



Evaluation of Different Tests and their Comparisons by Combining Cement with Various Binders

Palakurthi Manoj Kumar¹ | Gomasa Ramesh¹ | Dr. Annamalai Rangasamy Prakash²

¹ PG Scholar, Structural Engineering, Vaagdevi College of Engineering, Warangal, India,

² Assistant Professor, Civil Engineering, Vaagdevi College of Engineering, Warangal, India.

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ABSTRACT

Cement and binding materials are very important for any construction of structures. for a good and durable structures binder are plays an important role to achieve good strength and good bond between the two materials. So, by using different types of tests, we can know the strengths and properties of the binder material. in this paper mainly focuses on using of binders with the cement and importance of its and conducted different types of tests to know the properties of the material. in this we used different types of binders which may include GGBS, silica and fly ash and metakaolin etc. all are performed very good in different environmental conditions. So, selection of binders is also depending on suitable environmental conditions and weathering agencies and so on. So, this study is helpful for using of binders with respect to the cement and performances are also very good.

KEYWORDS: GGBS, Fly Ash, Silica Fume, Metakaolin, Binders, Strength Tests.

INTRODUCTION

Cement is one of important material used for all types of constructions in the world. It can be used for all types of works including small, medium and large works. In this paper mainly discusses on importance of cement and binders in the construction industry. Now a days we are seeing lot of different types of cements and binders in the market. Lot of researches are going on binding materials especially cement and fly ash and GGBS. These materials are used with cement for better results. Cement and its production are lengthy process and which includes lot of steps in manufacturing process. Now a day's emissions from greenhouse gases are plays a critical role for damaging the structures. so, by using suitable binding materials we can protect the structure from external agents. In this paper mainly focuses

on binding materials such as metakaolin and fly ash and silica and some of other pozzolanic materials etc. mostly these are used as replacement of cement in the concrete. Lot of researches are going in India as well as other countries.

LITERATURE REVIEW

Morrison et al. (2015)

In this paper author mainly explains on cement and mechanical properties of concrete and which are replacing by using suitable binding materials. Where in this used metakaolin and fly ash mainly for binding materials. Author tests and investigated on cement and its properties specially setting time and soundness etc. author also tested various types of strength tests such as compressive

and tensile and flexural tests. then author got good results in these tests.

Tran et al. (2015)

In this author explains that importance of reinforced concrete structures with respect to marine environments. Most of the RCC structures are damaged due to environmental conditions. This research helps to importance of binding capacity by using the binders. The major problem due to environment is corrosion in RCC structures. by using suitable binders, we can minimize and protect the RCC structures.

Marwen et al. (2013)

This research work helps that chemical and physical effects of binders. These properties are mostly seen during hydration process of cement. By using these properties, we can increase the mechanical properties of the cement and as well as binders. By using these tests, we can estimate the strength and durability to the structures. in these authors are conducted different types of tests like compressive and tensile strength tests and author also got good and acceptable results.

ADVANTAGES OF USING BINDERS

- Increase the Binding Capacity
- Increase load bearing capacity
- Increase the strength
- Increase the performance
- Increase the durability
- Cost effective
- Economical
- Easy to use
- Easy to perform

MATERIALS USED

- Cement
- Fine aggregate
- Water
- Concrete
- Fly ash
- Silica
- GGBS
- Metakaolin

TESTS AND RESULTS

SETTING TIME AND CONSISTENCY RESULTS

S.NO	Replacement %				Standard consistency (%)	Initial setting time (min)	Final setting time (min)
	FA	GGBS	SF	MK			
1	0	0	0	0	33	75	280
2	15	15	5	0	32	90	260
3	15	15	0	10	34	100	300
4	15	0	5	10	33.5	95	320
5	0	15	5	10	34	95	300
6	15	15	5	10	34.5	90	290

COMPRESSIVE STRENGTH OF CONCRETE RESULTS

In this test generally standard cubes are used as per IS Code guidelines. Mould is filled with Concrete and after that tamping is done by using tamping rod. By using this we can remove unnecessary voids, gaps and empty spaces from the mix. Later the surface of specimen is levelled by using suitable trowel. After 24 hours moulds are removed and test specimens are placed into the curing tank. These specimens removed from the curing after 7, 14, 28 days and tested by compression testing machine.



S.N.	Replacement %				Compressive Strength(N/mm ²)		
	FA	GGBS	SF	MK	7 Days	14 Days	28 Days
1	0	0	0	0	29	39	50
2	15	15	5	0	27.4	33.2	43.55
3	15	15	0	10	25.3	29.10	39.2
4	15	0	5	10	35.21	37.21	48.7
5	0	15	5	10	30.1	33.5	47.08
6	15	15	5	10	22.8	25	35.28

SPLIT TENSILE STRENGTH OF CONCRETE RESULTS

For cylinder test, moulds used are dia up to 15 cm and height is about 30 cm. Concrete is placed and the mould is filled in the concrete and tampered properly by using tamping rod for removal of voids and empty spaces in the mixture. Next then specimen top surface is levelled and cleaned by



using trowel. to make a specimen smooth and even in nature. these moulds are removed after 1 day and next the test specimen is kept in the curing tank. These specimens are removed from tank at intervals of 7, 14, 28 days and tested by compression testing machine.

S.NO	Replacement %				Split tensile strength (N/mm ²)		
	FA	GGBS	SF	MK	7 Day	14 Day	28 Day
1	0	0	0	0	3.5	3.71	4.02
2	15	15	5	0	2.21	2.45	2.64
3	15	15	0	10	1.98	2.09	2.27
4	15	0	5	10	2.26	2.39	2.61
5	0	15	5	10	3.11	3.28	3.57
6	15	15	5	10	1.22	1.29	1.52

CONCLUSION

From the above experimental study, we conclude that combining cement with various binders have their own different effects on different tests that are been conducted in this project. These are the major conclusions from the study;

1. Replacement of OPC by FA (15%) +GGBS (15%) +MK (10%) +SF (5%) impact on the increase of the consistency
2. Replacement of OPC by FA (15%) +SF (5%) +MK (10%) impacts on the increase of the setting time. Combining cement with various binders shows the decrease percentage of strength of compressive and split tensile.

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