Comparative Study of Conventional Concrete Strength with Quarry Dust Replacing Sand in Concrete

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Abstract – The paper describe the role of quarry dust in the construction of buildings and comparative study of Plane cement concrete strength with concrete replacing sand with quarry dust to control the demand of sand by using quarry waste At various proportion while making concrete in construction. This project presents the feasibility of usage of Quarry Rock Dust as30%, 40% & 50% substituent for conventional concrete and compare with plane concrete having grade M20 & M25. The compressive strength of compressed concrete compare for 7 day & 28th days. Due to this project work we can optimise the natural sand replacing waste quarry dust.

Keywords: Sand, flash, quarry dust (QD), sieve analysis, slum cone test. Compressive test

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I. INTRODUCTION

Now a day in construction utilization of Quarry rock dust has been accepted as a building material in the industrially advanced countries. As a result of increasing application of this industrial waste quarry dust. The level of use quarry rock dust in the industrialized nation has been reached more than 50% of its total production. The use of natural sand in India has not been much when compared to most developed countries. This paper presents the feasibility of the usage of Quarry Rock Dust as some percent substitutes for Conventional Concrete. Tests were conducted on cubes and study the compressive strengths of concrete made of Quarry Dust for two different proportions and compared with the Conventional Concrete.

II. PROPOSED METHODOLOGY

Test on Materials

Test on Aggregate and Sand

1. Sieve Analysis
2. Specific Gravity

Sieve Analysis: The sieve analysis is conducted to determine the particle size distribution of sand or aggregate, which we call gradation of material

Specific Gravity: Specific gravity of aggregate test is required to calculate the compacting factor. Average specific gravity of the rocks varies from 2.6 to 2.8

Test on Concrete

1. Slump Cone Test
2. Compression Test

Slump Cone Test: This test is performed to check the workability of freshly made concrete. This test s separately performs on fresh concrete and the concrete replacing sand with quarry dust to find the workability.

Compression Test:

The compression test is carried out on cubical specimen; the cube specimen is of size 150mm×150mm×150mm. The aggregate size of 20mm will be used to make concrete mixes. This test will be done for conducted for concrete cubes of 30% then 40% and 50% replacement of sand by Quarry dust for M_{20} and M_{25} mixes.

III. EXPERIMENTAL RESULTS

I. Results for Compressive Strength Test

Table 1: For Normal Concrete (7 Days)

Grade of Concrete	W/C Ratio	Hydraulic Force(KN)	Compressive Strength(N/mm^2)
M20	0.7	182.89	8.13
	0.7	188.79	8.39
	0.7	190.8	8.48
M25	0.7	255.6	11.36
	0.7	333.33	14.8
	0.7	248.76	11.06

II. Results for Compressive Strength Test

Table 2: For Normal Concrete (28 Days)

Grade of Concrete	W/C Ratio	Hydraulic Force(KN)	Compressive Strength(N/mm2)
M20	0.7	423.56	18.82
	0.7	425.89	18.93
	0.7	426.01	18.93
M25	0.7	520.37	23.13
	0.7	526.52	23.4
	0.7	554.06	24.62

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TABLE 3: Results for Compressive Strength Test for Quarry Dust mix Concrete (7 Days)

Grade of Concrete	Amount of Q.D.	W/C Ratio	Hydraulic Force (KN)	Compressive Strength (N/mm^2)
M20 (1 :1.5: 3)	30%	0.7	221.69	9.85
			220.5	9.8
			222.56	9.89
	40%	0.7	172.3	7.66
			169.12	7.52
			173.86	7.73
	50%	0.7	200.65	8.92
			199.13	8.85
			189.54	8.42
M25 (1:1:2)	30%	0.7	191.74	8.52
			177	7.86
			187.96	8.35
	40%	0.7	160.2	7.12
			177	7.86
			181.14	8.05
	50%	0.7	222.71	9.89
			182.89	8.12
			192.54	8.56

TABLE 4:.Results for Compressive Strength Test for Quarry Dust mix Concrete (28 Days)

Grade of Concrete	Amount of Q.D.	W/C Ratio	Hydraulic Force(KN)	Compressive Strength (N/mm^2)
M20 (1 :1.5: 3)	30%	0.7	399.19	17.74
			401.23	17.83
			412.84	18.35
	40%	0.7	421.12	18.72
			424.01	18.84
			404.1	17.96
	50%	0.7	430.2	19.1
			428.31	19.04
			418.24	18.6
M25 (1:1:2)	30%	0.7	512.8	22.8
			510.43	22.7
			515.55	22.91
	40%	0.7	531.41	23.62
			523.04	23.25
			520.32	23.13
	50%	0.7	551.1	24.5
			541.45	24.06
			536.21	23.83

III Comparison of Results

Table 5: For Normal Concrete

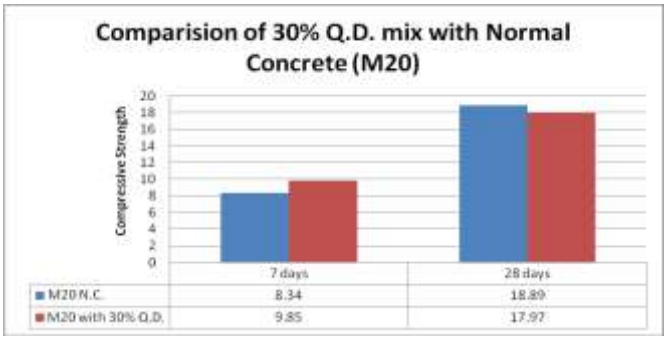
Grade of Concrete	Average Compressive Strength(N/mm^2)	
	7 Days	28 Days
M20	8.34	18.89
M25	12.41	23.72

Table 6: for Quarry Dust mix Concrete

Grade of Concrete	Amount of Quarry Dust	Average Compressive Strength	
		7 Days	28 Days
M20	30%	9.85	17.97
	40%	7.64	18.51
	50%	8.73	18.91
M25	30%	8.24	22.8
	40%	7.68	23.33
	50%	8.86	24.13

II. Results for Compressive Strength Test in Bar Chart

Chart no. 1



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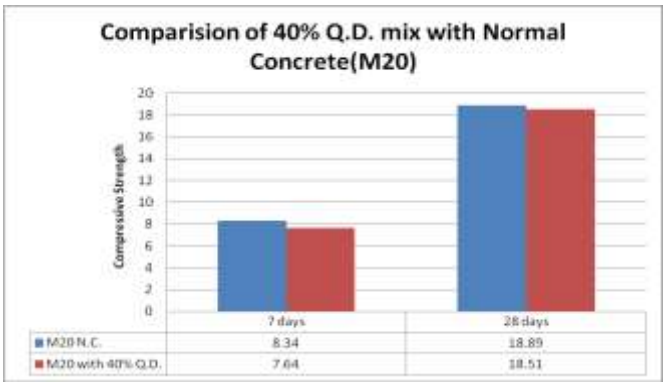

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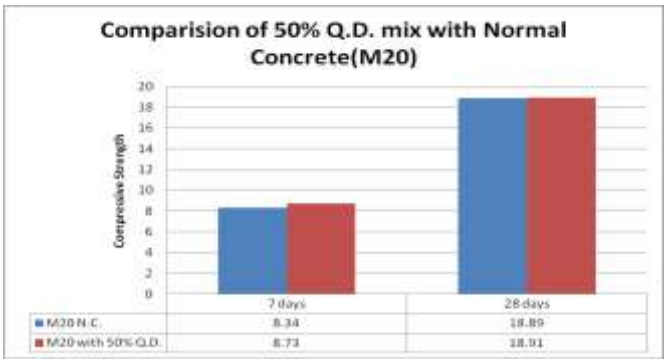
Chart no. 3



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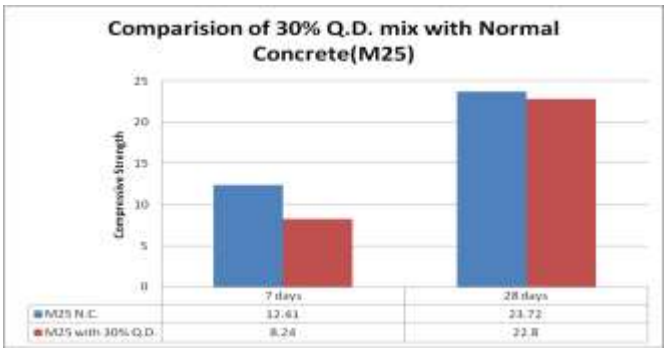

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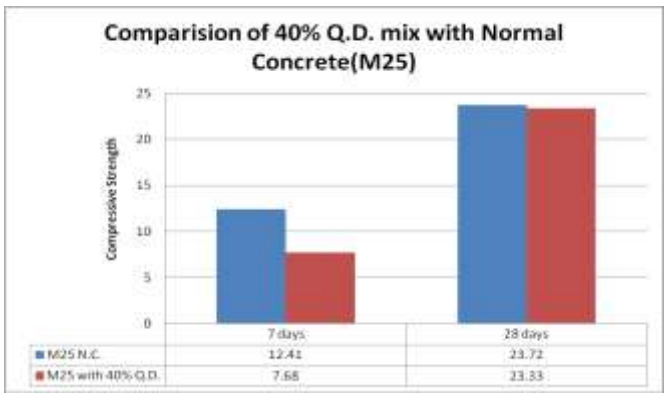

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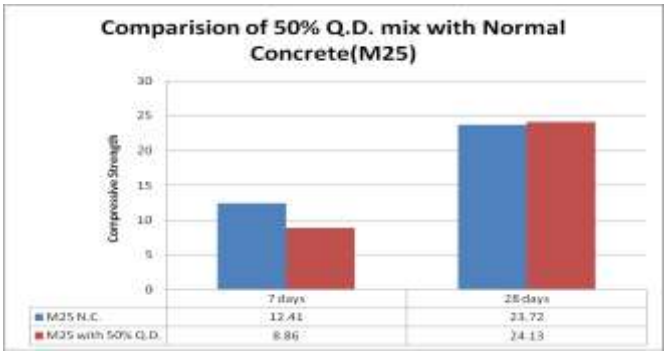

IV. CONCLUSION

Based on the results and discussion mentioned above, the following conclusions are obtained:

1. Mix ratio of 1:1.5:3 give the optimum strength in this study.
2. As the percentage of Quarry Dust gradually increases, the Compressive strength of concrete will also increase with condition that percentage of Quarry Dust should not exceed 50%.
3. The compressive strength of compressed concrete increase with the increase of age of maturity. The value of strength for 28^{th} days higher than the strength for 7^{th} days.
4. Mix ratio of 1:1:2 (cement: aggregate : sand+ quarry dust) gives better strength as compared to mix ratio of 1:1.5:3 and can be declared as optimum mix ratio of compressed concrete using quarry dust.

V. FUTURE SCOPES

The compressive strength value is high up to some limit and it show that quarry dust suitable to use as sand replacement. Quarry Dust can be well utilized in construction. The utilization of Quarry dust as a partial replacement of sand in concrete can reduce the cost of construction as well as quantity of sand

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