COST ANALYSIS OF CONCRETE USING PLASTICS AS A REPLACEMENT OF NATURAL AGGREGATES

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ABSTRACT
Concrete is the most widely used construction material in today's world. It is very difficult to point out another nstruction as versatile as concrete. It is a material of choice where strength, durability, permanence, impermeability, fire resistance and abrasion resistance are required. It is so closely associated now with every human activity that it touches every human being in day today living. The basic materials required for producing concrete include cement, fine aggregate (sand), coarse aggregate (broken stone or boulders) and water. Sand and coarse aggregate required for making concrete are obtained from earth's crust, mainly from river basins. The extraction of aggregates from rivers has led to deterioration of river basins, large scale soil erosions, depletion of water table, decrease in sediment supply and has also led to increase in pollution and changes in pH level. Concrete being a crucial building material is utilized all over the world in billions of tonnes annually and the consumption is increasing at a faster rate with the every passing year. The requirement of aggregates is also increasing with increase in the production of concrete.This large scale extraction of aggregates will ultimately lead to irrepairable damages to the earth's natural resources.So, we need to search for new construction materials. A no. of innovative ideas have been put forward by many researchers suggesting the potential replacements of conventional concrete constituents, particularly coarse and fine aggregates. Plastic wastes in the form of powder as well as solid pieces have also been suggested as potential replacements of conventional sand and stone aggregate. Use of plastic wastes will not only help in reducing the adverse affects if plastic pollution but will also help in producing economical and light weight concrete.In my experimental work, I am going to prepare concrete by replacing certain percentage of fine and coarse aggregate by plastic waste powder and solid plastic waste pieces respectively, and find its effects on physical properties as well as the decrease in pollution due plastic wastes and economic characteristics of concrete.

INTRODUCTION

Concrete is a composite construction material which is prepared by mixing an aggregate like sand or broken stone with dry Portland cement and water forming a plastic mass that can be easily moulded into any shape. The cement reacts chemically with water to form a hard matrix which binds all the materialstogether into durable stone like material called concrete. Certain materials are added to concrete to increase its properties like tensile strength, flexural strength, impact strength, this type of concrete is called reinforced concrete. The reinforcing materials used may be steel bars, fibres like asbestos, nylon, glass etc, polymers like polyster-styrene, methyl meta-crylate. Nowadays, experiments have been made for using plastics in concrete.Concrete is a crucial building material utilized all over the world. Concrete is best known for its long-lasting and dependable nature. However, additional ways that concrete contributes to social progress, economic growth, and environmental protection are

often overlooked. Concrete structures are superior in energy performance. They provide flexibility in design as well as affordability, and are environmentally more responsible than steel or aluminum structures.

The concrete industry is today consuming billions of tonnes of concrete every year. All the materials required to produce such huge quantities of concrete from the earth's crust, thus depleting its resources every year creating ecological imbalance and environmental problems.

EXPERIMENTAL INVESTIGATION

Four trails were conducted in this investigation. Fine aggregate was replaced with 0 % polyethylene plastic powder in first trail, 3 % in second trail, 6 % in third trail and 9 % in fourth trail. The quantity of cement, fine aggregate, coarse aggregate and polypropylene powder used per 150 mm x 150 mm x 150 mm cube in each trail is given in the table below.

Trail	Percent Fine Aggregate Replaced	Cement kg	Fine Aggregate Kg	Coarse Aggregate kg	LDPE Powder kg	Water kg
Trail 1	0 %	1.39	2.18	3.93	0.00	0.62
Trail 2	3 %	1.39	2.11	3.93	0.066	0.62
Trail 3	6 %	1.39	1.99	3.93	0.132	0.62
Trail 4	9 %	1.39	1.78	3.93	0.198	0.62

5.1 SLUMP TEST RESULTS OF FRESH CONCRETE

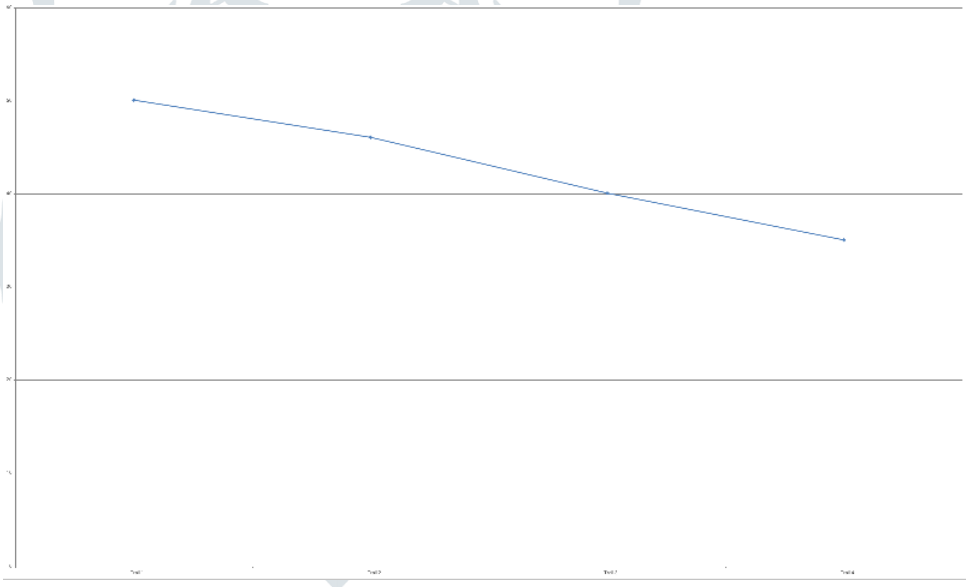
The slump test for each of the four trails was conducted and the observations are given in the table below.

S. No.	Trail	Percent Fine Aggregate Replacement	Slump Value (mm)
1	Trail 1	0%	50
2	Trail 2	3%	46
3	Trail 3	6%	40
4	Trail 4	9%	35

5.1.1 POLYETHYLENE POWDER PERCENTAGE VS SLUMP VALUE GRAPH :

SLUMP VALUE

Cmm)



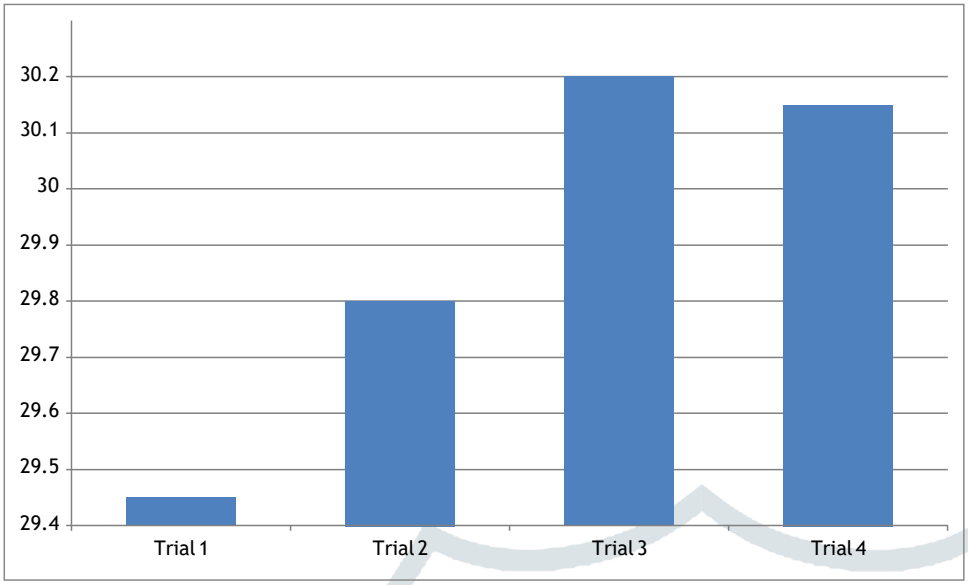
5.2

COMPRESSIVE STRENGTH TEST

For each of the four trails three cubes were casted. Each of the cubes was test for copresssive strength after 28 days of curing in compression testing machine. The observations of the compression test are given in the table below.

S. No	Percent Fine Aggregate Replacement	Grade Of Concrete	Compressive Strength N/mm^2			Average Compressive Strength N/mm^2
			CUBE 1	CUBE 2	CUBE 3	
1.	0 %	M 25	30.31	29.53	28.52	29.45
2.	3 %	M 25	30.00	30.45	29.00	29.80
3.	6 %	M 25	29.82	30.43	30.25	30.20
4.	9 %	M 25	30.40	29.95	30.10	30.15

5.2.1 POLYETHYLENE POWDER VS COMPRESSIVE STRENGTH GRAPH :



Y-A XIS INDICATES THE COMPRESSIVE STRENGTH IN N/mm^2

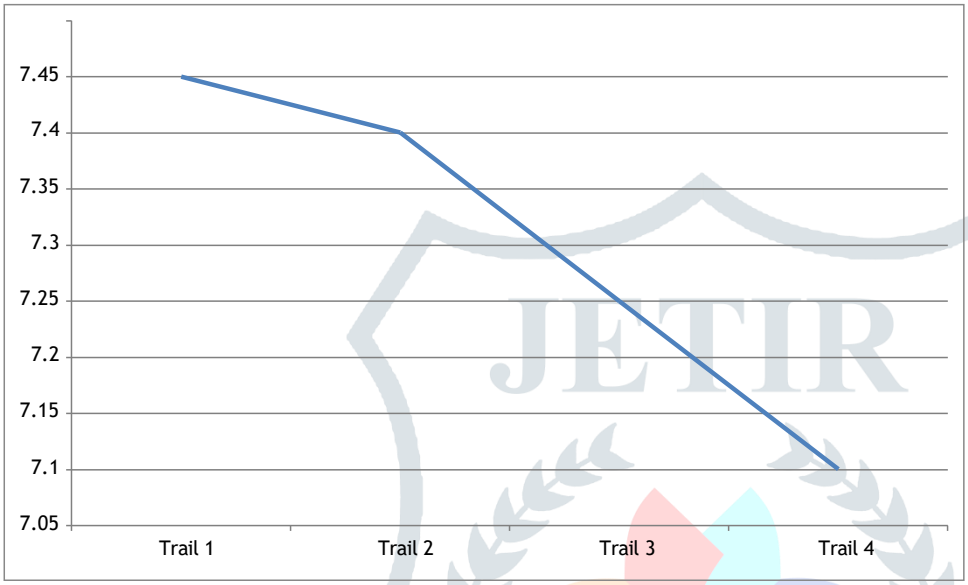
4.2 WEIGHT ANALYSIS :

The weight of the cubes in each trial was found out and the observations are given in the table below.

S. No.	Trial	Percentage of fine aggregate replacement	Weight kg			Average Weight kg
			Cube 1	Cube 2	Cube 3	
1.	Trail 1	0 %	7.50	7.45	7.40	7.45
2.	Trail 2	3 %	7.35	7.40	7.40	7.40
3.	Trail 3	6 %	7.25	7.20	7.30	7.25

4.	Trail 4	9 %	7.10	7.05	7.15	7.10

5.3.1 GRAPH SHOWING THE VARIATION OF WEIGHT WITH POLYETHYLENE POWDER CONTENT :



Y-A XIS INDICATES THE WEIGHT OF CONCRETE CUBES IN KILOGRAM.

CHAPTER – 6 COST ANALYSIS

1. NORMAL CONCRETE :

Cost per kg of fine aggregate = Rs 5.00 Quantity of fine aggregate used in one M 25 cube = 2.18 kg

Cost of fine aggregate used in one cube = 2.18 x 5.00 = Rs 10.9 Quantity of fine aggregate required for producing 1 m^3 M 25 concrete = 647 kg

Cost of fine aggregate per cubic meter of m 25 concrete = 647 x 5 = Rs 3235

2. MODIFIED CONCRETE :

- 3 % Replacement of Fine Aggregate :

Cost per kg of polyethylene powder = Rs 3.50

Cost incurred per cube in fine aggregate at 3 % dosage

= 2.11 x 5.00 + 0.0654 x 3.50

= Rs 10.7

Cost incurred in fine aggregate in 1 m^3 of concrete at 3 % dosage

= 627.59 x 5.00 + 19.14 x 3.5

= Rs 3205

Saving per cubic meter of M 25 concrete at 3 % dosage

= 3235 – 3205 =Rs 30

- 6 % Replacement of Fine Aggregate :

Therefore, saving per m^3 of M 25 concrete at 6 % dosage = 30 + 30

= Rs 60

- 9 % Replacement of Fine Aggregate :

Saving per cubic meter of M 25 concrete at 9 % dosage = 30 + 30 +

30

= Rs 90

The cost per cubic meter of concrete seems to decrease by a small margin at these dosage but keeping in mind that billions and billions of cubic meters of concrete are produced every year throughout the world. Therefore even at these small dosages there is an enormous scope of saving money and resources.

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