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EXPERIMENTAL STUDY OF QUARRY DUST AS A SUBSTITUTE FOR CEMENT

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ABSTRACT

Twenty-five percent of the stone crusher unit's final output is quarry dust, a byproduct of the crushing process. The environmental effects of quarry dust discharged directly into the environment are unknown. Quarry dust may be reused to create other goods or used into concrete as an additive to make better use of scarce materials and lessen its negative effects on the environment and on people. In this case, we are investigating the strength property of concrete by using quarry dust as a partial substitute for cement.

In this experiment, fine quarry dust is employed as a cement substitute. The use of quarry dust as a cement substitute is investigated in this study. For an M30 grade mix, quarry dust may substitute cement at a weight ratio of 0%, 5%, 15%, 25%, and 35%. Compressive strength, split tensile strength, and flexural strength experiments were conducted on hardened concrete at 7, 14, and 28 days, respectively, while workability tests were conducted on the fresh qualities of concrete. In an effort to conserve the environment by lowering cement use, quarry dust was tested as a potential cement alternative.

Keywords: Compressive strength, split tensile strength, flexural strength, workability, and cement/quarry dust/workability all factor in.

INTRODUCTION

GENERAL:

Quarry dust is a byproduct of the quarrying industry. As an alternative to cement, it may be utilized as an efficient filler material. In order to keep up with the demands of globalization, India is investing heavily in the development of its infrastructure, particularly its express roads, power projects, industrial projects, etc. Concrete is used in the construction of many different types of constructions.

In India, many different kinds of manufacturing produce by-products and garbage. The disposal of trash has regional environmental impacts. Therefore, there is considerable potential in the building sector to recycle these waste materials. Many studies have shown that by including waste items like Quarry dust into the mix, concrete may obtain superior qualities to those of regular concrete.

This research thus takes quarry dust to test its viability as a Cement substitute in concrete production. Crushing aggregates results in a by-product known as quarry dust, which has a surprisingly wide range of potential uses in the building industry. It is an alternative to quarry dust because of its comparable physical qualities to cement. It is the byproduct of Aggregates production. The disposal of this trash is a major contributor to pollution. Only in the building industry may waste products like

Quarry dust be used without risk. Using it as a substitute material in concrete reduces pollutants, solves the shortage of space, and lowers the price of concrete.

1.0 BACK GROUND OF QUARRY DUST:

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste.

So, it becomes as a useless material and also results in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the cost of construction and the construction material would be saved and the natural resources can be used properly. Most of the developing countries are under pressure to replace Cementin concrete by an alternate material also to some extent or totally without compromising the quality of concrete. Quarry dust has been used for different activities in the construction industry, such as building materials, road development materials, aggregates, bricks, and tiles.

1.1 PRODUCTION OF QUARRY DUST

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste.

The amount of industrial waste is increasing year by year. Industrial waste is defined as waste generated by Manufacturing or industrial processes. One types of industrial waste is quarry dust. During the production of aggregates through the crushing process of rocks in rubble crusher units, quarry dust is obtained as a by-product. Quarry dust waste has been used for different activities in the construction industry, such as road construction and building materials. Quarry dust waste act as lightweight aggregates, bricks, tiles, and autoclave blocks. Quarry dust waste also a waste material that is generated from the stone crushing industry which is abundantly available to the extent of 200 million tons per annum. This will lead to landfill disposal problems, health and environmental pollution. In addition, environmental pollution caused by quarry dust waste and heavy metals has been a problem for many years in our world Dust from quarrying has been reported to stall the growth and flowering of crops

1.4. WHY REPLACING?

Construction industries of developing countries are in stress to replace cement in concrete by an alternate material either partially or completely without compromising the quality of concrete. On the other hand, the advantages of utilization of by-products obtained as waste materials are pronounced in the aspects of reduction in environmental load & waste management cost, reduction of production cost as well as augmenting the quality of concrete.

By reducing cement consumption environment can be protected. An attempt was made to partially replace the cement with waste material quarry dust with an aim not to lose the strength Cr from original concrete mix. From the observations of test results, cement can be replaced with 25% of quarry dust in concrete. The physical and mechanical properties of materials used in concrete were investigated. For each replacement 6 cubes were cast for measuring 7days and 28days compressive strength.

1.5 USE OF QUARRY DUST IN

CEMENT:

Since the main composition of Quarry dust is vitreous FeSio3, it has low melting point and could reduce the calcination temperature for cement clinker. Thus, the use of Quarry dust to replace iron powder as iron adjusting material Ciliates cement production and reduces or eliminates the need of mineralizes has been pointed out by (Huang 2001). The performance testing results indicated that cement produced by using Quarry dust performed even better than using iron powder. Quarry dust was used as a Portland cement replacement together with 1.5% of hydrated lime as an activator to pozzolanic reaction. Result indicated a significant increase in the compressive strength.

1.6 ADVANTAGES OF QUARRY DUST:

- Reduces the construction cost due to saving in material cost.
- Reduces the heat of hydration.
- Refinement of pore pressure.
- Reduces permeability.
- Reduces the demand for primary natural resources.
- Reduces the environmental impact due to quarrying and aggregate mining.
- Found naturally so easy to extract.
- Quarry dust is a natural product, available and low cost.
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1.7 NEED FOR PRESENT INVESTIGATION:

Though a lot of research is focused in the last decade on use of various admixtures in producing concrete, very little information is available on quarry dust concrete. Thus, this new admixture has lot of potential for use in concrete. Hence, there is need to study the strength and workability characteristics of quarry dust as admixture in concrete.

A material other than water, aggregates, or cement that is used as ingredient of concrete or mortar to control setting and early hardening, workability, or to provide additional cementing properties. Over decades, attempts have been made to obtain concrete with certain desired characteristics such as high compressive strength, high workability, and high performance and durability parameters to meet the requirement of complexity of modern structures.

1.9 OBJECTIVES OF RESEARCH WORK

In this work, an extensive study using Quarry dust has been carried out to investigate the following,

1. To find the optimum proportion of Quarry dust that can be gained maximum strength and that proportion will be used as a replacement substitute material for Cement in concrete.
2. To debrief the physical and chemical properties by use of Quarry dust for Cement in concrete specimens.
3. To inspect the performance of concrete made with Quarry dust as replacement of fine aggregate.
4. To evaluate the compressive, tensile and flexural strength of concrete by using Quarry dust in concrete specimens.

2.0 LITERATURE REVIEW

Syed Yaqub Abbas,V.C.Agarwal (2015) they studied by taking M25 grade concrete using stone dust as partial replacement at different mix proportions like 10%,20%,30%,40%,50%,60% to the total weight of fine aggregate. They got the maximum compressive strength at 50% replacement. The aim of their project is to study the strength parameters of concrete

Mr. Lokesh Kumar and Prof. Gautam Bhadoriya (2015) these authors explained that, with 25% cement replacement with fly ash and 40% fine aggregate replacement with stone dust gives the maximum compressive strength of concrete.

Sandeep Kumar Singh, Vikas Sri Vastava (2014) in their study, they taken M25 grade concrete using stone dust as partial replacement at different mix proportions like 20%, 30%, 40% and 50% to the total weight of fine aggregate. They got the maximum compressive strength at 40% replacement.

Pandyala Chanakya, Diptikar Behr. Metakaolin is a highly pozzolanic material. The present study investigates the effects of metakaolin and super plasticizer on strength properties of M-30 grade concrete. The replacement levels of cement by metakaolin are selected as 4%, 8%, 12%, 16%, and 20%. For constant w/c material ratio of 0.43. In this study show that 12 % replacement of cement by metakaolin gives higher strength.

Gokhan Guahan, Ridwan Aslaner. In this paper fly ash was used as the raw material in the preparation of geopolymer paste and metakaolin was used as a substitution material in different ratio. Metakaolin material was made of kaolin clay calcined at a temperature of

1000 °C and at a final temperature for 1h in a laboratory type electric arc furnace. The fly ash in the prepared mixture was substituted by metakaolin ranging from 10-40%. As a result, ideal curing temperature and curing time were decided to be 60 °C and 2h for the production of the geopolymer paste. It was also determined that the compressive strength valve of sample subjected to curing reached up to 25.10 Map and that a 40%.

Vikas Srivastava. Investigated the suitability of silica fume and metakaolin combination in production of concrete. The optimum combined does of silica fume and metakaolin were found out as 6%, and 15% (by wt.) respectively. The 28th day compressive strength of concrete generally increased with the metakaolin content for at all the silica fume content.

3.0 TESTING FOR PHYSICAL PROPERTIES OF MATERIALS

3.1 TESTS ON CEMENT

S.NO	NAME OF THE TEST	RESULT
1	% of Weight of Cement Retained on the Sieve	**2.88%**
2	Standard consistency of cement	**27**
3	Specific gravity of cement	**3.11**
4	Initial setting time (min)	35 min
5	Final setting time (min)	420min

Table 3.1 Tests on cement

3.2 TESTS ON QUARRY DUST

S.NO	NAME OF THE TEST	RESULT
1	% of Weight of Quarry Dust Retained on the Sieve	**2%**
2	Specific gravity of Quarry Dust	**2.51**

Table 3.2 Tests on Quarry dust

3.3 TESTS ON FINE AGGREGATES

S.NO	NAME OF THE TEST	RESULT
1	Moisture content	**2.037**
2	Fineness Modulus	**2.66%**
3	Grading Zone	**II**
4	Specific gravity	2.67
5	% of Water Absorption	2.8%
6	% of bulking	2.23%

Table 3.3 Tests on Fine aggregate

3.4 COARSE AGGREGATES

S.NO	NAME OF THE TEST	RESULT
1	Specific gravity of given coarse aggregates	**2.637**
2	Water Absorption of given coarse aggregates	**3.423**

Table 3.4 Tests on Coarse aggregate

4.0 MIX DESIGN

Cement	Fine aggregate	Coarse aggregate	Water Cement ratio
442 kg/ m³	566 kg/ m³	1304 kg/ m³	0.40
1	1.28	1.93	

Table: 4.1. Mix Design

5.0 METHODOLOGY

S. No	% Of Quarry Dust + % of Cement	Compressive Strength of Concrete			Split Tensile Strength of Concrete		Flexural Strength of Concrete	
		7 days	14 days	28 days	7 days	28 days	7 days	28 days
1	0% QD + 100% C	3	3	3	3	3	3	3
2	05% QD + 95% C	3	3	3	3	3	3	3
3	15% QD +85% C	3	3	3	3	3	3	3
4	25% QD + 75% C	3	3	3	3	3	3	3
5	35% QD + 65% C	3	3	3	3	3	3	3

Total	45 Cubes	30 Cylinders	30 Beams

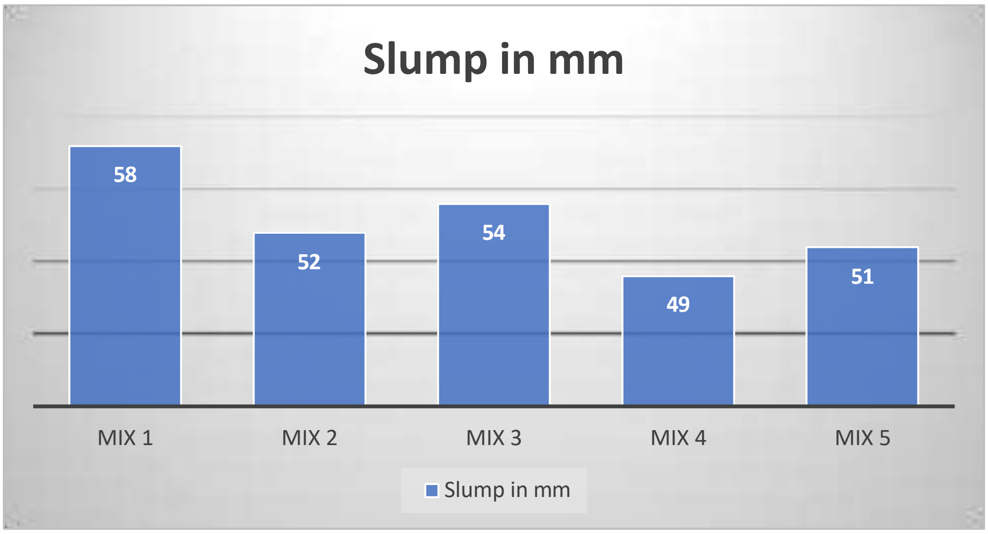
Table 5.1: Specimens Required for The Study

6.0 RESULTS AND DISCUSSIONS

6.1 WORKABILITY OF CONCRETE:

S. No	% Of Quarry Dust + % of Cement	Mix Names	Slump in mm
1	0% QD + 100% C	**Mix 1**	58
2	05% QD + 95% C	**Mix 2**	52
3	15% QD +85% C	**Mix 3**	54
4	25% QD + 75% C	**Mix 4**	49
5	35% QD + 65% C	**Mix 5**	51

Table 6.2: Slump cone test results

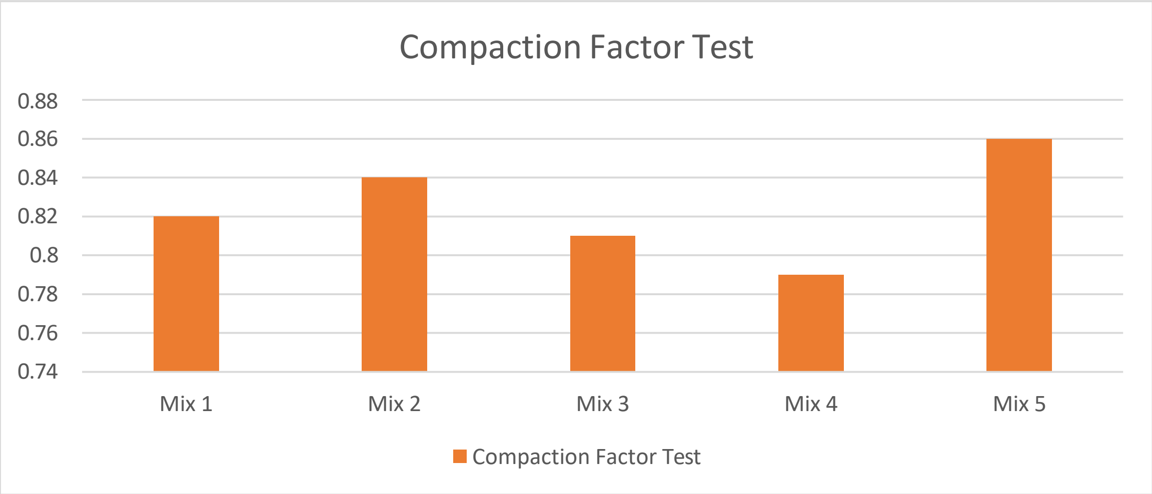


Graph 6.1: Slump cone test results

6.1.2 Compaction factor test

S.No	% Of Quarry Dust + % of Cement	Mix Names	Compaction Factor
1	0% QD + 100% C	**Mix 1**	0.82
2	05% QD + 95% C	**Mix 2**	0.84
3	15% QD +85% C	**Mix 3**	0.81
4	25% QD + 75% C	**Mix 4**	0.79
5	35% QD + 65% C	**Mix 5**	0.86

Table 6.3: Compaction Factor test results



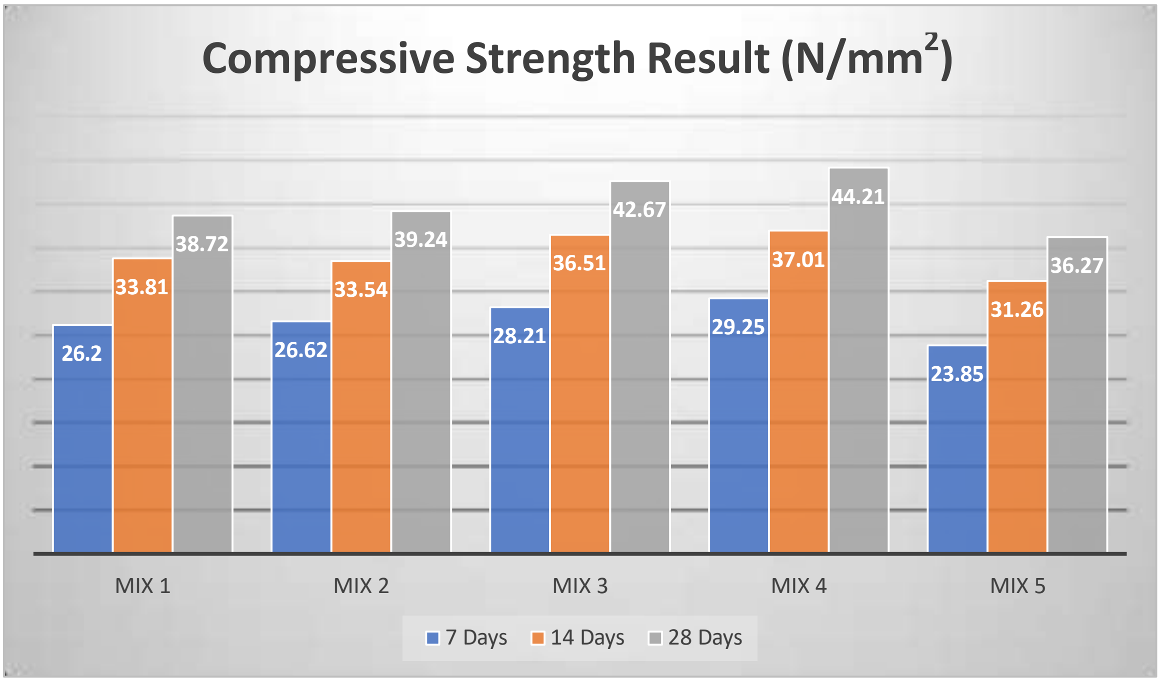
Graph 6.2: Compaction Factor test results

6.2 TESTS TO BE CONDUCTED ON CONCRETE

6.2.1 COMPRESSIVE STRENGTH OF CONCRETE

S.No	% Of Quarry Dust + % of Cement	Mix Names	Compressive strength in MPa		
			7 Days	14 Days	28 Days
1	0% QD + 100% C	**Mix 1**	26.20	33.81	38.72
2	05% QD + 95% C	**Mix 2**	26.62	33.54	39.24
3	15% QD +85% C	**Mix 3**	28.21	36.51	42.67
4	25% QD + 75% C	**Mix 4**	29.25	37.01	44.21
5	35% QD + 65% C	**Mix 5**	23.85	31.26	36.27

Table 6.4: Compressive Strength test results

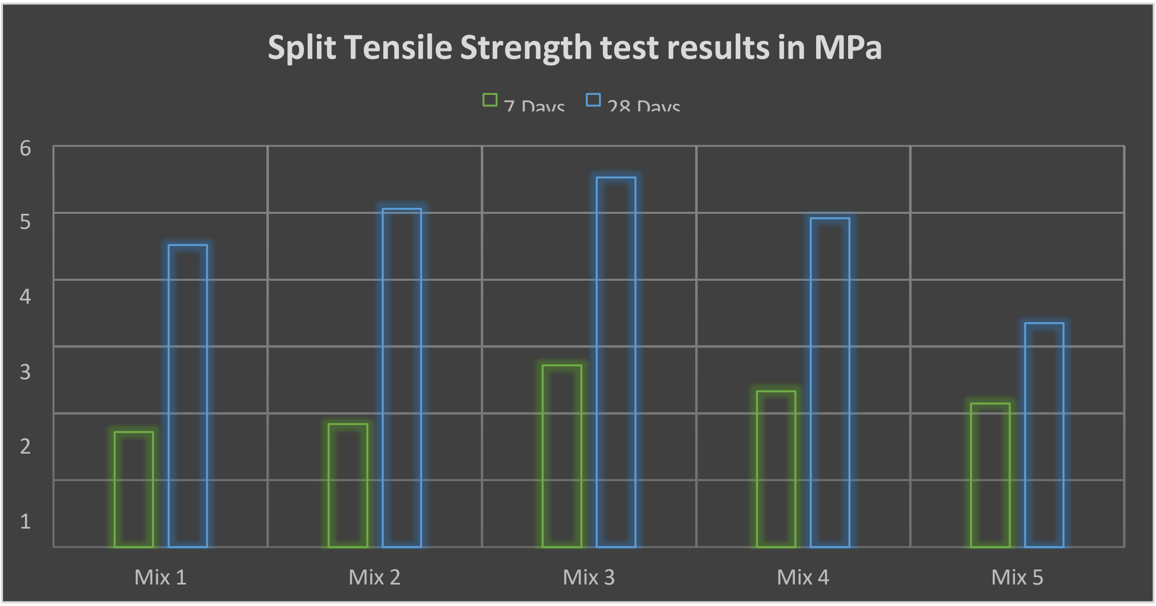


Graph 6.3: Compressive Strength test results

6.2.2 SPLIT TENSILE STRENGTH OF CONCRETE

S.No	% Of Quarry Dust + % of Cement	Mix Names	Split Tensile strength in MPa	
			7 Days	**28 Days**
1	0% QD + 100% C	**Mix 1**	1.72	4.52
2	05% QD + 95% C	**Mix 2**	1.84	5.06
3	15% QD +85% C	**Mix 3**	2.72	5.53
4	25% QD + 75% C	**Mix 4**	2.33	4.92
5	35% QD + 65% C	**Mix 5**	2.15	3.35

Table 6.5: Split Tensile Strength test results

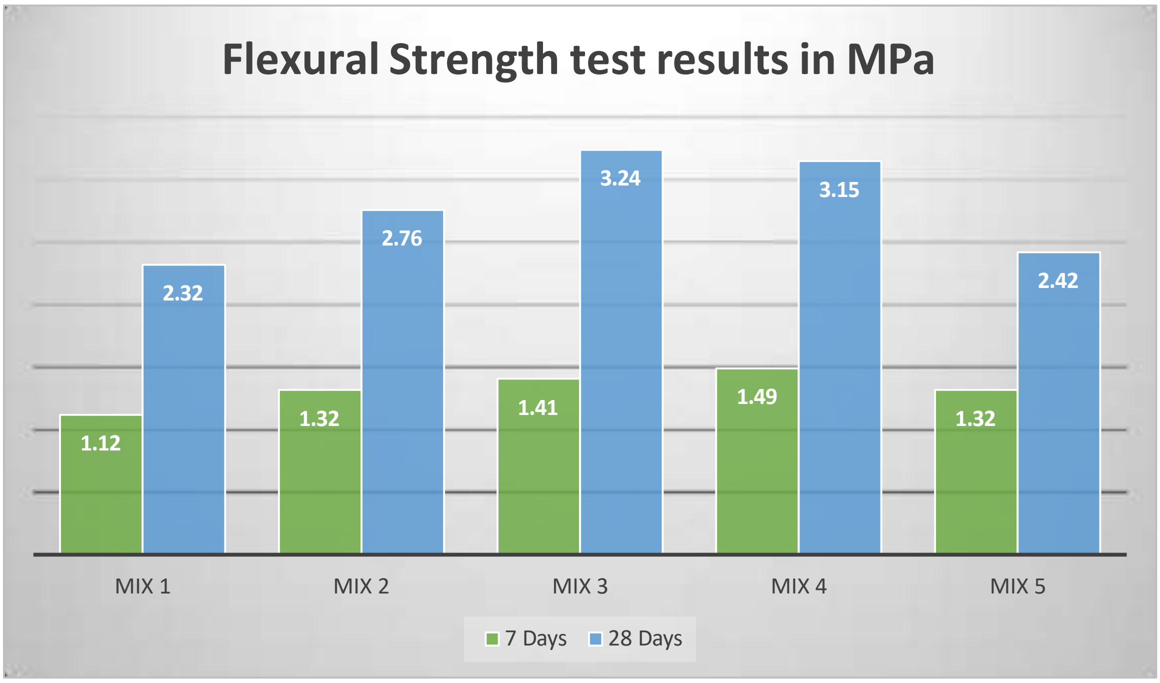


Graph 6.4: Split Tensile Strength test results

S.No	% Of Quarry Dust + % of Cement	Mix Names	Flexural strength in MPa	
			7 Days	28 Days
1	0% QD + 100% C	**Mix 1**	1.12	2.32
2	05% QD + 95% C	**Mix 2**	1.32	2.76
3	15% QD +85% C	**Mix 3**	1.41	3.24
	25% QD + 75% C	**Mix 4**	1.49	3.15
5	35% QD + 65% C	**Mix 5**	1.32	2.42

6.2.3 FLEXURAL STRENGTH OF CONCRETE

Table 6.6: Flexural Strength test results



Graph 6.5: Flexural Strength test results

6.0 CONCLUSIONS

- The value of slump for the concrete decreases with increasing the percentage of Quarry Dust for concrete.
- The value of compaction factor for the concrete is maximum for MIX 5 (35% QD + 65% C)
- The compressive strength of concrete increase when cement is replaced by quarry dust up to 25%. At 25% replacement, the maximum compressive strength obtained is 44.21 N/mm2.The compressive strength increased by 14.17% when compared to conventional concrete.
- The spilt tensile strength of concrete increase when cement is replaced by quarry dust up to 15% and later the strength gradually decreased when cement is replaced beyond 15%. At 15% replacement, the maximum split tensile strength obtained is 5.53 N/mm2. The spilt tensile strength increased by 22.34% when compared to conventional concrete.
- The flexural strength of concrete increased when cement is replaced by quarry dust up to 15% and later the strength gradually decreased when cement is replaced up to 35%.
- At 15% replacement, the maximum flexural strength obtained is 3.24 N/mm2. The flexural strength increased by 39.65% when compared to conventional concrete.
- Results of present study indicates that mechanical properties of concrete are high in which cement is replaced with quarry dust compared to Conventional Concrete.
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REFERENCES

[1] Comparative Study on Partial Replacement of Cement with Quarry Dust and Rice Husk Ash, Volume: 06 Issue: 03, Mar 2019 IRJET

[2] Partial Replacement of Cement with Quarry Dust and Rice Husk Ash in Concrete (IRJET) (Volume 5).

[3] Strength Properties of Concrete with Partial Replacement of Cement by Granite Quarry Dust (IJERT).

[4] Stone waste in India for concrete with value creation opportunities, International Journal of Latest Trends in Engineering and Technology (IJLTET), 2(2):113-120.

[5] Influence of using granite waste on the mechanical properties of green concrete, ARPN Journal of Engineering and Applied Sciences, 11(5): 2805-2811.

[6] Shaik Nazma and S. Madhavi , “SPECIAL CONCRETE BY USING QUARRY DUST
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AS PARTIAL REPLACEMENT OF CEMENT”.TEST Engineering and Management, vol. 83, pp 2020-2026, April -2020

[7] Venkata Sairam Kumar N., Dr. B. Panduranga Rao, Krishna Sai M.L.N, “EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT WITH QUARRY DUST”. International Journal of Advanced Engineering Research and Studies E- ISSN2249–8974 IJAERS/Vol. II, pp136-137 April-June,20