Strength Assessment of Concrete Using Synergy of Bagasse Ash and Fume-Silica

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Abstract—*The* reason for the test contemplate to be discover impact regarding fume –Sio2 (FS) & B-A lying on quality characteristics of cement. An industrialized production just as B-A & fume-Sio2 are used while halfway extra of bond. Presently current test examine bond be mostly including 10 percent & 20 percent regarding B- fiery debris & fume-Sio2 (1, 2 & 3) percent by means of weight ,effect regarding shared use of B- cinder & fume- Sio2 on crushing quality , review of concrete is examined. The explore test eventual outcomes of concrete arranged usage the diverse degrees of B- fiery remains & fume- Sio2 are analyzed against restricted concrete, distinction regarding various examination aftereffects of concrete masterminded amid a few extents of B- fiery debris & fume-Sio2 demonstrates comparable pattern. In view of examination outcomes, might have been resolved a concrete arranged among 10% B-powder & 2% fume-Sio2 blend saves superior qualities contrasted against restricted concrete. S-E-M investigation be completed acquiring knowledge about bond qualities in concrete sample.

Keywords—Concrete, Fume silica, Compressive strength, Bagasse Ash (B-A).

I. *INTRODUCTION*

Concrete a stuff of current & additionally hope, in structures it has a broad use, as of structures to handling plants, from expansions to plane terminals, makes a champion among the mainly analyzed substance of 21st era . Because of fast populace blast & innovation blast taking into account all these necessities, an earnest want to enhance strength & solidness regarding concrete. Beside from all resources utilized for making of concrete, bond assumes noteworthy part because of its mass & glue belongings. In this way by creating a concrete amid with enhanced qualities, system regarding bond hydration must have contemplated legitimately &improved substitutes in case it. Enhancing qualities of concrete, miscellaneous resources acknowledged as accompanying cementitious supplies are added. One of them is fly- fiery debris, blast heater- slag, rice- husk, Sio2 exhaust & even microscopic organisms. Beside different innovations being used, fume -innovation appears hopeful methodology regarding enhancing qualities of concrete.

Sugarcane is principle nourishment trim in subtropical & tropical environment. A significant asset in sugar generation. B-A is a waste made from sugar-cane juice. B-Fiery remains (S-C-B-A) procured through organized consuming B-A, makes ecological irritation because of direct transfer on the open terrains and structures trash stacks around there. As indicated by Barroso a 1000 kg sugar-cane produces 280 kilogram B- squander, which produces financial matters and additionally ecological linked issues, understanding these circumstances, tremendous endeavors been worldwide towards B-squander administration just as dealing with, arranged off & applications . Diminishing ecological weight, utilization squander goods in concrete , a vast perspective, B- fiery remains a squander stuff regarding sweet industry, having well-mannered possible usage of concrete's bond replacement. Sugar-cane be principle trim what's a high worth yield regarding south Asia typically named money yield, imperative to sweet & manufacture identified with it, in Pakistan sugar commerce, a basic influence in nationwide financial system . As indicated by Pakistan's sugar report regarding factories affiliation, our country delivered in the year 2015-16, 65.45 million - tons of sugar-cane& creation regarding 2016-17 ,gauged at 71.371 million- tons ,universally analysts are focusing the use regarding modern, industrial & agricultural squander, a raw stuff hotspots regarding business & proper utilization of waste.

Concrete, a first essential supplies among construction resources in a wide range regarding structural designing mechanism, a variety of concrete since as construction stuff, load of looks into& examines are made for building up prevalence, quality & sturdiness regarding it. Comparative moment endeavors additionally are made for conserving solid concrete development contrasted with elective materials.

Concretes are frequently pondered in light of the fact that the most by and large utilized in the development subject. The present day's development takes place jointly with strength quality.

Proportionate importance gives crushing strength regarding concrete. Standard Code of training for plain & strengthened solid grasps, most reduced bond substance to charm the sturdiness and strength.

The development business utilizes concrete to a huge degree. It is the most utilized synthetic material around the world. In 2013, around 3.97 billion tons of concrete was created far and wide. In light of this assessed esteem and considering normal cement substance of 11percent & 70 percent regarding cement based item common in market, overall creation regarding concrete, around (30.6- billion tons), an additional measurement evaluated so as to by and large, around 1000 kg of concrete is created every year meant for each person on earth. The measure of concrete utilized around the world, 1000 kg for 1000 kg, twice of steel, plastics wood & AL consolidated. Its utilization in advanced, humankind is surpassed just by that of normally happening water. It is utilized in framework & in structures, out of granular resources regarding various dimensions & size scope of making strong blend covers quite a few years.

The general evaluating of the blend, particles range (300 nm to 32 mm), decides different qualities regarding concrete .The qualities in new condition (stream qualities & usefulness) are e.g administered by molecule estimate appropriation (PSD), yet in addition the properties of the concrete in solidified state, for example, quality and sturdiness, are influenced by the blend evaluating and coming about molecule pressing. One approach to additionally enhance the pressing is to expand the molecule measure range, for example by incorporating particles of mass beneath 300 Nano meter. Conceivable materials which are as of now accessible are soil minerals i.e lime-stone & Sio2 fines, for example, SiO_2 flour (Sf), miniaturized SiO_2 silica (mS) & Fume -silica (nS). Due to a broad utilization of cement around the world, it is important to assess the natural effect regarding said material. Moreover, for guaranteeing a hope & aggressiveness regarding concrete as construction stuff, basic for enhancing manageability regarding concrete structures. In accompanying, this is clarified how a natural effect & manageability of cement could be enhanced utilizing distinctive methodologies and the consolidated utilization of silica fines with a solid blend configuration apparatus created by(Hüsken and Brouwers).

ECOLOGICAL EFFECT REGARDING CONCRETE

The most important ecological effect regarding concrete is ascribed toward CO2-discharges amid towards bond generation, because of the calcinations and crushing procedure (Proske et al., 2013). The CO2-outflows are basically identified with the de-carbonation of lime-stone & the vitality (power & fuel) devoured amid towards generation regarding clinker (Van sanctum Heede and De Belie, 2012). Distinctive creators assessed every year roughly 4.5 - 8% regarding worldwide anthropogenic CO2-outflows be caused by overall concrete generation (Naik and Kumar, 2010; Van lair Heede and De Belie, 2012; Olivier et al, 2013). In this way, diminishing the bond clinker substance may affect sly affect the ecological parts of concrete. The measure of CO2-outflows relies upon the solid sort (quality class, cover compose and sum) and the generation procedure (precast, self-compacting, vibrated, and so forth.) which likewise influences the epitome vitality utilized for creation (Hammond and Jones, 2008) it is conceivable that despite the fact that concrete is related with high CO2 impression, it is material with a low connection among proportional CO2 & vitality necessary designed for generation contrasted with new construction resources (e.g aluminum or MS steel). Fundamental issues regarding cement, comparatively little cost & overall broad utilize. Above all development resources Concrete speaks by means of volume 84%of the entire as per Kline and Barcelo (2012), essentially influence on earth. Distinctive methodologies, open doors regarding lessening ecological effect & utilization regarding rare assets, now recognized in field of concrete expansion, particularly in creation of materials in raw form, concrete innovation & structures. The ways to deal with decrease the ecological effect of concrete incorporate improved calcinations and pounding procedure of raw materials, new concrete innovation techniques such as upgraded evaluating bends, and utilization regarding latest super-plasticizer & responsive fasteners or latent fillers, adjusts hydration conduct (retarders or quickening agents) .At present, concrete which are delivered considering a portion of the beforehand specified ways to deal & making the concrete all of more earth's cordial called as "Green- Concrete" (Nielsen et al., 2007; Meyer 2009) or eco cements. Be that as it may, the execution of these "green" ideas infers that specific parameters in the blend configuration should be changed to acquire an adequately useful, strenghty and sturdy concrete. In addition, the particular purpose & ecological (introduction period) for the concrete utilization, should viewed as (Van nook Heede and De Belie, 2012). Late improvements within fume-technology demonstrate huge guarantee inside tending to a significant number of the difficulties to deliver naturally neighborly concrete. A portion of the methodologies, the utilization of nanotechnology gave as of now leaps forward in numerous regions, for example, pharmaceutical and social insurance, vitality, biotechnology, data innovation, hardware, resources & producing, & numerous others (Sobolev et al., 2006; Sanchez and Sobolev, 2010). The nano-technology idea be presented out of blue .Feynmam (1960) a renowned work by him entitled "There's a plenty of room at the bottom". The last term have no importance until Taguchi (1974) linked nano-technology handling of resources, particle via iota or atom via atom.

Afterward, supplementary precise meaning regarding nano-technology is exhibited by Drexler (1981), for example, generation through measurements & accuracy among 0 nm, 1 nm & 100 nm. An additional acknowledged expression, nano-technology includes investigation by nano-run (1 n-m equal's 1x10-9 meter). According to RILEM Technical Committee report 197-(NCM), "Nano-technology within development resources" (Bartos et al., 2002), be primary record with the intention of stresses unmistakably capability of nanotechnology as far as improvement regarding development & construction supplies, a multi-scale material known as Concrete will be considered beginning or starting ,ranging nano scale (10 to 9 meter) to a full scale (10 to 2 meter).,additionally holds regarding binary concrete fixings (ranging nano powders to C.A & microstructure of concrete (nano sized CSH gel to C.A) All

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such things considers, the development segment is moderately ease back to embrace the upheaval in nano-technology that is continuous in different areas of supplies look into (Garboczi, 2009), a few conceivable purposes behind that deferral, incorporating the need in comprehension regarding physical & compound systems & a configuration on nano-meter level, an absence regarding appropriate instrumentation & furthermore moderately low down concrete's cost, regularly restricting components regarding usage of nano-technology. Right now, utilization of nano materials & examination at nano-scale of concrete is considered since developing themes of intrigue furthermore, have turned into concentration by some analysts.

II. *Methodology & Results*

A. *Cement*

Cement (Portland) confirming in with ASTM C150/C150M-18 is utilized for getting ready concrete cubes.

B. *Fine Aggregate*

Locally accessible waterway sand affirming to ASTM C33/C33M-18 particulars was used as f- aggregates in concrete. The f-aggregate, going through sieve 4.75mm be used.

C. *Coarse Aggregate*

20mm down size C- aggregates are used in the investigation crushed stones gained from quarries, affirming to ASTM C33/C33M.

D. *Bagasse Ash*

B- Cinder leftovers comprise approximately half of cellulose, 25% of hemicelluloses and 25% lignin. These deposits on burning contributes a substance arrangement drives (SiO2). Slighting nearness a texture of burdensome debasement which contributions compelled supplements, fiery the powder is used in farms as synthetics in the sugar-cane gathers.

E. *Fume-SIO2*

In this examination, a powder compose known as fume-Sio2 is used, likely more than the inverse of materials like pozzolanz' attributable to high substance of amorphous Sio2 (greater than 99%) & in this way diminished mass of its round particles of request (10-19nm). Amid this investigational consider the bond is substituted by 1, 2 & 3% of F –Sio2 by weight.

F. *Water*

For examination ordinary domestic water was utilized. Chacteristics are thought to be same as that of normal water. Specific- gravity is in use as 1.00.

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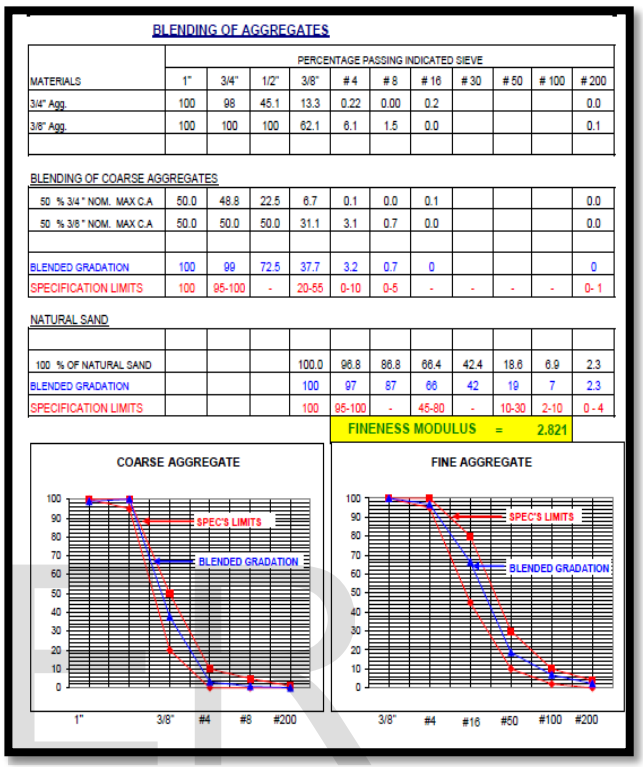
G. *Test Specimens*

Concrete test samples comprise of 6inch×6inch×6inch shapes, respectively. Concrete cubes were tried distinctive curing periods (7 and 28 days) to get compressive quality. The rate of loading is according to the ASTM determination

H. *Mix Design And Mix Calculations*

For acquiring of Samples of Coarse and fine aggregate, Sources were visited in a considerable quantity of the sample was taken in a specified manner for the representation of the samples and then stored. Three trials of gradation were done at a constant temperature and moisture content, by following ASTM 702. For mixing of concrete, courting box has been used and the mixing has been repeated for 3-4 times.



BLENDING OF AGGREGATES

MATERIALS	PERCENTAGE PASSING INDICATED SIEVE										
	1"	3/4"	1/2"	3/8"	# 4	# 8	# 16	# 30	# 50	# 100	# 200
3/4" Agg.	100	98	45.1	13.3	0.22	0.00	0.2				0.0
3/8" Agg.	100	100	100	62.1	6.1	1.5	0.0				0.1
BLENDING OF COARSE AGGREGATES											
50 % 3/4 " NOM. MAX C.A	50.0	48.8	22.5	6.7	0.1	0.0	0.1				0.0
50 % 3/8 " NOM. MAX C.A	50.0	50.0	50.0	31.1	3.1	0.7	0.0				0.0
BLENDED GRADATION	100	99	72.5	37.7	3.2	0.7	0				0
SPECIFICATION LIMITS	100	95-100	-	20-55	0-10	0-5	-	-	-	-	0- 1
NATURAL SAND											
100 % OF NATURAL SAND				100.0	96.8	86.8	66.4	42.4	18.6	6.9	2.3
BLENDED GRADATION				100	97	87	66	42	19	7	2.3
SPECIFICATION LIMITS				100	95-100	-	45-80	-	10-30	2-10	0 - 4

FINENESS MODULUS = 2.821

Fig 1. Shows blending of a coarse and Fine aggregate

I. *Discussion Regarding Conducting Tests*

Four tests compressive strength test, Schmidt hammer test and UPV tests and FESEM (Field Electron Spectrograph Emission Microscope were performed in lab by following all ASTM rules and regulations and all the tests were performed in a control environments i.e. temperature and humidity, to avoid any errors in testing procedures.

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Fig 2. Performing of compressive strength tests using compression testing machine.

Fig 3. Performing Schmidt hammer test using Schmidt hammer apparatus.

Fig 4. Performing ultrasonic pulse test for concrete samples.

Materials Composition	Corrected Weights, kg./m3	corrected weight lb/yard³
Cement	300 kg/m3	24.48 lb/yard³
Water	211 Lit./m3	17.22 lb/yard³
3/4" Agg	493 kg/m3	40.24341 lb/yard³
3/8" Agg	492 kg/m3	40.16178 lb/yard³
Sand	857 kg/m3	69.95659 lb/yard³
B-A	0.0 Kg/m3	0 lb/yard³
F-S	0.0 Kg/m3	lb/yard³

Table1: Batch weight for 1 cubic meter of concrete

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.2570	kg/m3	0.020979 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	0.016734 lb/yard³
B-A	0	Kg/m3	0 lb/yard³
F-S	0	Kg/m3	0 lb/yard³

Table2: Batch weight for four cubes of 1:2:4 concrete (0% Bagasse Ash and 0% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.2313	kg/m3	0.018881 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	0.016734 lb/yard³
B-A	0.02570	kg/m3	0.002098 lb/yard³
F-S	0	kg/m3	0 lb/yard³

Table3: Batch weight for four cubes of concrete (10% Bagasse Ash and 0% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.2056	kg/m3	0.016783 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	0.016734 lb/yard³
B-A	0.05140	Kg/m3	0.004196 lb/yard³
F-S	0	Kg/m3	0 lb/yard³

Table4: Batch weight for four cubes of concrete (20% Bagasse Ash and 0% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.25443	kg/m3	0.020769 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	0.016734 lb/yard³
B-A	0	Kg/m3	0 lb/yard³
F-S	0.00257	Kg/m3	0.00021 lb/yard³

Table5: Batch weight for four cubes of concrete (0% Bagasse Ash and 1% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.22873	kg/m3	0.018671 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.02570	Kg/m3	0.002098 lb/yard³
F-S	0.00257	Kg/m3	0.00021 lb/yard³

Table6: Batch weight for four cubes of concrete (10% Bagasse Ash and 1% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.2570	kg/m3	0.020979 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.2750	Kg/m3	0.022448 lb/yard³
F-S	0.00514	Kg/m3	0.00042 lb/yard³

Table7: Batch weight for four cubes of concrete (10% Bagasse Ash and 2% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.22395	kg/m3	0.018281 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.02570	Kg/m3	0.002098 lb/yard³
F-S	0.00771	Kg/m3	0.000629 lb/yard³

Table8: Batch weight for four cubes of concrete (10% Bagasse Ash and 3% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.20303	kg/m3	0.016573 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.0514	Kg/m3	0.004196 lb/yard³
F-S	0.00257	Kg/m3	0.00021 lb/yard³

Table9: Batch weight for four cubes of concrete (20% Bagasse Ash and 1% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.2568	kg/m3	0.020962 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	0.016734 lb/yard³
B-A	0	Kg/m3	0 lb/yard³
F-S	0.005148	Kg/m3	0.00042 lb/yard³

Table10: Batch weight for four cubes of concrete (0% Bagasse Ash and 2% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.200452	kg/m3	0.016363 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.05148	Kg/m3	0.004202 lb/yard³
F-S	0.005148	Kg/m3	0.00042 lb/yard³

Table11: Batch weight for four cubes of concrete (20% Bagasse Ash and 2% Fume Silica b.w.c)

Materials Composition	Batch Weights,g.4 Cubes		corrected weight lb/yard³
Cement	0.19789	kg/m3	0.016154 lb/yard³
Water	0.1460	Lit./m3	0.011918 lb/yard³
3/4" Agg	0.205	kg/m3	0.016734 lb/yard³
3/8" Agg	0.205	kg/m3	0.016734 lb/yard³
Sand	0.2050	kg/m3	
B-A	0.0514	Kg/m3	0.004196 lb/yard³
F-S	0.00371	Kg/m3	0.000303 lb/yard³

Table12: Batch weight for four cubes of concrete (20% Bagasse Ash and 3% Fume Silica b.w.c)

III. RESULTS

Compressive Strength

Fig5 gives blend of 10% B- Ash + 10% B- ash + 1% Fume-S, crushing quality 2997 & 3309 psi, 3184.8 & 3809psi by 7 and 28 days separately. In like manner blend 10% B-red hot garbage +2% fume-S the crushing quality be 3250 psi & 3812 psi by 7 and 28days separately. By keeping the B- red hot (10%B-A) & growing fume-S , 2 to 3% crushing quality decreases i.e. 1935 psi & 3091 psi by 7 and 28of curing. Our line graph recognized an increment in % of crushing quality for 10%B-A & 10 % B-A +1% F-S is 6% in 7 days and 15% at 28 days. Independently when appeared differently in relation to 10% Bagasse searing stays content mix the extending of level of fume-silica i.e. from 1 to 2% F-S the increase in percentage of crushing quality is 2.04% for 7days and 0.078% at 28 days. When stood out from 10% Bagasse slag content mix + 2% F-S to10 % B-A + 3% F-S, crushing quality is decrease to 40.46% at 7 days 18% at 28 days. We see 10% B- fiery debris + 2% fume-S will be more triumphant.

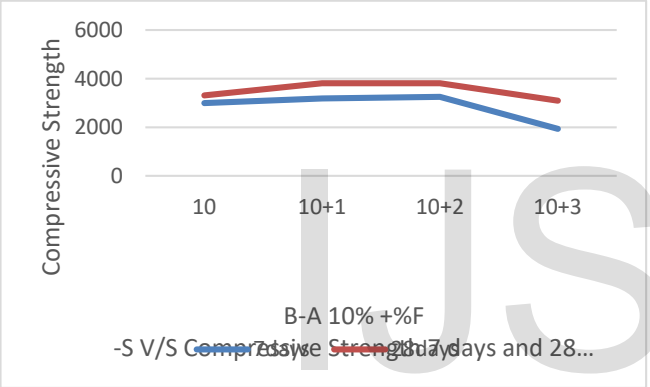

Fig. 5: BA10% + % NS V/s Compressive Strength 7 Days and 28 Days

UPV Test

U-P-V examination, gives idea of concrete be incredible. 28-day crushing quality be better than the 7-days crushing quality, 1:2:4 specimen's examinations have higher crushing quality diverged from mixed concrete specimens

Schmidt Hammer Test

Fig 6 gives blend of 10% B- Ash and10% B-A+ 1% Fume-S of crushing quality of 2867 psi and 3400 psi, 3000psi & 3867psi by of 7 & 28 days respectively. In like manner blend 10% B- red hot garbage + 2% fume-S the crushing quality is 3320 psi & 3978 psi by 7 & 28days separately. The B. red hot stays (10%B-A) and growing the fume-S in the mix from 2 to 3% it is found that the crushing quality decreases like 2000 psi & 2800 psi by 7 and 28 of curing. Our line graph recognized an increment in percentage of crushing quality for 10%B-A & 10 % B-A + 1% F-S is 4.63 in 7 days and 13.75% at 28 days . Independently when appeared differently in relation to 10% B-A searing stays mix the extending level regarding fume-S i.e. i.e. starting 1 to 2% F-S, an increment in % of crushing quality is 10.66% for 7days and 2.87 % at 28 days. When stood out from 10% B-slag content mix + 2% F-S to10 % B-A and 3% F-S, crushing quality is decrease to 39.75% at 7 days 29.6% at 28 days. We see 10% B-fiery debris +2% fume-S blends will be more triumphant.

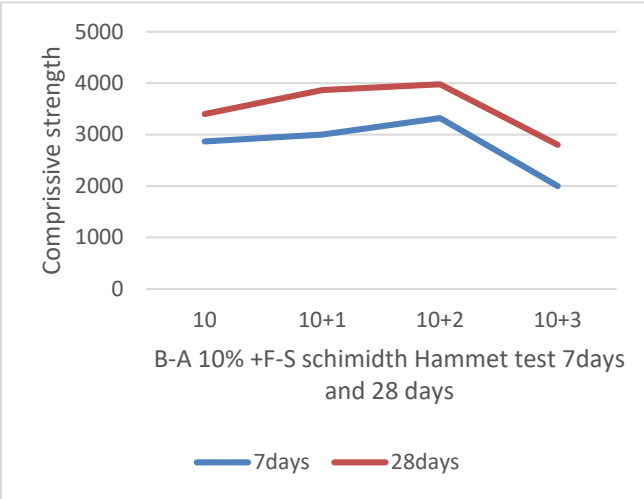

Fig. 6. BA10% + % NS V/s Schmidt Hammer Strength 7 Days and 28 Days

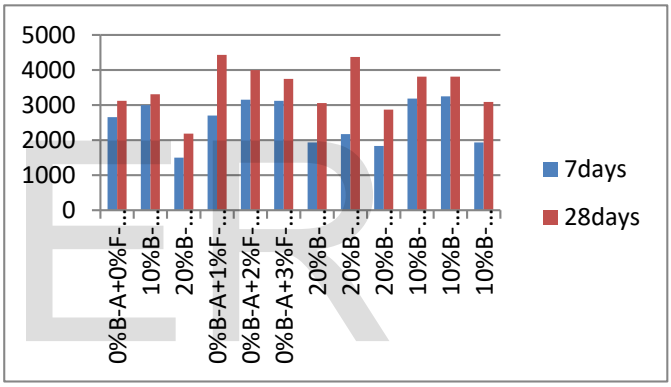

Fig. 7: crushing quality7 Days & 28 Days (comp)

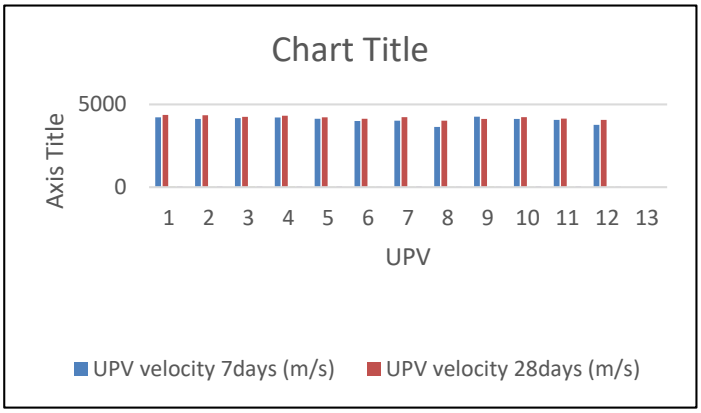

Fig8: UPV velocity 7, 28 days & time 7, 28 days

IV. CONCLUSION

Following has been concluded after detailed study of literature and the experimental and theoretical work reported in this thesis:

1. Test examination gives blend having 10% B- Fiery Debris will make well swap of bond.

2. Crushing quality examination gives that 10% B-slag replacement of bond will make upper Crushing quality with normal cement.
3. From the trail work the extension of 0% B- blazing flotsam and level of assortment of fume silica (i.e 1%, 2%, and 3%) which gives the extending requests of compressive quality.

4. Also 10% of B- ash + 2%on fume silica can be better than average substitute of concrete.

5. Better Cube compressive qualities separately when diverged from standard concrete .we can construe the choice of up to 10% of B- slag and expansion of 2 % F-S, as extra for attach, make structural concrete, be use in favor of essential convenient utilization.

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