Comparison Of Properties of Soil Sample Before and After Addition of Quarry Dust

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Abstract

Now-a-days' the utilization of fly ash in manufacturing bricks is finding a new way in order to control the pollution. The strength characteristics of fly ash brick made up of different material have been evaluated and compared. The other important characteristics of fly ash and bricks have been evaluated. This include physical properties and chemical properties of fly ash like bulk density, dry density, water content, specific gravity etc. and properties of bricks like water absorption, compressive test etc. It has been seeing that the demand of electricity is increasing day-by -day according to the consumption of electricity. Hydro power station is not capable to fulfill the huge demand of electricity so, number of thermal power stations have been installed. Because of thermal power stations there is having increment in the amount of generation of fly ash which is responsible for pollution. It has been seen that several researches have been done on fly ash in order to utilize the fly ash resulting from thermal power plants' to control the pollution and maintaining the ecological balance of earth. The utilization of fly ash in manufacturing bricks reduces' the disposal problem which generally seen in thermal power stations'. Fly ash bricks mostly extensively used in all building constructional similar to that of burnt clay bricks. Fly ash lime bricks are chemically bonded bricks' manufactured by utilization of fly ash in major, lime, sand and dust. Fly ash lime bricks are manufactured process by blending the process including raw material which then moulded into bricks and then to curing process start . In this project mostly waste materials were used which results' from thermal power stations'. The other important characteristics like water absorption, density, specific gravity e tc. have been evaluated by standard methods'.

Keywords— Fly Ash, Lime, Sand (Fine Aggregate), Sea Sand, Water, Rice Husk Ash, Dust (Crushed Stone), Cement

1. Introduction

Important material in fly ash brick are ash , which is formed coal is when burned and formed a powder which very fine is called as fly ash. other all ashes settle at the bottom of the furnace where the coal is burned, fly ash is light in weight and very fine enough that the gases are able to carry it up through the chimney. Fly ash bricks are partially constructed from the residue called burnt coal. On the basis of type and property of coal that is burned, the resulting fly ash forms. Fly ash require a cementing agent property like quicklime or Portland cement. Other types contain a large percentage of lime there for they are self setting, requiring addition of water to form fly ash bricks.

The different type of construction and quality of these type of bricks has varied over the years by years, with certain mixes are common and others when in contact with water or any type of moisture swelling or deforming property in process. Developments in the early 21st century led to bricks like fly ash that contained a fly ash that is naturally higher percentage in lime and which can exceed specifications for traditional types of bricks.

Literature review

1. K.P. Das (2014) et.al they had investigated sub soil and suitable type of foundation for construction of superstructure in the bank of Ganguanalla, Bhubaneswar. They concluded that the groundwater table varies from 1.1 to 1.3 meters and expansive clay strata extended up to 10 meters below the ground and suggested that deep foundation would be the most suitable type.
2. Caroline Onyancha (2001) et.al they had studied the engineering behaviour of Nairobi sub soil. The soil showed variability in engineering properties. They located weaker and stronger zones to investigate relationship between total and differential settlements.
3. Dr. S.K. Tiwari(2013) et.al they gave guide lines for planning soil investigation of building projects. They concluded that site investigation based on sound technical judgement is necessary to determine the nature of the soil and before designing the foundation soil investigation report must be examined well for deciding the type of foundation.
4. Oyedele, K.F (2010) et.al they had investigated sub soil using ingrated method at Lagos, Nigeria. It revealed thepresence of five sub surface geo electric layer consisted of top soil, sandy clay, sand, clay and sand. The land ranges in thickness from 14.33 to 37.3 m while depth of to the sand body varies from 3.35 to over 70 m. the ranges clay layer in depth from 20.4 to 41.89 m while its thickness varies from 27.64 to 55.89 m. they finally concluded that shallow foundation may be used as foundation.
5. H.O Nwankwoala (2014) et.al they had done geotechnical investigation and characterization of sub soil in Yenagoa, Bayelsa state, Central Niger Delta, Nigeria. Their study aimed at establishing the sub soil type and profile to ascertain the geotechnical characteristics of the underlying soil. Four boreholes were dug and samples were taken at every 1meter. They came with result that the soil has avg. water level of 2m, liquid limit 35%, moisture content 27%, plastic limit 22%, plasticity index 13%, average liquidity index 387.
6. Ritika Dubey (2013)et. al done case study of geotechnical solution for foundation of a multi-storeyed residential buildings. They concluded that raft foundation is best suited to expansive soil other than deep foundation or ground improvement as they may be proved costlier and it makes the structure distressed, free from conditions failure arising out of possible soil liquefaction ,shear failure and settlement failure during seismic activity.
7. Harichran T S (2010) et.al done laboratory investigation of expansive soil stabilized with natural inorganic stabilizer. They attempted with RBI-81 stabilizer on black cotton soil and came with great result, the unconfined compressive strength of the soil treated with RBI-81 increases approximately by 250% and further CBR value of the soil increases by 400% further.
8. Murad Abu Farooq (2008) et.al done the laboratory investigation of the behavior of the square footing ad reinforced crushed lime stone. The aim was to study investigation of spread footing on the crushed lime stone using alb model test. The investigation evaluates the behavior of reinforced limestone foundation. This test also evaluate in terms of bearing capacity ratio at limit settlement level and the settlement reduction factor at different surface pressure. It improved the soil bearing capacity.
9. Hussein Elarabi (2011) described the evaluation method used for the qualification of the site under study. The in situ and laboratory testing is carried out to make data available for evaluation based on the geotechnical investigation. The top clay layer is potentially expansive and having excessive amount of moisture. Measures and precaution should be taken to avoid excessive moments especially under lightly loaded building such as floors, underground structures, etc.
10. Sandra L. Houstan (2009)et.al studied expansive soil and residential foundation on expansive in Arizona. Construction con expansive soil is challenging. Theengineer's community use local experience to address these problems. Using data obtained from the files and geotechnical firms and government.
11. H.Venkateshwarwarlu (2015) et.al studied behavior of the expansive soil with quarry. They had studied the properties of expansive soil at different percentage at 0%, 5%, 10%,

and 15%. They concluded that atterberg limit, cohesion, moisture content goes on decreasing and CBR value and Maximum dry density goes on increasing with the increase in the addition of percentage of the quarry dust. They found that addition of 10% of quarry dust is effective and beyond it is not effective.

2. Utilization of various Materials

In the construction form in India fly ash bricks are alternative to burnt clay bricks. Now at this time India is witnessing a new phase in development with rapid economic growth and high rate of the urbanisation. Over inflation because of building construction costs are increasing at rates. Primarily due to the increase in the cost of basic building materials like timber, steel ,burnt brick, cement etc. Fertile top soil, forest cover and excessive consumption of energy are the depletion of key renewable resources like. Therefore, adopt cost-effective, environmentally appropriate technologies by the up gradation of the traditional technologies. Also using local available materials as well as using correct and intermediate technologies using modem type of construction materials. Fly ash are a basically a waste material, as it can be converted to a resource with minimum amount of investments. It can help to the increase quality of construction and speed. There for helping in increasing the efficiency of housing developing mechanism.

Most of the material used for manufacturing fly ash brick in this study is generally waste produce by thermal power stations, agriculture, etc. Fly ash generally results in powder form after the combustion of coal. Fly ash in this study is available from Reliance Thermal Power Station, Nagpur. These by products can pollute the environment hence suitable disposal of such material is important. Rice husk ash generally results from agricultural land. Sand used in this study is waste sand available from INDO RAMA THERMAL POWER STATION, BUTIBORI, NAGPUR after the combustion process in boiler at the power plant. Crushed stone particles which is generally in form of dust is used for manufacturing the bricks in this study which available from PRITHVI STONE INDUSTRIES, HINGNA. There are two types of lime which used in this study namely quick lime and hydraulic lime which available from ADITYA AND VANI LIME SUPPLIER, NAGPUR.

Several researches give some information about the characteristics of material which is generally considered as waste material. The results show that these materials can be used successfully and give better properties in cement and for manufacturing bricks. Researchers concluded at a point that these materials can be utilized in manufacturing. The materials which are considered as waste material from thermal power plants, agriculture, etc. after these researches are gaining its utilization. Now a day the utilization of fly ash in cement is increased and govt. declares it mandatory because of environmental concerns.

2.1. RAW MATERIALS:

2.1.1. Fly Ash:

Pulverized fuel ash now a days commonly called as fly ash is a useful by-product from thermal power stations using pulverized coal as fuel .This national resource has utilized for manufactured of pulverized fuel ash-lime bricks as a supplement to burnt clay buildings bricks leading to conservation of natural resources and improvement in quality.
Class F fly ash called as non-self-cementing fly ash is produced from the burning anthracite and bituminous coals and contains little amount of lime (CaO) to produce cementitious products. Portland cement or lime added an activator. Class C fly ash called as self-cementing fly ash is produced from sub-bituminous and lignite coals and usually

contains very small amount of lime . This type class C is self-cementing because it contains a high percent of calcium oxide (CaO) which ranging from 20% to 30%.

Lime

Lime is a important material in any type of construction project. Lime has been used in India as a construction material from very ancient days. Lime can be used to prepare the construction site by stabilizer. Lime is most important material and can be used in the masonry systems as a component of mortar unit. Exterior and interior plaster systems can also contain lime. The decorative finishes in any type of work can be created with the help of lime. Construction building material like lime has been used in India to create durable plaster. In the plastic state stage , lime can enhance the water retention and workability of plasters and mortars. In the hardened state, lime products reacted with carbon dioxide to form calcium carbonate or limestone. Since initial strength is used in most applications, such as gypsum additives, construction applications cement are mixed with lime. Lime can react with pozzolanic materials in the mortar to produce product called as a cement. This is a slow, gradualed process which increase the hardness of the finished surface and allows for the healing of hairline cracks by a process called autogenous healing. This is use in restoration applications where less strengths and more vapor permeability are needed.

2.2.2. Sand (Fine Aggregate):

Waste sand was used which is available from Reliance thermal power station Nagpur region. The Specific gravity was found 1.6. by pycnometer method. Sand is an important material for the construction but this important material must be purchased with all care and vigilance. Sand which is used in the construction purpose must be free from waste stones, clean and free from impurities. It is very much important to know that what type of sand is beneficial for construction as Sand is also classified into three different forms make it suitable for specific type of construction..

Sand is classified as: Medium Sand (0.425 to 2 mm), Fine Sand (0.075 to 0.425 mm), and Coarse Sand (2.0 to4.75 mm).

2.2.3 WATER

The water is required for preparation of mortar for curing work during construction work, mixing of cement concrete. Water is one of the important elements in construction but people still ignore quality aspect of this element.The quantity and quality of water are much effect on the strength of cement and mortar in work of construction

2.2.4 Rice husk ash:

As India is having agribusiness there is having production of waste rice husk from the agricultural field after cutting the crops. And the ash produced is termed as rice husk ash. In India most population of India were depends upon agriculture.

2.2.5 Dust (Crushed Stone):

Crushed stone which is particles generally known as dust. These dust particles having generally the shape of it is angular and 6mm size. The crushing of stone in stone crusher industries these stone particles are available. These small dust particles can be used in manufacturing bricks and pavements, etc. The specific gravity by using pycnometer method particle was found to be 2.1. Such dust particle can be available quarry. In this study locally available crushed stone particle was used. The crushed stone or aggregate particles should be such that the bonding of other will not affect.

2.2.6 Cement

The binding material which is used in order to hold the material together is the cement. The bricks bonding depends mainly upon this material after lime because

3. Characterization of fly ash

The chemical composition of fly ash of Vidharba Industries Ltd. (Reliance), Nagpur : SiO_2 (66.57%), Fe_2O_3 (13.05), Al_2O_3 (14.38%), TiO_2 (1.02%), CaO (1.78%), MgO (0.99%), Na_2O (0.73%), K_2O (0.66%), SO_3 (0.07%), P_2O_5 (0.23%), MnO (0.16%) , Y_2O_3(0.002%), ZrO_2 (0.04%) ,CrO_3 (0.01%), NiO (0.01%), CuO (0.01%), SrO (0.01%), Cl (0.01%), B_4O (0.06%), Rb_2O (0.003%), Rb_2O (0.002) It was observed from the fly ash chemical composition that SiO_2 largest content about 67% , Al_2O_3 and Fe_2O_3 contents about 27% of the amount total content. Particle size distribution was using standard method by passing the fly ash over the standard size sieves. It was found that 89.12 % fly ash particles have size below 75 μm.

Sr. No.	Type of Brick	Water Absorption (%)
1	Fly ash lime sand brick	13.26
2	Fly ash cement dust brick	15.58
3	Rice husk ash lime brick	14.63

Table 1: Table for determination of water absorption

Sr. No.	Type of Brick	Load Taken(KN)	Crushing Strength(N/mm^2)
1	Fly ash sand dry lime wet lime dust brick	90	3.56
2	Fly ash wet lime sand dust brick	173	3.56
3	Rice husk ash sand brick	97	3.83
4	Fly ash cement dust brick	110	4.34

Table 2:Table for for determination of compressive Strength (Brick Size 230X110X70)

Sr. No.	Type of Brick	Load Taken(KN)	Crushing Strength(N/mm^2)
1	Fly ash dry lime brick	418	12.12
2	Fly ash cement dust brick	373	10.81

(BRICK SIZE 230X110X70)

4. Result and Discussion

The present project replicate the effect in compressive strength of fly ash bricks. The Fly ash sand dry lime wet lime brick, Fly ash wet lime sand dust bricks ,Rice husk ash sand bricks, Fly ash dry lime bricks, compressive strength were calculated and following results obtained:-

1. Bricks of size 230x110x70mm: The fly ash sand dry lime wet lime bricks gave compressive strength of **3.56 N/mm^2**. The fly ash sand wet lime brick gave compressive strength of **6.83 N/mm^2**.The rice husk ash sand brick gave compressive strength of **3.83 N/mm^2**. The fly ash sand dust brick gave compressive strength of **4.34 N/mm^2**.

2. Bricks of size 230x150x90mm: The fly ash dry lime sand brick gave compressive strength of **12.12 N/mm^2**. The fly ash cement dust brick gave compressive strength of **10.81 N/mm^2**

Thus from above study, this project concluded that, with the manufacturing of bricks with fly ash sand wet lime gave greater compressive strength than other bricks which used in the study of size (230x110x90mm) and fly ash dry lime sand bricks gave more strength than fly ash cement dust brick of size (230x150x90mm).

The fly ash sand wet lime brick is also more economical as the cost of lime is less than cement. This brick gives better compressive strength than other bricks which used in this study.

Brick projects for different, we hope that this project will act as guidance in terms of strength like compressive.

There is having a great scope in manufacturing fly ash bricks in present and future also as the land is utilizing day by day for different purposes, therefore clay for making bricks is not vastly available.

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