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# FLY ASH BASED GEOPOLYMER CONCRETE AND REPLACEMENT OF SAND WITH QUARRY STONE DUST (QSD)

**Bandla Hima Bindu[1], Songa Madhu Bala[2]**

*M.Tech, Priyadarshini Institute Of Technology & Management, Guntur, Andhra Pradesh[1]*

*Assistant Professor, Priyadarshini Institute Of Technology & Management, Guntur, Andhra Pradesh [2]*

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**Abstract:- Geo Polymer Concrete is created without bond as a cover. The base material, viz. fly powder, is enacted by antacid answer for create the fastener which is wealthy in Silica (Si) and Aluminum (Al). Geo Polymer Concrete has great quality and appearance like ordinary cement produced using the Portland bond. From the survey of accessible writing it is seen that there is no legitimate plan system for Geo Polymer Concrete. With the conventional data accessible on Geo Polymers, a thorough experimentation strategy was received to build up a procedure of assembling fly powder based Geo Polymer Concrete.The antacid fluids utilized in this examination for the polymerization are the arrangements of Sodium hydroxide (NaOH) and sodium silicate (Na2SiO3). The molarity of sodium hydroxide arrangement is settled as 12.**

**In India, normal stream sand (fine total) is customarily utilized in cement. In any case, developing natural limitations to the abuse of sand from waterway beds is prompting research for usage of an elective material for fine totals in the development business. This paper explores about utilizing quarry stone residue as a fine total substitution material, as an option in geo-polymer concrete. This examination work is concerned with exploratory examination on quality of geo-polymer cement and discovering ideal level of substitution by supplanting fine totals from 0% to100%. Concrete blends were delivered, tried and thought about as far as functionality and quality with the regular geo-polymer concrete. Encompassing restoring strategy was favored in this examination work. Tests were completed to assess the mechanical properties at 7, 14 and 28 days.**

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## I INTRODUCTION

For the development of any structure, Concrete is the primary material. The principle fixing to deliver concrete is Portland bond. On the opposite side an Earth-wide temperature boost and natural contamination are the greatest hazard to mankind on this planet today. The generation of bond implies the creation of contamination due to the outflow of CO2 amid its generation. There are two distinct wellsprings of CO2 outflow amid concrete creation. Burning of petroleum products to work the rotational oven is the biggest source and other one is the substance procedure of calcining limestone into lime in the concrete furnace likewise delivers CO2.In India the emanation of CO2 is 1.8 tons for every capita in the time of 2017. The concrete business contributes around 7% of aggregate worldwide carbon dioxide discharges. And furthermore, the concrete is fabricated by utilizing the crude materials, for example, lime stone, mud and different minerals. Quarrying of these crude materials likewise causes ecological debasement. To create 1 ton of bond, around 1.6 tons of crude materials are required and the time taken to frame the lime stone is any longer than the rate at which people utilize it. Be that as it may, the interest of cement is expanding step by step in light of its simplicity of getting ready and manufacturing in a wide range of advantageous shapes. So to conquer this issue, the solid to be utilized ought to be natural well disposed.

This exploration plans to have an elective fine total in Geo Polymer Concrete. In such manner Geo Polymer concrete is delivered with Geo Polymer fastener which comprises of Fly fiery remains and antacid fluid. Fine total is supplanted with quarry stone residue since it is most sparing than normal sand. The consequences of exploratory examinations are introduced in this paper.

## II LITERATURE REVIEW

**Djwantoro Hardjito, et al (1992)** portrayed the impacts of a few factors on the properties of fly fiery remains based

Geo Polymer concrete, particularly the compressive quality. The test factors included were the time of solid, relieving time, restoring temperature, amount geo-polymer of super-plasticizer, the rest time frame preceding relieving, and the water substance of the blend. They inferred that compressive quality of cement does not fluctuate with age, and relieving the solid examples at higher temperature and longer restoring period will result in higher compressive quality. They likewise finished up Naphthalene-based super-plasticizer enhances the usefulness of new geo-polymer concrete.

**D. M. J. Sumajouwet al (2007)** introduced the consequences of test study and examination on the conduct and the quality of fortified Geo Polymer concrete slim segments. They inferred that warmth restored low-calcium fly fiery debris based Geo Polymer concrete has incredible potential for applications in the precast business. The items at present delivered by this industry can be fabricated utilizing Geo Polymer concrete.

**GanapatiNaidu.P (2011)** evaluated the diverse quality properties of Geo Polymer solid blend with G.G.B.S supplanted in rate to fly powder. Making functional, high quality and sturdy Geo Polymer concrete containing G.G.B.S (Slag) without use of conventional Portland bond.

**B. H. Shinde1,et al (2016)** introduced the reasonableness of treated and untreated ocean sand in bond concrete and geopolymer concrete, based on compressive quality.

**Shuguang Hu, et al (2007)** prepared three repair materials by utilizing concrete based, geo-polymeric, or geopolymeric containing steel slag fasteners. They presumed that the geo-polymeric materials would do well to repair attributes than concrete based repair materials, and the expansion of steel slag could enhance altogether the scraped area obstruction of geopolymeric repair. By methods for checking electron microscopy (SEM) it can likewise be inferred that the steel slag was completely ingested to partake in the alkaliactivated response and be immobilized into the undefined aluminosilicategeopolymer network.

**Zhu Pan and B. V. Rangan(2009)** reasoned that the malleability of the mortars has a noteworthy connection to this quality gain/misfortune conduct. They arranged the examples with two diverse fly fiery remains, with qualities running from 5 to 60 MPa, were explored. They inferred that the quality misfortunes diminish with expanding pliability, with even quality increases at abnormal amounts of flexibility. This relationship is credited to the way that mortars with high malleability have high ability to suit warm incongruencies.

**Christina K. Howl, et al (2008)** exhibited the compressive quality of networks arranged with overwhelmingly undefined calcium silicates (impact heater slag) or containing crystalline stages particularly produced for reactivity (concrete) is significantly higher than when the calcium is provided as crystalline silicate minerals. They inferred that the compressive quality of lattices containing common (crystalline) calcium silicates enhances with expanding alkalinity, anyway the contrary pattern is seen in networks orchestrated with handled calcium silicate sources.

## III MATERIALS USED

### FLY ASH

As per ASTM C-618, two noteworthy classes of fly fiery debris are perceived. These two classes are identified with the sort of coal consumed and are assigned as Class F and Class C in a large portion of the present writing. Class F fly fiery debris is typically created by consuming anthracite or bituminous coal while Class C fly cinder is for the most part acquired by consuming sub bituminous or lignite coal.

In this undertaking class F fly fiery remains is utilized and its particular gravity esteem is 2.52.

### COARSE AGGREGATES

Those particles that are transcendently held on the 4.75 mm (No. 4) strainer and will go through 3-inch screen, are called coarse total. The coarser the total, the more sparing the blend. Bigger pieces offer less surface region of the particles than a comparable volume of little pieces. Utilization of the biggest reasonable most extreme size of coarse total allows a decrease in bond and water prerequisites. Pulverized stone blend of 20mm and 10mmsize are utilized in this task.

The particular gravity, fineness modulus and water retention of 20mm size coarse totals are 2.69, 7.22 and 0.25% separately.

The particular gravity, fineness modulus and water assimilation of 10mm size coarse totals are 2.57, 6.4 and 0.5% separately.

**FINE AGGREAGTES:**

Those particles passing the 9.5 mm (3/8 inches) Sieve, as a rule passing the 4.75 mm (No. 4) sifter, and overwhelmingly held on the 75 µm (No. 200) sifter are called fine total.

The particular gravity and fineness modulus of fine total utilized in this task are 2.55 and 2.96 separately.

**QUARRY STONE DUST (QSD)**

The idea of substitution of normal fine total by Quarry Stone Dust which is featured in this investigation could help the utilization of quarry dust produced from quarries. By substitution of quarry stone residue, the prerequisite of land fill territory can be decreased and can likewise tackle the issue of regular sand shortage.

The particular gravity and fineness modulus of quarry stone residue utilized in this task are 2.62 and 5.3 separately.

## IV CASTING OF GEO POLYMER CONCRETE

Geo Polymer cement can be produced by embracing the customary procedures utilized in the fabricate of Portland bond concrete. In the research facility, the fly powder and the totals were first combined dry in 80-liter limit container blender for around three minutes. The totals were set up in immersed surface-dry (SSD) condition, and were kept in plastic containers with lid.The basic fluid was blended with the super plasticiser and the additional water, assuming any. The fluid segment of the blend was then added to the dry materials and the blending proceeded as a rule for another four minutes.The crisp cement was thrown and compacted by the typical strategies utilized on account of Portland bond concrete.

Compaction factor test and Vee honey bee consistometer test were led in crisp territory of Geo Polymer Concrete.

Compressive, Tensile and Flexural qualities of created Geo Polymer Concrete blended containing distinctive extents of Quarry Stone Dust have been gotten by testing the examples.

## V. RESULTS AND ANALYSIS

The following notations have been used in this study for different mixes

Mix-1 (M1) – 100% Sand + 0% QSD

Mix-2 (M2) – 80% Sand + 20% QSD

Mix-3 (M3) – 60% Sand + 40% QSD

Mix-4 (M4) – 40% Sand + 60% QSD

Mix-5 (M5) – 20% Sand + 80% QSD

Mix-6 (M6) – 0% Sand +100% QSD

The results of workability tests are presented in graphical forms.

The result of compaction factor test is presented in the graphical form in Fig.1.

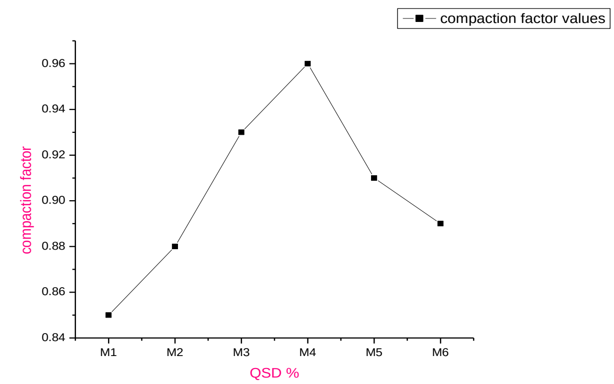


Fig.1 variation of compaction factor values

It can be observed that the compaction factor value increases with increase in percentage of Quarry Stone Dust and then decreases after reaching optimal value at 60% replacement level.

The results of Vee bee consistometer test are depicted in Fig.2. It can be noticed that the Vee-Bee test results confirm the same trend as per compaction factor test.

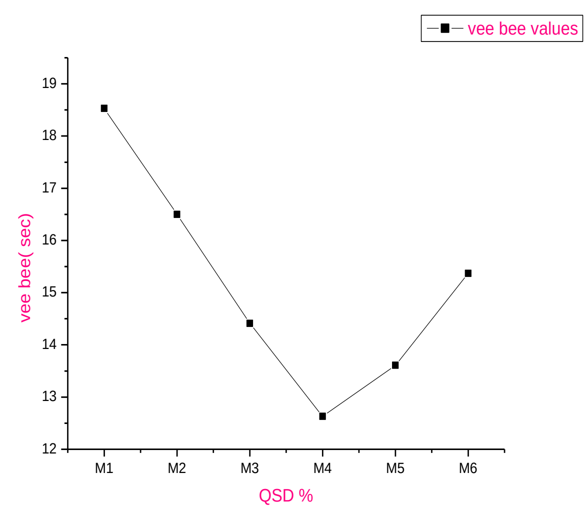


Fig.2 Variation of Vee Bee time (seconds)

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**Strength tests:**

The results of compressive strength tests are presented in graphical form in Fig3,4&5.

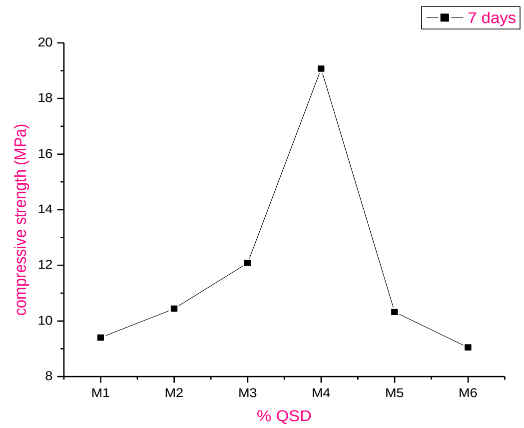


Fig.3 Compressive strength for different mixes at 7 days

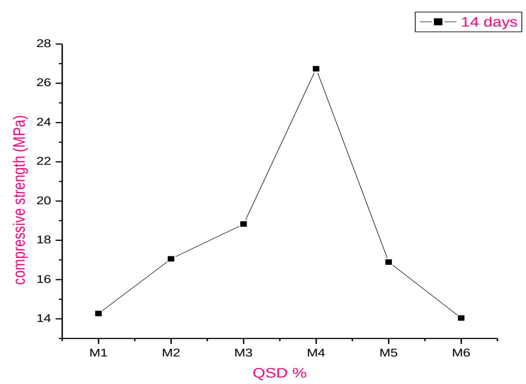


Fig.4 Compressive strength for different mixes at 14 days

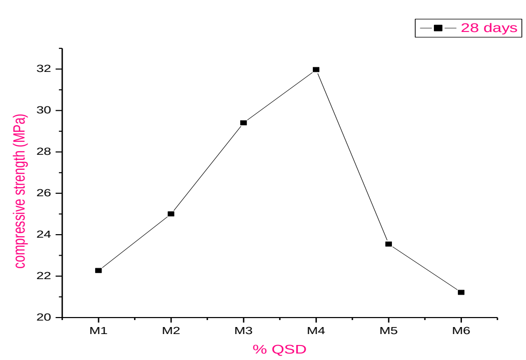


Fig.5 Compressive strength for different mixes at 28 days

The comparison of compressive strength of different mixes for 7, 14 and 28 days is shown in the graphical form in Fig.6

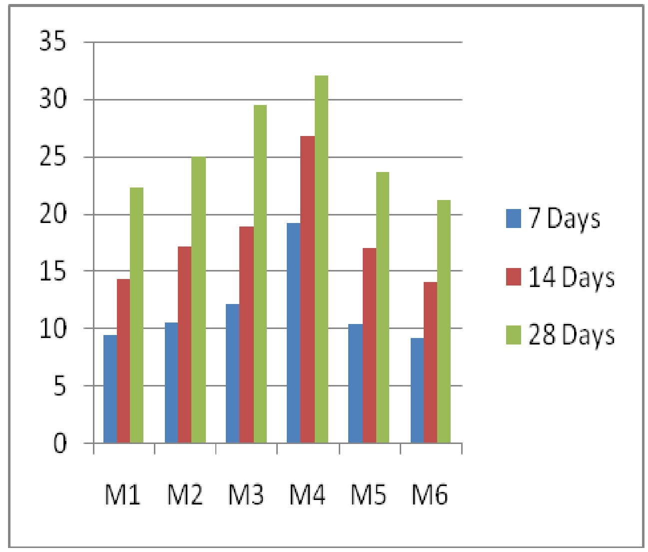


Fig.6:variation of 7,14 and 28 days compressive strength

The compressive strength value increases with increase in percentage of Quarry Stone Dust and then decreases after reaching optimal value at 60% replacement level.

For all mixes, the compressive strength increases with increase in Age.

The result of Tensile strength test for 7, 14 and 28 days represented in the graphical form in Fig.7,8,&9 respectively.

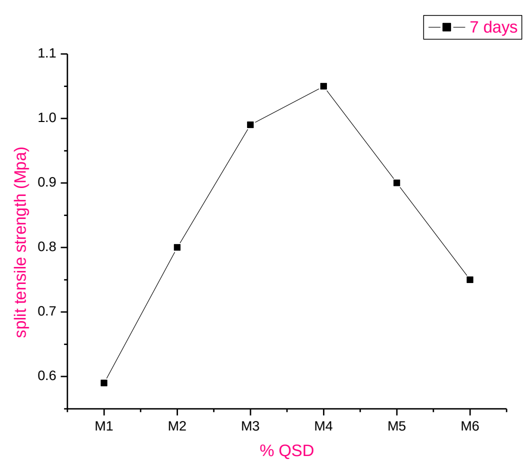


Fig.7 Tensile strength for different mixes at 7 days

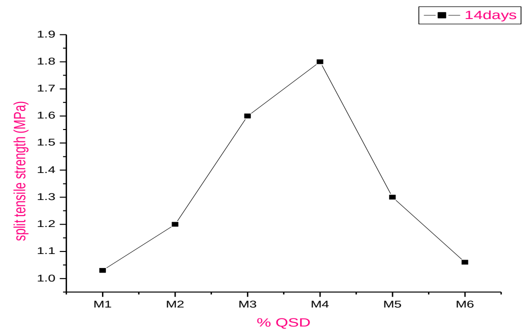


Fig.8 Tensile strength for different mixes at 14 days

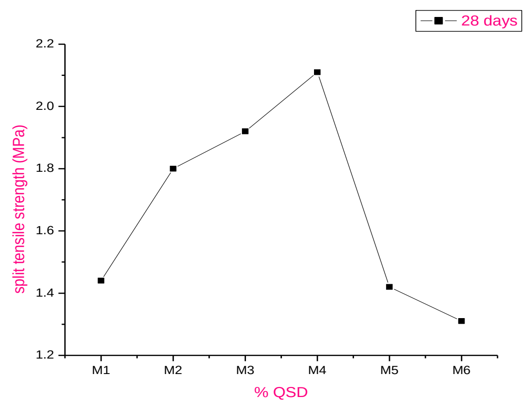


Fig.9 Tensile strength for different mixes at 28days

The comparison of Tensile strength of different mixes for 7, 14 and 28 days is shown in the graphical form in fig.10

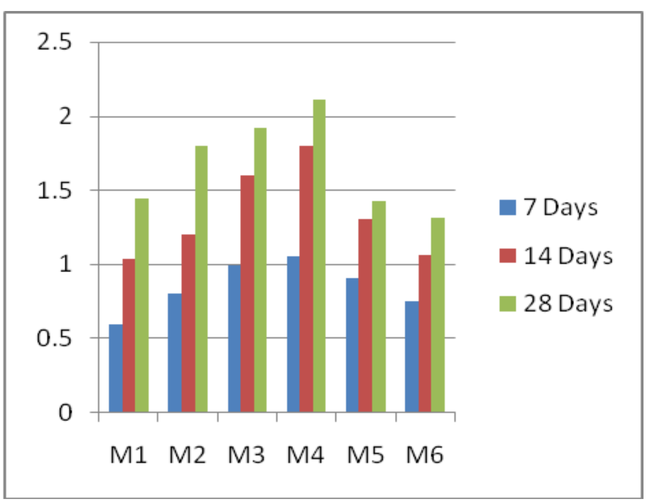


Fig.10:variation of 7,14 and 28 days Tensile strength

The Tensile strength value increases with increase in percentage of Quarry Stone Dust and then decreases after reaching optimal value at 60% replacement level.

For all mixes, the Tensile strength increases with increase in Age.

The results of Flexural strength test for 7 and 28 days are represented in the graphical form in Fig.11&12 respectively.

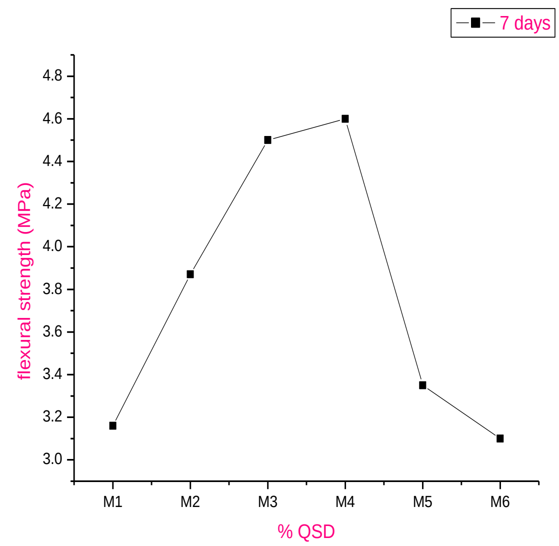


Fig.11 Flexural strength for different mixes at 7 days

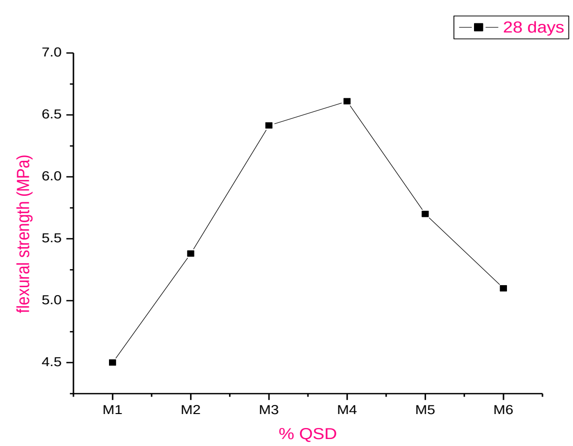


Fig.12 Flexural strength for different mixes at 28 days

The comparison of Flexural strength of different mixes for 7 and 28 days is shown in the graphical form in fig.13.

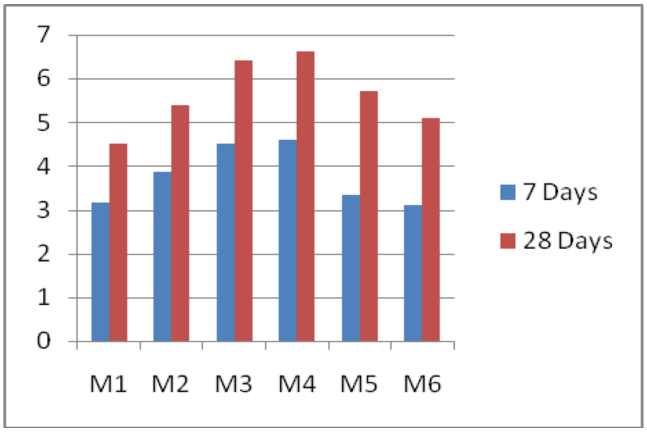


Fig.13:variation of 7and 28 days Flexural strength

The Flexural strength value increases with increase in percentage of Quarry Stone Dust and then decreases after reaching optimal value at 60% replacement level.

For all mixes, the Flexural strength increases with increase in Age.

## VI CONCLUSIONS

From this study the following conclusions were made

1. The compaction factorworkability of Geo Polymer concrete increases with increasing the percentage of QSD upto 60% and then decreases.
2. The Vee Bee test values of Geo Polymer concrete decreases with increase in the percentage of QSD upto 60% and then decreases indicating increasing of workability upto 60%.
3. The maximum value of compressive strength was observed at 40% sand + 60% QSD at all ages. The compressive strength of concrete decreases with increase in Quarry Stone Dust beyond 60%.
4. The maximum value of Split tensile strength was observed at40% sand + 60% QSD at all ages. The tensile strength of Geo Polymer concrete decreases with increase in Quarry Stone Dust beyond 60%.
5. The maximum value of Flexural strength was observed at 40% sand + 60% QSD at all ages. The flexural strength of concrete decreases with increase in Quarry Stone Dust beyond 60%.

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