Review Paper on Properties of Concrete Using Glass Powder as Partial Replacement of Fine Aggregate

Dipesh Kumar[1], Pratiksha Malviya[2], Bharti Tantaway[3]

[1]*M. Tech. Scholar* [2,3]*Professor Department of Civil Engineering*

Millennium Institute of Technology, Bhopal, India

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.

Keywords: 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.

The raw materials need for manufactures of the product square measure Portland cement and aggregates that square measure accessible domestically in each half of the country. Market potential cement concretes paving blocks realize applications in pavements, footpaths, gardens, passengers waiting sheds, bus- stops, trade and alternative public places. The product is often utilized in urban areas for the on top of applications. Hence, the unit could also be established in urban and semi urban areas, close to the market.

Interlocking Pavers are the modern day solution for low cost outdoor application. Paver block is solid, unreinforced pre-cast cement concrete paving units used in the surface course of pavement. They are high strength concrete precast elements in various shapes, sizes & colors to suit the imagination of landscape architects & nature's essence. By improving its compressive strength it can be used in heavy traffic area also. Interlocking pavers are manufactured concrete product that is individually placed in a variety of patterns and shapes as per the requirement.

II. SCOPE OF THE STUDY

Scope of the study is to make rural roads effective and also construction of rural roads becomes easy and economic.

The performance of paver blocks pavement depends on mechanical properties of concrete blocks and structural design of the pavement, for a serviceable paver blocks pavement, both factors have to be studied. paver block pavement have a unique ability of transferring loads and stresses over large areas for paving, They also have a good wearing resistance and adequate skid resistance and laying can be done by unskilled labor under proper supervision. Paver block pavement can be used immediately after laying. Maintenance cost of paver blocks roads is less and No thermal expansion and contraction of concrete. Other scope of this study is to enhance the industry understanding of the sustainable utilization of Glass Powder, and to identify any gaps in current knowledge. Utilization implies the use of Glass Powder to their full potential to meet the needs of the present, while at the same time conserving natural resources and finding ways to minimize the environmental impacts associated both with Glass Powder production and use.

III. RELATED WORK

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.

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.

Mohammadreza Mirzahosseini and Kyle A. Riding. " June 2015, Have examined that the finely ground glass hs the potential for pozzolanic reactivity and can fill in as a supplementary cementitious material uniform structure, amorphous nature, and high silica content influenced ground to glass perfect for concentrate the impacts of glass write and molecule estimate on smooth material reactivity at various temperature. This investigation centers around how the blend of glass composes and particles sizes influences the microstructure and execution properties of cementitious framework containing glass cullet as a supplementary cementitious materials. They found that the response rate pozzolanicity and hydration degree capability of four arrangements of consolidated glass composes and sizes were examined utilizing isothermal calorimetric concoction shrinkage, thermo gravimetric investigation and examination of checking electron magnifying lens pictures, additionally compressive quality and water sorptivity were performed on mortar tests to connect reactivity of cementitious materials containing glass to the execution of cementitious blends. Results demonstrated that joined glass can expands response rate and show pozzolanic properties, particularly when particles of clear and green glass underneath 25 micron were utilized at a curing temperature of 50 degree Celsius. The synchronous impact of sizes and kinds of glass cullet (surface zone) on response rate of Glass Powder additionally can be represented through a straight option mirroring that the surface territory would fundamentally influence glass cullet reactivity. However execution properties a cementitious frameworks containing joined glass writes and measure carried on diversely as they took after the weaker segment of the two particles.

Brajesh Kumar Suman, Vikas Sribastava. April 2015. Have considered that the stone tidy is such an elective material which can be adequately being utilized as a part of development as halfway substitution of normal sand. In this examination, a test program was completed to think about the reasonableness and potential utilization of stone clean as incomplete substitution of fine total in concrete. To achieve this example were thrown for various substitution level at an interim of % to decide workability and compressive quality of cement at various level of fine total with stone tidy. Results demonstrates that ideal

supplanting with stone tidy is 60% in light of compressive quality.

Arame Niang, Nathalie Roy, and Arezki Tagnit-Homou. March 2015, Have contemplated that Concrete created by utilizing Glass Powder as a fastener demonstrates low porousness to chloride particles. Furthermore, broad research venture on the utilization of Glass Powder as cementitious material is in progress at the college of Sherbrook, Quebec, Canada. The northeastern Canadian region of Quebec has a strategy on squander administration to advance the recuperation and administration of materials from the city, modern, business and institutional divisions. In this way new options for utilizing reused glass are required. Glass Powder contains around 70% silicon dioxide. In this manner the supplanting of 20% of bond with the consolidation of Glass Powder into the detailing of cement gives monetary and natural advantages. Besides, it has been demonstrated that solid with 20% Glass Powder has a low penetrability to chloride particles, which makes it an appropriate answer for reinfor4ced solid components subject to eroding condition, for example, deicing items or a salty climate. The outcomes from an investigation on the auxiliary conduct of strengthened solid section consolidating Glass Powder. The solid section made with Glass Powder indicate attractive basic conduct. The outcomes demonstrated that for a water-folio proportion of 0.4 the substitution of 20% of bond by Glass Powder postponed breaking o the solid cover and marginally enhanced the heap conveying limit. For water-folio ration0.55 the outcomes for segments with Glass Powder tried at 91 days were still somewhat lower than those without Glass Powder. In any case, the distinction was littler than for sections with a similar water-cover proportion that were tried at 28 days. Generally, the outcomes demonstrated that auxiliary conduct of fortified solid segments made utilizing concrete with Glass Powder is like section made with ordinary cement with 20% Glass Powder for the development of practical building structures.

Dr. Lalit Kumar, Er. Arvinder Singh. January 2015.Have examine the likelihood of utilizing pounded stone tidy as fine total incompletely or completely with various evaluations of solid composites. The reasonableness of smashed stone tidy waste as a fine total for concrete has been surveyed by contrasting its fundamental properties and that of traditional cement. Two essential blends were decided for regular sand to accomplish M25 and M30 review concrete. The comparable blends were acquired by supplanting regular sand by stone tidy mostly and completely. The test outcomes demonstrates the smashed stone tidy can be utilized viably to supplant characteristic sand in concrete. In the exploratory investigation of quality attributes of solid utilizing smashed stone tidy as fine total it is discovered that there is increment in compressive quality, flexure quality and elasticity.

Sadoon Abdallah, Mizi Fan. June 2014. Have examines that the attributes of cement containing fine pulverized glass amid its procedure, the best proportion of fine squashed glass which prompts higher quality of cement with a specific end goal to create solid squares, and the impacts of waste glass substitution on extension caused by Alkali-Silica response. The droop unit weight, compressive quality part rigidity, flexure quality modulus of flexibility, ultrasonic heartbeat speed, dry thickness, water retention and Alkali-Silica response were examined as far as waste glass content (0%, 5%, 15% and 20%) under various curing age of 7, 14, and 28 days. It was discovered that the droop of cement containing waste glass as fine total supplanting diminished with expanded in the waste glass however without loss of workability. The compressive, part ductile and flexure quality of cement with 20% waste glass content expanded by 5.28%, 18.38% and 8.92% separately at 28 days. The coxes with squander glass substitution demonstrated a denser inside solid structure or more steady structure under ultrasonic heartbeat speed evaluation. There was a reasonable diminished in the water retention with an increment of waste glass total proportion, and an unmistakable decrease in the development of the waste glass solid, demonstrating a soluble base silica response in solid which happened between the dynamic silica of waste glass and silica of concrete glue.

Ali A. Aliabdo, Abd Elmoaty M. Abd Elmoaty, Esraa M. Auda. January 2014,Have discover the utilization of marble clean in solid creation as bond substitution or as sand substitution (bond expansion) continuously improves both of the Mechanical and Physical properties of cement particularly with bring down w/c proportion. Marble clean demonstrated a filler impact in concrete and had no recognizable part in the hydration procedure. However concrete made with marble tidy as sand substitution accomplished better execution contrasted with concrete made with marble tidy as bond substitution.

M. Vijayalakshmi, A.S.S. Sekar., G. Ganesh PrabhuSeptember 2013, Have examined that the rock stone handling industry produces huge amounts of non-biodegradable fine powder squanders and usage of that risky waste in solid generation will prompt green condition and reasonable solid innovation. Solid blend were set up by 0%, 5%, 10%, 15%, 20% and 25% of fine total substituted by stone powder squander. The acquired test outcomes were demonstrated that the substitution of regular sand by rock powder squander up to 15% of any definition is good for the solid making without antagonistically influencing the quality and strength criteria. Notwithstanding it is prescribed that the rock

powder waste ought to be subjected to a compound blanching process preceding mix in the solid to build the sulfate protection.

Dr. G. Vijayakumar, Ms H. Vishliny, Dr. D. GovindarajuluFeb 2013 Have contemplated that finely powdered waste glasses are utilized as a fractional substitution of bond in concrete and contrasted it and regular cement. This work looks at that the likelihood of utilizing Glass Powder as a fractional substitution as 10%, 20%, 30% and 40%. What's more, tried for its compressive, ductile and flexure quality up to 60 days of age and were contrasted and those of traditional solid: frame the outcomes acquired, it is discovered that Glass Powder can be utilized as bond substitution material upto molecule measure under 75 micron to avoid salt silica response.

Kalingarani et al. (2012) concluded that Interlocking concrete paver block (ICPB) is having advantages in the exterior flooring. His aim of the study is making ICPB by using a maximum amount of industrial waste like fly ash and copper slag.

Vaz Aaron et al. (2012) found that now a days cement concrete is second mostly used commodity material in the world, because cement is responsible for producing a large amount of carbon dioxide & also responsible for global warming effect. Now a dyas Geopolymer concrete used as an option for OPC in precast concrete products. Geopolymer concrete is a eco friendly option for waste stabilization. Geopolymer concrete paver blocks have advantages on OPC in form of high compressive strength . They also have high early strength gain curing time 24hours at 60°C and OPC is curing 28 days in water so geopolymer concrete used Benefit in the manufacture paver block.

M ravi et al. (2012) analyzed the close study on different strength characteristics and water absorption capacity of iron ore tailings based concrete paver blocks. iron ore tailings based concrete paver blocks are compared with the conventional type concrete paver blocks. Mining industry is the source from where iron ore tailings is obtained. The waste handling and disposing is a very big problem so iron ore in concrete is used for the improvement in strength of that. The use of iron ore tailing from 5% to 10% has shown increases in the strength in compression of the concrete.

H.M.A. Mahzuz, A.A.M. Ahmad and M.A. Yusuf. May 2011. Have considered that stone tidy delivered from stone pounding zones shows up as an issue for compelling transfer. Sand is basic fine total utilized as a part of development fill in as fine total. In this investigation the principle concern is to locate an option of sand. Substitution of ordinary sand by stone powder will serve both strong waste minimization and waste recuperation. Cement of stone powder and block chip increased around 10% higher quality than that of the solid typical sand and stone chip concrete. The most astounding compressive quality of mortar found from stone powder, which is 33.02MPa, demonstrates that better mortar can be set up by the stone powder. The compressive quality of cement from stone powder demonstrates 14.76% higher incentive than that of the solid made of typical sand. Then again, concrete from block chip and stone powder deliver higher compressive incentive from that of block chip and typical sand concrete.

Her-Yung Wang, Wen-Liang Huang. " June 2010, Have contemplated that the fluid precious stone glass sand is utilized of total. The outcomes show that the droop stream of self-compacting glass solid increments with higher glass sand content. Also, supplanting 20 % of the totals yields the most elevated compressive and flexure qualities. Self-compacting glass concrete has the most noteworthy ultrasonic heartbeat speed. Following 56 days, the electric resistivity is higher than 20kω. At long last, when the volume of glass is expanded to 30 % the measure of chloride particle entrance is decreased and the sturdiness of the self compacting glass concrete is progressed.

IV. 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.

V. 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.

VI. CONCLUSION

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.

REFERENCES

[1] Mbachu, J.I.C. and J.O. Kolawole (1998): Shrinkage and Elastic Moduli of Ordinary Portland Cement (OPC) and Rice Husk Ash (RHA) Concrete made with difference Coarse Aggregate Types. Journal of Environmental Science 1(2): 35-40.

[2] Opara Patrick Nnamdi Building Materials Research And Development Center Ebonyi State University Abakaliki. June 2011 Journal of "Sustainable Development and Environmental Protection" Volume 1 Number 1.

[3] P Lawrence, M Cry,E. Ringot, Mineral admixtures in mortar of type, amount and fineness of fine constituents on compressive strength, cement concrete Res. 35 (2005) P 1092-105.

[4] P.K. Mehta (1977). Properties of Blended Cements Made From Rice Husk Ash, Journal of American Concrete Institute, 74 (9), pp 440-442.

[5] R E H Sweeney,C.d. Hills,N.R. Buenfeld, investigation in to the carbonation of stabilized/ solidified synthetic waste, environmental Technology,19(1998) P893-902.

[6] R S Deotale, S.H. Sathawane, A.R.Narde Effect of partial replacement of cement by fly ash, Rice husk ash with using steel fibre in concrete , International journal of scientific & Engineering Research, volume3,issue 6, june-2012.

[7] R.S. Deotale , S.H Sathawane, A.R.Narde 'Effect of partial replacement of cement by fly ash, rice husk ash with using steel fiber in concrete, International journal of scientific & engineering research, vol. 3,issue 6th june 2014.

[8] S. B. Park, B. C Lee and J. H. Kim, "Studies on mechanical properties of concrete containing waste glass aggregate," Cement and Concrete Research, vol. 34, pp. 2181–2189, Dec. 2004.

[9] Studies on Concrete using Fly Ash, Rice Husk Ash and Egg Shell Powder Jayasankar.R 1,Mahindran.N 2 Ilangovan.R 3 international journal of civil and structural Engineering Volume 1, No 3, 2010.

[10] Sumrerng Rukzon1), Prinya Chindaprasirt2), and Rattana Mahachai3), Effect of grinding on chemical and physical properties of rice husk ash. International Journal of Minerals, Metallurgy and Materials Volume 16, Number 2, April 2009, Page 242.

[11] V. Johansen, P.J.Andersen, particle packing and concrete properties. In : J Spacing, S. Mindess, editors, Materials science of concrete II. The American ceramic society inc;(1989) P 111-48.

[12] V.S. Ramachandran, waste and recycled materials in concrete technology building materials section, divison of building research, National Research council, Canada P 649-671.(1983).

[13] Zivica, Hardening and properties of cement based materials incorporating heavy metal oxides. Bulletin material science, 20(1997) p 677-683.