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STRENGTH ASSEESEMENT OF CONCRETE BY FRACTIONAL SUBSTITUTION OF THE AGGREGATE WITH GLASS POWDER

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ABSTRACT

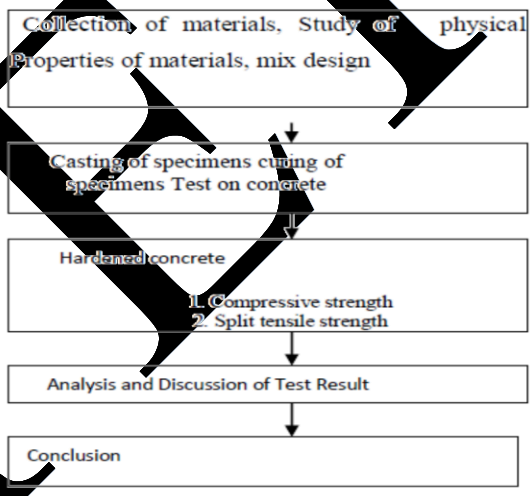
Glass powder (GP) employed in concrete creating results in greener atmosphere. In shops, broken glass sheets &flat solid cuttings square measure move to waste, that aren't recycled at the present and typically delivered to landfills for disposal. Victimization physician in concrete is a noteworthy risk for economy on waste disposal sites and conservation of atmosphere. This projec examines the chance of victimization physician a ine mixture replacement in concrete. Natural sa was part replaced (0%-40%) with physician in co te. enduringness, Compressive strength (cubes cylinders) and Flexural strength up to twenty-eigh days more matured were compared hose of high performance concrete created w n natu nd.

KEYWORDS: Glass powder, Na ral sand en ringness, Compressive strength

INTRODUCTION:

Concrete is als ood used m al inside the planet. Supported world ge it's plac t second position on water. Waterco sand is one ach of the cons ts used within t ssembly of normal concrete has me extraordinari ricey and to boot scare. Inside the ery of such a bleak tmosphere, there is associate large nd for n us materials from industrial waste. Som erous materials have already been used as a locality of sand. As an example ash, slag, red mud, pounded s es were used in concrete mixtures as a partial replacement of natural sand. Equally the waste glass square measure collected from the retailers square measure used. The collected glasses square measure crushed to sand size associated it's going to be used an alternate material for natural sand as partial replacement. In brief, palm utilization of glass as fine mixture will flip this material into a valuable resource.

METHODOLO OF TH DY:



EFFECT OF GLASS POWDER ON STRENGTH OF CONCRETE

Name of author with year of publications	Form of Glass, particle size and % replacement to cement	Concrete Mix	Conclusion
C Meyer et.al.[1998]	as coarse aggregates		Efforts were thwarted by the problem of alkali:-silica reaction (ASR), which was not well understood
Meyer C. and Baxter S [1999]	as coarse aggregates	—	Glass almost an ideal aggregate to study the ASR phenomenon and to search for methods to avoid it or to mitigate its detrimental consequences
C. Meyer, N. Egosi, and C. Andela[2001]	as coarse aggregates		Use of waste glass as coarse aggregates did not have significant effect on workability and strength but decreases the slump, air content and fresh weight of concrete
Byars, E. A. et [A-2004] & [B-2004]	as fine & course aggregates	—	Main deficiency of incorporating WG aggregates, either in form of coarse or fine fraction, is the resultant Alkali-Silica Reaction (ASR) which undermines strength of concrete. the feasibility of long-term use of glass aggregates is questionable.
EsraaEmam Ali &Sherif H. Al-Tersawy [2012]	as fine aggregates 0% 50%.	M40 M50 M60	The compressive strength, splitting tensile strength, flexural strength, and static modulus of elasticity decrease with the increase of recycled glass content. Poor contact between the cement matrix and the recycled glass, attributed to the decrease in bond strength between the cement paste and the recycled glass
Sunny O.N. et. al. [2013]	as fine aggregates < 300 µm 5,20 & 30%	M20	Grind glass could enhance the properties of the final concrete product if used at the right level of replacement Water absorption increased with increased glass powder content.
AnkurMeena&Randheer Singh [2012]	as cement replacement (150-100)µm & (100-50)µm	M20	Smaller particle size of the glass powder has higher activity with lime resulting in higher compressive strength. Finer glass powder concrete had slightly higher early strength as well as late strength
Jitendra B.J et. al. [2014]	as cement replacement < 90 µm 5 - 40%	M30	Strength point of view, replacement of GP shows positive results and 20% rep. gives higher strength Workability decreases as percentage of GP increases.
M.N.Bajad et. al. [2014]	as cement replacement 75 µm 5 - 40%	M20	Comp.& tensile strength inc. till 20% GP than it decreases and higher strength achieved when 20% cement replaced by GP Density of concrete reduces with the inc. in %of GP
RahmatMadandoust& Reza Ghavidel [2013]	as cement replacement 75µm 0% - 20% GP and 0% - 20% RHA	M30	Concrete containing 10% GP and 5% RHA as cement replacements can be adopted as an optimal combination. In short term, the compressive strength enhancement for con.G10 R05 is lower than that of conventional concrete but shows the results of higher pozzolanic activity in long term activity Tensile strength will be increased with age due to the higher pozzolanic activity.
Shilpa Raju & Dr. P. R. Kumar [2014]	as cement replacement 45µm 0 - 40%	M20	Glass powder shows pozzolanic activity when particle size is less than 75µm. Enhancement of compressive strength Very finely ground glass has been shown to be excellent filler and may have sufficient pozzolanic properties to serve as partial cement replacement ASR appear to be reduced with finer glass particles, with replacement level
VitoldasVaitkevic˘ius et. al.[2014]	as cement replacement 25.80µm QP/GP0 QP/GP100 QP/GP100SF/GP100 SF/GP100	—	Glass powder, when milled to particle size of cement, benefits the structure and properties of ultra-high performance concrete. Glass powder increases dissolution rate of Portland cement, thus hydration process is accelerated. Compressive strength (221 MPa) was observed in composition with combination of silica fume and glass powder.
Ahmad Shayan&AiminXu [2006]	as cement replacement >10µm - <15 µm 0%, 20% & 30%	M40	Both GP and glass aggregate can be used together in 40 MPa concrete without any adverse reaction.
Sachinbhosale et. al. [2014]	as cement replacement <13 µm 20% by wt. cement & IWS	M25	20% replacement show higher early strength and strength decreases after 28 days. Adding industrial sand decreases strength.
M. B. Vanjare et. al. [2012]	as cement replacement 0%, 5%, 10%, 15%	M20, M25, M30 (SCC)	Addition of GP reduces self-compatibility characteristics, workability. Also reduces 28th day compressive, tensile & flexural strength of SCC

EXPERIMENTAL INVESTIGATION:

MATERIALS:

The crushing method of recycled waste glass is found within the authors' previous work (Tan and Du 2013; Du and Tan 2014a, 2014b). Waste bear bottles (soda lime glass) were collected from a neighborhood recycler in Sin- gapore. To finely grind the sand-sized particles, a ball miller was used. The scale distributions of ground physician and cement. Each cement and physician show identical median particle size of around ten μm. The chemical compositions of physician and OPC square measure displayed. The precise gravities of cement and physician square measure three.15 and 2.53, severally. The surface look of physician and OPC square measure compared. The foremost common of all checks on hardened concrete is that the compressive strength checks. This will be half as results of its straightforward to make, and half as a results of many through not all, of the fascinating characteristics of concrete square measure qualitatively related to its strength, but primarily as a results of the intrinsic importance of the compres strength of concrete in construction

PROPERTIES OF WATER:

Water used for combining and solidification sh be clean and free from injurious amounts of Oils, Acids, Alkalis, Salts, Sugar, Organic mate e water is usually thought of satisfactory or combi concrete combining and solidification w ean water shall not be allowable. The hydrogen ion con ation p shall not be but six.

RECENT CONCRETE PRO TIES:

The natural philosop roperties of t paste containing hysician were d ined by coaxial-cylinder m ring device name toVisco one. When combining the ent paste within e port mixer for regarding three m es, a sample weigh- ing regarding a hundred and fifty g taken ou d placed within the outer cylinder of the asuring device, followed by inserting the inner cylinde real time. The device then began to rotate at totally different shear rate whereas the force was re- twilled. Equal mensuration was performed on triplicate paste samples by victimization associate eight-channel small measuring instrument (TAM AIR).

DETERMINATION OF COMPRESSIVE STRENGTH:

All specimens shall be tested inside one hour of removal from the water or mist chamber, while they're still wet. simply before commencing the static modulus of physical property check, the compressive strength of the wrought specimen shall be determined from the 2 normal a hundred and fifty millimeter cubes of identical batch, created and cured underneath similar conditions because the specimen. The cubes shall be crushed and therefore the concrete strength born-again to equivalent cylinder strength by multiplying the ube strength by an element of zero.8. For concrete core ete compressive strength shall be determined in acc ance with the procedure given in Section fifteen of th mal. The mean of the compressive strength.

B. COMBINE PROPORTION A OF TESTING SPECI ENS:

MIX DESIGN:

The c ncrete combine styl was planned by imization In a normal for management concrete. The gr was M20. The mixt es are ready with the cement conte 330kg/m3 and ater to cement quantitative relation zero.53. Th combination proportion of aterials is 3:3.6 per IS 10262-2009. Then natural ne mixture w d. The replacement levels of cement, glass powder we employed in terms of 100%, 20%, half-hour and four-hundredth in concrete. Chemical admixture isn't used here.

RONMENTAL SIGNIFICANCE:

Alkalinity is very important for fish and aquatic life as a result of it protects or buffers against fast hydrogen ion concentration changes. Higher pH scale levels in surface waters can buffer air pollution and different acid wastes and stop hydrogen ion concentration changes that square measure harmful to aquatic life. Great deal of pH scale imparts bitter style in water. The principal objection of alkaline water is that the reactions which will occur between

7 DAY COMPRESSIVE STRENGTH CHECK:

The average price recorded from compressive strength tests dispensed on specimens cured for seven days .An increasing trend is witnessed together with the addition of glass mixture, till the most compressive strength (46.5 MPa) was developed at a replacement level of half-hour. All mixture proportions containing waste glass to the current purpose exceeded the strength developed by the management, with the half-hour glass combine recording a compressive strength Sept. 11 higher. These findings support earlier analysis conducted by

Tuncan et al. (2001), wherever the compressive strength of concrete when seven days of solidification was found to extend with the addition of glass, albeit at lower levels of replacement. Addition of waste glass on the far side the optimum level resulted in an exceedingly important reduction to the extent of compressive strength developed. At a glass replacement levels of four-hundredth, the compressive strength achieved (35.1 MPa) was one7% below the management and25% below the most recorded price.

28 DAY COMPRESSIVE STRENGTH CHECK:

The results of compressive strength tests following 28days of solidification. The results closely mirror that of the seven day check, with the compressive strength following associate increasing trend with the addition of waste glass up till associate optimum share of half-hour. At now, the most compressive strength developed was 58.5 MPa, 6 June 1944 on top of that achieved by the management (55.1 MPa). The rise in strength higher than that of the management is attributed to the angular nature of the glass mixture that features a bigger extent than the naturally rounded sand particles. This accrued extent permits for bigger bonding with the cement paste, leading to a stronger concrete matrix. The specimen containing four-hundredth waste glass was found to possess achieved compressive strength of forty seven.2 MPa, 1 MPF below achieved by the management. This occurs with the results obtained from the seven day check and it will thus be ended that levels of glass replacement more than hour adversely have an effect on the evolution of compressive strength. Similar findings were obtained by Nader et al. (2013), WHO found that concrete strength achieved by V-E Day at glass replacement share of four-hundredth once adopting an identical glass particle distribution on that adopted during this study. while previous studies have understood that this tendency may be a results of reduced adhesion between the glass particles and cement paste (reference), the results from this study counsel that the angular nature of the glass particles might any contribute to the witnessed reduction in strength. it's instructed that wherever glass mixture is gift in higher proportions, there's meager cement paste offered inside the combination to facilitate bonding with all particles, leading to the formation of microscopic voids that adversely have an effect on concrete strength.

RESULT AND DISCUSSION:

The shear stress (τ) was recorded with shear rate ($\dot{\gamma}$) decreasing from fifty to zero.5 s-1 throughout the descendant branch of the check loop. Check results square. Yield stress (τ0) and plastic consistence (μ) of recent cement paste square measure linearly connected victimization Bingham model (Mindess et al. 2003).

$$\tau = \tau_0 + \mu \dot{\gamma} \qquad (1)$$

The values of τ0 and μ for pastes with numerous physicians. Each the yield stress (τ0) and consistence (μ) decrease with higher cement replacement level. Yield stress indicates the stripped-down stress to form the mixture flow able. The reduced yield stress implies that the entomb force between cement and glass particles is smaller amount than that between cement and cement particles. With increasing physician content, the particle density of cement is diluted and hence lesser interaction between cement and water, resulting a smaller yield stress and plastic consistence. This might even be attributable to the negligible water absorption and therefore the swish surface of physician. Previous studies additionally indicate that the bond between cement paste and fine glass particles was diminished attributable to the surface smoothness of glass powder (Taha and Nounu 2009; Ali and Al-Tersawy 2012).

In this study, the cement has been replaced by weight rather than by volume. Because the relative density of glass powder is below cement, the solid-to-water quantitative relation by volume is higher for physician merging paste compared with pure cement paste. However, this adverse result at the next solid-to-water volume quantitative relation is a smaller amount pronounced compared to the dilution of cement and swish glass surface, as mentioned earlier. The ceaselessly decrumpled yield stress and plastic consistence represent a more robust workability of paste mixture with higher content of physician. it's additionally noted that each the yield stress and consistence increase considerably for the combination with V-J Day extra physician, attributed to the accrued quantity of solid-to- water quantitative relation.

B. SPLIT STURDINESS CHECK:

Split sturdiness of concrete is usually found by testing plain concrete cylinders. Cylinders of size 100mm x 2 hundred millimeters were casting practice M50 grade concrete. Specimens with Nominal concrete and glass powder concrete (glass powder is part replaced with Natural sand) were casted. Throughout molding, the cylinders were manually compacted practice tamping rods. Once twenty four hours, the specimens were far away from the mould and subjected to water activity for twenty eight days. Once activity, the specimens were tested for compressive strength using a label compression testing machine.

Fig. Crack occurred inside [illegible]er

FLEXURAL STRENGTH OF PC[illegible]EAMS:

Flexural strength is that the o[illegible] each o[illegible]he live of sturdiness of concrete. it is the pow[illegible] f a[illegible] failure in bending. it[illegible]asured by l[illegible] un-reinforced 150mmX150mm concrete[illegible]s with a spa[illegible]0mm. Beam of size 150mm x 150mm [illegible]00 millimeter[illegible] casting practice M5[illegible] grade concrete.[illegible]ecimens wit[illegible]ominal concrete[illegible]lass powder concr[illegible]glass powder is part replaced wit[illegible]atural sand) were[illegible]asted. Throughout moulding, the b[illegible] were manually [illegible]ompacted practice tamping rods. Once [illegible]y four hou[illegible] specimens were far away from the mould[illegible] subjected to water activity for 28days. Once activity, [illegible]ecimens were tested for compressive strength on a typ[illegible]al concrete. The bed of testing machine need to be supported, and these rollers need to be mounded that the gap from center is 300mm for 1200mm specimen. The beam is simply supported and subjected to a minimum of one third points loading flexure failure. The utmost tensile stress reached inside the modulus of rupture values for concrete practice sand and glass powder.

Fig. C[illegible]cks Occu[illegible] In Beam Specimen

FUTUR[illegible]OPE:

It is counseled for future stu[illegible] that the analysis on u[illegible] of glass po[illegible]der is need to increase [illegible] wider perspective [illegible]s to grasp th[illegible]articular behavior a[illegible]d resultive utilization o[illegible]s powd[illegible] which pro[illegible]des a thought to check additional para[illegible]s and totally diff[illegible]ent governing effect of glass powder [illegible]engineering pr[illegible]erties of recent and hardened concrete. T[illegible]e future w[illegible]k is extended as follow

To r[illegible]iz[illegible] the result of various kind of glass powder on concr[illegible] strength.

- Effect o[illegible] glass powder on high strength concrete.
- Effect of glass powder on strength of concrete with numerous w/c ratios.

Effect of glass powder on strength of concrete with [illegible]ination of glass powder with totally different [illegible]rengthening agent.

To know the precise reason behind the increment in strength of concrete.

To know the result of glass powder on bond strength between inter-materials and between materials and steel

CONCLUSIONS:

The improvement of cement with glass powder as fine total has been effectively finished and the outcomes were displayed and investigated in the past sections. In view of the test consequences of M50 cement the accompanying determinations are made: A. General Conclusions

1) It is conceivable to supplant glass powder by rare sand for cement.

2) The glass powder cement is less workable, solid and tough contrasted with sand concrete

B. PARTICULAR CONCLUSIONS:

1) The expansion of 10 % in the 28 day solid shape compressive quality of glass powder solid when contrasted with Conventional cement.

2) Increase chamber elasticity there is an expansion of around 23% in 28 days of glass powder solid when contrasted with customary cement.

3) There is an expansion of 76 % in the 28 day flexural quality of glass powder solid when contrasted with customary cement

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