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An Experimental Study on Properties of Concrete using Granite Dust and Flyash as a Partial Replacement of Fine Aggregate & Cement

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ABSTRACT

Concrete is the most widely used construction material in the world it is a mixture of cement, sand, coarse aggregate and water. Storage and safe disposal of industrial byproduct such as fly ash and granite dust is a huge problem everywhere, reuse of these waste eliminates/reduce the problem. In this experiment fine aggregate is replaced 0%, 10%, 20%, 30% and 40% of its weight by granite dust and cement is replaced 10% of its weight by fly ash in all concrete mix and there effects are studied. In this experiment the compressive strength of the concrete is increased. It is found that the strength increases with the replacement of cement and fine aggregate by fly ash at about 10% and granite dust at about 40%, and beyond this the workability of concrete will not achieved.

INTRODUCTION

- Concrete is one of the oldest and most common construction materials in the world, its availability, long durability, and ability to sustain extreme environmental condition.
- Concrete structures are seen everywhere, such as buildings, roads, bridge and dams etc.
- The concrete having cement, sand and coarse aggregates mix up in an appropriate percentage in addition to water is called Plain cement concrete.

Objectives

The objectives of the research are outlined below:

- To check the workability of the concrete by adding fly ash and granite powder.
- The objectives of the present investigations are to investigate the development of Concrete Strength using granite powder as a fine aggregate and also trial mixes by replacing 0, 10, 20, 30 and 40 percent of the weight of river Sand by Granite powder and 10% fly ash by cement.

Experimental programmed

In this stage the experimental work is carried out by using cement, fine aggregate, coarse aggregate, Granite powder and fly ash. The specimens were casted for M30 grade of concrete by replacing the fine aggregate 10%, 20%, 30%, and 40% by granite powder and 10% cement is replaced by fly ash. The fresh concrete is tested for workability by slump test while casted specimen is tested for compressive, flexure and split tensile test at the age of 7, 14 and 28 days. The results are shown in tabular as well in graphical form for both the grade of concrete.

Workability Test

In this work the workability is tested by slump test. When the concrete is freshly mix then it is tested by filling the fresh concrete in the slump cone. The workability is measured by removing the slump cone and measured the subsidence of the concrete this value is called the slump value of the concrete.

The slump value for the M 30 grade of the concrete with using fly ash are shown in the Table. And with using fly ash as cement replacement for M 30 grade is shown in the Table 5.2. There graphical representations are shown in the Figure 5.1.

Table 1 Slump Value of the Different mix M-30 Concrete (with Fly ash)

Designation	Ingredients					Slump Value in (mm)
	Coarse Aggregate %	Fine Aggregate %	Granite Powder %	Cement %	Fly ash %	
$A'_1 - 10$	100	90	10	90	10	75
$A'_1 - 20$	100	80	20	90	10	72
$A'_1 - 30$	100	70	30	90	10	63
$A'_1 - 40$	100	60	40	90	10	56

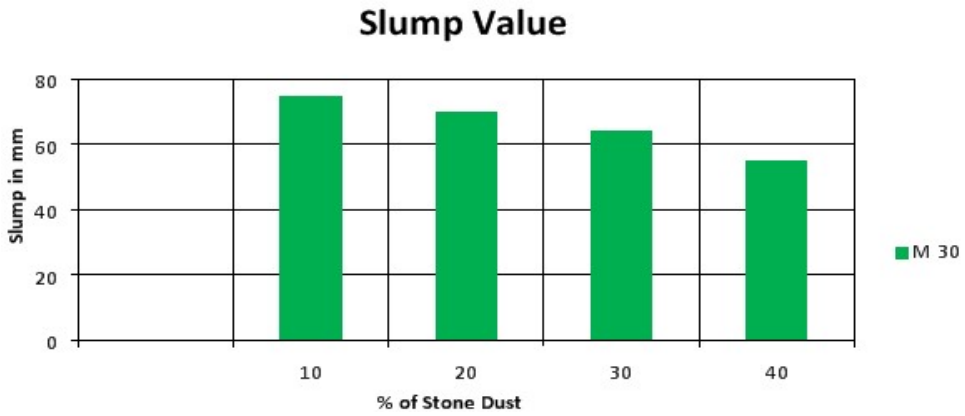

Figure 5.1 Slumps of M-30 with 10% Flyash

Discussion: By analyzing the slump value, it is understand that the slump value is always decreases by increasing the percentage of the Granite powder and replacing the cement by fly ash. The concrete with fly ash (10%) has the slump value lower than that of concrete does not contain any fly ash.

COMPRESSIVE STRENGTH TEST

The result of the compressive strength with partial replacement of Granite powder and without using fly ash for 7, 14 and 28 days are shown for M-30 concrete and their graphical representation in the Figure 5.4 for M-30 Concrete. And by replacing 10% cement with fly ash along with Granite powder is shown in the Table 5.9 for M-30 concrete and their graphical representation is shown in the Figure 5.5 and Figure 5.6 respectively.

Table 2 Compressive Strength of Different Mix of M-30 Concrete (with Flyash 10% & Cement 90%)

Granite Dust	Compressive Strength in N/mm² with 10% fly ash			Sand	Cement	Fly ash %
%	7 Days	14 Days	28 Days	%	%	
0	20.02	26.62	32.52	100	100	0
10	24.74	27.42	34.36	90	90	10
20	25.96	28.9	35.8	80	90	10
30	26.32	29.21	35.26	70	90	10
40	28.8	30.6	36.96	60	90	10

Discussion: From the above table is seen that the compressive strength with 10% fly ash and 90% cement in M 30 grade of concrete at 7, 14 and 28 days increases when the percentage of the Granite powder increase from 10% to40%

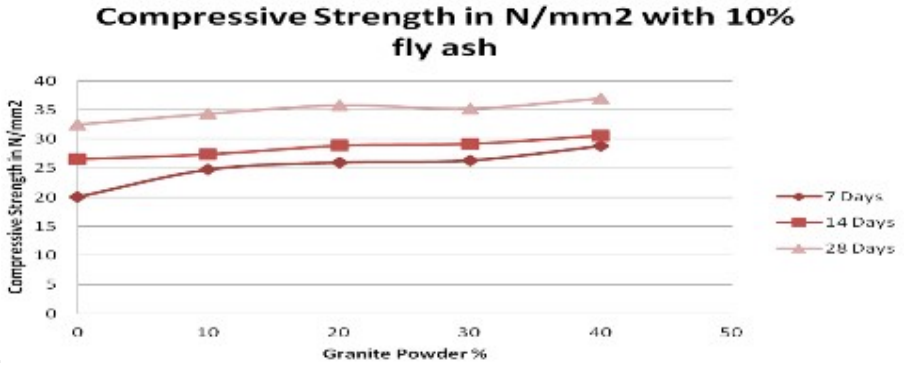

Figure 5.2 Compressive Strength of Different Mix of M-30 Concrete
(With Fly ash 10% & Cement 90%)

FLEXURE STRENGH TEST

The result of the flexure strength with partial replacement of Granite powderand without using fly ash for 7, 14 and 28 days are shown in for M-30 concrete and their graphical representation in the for M-30 Concrete. And by replacing 10% cement with fly ash along with Granite powder is shown in the Table.

Table 3 Flexure Strength of Different Mix of M-30 Concrete (with Fly ash 10% & Cement 90%)

Granite Dust	Flexural Strength in N/mm2			Sand	Cement	Fly ash %
%	7 Days	14 Days	28 Days	%	%	
0	4.12	4.98	5.2	100	100	0
10	4.22	5.41	6.39	90	90	10
20	4.36	5.32	6.69	80	90	10
30	4.82	5.37	7.02	70	90	10
40	4.98	5.38	7.08	60	90	10

Discussion: From the above table is seen that the flexure strength in M 30 grade of concrete with 20% fly ash and 90% cement at 7, 14 and 28days increases when the percentage of the Granite powder increase from 10% to 40%.

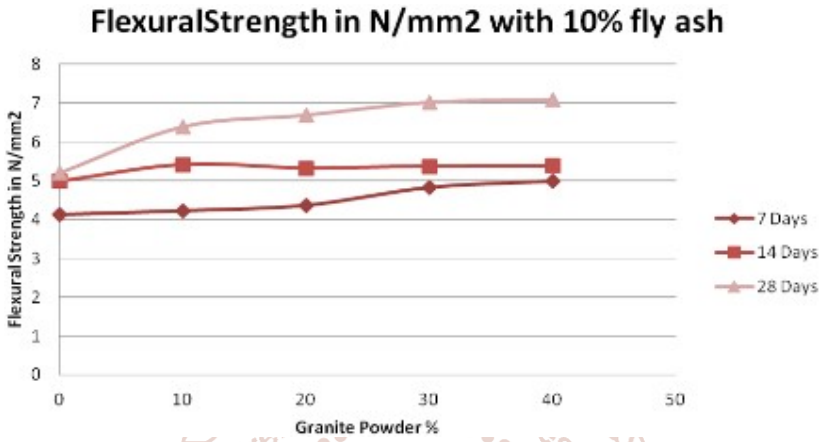

Figure 5.3 Flexure Strength of Different Mix of M-30 Concrete (with Fly ash 10% & Cement 90%)

5.6 SPLIT TENSILE STRENGH TEST

The result of the split tensile strength with partial replacement of Granite powder and without using fly ash for 7, 14 and 28 days are shown in the Table 5.15 for M-30 concrete and their graphical representation in the M-30 Concrete. And by replacing 10% cement with fly ash along with Granite powder is shown in the Table for M-30 concrete and their graphical representation is shown in the Figure.

Table 4 Split Tensile Strength of Different Mix of M-30 Concrete (with Fly ash 10% & Cement 90%)

Granite Dust	Split Tensile Strength in N/mm2			Sand	Cement	Fly ash %
%	7 Days	14 Days	28 Days	%	%	
0	2.26	2.85	3.09	100	100	0
10	3.12	3.75	4.17	90	90	10
20	3.15	3.58	4.25	80	90	10
30	3.18	3.74	4.36	70	90	10
40	3.22	3.96	4.49	60	90	10

Discussion: From the above table is seen that the split tensile strength with 20% fly ash and 80% cement in M 30 grade of concrete at 7, 14 and 28 days increases when the percentage of the Granite powder increase from 10% to 40%.

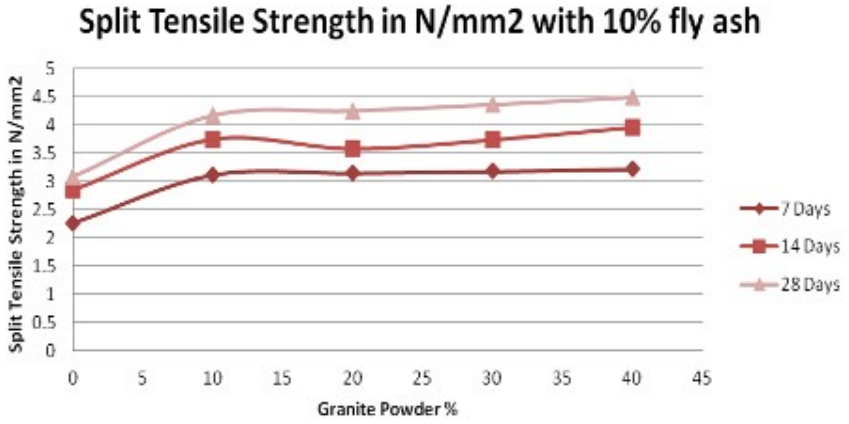

Figure 5.4 Split Tensile Strength of Different Mix of M-30 Concrete (With Fly ash 10% & Cement 90%)

Conclusion

From the above experiments, the study focuses the relative performance of concrete by using the Granite powder as partial replacement of the normal sand and fly ash as partial replacement of cement. From the laboratory study, it can be concluded that the Granite powder is well appropriate for normal sand up to certain limits. And it has better performance as compared to the sand. It is also concluded that the fly ash can be used as cement replacement to certain limits.

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