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"Evaluation of Concrete Properties by Partial Replacement of Fly Powder and Glass Grind with Cement & Recycled Aggregate with Nca"

Rakesh Kumar Jatav & Arpit Chawda

ABSTRACT

Preservation of environment and conservation of natural resources is the essence of any development. Also the present R and D continuously deal with technological and industrial development on waste management. In order to address environmental effects associated with cement manufacturing, it is crucial to advance alternative binders to compose concrete. Consequently extensive delving is continuing, on substitution of cement by differing waste materials and industrial offshoot. As partial replacement of cement and/or aggregate attempts on fly ash, demolished concrete, waste glass, rice husk etc. have already been accomplished in concrete industries. If little waste material found convenient and economical for concrete manufacturing, a major gain will be achieved in disposal of waste management and depression in construction cost. The work audits the feasibility of fly ash, glass powder and demolished concrete as partial substitute of cement and natural coarse aggregate respectively.

For this intent, procedure is partitioned into two stages. The initial stage proceeds with replacing 25% cement content by variant proportions of fly ash (FA) and glass powder (GP). Further tested for compressive and flexural strength, at 7 days, 14 days &28 days and correlated with conventional concrete. The adequate results were attained with the combination of cement 75% and fly ash 25% in ratio, w.r.t properties tested. In second stage, same optimum ratio of cement and fly ash is added with partly replaced natural coarse aggregate (NCA) with recycled concrete aggregate (RCA) in concrete. For test intent, recycled aggregates were accessed from crushed concrete cubes of grade M25 in laboratory. Variant composition of natural coarse aggregate and recycled aggregate adopted and test samples from this matrix were prepared for the same test as mentioned above. Observations reveal, combination of 90% NCA and 10% RCA in ratio, leads to adequate results.

INTRODUCTION

Besides using waste glass as cullet in glass developed, waste glass is crinkled into specified sizes for use as aggregate in various applications such as water filtration, sand cover for activity turf, grit plastering and sand substitution in concrete. Since the response in the concrete production is growing every day, the consumption of river sand as fine aggregate leads to exploitation of natural assets,

lowering of water table, descending of the bridge piers, etc. as a common treat. Attempts have been made in using crushed glass as fine aggregate in the substitution of river sand." Chi sing lam, chi sun poon and Dixon chan, 2007. Glass is broadly utilized within our lives through fabricated items for example, sheet glassware, glass, bottles, also vacuum tubing. Glass will be a Perfect material for reusing. The utilization for reused glass on new compartment aides spare from claiming vitality. The measure for waste glass will be bit by bit expanded through those late a considerable length of time because at any point developing utilization of glass results. When waste glass is reused to make cement products, the creation expense of cement will go down. Pounded glass or cullet, in appropriately measured and processed, could show aspects similar to that of gravel or sand.

However, unsafe soluble base and silica reaction might occur in glass concrete because of its secondary silica constituent. Some solutions have been formed to act as catalyst in alkali and silica response, but these answers have some restrictions which made it still particularly important to investigate the utilization of glass in concrete. The constraints incorporate the long haul inspecting of the adequacy for soluble base and silica reaction suppressants.

Cement organizations must treat a mix of OPC and virgin fly ash as a benchmark, As far as workability, cost, strength, etc., when setting execution focuses to the generation for PPC. The utilization of PPC or a mix of OPC and fly ash are needed to get the pressing necessity about today to keep up manageability for development.

OBJECTIVE OF STUDY

In this experimental procedure of investigation the following are the main objectives of study:-

1. To understand the effectiveness of fly powder, glass grinds and recycled aggregate in strength enhancement.

2. To appraise the utility of fly power, glass grinds and recycled concrete aggregates as a partial replacement of materials in conventional concrete.

MATHODOLOGY AND TESTING

Materials Used

Cement

Cement is an extremely ground material having adhesive and cohesive properties which provide a binding medium for the discrete ingredients. Chemically cement constitutes 60-67% Lime (CaO), 17-25% Silica (SiO_2), 3-8% Alumina (Al_2O_3), 0.5-6% Iron Oxide (Fe_2O_3), 0.1-6% Magnesia (MgO), 1-3% Sulphur Trioxide (SO_3), 0.5-3% Soda And Potash (Na_2O+K_2O).

Sand

Sand is a naturally happening granular material made of finely isolated rocks and mineral particles. It is characterized by size, being finer than gravel and coarser than silt. Sand could additionally be referred as textural class of soil or soil type; i.e. a soil holding more than 85% sand-sized particles (by mass).

The contents of sand varies, relying upon local rock sources and conditions, yet the most regular constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, alternately SiO2), in quartz form.

As far as particle size utilized by geologists is concerned, sand particles diameter ranges 0.0625 mm (or 1⁄16 mm) to 2 mm. An individual particle in this range size may be termed a sand grain. Sand grains would between gravel (with particles extending from 2 mm up to 64 mm) and silt (particles between 0. 0625 mm down to 0. 004 mm).The size specification between sand and gravel has remained constant for more than a period, but particle size is as low as 0.02 mm is considered sand less than the Albert Atterberg's standard in use during the early 20th century. A 1953 engineering customary issued by the American Association of State Highway and Transportation Officials set the smallest sand size at 0.074 mm. A 1938 plan of the United States Department of Agriculture was 0.05 mm. Sand textures tenacious when scrubbed between the fingers (silt, by judgment, senses like touching flour).

Natural Coarse Aggregate

Construction aggregate, or essentially "Aggregate", is an expansive classification of coarse particulate material utilized within construction, including gravel, sand, crushed stone, recycled concrete, slag and geo engineered aggregates. The majorly mined materials in the universe are aggregates. Aggregates are comprised of composite materials for example, concrete and asphalt concrete; the aggregate serves as reinforcement for overall composite material. Because of the relatively high hydraulic conductivity value as contrasted with most soils, aggregates are generally utilized within waste requisitions for example, foundations and French drainage system, septic channel fields, retaining wall drainage system, and road side edge drains. Aggregates are likewise utilized as base material under foundations, roads, and railroads.

Fly Ash

Fly ash, otherwise called flue-ash, may be a standout amongst the residues created under combustion, and comprises those fine particles that rise with flue gases. Ash that doesn't rise is called bottom ash. In mechanical context, fly ash typically alludes with burning of coal. Fly ash is by and large caught by electrostatic precipitators or other molecule filtration gear before those pipe gasses arrive at the chimneys of coal-fired power plants. Liable upon the source and creation of the coal continuously burned, the contents for fly ash change considerably, in any case all fly ash incorporates significant sums of silicon dioxide (SiO2) (both amorphous and crystalline)

and calcium oxide (CaO), both being endemic parts in many coal-bearing rock strata.

Constituents rely on that particular coal bed makeup, but might incorporate some or a greater amount of the accompanying components alternately substances found in trace amounts (up to few hundreds ppm): arsenic, beryllium, boron, chromium, hexavalent chromium, mercury, cadmium, cobalt, lead, manganese, molybdenum, selenium, thallium, strontium and vanadium, alongside dioxins Furthermore PAH exacerbates.

In the past, fly ash might have been by and large discharged into the atmosphere, yet contamination control gear mandated in later decades that it be caught prior to discharge. In the US, fly ash is stored at coal energy plants or placed in landfills. Something like 43% may be recycled, regularly utilized as pozzolanic to prepare hydraulic cement or hydraulic plaster or a partial replacement for Portland cement in concrete production**.**

Pozzolans guarantee setting of concrete and plaster and provides concrete with more protection from chemical attacks and wet condition.

Glass Powder

Glass being transparent material produced by melting a mixture of silica, soda ash, and CACO3 at temperature emulated by cooling during which hardening happens without crystallization.

Glass is generally utilized in our lives through fabricated items for example, sheet glass, bottles, glassware, also vacuum tubing. The measure of waste glass may be increased bit by bit over the recent years due to ever-growing utilization of glass items. The majority waste glasses have been dumped under landfill destinations. The area filling for waste glasses is undesirable since they are not biodegradable, which makes them less eco-friendly. Glass powders comprise of different glass compositions ground down into little particles. SCHOTT offers molecule sizes of > 30µm down to as low as 0. 4 µm (D50). SCHOTT's Glass Powder technology is based on emulating procedure steps:

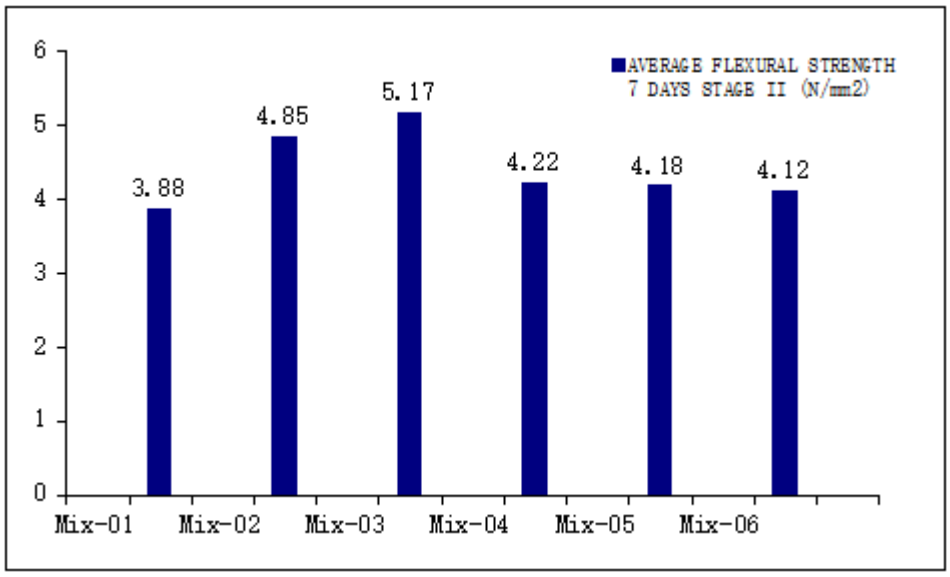
RESULTS AND DISCUSSIONS

Flexural Strength

Beams of size 10cm*10cm*50cm are casted for determining flexural strength. Test on beams are performed at the age of 28 days of the sample. Placement of sample in instrument is done as per IS: 516-1959 in the clause no 8.3.1 page no 17. Load is applied at increasing rate of 1.8KN/min. Load is applied until specimen fails and load at which sample fails is recorded. As specified in the IS code flexural strength is calculated and tabulated below:-

Table no. 1 Flexural Strength Result for 7 days

S.NO.	COMBINATION	BEAMS	MAXIMUM LOAD (KN)	FLEXURAL STRENGTH (N/mm^2)	AVERAGE FLEXURAL STRENGTH (N/mm^2)
Mix-01	C+S+NCA	Beam-1	9.40	3.76	3.88
		Beam -2	10.00	4.00	
Mix-02	C(75%)+S+FA(25%)+ GP(0%)+NCA(100%)	Beam -1	11.80	4.72	4.85
		Beam -2	12.45	4.98	
Mix-03	C(75%)+S+FA(25%)+ GP(0%)+NCA(90%)+ RCA(10%)	Beam -1	13.15	5.26	5.17
		Beam -2	12.70	5.08	
Mix-04	C(75%)+S+FA(25%)+ GP(0%)+NCA(80%)+ RCA(20%)	Beam -1	10.30	4.12	4.22
		Beam -2	10.80	4.32	
Mix-05	C(75%)+S+FA(25%)+ GP(0%)+NCA(70%)+ RCA(30%)	Beam -1	11.00	4.40	4.18
		Beam -2	9.95	3.96	
Mix-06	C(75%)+S+FA(25%)+ GP(0%)+NCA(60%)+ RCA(40%)	Beam -1	10.00	4.00	4.12
		Beam -2	10.60	4.24	

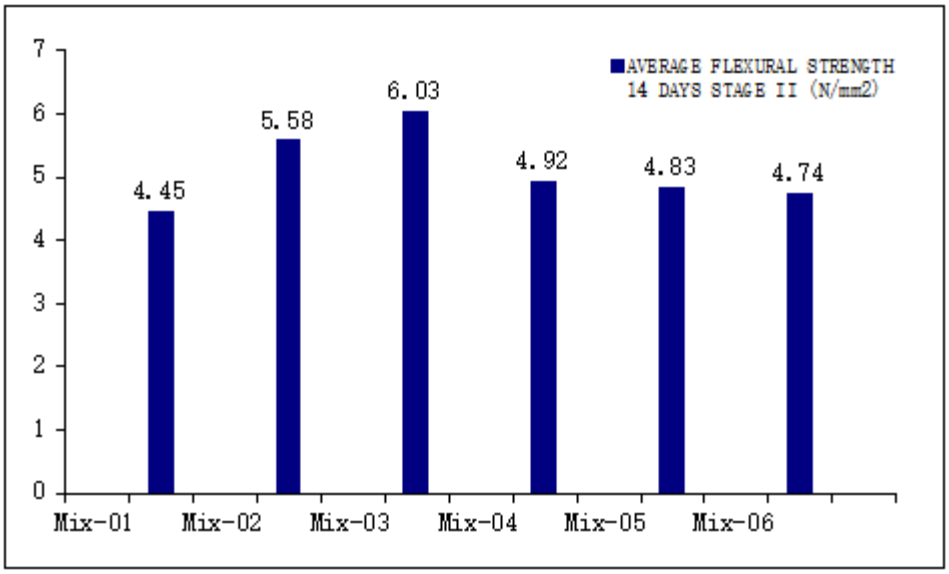


Graph 1: Flexural Strength at 7 days

Table no. 2 Flexural Strength Result for 14 days

S.NO.	COMBINATION	BEAMS	MAXIMUM LOAD (KN)	FLEXURAL STRENGTH (N/mm^2)	AVERAGE FLEXURAL STRENGTH (N/mm^2)
Mix-01	C+S+NCA	Beam-1	10.80	4.32	4.45
		Beam -2	11.45	4.58	
Mix-02	C(75%)+S+FA(25%)+GP(0%)+NCA(100%)	Beam -1	13.70	5.48	5.58
		Beam -2	14.20	5.68	
Mix-03	C(75%)+S+FA(25%)+GP(0%)+NCA(90%)+RCA(10%)	Beam -1	15.30	6.12	6.03
		Beam -2	14.85	5.94	
Mix-04	C(75%)+S+FA(25%)+GP(0%)+NCA(80%)+RCA(20%)	Beam -1	12.15	4.86	4.92
		Beam -2	12.45	4.98	
Mix-05	C(75%)+S+FA(25%)+G	Beam -1	12.50	5.00	4.83

	P(0%)+NCA(70%)+RCA(30%)	Beam -2	11.65	4.66	
Mix-06	C(75%)+S+FA(25%)+GP(0%)+NCA(60%)+RCA(40%)	Beam -1	11.60	4.64	4.74
		Beam -2	12.10	4.84	

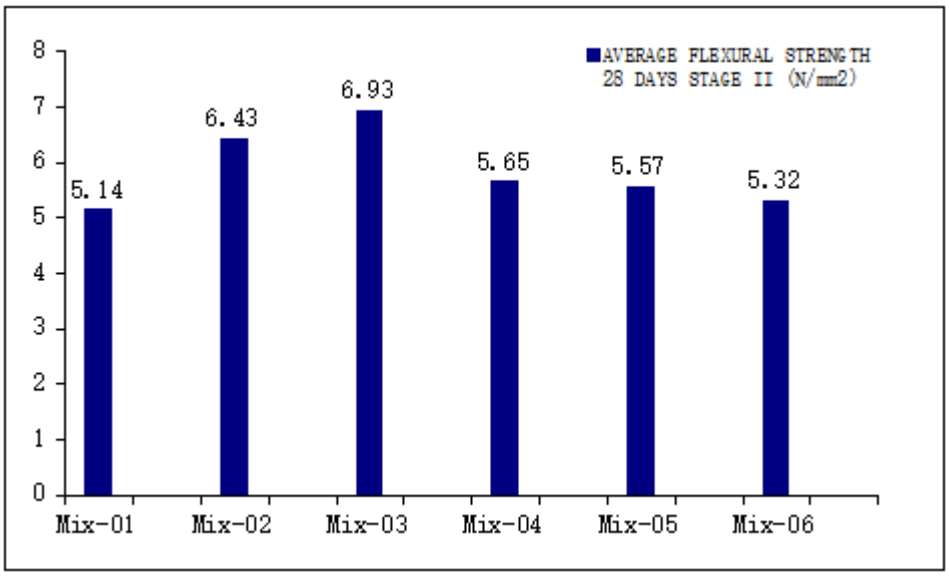


Graph 2: Flexural Strength at 14 days

Table no. 3 Flexural Strength Result for 28 days

S.NO.	COMBINATION	BEAMS	MAXIMUM LOAD (KN)	FLEXURAL STRENGTH (N/mm^2)	AVERAGE FLEXURAL STRENGTH (N/mm^2)
Mix-01	C+S+NCA	Beam-1	12.40	4.96	5.14
		Beam -2	13.30	5.33	
Mix-02	C(75%)+S+FA(25%)+GP(0%)+NCA(100%)	Beam -1	15.50	6.20	6.43
		Beam -2	16.65	6.66	
Mix-03	C(75%)+S+FA(25%)+G	Beam -1	17.40	6.96	6.93

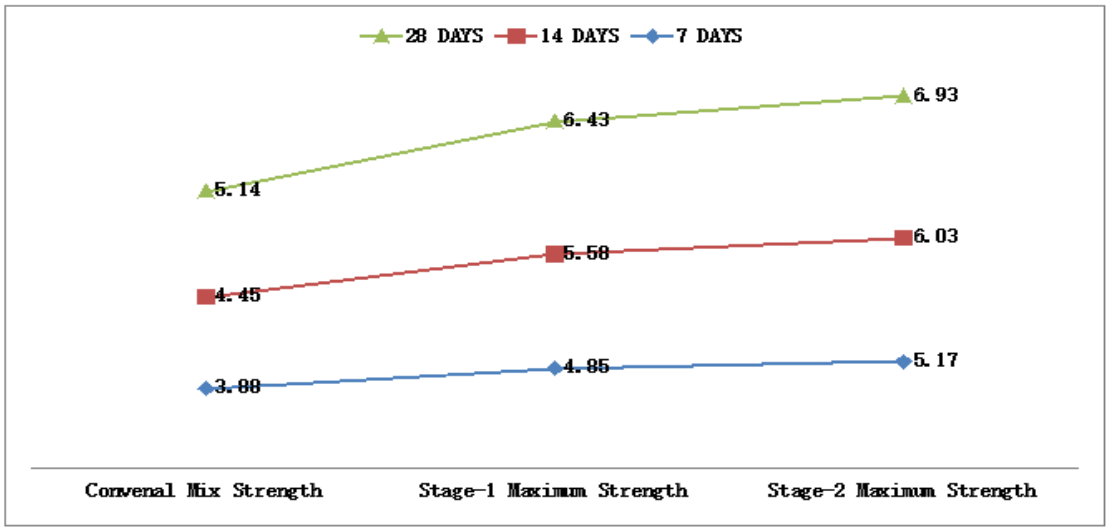
	P(0%)+NCA(90%)+RCA (10%)	Beam -2	17.25	6.90	
Mix-04	C(75%)+S+FA(25%)+GP(0%)+NCA(80%)+RCA (20%)	Beam -1	13.85	5.54	5.65
		Beam -2	14.40	5.76	
Mix-05	C(75%)+S+FA(25%)+GP(0%)+NCA(70%)+RCA (30%)	Beam -1	14.60	5.84	5.57
		Beam -2	13.25	5.30	
Mix-06	C(75%)+S+FA(25%)+GP(0%)+NCA(60%)+RCA (40%)	Beam -1	13.45	5.38	5.32
		Beam -2	13.15	5.26	



Graph 3 Flexural Strength at 28 days

CONCLUSION

As discussed in the chapter results and discussion, I can conclude this dissertation work with some key points. In this dissertation work there were two stages, and based on the results, graphs are plotted for the flexural strength.



Graph 4 Flexural Strength (N/mm^2) comparisons

It can be concluded from this dissertation work that FA can be used as a partial exchanging of cement and RCA can be used as a partial exchanging of NCA up to an optimal values. GP is not that useful as far as exchanging of cement is worried about. A more detailed revision can be voted out to discuss use of concrete having such materials in future.

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