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# "Experimental Investigation By Using Natural Minerals As New Edge Sustainable Building Material"

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**Abstract:**

We expect to develop one more kind of light weight substantial squares by adding mineral admixture which brings about huge expansion in strength. The primary explanation for this to lessen the utilization of regularly utilized unrefined substance and to expand the strength of the substantial. The utilization of mineral admixture relies on accessibility of material in the close by area and primarily on the maintainability of materials. There are such countless sorts of mineral admixtures by and by accessible which can be utilized as the beneficial cementitious material, for example, fly debris, calcite, silica exhaust and GGBS for example Ground Granulated impact heater slag, yet these material conduct never been abundantly investigated, to observe the huge use in the light weight material substantial squares as what they act and mean for the strength property also business feasibility on the lookout. To concentrate on their solidarity boundaries of material when utilized with aluminum dioxide in the light weight substantial squares.

**Keywords:** GGBS, silica smolder, fly debris and quarry dust

## I. EXPERIMENTAL PROGRAM

TESTING OF PHYSICAL PROPERTIES

⇩

CONCRETE MIX PREPARATION

⇩

CONCRETE CURING

⇩

TESTING OF CONCRETE

⇩

ANALYSIS OF DATA

⇩

CONCLUSION

'Flow Chart A' Path of Work

To concentrate on the strength boundary of material when utilized with various mineral admixtures in light weight substantial squares. The accompanying blend have been arranged and different test is performed. Here we involved 1:1 blend extent for making LWC blocks.

In this first case sand is kept steady 100 percent however varieties is done in cementitious material, i.e in M101, M102, M103, M104 Cement is supplanted with 0% fly debris, 10% fly debris, 20% fly debris and 30% fly debris without expansion of calcite. From M5 there is little change is made as displayed in M4 - CEMENT 85% + 10% FLY ASH + 5% CALCITE , M6 - CEMENT 70% + 20% FLY ASH + 10% CALCITE, M7 - CEMENT 55% + 30% FLY ASH + 15% CALCITE

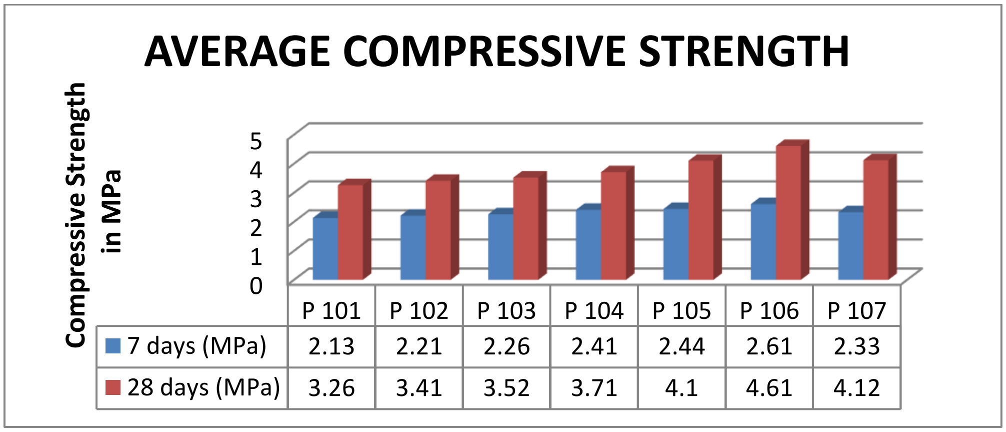
**TABLE 1.1** First Preliminary P 101 to P 107 and their mix combinations

| Mix | Cement | Flyash | Calcite | Sand |
|---|---|---|---|---|
| P 101 | 100 | 0 | 0 | 100 |
| P 102 | 90 | 10 | 0 | 100 |
| P 103 | 80 | 20 | 0 | 100 |
| P 104 | 70 | 30 | 0 | 100 |
| P 105 | 85 | 10 | 5 | 100 |
| P 106 | 70 | 20 | 10 | 100 |
| P 107 | 55 | 30 | 15 | 100 |

**TABLE 1.2** First Preliminary Compressive Strength in MPA

| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|

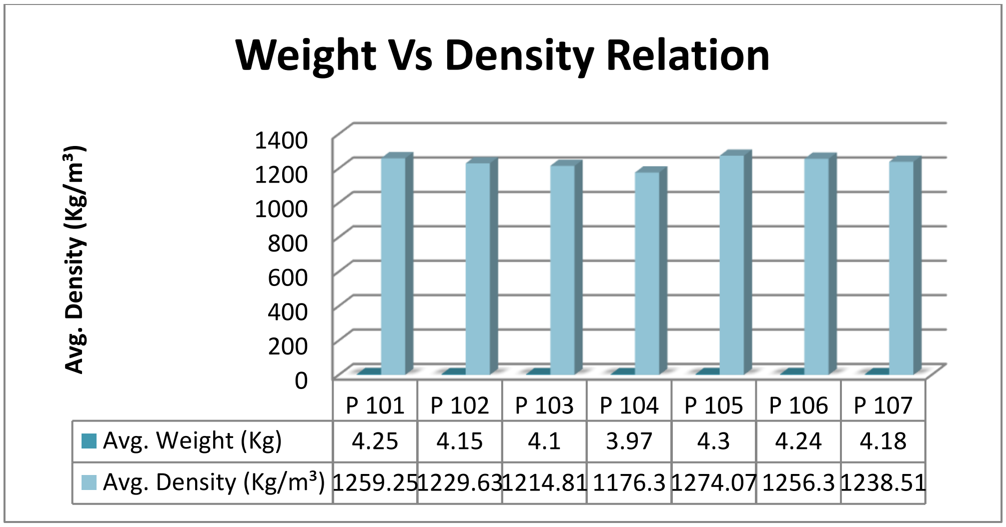
| | | |
|---|---|---|
| P 101 | 2.13 | 3.26 |
| P 102 | 2.21 | 3.41 |
| P 103 | 2.26 | 3.52 |
| P 104 | 2.41 | 3.71 |
| P 105 | 2.44 | 4.10 |
| P 106 | 2.61 | 4.61 |
| P 107 | 2.33 | 4.12 |




**GRAPH. 1.1 COMPRESSIVE STRENGTH IN MPa**

TABLE 1.3 First Preliminary Weight To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density (Kg/m³) |
|---|---|---|
| P 101 | 4.25 | 1259.25 |
| P 102 | 4.15 | 1229.63 |
| P 103 | 4.10 | 1214.81 |
| P 104 | 3.97 | 1176.30 |
| P 105 | 4.3 | 1274.07 |
| P 106 | 4.24 | 1256.30 |
| P 107 | 4.18 | 1238.51 |




**GRAPH. 1.2 WEIGHT & DENSITY GRAPH**

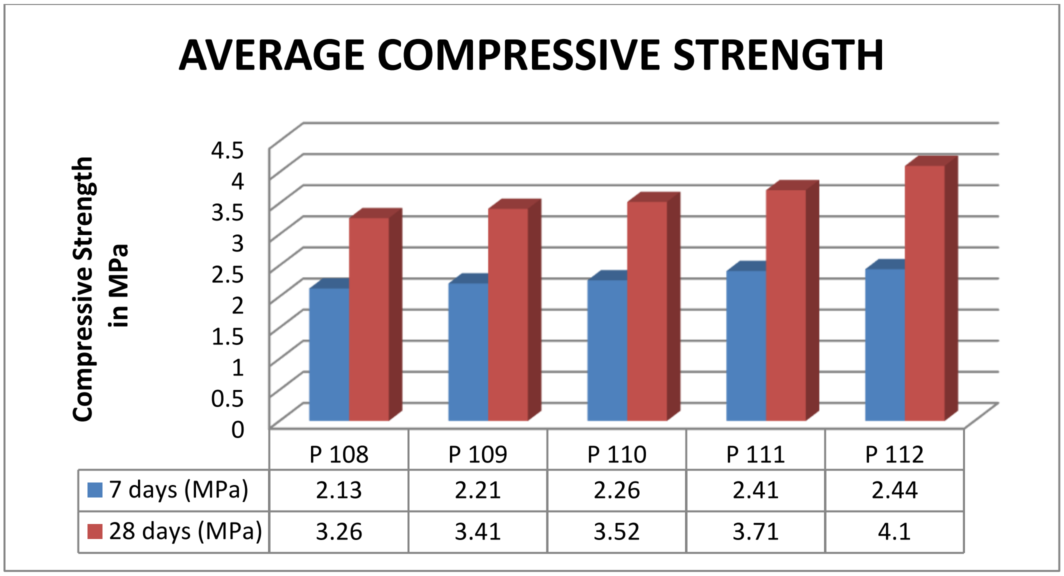
In second preliminary we did varieties among sand and quarry dust in this we supplant sand with quarry dust with 10% quarry dust, 20% quarry dust, 30% quarry dust, 40% quarry dust and half quarry dust separately keeping worth of cementitious materials at ( concrete 70% + fly debris 20% + Calcite 10% )

**TABLE 2.1** Second Preliminary P 108 to P 112 and their mix combinations

| Mix | Cement | Flyash | Calcite | Sand | Quarry dust |
|---|---|---|---|---|---|
| P 108 | 70 | 20 | 10 | 90 | 10 |
| P 109 | 70 | 20 | 10 | 80 | 20 |
| P 110 | 70 | 20 | 10 | 70 | 30 |
| P 111 | 70 | 20 | 10 | 60 | 40 |
| P 112 | 70 | 20 | 10 | 50 | 50 |

**TABLE 2.2** Second Preliminary Compressive Strength in MPA

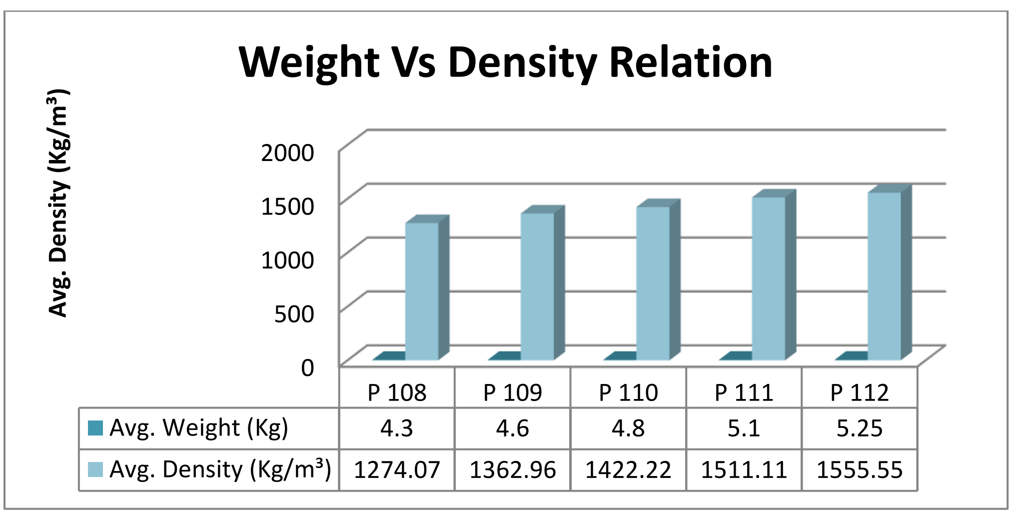
| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|
| P 108 | 2.45 | 3.76 |
| P 109 | 2.51 | 3.85 |
| P 110 | 2.59 | 3.96 |
| P 111 | 2.68 | 4.71 |
| P 112 | 2.51 | 3.76 |




**GRAPH. 2.1 COMPRESSIVE STRENGTH IN MPa**

**TABLE 2.3** Second Preliminary Weight To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density ($Kg/m^3$) |
|---|---|---|
| P 108 | 4.3 | 1274.07 |
| P 109 | 4.6 | 1362.96 |
| P 110 | 4.8 | 1422.22 |
| P 111 | 5.1 | 1511.11 |
| P 112 | 5.25 | 1555.55 |



**GRAPH. 2.2 WEIGHT & DENSITY GRAPH**

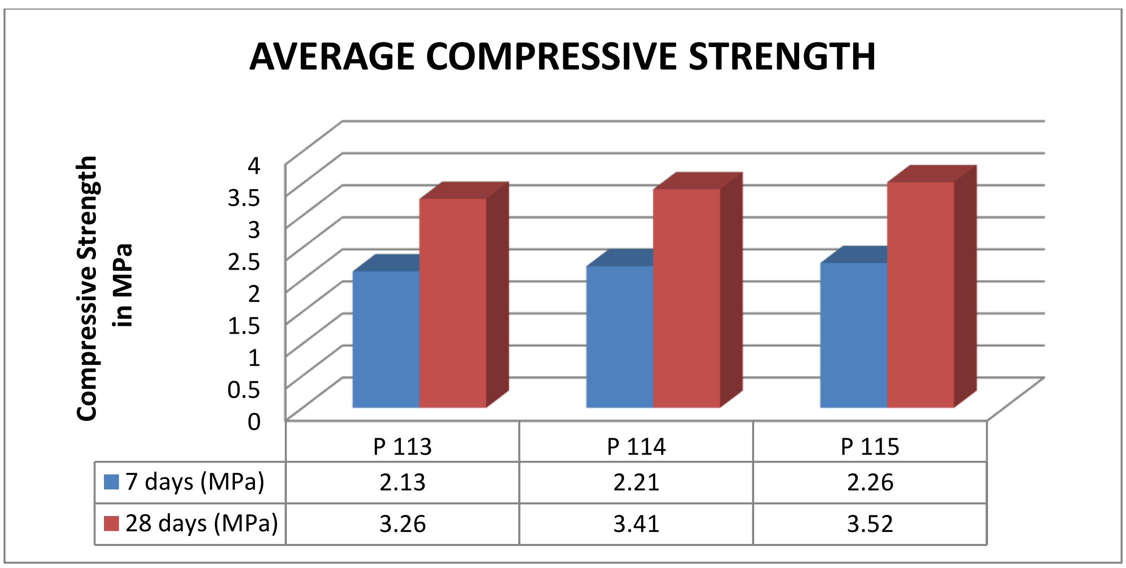
In third preliminary we kept sand as consistent where as we did varieties in cementitious material in which concrete is supplant from 10% to 30% with silica smolder

**TABLE 3.1** Third Preliminary P 113 to P 115 and their mix combinations

| Mix | Cement | Silica fume | Sand |
|---|---|---|---|
| P 113 | 90 | 10 | 100 |
| P 114 | 80 | 20 | 100 |
| P 115 | 70 | 30 | 100 |

**TABLE 3.2** Third Preliminary Compressive Strength in MPA

| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|
| P 113 | 2.51 | 4.21 |
| P 114 | 2.42 | 3.51 |
| P 115 | 2.21 | 3.2 |

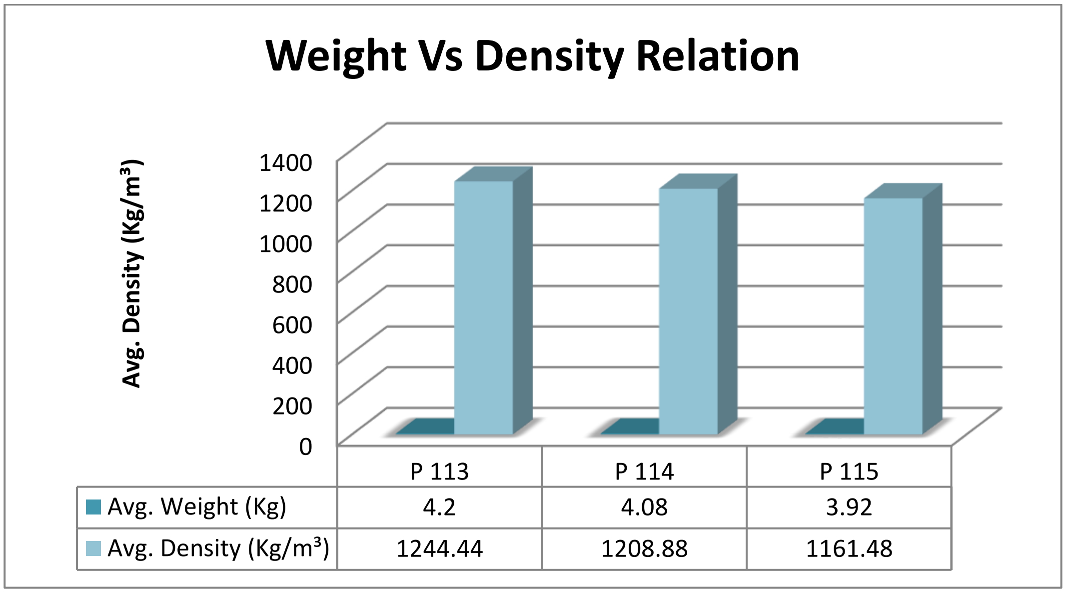



**GRAPH. 3.1 COMPRESSIVE STRENGTH IN MPa**

**TABLE 3.3** Third Preliminary Weight To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density (Kg/m$^3$) |
|---|---|---|

| | | |
|---|---|---|
| P 113 | 4.2 | 1244.44 |
| P 114 | 4.08 | 1208.88 |
| P 115 | 3.92 | 1161.48 |

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**GRAPH. 3.2 WEIGHT & DENSITY GRAPH**

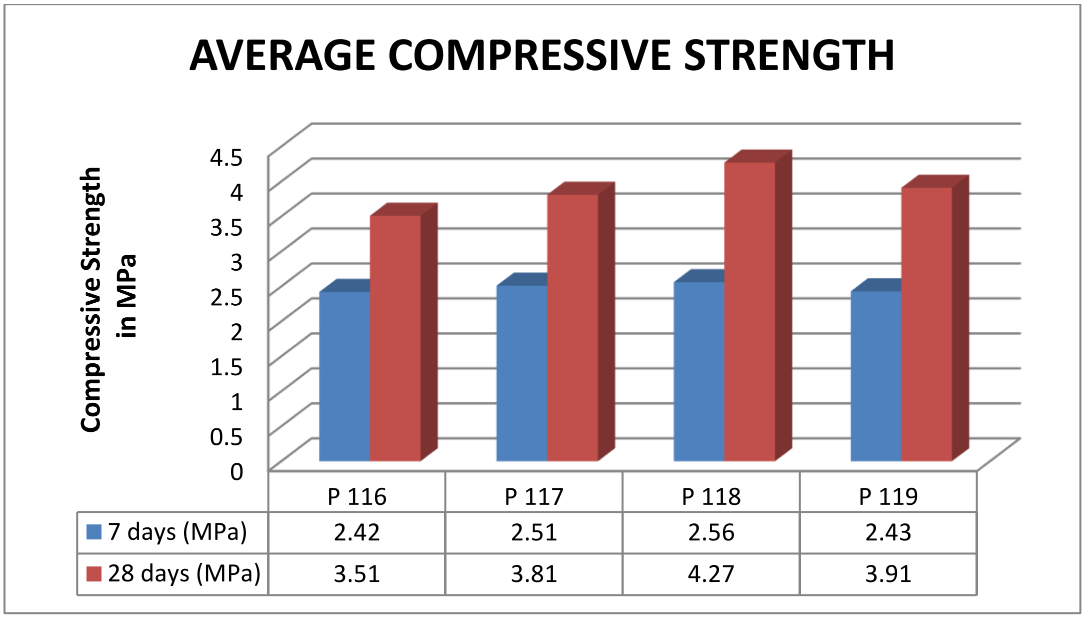
In fourth preliminary we kept sand as consistent where as we did varieties in cementitious material in which concrete is supplant from 10% to 40% with GGBS

**TABLE 4.1** Fourth Preliminary P 116 to P 119 and their mix combinations

| Mix | Cement | GGBS | Sand |
|---|---|---|---|
| P 116 | 90 | 10 | 100 |
| P 117 | 80 | 20 | 100 |
| P 118 | 70 | 30 | 100 |
| P 119 | 60 | 40 | 100 |

**TABLE 4.2** Fourth Preliminary Compressive Strength in MPA

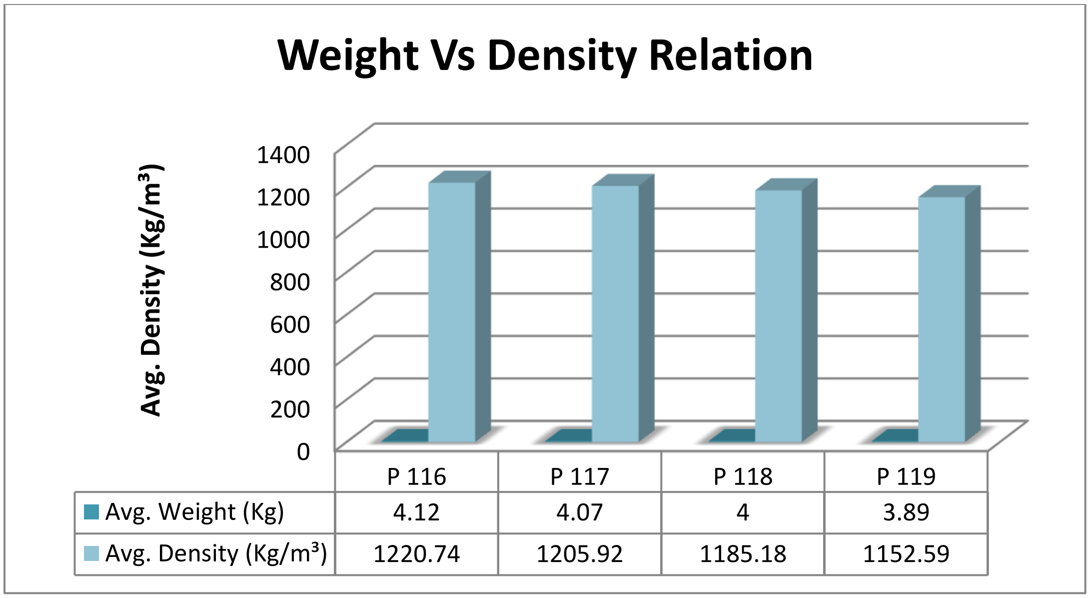
| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|
| P 116 | 2.42 | 3.51 |
| P 117 | 2.51 | 3.81 |
| P 118 | 2.56 | 4.27 |
| P 119 | 2.43 | 3.91 |




**GRAPH. 4.1 COMPRESSIVE STRENGTH IN MPa**

**TABLE 4.3** Fourth Preliminary Weights To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density ($Kg/m^3$) |
|---|---|---|
| P 116 | 4.12 | 1220.74 |
| P 117 | 4.07 | 1205.92 |
| P 118 | 4 | 1185.18 |
| P 119 | 3.89 | 1152.59 |




**GRAPH. 4.2 WEIGHT & DENSITY GRAPH**

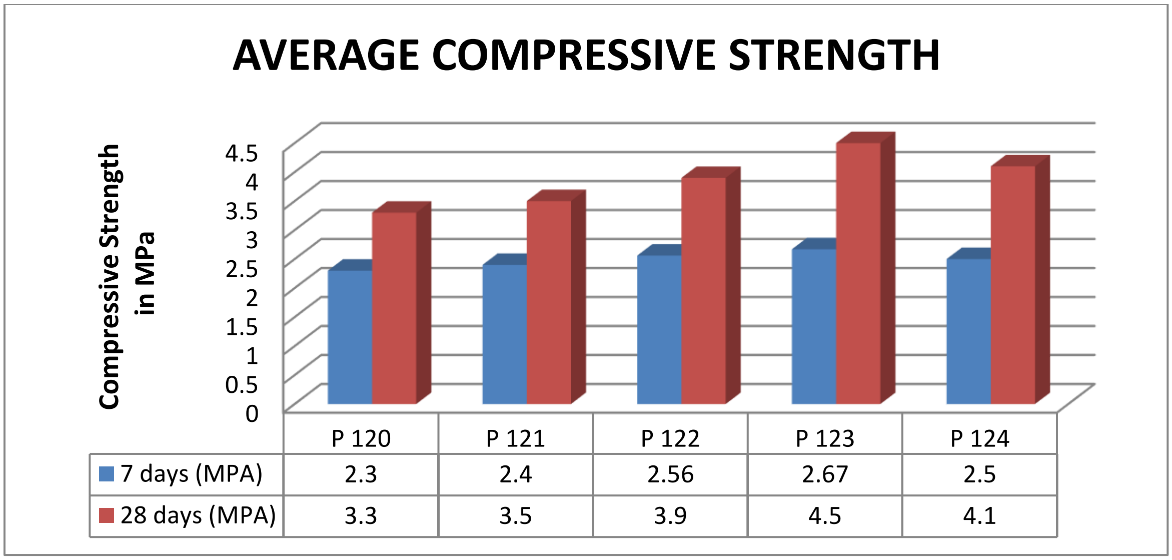
In fifth preliminary we kept concrete + Silica seethe at 90% concrete + 10% silica rage consistent and in sand and quarry dust we did varieties structure 10% to half.

**TABLE 5.1** Fifth Preliminary P 120 to P 124 and their mix combinations

| Mix | Cement | Silica fume | Sand | Quarry dust |
|---|---|---|---|---|
| P 120 | 90 | 10 | 90 | 10 |
| P 121 | 90 | 10 | 80 | 20 |
| P 122 | 90 | 10 | 70 | 30 |
| P 123 | 90 | 10 | 60 | 40 |
| P 124 | 90 | 10 | 50 | 50 |

**TABLE 5.2** Fifth Preliminary Compressive Strength in MPA

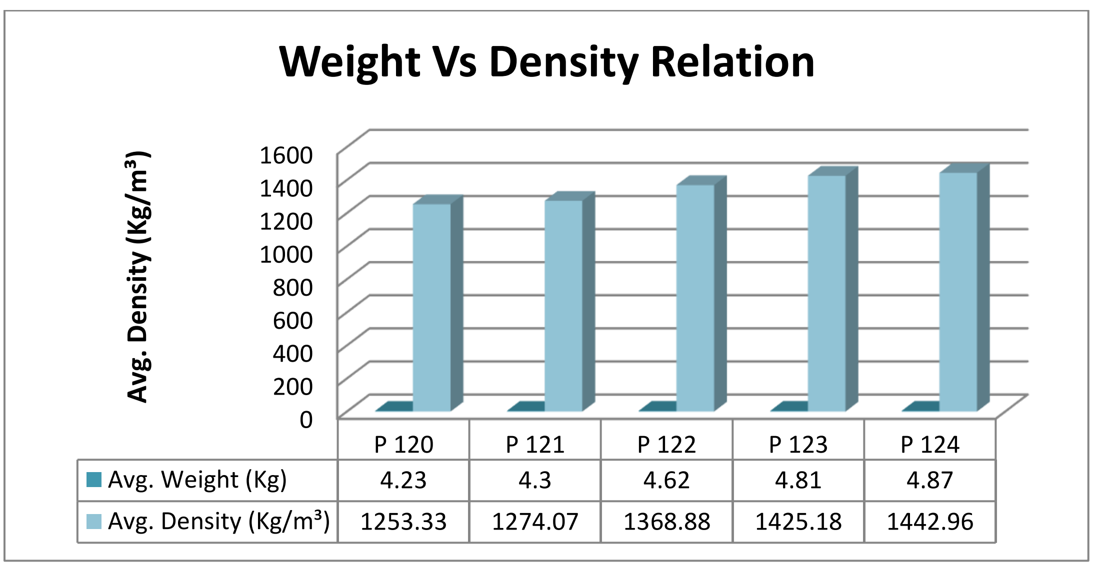
| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|
| P 120 | 2.3 | 3.3 |
| P 121 | 2.4 | 3.5 |
| P 122 | 2.56 | 3.9 |
| P 123 | 2.67 | 4.5 |
| P 124 | 2.5 | 4.1 |




**GRAPH. 5.1 COMPRESSIVE STRENGTH IN MPa**

**TABLE 5.3** Fifth Preliminary Weights To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density ($Kg/m^3$) |
|---|---|---|
| P 120 | 4.23 | 1253.33 |
| P 121 | 4.3 | 1274.07 |
| P 122 | 4.62 | 1368.88 |
| P 123 | 4.81 | 1425.18 |
| P 124 | 4.87 | 1442.96 |



**GRAPH. 5.2 WEIGHT & DENSITY GRAPH**

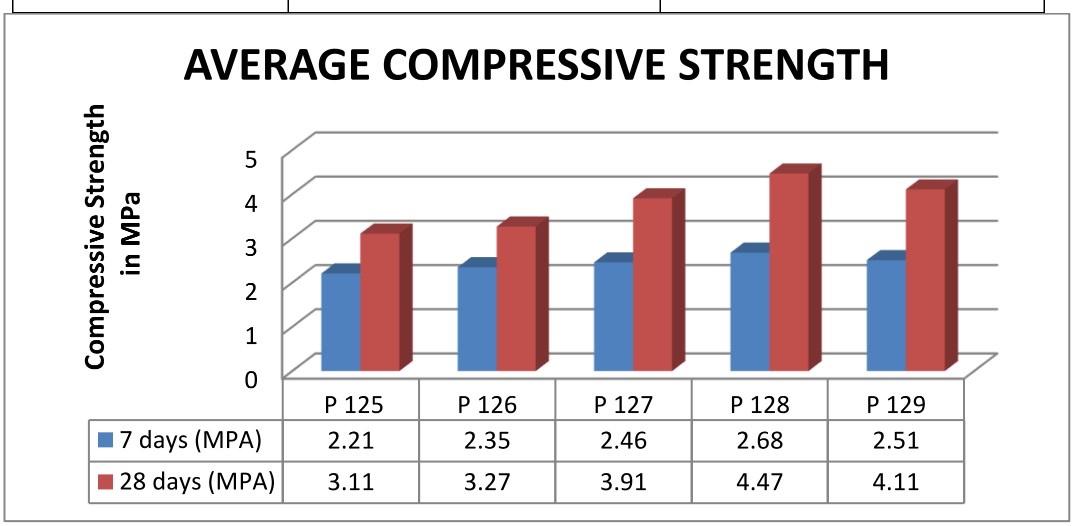
In 6th preliminary we kept concrete + GGBS at 70% concrete + 30% silica seethe steady and in sand and quarry dust we did varieties structure 10% to half.

**TABLE 6.1** Sixth Preliminary P 125 to P 129 and their mix combinations

| Mix | Cement | GGBS | Sand | Quarry dust |
|---|---|---|---|---|
| P 125 | 70 | 30 | 90 | 10 |
| P 126 | 70 | 30 | 80 | 20 |
| P 127 | 70 | 30 | 70 | 30 |
| P 128 | 70 | 30 | 60 | 40 |
| P 129 | 70 | 30 | 50 | 50 |

**TABLE 6.2** Sixth Preliminary Compressive Strength in MPA

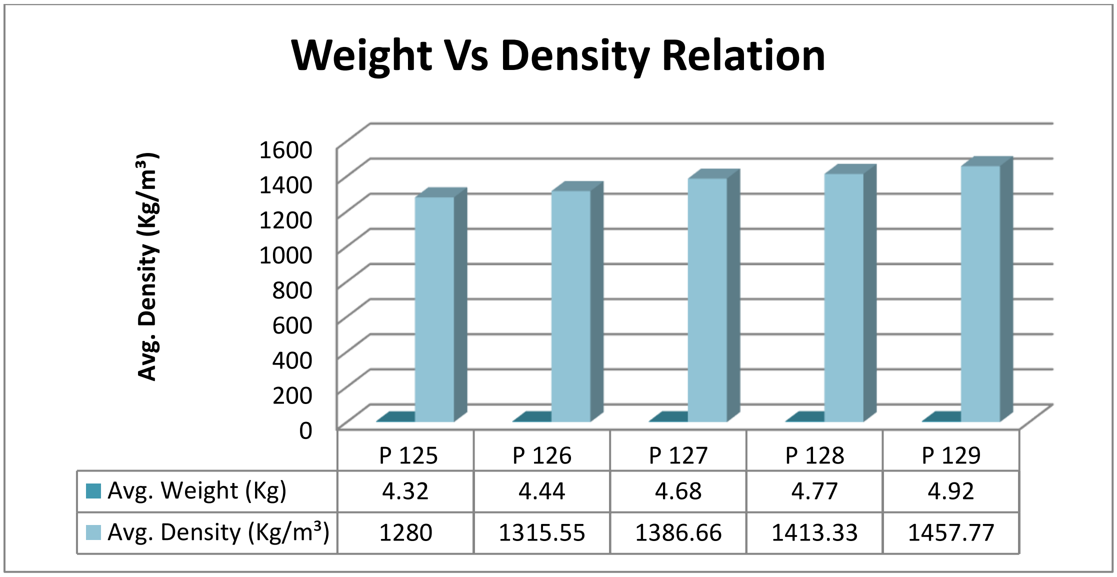
| Mix | 7 days (MPA) | 28 days (MPA) |
|---|---|---|
| P 125 | 2.21 | 3.11 |
| P 126 | 2.35 | 3.27 |
| P 127 | 2.46 | 3.91 |
| P 128 | 2.68 | 4.47 |
| P 129 | 2.51 | 4.11 |




**GRAPH. 6.1 COMPRESSIVE STRENGTH IN MPa**

TABLE 5.3 Sixth Preliminary Weights To Density Results

| Trial Mix | Avg. Weight (Kg) | Avg. Density (Kg/m³) |
|---|---|---|
| P 125 | 4.32 | 1280 |
| P 126 | 4.44 | 1315.55 |
| P 127 | 4.68 | 1386.66 |
| P 128 | 4.77 | 1413.33 |
| P 129 | 4.92 | 1457.77 |




**GRAPH. 6.2 WEIGHT & DENSITY GRAPH**

## II. RESULTS & DISCUSSION

1. The strength of P 106 and P 107 is diminished due higher halfway substitution concrete, it has been seen that the utilization of abundance of mineral admixture decreased a definitive strength.

2. M5 blend shows higher strength among every one of the blends which is having fly debris and calcite as an incomplete substitution, this is because of when hydration happens in crude concrete it produce C3A, C2S and C3S which assists the concrete with developing fortitude with the progression of time.

3. When the mineral admixture like Fly Ash, silica rage and so forth, blended in with these concrete as an incomplete supplanting they respond with calcium hydroxide and fostered extra C-S-H gel which assists with further developing strength of blend. This specific peculiarities can be seen in M4 and M5 blend.

4. The M5 blend results shows that the utilization of fly debris and calcite as a halfway substitution of concrete assists with expanding the strength of blend, subsequently the this proportion is additionally outlined in M8, M9, M10, M11 and M12 were just distinction in the blend is that, the fine total is to some extent supplanted with quarry dust. To get more efficient LWC concrete.

5. M11 has the higher strength when contrasted with different blends, which are having different substitution proportion. The strength of blend is viewed as expanded predominantly due the compaction idea of sand with quarry dust which assists with further developing the strength property of the blend.

6. The strength of blend M11 and M12 is contrasted and each other the better aftereffects of compressive strength is presented by the M11 blend which has the up to 40% sand supplanted with quarry dust.

7. When the M4 and M12 test is thought about it tends to be say that M12 test could be more affordable than M4 test.

8. The expansion of silica in concrete outcomes in create in strength because of response with calcium hydroxide. As we realize that silica is a pozzolanic material and its presence in concrete blend work on the strength of combination.

9. The overabundance expansion of silica rage brings about impressive reduction in strength, it occurs because of un responded silica particles which stay in concrete. This is because of the inadequate measure of calcium hydroxide present in mortar after hydration.

10. The M16 stir which is having least substitution of concrete up to 10% addition the strength in 7 and 28 days is viewed as more when contrasted and M15 blend, henceforth further blends are completed.

11. The M18 blend shows the better 7 and 28 days strength when contrasted and different combinations which are having different incomplete supplanting of concrete with GGBS.

12. The strength of blend M19 diminished as contrasted and M18 combination test. This is because of inadequate present of calcium particles for additional hydration.

13. M23 blend which is having normal sand supplanted by 40% with quarry dust shows the better 7 and 28 days strength as contrasted and other example.

14. When the M23 blend is contrasted and the M13 blend is been clear the utilization of quarry dust in the combination can be the better choice to keep up with economy and improvement in strength.

15. The M28 blend shows the critical expansion in the strength when contrasted and the stir M18 which is having substitution up to 30% of concrete as ground granulated impact heater slag (GGBS), this strength gain is accomplished because of expansion of quarry dust as a halfway substitution of regular sand.

16. The GGBS has worked on the property of union and which results on the better bouncing of material. The abundance water which is expected for quarry dust is additionally essentially less.

**III. CONCLUSION:**

Utilization of abundance of mineral admixture diminished a definitive strength. The strength of blend is viewed as expanded mostly due the compaction idea of sand with quarry dust which assists with further developing the strength property of the blend. The expansion of silica in concrete outcomes in create in strength because of response with calcium hydroxide. The utilization of quarry dust in the combination can be the better choice to keep up with economy and improvement in strength. The GGBS has worked on the property of attachment and which results on the better bouncing of material.

**REFERENCES**


[1]. IS 383:1970 "Specifications for coarse and fine aggregates from natural sources for concrete", Bureau of Indian Standards, New Delhi.

[2]. IS 456: 2000, "Code of practice for plain and reinforced concrete", Bureau of Indian Standards, New Delhi.

[3]. IS: 10262: 1982, "Recommended guidelines for concrete mix design" Bureau of Indian Standards, New Delhi.

[4]. IS 2386:1963 "Methods of tests for aggregates for concrete", Bureau of Indian Standards, New Delhi.

[5]. Roshan Gawale1, Shubham Mishra. "Light Weight Concrete by using EPS Beads". International Conference on Emerging Trends in Engineering and Management Research (ICETEMR-16), ISBN: 978-81-932074-7-5.

[6]. Ankur Tayal, Gaurav Gupta, Praveen Choudhary. "Lightweight Concrete using Recycled Expanded Polystyrene Beads" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 05 | May-2018.

[7]. Jaydeep Singh, Sangeeta Dhyani. "Light Weight Concrete using EPS" International Journal Of Research in Technology and Management ISSN 2454-6240, www.ijrtm.com, Volume 3 Issue 3, June 2017

[8]. Suhad M Abd, Dhamya Gh.,Maan Hattem1 and Dunya Khalil. "Effective Replacement of Fine Aggregates by Expanded Polystyrene Beads in Concrete", International Journal of

Engineering Research and Science and technology. ISSN 2319-5991, www.ijerst.com, Vol. 5, No. 3, August 2016
[9]. M Dhivakar Karthick, S. Bhagavath Ramya. "Experimental study on strength behavior of concrete block with partial replacement of EPS beads", International Journal of Engineering Research & Technology (IJERT). ISSN: 2278-0181, ICITMSEE – 2018, Volume 6, Issue 10.
[10]. Abhijit Mandlik, Tarun Sarthak Sood, Shekhar Karade, Sangram Naik, Amruta Kulkarni. "Light-weight concrete using EPS," International Journal of Science and Research (IJSR). ISSN (Online): 2319-7064
[11] K. Krishna BhavaniSiram, K. Arjun Raj "Concrete + Green = Foam Concrete", International Journal of Civil Engineering & Technology (IJCIET), Volume 4, Issue 4, July – August 2013, pp. 179 - 184, ISSN Print:0976 – 6308, ISSN Online: 0976 – 6316.
[12] K. Krishna BhavaniSiram "Foam Concrete – The Present Generation's Building Solution", International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD), Volume 3, Issue 4, October 2013, pp. 59 - 62, ISSN:2249 – 6866.
[13] Ali J. Hamad "Materials, Production, Properties and Application of Aerated Lightweight Concrete", International Journal of Materials Science and Engineering Vol. 2, No. 2 December 2014.
[14] Dr. N. Arunachalam, V. Mahesh, P. Dileep kumar, and V. Sounder "Development Of Innovative Building Blocks (TNSCST- Sponsored Research Project)" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-ISSN: 2278 - 1684, p-ISSN: 2320 - 334X, pp 01-07.
[15] F. Ansari. Practical Implementation of Optical Fiber Sensors in Civil Structural Health Monitoring. Journal of Intelligent Material Systems and Structures, 18(8):879-889, 2007.
[16] Aasif Ahmad Ganie, Shree Prakash, Light Weight Concrete (Partial Replacement Of Coarse Aggregate Using Polystyrene Beads) International Journal For Technological Research In Engineering, ISSN (Online): 2347 – 4718, Volume 5, Issue 11, July-2018.
[17] Soni Kumari, Development of Light Weight Geo blocks for WALL Building Units using EPS Beads and Fly Ash. International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 6 Issue 04, April-2017.

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