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Analysis of Fly Ash In Cement Concrete Pavement For Road Construction

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Abstract:

The main aim of study is to analyze the compressive strength of fly ash cement concrete for the pavement for road construction in a standard way. From research, it has been observed that use of 30% of fly-ash & 70% of cement possess a superior bond and performence.Industries produced fly ash in huge quantity, so using this waste in the construction of roads help to dispose the fly-ash and also help to reduce the pollution created by this waste. A number of experiments were conducted on fly-ash to check its properties, may be used in the development of roads, dam construction etc. Fly-ash used in my project is collected from sidco industrial area Rangreth Srinagar J&K. In this project partially replacement of cement will be replaced by the fly-ash with proportions 15%, 25%, and 35% by mass respectively. Workability is improved and water demand is reduced when percentile volume is added to concrete. To determine the properties of fly-ash such as compressive strength, specific gravity, workability, consistency etc which can help more in account of construction. If the industrial waste can be considered as an alternative to concrete used for the development of road construction it will enhance the stability of pavement and will reduce the overall cost.

Keywords: Concrete Mixture, Fly-ash, Compressive Strength, Construction Material, Road Pavement.

Introduction:

In 1929 during the construction of Hoover dam in U.S where engineers start to use fly ash concrete in structure. In India, first used in RIHAD dam. One of the most development of any country is

electricity and roads. While talking of India, major source of power generation are based on coal-based thermal power plant. Through these coal-based thermal power plants large amount of flyash is obtained. Fly ash is a by-product of coal-fired electric generating plants. Fly ash is a fine powder produced as a product from industrial Plants using pulverized coal or lignite as fuel .It is the most widely used pozzolona siliceous or alumina siliceous in nature in a finely divided form .They are spherical shaped "balls' 'finer than cement particles. Fly ash is a fine, glass like powder recovered from the gases of coal fired electricity production Inexpensive replacement of Portland Cement Improves strength, segregation and ease of pumping the concrete. these by products are highly heterogeneous consisting with various crystalline phase like quartz and oxides of iron. Although flyash cement itself is less dense than Portland cement, the produced flyash concrete is denser and results in smoother surface with sharper details.

Objective And Scope Of The Study:

The most important and significant benefit of flyash is that it reduces the permeability to water and aggressive chemicals. Properly cured concrete made with fly ash creates a denser product because the size of pores is reduced which increases strength.

Objective Of This Study:

To tests and analysis on flyash concrete prepared by flyash optimum replacement with cement.28 days compressive strength of flyash concrete is to verified.

Scope Of Work:

Following procedure to be done for this work-

- Experiment is to be conducted to check out the physical properties of materials used.
- Proper propositions of materials should be mixed well and molded in a cube
- In this experiment, normal grade of cement have to taken.
- Prepare flyash concrete by mixing flyash with maximum replacement of cement. Various specimen mixing propositions of cement & flyash prepared ,replacement of cement by weight 0%,15%,25%, and 35% by flyash.
- These specimens of flyash cement concrete are to be tested & normal 28 days compressive strength is to be checked.
- Analyzing the desired results.

Uses of Flyash in Construction:

Flyash used in concrete improves the workability and stability of concrete and thre strength and durability of hardened concrete. It cab be used as prime material in cement based products such as poured concrete, concrete blocks bricks etc.It was also used in ancient times but in very low amount, but during nowadays coal thermal plants produces trillions of flyash which can be used in construction and protect the environment from pollution.Flyash is used as follows:

- In 1929 flyash concrete was ist used in a dam known as Hoover dam located at U.S.
- Nearly about 130,000 metric tons of fly ash concrete is used in Horse Dam which is located at Hugary built in 1948 by Bureau Of Reclamtion in five Years.
- High Volume Flyash Concrete (HVFAC) was also used in seven storey building of ice space in canada with compresssive stregth 40-50N/mm2
- The ash generated from Volcanoes was used extensively in the construction of Roman structures. Colosseum is a classic example of durability achieved by using volcanic ash. This is a building constructed 2000 years ago and still standing today.
- The Pantheon temple and the Roman Coliseum were built with high volumes of volcanic ash in the cement mixture. The Pantheon, built in Rome in 128 A.D.

Chemical Composition:

Table No 1:

Materials	Portland Cement %	Fly Ash %
SiO_2	21.82	53.39
Fe_2O_3	1.93	13.05
CaO	60.74	6.33
MgO	1.08	5.48
SO_3	2.62	1.06
Na_2O	0.14	1.59
Free CaO	0.84	0.11

Experimental study working procedure :

The work done in this experiment are as follows:

1. Collection of Materials
2. Check Physical
3. Mixing Process

4. Casting And Moulding Process
5. Curing Process
6. Analysis & Testing Process.

Material Used:

Cement: For this executed work, Ordinary Portland cement grade (43) was used having specific gravity 3.15

Fine Aggregates: Fine aggregates conforming to zone 1 was used with specific gravity of 2.62, testing of sand was done as per IS 383-1970. Water absorption of fine aggregates was found to be 0.5%

Coarse Aggregates: The aggregates used have maximum size of 20mm with a specific gravity of 2.66, the grading test was done as per IS 383.1970. Water absorption of coarse aggregates was found to be 0.3%.

Water: Potable water was used which was free from impurities. The pH value of water was not less than 6.

Flyash: Flyash was used with accordance to IS 3812. The specific gravity of flyash is 2.27.

Methodology:

Mix Design: Mix design executed throughout this research for M30 grade weighed in proper way.M30 grade of concrete having propositions of 1:1.73:2.63 with adopted water ratio of 0.45 was used. There was no any addition of chemical admixtures.

Casting Or Molding Process: The size of cubes in which concrete mix were moulded was 150*150*150*mm3.The cubes consisting of 12 No's with Designed grade of concrete M30 in which 6 cubes were tested after 7 days and rest 6 cubes were tested after 28 days. The concrete designed were mixed by hand and compacted well by tapping and rodding so that no voids left in the concrete.

Curing Process: The cubes were de-moulded after 24 hrs and these concrete cubes must be immersed 16 to 24hr at a temperature of 27 +/- 5 C in water so that it will attain maximum strength and were cured for 7 days & 28 days accordingly. Curing plays a significant role in obtaining the strength of concrete.

Testing Details: Compressive strength tests of concrete cubes casted with different percentages of flyash was conducted at 7 & 28 days to find out the compressive strength of concrete. whether by means of compressive strength or not in comparison to conventional plain concrete. The testing of the cube to find the compressive strength of cube is done by the machine called Compression Testing Machine (CTM). Testing of specimen is shown in fig:

Test Results & Analysis: Various tests were conducted during the experimental work on materials and concrete.the 7 and 28 days cube compressiive strength of plain and flyash concrete cube specimens are in tabular forms below:

Table No 2: Below tests were performed during the tests

1.	**Physical Properties of cement** 1. Specific Gravity 2. Fineness Modulus 3. Initial Setting Time Of Cement 4. Moisture Content	 3.15 10% 35 – 40 Minutes 29 P
2.	**Property of Flyash** 1. Moisture Content 2. Specific Gravity	 20.12% 2.27
3.	**Property of Fine Aggregates** 1. Standard Consistency 2. Moisture Content	 2.69 9.22%

Table No 3: (Results obtained at 7 days)

Grade of Concrete	Sample No	%age of Flyash	Load KN	Compressive Strength (N/MM^2)	Average Compressive Strength (N/MM^2)
M30	1	0	450	20.00	20.41
	2	0	466	20.71	
	3	0	462	20.53	
M30	1	15	499	20.17	20.73
	2	25	466	20.71	
	3	35	435	19.33	
M30	1	15	356	15.82	15.45
	2	25	349	15.51	
	3	35	338	15.02	
M30	1	15	331	14.70	14.45
	2	25	326	14.48	
	3	35	319	14.17	

Table No 4: (Results obtained at 28 days)

Grade of Concrete	Sample No	%age of Flyash	Load KN	Compressive Strength (N/MM^2)	Average Compressive Strength (N/MM^2)
M30	1	0	849	37.73	37.74
	2	0	851	37.82	

	3	0	848	37.68	
M30	1	15	904	40.17	39.13
	2	25	888	39.46	
	3	35	850	37.77	
M30	1	15	800	35.55	33.37
	2	25	750	33.33	
	3	35	703	31.24	
M30	1	15	779	34.62	32.04
	2	25	714	31.73	
	3	35	670	29.77	

Conclusion:

Based on the experimental results obtained from the investigations. Compressive strength test done to check the quality and compressive strength of the flyash concrete and the normal concrete. Points below are the conclusions :

- The introduction of fly ash in cement concrete proved to enhance the overall compressive strength of concrete by 10.11% when cement was replaced by flyash in various percentages
- It was seen that the specific gravity of flyash was less than the specific gravity of cement.
- By means of an average compressive strength of concrete there was an increase of 5.6%
- Plain concrete absorbs less water than flyash concrete.
- Replacement of flyash partially with cement for the construction of road pavements are safe to sustain better quaility
- Flyash is also an environmentally ecofriendly solution, so while using it in for the construction purpose no threat to environment.

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