A study of how well concrete performs when granite and marble dust are used in place of sand

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Abstract - *Since 15 years ago, it has been obvious that there is less natural sand accessible. When natural sand is not accessible, environmental issues arise. Crushing rocks such as granite, gneiss, dolerite, and basalt that are used as the source material produces some artificial sands. To use additional profits for concrete, marble and granite dust must be manufactured similarly to river sand, and MD/GD must increase concrete's strength in comparison to goods made with an equivalent amount of river sand without reducing their workability. Construction projects including roads, the production of building materials and components such light aggregates and bricks/tiles, and other jobs all benefit from the use of MD & GD.*

The results of experimental research on "Quarry sand" and details of concrete constructed with Quarry sand are presented in our paper. When tests for compressive strength, flexural strength, split tensile strength, bond strength, and stress-strain curve are performed on M30 Grade concrete with and without Granit Dust and Marble Dust after 28 days of curing. Granit dust and marble dust were evaluated for strength as a partial sand substitute in conventional concrete for M30 grade after being added to the mix in amounts of 15%, 25%, 40%, and 50%, respectively.

The discussion claims that when 15% of the sand is replaced with granite dust, the strongest bond results. The compressive strength is somewhat decreased when 25% of the sand is replaced by granite dust, but it reaches its maximum strength when 25% of the sand is replaced with marble dust. Therefore, it is clear that using granite and marble dust in place of 25% of the sand can generate concrete of high quality. All of the concrete generated by substituting marble and granite dust exhibits greater strength when compared to the reference mix with a 0% replacement of natural sand.

***Key Words*:** Granite Dust, Marble Dust, Compressive Strength

1.INTRODUCTION

Concrete is a very practical building material used all over the world. It is a versatile building material because of its reasonable cost and easy access to its parts. Building quality is the most important criterion considered in the construction sector. Water, coarse aggregate, and cement are all naturally occurring materials. Cement is created in factories. A frequent source of fine aggregate is riverbeds. River sand has been the most frequently employed option for the fine aggregate. One of the key components is sand, which accounts for around 35% of the volume of concrete. Usually, the quality of river sand is determined by its source.

Concrete's pozzolanic components, such as silica fume, fly ash, slag, and others, may be replaced by granite dust, a by-product of the granite polishing industry. These products can be used as filler materials in concrete to reduce the number of voids (in place of sand). A member of the igneous rock class is granite. Granite has a density of 2.65 to 2.75 g/cm3 and a compressive strength of greater than 200 MPa. It was found that granite powder possessed the traits and advantages of the sharpening devices. The distribution of particle sizes in the granite powder was determined using a measurement device (hydrometer analysis) because the powder was so tiny.

The marble dust was obtained from deposits of marble industries, which are created as a by-product of the sawing and shaping of marble in the Elazig region. The wet marble sludge had to be dried before the samples could be made. The marble dirt was extracted from the depleted material using a 0.25 mm screen and used as a fine sand aggregate in the experiments.

Utilizing these marble wastes inside the business itself would lessen joint over-mining of sand resources and safeguard the environment from marble landfills.

2. OBJECTIVE OF STUDY

to investigate the strength of concrete when some of the sand is replaced with granite and marble dust. Below is a summary of the thesis' main objective.

- To modify Concrete Mixes M30 such that Granite Dust and Marble Dust are used in place of natural sand.
- To investigate the many characteristics of concrete made using marble and granite dust.
- To compare the result to ordinary concrete.

3 METHODOLOGIES

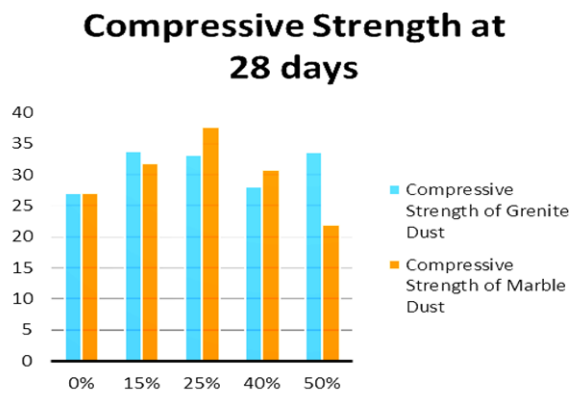
The job is separated into stage I and stage II in order to accomplish the goal. In this thesis, stage I's granite dust replaces some of the sand, and stage II's marble dust replaces some of the sand. A variety of cubes, beams, cylinders, and cubes with embedded roadways were then cast. Then, several tests are carried out, including the compression test, the flexural strength test, the split tensile strength test, the bond strength test, and lastly the stress-strain curve of concrete.

As shown in table 1.1 below, stage I entails replacing a portion of the sand with granite dust in a range of proportions, including 15%, 25%, 40%, and 50%. Five batches are produced using different ratios, including the conventional concrete mix. Cubes, beams, and cylinders are cast in order to measure the concrete's 28-day compressive, flexural, split tensile, bond, and stress-strain curve tests.

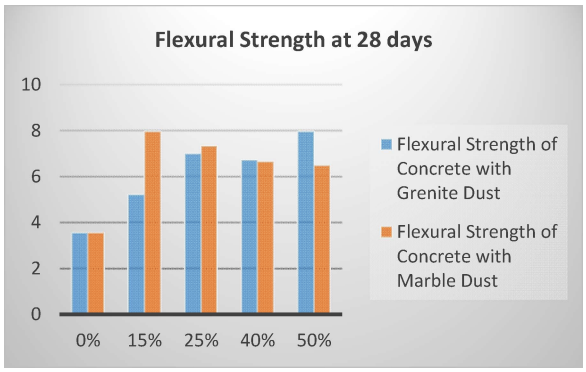
In Stage II, as shown in table 1.2 below, marble dust is substituted for some of the sand in a range of ratios, including 15%, 25%, 40%, and 50%. Five batches are produced using different ratios, including the conventional concrete mix. Concrete is evaluated using cubes, beams, and cylinders for its

compressive strength, flexural strength, split tensile strength, bond strength, and stress-strain curve at 28 days.

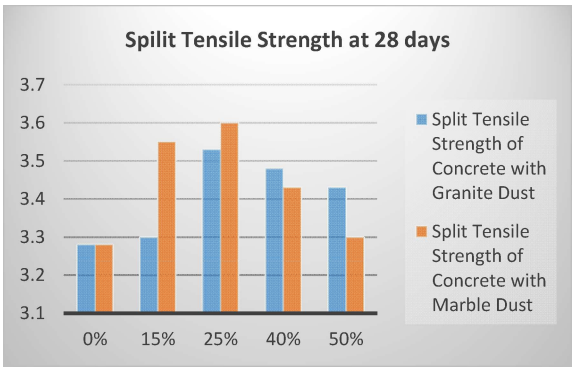
4. RESULTS



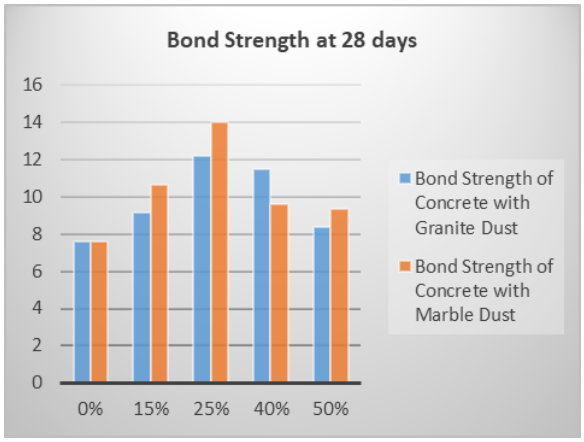
Graph 1 Comparison of Compressive Strength at 28 days in N/mm2



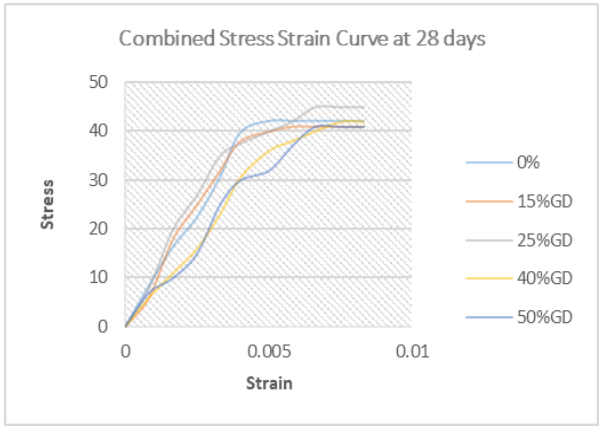
Graph 2 Comparison of Flexural Strength at 28 days



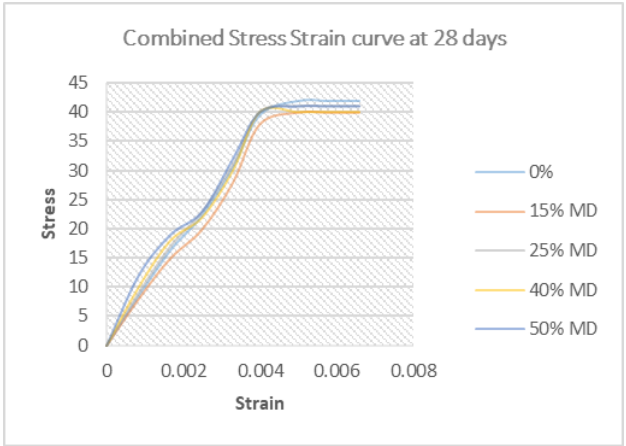
Graph 3 Base Shear V/s Different Soil Condition



Graph 4 Comparison of Bond Strength at 28 days



Graph 5 Combined Stress Strain curve of concrete with Granite dust



Graph 6 Combined Stress Strain curve of concrete with Marble dust

5. CONCLUSION

- After 28 days of curing, the M30 Grade of concrete is put through testing to determine its compressive strength, flexural strength, split tensile strength, bond strength, and stress-strain curve. Granit dust and marble dust were evaluated for strength as a partial sand substitute in conventional concrete for M30 grade after being added to the mix in amounts of 15%, 25%, 40%, and 50%, respectively.

- The discussion claims that 15% of the sand needs to be replaced with granite dust in order to achieve the highest level of strength. The compressive strength is somewhat decreased when 25% of the sand is replaced by granite dust, but it reaches its maximum strength when 25% of the sand is replaced with marble dust.
- Maximum Flexural Strength can be achieved by replacing a portion of the sand with marble dust at a rate of 15% rather than granite dust at a rate of 50%. However, maximum strength is actually quite decent at 25%. The Bond Strength reaches its maximum at 25% when both Granite and Marble dust replace some of the sand. The Split Tensile Strength also reaches its maximum at 25% as granite and marble dust replaces some of the sand.
- The stress-strain curve of the concrete is comparable to that of regular concrete when sand is partially replaced by granite or marble dust in various percentages. Therefore, it is clear that using granite and marble dust in place of 25% of the sand can generate concrete of high quality. All of the concrete generated by substituting marble and granite dust exhibits greater strength when compared to the reference mix with a 0% replacement of natural sand.

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