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EFFECT OF ADDITION OF DIFFERENT PERCENTAGES OF BENTONITE AND FLY ASH ON COMPRESSIVE STRENGTH OF CONCRETE

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Abstract- Concrete is stone like manmade very used construction material and it is prepared by the use of cement, aggregates (Fine and Coarse aggregates) and water. Concrete is very strong construction material. It have very good strength in compressive. It is the most used material after water and its utilization is about a metric ton per annum per capita. Its remarkable properties in fresh and hardened state have raised its usage to 12 billion tons per year globally. It is a cheaper material and performs better than aluminum and steel. This research work is carried out for to investigate the effect of different percentages of Bentonite and Fly Ash on the compressive strength of concrete. In this research Calcium Bentonite and F class Fly Ash is used. Four types of samples are prepared in which M1, M2, M3 and M4 contains (0%Bentonite, 0% Fly Ash),(05%Bentonite, 05% Fly Ash), (15%Bentonite, 15% Fly Ash),(25%Bentonite, 25% Fly Ash) respectively. A 6" by 12" cylinder is used for to determine the compressive strength of concrete and total 36 cylinders were prepared in four groups according to different mix proportions. The composition mixture rate for water-cement (w/c) is 0.59 and target Compressive Strength is 2400kg/m^3.Then, the samples were cured for 7th, 14th and 28th days before testing. The result obtained showed that the concrete with additive material achieved lower compressive strength but the workability was increased.

At 5% addition of Bentonite and Fly Ash maximum Compressive Strength of concrete was achieved.

Keywords- FA: Fine aggregate , CA: Coarse aggregate, FA: Fly ash, BTN: Bentonite , WA: Workability

1 INTRODUCTION

1.1 General

In this research work concrete sample was made according to ASTM C-78. And this research work carried out for to determine the effect of different percentages of Bentonite and Fly Ash on workability and compressive strength of concrete. Different percentages of Bentonite and Fly Ash were replaced by cement at 5%, 15% and 25% by weight. Thirty-six samples was made and cured up to 28 days. Testing was preformed according to ASTM C-78 after 7, 14 and 28 days. Results indicate that compressive strength of concrete decrease as Bentonite and Fly Ash content increase. The increase in amount of both contents the workability increases. The optimum strength of concrete was achieved at 5% of Bentonite and Fly Ash.

1.2 Problem Statement

Cement manufacturing is a very complex procedure. A lot of Carbon dioxide (CO_2) is produced that causes global warming. As present water crisis condition in Pakistan reached at peak point, in making of cement there is lot of water is consumed. Cement is getting uneconomical day by day. This is partly the reason why the majority of the people are left with poor services. On the other hand, concrete is a porous material and concrete may contain some amount of salts and that cause efflorescence in concrete. As well as Bentonite and Fly Ash are useless material on the earth, which effect the aesthetics of natural beauty.

1.3 Objectives

- To investigate the effect of different percentages of Bentonite and Fly Ash on workability of concrete.
- To investigate the effect of different percentages of Bentonite and Fly Ash on compressive strength of concrete.
- To explore the implementation of Bentonite and Fly Ash with different construction activities.

1.4 Scope of Work

This research work will play a greater part in future to guidance of forthcoming researchers who aims to do work on Bentonite, Fly Ash and its "Effects on workability and compressive strength of normal weight concrete" in future. Also, this will help Technologist/Engineer to provide an alternative binding material of cement that will be helpful in making construction more economical as well as strong.

2 RESEARCH METHODOLOGY

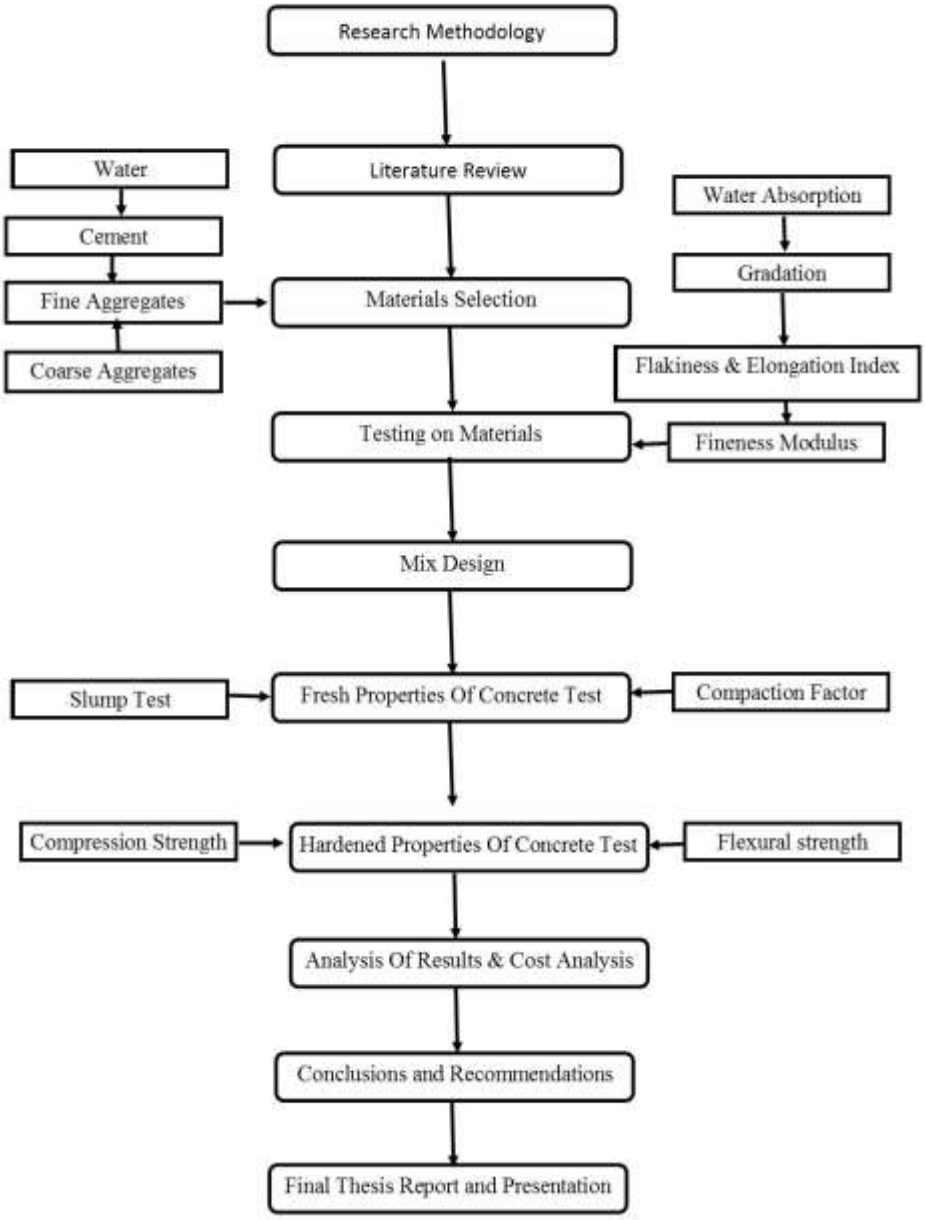

Figure 1: Research Flow Diagram

2.1 Mixing Details

By adding different percentage of Fly Ash and Bentonite 4 type of mixes was made for compression strength test:

- M1 = C (100%) + B (0%) + FA (0%) + S + A
- M2 = C (90%) + B (05%) + FA (05%) + S + A
- M3 = C (70%) + B (15%) + FA (15%) + S + A
- M4 = C (50%) + B (25%) + FA (25%) + S + A

a. Mix Design

In this research work 0.59 value used as Water/cement ratio. And for to achieve 3000 psi compressive strength 1:2:4 ratio was used.

b. Casting & Curing

Sr. No	Curing Days	M1	M2	M3	M4	Total
1	7	3	3	3	3	12
2	14	3	3	3	3	12
3	28	3	3	3	3	12
				Grand Total		36

2.2 Tests of Concrete

Following Tests was performed on Concrete:
2.2.1 Fresh Stage of Concrete

- Workability Test (Slump Test)

2.2.2 Hardened Stage of Concrete

- Compressive strength Test (Compression Test)

2.2.1.1 Slump Test of Concrete

Reference Code: *ASTM C-143/C-143 M-03*

Workability of fresh concrete is determined by slump test: The slump test was performed as per the ASTM C-143 standards guidelines. In this test the slump cone was used. Concrete filled in cone in three equal layers and compressed using 25 strokes of crimping rod. The rod was tempered having a diameter of 5/8in and length of 24 in. The slump test provides a good estimate of expected operability.

Figure 2: Slump Test

3 RESULTS AND DISCUSSIONS

3.1 Compressive Strength Results

For to investigate the compressive strength of concrete cylinder specimen were used at different curing days with different proportioned of Bentonite and Fly Ash.

Compressive strength performed on cylinder as per ASTM standard test method ASTM C-39.

3.1.1 At 7 Days

Table No 02: Average Compressive Strength (MPa) at 7 Days

Sr #	**Days Interval**	**M-1 (0%)**		**M-2 (5%)**		**M-3 (15%)**		**M-4 (25%)**	
		MPA	**KN**	**MPA**	**KN**	**MPA**	**KN**	**MPA**	**KN**
A	**7**								
	I	11.90	210.3	9.61	169.8	6.30	112.5	3.38	59.7
	II	11.73	207.3	10.71	189.2	6.29	111.2	3.91	69.1
	III	11.86	209.7	8.34	147.5	5.57	98.4	3.04	53.7
Average		**11.83**	**209.10**	**9.55**	**168.83**	**6.05**	**107.37**	**3.44**	**60.83**

Table 2: Shows the Average Compressive Strength (MPa) of concrete at 7 Days.

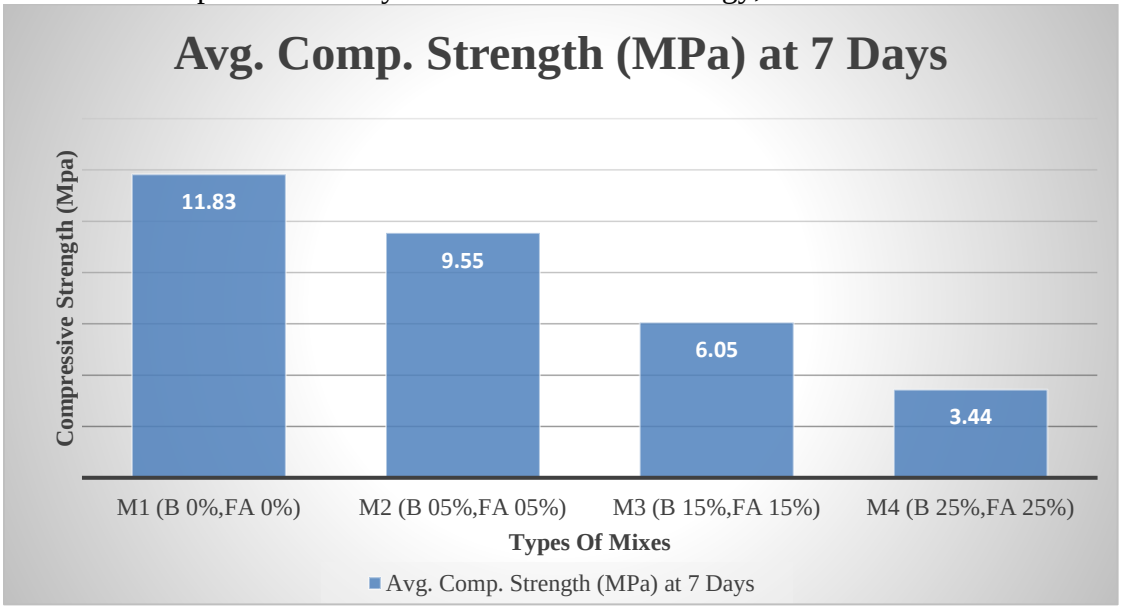

Figure 3: Average Compressive Strength (Mpa) at 7 Days.

After testing of sample at 7 days, M1 show maximum compressive strength and M4 show minimum compressive strength as detail show in table and figure above.

3.1.2 At 28 Days

Table 3: Shows the Average Compressive Strength (MPa) of concrete at 28 Days.

Sr #	Days Interval	M-1 (0%)		M-2 (5%)		M-3 (15%)		M-4 (25%)	
		MPA	KN	MPA	KN	MPA	KN	MPA	KN
C	28								
	I	18.03	318.6	18.07	319.4	10.07	177.9	5.92	104.6
	II	19.73	348.6	18.15	326.26	8.97	158.4	5.16	91.2
	III	18.54	327.7	17.92	316.92	9.55	168.9	4.83	85.4
Average		**18.77**	**331.63**	**18.04**	**320.86**	**9.53**	**168.40**	**5.30**	**93.73**

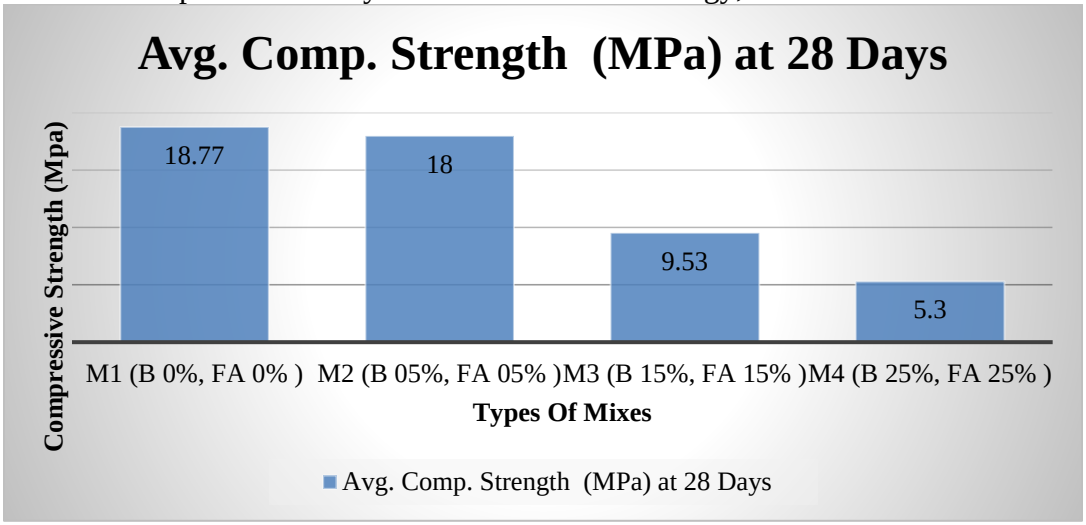

Figure 4: Average Compressive Strength (Mpa) at 28 Days.

After testing of sample at 28 days, M1 show maximum compressive strength and M4 show minimum compressive strength as detail show in table and figure above.

3.1.3 Compressive Strength Comparison at different Concrete days

Table 3: Average Compressive Strength Comparison

No of Mixes	**M-1**	**M-2**	**M-3**	**M-4**
Curing Ages	Mpa	Mpa	Mpa	Mpa
7	11.83	9.55	6.05	3.44
14	17.51	17.42	6.12	4.38
28	18.77	18.04	9.53	5.30

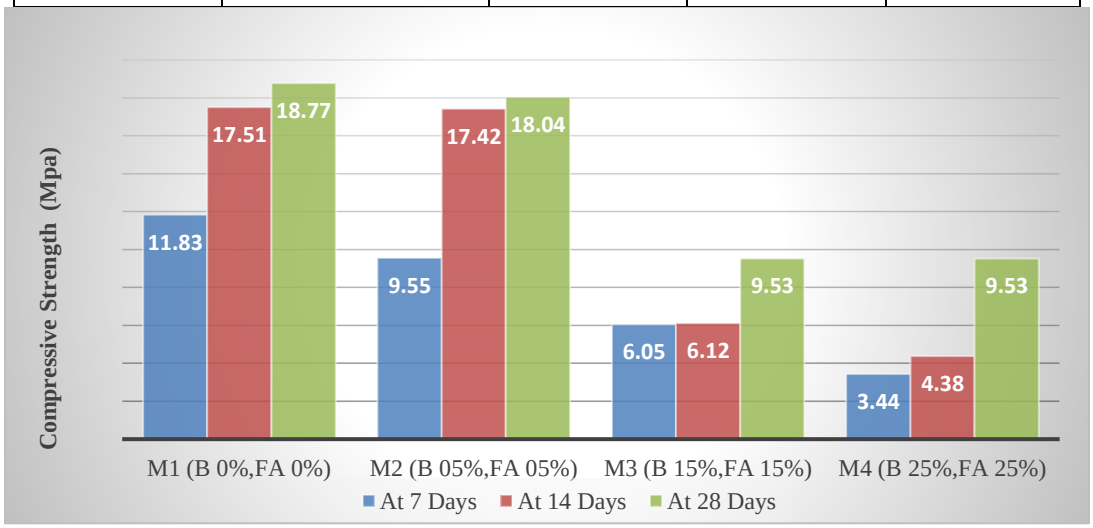

Figure 5: Compressive Strength Comparison

4. CONCLUSION & RECOMMENDATIONS

4.1 Conclusions

- Workability of concrete increase as percentage of Bentonite and Fly Ash increases;
- According to Lab results, Compressive Strength of concrete decrease by increasing the proportion of Bentonite and Fly Ash;
- At 10% of Bentonite and Fly Ash, Concrete achieved maximum compressive strength as compared to other mixes; and
- At 30% & 50% of Bentonite and Fly Ash, the compressive strength of concrete is achieved 45% and 27 % respectively of pure concrete.

4.2 Recommendations

- In this research we use the different proportions of Bentonite and Fly Ash for the scope. However, the other proportion can be used in future research;
- In this research Calcium Bentonite and F class Fly Ash is used. However, the other can be use sodium Bentonite and C class Fly Ash;
- By changing water/cement ratio, can also check the effect on compressive strength & workability of concrete;
- By changing the aggregates (fine & coarse) type, can also check the effect on compressive strength & workability of concrete; and
- By changing Cement types can also check the effect on compressive strength & workability of concrete.

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