Strength Properties of Concrete using Stone Dust as a Replacement Material for Fine Aggregate

A. Arunya, R. Chitra, Thendral S

Abstract*: Fine total is one of the significant material in the planning of cement. Concrete is most generally utilized in development materials Major segments of cement are totals which are typically accessible in regular structure. The interest for waterway sand in the development business has therefore expanded because of the broad utilization of cement. The huge scale exhaustion of common sand makes ecological issues, for example, soil disintegration, disappointment of waterway banks, bringing down of stream bed, saline water interruption into the land. To evade these sort of issues and to save common assets fine total utilized in concrete is supplanted by stone residue. Utilization of stone residue in concrete improve the nature of concrete as well as go about as reasonable elective material for common stream sand for who and what is to come. In the present examination a trial program was done to consider the quality and properties of regular solid utilizing stone residue concrete in M45 grade. In view of the test examinations led, it is presumed that the stone residue is best option for the fine total since fine total and stone residue has comparable physical and mechanical properties. It is discovered that 40% supplanting of fine total with stone residue invigorates conspicuous than customary cement.

Keywords – Stone dust, Conplast SP430, Compressive strength &Split tensile strength

I. INTRODUCTION

The Ordinarily Concrete is a composite material made of bond, fine total, coarse total and water. At present development industry is becoming exponentially because of a few other factor other than expanding formative exercises. This outcomes in colossal interest of development materials. Significant segments of cement are totals which are generally accessible in characteristic structure. Fine Aggregate utilized in concrete is normally waterway sand accessible locally or at close by area[1]. The interest for waterway sand in the development business has thusly expanded because of the broad utilization of cement bringing about the decrease of sand sources and increment in price.Going for elective and advantageous material which can be utilized as fractional or full substitution of ordinary material can assume a crucial job in preservation of common assets. Because of quick development of development movement, the accessible wellsprings of common sand are getting depleted. Consequently preservation of regular assets is extraordinary test for structural designers since development exercises can't be reduced as it is personal capable. The main route is to look through choices material which can completely or halfway supplanted normally accessible material in development. Stone dust is such an elective material which can be successfully being utilized in development as incomplete substitution of normal sand[2]. Thus an examination is completed to recognize reasonable substitute that is eco-accommodating, cheap and better for quality execution

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II. MATERIALS

A) Fine Aggregate

Locally accessible stream sand going totally through 4.75mm opening size strainer and adjusting to zone-II according to IS:383-1970 particular is used in this investigation . The fundamental test was completed and the test outcomes are classified in Table 1.

Table – 1 Properties of sand

Properties	Values
D_{60},mm	1.80
D_{30},mm	1.30
D_{10},mm	0.66
Cc	1.42
Cu	2.72
Classification	S.P

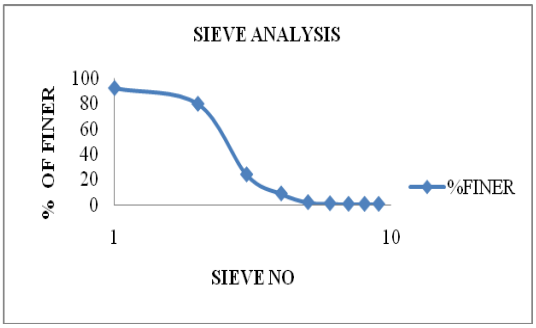


Figure – 1 Grain size distribution of soil

B. Coarse Aggregate

Locally accessible waterway sand going totally through 4.75mm opening size sifter and adjusting to zone-II according to

IS:383-1970 determination is used in this examination[3]-[5]. The primer test was done and the test outcomes are arranged in Table 2.

Table – 2 Properties of coarse aggregate

Properties	Values
Specific Gravity	2.7
Impact Value %	27.3
Crushing Value %	17.5
Water absorption %	0.10
Abrasion value %	14.2
Bulk Density Loose condition Dense condition	 1219 1425

C. Cement

In this examination Ordinary Portland Cement (OPC) 43 evaluation of single cluster was utilized adjusting to IS 8112:1989 details. Properties of OPC are recorded beneath in Table.3

Table – 3 Properties of Cement

Properties	Values
Finess%	8
Normal consistency%	33
Initial setting time	30 min
Final setting time	187 min
Specific gravity	3.15

D. Stone dust

Stone dust got from the devastating plant at kasbapuram local zone of kanchipuram District in Tamilnadu[6]-[10]. It was dark in shading, dry in condition,used as a thoroughlyretained on 150 micron sifter for whole investigation.The properties of the material are classified in Table.4

Table – 4 Properties of stone dust

Properties	Values
Bulk Density (Kg/cm^3)	18.1
Specific gravity	2.6
Bulking of sand %	4.9
Finess modulus	2.4
Water Absorption %	6.2

E. Conplast SP430

In this investigation conplast SP430 is utilized to give magnificent speeding up of solidarity gain at early ages and significant increments in quality at all ages by altogether diminishing water request in a solid blend and furthermore to makes conceivable significant decreases in water: bond proportion which permit the generation of high quality cement without inordinate concrete substance. According to May be: 9103-1999 detail. It is in fluid structure which is dark colored in shading which has a decent consolidating property with water. The properties of Sp430 are classified in Table.6

Table.6 Properties of Conplast (SP430)

Properties	Values
Appearance	Brown in liquid
Specific gravity	1.2
Chloride content	Nil

III. METHODOLOGY

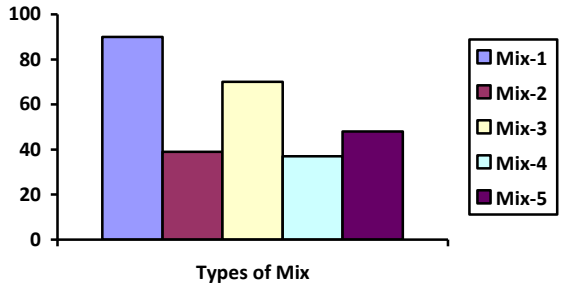
A. Fresh concrete Workability

To decide consistency of solid, Slump test was led. Usefulness as droop test for consistency of each bunch of solid blend complies with IS:1199-1959 details was done. Droop estimated was recorded regarding millimeter of subsidence of the example during test.The aftereffects of droop esteem are organized in Table.7[26]-[29]

Table.7 Slump Test Values

Mix	Type	Slump value, mm
Mix-1	Conventional Concrete	90
Mix-2	40% of Stone dust with SP	39
Mix-3	40% of stone dust without SP	70
Mix-4	100% of Stone dust with SP	37
Mix-5	100% of Stone dust without SP	48

Figure – 2 Graphical representation of Slump Value



B. Compressive Test

The shape specimens(150*150mm) were tried for compressive quality toward the finish of 7 days and 28 days.

The examples were tried after surface of the example dried[11]-[14]. The heap was

applied on the smooth sides without stun and expanded constantly until the disappointment of the example. The most extreme burden withstand by the examples is noted, mean compressive quality is resolved and introduced in Table.8 and Table.9

Table.8 Compressive strength test results @ 7 days

Mix	Type	Compressive strength,N/mm^2		
		Trail-1	Trail-2	Trail-3
Mix-1	Conventional Concrete	47.2	48.8	46.3
Mix-2	40% of Stone dust with SP	49.9	49.4	49.0
Mix-3	40% of stone dust without SP	46.3	46.9	46.6
Mix-4	100% of Stone dust with SP	44.3	45.0	44.2
Mix-5	100% of Stone dust without SP	43.8	43.7	44.1

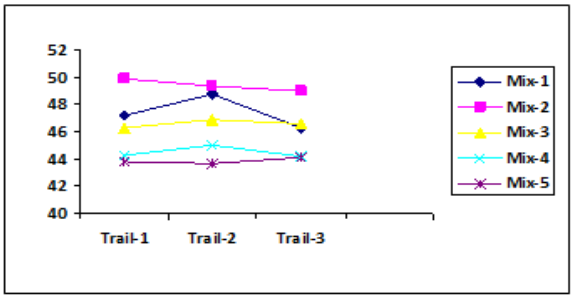


Figure - 2 Graphical representation of Compressive Strength @ 7 days

Table.9 Compressive strength test results @ 28 days

Mix	Type	Compressive strength, N/mm^2		
		Trail-1	Trail-2	Trail-3
Mix-1	Conventional Concrete	47.23	48.82	46.33
Mix-2	40% of Stone dust with SP	49.93	49.47	49.09
Mix-3	40% of stone dust without SP	46.34	46.95	46.66
Mix-4	100% of Stone dust with SP	44.34	45.00	44.29
Mix-5	100% of Stone dust without SP	43.84	43.71	44.11

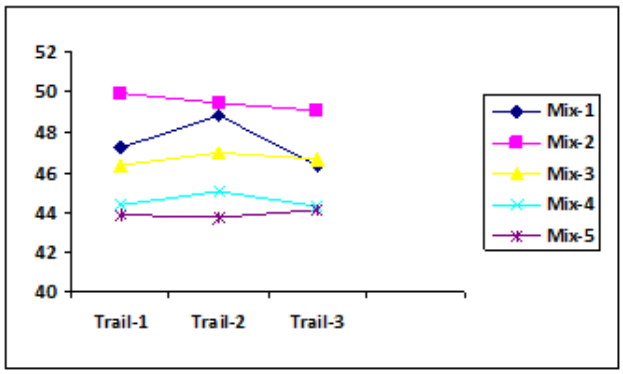


Figure – 3 Graphical representation of Compressive Strength @ 28 days

C. Split Tensile strength Test

A chamber of example 100mm dia and 200mm length were tried for split rigidity toward the finish of 7 days and 28 days[30]-[34]. Parting rigidity test on solid chamber is a strategy to decide the elasticity of cement. The solid is extremely frail in strain because of its fragile nature and isn't relied upon to oppose the immediate pressure[15]-17]. The solid creates breaks when exposed to ductile powers. In this way, it is important to decide the rigidity of cement to decide the heap at which the solid individuals may split. The aftereffects of the split elasticity are arranged in Table.10 and Table.11

Table.10 Split Tensile strength test results @ 7 days

Mix	Type	Split Tensile Strength, N/mm^2		
		Trail-1	Trail-2	Trail-3
Mix-1	Conventional Concrete	4.30	4.34	4.13
Mix-2	40% of Stone dust with SP	4.78	4.77	4.73
Mix-3	40% of stone dust without SP	4.54	4.60	4.45
Mix-4	100% of Stone dust with SP	4.11	4.09	4.17
Mix-5	100% of Stone dust without SP	3.92	3.96	4.13

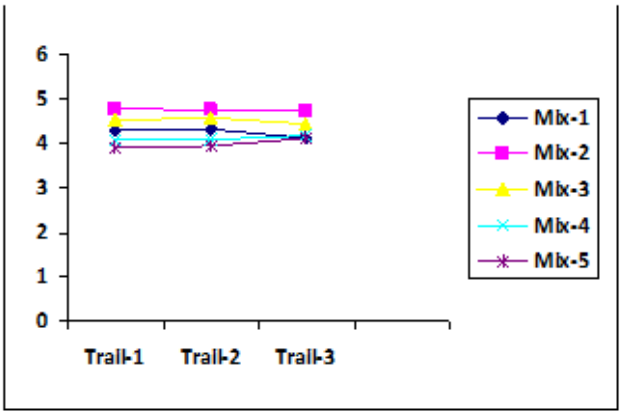


Fig.4 Graphical representation of Split Tensile Strength @ 7days

Table - 11 Split Tensile strength test results @ 28 days

Mix	Type	Split Tensile Strength, N/mm^2		
		Trail-1	Trail-2	Trail-3
Mix-1	Conventional Concrete	6.44	6.42	6.45
Mix-2	40% of Stone dust with SP	6.98	7.04	6.95
Mix-3	40% of stone dust without SP	6.31	6.29	6.32
Mix-4	100% of Stone dust with SP	5.81	5.84	5.87
Mix-5	100% of Stone dust without SP	5.68	5.71	5.71

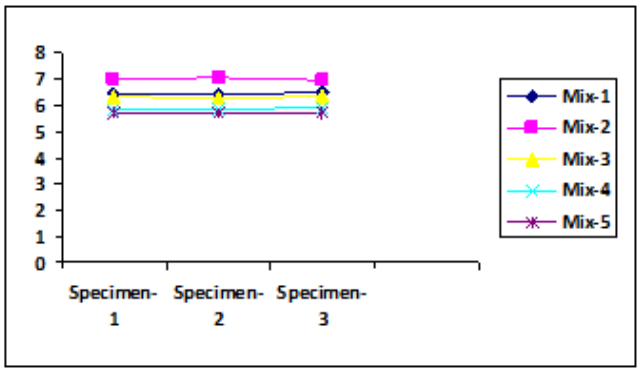


Figure - 5 Graphical representation of Split Tensile Strength @ 28 days

IV. RESULTS AND DISCUSSION

Compressive quality and Split Tensile quality of the solid 3D square and Cylinder examples was determined by separating the most extreme burden applied to the example during the test by the cross-sectional area[18]-[22].The normal of three estimations of compressive quality was taken as the delegate compressive quality and Split Tensile quality. In test block and chamber example was put in the CTM machine in such way that the heap applied to the contrary sides of the examples as cast that isn't to the top and base according to IS;516;1959 particulars.

An absolute number of 60 solid 3D shape and chamber examples as a gathering of 12 3D squares (3 3D squares and 3 chambers for 7 days and 3 blocks and 3 chambers for 28 days test)were thrown with 5 diverse blends in with the expansion of superplasticizer.40% and 100 % supplanting of common stream sand with stone dust with and without superplasticizer and drenched completely in consumable water for restoring and tried for 7 days and 28 days compressive and split pliable strength[23]-[25].The normal results for compressive and split rigidity for 7 and 28 days are organized in Table 12 and Table 13.

Table - 11 Compressive strength test results @7 & 28 days

Grade	Mix	Type of mix	7 days Avg Compressive Strength, N/mm^2	28 days Avg Compressive Strength, N/mm^2
M_{45}	Mix-1	Conventional Concrete	40.27	47.45
	Mix-2	40% of Stone dust with SP	42.10	49.49
	Mix-3	40% of stone dust without SP	41.74	46.65
	Mix-4	100% of Stone dust with SP	38.24	44.54
	Mix-5	100% of Stone dust without SP	36.35	43.88

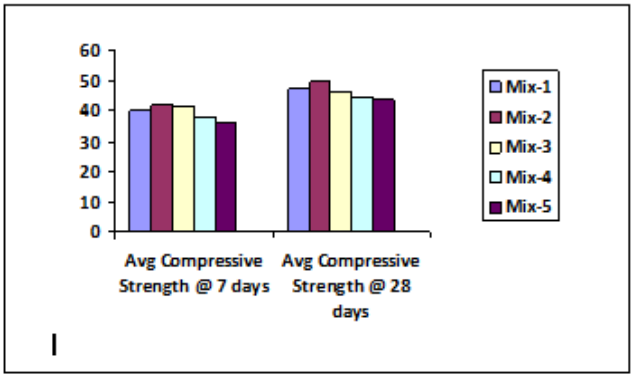


Figure – 6 Graphical representation of Compressive Strength @ 7 & 28 days

Table - 12 Split Tensile strength test results @7 & 28 days

Grade	Mix	Type of mix	7 days Avg SplitTensile Strength, N/mm²	28 days Avg Split Tensile Strength , N/mm²
M_{45}	Mix-1	Conventional Concrete	4.3	6.4
	Mix-2	40% of Stone dust with SP	4.7	6.9
	Mix-3	40% of stone dust without SP	4.5	6.3
	Mix-4	100% of Stone dust with SP	4.1	5.8
	Mix-5	100% of Stone dust without SP	3.9	5.6

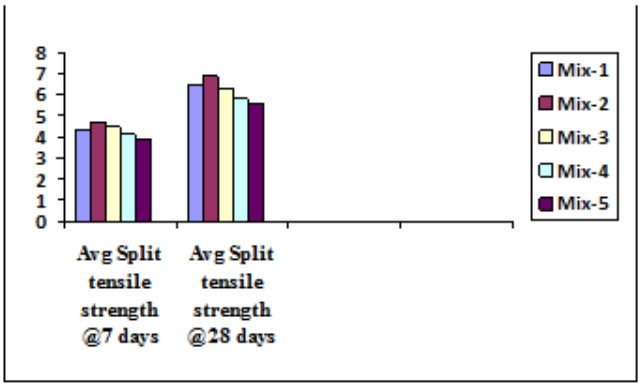


Figure – 7 Graphical representation of Split tensile strength @ 7 & 28 days

V.CONCLUSION

Based on the results and discussions, the following points are concluded,

i. Slump of cement made utilizing stone residue diminishes with increment in substitution level

ii. There is a critical increment in both compressive and split malleable test at 40% substitution of stone residue.

iii. Stone residue can be utilized as one of the substitute for Fine total if there should be an occurrence of non-accessibility of normal waterway sand at a sensible expense.

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