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SOIL STABILISATION BY UTILISING PHOSPHOGYPSUM AND CALCIUM CARBIDE RESIDUE

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ABSTRACT - *The impact of balancing out specialist like Phosphogypsum and Calcium carbide build-up has been contemplated for quality, change in shifting rates (I.e., 2, 4, 6 and 8%). The unconfined pressure test (UCS) of the dirt with a various level of added substances were resolved independently. Soil adjustment is the way toward enhancing the properties of soil and making it more stable. The minerals present in stabilizers will impart strength by reacting with the soil. This is Economic and effective use of locally available materials to improve the geotechnical properties by ground improvement techniques. Calcium carbide residue (CCR) is obtained as by-products from manufacturing acetylene gas This CCR contains high amount of calcium content which acts as binding material .Basic properties of soil like Atterberg limits, swelling potential, compaction characteristics and strength characteristics were determined. The dirt example is treated with various rates of CCR (2%, 4%, 6% and 8%). Most extreme dry thickness diminishes with increment in CCR substance and ideal dampness content increases. The swelling nature of dirt abatement with increment in CCR content. The soil samples were treated with CCR and determined the strength characteristics by UCS and CBR .By the treatment MDD, OMC and swelling nature were determined with various percentages of CCR with soil.*

***Key Words*: soil stabilization, phosphogypsum and calcium carbide residue, compaction, CBR, UCS.**

1. INTRODUCTION

Far reaching soil has been a test for structural specialists in the outline and development of Infrastructure ventures. The real issue with clay is low quality and compressibility. This dirt must be dealt with before initiating the Constitution activity to accomplish wanted properties. The substance method is an A typical soil adjustment approach, it creates a quality soil with excess in quality and toughness. Adjustment of the soils is particularly done if locally accessible regular/modern assets are accessible. The utilisation of Phosphogypsum in soil adjustment is a minimal effort construction and can give and condition inviting of their transfer and improve the Engineering of the dirt. Phosphogypsum is a side-effect in the wet procedure for produce of phosphoric corrosive (ammonium phosphate compost) by the activity of sulphuric corrosive on the stone phosphate. At the point Shen et AL. (2009) prepared another sort of steel slag-Phosphogypsum cemented material made out of strong squanders to be used as asphalt material. The Phosphogypsum measurement of 2.5% out-comes in most noteworthy quality. The hardened material had best water steadiness among those asphalt materials. Shweikani et al. (2013) consider the radiation dosage estimation was performed utilising a suitable radiation presentation display in light of radiation limit. Radium comparable and movement power list safety criteria were ascertained. Degirmenci et al. (2007) depicted soil adjustment with the utilisation of Phosphogypsum. Unconfined compressive quality standard delegate compaction and Atterberg restrain test were completed on the dirt examples. Clay soils are weak ,undergoes shrinkage and swelling with change in water content .Good soils for construction becomes extinct , there is a need to go for the soil is available for construction purpose. Calcium carbide residue (CCR) is the result delivered amid the creation of Acetylene gas.

This Calcium carbide residue contains calcium which goes about as restricting material to pickup quality to the soil. The Standard proctor test and California bearing ratio tests were conducted with various percentages. California bearing ratio value increased with curing period. Calcium carbide residue settled costly soil as a liner material in design land fill. The soil is treated with different percentages of Phosphogypsum and Calcium carbide residue.The OMC, MDD, hydraulic conductivity, UCC and volumetric shrinkage tests are conducted on different mixes. The balanced out silty clay soil with Calcium carbide residue (2, 4, 6 & 8%) and Phosphogypsum (2, 4, 6 & 8%).The Standard proctor test, UCC and California bearing ratio tests are conducted Clayey soils contains high regular pozzolanic materials, Ca (OH) 2 can be utilized as option establishing operator to create modestly high quality geomaterials. Stabilized earth is credited to three essential responses they are feline particle trade flocculation and collection and pozzolanic response. Clayey soil supplies an overabundance of Ca2+, and the feline particle trade will happen with Ca2+ supplanting disparate feline particles from the trade complex of the soil. This causes flocculation and collection of the dirt portion. Calcium hydroxide can react with silicates and aluminates in the clay (<0.002 mm particles) to shape cementetious materials, it comprising of calcium silicates and aluminates hydrates. Calcium carbide residue (CCR) is side -effect of acetylene production process. It contains essentially calcium hydroxide, Ca (OH) 2. Its creation is portrayed in the accompanying condition.

$$CaC2 + 2H2O \rightarrow C2H2 + Ca(OH)2$$

In this condition 64 gms of calcium carbide (CaC2) provides 26 gms of acetylene gas (C2H2) and 74 gms of CCR as for as Ca (OH) 2.The CCR adjustment is more compelling than

other adjustment compound. The CCR contain is in the crumbling zone. The part of contribution on the quality and the toughness advancement is dissected .in light of test outcomes an exact connection between W-D cycle quality and unsoaked quality is proposed.

1.1 LITERATURE REVIEW

1: SHWEIKANI (2013):

The radiation does estimation because of the nearness of Phosphogypsum in bond a suitable radiation presentation show in view of radiation limit (gamma spectroscopy and solid state nuclear track indicator CR-39). The radium identical and action force list were figured.

It was discovered that the additional measurements to the general population because of this option was within the adequate levels. Results demonstrated that utilising Phosphogypsum is protected in development material. The level of including the ideal estimation of Phosphogypsum is added to silty soil or clayey soil.

2: DEGIRMENCI (2007):

Soil adjustment with the utilisation of Phosphogypsum, unconfined compressive strength standard proctor compaction and Atterberg limit tests were completed on the soil samples.

It demonstrates that the expansion of Phosphogypsum and calcium carbide diminishes the plasticity index of the soil, the maximum dry unit weight increments as the content of Phosphogypsum increments and reduction with calcium carbide content.

The ideal dampness substance of the balanced out soil samples diminishes with the expansion of calcium carbide and Phosphogypsum

This out-comes in an expansion of unconfined compressive quality of the soil. The loss by result of the Phosphogypsum and calcium carbide may give in costly and beneficial development items.

The quality of the dirt expanded in the Phosphogypsum up to 20% as showed in the CBR test. The connection co-efficient identified with everyone of the information in test try.

1.2. MATERIALS AND METHODOLOGY

1.2.1 Materials:

Black cotton soil:

The black cotton soil was gathered from karanja jalashaya near humanabad, bidar district from an open excavation at a depth more than 2M from the ground level surface.

Table 1 Basic Properties of Black Cotton Soil

Sl No	Properties of soil	Value
1	Specific Gravity	2.48
2	Liquid limit	90.47%
3	Plastic limit	48.30%
4	Shrinkage limit	18.42%
5	Plasticity index	42.70%
6	Maximum dry density	1.72 KN/M3
7	Optimum Moisture content	23.68%
8	Unconfined compressive strength	0.87kg/ cm2
9	CBR(Soaked)	2.72
10	CBR(Unsoaked)	3.44

Phosphogypsum (Pg)

It is a loss side-effect from preparing of phosphate shake by wet corrosive technique for phosphoric corrosive generation.

Calcium Carbide Residue (CCR)

It is a by-product manufacturing from Acetylene gas.

METHODOLOGY:

The various laboratory tests are conducted on soil samples as per I.S standard. To determine the engineering properties .The soil sample is mixed with various percentages (2%, 4%, 6% and 8%) of Calcium carbide residue. The above mentioned blend percentage, swelling characteristics are determined by free swell test and compaction (OMC & MDD) are determined by standard proper test. The strength characteristics of (UCS & CBR) soil samples for corresponding OMC and MDD at various percentages of material adding. Phosphogypsum materials have fluctuating degrees of hurtful impact on the environment. In this test four soil example containing distinctive centralization of Phosphogypsum material; namely: 2%, 4%, 6% and 8% were blended with dark cotton soil. The arrangement of soil and Phosphogypsum was identified with some assignment: M145-91 (Ministry of public works and housing, 2003). The most extreme dry thickness and ideal dampness content identified with standard proctor test. Moisture thickness in soils utilising 4.5kg rammer and 457mm drop remove as demonstrated by assignment, demonstrated that non plastic soil does not have a fluid limit, plastic limit and plasticity index. Phosphogypsum is utilised as a crude material, the variety of dampness content (DC), Dry Density (DD) at various substance of Phosphogypsum got from Proctor test. Maximum dry density (MDD).CBR test gives the level of the

quality was ascertained for determined standard penetration.

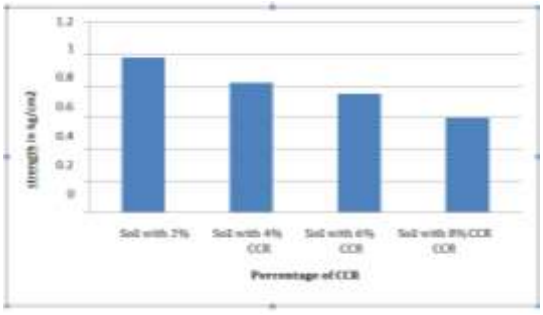
1.3 RESULTS AND DISCUSSION

UNCONFINED COMPRESSION TEST

Table 2: The unconfined compression test by using CCR at 2%, 4%, 6% and 8%.

Sl No	Description	Unconfined Strength qu kg/cm2
1	Soil with 2% CCR	1.1
2	Soil with 4% CCR	0.82
3	Soil with 6% CCR	0.75
4	Soil with 8% CCR	0.6

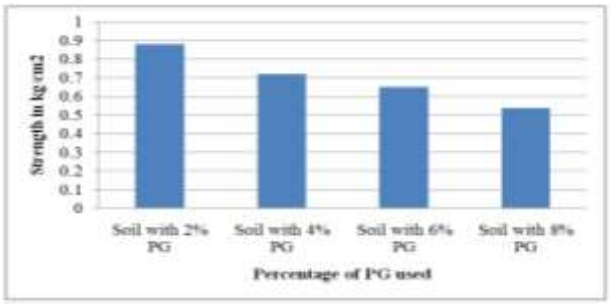
Graph: 1 Unconfined Compressive strength (Kg/cm2) of Black Cotton Soil with CCR 2%, 4%, 6% and 8%.



The Unconfined compressive strength by using Black cotton soil with Calcium carbide residue of different percentages ,i.e., 2%,4%,6% and 8% are 1.68,0.75, 0.82 and 0.6 kg/cm2 respectively .The percentage of the material increases the Unconfined compressive strength decreases.

TABLE 3 : UCS for phosphogypsum of 2%, 4%,6%, 8%.

Sl No	Description	Unconfined Strength qu kg/cm2
1	Soil with 2% PG	0.88
2	Soil with 4% PG	0.72
3	Soil with 6% PG	0.65
4	Soil with 8% PG	0.54

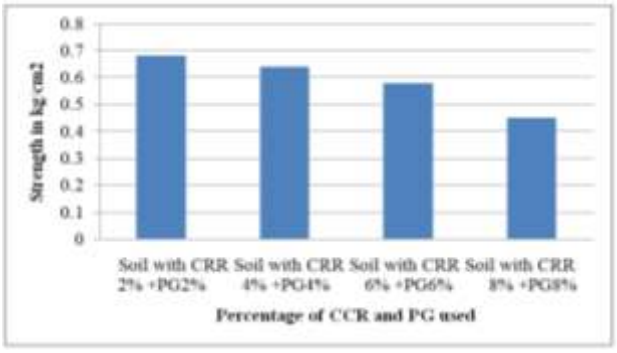


Graph 2: Unconfined compressive strength (kg/cm2) of Black Cotton soil with PG 2, 4, 6 and 8%.

The Unconfined compressive strength by using Black cotton soil with Phosphogypsum at different varying percentage i.e., 2, 4, 6 and 8% the results obtained 0.88, 0.72, 0.65 and 0.54 kg/cm2.

Table 4: The Unconfined compressive strength test by mixing both Phosphogypsum and Calcium carbide residue at different percentages.

SI No	Description	Unconfined Strength qu kg/cm2
1	Soil with CCR 2% +PG2%	0.68
2	Soil with CCR 4% +PG4%	0.64
3	Soil with CCR 6% +PG6%	0.58
4	Soil with CCR 8% +PG8%	0.45



Graph 3: Unconfined Compressive Strength (kg/cm2) of Black Cotton soil with CCR and PG.

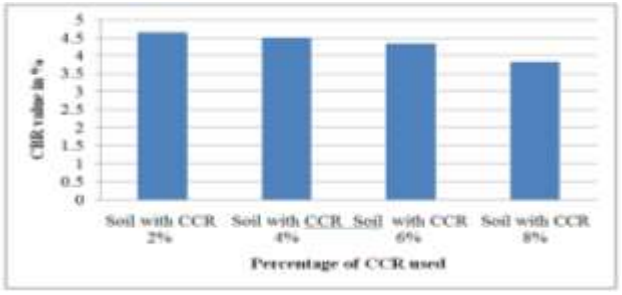
The Unconfined compressive strength is done by using Black cotton soil by mixing of both CCR and PG at Different percentages is 2, 4, 6 and 8% respectively. The results obtained for these percentages of materials are 0.68, 0.64, 0.58 and 0.45 kg/cm2 .The strength decreases the percentage of the material increases.

CALIFORNIA BEARING RATIO:

The California bearing ratio strength is done by using Calcium carbide residue and Phosphogypsum at different proportion is 2%, 4%, 6% and 8% and 2%, 4%, 6% and 8% respectively.

Table 5: California bearing ratio test by using Calcium carbide residue.

Sl No	Description	CBR (%)
1	Soil with CCR 2%	4.65
2	Soil with CCR 4%	4.5
3	Soil with CCR 6%	4.35
4	Soil with CCR 8%	3.84

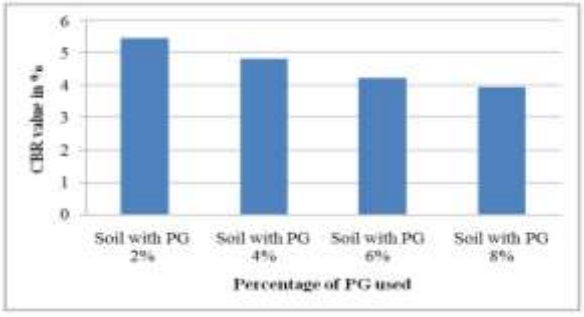


Graph 4: California bearing ratio value of Black Cotton soil with CCR

The California Bearing ratio is done by using Calcium carbide ratio at varying percentage is 2%, 4%, 6% and 8%. The respective CBR value obtained are 4.62, 4.2, 4.35 and 3.84 %.

Table 6: California bearing ratio for Phosphogypsum.

Sl No	Description	CBR (%)
1	Soil with PG 2%	5.45
2	Soil with PG 4%	4.82
3	Soil with PG 6%	4.24
4	Soil with PG 8%	3.95

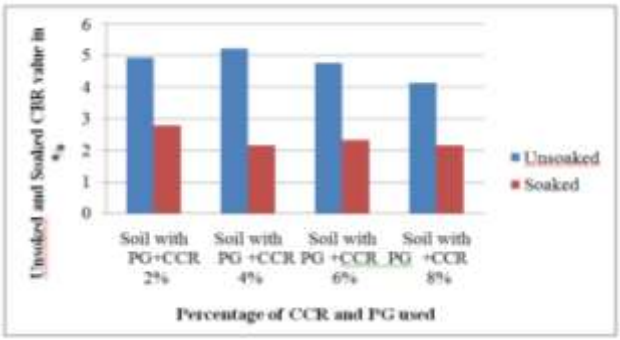


Graph 5 : California bearing ratio value of Black Cotton soil with PG

The California Bearing ratio is done by using Phosphogypsum ratio at varying percentage are 2%, 4%, 6% and 8% . The respective CBR value obtained are 5.45, 4.82, 4.24 and 3.95 %.

Table 7: California bearing ratio for Phosphogypsum

Sl No	Description	CBR % (Unsoaked)	CBR %(Soaked)
1	Soil with PG+CCR 2%	4.92	2.78
2	Soil with PG +CCR 4%	5.22	2.15
3	Soil with PG +CCR 6%	4.75	2.33
4	Soil with PG +CCR 8%	4.14	2.15



Graph 6: The Unsoaked and Soaked California bearing ratio value of Black Cotton soil with PG and CCR.

By mixing of both Calcium carbide residue and Phosphogypsum at 2%, 4%, 6% and 8% respectively is treated with Black Cotton soil as Unsoaked and Soaked California Bearing ratio is obtained the test results are 4.92, 4.22, 4.75, 4.14% and 2.78, 2.15, 2.33 and 2.15% respectively.

CONCLUSIONS

1. In light of the above test outcomes and result made the conclusion according to the accompanying;

2. Calcium carbide build-up has a high Ca (OH) 2 substance of around 76.7% to enhance the bearing limit of clayey soil, contains abnormal state of characteristic pozzolanic material.

3. The natural pozzolanic material reacts with Calcium carbide residue.

4. The Phosphogypsum is a loss by item from handling of Phosphate shake by wet corrosive.

5. The OMC and MDD of treated soil is varies with the dry density and moisture content ,is adding 2%, 4%, 6% and

8% of Calcium carbide residue .The MDD results are 1.85gm/cc, 1.46gm/cc, 1.4gm/cc and 1.44gm/cc and OMC results are 20.5%, 27.27%, 29.41% and 34.21% .

6. The OMC and MDD of treated soil is varies the dry density and moisture content is adding 2%, 4%, 6% and 8% of Phosphogypsum. The MDD results are 1.64 gm/cc, 1.63 gm/cc,1.42gm/cc and 1.4gm/cc and OMC results are 14.50%, 27.3%, 29.41% and 34.21%.

7. The combination of Phosphogypsum and Calcium carbide residue of 2%, 4%, 6% and 8%.The MDD results is 1.45gm/cc, 1.47gm/cc, 1.5gm/cc and 1.45gm/cc and OMC results are 14.5%, 27.3%, 30.8% and 33.5%.The dry thickness and ideal dampness is varies with OMC and MDD .

8. The Unconfined compressive strength (UCS) test is adding of 2%, 4%, 6% and 8% Calcium carbide residue the compressive strength values is 1.68 kg/cm2, 0.82kg/cm2, 0.75 kg/cm2, 0.6kg/cm2.The percentage of Calcium carbide increases the UCS value decreases.

9. The Unconfined compressive strength (UCS) test is adding of 2%, 4%, 6% and 8% Phosphogypsum the compressive strength value is 0.88 kg/cm2, 0.72 kg/cm2, 0.65kg/cm2 and0.54kg/cm2.The percentage of Phosphogypsum increases the UCS value decreases.

10. The Unconfined compressive quality (UCS) test is the mix of Phosphogypsum and Calcium carbide deposit is including 2%, 4%, 6% and 8% is 0.68 kg/cm2, 0.64 kg/cm2, 0.58 kg/cm2 and 0.45 kg/cm2 the level of Phosphogypsum and Calcium carbide build-up expands the esteem diminishes.

11. The California bearing ratio (CBR) test is adding of 2%, 4%, 6% and 8% 0f Calcium carbide residue .The bearing capacity values are 4.65%, 4.20%, 4.35% and 3.84%. The percentage of CCR increases the bearing capacity decreases.

12. The California bearing ratio (CBR) test is adding of 2%, 4%, 6% and 8% of Phosphogypsum. The bearing capacity values are 5.45%, 4.82%, 4.24% and 3.95%. The percentage of Phosphogypsum increases the bearing capacity decreases.

13. The California bearing ratio (CBR) test is adding of 2%, 4%, 6% and 8% of Phosphogypsum and Calcium carbide residue. The CBR (Unsoaked) values are 4.92%, 5.22%, 4.75% and 4.14%,and the CBR(soaked) values are 2.78%, 2.15%, 2.33%, and 2.15%.In this case the soaked and unsoaked bearing capacity values are increase first and then decreases in unsoaked case , same in the case of soaked condition.

14. The splash quality is by and large lower than the unsoaked strength, in light of fact that the ingested water increments.

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