AN EXPERIMENTAL STUDY OF EFFECT OF REINFORCEMENT ON STRESS-STRAIN BEAHAVIOUR

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ABSTRACT:

In India, approximately 73% of total install power production capability is from thermal in which coal-based production contributing 90%. Most of the thermal power stations and several captive power plants used bituminous and sub-bituminous coal and produced large quantities of fly ash as a residue and these are disposed of on-site impoundments behind engineered earth dam. The country's faith on coal for power production has unchanged. Thus fly ash management is a cause of concern for the future. One of the finest applications of fly ash is using it as a construction material as embankments, fills and others.

In the present study, an attempt had made to learn the properties of fly ash and properties of GI reinforcement and effect of the reinforcement on the stress-strain behavior of fly ash. A comprehensive set of laboratory uni- axial compression tests were carried out on fly ash with dry density and different optimum moisture content (OMC) which are obtained from standard proctor test. Uni- axial compression tests are done on fly ash with and without reinforcement. The above procedure repeated using dry density and optimum moisture content obtained from the modified proctor test. The stress strain behavior was analyzed by changing galvanized (GI) reinforcement numbers and location. The influence on number & location of GI iron reinforcement on stress strain behavior of sample were studied. It was observed that the inclusion of GI reinforcement increases the peak stress; axial strain at failure. It is observed that increase the numbers of GI reinforcement effect of reinforcement on fly ash also decrease and also observed that decrease the percentage of moisture content strength of fly ash increase. In general, inclusion of reinforcement in fly ash layer can greatly increase the strength, stiffness of fly ash layer thereby comparable strength can be obtained even with decrease of thickness of layer.

Keywords: *Uni-axial Compression Test, GI Effect, Stress-Strain Behavior, Fly ash.*

INTRODUCTION

Composite materials consisting of more than one chemically distinct ingredient on a macro scale having a discrete interface separating them and having bulk performance which is considerably different from those of any of its individual constituents. Whether they used in buildings, bridges, pavements, or any other of its abundant areas of service, composite must have strength, the capability to combat force. The forces to resist may result from applied loads Composites are materials that include strong load carrying material known as reinforcement. . Reinforcement provides strength, stiffness and helping to support the load.

Fly ash, residue from coal based thermal power plants, and comprise of fine particles that rise with the chimney gases. The quantity of fly ash collect from furnace lying on a single plant can differ from a lesser amount of than one ton per day to several tons per minute. Normal we divided fly ash into 2 different categories; depend on their basis and their chemical and mineralogical work. Ignition of anthracite or bituminous coal commonly produce low-calcium fly ashes; high-calcium fly ashes product from flaming lignite or sub-bituminous coal. Both types have a preponderance of amorphous glass. Fly ash is a general term given for both bottom ash and pond ash. However, these ashes generally coming from coal plants and depending on storage, size these ashes. Fly slag is typically catch by electrostatic precipitators or other molecule filtration supplies before the vent gas achieve the stacks of coal-let go force plants, and working together with bottom cinder expelled from the lowest part of the heater is for this situation mutually known as coal powder. Contingent on the source and cosmetics of the coal being smoldered, the segments of fly slag shift impressively, yet all fly powder incorporates considerable measures of silicon dioxide(sio2) (both indistinct and crystalline) and calcium oxide (Cao), both being endemic elements in numerous coal-bearing rock strata. Pulverization of solid fuels for the large boilers used in power stations generates an instant, urgent quandary safe umping of fly ash, a waste conclusion of thermal power plants, is a challenge that the engineers and environmentalist are facing in the modern era of urbanization.

LITERATURE REVIEW

This section provide the background information on the issues Consider in the present research effort and to focus the significance of the current study, the work already done so far and also to show the relevance of the current research work. Fly ash has been using an element for use of in concrete 1915. Though, for the first time the use of fly ash in the concrete conduct by Davis et al. (1937). Abdun Nur (1961) compile information under the property and uses of fly ash from the literature from 1934 to 1959 including an annotated bibliography. Several other extensive review papers on the use of fly ash in concrete published over the years (Synder 1962. Joshi 1979, Berry and Malhotra 1985 and 1987, Swamy 1986) [2].

Before 1980 maximum research on literature for the fly ash in concrete maximum coming from power, chosen as Class F pozzolans in ASTM condition. Before 1960 only class F fly ash is there and then we found the applications of this fly ash next uses and disadvantages of class F fly ash found. Joint tests were conducted by ASTM group C-9 (1962) and study on the main exclusivity of Class F fly ashes was account by Minnick (1959) from side to side this period.[2]

In the power plants burning of coal in maximum of carbon burned.th the burning of pulverized coal in suspension-fired furnaces of modern thermal power plants, the unstable matter carbon burned off. In these carbon ash minerals like clay, quartz, feldspar formed in different temperature. The slog particles and unburned carbon are collected as ash. The particles which have big size particles fall down in bottom, we can collect those type particles by bottom furnace The finer particle that get away with chimney gas are composed as fly ash using cyclone separators, electrostatic precipitators or bag houses[3]. Max of 86- 99% ash collected from the various furnaces from the fuel gases are fly ash only. in total coal ash up to 80% fly ash only remaining bottom. Generally Fly ash is pozzolanic or sometimes self cemantinous due to mineralogical concerto. The ash collected from bottom of the furnace is maximum pozzolanic nature. The ash released in the power plants not only fly ash it also contains different minerals and all the power plants not produce equal amount of pozzalanic so we have to take care while using in the concrete while mixing[3].

METHODOLOGY

DETERMINATION OF SPECIFIC GRAVITY:

Objective: find the specific gravity of fly ash

Use of this test:

We may know that about specific gravity and what there uses; where we used this test like find the fly ash properties void ratio, degree of saturation etc.

Apparatus Required

1. Glass bottle of 60 ml with hole.
2. Weighing machine
3. Cleaning bottle with good water.

Procedure

1. Remove the waste from bottle and wash with good water and dried it.

It followed 3 steps below

(a) Clean the bottle with water and dry it

(b) Clean the bottle with alchol.

(c) Clean the bottle again with water and dry it.

2. Note down the weight of the empty glass bottle (w1)
3. After that take the 15 grams of fly ash and fly ash must be passing 4.75 mm and fill in the bottle. Measure the weight of the glass bottle which is filled with fly ash (w2).
4. Next take water nearly 25 ml and pour into glass bottle. It is sued for the soaking fly ash in glass bottle. Don't disturb this sample up to 30 min.
5. Next fill the water in glass bottle completely.
6. Take the bottle outside and clean the outside edges and measure the weight (w3)

Observation & Calculation:

Specific gravity of flyash

$= W_2-W_1$

$(W_2-W_1)-(W_3-W_4)$

Results: Specific gravity of the sample =2.43

COMPACTION TEST

Standard Proctor Test

To determine maximum dry density (M.D.D.) and optimum moisture content (O.M.C.) of Fly ash by the standard proctor method.

THEORY

This procedure find the most favorable quantity of water be diverse with a flyash : - Sequentially to acquire maximum compaction a given comp active effect. This will enable the field engineering to plan field compaction of the soil to a degree comparable to that obtain in the lab by properly varying the effective raise or amount of passes with the existing roller. Maximum energy lead to maximum dry density and hence the buckle and force distinctiveness of the fly ash turn out to be finest probable value. The test named as standard proctor test because of R.R. Proctor (1933). This test gives satisfy result for the cohesive soils like fly ash but we can't get proper result if use for the cohesion less soils like gravels because we can't compact properly with hammer because the gravel displaces while compacting. If u wants higher density u has to use max energy for compaction. For this modified proctor test is adopted:

1. for this test we have take mould in cylindrical shape metal mould, dimension mould 100cm diameter having and height 125 mm volume 1000 ml.
2. Detachable bottom platter.
3. Neck 5 cm in efficient height
4. Rammer 2500 grams in collection declining from a height of 305 mm.

For this test we have to compact the soil in in 3 different layers with same height of fall hammer 305mm, same hammer with weight 2500grms. We have compact each layer by 25 blows. Here for the finding the dry density for every test we have to calculate mass of compacted fly ash and water content. The comp active power worn meant for this test is 6066 kg 100 ml of fly ash. For this test we have take approximately 2.4 kg of fly ash which are passing 4.75mm sieve. Next take approximate amount of water and mix the fly ash with water properly. The amount of water to be added different from different soils. For fly ash we used 20% water initially. The vacant mould close with the bottom cover is weighted lacking lapel. The collar is then close the mould. The flyash with water mixture positioned in the cast and compacted by generous 25 blow the rammer

Consistently circulated over the outside, such that the packed in height of the soil is about 1/3 the height of the mould. The same procedure followed for 2nd and 3rd layers also after that remove collar and top layer extra soil is remove it upto level of mould. The bulk density, dry densities are found by below using relations.

$\rho = M/V$ g/cc

$\rho_d = \rho / (1+W)$ g/cc

Where, ρ = Bulk density of fly ash (g/cc)

ρ_d = Dry density of fly ash(g/cc)

M= mass of fly ash with water and mould (g)

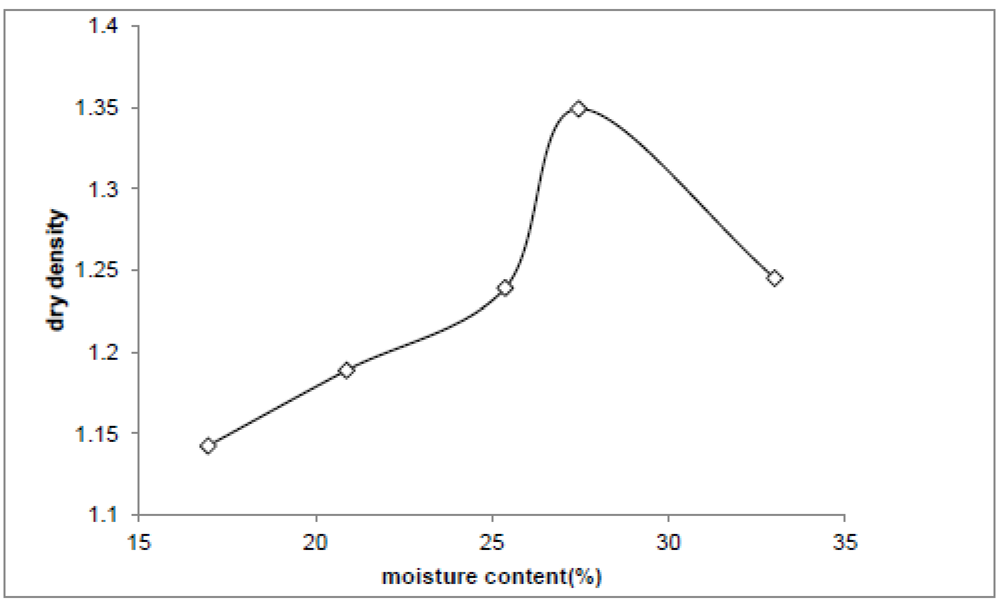
W= water content ratio (%)

V= volume of the mould (1000 ml)

After this test we have to plot curve by taking water content on x axis, and dry density on y axis in order to find the maximum dry density and optimum moisture content .optimum moisture content can be found using maximum dry density. This density is called maximum dry density (MDD) and the corresponding moisture content is called optimum moisture content (OMC).

Sl.No	density	water cont	dry density
1	1.336	16.96	1.1423
2	1.437	20.88	1.1887
3	1.554	25.37	1.239
4	1.72	27.45	1.284
5	1.656	33	1.245

Table: modified proctor test results



Graph between dry density and moisture content using modified proctor test

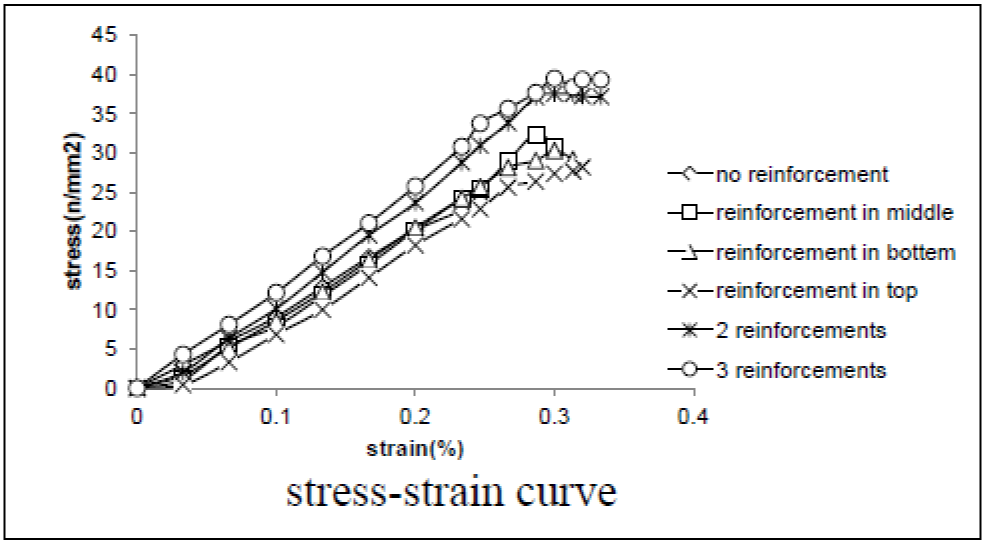
RESULT AND DISCUSSIONS:

The parameters dry density γd and OMC obtained from standard proctor test. Unconfined compression test, was conducted using the obtained OMC and γd values, and stress-strain curves obtained.

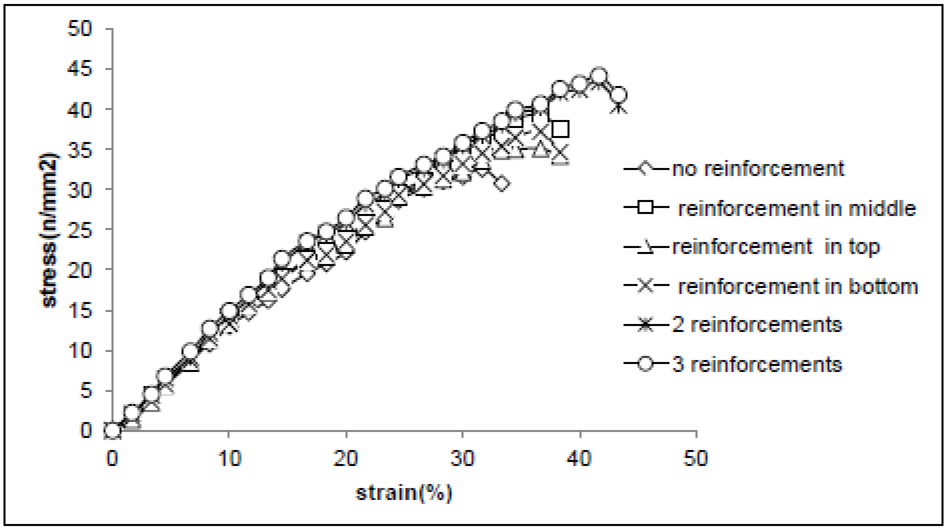
The typical stress-strain curves for unreinforced and reinforced sample with different number of reinforcement and different locations under 80% and 90% 100% OMC have been shown in Figs.

Table: stress-strain values for different no have and position of GI reinforcement at 100% OMC using standard proctor values

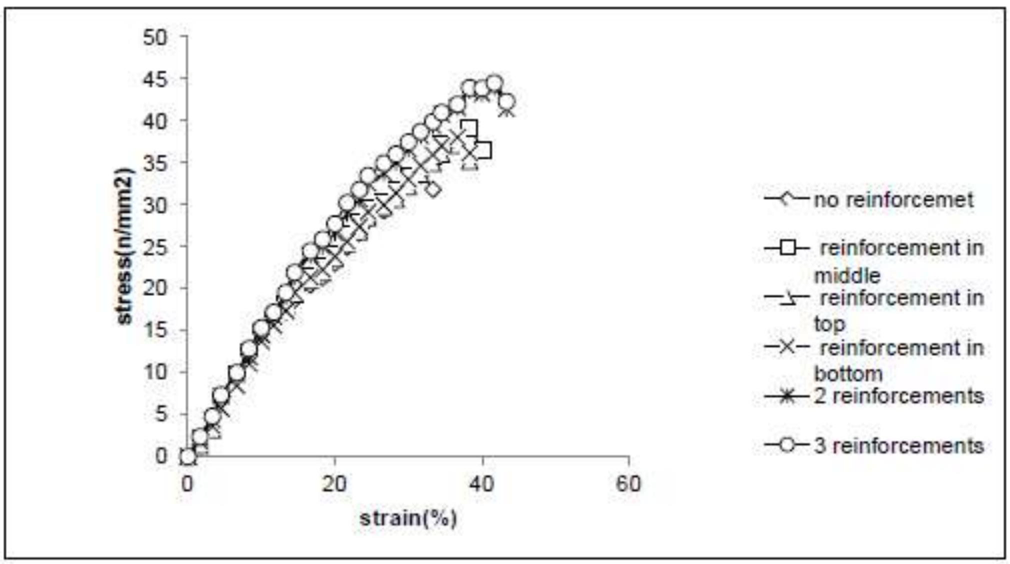
			STRESS					
SL. No	strain(%)	Area	No reinforcement	reinforcement in middle	reinforcement in bottom	reinforcement in top	2reinforcements	3 reinforcements
1	0	4415.63	0	0	0	0	0	0
2	0.033	4417.08	2.96	1.06	1.62	0.42	2.04	4.30
3	0.066	4418.54	5.99	5.36	5.14	3.31	6.34	8.10
4	0.1	4420.05	9.088	7.89	8.59	6.83	10.15	12.19
5	0.1333	4421.52	12.88	11.76	12.25	10.10	14.79	16.83
6	0.1666	4422.99	16.68	15.77	16.34	14.08	19.50	21.05
7	0.2	4424.47	20.13	20.13	20.48	18.23	23.65	25.76
8	0.2333	4425.95	22.65	24.20	24.20	21.59	28.77	30.82
9	0.2466	4426.54	23.88	25.39	25.68	22.86	30.95	33.77
10	0.2666	4427.43	22.80	28.98	28.13	25.60	33.83	35.66
11	0.2866	4428.32	-	32.42	29.04	26.37	37.13	37.69
12	0.3	4428.91	-	30.79	30.30	27.35	37.55	39.51
13	0.3133	4429.50	-	-	29.17	27.69	37.54	38.38
14	0.32	4429.80	-	-	-	28.19	37.26	39.37
15	0.3333	4430.39	-	-	-	27.55	37.18	39.35



Stress-Strain curve (100%OMC)



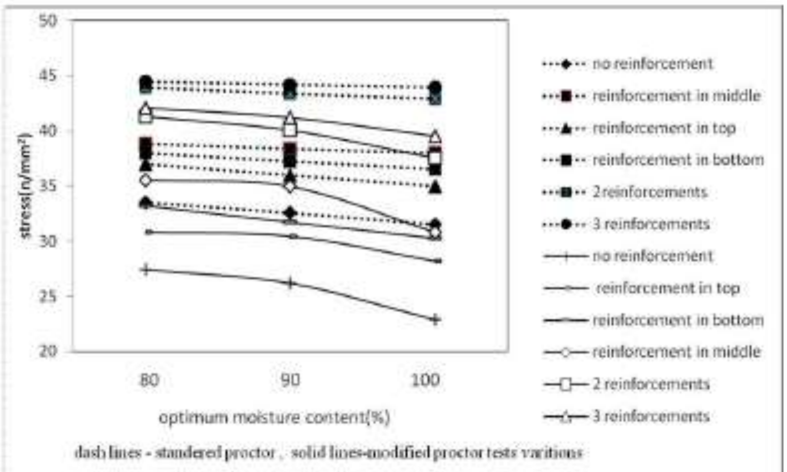
Stress-Strain curve (90% OMC)



Stress-Strain curve (80% OMC)

Sl. no	OMC (%)	no reinforcement	reinforcement in middle	reinforcement in top	reinforcement in bottom	2reinforcement	3reinforcements	No reinforcement	reinforcement in middle	reinforcement in top	reinforcement in bottom	2reinforcements	3reinforcemens
1	80	33.51	38.87	37	38	43.93	44. 5	27.44	30.83	33.19	35.54	41.3	42.1
2	90	32.57	38.4	36	37.23	43.4	44.2	26.15	30.47	31.72	34.96	40.1	41.22
3	100	31.54	38	35	36.5	42.96	43.9	22.83	28.19	30.31	30.79	37.6	39.52

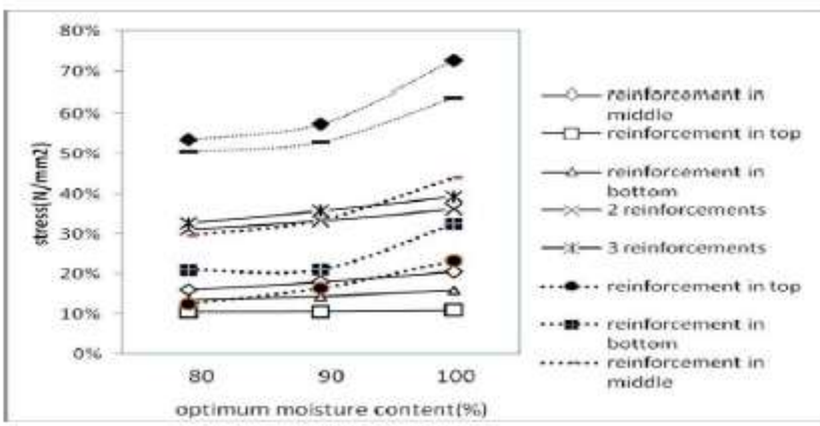
Peak Stress for Different Reinforcement position and no's



Comparison of different peak stress at OMC

Sl. no	OMC (%)	reinforcement in middle	reinforcement in top	reinforcement in bottom	2reinforcement	3reinforcemens	reinforcement in middle	reinforcement in top	reinforcement in bottom	2reinforcements	3reinforcemens
1	80	16%	10.41%	13.40%	31.1%	32.6%	12.35%	20.95%	29.52%	50.5%	53.43%
2	90	17.90%	10.53%	14.30%	33.2%	35.7%	16.31%	21.09%	33.46%	52.9%	57.36%
3	100	20.48%	10.97%	15.72%	36.2%	39.2%	23.19%	32.43%	44.03%	63.9%	72.68%

Difference between peak stress reinforced and unreinforced fly ash



Comparison stress between unreinforced & reinforced fly ash (locations& no's)

The optimum no of GI reinforcement are 3 for the parameters dry density γd and OMC 80%obtained from the Modified proctor test. It can be observed that, there were no pronounced failure points in stress-strain behavior as increasing the number of reinforcement layers resulted in more ductility of the samples as clogging developed in shear band within specimens. The figures also shows that the beneficial effect of GI reinforcement to enhance the strength of reinforced samples appear in high strain. It means that, the high strain levels should be imposed to appear the effect of GI reinforcement layers to increase the strength of samples.

CONCLUSION

A series of uni-axial compression tests were performed on number of samples both reinforced and unreinforced condition. From the experimental results the following conclusions can be drawn as follows,

• It is noted that GI reinforcement inclusion considerably increases the peak strength, axial strain at failure and reduces post-peak loss of strength.

• The increase in peak stress in case of samples prepared at standard proctor density is found to be lower than the modified density. A similar pattern also observed for peak strain.

• It is also noted that the percent deviation of OMC in all the tested cases found to vary significantly.

FUTURE SCOPE

The Future scope project includes:

1. The fly ash can be replaced by other materials like red mud, pond ash, and different other combinations.
2. An alternative reinforcement material can be replaced with GI reinforcement and the strength criteria can be studied.

The present study can also be modeled with the confining study cases to simulate with the field study.

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