

USE OF FLY ASH IN CONCRETE

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ABSTRACT

Fly ash, a waste generated by thermal power plants is as such a big environmental concern. The investigation reported in different paper is carried out to study the utilization of fly ash in cement concrete as a partial replacement of cement as well as an additive so as to provide an environmentally consistent way of its disposal and reuse. The cement in concrete matrix is replaced from 5% to 25% by its weight with different proportions. It is observed that replacement of cement in any proportion lowers the compressive strength of concrete as well as delays its hardening.

Keywords: Fly ash, Cement, Compressive strength.

1. INTRODUCTION

As a construction industry is very huge industry which can consume large amount of natural resources. As natural resources are limited and its demand is going to increase as population is increasing. Technician is needed to find and develop a methodology to minimize the consumption of resources. In India, construction development is on its peak, generally fly ash is a waste product of coal burning and it can be used in concrete as an additional substitute or with partial replacement to cement.

Fly ash is a by-product of burning pulverized coal in an electrical generating station. Specifically, it is the unburned residue that is carried away from the burning zone in the boiler by the flue gases and then collected by either mechanical or electrostatic separators. The heavier unburned material drops to the bottom of the furnace and is termed bottom ash.

Fly ash is the finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chamber by exhaust gases. Over 61 million metric tons (68 million tons) of fly ash were produced in 2001. It is called fly ash because it is transported from the combustion chamber by exhaust gases. Fly ash is the fine powder formed from the mineral matter in coal, consisting of the noncombustible matter in coal and a small amount of carbon that remains from incomplete combustion.

Concrete is a composite material composed of aggregate bonded together with a fluid cement that cures over time. Concrete is the second-most-used substance in the world after water, and is the most widely used building material. Its usage worldwide, ton for ton, is twice that of steel, wood, plastics, and aluminium combined.

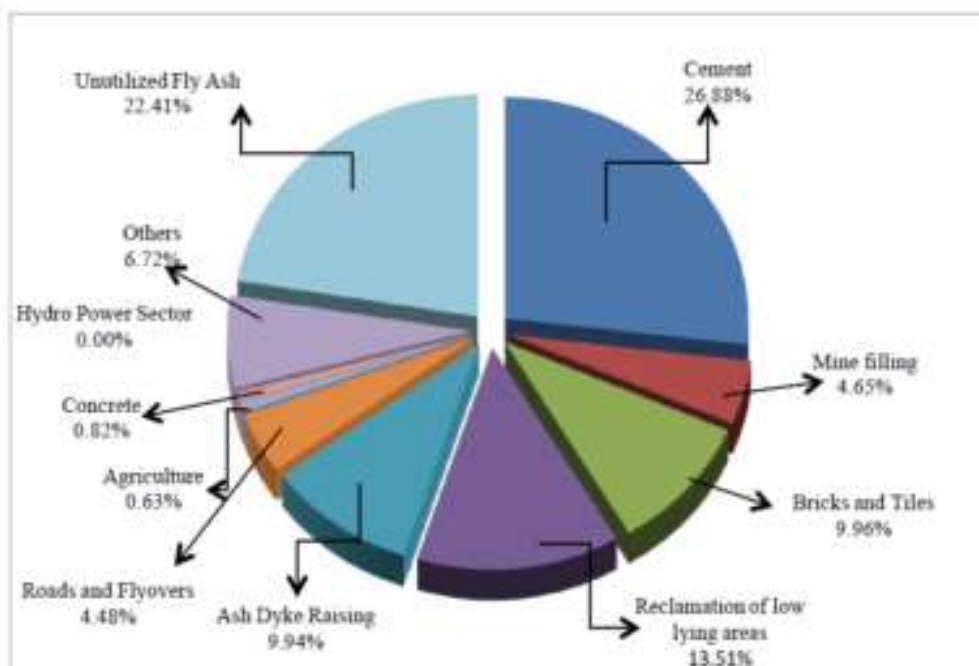


Fig 1: Major modes of fly ash utilization during the year 2018-19

Chemical Properties of Fly Ash

Fly ash is compare with portland cement in below table:

Sr.no.	Constitute materials	Portland cement	Fly ash
1.	CaO	60.74	6.33
2.	SiO ₂	21.82	53.39
3.	Al ₂ O ₃	6.49	16.07
4.	SO ₃	2.62	1.06
5.	Fe ₂ O ₃	1.93	13.05
6.	MgO	1.08	5.48
7.	Na ₂ O ₃	0.14	1.59

2. METHODOLOGY

1.2 Effect Of Addition Of Fly Ash On Concrete

1.2.1 Workability

The use of good quality fly ash with a high fineness and low carbon content reduces the water demand of concrete and, consequently, the use of fly ash should permit the concrete to be produced at a lower water content when compared to a portland cement concrete of the same workability. Although the exact amount of water reduction varies widely with the nature of the fly ash and other parameters of the mix, a gross approximation is that each 10% of fly ash should allow a water reduction of at least 3%. A well-proportioned fly ash concrete mixture will have improved workability when compared with a portland cement concrete of the same slump. This means that, at a given slump, fly ash concrete flows and consolidates better than a conventional portland cement concrete when vibrated. The use of fly ash also improves the cohesiveness and reduces segregation of concrete. The spherical particle shape lubricates the mix rendering it easier to pump and reducing wear on equipment.

1.2.2 Bleeding

Generally fly ash will reduce the rate and amount of bleeding primarily due to the reduced water demand. High levels of fly ash used in concrete with low water contents can virtually eliminate bleeding. Therefore, the freshly placed concrete should be finished as quickly as possible and immediately protected to prevent plastic shrinkage cracking when the ambient conditions are such that rapid evaporation of surface moisture is likely. An exception to this condition is when fly ash is used without an appropriate water reduction, in which case bleeding (and segregation) will increase in comparison to portland cement concrete.

1.2.3 Setting Time

The impact of fly ash on the setting behavior of concrete is dependent not only on the composition and quantity of fly ash used, but also on the type and amount of cement, the water-to-cementitious materials ratio (w/cm), the type and amount of chemical admixtures, and the concrete temperature. It is fairly well-established that low-calcium fly ashes extend both the initial and final set of concrete. During hot weather the amount of retardation due to fly ash tends to be small and is likely to be a benefit in many cases. During cold weather, the use of fly ash, especially at high levels of replacement, can lead to very significant delays in both the initial and final set. These delays may result in placement difficulties especially with regards to the timing of finishing operations for floor slabs and pavements or the provision of protection to prevent freezing of the plastic concrete. Practical considerations may require that the fly ash content is limited during cold-weather concreting. The use of set-accelerating admixtures may wholly or partially offset the retarding effect of the fly ash. Higher-calcium fly ashes generally retard setting to a lesser degree than low-calcium fly ashes, probably because the hydraulic reactivity of fly ash increases with increasing calcium content.

1.2.4 Effect on compressive strength

Compressive strength test was performed to determine the maximum load that can be received by concrete. The testing tool of compressive concrete strength is the UTM (Universal Testing Machine). It can be seen that the greater the percentage of use of Fly Ash as a substitute for cement, the compressive strength decreases. Fly Ash which cannot react causes the binding strength of the concrete mixture to decrease and the result is the strength of the concrete decreases

1.2.5 Finishing and Curing

The use of fly ash can lead to significant retardation of the setting time, which means that finishing operations may have to be delayed. At normal temperatures, the rate of the pozzolanic reaction is slower than the rate of cement hydration, and fly ash concrete needs to be properly cured if the full benefits of its incorporation are to be realized. When high levels of fly ash are used it is generally recommended that the concrete is moist cured for a minimum period of 7 days. If adequate curing cannot be provided in practice, the amount of fly ash used in the concrete should be limited. The finishing and curing of requirements for high-volume fly ash concrete exposed to cyclic freezing and thawing which affect on Fly Ash on the durability concrete.

3. CONCLUSION

From various research it has been clear that fly ash can be utilize as additional constitute in concrete. Fly ash reduces the bleeding and heat of hydration. Addition of fly ash increases the workability, setting time. The addition of fly ash reduces the compressive strength in certain amount. The main advantages of addition of fly ash in concrete is reduction in disposal problem and reduction in CO₂ emission with reduction of green house gas effect.

4. REFERENCES

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