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# EXPERIMENT STUDY ON QUARRY DUST FILLER CONCRETE

**Anurag Gautam[1], Kirti Chandraul[2], Manindra K Singh[3]**

*[1]M.Tech Student Jawaharlal Nehru College of Technology Rewa, M.P.*
*[23]Assistant Professor, Dept. of Civil Engineering, J. N. C.T. College, Rewa, M.P., India*

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***Abstract -*** *There is high demand in construction industry, it is obtained from river bed and sand mining has environmental issues. Amount of River sand is keeps on reducing, thus alternative materials has to be explored. Quarry dust is the by- product of quarring of natural rock, the finer material lefts there due to its no use. the finer material called as quarry dust can be taken as alternative material. The river sand is replaced partially by quarry dust. The proportions of quarry dust replacing by 0%, 25%, 35%,45% and 55%. The materials testing, workability, compressive and tensile strength of concrete were examined at 7th, 14th and 28th day of curing of M20 grade of concrete. Then the same ratio has been examined with nylon 66 fibre to improve the tensile strength of size 6mm and quantity of 0.1% of weight of cement. Same testing is done for fibre reinforced concrete. The light weight fibre reinforced concrete is made and compared in between normal concrete, quarry dust replaced concrete and fibre reinforced quarry dust replaced concrete.*

**Key Words**: Quarry dust, nylon 66 fibre, compaction factor, compressive strength and tensile strength.

## 1. INTRODUCTION

Concrete is the most widely used material in structural development throughout the world. the raw material of concrete which is namely used are cement, fine aggregate, coarse aggregate and water. River sand is used as the fine aggregate. due to increase in demand of natural sand river erosion and other environmental issues are led to scarcity of river sand. In order to reduce use of natural sand and also reduce the cost of concrete production , it is necessary to find alternate materials which can replace the natural sand, so that the excess in river erosion is prevented and also to gain strength of concrete at low cost. One alternative partial replacement of natural sand can be quarry dust. it has the properties as sand to strengthen the concrete.

### 1.1 Objective

- Effect of use of quarry dust on workability.
- Effect on compression strength of concrete by using quarry dust.
- Effect on tensile strength of concrete using fibers.
- use of fibers will reduces lmicro cracks.

To give a solution regarding disposal of quarry dust which creates environmental pollution mainly landfill.

## 2. LITERATURE REVIEW

The present research work mainly deals with the influence of different replacement proportions of cement , sand and aggregate. In this report we have replaced sand by quarry dust. The suitability of dust by replacing sand gives the properties are improved in different proportions. Some experiments on quarry dust by Akshay A.Waghmare, Akshay G. Kadao, Ayushi R. Sharma Civil Engineering Dept. P.R.M.I.T. & R.Badnera Amravati, India reported significant increase in compressive strength modulus of rupture and split tensile strength when 40 percent of sand is replaced by Quarry Rock Dust in concrete. Perumal Associate Professor and Head, Department of Civil Engineering, Jayamatha Engineering College, Aralvoimozhi concluded that Concrete acquires maximum increase in compressive strength at 50% sand replacement. The percentage of increase in strength with respect to control concrete is 24.04 in M20. The overall test results disclosed that quarry waste fine aggregate can be utilized in concrete mixtures as a good substitute of natural sand. It is found that the flexural strength, compressive and Durability Studies of concrete made of Quarry Rock Dust are almost equal to that of conventional concrete.

## 3. MATERIAL AND METHODOLOGY

On mixing the water, cement hardens and hence all the ingredients are bounded together. Portland cement is the most commonly used cement with the composition of alumina, silica, lime, iron, and gypsum. The concrete mixtures consist of both coarse and fine aggregates which helps in increasing the strength of concrete. Nowadays, sand, gravel, crushed stone, recycled materials, including blast furnace slag, glass (mostly for decorative purposes), and ground-up concrete are used as aggregates. The water in the concrete mix should be clean and free of impurities. The change in water content with respect of cement decides the properties of the cement like how easily the concrete flows, but also affects the final strength of the concrete. Excess water implies to easier flow of concrete, but decreases its strength.

**3.1 Quarry Dust:** Quarry Dust, also known as rock powders, rock minerals, rock flour, soil re-mineralization, and mineral fines, consists of finely crushed rock, processed by natural or mechanical means, containing minerals and trace elements are mainly used in organic farming. The igneous rocks basalt and granite often contain the highest mineral content, whereas limestone, considered inferior in this consideration, is often deficient in the majority of essential macro-compounds, trace elements, and micronutrients. Quarry dust is not a fertilizer, for it lacks the qualifying levels of nitrogen, potassium, and phosphorus. Quarry dust is also the limestone-based product sprayed on walls inside underground coal mines to keep coal dust levels down.

**3.2 Fiber (Nylon 66):** Nylon 66 (aka nylon 6-6, nylon 6/6 or nylon 6,6) is a type of polyamide or nylon. Nylons are available in many types, and the two most commonly used fibers are nylon 6 and nylon 66. Nylon 66 is made of two monomers each containing 6 carbon atoms, hexa methylene di amine and adipic acid, which give nylon 66 its name. It is synthesized by poly condensation of hexa methylene diamine and adipic acid. Equivalent amounts of hexamethylenediamine and adipic acid are combined with water in a reactor.

$$n\ HOOC\text{-}(CH_2)_4\text{-}COOH + n\ H_2N\text{-}(CH_2)_6\text{-}NH_2 \rightarrow [\text{-}OC\text{-}(CH_2)_4\text{-}CO\text{-}NH\text{-}(CH_2)_6\text{-}NH\text{-}]_n + (2n\text{-}1)\ H_2O$$

## 4. RESULT AND ANALYSIS

### 4.1 COMPECTION FACTOR

Table No.1: Result of Compaction Factor

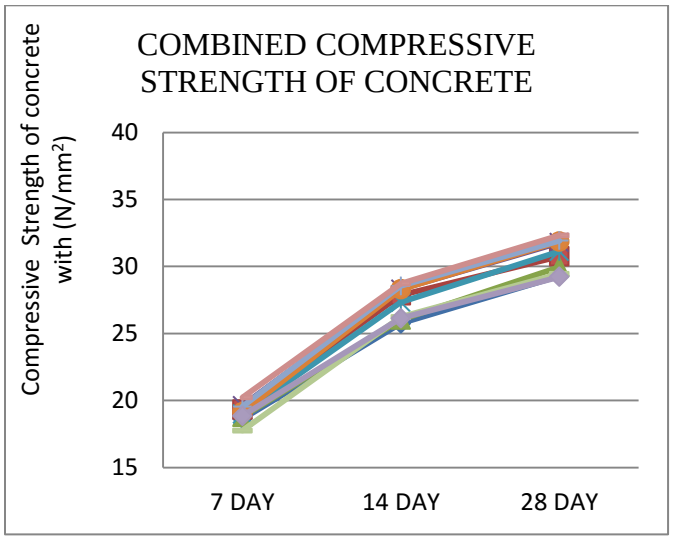
| S. No. | SPECIMEN | Mix | Nylon fibre | Compaction Factor |
|---|---|---|---|---|
| 1. | N1 | 0% | - | 0.87 |
| 2. | N2 | 0% | 0.1% | 0.88 |
| 3. | K1 | 25% | - | 0.88 |
| 4. | K2 | 25% | 0.1% | 0.87 |
| 5. | K3 | 35% | | 0.87 |
| 6. | K4 | 35% | 0.1% | 0.86 |
| 7. | K5 | 45% | - | 0.87 |
| 8. | K6 | 45% | 0.1% | 0.88 |
| 9. | K7 | 55% | - | 0.85 |
| 10. | K8 | 55% | 0.1% | 0.86 |

### 4.2COMPRESSIVE STRENGTH

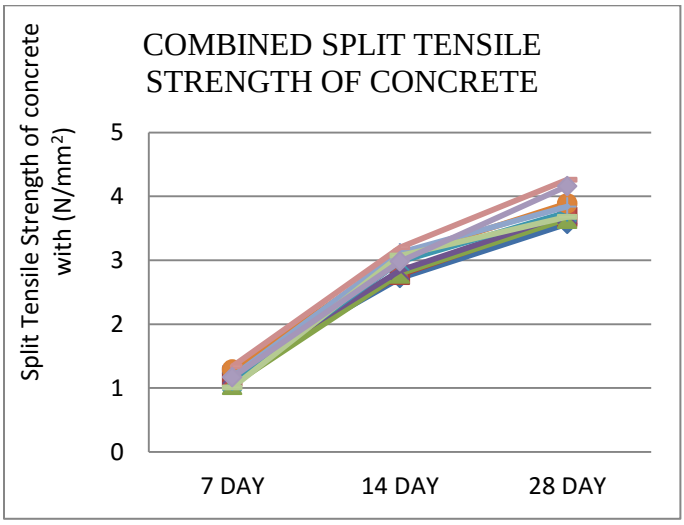
Table No.2: Compressive Strength

| S. No. | Name | Average Compressive Strength In N/mm sq | | |
|---|---|---|---|---|
| | | 7 Days | 14 Days | 28 Days |
| 1. | N1 | 18.63 | 25.75 | 29.3 |
| 2. | N2 | 19.33 | 27.85 | 30.76 |
| 3. | K1 | 18.78 | 26.03 | 29.95 |
| 4. | K2 | 19.61 | 28.31 | 31.78 |
| 5. | K3 | 18.98 | 27.33 | 31.12 |
| 6. | K4 | 19.13 | 28.3 | 31.86 |
| 7. | K5 | 19.55 | 28.55 | 31.92 |
| 8. | K6 | 20.23 | 28.72 | 32.32 |
| 9. | K7 | 17.75 | 26.23 | 29.45 |
| 10. | K8 | 18.85 | 26.13 | 29.23 |

The quarry dust replacing with fine aggregate is an alternative solution because fine aggregate that is Natural River and is less due to huge constructions. Quarry dust is fines available during the quarring of rock. it is also considered as waste material available in ample quantity in India. From the researchers we found that the use of quarry dust upto 35% or 45 have only done, no one has used quarry dust more that 45%. Here we are partially replacing quarry dust upto 55% of fine aggregate also using fiber to improve the tensile strength as well as to get rid of micro cracks. Nylon 66 of 0.1 % of cement by weight is used with the size 6mm constantly for all replacements of quarry dust. The hardened such as compressive and tensile strength were examined at 7th, 14th and 28th day.




**Graph1** Compressive strength of concrete




**Graph2** Split Tensile Strength of concrete

It is replaced in many proportions such as 25%, 35%, 45% and 55% with and without fiber. The naming shows the ratios. The standard compressive strength were found at 28th day of curing i.e 29.30 N/mm2, 31.21 N/mm2, 29.95 N/mm2, 31.78 N/mm2, 31.12 N/mm2, 31.86 N/mm2, 31.92 N/mm2, 32.32 N/mm2, 29.45 N/mm2 and 29.23 N/mm2 for N1, N2, K1 K2, K3, K4, K5, K6, K7, K8 respectively. The compressive strength is increasing upto 45 % of replacing fine aggregate by quarry dust for the with and without fiber. The maximum result of compressive strength without fiber has obtained at 45% of replacement i.e 19.55 N/mm2, 28.55 N/mm2 and 31.93 N/mm2 and with fiber 20.23 N/mm2, 28.72 N/mm2 and 32.32 N/mm2 at the age of 7th, 14th and 28th day of curing respectively. From the above result we got that the use of fiber with quarry dust increases the strength.

### 4.3 SPLIT TENSILE TEST

**Table 3:** Split Tensile Test

| S. No. | Name | Average Split Tensile Strength In N/mm sq | | |
|---|---|---|---|---|
| | | 7 Days | 14 Days | 28 Days |
| 1. | N1 | 1.23 | 2.72 | 3.57 |
| 2. | N2 | 1.18 | 2.77 | 3.68 |
| 3. | K1 | 1.05 | 2.79 | 3.65 |
| 4. | K2 | 1.21 | 2.84 | 3.72 |
| 5. | K3 | 1.1 | 2.98 | 3.75 |
| 6. | K4 | 1.29 | 3.05 | 3.89 |
| 7. | K5 | 1.18 | 3.12 | 3.84 |
| 8. | K6 | 1.34 | 3.2 | 4.26 |
| 9. | K7 | 1.01 | 3.07 | 4.18 |
| 10. | K8 | 1.17 | 2.98 | 4.16 |

The standard Split Tensile Strength were found at 28th day of curing i.e 3.57 N/mm2, 3.68 N/mm2, 3.65 N/mm2, 3.72 N/mm2, 3.75 N/mm2, 3.89 N/mm2, 3.84 N/mm2, 4.26 N/mm2, 3.68 N/mm2 and 4.16 N/mm2 for N1, N2, K1 K2, K3, K4, K5, K6, K7, K8 respectively. The Split Tensile Strength is increasing upto 45 % of replacing fine aggregate by quarry dust for the with and without fiber. The maximum result of Split Tensile Strength without fiber has obtained at 45% of replacement i.e 1.18 N/mm2, 3.12 N/mm2 and 3.84 N/mm2 and with fiber 1.34 N/mm2, 3.20 N/mm2 and 4.26 N/mm2 at the age of 7th, 14th and 28th day of curing respectively. From the above result we got that the use of fiber with quarry dust increases the strength.

### 5. CONCLUSION

Here quarry dust is a locally available material which is also an industrial wastage . Thus to reduce the use of natural sand we can use the quarry dust as a alternate material. The results are comparatively good by replacing partially with natural sand. the replacement of quarry dust upto 45% gives better result. The compressive strength and tensile strength of 45% replacement gives 31.92N/mm2 and 3.85N/mm2 respectively at 28th day of curing. To improve tensile strength, fiber can be used which will also control the micro cracks. By adding nylon fiber the strength of concrete will be increased by 32.32 N/mm2 and .26 N/m4m2 in compressive and tensile strength at 28th day curing

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Anurag Gautam
M.Tech Student
J.N.C.T. Rewa, M.P., India

Prof. Kirti Chandraul
Assistant Professor
J.N.C.T. Rewa, M.P., India

Prof. Manindra Kumar Singh
Assistant Professor
J.N.C.T. Rewa, M.P., India