete paver blocks and its effects are studied. Glass Powder is material of stone trade and generated as a waste throughout the method of cutting and crushing of stones area unit reaching to use as fine mixture during this project. Fine mixture goes to switch by Glass Powder (which is maintained on 4.75 mm IS sieve) up to 100% at associate degree interval of 100% and take a look at like compressive strength at the side of flexural strength is performed on paver blocks. Workability of the concrete is additionally checked.

Key Words: Paver blocks, Rural roads, Glass Powder, Compressive Strength, Flexural Strength, and Workability.

I. INTRODUCTION

Many of the poor communities are isolated by distance, bad road conditions, lack of or broken bridges and inadequate transport. These conditions build it troublesome for folks to urge their product to plug and themselves to put of labor, to handle health emergencies, to send kids to high school, and to get public services. A community while not roads doesn't have the way out. If we have a tendency to get the road, we'd get everything else, community centre, employment, post-office, telephone etc. Rural Road property may be a key element of rural development, since it promotes access to economic and social services, thereby generating magnified agricultural productivity, non-agriculture employment likewise as non-agricultural productivity, that successively expands rural growth opportunities and real financial gain through that financial conditions are often reduced. A study disbursed by the International Food Policy analysis Institute on linkages between government expenditure associated financial condition in rural Asian country has unconcealed that an investment of Rs one large integer in roads lifts 1650 poor persons on top of the personal income. Public investment on roads impacts rural financial condition through its impact on improved agricultural productivity, higher non-farm employment opportunities and magnified rural wages. Improvement in agricultural productivity not solely reduces rural financial condition directly by increasing financial gain of poor households, it additionally causes decline in financial condition indirectly by raising agricultural wages and lowering food costs (since poor households square measure web consumers of food grains). Similarly, magnified non-farm employment and better rural wages additionally enhance incomes of the agricultural poor and consequently, scale back rural financial condition.

II. RELATED WORK

[1] P.P.Shanbhag , V.G.Patwari JULY 2017, The present study is aimed at utilizing Waste marble powder and quarry sand as partial replacement of cement and fine aggregate in concrete and comparing it with conventional concrete. This experimental investigation is carried out in three phases in 1st phase M20 grade of concrete is produced by replacing cement with 0%, 5%, 10% & 15% of Marble Powder. In 2nd phase concrete is produced by replacing sand with 0%, 30%, 40% & 50% of quarry sand and in 3rd phase concrete is produced by replacing cement and fine aggregate in the percentage of 0%, 5%, 10% & 15% of Marble Powder and 0% , 30%, 40% & 50% of quarry dust respectively. It is found that the studies of concrete made of waste marble powder and quarry sand

increases at 10% and 40% respectively. Therefore the quarry dust and waste marble powder should be used in construction works, then the cost of construction would be saved significantly and the natural resources would be used efficiently.

[2] Kaveh Afshinnia, Prasada Rao Rangaraju. August 2016., Examined that the effect of utilizing ground Glass Powder as either a bond substitution material or as a total substitution material on the crisp and Mechanical properties of Portland bond concrete were explored. Results from this examination demonstrated that the workability of cement was essentially influenced relying upon whether the Glass Powder was utilized as bond or total substitution material, however air substance and thickness of cement were influenced just when Glass Powder was utilized as concrete substitution material. As far as mechanical properties without Glass Powder in concrete, the compressive and part rigidity estimations of the solid examples containg pulverized glass total were altogether lower than that of the solid containing Natural mineral total. At the point when Glass Powder was utilized as a bond substitution material in concrete, the compressive quality of solid abatements paying little mind to the total kind. Nonetheless, when Glass Powder was utilized as a total substitution material, the compressive quality of cement relied upon the sort containing pounded glass total expanded while the compressive quality of cement containing regular mineral total diminished.

3] K. Sundara Kumar, M. Siva Chennakesava Rao August 2016 , Analyzes that the likelihood of utilizing Glass Powder as a fractional swap of bond for new concrete,. The worldwide concrete industry contributes around 7% of green house gas discharge into the world's environment. Squander glass is one materials when ground to a fine powder indicates pozzolanic properties which can be utilized as a halfway swap for bond in concrete. Endeavors have been made to discover the quality of cement containing waste Glass Powder as a halfway trade of bond for concrete. For this the finely powdered waste glasses are utilized as an incomplete substitution of bond in concrete and contrasted it and traditional solid Glass Powder was mostly supplanted bond by 5%, 10%, 15%, 20%, 25%, 30%, 35% and 40% and tried for compressive, split elastic and flexure quality at 7 days, 28 days of age and were contrasted and those of customary that Glass Powder can be utilized as bond substitution material up to 20% and past 20% the quality reductions.

[4] Sarbjeet Singh, Ravindra Nagar, Vinal Agrawal, July 2016, Have examined that the waste age from rock stone industry is as non-biodegradable fine powder the use of this loss in solid will help in supportable and greener improvement.

[5] Hocine Siad, Mohamad Lachemi, Mustafa, Sahmaran, Khandaker M. Anwar Hossain, June 2016 , An examination concerning the impact of fusing Glass Powder as a bond substitution on mortar protection against sulfuric corrosive assault. The examination inspected compressive quality, ultrasonic heartbeat speed and electrical resistivity changes of mortars in view of 15, 30 and 45 % Glass Powder substitution rates and 12 weeks inundation in crisp water and 5 % corrosive arrangements. The impacts of double fasteners in view of Glass Powder and limestone powder, Glass Powder and slag and Glass Powder and fly fiery debris were additionally explored. Exploratory outcomes indicated enhanced sulfuric corrosive protection with expanded Glass Powder substance and paired folio comes about affirmed the helpful impact of joining limestone powder with Glass Powder. Mortars with 45 % Glass Powder and double folio in view of 20 % Glass Powder and 20 % limestone demonstrated a misfortune that was altogether lower as far as Physical and Mechanical qualities. Micro structural investigation demonstrated that Si/Al-rich deposit, which was surface produced from pozzolanic response of Glass Powder, can possibly restrain advance erosion by going about as a boundary to corrosive particles. Consequently consolidating Glass Powder up to 45 % substitution of bond can upgrade mortar protection from forceful sulfuric corrosive assault.

[6] Ahmed Omran, Arezki Tagnit-Hamou, 15 April 2016, Examined that the blended shaded glass can't be reused and is regularly discarded in landfills, causing evident natural issues. So if this glass subsequent to pounding to same fineness as bond permit its utilization as supplementary cementitious materials specially it has pozzolanic conduct. The examination gave an account of in this shows the in situ execution of cement containing Glass Powder utilized as an incomplete substitution of concrete at different development locales including inside and outside chunks and auxiliary divider components. Notwithstanding the natural advantages the solid made with 20% Glass Powder substitution indicated increments in 91-days compressive quality (7%). 28-days rigidity (35%) and 28-days flexure quality (4%) contrasted with reference blends without Glass Powder. A huge increment in protection from chloride-particle entrance can be gotten when utilizing Glass Powder concrete.

[7] Min-Cheol Han, Donglop Han, Jae-Kyung Shin, November 2015, Examined the results of base fiery remains and stone clean can be changed over to lightweight solid total; both stone tidy and base cinder have a synthetic synthesis perfect for use as sweeping lightweight totals. This examination additionally discovered that and broiler dried thickness of 1.46g/cm3 with and ingestion proportion of 8.5 % can deliver light

weight totals perfect for use as light weight concrete for basic employments.

[8] Amit Kumar Singh, Vikas Srivastava, V.C. Agarwal. August 2015. Have considered that stone tidy is a waste material acquired from crusher plants. It can possibly be utilized as fractional substitution of normal waterway sand in concrete. Utilization of stone tidy in concrete enhances the nature of concrete as well as save the normal stream sand for who and what is to come. They examine a test program was done to think about the workability and compressive quality of cement made utilizing stone tidy as incomplete substitution of fine total in scope of 10%-100%. M25 review of cement was composed utilizing Portland pozzolana bond for referral concrete. Workability and compressive quality were resolved at various substitution level of fine total viz. a viz. referral concrete and ideal substitution level was resolved in view of compressive quality. Results demonstrated that by supplanting 0% of fine total with stone tidy cement of greatest compressive quality can be made when contrasted with all other substitution levels.

III. PROBLEM IDENTIFICATION

- Natural resources are depending past researches for substitute construction materials is being done rapidly.
- Some of factory serape, garbage's by products are useful as substitute for natural resources .Such materials cause additional problems of storage, environmental eco and transportation as well literature survey indicated those glass ,serape of a glass factory can be used as substitute material for fine aggregate.
- Glass powder is generated in a large amount in the production of glass industries and crusher plants, window repair shops, old tube light, electric bulb etc.

IV. OBJECTIVE

• The objective of the research is to study the effect of the use of ‘Glass Powder’ as a replacement of fine aggregate for Paver Blocks.

• The objective of this study is also to search alternative materials of fine aggregate which can replace naturally available material for construction work.

• To check the workability of the concrete by adding glass powder for paver block.

• To find out the strength of concrete by adding glass powder 0% to 100%.

The investigation centers to decide the relative execution of sand by utilizing above waste items.

V. METHODOLOGY

This chapter shows detailed methodology adopted for this project. In this chapter, how paver block is manufactured for experimental work is described. 60 mm thick Paver block of M-35 grade is cast for the experimental work. For manufacturing of paver blocks.

VI. EXPERIMENTAL RESULTS

The apparent compressive strength of individual specimen shall be calculated by dividing the most load (in N) by means of the plan area (in mm2). The corrected compressive strength shall be calculated with the aid of multiplying the obvious compressive strength through the precise correction aspect from table sixteen. The energy shall I be expressed to the closest 0.1 N/mm2.

Table 1: Correction Factors for Thickness and Arise / Chamfer of Paver Block for Calculation of Compressive Strength

S.No.	Paver Block Thickness (mm)	Correction factor	
		Plain Block	Arised/Chamfered Block
1.	50	0.96	1.03
2.	60	1.00	1.06
3.	80	1.12	1.18
4.	100	1.18	1.24
5.	120	1.28	1.34

For other thickness of paver blocks between 50 mm and 120 mm, linear extrapolation of-concrete factor shall be made.

Table 2: Corrected compressive strength of Glass Powder paver blocks

Mix Name	*Compressive strength (N/mm^2)*	
	7 days	*28 days*
CC	31.33	41.16
GP10	32.72	45.62
GP20	32.53	45.15
GP30	39.68	49.64
GP40	34.68	45.55
GP50	34.38	44.10
GP60	32.28	43.65
GP70	27.58	38.74
GP80	27.23	37.88
GP90	26.72	36.35
GP100	26.11	35.12

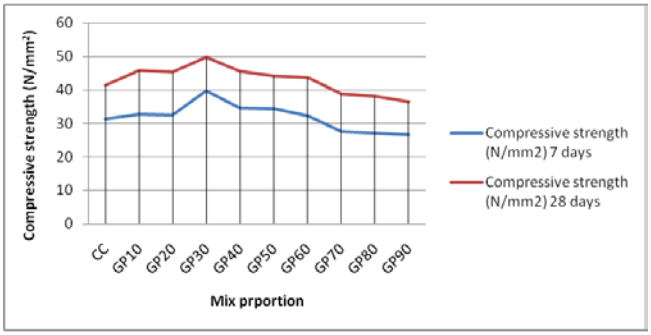

Figure 1: Corrected compressive strength of Glass Powder paver blocks (Line Figure)

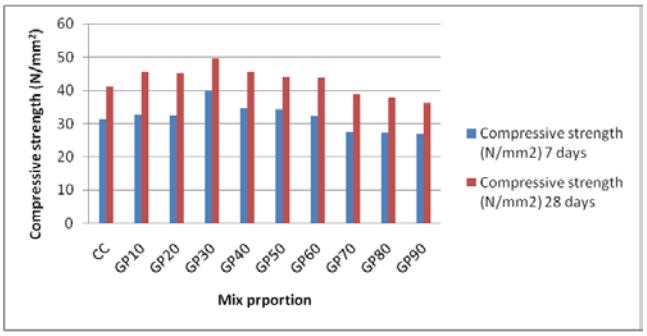

Figure 2: Corrected compressive strength of Glass Powder paver blocks (Bar Chart)

VII. CONCLUSION

Slump cone test checks out the workability of concrete; quarry fine is replaced with sand which gives decrement to slump value of concrete, for this project concrete is designed for 100 mm slump and its control concrete mix (CC) gives slump value of 93 mm which decreases with the percentage increase in Glass Powder in the composition of concrete. It shows decrement of 42 mm slump i.e. approximately 45%.

Compressive strength of Glass Powder paver blocks increases when Glass Powder is replaced by sand in the composition of paver blocks and after correction as per IS 15658 recommendation it gives optimum value of 30%. Concrete mix gives compressive strength of 41.16 N/mm2, when 30% Glass Powder is added by the weight of the sand, it attains maximum compressive i.e. 49.64 N/mm2, gives 30% optimum value of Glass Powder, further Glass Powder added in the composition compressive strength goes down to 35.12 N/mm2, as whole it is concluded that for M35 characteristic mean strength is 35 N/mm2 and as per IS 15658 : 2009, minimum average 28 days compressive strength should be Fck + 0.825 * 0.5 (standard deviation), so minimum compressive strength required for paver blocks is 35.41 N/mm2, in this case 90% of the Glass Powder can be replaced by sand in the composition of paver blocks.

Future Scope of Work

The study can also be carried out by used different building scrap with Glass Powder.

The engineering properties like water absorption, reduction in weight of concrete and density of the concrete can be studied by using the stone dust and Glass Powder.

The effect temperature and humidity can also be studied.

The study can also be carried out by using higher grade of concrete with Glass Powder.

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