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Strength of M25 and M60 Grade Concrete with Used Foundry Sand

Gatadi Kiran Kumar, Ipsita Bose Roy Choudhury, V. Subbalakshmi, Alluri S Naveen Reddy

ABSTRACT---Abstract: Used or Waste Foundry Sand can be utilized as an alternative for fine aggregate in conventional concrete. WFS or UFS can be used in large volume by partially replacing sand in construction industries.

Here the strength properties of M25 and M60 grade concrete replaced by WFS by 0,10,20,30,40 and 50 percent w/w of fine aggregate is evaluated by measuring compression, split tensile and flexural strength at 7 days and 14 days.

Keywords: Waste foundry sand-WFS, used foundry sand -UFS M25 & M60 grade concrete.

I. INTRODUCTION

WFS or UFS is a byproduct obtained from metal casting industry which can be blended as various proportions of fine aggregates to make economical concrete by reducing effluence and disposal problems of foundry sand. Foundry sand is made up of thin film of burnt carbon silica, residual binder and dust. Concrete strength and other durable properties can be increased with WFS

WFS is very uniform in grain size distribution with most of the material between 0.6mm to 0.15mm.In general, WFS are dry ,non-plastic and have low absorption. Foundry sand is too fine for full substitution, so blended with coarser river sand and used as partial replacement.

II.LITERATURE REVIEW

Rafat Siddique, Geert de Schutter and Albert Noumowe, (2008): This paper displays the aftereffects of a complete test to find the concrete properties with FA s in part supplanted with 10%, 20%, and 30% UFS. Compressive quality, parting rigidity, flexural quality, and modulus of versatility were resolved at 28days, 56days, 91days, and 1year. Test outcomes showed minimal increment in the quality of ordinary concrete by consideration of UFS as fractional substitution of natural sand.

Gurpreet Singh and Rafat Siddique, (2011): This experiment was performed to evaluate the strength and durability of concrete where normal sand was supplanted with WFS taking 0%, 5%, 10%, 15%, and 20% by weight of it. Pressure test and parting rigidity test, Modulus of flexibility and ultrasonic heartbeat speed test were completed to assess the quality properties of cement at the age of 7, 28 and 91 days.

Dr. Bhimani, Jayesh Kumar Pitroda, Jayabev bhai (2013): In this research work, strength, behavior of concrete by partial replacement of FA with 0%,10%,30% & 50% UFS by weight for M20 grade concrete.

III. PROPERTIES OF MATERIALS

A. Cement: OPC (ACC 43 grade) arrangement to IS – 12269 having sp.gr. 3.12

B. Fine Aggregate: River sand as per IS-385 zone II having sp.gr 2.39 (by pycnometer) and water absorption of 0.8%..

C. Course Aggregate: 20mm Crushed granite angular aggregate, sp.gr. 2.56, and absorption of water 0.18%

D. Chemical admixture/Super Plasticizer (SP): Conplast 430

E. Foundry Sand obtained from Bhadravathi with specific gravity 2.69 and fineness index 56.67 and material finer than 75µm is 3.98%

Chemical composition of Foundry sand

Sl.No	Chemical Properties	% Weight
1	Calcium Oxide	0.16
2	Silicon di Oxide	89.78
3	Aluminium Oxide	4.65
4	Magnesium Oxide	0.36
5	Phosphorous	0.02
6	Ferric oxide	0.97
7	Potassium Oxide	0.27

IV. MIX DESIGN

It is the method of choosing appropriate material in proper proportions which makes concrete have proper workability, consistency, strength, water cementitious ratio, density and durability.

Table1: M25 grade nomenclature

Sl. No.	Concrete	Description
1	M25-00	0%foundry sand mixed with concrete M25
2	M25-10	10%foundry sand sand mixed with concrete M25
3	M25-20	20%foundry sand sand mixed with concrete M25

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* Correspondence Author

G.Kiran Kumar, Department of Civil Engineering, CMR Institute of Technology, Hyderabad, Telangana, India. (Email: gatadikiran143@gmail.com)

Ipsita Bose Roy Choudhury, Department of Civil Engineering, Malla Reddy Institute of Technology, Hyderabad, Telangana, India. (Email: ipsita.das.hyd@gmail.com)

V.Subhalakshmi, Department of Civil Engineering, Malla Reddy Institute of Technology, Hyderabad, Telangana, India. (Email: lakshmirajesh07@gmail.com

Alluri S NaveenReddy, Civil Engineer-execution in MeghaEngineering &Infrastructures Ltd. Hyderabad, Telangana, India. (Email: asnaveenreddy@gmail.com)

4	M25-30	30%foundry sand sand mixed with concrete M25
5	M25-40	40%foundry sand sand mixed with concrete M25
6	M25-50	50%foundry sand sand mixed with concrete M25

Table2: Mix proportion of M25grade concrete

Concrete Type	M25-00	M25-10	M25-20	M25-30	M25-40	M25-50
W/C	0.5	0.5	0.50	0.5	0.5	0.5
Cement(kg)	372	372	372	372	372	372
River sand (kg)	620	558	496	431	372	310
WFS (Kg)	0	62	124	186	248	310
CA (Kg)	1144	1144	1114	1144	1144	1144
SP (%)	0	0	0	0	0	0
Water(lts)	186	186	186	186	186	186
Proportions= 1:1.67:3.07						

Table3: M60 grade nomenclature

Sl. No.	Concrete	Description
1	M60-00	0%foundry sand mixed with M60
2	M60-10	10%foundry sand mixed with M60
3	M60-20	20%foundry sand mixed with M60
4	M60-30	30%foundry sand mixed with M60
5	M60-40	40%foundry sand mixed with M60
6	M60-50	50%foundry sand mixed with M60

Table4: Mix proportion of M60grade concrete

Concrete Type	M60-00	M60-10	M60-20	M60-30	M60-40	M60-50
W/C	0.32	0.32	0.32	0.32	0.32	0.32
Cement(kg)	420	420	420	420	420	420
River sand (kg)	630	567	504	444	378	315
WFS (Kg)	0	63	126	186	252	315
CA (Kg)	1160	1160	1160	1160	1160	1160
SP (%)	1	1	1	1	1	1
Water(lts)	186	186	186	186	186	186
Proportions = 1:1.34:2.47						

V. TESTING& RESULTS

Each fresh concrete batches was tested for immediate consistency by slump cone test as per IS 1199-1959.

Characteristic compressive strength of 150x150x150mm cubes is obtained by testing at 28days.The testing machine used is as per IS 516-1959, of 2000KN capacity.

Tensile strength is calculated in an indirect way, a cylinder (300mm height, 150mm dia) of concrete horizontally placed in the loading surface of CTM.(according to IS 5816-1970).

Flexure test is done on un-reinforced concrete beams, span being 3 times depth. Flexure strength (modulus of rupture) is beam's ability in bending against failure.

VI. RESULT AND DISCUSSION

A.Slump Test on Fresh Concrete

Table5: Slump Data of M-25 grade concrete

Sl. No.	Concrete	Slump
1	M25-00	58
2	M25-10	52
3	M25-20	45
4	M25-30	38
5	M25-40	34
6	M25-50	28

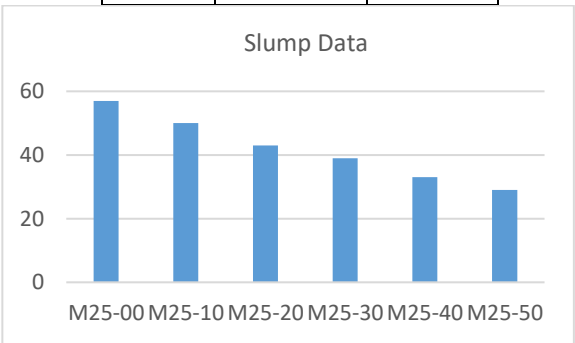
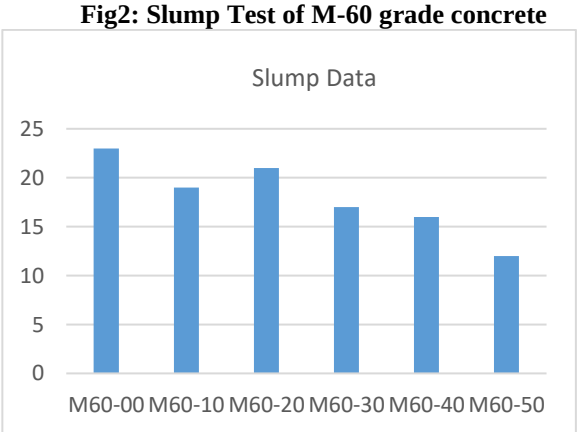


Fig1: Slump Test of M-25 grade concrete

Table6: Slump Data of Table6: M-60grade concrete

Sl. No.	Concrete	Slump
1	M60-00	24
2	M60-10	20
3	M60-20	22
4	M60-30	18
5	M60-40	15
6	M60-50	11

Fig2: Slump Test of M-60 grade concrete



B. Compressive test on hardened concrete:

Table7: Compressive strength of M-25 cubes

Sl. No.	Concrete	Av. Comp. St.(N/mm^2)	
		7 days	28 days
1	M25-00	15.3	23.56
2	M25-10	18.18	27.97
3	M25-20	18.19	28.92
4	M25-30	18.85	29.77
5	M25-40	18.88	28.85
6	M25-50	17.38	26.76

Fig3: Comp.St. of M-25 grade concrete

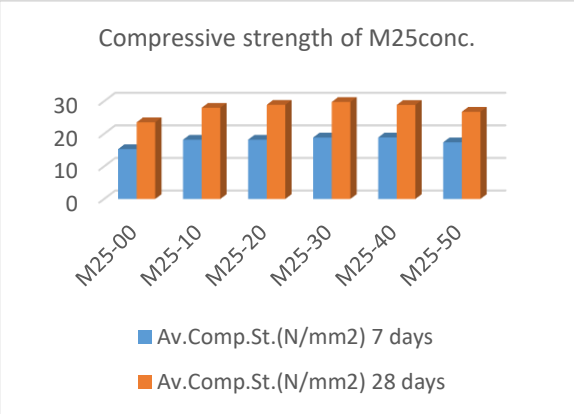
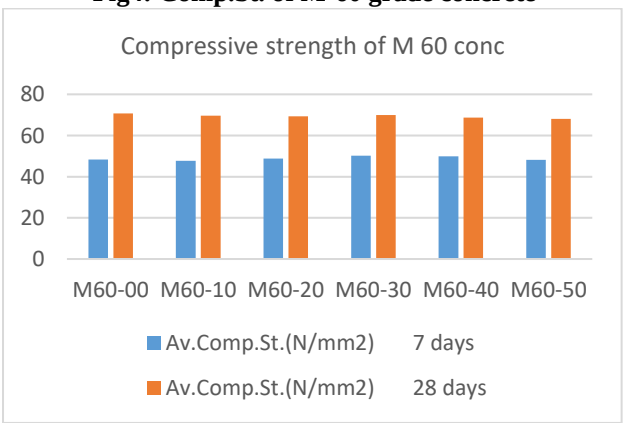


Table8: Compressive strength of M-60 cubes

Sl. No.	Concrete	Av. Comp. St.(N/mm^2)	
		7 days	28 days
1	M60-00	48.35	70.68
2	M60-10	47.66	69.70
3	M60-20	48.75	69.28
4	M60-30	50.16	69.88
5	M60-40	49.85	68.76
6	M60-50	48.15	68.07

Fig4: Comp.St. of M-60 grade concrete



C. Tensile strength test on hardened concrete:

Table9: Split tensile strength of M-25 grade

Sl. No.	Concrete	Av. Split tensile Strength.(N/mm^2)	
		7 days	28 days
1	M25-00	2.98	4.32
2	M25-10	2.52	3.55
3	M25-20	2.45	3.65
4	M25-30	2.39	3.47
5	M25-40	2.28	3.37
6	M25-50	2.22	3.19

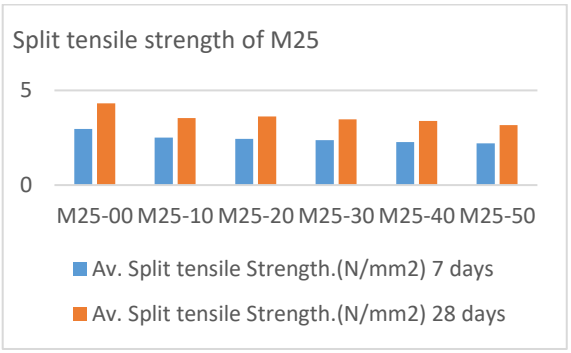


Fig5: Tensile .St. of M-25 grade concrete

Table10: Split tensile strength of M-60grade concrete

Sl. No.	Concrete	Av. Split tensile Strength.(N/mm^2)	
		7 days	28 days
1	M60-00	3.32	4.73
2	M60-10	3.27	4.27
3	M60-20	3.87	4.92
4	M60-30	3.15	3.94
5	M60-40	3.87	4.61
6	M60-50	2.27	3.54

Fig6: Tensile .St. of M-60 grade concrete

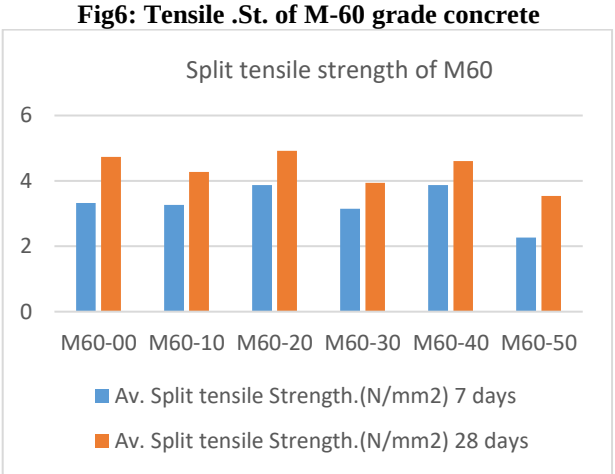


Table11: Flexural strength of M-25 grade

Sl. No.	Concrete	Flexural strength (Mpa)	
		7 days	28 days
1	M25-00	2.95	3.15
2	M25-10	3.04	3.25
3	M25-20	3.15	3.45
4	M25-30	3.05	3.17
5	M25-40	3.28	3.54
6	M25-50	3.38	3.48

Fig7: Flexural St. of M-25 grade concrete

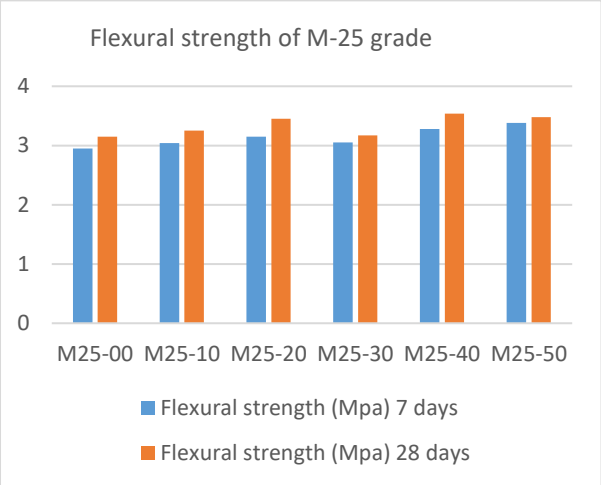
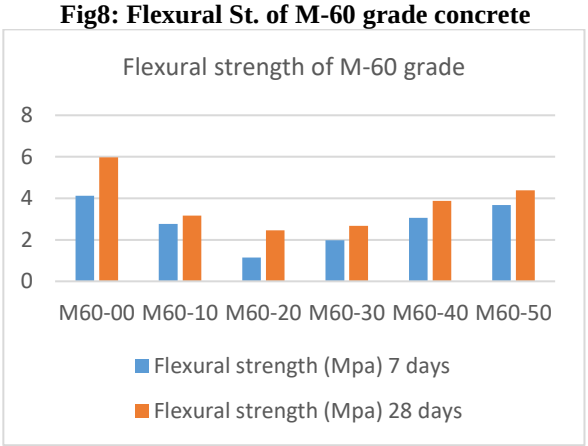


Table12: Flexural strength of M-60 grade

Sl. No.	Concrete	Flexural strength (Mpa)	
		7 days	28 days
1	M60-00	4.13	5.98
2	M60-10	2.76	3.17
3	M60-20	1.15	2.45
4	M60-30	1.98	2.68
5	M60-40	3.06	3.87
6	M60-50	3.68	4.38

Fig8: Flexural St. of M-60 grade concrete



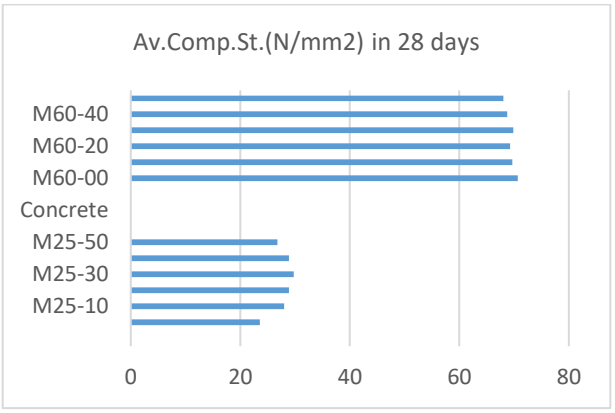
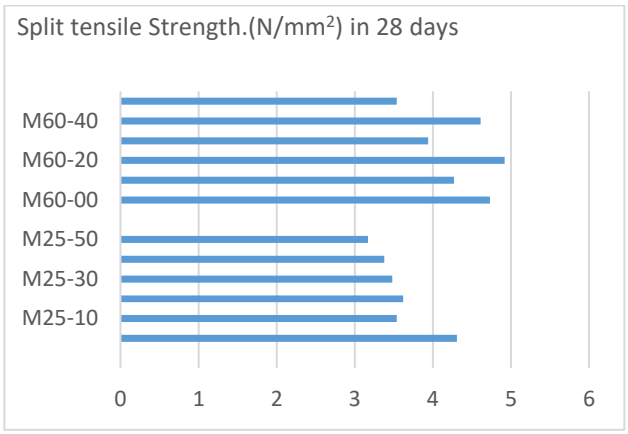


Fig9: Comparative compressive strength of two mixes



.Fig10: Comparative tensile strength of two mixes

VII. CONCLUSION

Experimental study conducted on M25 and M60 concrete using Waste Foundry sand have the following conclusions:

A. Using WFS as fine aggregate in making concrete show increase in compressive strength and30% substitution show optimum compressive strength as in fig 9.

B. Substitution of river sand by WFS reduce construction cost significantly also results in sustainable building material.

C. Concrete containing WFS percentage more than 20% replacement show degradation in split tensile strength as shown in fig.10.

REFERENCES

1. Rafat Siddique, Geert de Schutter and Albert Noumowe, "Effect of used-foundry sand on the mechanical properties of concrete",in Construction and Building Materials, 2008,vol. 23, pp 976–980.
2. Gurpreet Singh and Rafat Siddique, "Effect of waste foundry sand (WFS) as partial replacement of sand on the strength, ultrasonic pulse velocity and permeability of concrete",in Construction and Building Materials,2011, vol. 26, pp 416–422.
3. Dushyant R Bhimani, Dr. Jayeshkumar Pitroda, Jaydev Jagmohandas Bhavsar ,"A study on foundry sand: opportunities for sustainable and economical concrete" - Global Research Analysis. Índia, DOI: 10.15373/22778160/January2013/64
4. Bavita Bhardwaj and Pardeep Kumar, "Waste foundry sand in concrete:A review,in Construction and Building Materials,Dec,2017, vol. 156, pp 661–674.
5. Bureau of Indian standards 383:1970,"Specification for Coarse and Fine aggregates from Natural Sources for concrete, New Delhi.

6. Bureau of Indian standards 10262:2009,"Recommended guidelines for Concrete Mix Proportioning", New Delhi
7. Bureau of Indian standards 516-1959,"Method of tests for strength of concrete", New Delhi
8. Bureau of Indian standard 2386:1963,"Methods of test for Aggregate for concrete."
9. Concrete Technology Theory and Practice, By M.S.Shetty, S.Chand ,2008
10. Properties of Concrete(5th edition), By A.M.Neville,Pearson,2011.

AUTHORS PROFILE

G.Kiran Kumar did M.Tech in Structural Engineering from JNTUH affiliated MRIT securing 74.3% and B.Tech in Civil Engineering from CMRIT, Hyderabad, securing 70.4%.Successfully completed many projects on concrete. Paper published in IJARTET on the topic "Effect of sulfate attack on Self Compacting Concrete."

Worked as Assistant Professor in Malla Reddy Institute of Technology Hyderabad for 2 years. At present working as Assistant Professor in CMR Institute of Technology, Hyderabad

.

Ipsita Bose Roy Choudhury did M.Tech in Structural Engineering from JNTUH affiliated MRIT with 73% and B.Tech in Civil Engineering from JNTUH, Hyderabad. Have worked in consultancy for nearly 7 years in Autocad and Staadpro.

Paper published in IJAERD on the topic "Study on Structural Performance of Steel Fibre Reinforced Self Compacting Concrete."At present working as Assistant Professor in Malla Reddy Institute of Technology, Hyderabad

V.Subbhalakshmi completed M.Tech in Structural Engineering from MRIT affiliated to JNTUH securing 76% and B.Tech in Civil Engineering from JNTU, Hyderabad. Have worked in consultancy for 10 years in Autocad and Staadpro. Presentlyworking as Assistant Professor in Malla Reddy Institute of Technology, Hyderabad.

Alluri S Naveen Reddy completed M.Tech in Structural Engineering from MRIT affiliated to JNTUH securing 70.3% and B.Tech in Civil Engineering from TKR college of engineering and technology, Hyderabad, securing 70.4%

At present working as Execution engineer in Megha Engineering & Infrastructures Ltd. Hyderabad, India