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UTILIZATION OF FLY ASH AND HYDRATED LIME FOR RECLAMATION OF MUNICIPAL DUMPING GROUND

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ABSTRACT

Dumping ground occupies huge land, pollute environment and pose health issues with contaminated waste lying open to atmosphere. Most countries abroad have abandoned this practice in favor of reclaiming of waste land. It has become necessary to develop strategies of land re-use for completed landfills to improve environmental profile. This dumping site does not have enough strength to take load of structure to be built on it. In this research a strategy is developed for stabilization of such municipal dumping ground for reuse such land. Fly ash and hydrated lime is mixed in dumping ground at various proportions to improve strength of ground. This paper presents analysis of results obtained from experimental investigation done on stabilized dump. The strength of dump is measured using Dynamic Cone Penetrometer (DCP) Test. Use of Dynamic cone penetrometer is faster and easier way to determine the strength of stabilized dump.

KEYWORDS: Fly Ash, Hydrated Lime, Dumping Ground Stabilization, DCP

INTRODUCTION

Dump is a useless thing thrown at dumping sites by industries and individuals in the form of solid waste. Over the years waste has become an issue of major global concern. Current waste management systems are mostly affected by urban growth, traditional approaches of collection and disposal. The old solution is to dump waste on low-lying areas near the outer parts of city. This dumping ground leads to impact our ecosystem by air, water and soil pollution but also affects the property in the vicinity.

As major cities have acute shortage of useful land, the landfills developed from dumping of huge solid wastes can be reclaimed for future need of land in cities. Reclamation means Land improvement to investments making land more usable by humans. In terms of accounting, land improvements refer to any type of projects that improves the value of the property. Therefore intended research is regarding development of techniques to strengthen and stabilized the dump, so that dump site can be utilized for construction purpose. Restoration of dump sites is restoring the dump site to its natural state, in the process improving and enhancing the land conditions, so that the land is available for use and access. It has become important to develop strategies of land re-use. The process to create new land or land reclaimed is known as reclamation ground or landfill. Some of the most common usages of reclaimed land are for parks, golf courses and other sports fields. Increasingly, however, residential buildings and commercial uses are made on a completed landfill. In these latter uses, to reduce explosive hazard within the building methane capture is normally carried out.

MATERIALS

In the stabilization of dumping ground, fly ash and hydrated lime is used. Fly ash is collected from Thermal Power Station, Gujarat Energy Transmission Corporation Limited (GETCO), Gandhinagar, Gujarat. Chemical composition of fly ash used in this research is given in table 1. And chemical composition of hydrated lime used in this research is given in table 2.

Table 1: Chemical Composition Fly Ash

PARAMETER	UNIT	Test Method Standard	Results obtained	Specifications As per IRC:SP: 89-2010
Fe_2O_3+Al_2O_3+SiO_2	%	IS-1727	76.9	70% Min
Sio_2	%	IS-1727	62.3	35% Min
Reactive Slice	%	IS-1727	28.7	--
MgO	%	IS-1727	1.7	25 % Max
SO_3	%	IS-1727	1.2	2.75 % Max
Na_2O	%	IS-1727	1.4	--
Cl_2	%	IS-1727	0.02	0.05 Max
Loss of Ing.	%	IS-1727	2.9	5 Max
CaO	%	IS-1727	0.32	--
Phosphorous (P_2O_5)	%	IS-1727	0.02	--
Potassium (K_2O)	%	IS-1727	0.05	1.5 Max
PH	%	IS-1727	7.6	--

Table 2: Chemical Composition of Hydrated Lime

PARAMETER	UNIT	READING
SiO2	%	1.05
Al2O3	%	0.35
Fe2O3	%	0.17
MgO	%	1.45
CaO	%	0.98
CaCO3	%	92.3
Fineness 300 mu	%	99.8

EXPERIMENTAL INVESTIGATIONS

DCP test were performed using cylindrical mould at the same densities and moisture content in soaked condition as were done in the case of field test. The volume of mould is 92.401 m3 and weight is 58 kg. In which dump placed in specified volume of three layers as 30 m3. Each layer compacted by hammer to achieve density same as field. In DCP test the 8 kg hammer were dropped through the height of 575 mm on the anvil hammer is dropped by mechanical pulling arrangement, anvil is connected with rod attached by 60 degree cone of 20 mm diameter is kept on the top of the dump surface as shown in fig. 1.

After compacting and filling of dump, density (mm/blow) will be measured by cone penetration meter. The DCP test done in all three directions and penetration is measured on penetration scale. Lower penetration index shows the increase the density and strength of mix materials. DCP gave a result nearly about the field test.

Figure 1: Dynamic Cone Penetrometer Test

The penetration will be measure along the all directions in mould and find average penetration from all trials. This same procedure will led after mixing of fly ash and lime with different proportions. The mixing of fly ash done using layer method. Means take a specified proportion of fly ash and lime and mixing uniformly in a container. Then spreading a one third of mix on the dump and laid properly. The second layer of dump will be spread on the mix and continue this procedure onwards up to third layer of mix.

This mould is soaked for seven days and then the DCP test is performed on stabilized dump to find out the strength of mix. The strength of dump will based on observation was made of number of blows corresponding to penetration of cone. If number of blows decreases means density and strength of dump are increases. The results obtained from experimental analysis are shown in table 3.

METHODOLOGIES ADOPTED

It was planned to perform the Dynamic Cone Penetration (DCP) Test for 7 day soaked dump samples. The tests were performed for following proportion

a) Dump + Fly Ash (30, 40, 50, 60 percent of Dump) + Hydrated lime (5% of Dump)

b) Dump + Fly Ash (30, 40, 50, 60 percent of Dump + Hydrated lime (7% of Dump)

c) Dump + Fly Ash (30, 40, 50, 60 percent of Dump + Hydrated lime (9% of Dump)

RESULTS AND DISCUSSIONS

Results obtained from Experimental Investigation are used to evaluate strength parameter of stabilized dump. Fig. 2 shows when Fly ash and Lime proportion increases, DCP (mm/blow) decreases means increases the dry density which represents strength. Due to the fineness and pozzolonic properties of fly ash it is used as stabilizer. Hydrated lime has high binding properties which lead to increase in density.

The density of stabilized dump is measured in terms of DCP (mm/blow). The strength of dump will based on observation was made of number of blows corresponding to penetration of cone. If number of blows decreases means

density and strength of dump are increases. Results shows that at proportion of 30% fly ash and 9% hydrated lime DCP (mm/blow) is decreased to 4.10 from 13.53.

Table 3: Results Obtained from Experimental Analysis

Average Results	Results of core cutter test		Results of Dynamic cone penetration test						
			Results before stabilization			Fly Ash (%)	DCP Test Results after Stabilization (after adding Fly ash & Lime)		
	FMC w%	FDD kg/cm^3	FMC w%	FDD kg/cm^3	DCP mm/blow		DCP mm/Blow (Lime 5%)	DCP mm/Blow (Lime 7%)	DCP mm/Blow (Lime9%)
1.	12.73	0.57	28.31	1.18	13.53	30	9.20	5.12	4.10
2.	40.85	0.37	25.13	1.22	17.21	40	13.18	9.17	6.12
3.	7.67	0.81	23.11	1.25	21.60	50	14.11	11.18	8.13
4.	36.40	0.76	21.18	1.28	12.63	60	8.16	6.15	3.70

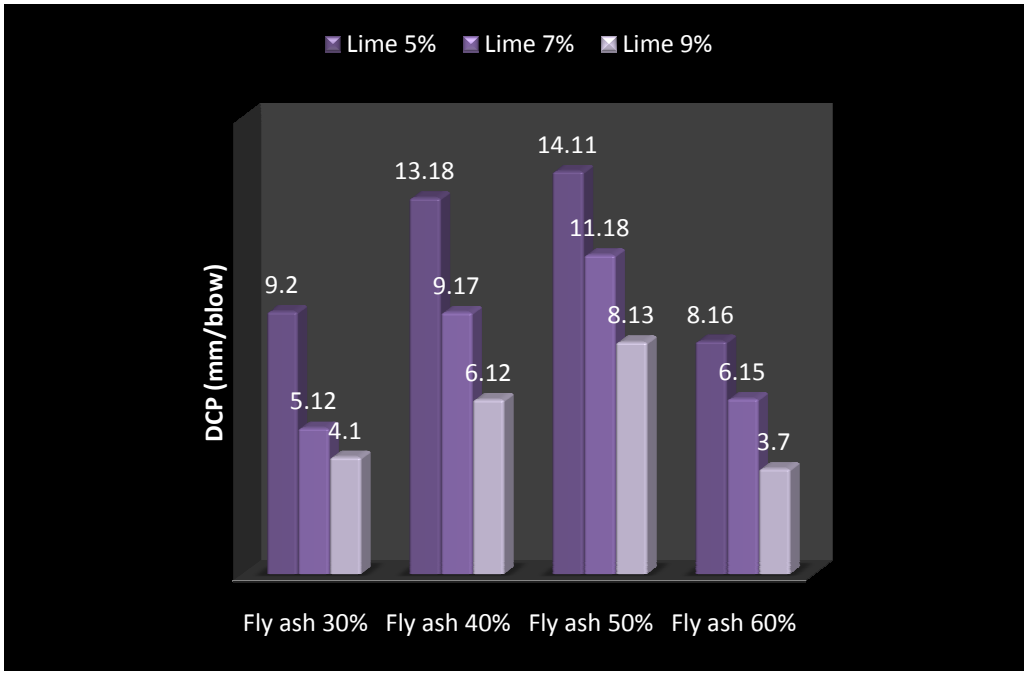

Figure 2: Variation in DCP at Various Proportions of Fly Ash and Lime

CONCLUSIONS

The above experimental analysis was carried out to develop strategy for stabilization of such municipal dumping ground for reuse such land for different purposes. Dump stabilization is done using fly ash and lime. Experimental analysis is done using dynamic cone penetrometer test which is quick and relatively good method for determination of strength parameter. Results shows that DCP (mm/blow) Values are increases as fly ash and lime content in dump increases. The proportion of 30 % fly ash and 9% lime shows best results so it can be taken a optimum content of these stabilizing agents. Fly ash is huge waste in India, which can be reducing by effective utilization of it in dump stabilization.

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