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IMPACTS ON THE DIFFERENTFRESH AND HARDEND PROPERTIES OF CONCRETE ON PARTIALLY REPLACING CEMENT WITH QUARRY DUST AND GLASS FIBRES

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ABSTRACT

The present investigation has been carried out to investigate the behavior of GFQDC under compression, tension and flexure. Experiments were carried out for quarry content 15%, 25%, 35%, 45 %. it has been observed that the effect of quarry fineness, aspect ratio and the quarry content more than 45% has not been considered and after doing experimentation on different proportion of Query Dust and comparative analysis was done with conventional concrete. Furthemore glass fibres were also used with Quarry Dust and different plots were drawn for different properties of harden concrete containing GFQDC.It has been seen that to a some extent there was improvement after adding GFQDC, and on increasing the content there was a escalation of strength of concrete.

INTRODUCTIONAs we know concrete plays vital role in the construction industry. It is widely used because of its sturdiness, flexibility and low-cost. For a mix (concrete), high-quality aggregate is major component of the mix and the most commonly used aggregate is river sand aggregates. The demand for natural sand within the subject of production is increasing day after day due to hugeutilisation of this aggregate in concrete. Natural river sand takes many years to shape due to its limited supply and excessive price of transportation, India is facing scarcity of natural sand, natural sand deposits are being used in a great amount which is further causing serious impactson environment and to the society.Therefore, research is must required to identify a substitute which is easily available and cheaper than river sand. Quarry dust (QD) has been seen asalternative to normal sand that will begiving the additional improved properties to the concrete. Quarry waste(mixture), which is normally considered as waste product after processing of rocks having size much less than 4. 75mm, reasons being the usage of quarry waste makes better mixture in concrete with additional improvements in concrete. In short, the utilization of quarry waste will changethis waste fabricinto useful resource in terms of fine aggregates. Glass fibrecontaining concrete (GFQDC) havesomecementitious properties.Glassfibreare used as reinforcing material in concrete. Quarry rock dust isa leftover or simply a byproduct material after the extraction and processing of rocks to shape quality having size less than 4. 75mm. Itis abundantly available to an extent of 200M tonnesper year which

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has further landfill disposal issues.

MATERIAL AND METHODOLOGY

TESTING OF MATERIALS

The main objective of this research is to obtain the properties of the different type of materials that can be used for making the specimens for our experimental studies. The data is enough to classify cement, sand, coarse aggregate and Quarry Dust.

TEST ON CEMENT:

The cement that we have use for the this research was Ultra tech cement 43 grade OPC as per the specifications of Indian Standard Code. The various test performed on the cement and their values are shown in the following Table

CONSISTENCY OF CEMENT PASTES:

Normal consistency tests, for the Quarry Dust with cement paste were done, by Vicat's apparatus, to evaluate the changes in water requirement of pastes due to further addition of Quarry Dust.

NORMAL CONSISTENCY OF QUARRY DUST WITH CEMENT PASTE

S.NO	TYPE OF MIX	CONSISTENCY%
1	OPC	33
2	MX(15%)	34
3	MX(25%)	35
4	MX(35%)	35
5	MX(45%)	35

CALCULATIONS:-

Specific Gravity (S.G.) = W5* (W3 – W1) / (W5 + W3 – W4)*(W2 – W1)

= 61(1335 – 631) / (61+1335–1380) (1515– 631)

= 42944/14144 = 3.04

SIEVE ANALYSIS OF FINE AGGREGATE (AS PER IS: 383- 1970)

Sr.No.	IS Sieve Designation	Mass Retained on sieve (gm)	%age passing(By weight)	Cumulative %age retained (C)

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1	4.75mm	0	100	0
2	2.36mm	40	96	4
3	1.18mm	350	61	39
4	600µ	460	15	85
5	300µ	130	2	98
6	150µ	20	0	100
∑ C				326

CALCULATIONS :-

Fineness modulus of sand = ∑ C/100

Fineness modulus of sand= 326/100=3.26

MIX DESIGN PROPORTION OF STANDARD (M 30) GRADE CONCRETE

Mix designation	**Water**	**Cement**	**Fine aggregate**	**Coarse aggregate**
MX0	186 kg/m^3	372kg/m^3	675.95 kg/m^3	1269.96 kg/m^3
	0.50	1	1.82	3.41

OR

0.50:1:1.82: 3.41

DISCUSSION OF RESULTS:

5.2.1 COMPRESSIVE STRENGTH:

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The compressive strength ofnormal mortar and GFQDC for different percentages of Quarry content has been illustrated in following tables,which shows the compressive strength after 7 and 28 days. The compressive strength of normal mortar has been obtained at 7 days as 24.29 Mpa and 38.59 Mpa after 28 days. This strength has been obtained 7 days as 24.74Mpa, 25.11 Mpa, 25.56 Mpa and 24.67 Mpa and 28 days as 39.18 Mpa, 39.85 Mpa , 40.44 Mpa and 40 Mpa for 15% , 25% , 35% and 45% percent Quarry contents respectively in the case of Glass fibre Quarry Dust concrete (GFQDC). It has been observed that the compressive strength of GFQDC is in increasing order with 15%,25%,35% than the compressive strength of plane mortar .At 45% replacement the strength goes in decreasing order as illustrated in Table 4.2 and Plotted in fig. 4.2 . This is due to the fact that the fineness of quarry increases enormously with consequent improvements in crack control toughness and compressive strength. It has been found that compressive strength of the GFQDC based specimens increased upto 35% replacement of quarry dust by weight of fineaggregate.

COMPRESSIVE STRENGTH AFTER 7 DAYS

Mix Designation	Percentage of Quarry Dust	Percentage of Glass fibre	Compressive Load(KN)	Compressive Strength (MPA)	Average Compressive strength (MPA)
MX0	0	0	545 540 555	24.22 24 24.67	24.29
MX1	15	0.4	565 555 550	25.11 24.67 24.44	24.74

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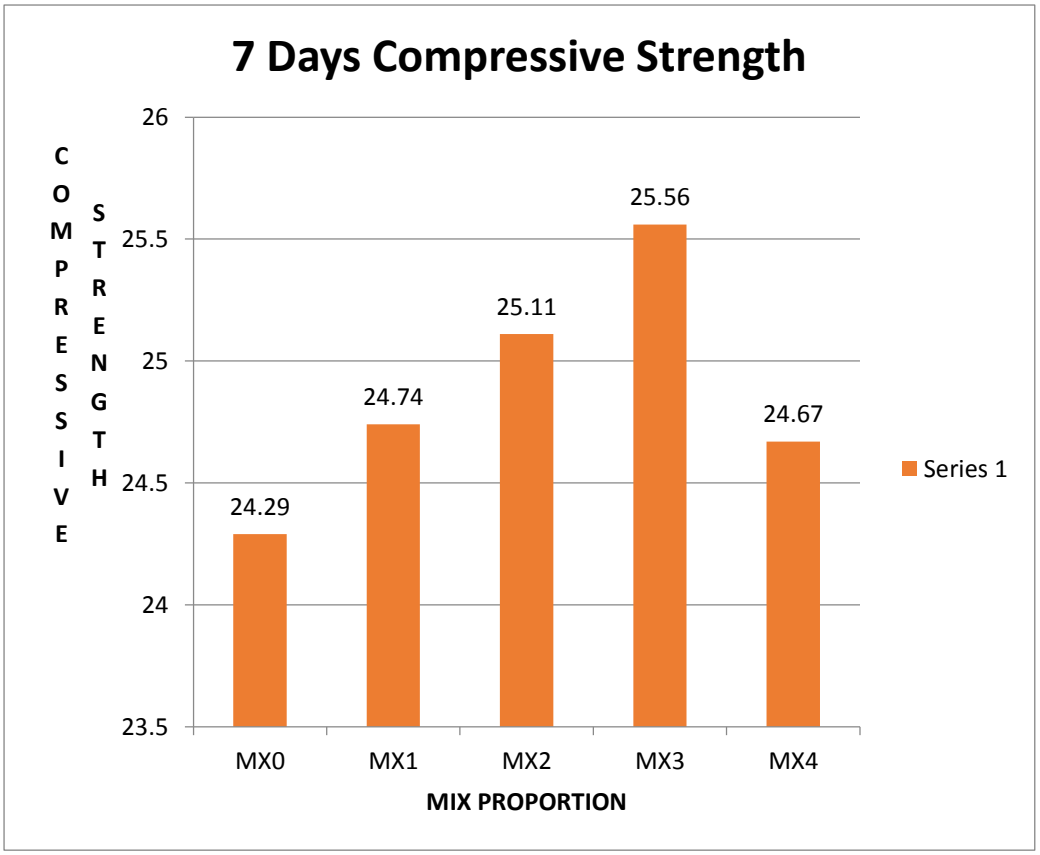
MX2	25	0.8	565 570 560	25.11 25.33 24.89	25.11
MX3	35	1.2	575 580 570	25.56 25.78 25.33	25.56
MX4	45	1.6	545 555 565	24.22 24.67 25.11	24.67



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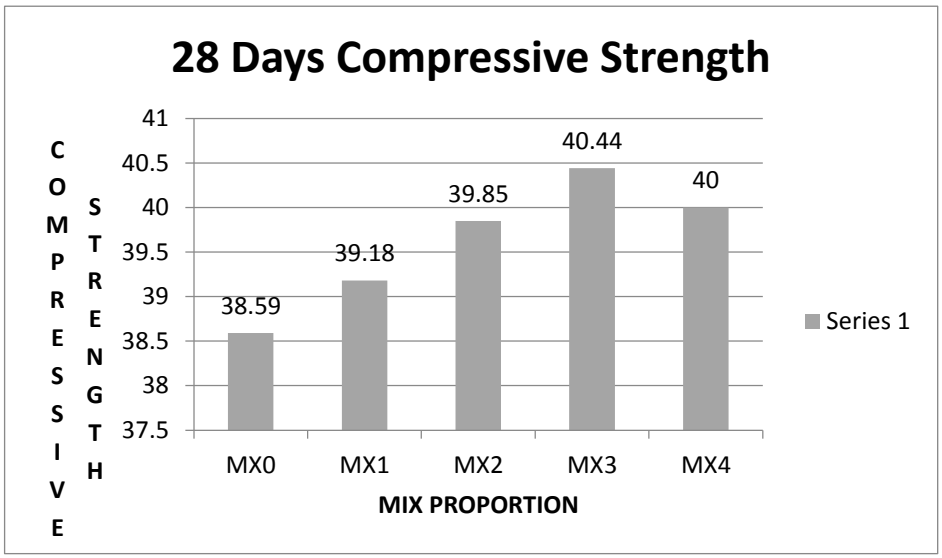

28 DAYS COMPRESSIVE STRENGTH

Mix Designation	Percentage of Quarry Dust	Percentage of Glass fibre	Compressive Load(KN)	Compressive Strength (MPa)	Average Compressive strength (MPa)
MX0	0	0	875 860 870	38.89 38.22 38.67	38.59
MX1	15	0.4	890 870 885	39.55 38.67 39.33	39.18
MX2	25	0.8	890 905 895	39.55 40.22 39.78	39.85
MX3	35	1.2	910 915 905	40.44 40.67 40.22	40.44
			905	40.22	

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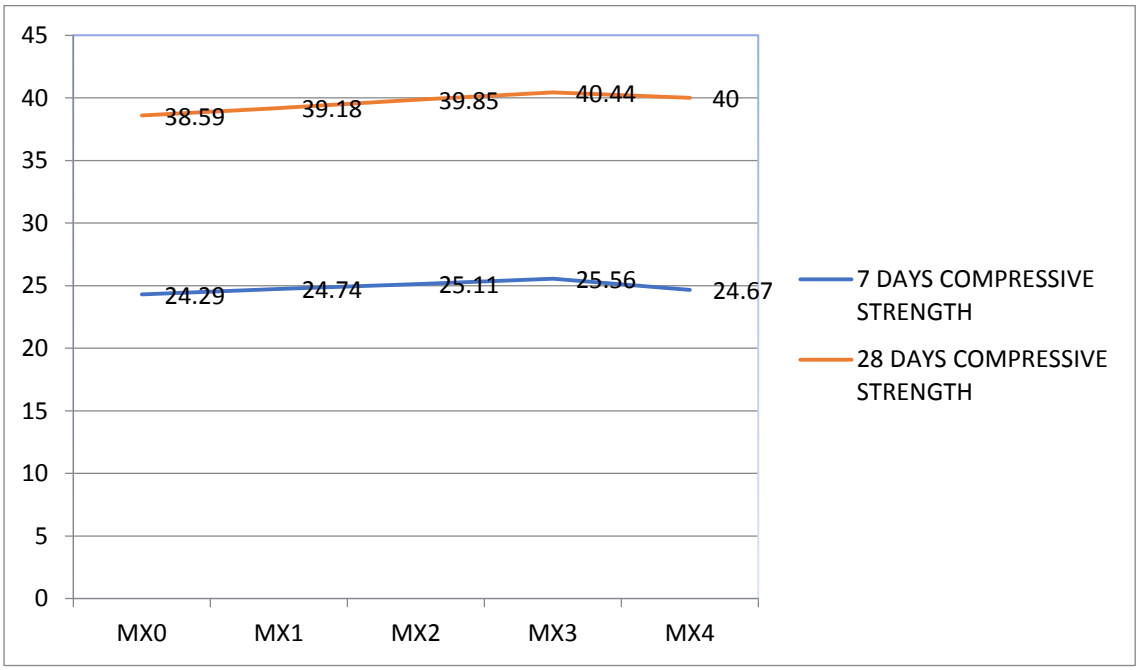
MX4	45	1.6	895 900	39.78 40	40

It can be seen from the above tables and figures that the Incorporation of quarry dust resulted in increase in compressive strength of concrete increase up to 35% both at the curing age of 7 days and 28 days respectively. Hence, these results shows that Quarry Dust possess good compressive behavior and helps in improving the properties of the M30 concrete .

VARIATION OF COMPRESSIVE STRENGTH AT DIFFERENT AGES



5FLEXURAL STRENGTH

Flexural strength of GFQDC has been observed by testing beams of 15cm×15cm×70cm under two-point loading. In this flexural strength, the effective length of the beam was 70cm. The

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flexural strength of normal mortar and GFQDC for various percentages of quarry content has been illustrated in tables, which shows the flexural strength after 7 and 28 days respectively.TheflexuralStrengthhasbeenobtained 7 days as2.17MPA,2.43MPA,2.71MPA, 2.91 MPA AND 2.76 MPA AND 28 DAYS AS 3.56 MPA, 3.96 MPA, 4.52 MPA, 4.93 MPA, 4.73 MPA respectively for GFQDC with 0, 15%, 25%, 35% and 45% percent of quarry content after 28 days. it has been observed that flexural strength of GFQDC with 15%, 25%, 35%, percent of quarry content is about on increasing order more than that of plane mortar. This increase in strength however is about more at the content of 35% percent quarry contents of GFQDC when compared with plane mortar as shown in table 5.4 and plotted in fig. 4.4. it has been observed that plane concrete specimen gets breakis two parts as we applied the load while in the case of GFQDC based beams developed some micro cracks and not the break in the two parts as in the case of plane mortar. It means quarry dust provides the ductility to the concrete.

TABLE 5.3

FLEXURE STRENGTH AFTER 7DAYS

Mix Designation	**Percentage of Quarry Dust**	**Percentage of Glass fibre**	**Load Taken(KN)**	**Flexural Strength (MPa)**	**Average Strength (MPa**
MX0	0	0	13.10 11.95 11.65	2.33 2.12 2.07	2.17
MX1	15	0.4	14.30 13.20 13.60	2.54 2.35 2.41	2.43
MX2	25	0.8	15.05 15.85 14.95	2.67 2.82 2.66	2.71
MX3	35	1.2	16.35 15055 17.35	2.91 2.76 3.08	2.91

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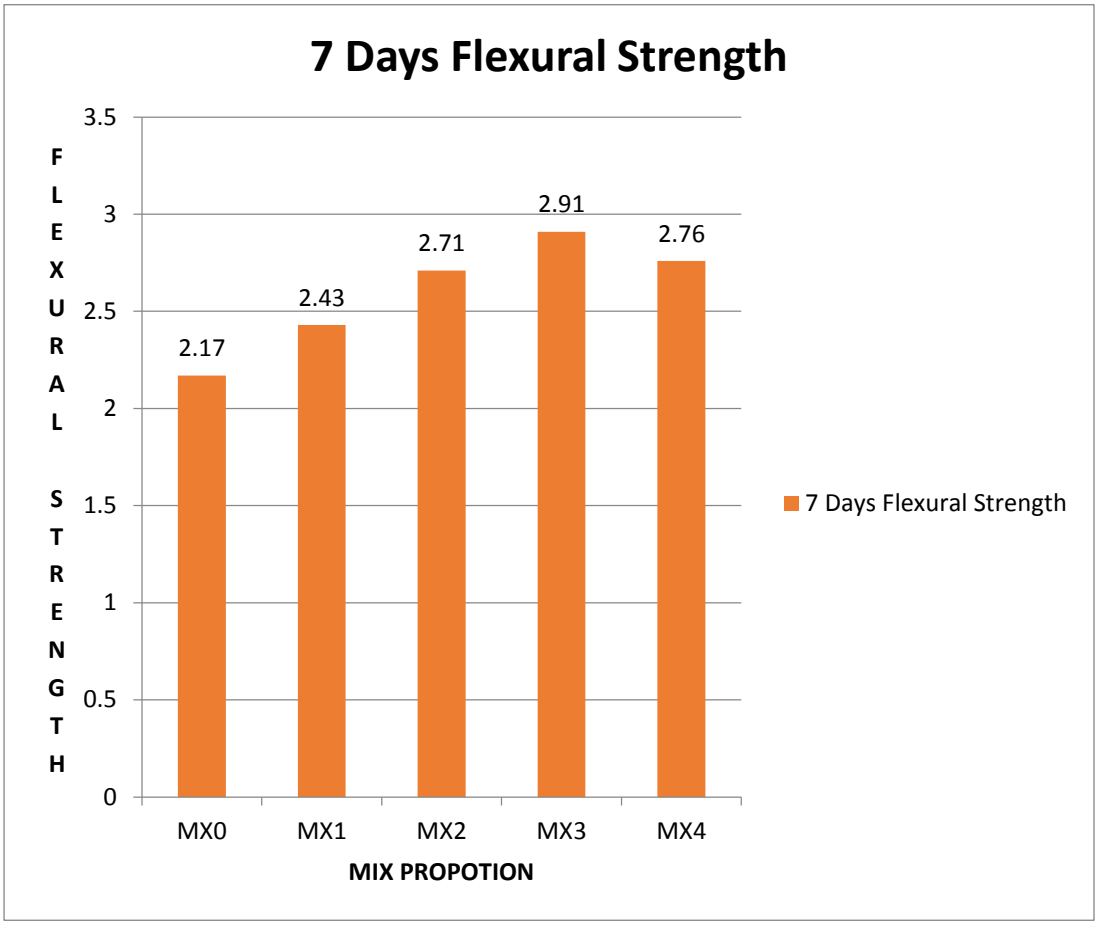
MX4	45	1.6	16.30 16.65 15.75	2.90 2.96 2.44	2.76



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FLEXURE STRENGTH AFTER 28 DAYS

Mix Designation	Percentage of Quarry Dust	Percentage of Glass fibre	Load Taken(KN)	Flexural Strength (MPa)	Average Strength (MPa
MX0	0	0	21.80 18.80 19.50	3.87 3.34 3.47	3.56
MX1	15	0.4	23.80 22.10 20.85	4.23 3.93 3.7.1	3.96
MX2	25	0.8	25.20 26.10 24.95	4.48 4.64 4.43	4.52
MX3	35	1.2	27.30 26.80 29.10	4.85 4.76 5.17	4.93

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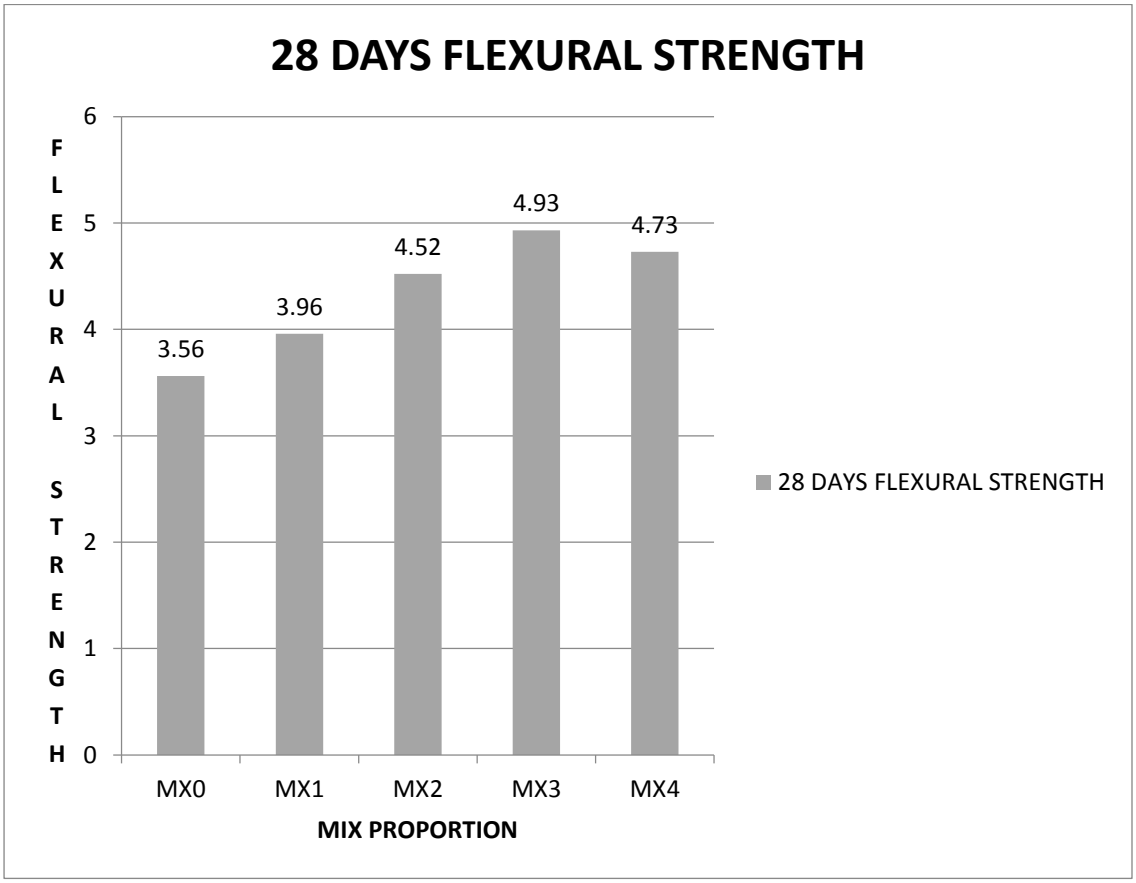
MX4	45	1.6	26.90 25.10 27.80	4.78 4.46 4.94	4.73



It can be clearly from the plot that flexural strength of the GFQDC increases with 35 % quarry dust as compared to plain concrete. And decrease with 45% replacement.

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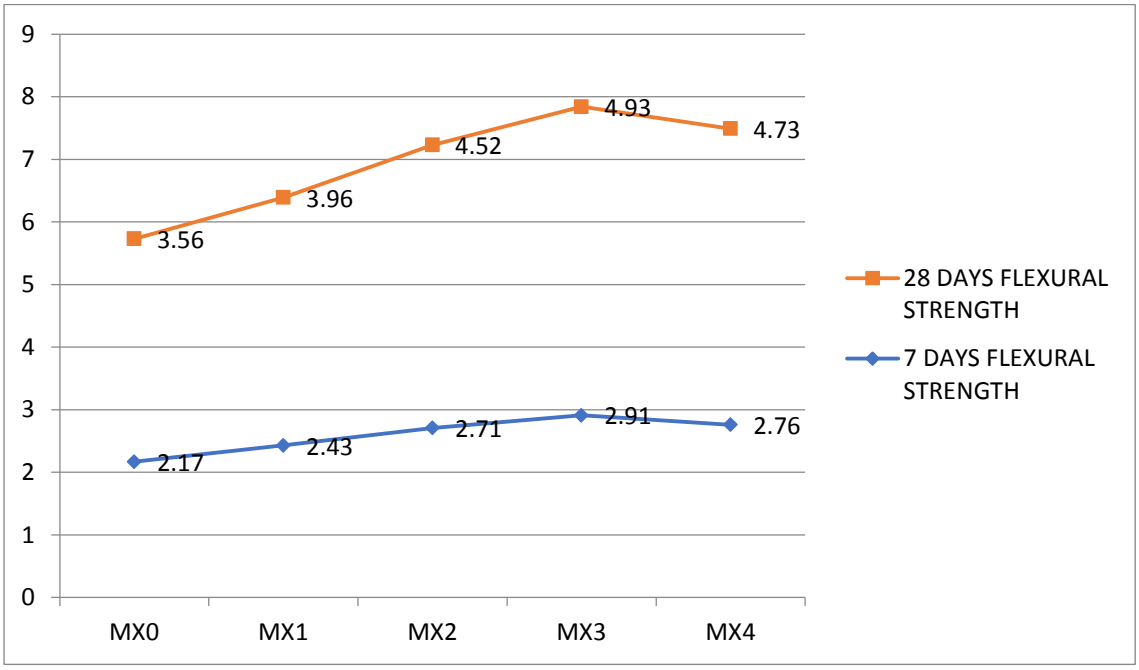
VARIATION OF FLEXURAL STRENGTH AT DIFFERENT AGES



SPLIT TENSILE STRENGTH

Split tensile strength of GFQDC has been iobserved by testing cylinders of 30cm × 15cm under Compression Testing Machine of 100 tonnes capacity. The cylinders have been tested by placing the cylinder in horizontal position. The split tensile strength of normal mortar and GFQDC for different percentages of quarrycontent has been illustrated in following Table. which shows the split tensile strength after 7 and 28 days respectively. The flexural Strength has been obtained 7 days as 1.92 MPA, 1.96 MPA, 1.98 MPA , 2.01 MPA andAND 1.98 MPA and 28 DAYS AS 3.61 MPA, 3.70 MPA, 3.75 MPA, 3.84 MPA and 3.75 MPA respectively for GFQDC with 0, 15%, 25%, 35%, and 45 percent of quarry content after 28 days. it has been observed that flexural strength of GFQDC with 15%, 25%, 35%, percent of quarry content is about in in increasing order and more than that of plane mortar. At 45% replacement strength goes to decreasing order.The increase in strength however is about more in the case of 35% percent quarry contents of GFQDC when compared with plane mortar as shown in table 4.6 and plotted in fig. 4.6 in the case of both 7 and 28 days.

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Split Tensile Strength after 7 Days

Mix Designation	Percentage of Quarry Dust	Tensile Load (KN)	Split Tensile Strength (MPa)	Average strength (MPa)
MX0	0	135.10 136.80 135.10	1.91 1.93 1.91	1.92
MX1	15	138.50 137.50 138.95	1.96 1.94 1.97	1.96
MX2	25	140.20 141.80 139.50	1.98 2.00 1.97	1.98
MX3	35	142.10 141.80 142.50	2.01 2.00 2.02	2.01
MX4	45	141.80 139.20 139.10	2.00 1.97 1.97	1.98

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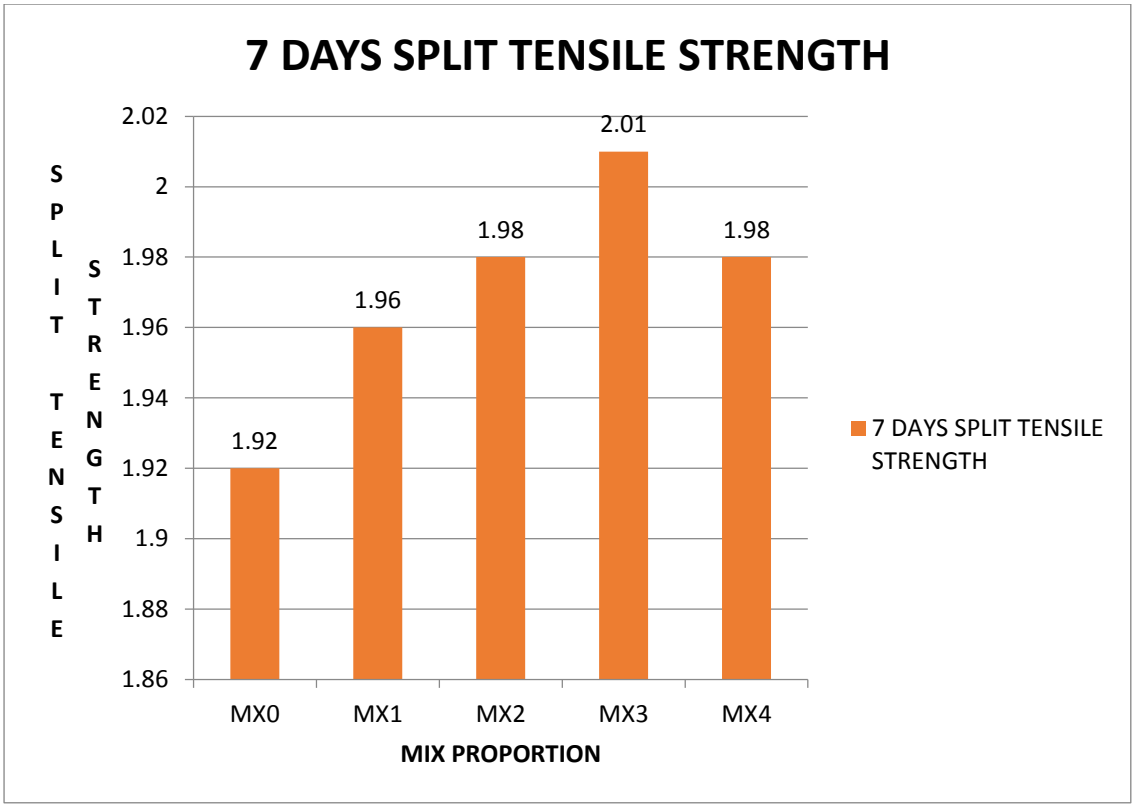

Split Tensile Strength after 28 Day

Mix Designation	Percentage of Quarry Dust	Tensile Load (KN)	Split Tensile Strength (MPa)	Average Strength (MPa)
MX0	0	260	3.67	3.61
		255	3.61	
		250	3.54	
MX1	15	255	3.61	3.70
		265	3.75	

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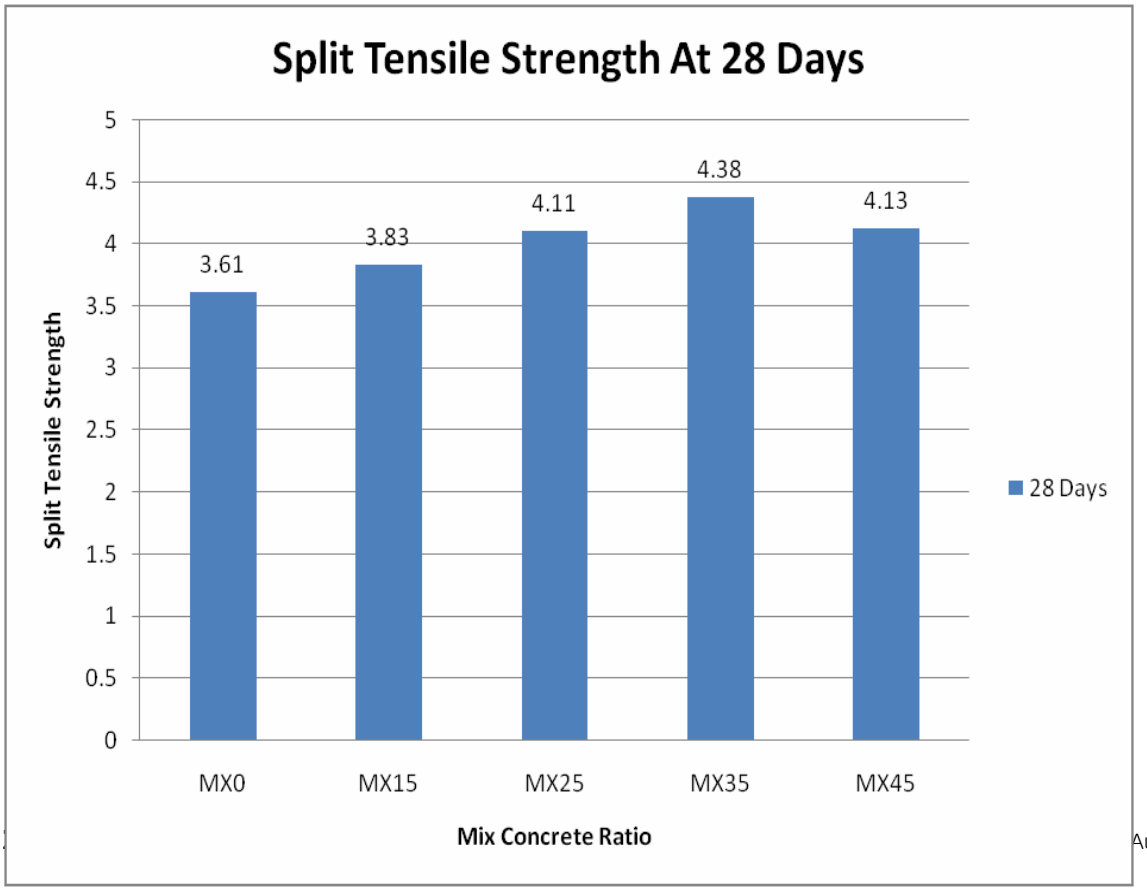
		265	3.75	
MX2	25	265 270 260	3.75 3.82 3.67	3.75
MX3	35	265 275 275	3.75 3.89 3.89	3.84
MX4	45	260 270 265	3.67 3.82 3.75	3.75



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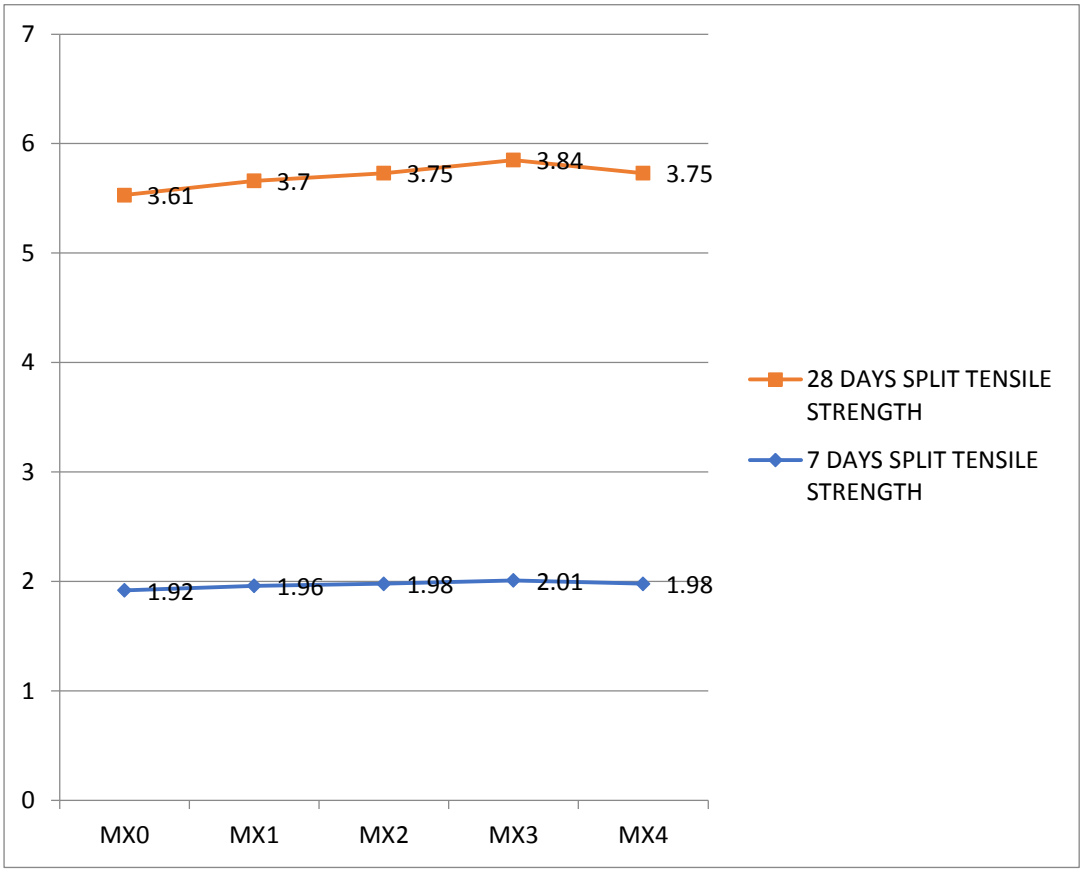
VARIATION OF SPLIT TENSILE STRENGTH AT DIFFERENT AGES



CONCLUSIONS

From the outcomes of the research the experimental observationsshows that properties of concrete getselevateddue toaddition of quarry dust(QD) and glass fibre (GF). The research observationssuggests that fresh properties (i.e. workability, compaction etc.) of GFQDC are almost same as that of normal concrete, notably as we increases the quarry (QD)amount is has been observed that the strength (compressive) of GFQDC gets improved upto 35% quarry dust (QD) compared to normal concrete. It has been seen that the addition of quarry dust(QD) and glass fibres (GF) into concrete improves the compressive strength at 28 days and the flexural strength of GFQDC expanded up to 35% compared to controleconcrete. It can be added that flexural strength of the GFQDC gets increased constantly and it will increase upto35% of QD amount. It is also discovered that the split

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tensile strength of quarry dust in mixconcrete gets increases as much as 35% replacement quarry dust in comparison to control concrete. Quarry dust concrete can be effective for betterenhanced flexural,tensile stresses compared to compressive stresses.. From this experimental study, it has been observed that the flexural strength of GFQDC gets considerably increasedas compared to compressive strength.