Reduce Seepage loss and Design of an Irrigation Channel / Water Pool

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1. Introduction

Morrums are utilized as Natural material for different Civil and filling works in a large portion of nations. These Natural soils are weathered by states of high temperatures and dampness with all around characterized wet and dry periods bringing about poor properties, for example, high pilancy, poor usefulness, high penetrability, propensity to hold water substance and high regular dampness content. The utilization of this common material is in this manner frequently ruined by trouble in dealing with especially under dampness and clammy conditions commonplace of tropical zones and must be usage after Modification/Stabilization. present such issues amid development process are named hazardous morrum.

The alteration/Stabilization of building properties of soil is perceived by architects as a critical procedure of ad libbing the execution of risky soils and improves peripheral soils execute as a structural designing material. The utilization of synthetic compounds, for example, normal Portland bond, lime, fly cinder and so on or a mix of these frequently result in the change of the dirt file properties which may include the cementation of the particles. Already, the most usually utilized added substance for soil adjustment or adjustment is the normal Portland bond. In any case, ongoing Studies have demonstrated that a large number of the dirt issues can improve by the expansion of rice husk cinder.

1.1. Rice Husk Ash (RHA)

RHA is a most broadly accessible agrarian waste in many rice delivering nations on the planet. Universally, approx. 600. MT of paddies are delivered each yearly period. Overall 20 % of the paddy is husk, giving a yearly aggregate creation of 120 MT. In most astounding of rice creating nations a significant part of the husk delivered from preparing of rice is either burned or dumped as waste or by glue assault. Consume Rice Husk(BRH) in amine environment leaves a buildup, called RHA. For every 1000 kgs. Of paddy processed, about 220.kgs (22 %) of husk is created, and when this RH is fire in the boilers, about 55.kgs (25 %) of RHA is produced.

1.2. Morrums

Morrums are soil types wealthy in iron and aluminum, framed in hot and wet tropical territories. Almost all morrum are corroded red in view of iron oxides. They create by escalated and durable weathering of the fundamental parent shake. Tropical weathering (laterization) is a drawn-out procedure of compound weathering which creates a wide assortment in the thickness, review, science and metal mineralogy of the subsequent soil. Most of the land zone containing Morrum is between the tropics of Cancer and Capricorn.

Truly, Morrum was cut into block like shapes and utilized in landmark building. After 1000 CE development at Angkor Wat and other south-east Asian destinations changed to rectangular sanctuary nooks made of Morrum, Brick and stone. Since the mi-1970s preliminary areas of bituminous surfaced low volume poles have utilized Morrum instead of stone as a base course. Thick Morrum layers are permeable and marginally penetrable, so the layers can work as aquifers in rustic territories. Locally accessible Morrum are utilized in a corrosive arrangement, trailed by precipitation to expel phosphorus and overwhelming metals at sewage treatment offices.

In India lateritic soils possess a territory of 130066 sq. km. what's more, it is very much created in on the summits of Deccan slopes, Karnataka, Kerala and Eastern Ghats and focal; some portion of Orissa and Assam and West Bengal. Morrums and lateritic soils from a gathering containing a wide assortment of red, dark colored, and yellow, fine – grained remaining soils of light surface and additionally nodular rock and solidified soils. They may change from a free material to an enormous shake.

1.3. Goal

The fundamental point of this undertaking is to assess the progressions of list properties of morrum with morrum balanced out with rice husk fiery debris and its viability in drainage decrease. The point has been accomplished through covering the accompanying explicit goals.

1.4. Objective
The above objective was accomplished with the accompanying explicit targets,

I. Researching the designing properties and characteristic of the morrum and rice husk fiery remains tests gathered (i.e., Dry thickness, Specific Gravity, Liquid limit, Plastic limit, Plasticity file, Compressive quality and so forth.)

II. Viability in Reduction of drainage in a channel by utilizing morrum homogeneously blended with (8.7%) rice husk powder concerning crude morrum in a lush field arranged at Malandighi, Durgapur, West Bengal (India).

Foundation of better appropriate mixes of morrum or morrum in addition to rice husk fiery remains syntheses for monetary channel lining.

2. Materials and Methodology

2.1. Study soil

The dirt example chose for this investigation is a ruddy dark colored lateritic morrum soil gathered by circulated Sampling from a get pit at profundities of somewhere in the range of 1.0 and 2.0 m in Malandighi, Durgapur. It has a place with the gathering of ferruginous tropical soils got from volcanic and changeable rocks.

2.2. Rice Husk Ash

Rice processing creates a result known as husk. This Surround the paddy grain. Amid processing of Paddy about 78% of weight is gotten as ice, broken rice and boycott. Rest 22% of the heaviness of paddy is gotten as husk. This husk contains about 75% natural unpredictable issue and the equalization 25% of the heaviness of this husk is changed over into slag amid the terminating procedure, is known as Rice Husk Ash (RHA). This RHA thusly contains around 85%-90 undefined silica.

2.3. Methodology

The tests and investigations which were utilized in the lab of Soil and Water Engineering Department to decide the progressions of physical properties of morrum blended with 8% rice husk cinder by weight as pursues,

I. Assurance of explicit Gravity (Using Specific Gravity Bottle)

II. Assurance of Liquid Limit of the example (Using Casagrande's contraption)

IV. Determination of Plastic Limit of the example (Using Atterberg's limit technique)

V. Determination of Grain estimate conveyance (Using Sieves and Hydrometer).

2.4. Specific Gravity

To determine the specific gravity of specimen material, the steps are,

I. The clean dried specific gravity bottle is weighted let that to be W₁ gm

II. Then it is filled with fresh distilled water and then kept in water bath at least half an hour at

\[
\text{[ Temperature 27°C±0.1°C ]}
\]

III. The bottle is then removed and cleaned from outside. The Specific gravity bottle containing Distilled water is now weighted. Let this be W₂ gm.

IV. Then the specific gravity bottle is emptied and cleaned. This soil sample is poured to fill about half of the bottle. Then it is weighed. Let this be W₃ gm.

V. The remaining space in specific gravity bottle is filled with distilled water at 27°C and is weighed Let this be W₄ gm. Then specific gravity of soil sample (W) is given by

Formula,

\[
\left(\frac{W_3-W_1}{W_2-W_1}\right) \cdot (W_4-W_3)
\]

[ Where, W₁ = Weight of empty bottle, W₂ = Weight of empty bottle + distilled water, W₃ = Weight of empty bottle + soil sample, W₄ = Weight of empty bottle + soil sample + water.]

2.5. Liquid Limit

The fluid furthest (Liquid Limit) reaches of an example is the dampness content, communicated as a level of the stove dry wt. of the example at which it will simply being to stream when dropped multiple times for tallness of 1cm. At this water content the example is basically fluid however has a specific shearing protection from stream. It is dictated by a standard contraption known as Casagrande's mechanical assembly. Fluid limit is said to be that water content in percent when 25 nos. of blows in the Casagrande's mechanical assembly, simply shut a notch of 2mm. thick which is cut in the example by a standard scoring device. Around 150 gms of an air-dried soil test passing 425µ Sieve is taken and blended altogether with distill water to give a firm and uniform glue. A bit of the glue was set in the container, leveled with the spatula and a straight notch was cut with the slicing apparatus along the distance across through the Center of the pivot. The handle of the contraption was spun at the rate of 2 RPM unit the furrow at the base shut. The no. of upset was tallied and recorded. Around 15 gms of the tried example was gathered in a bowl from the side of the furrow for the trial of its water content. It water substance was recorded. The above technique was rehashed for 4-5 times by expanding the water content step by step. For each set no. of blows and comparing water content were recorded. A stream bend is pruned on a semi long chart speaking to the no of blows in long scale as abscissa and water content as ordinate in number juggling scale. The water content relating to 25 nos. of blows will speak to the L.L of test.

2.6. Plastic Limit

Plastic limit is characterized as least water content which soil stays in plastic state. Plastic limit is resolved after the means given beneath:
I. An agent soil test of around 20 kg from the segment of the material passing 425 microns IS strainer is taken and blended altogether with refined water in a vanishing dish till the dirt mas ends up plastic enough to be effectively formed with fingers.

II. About 8 grams of this dirt mass is taken and rolled

III. Between the fingers and the glass plate with simply adequate Pressure to frame a string of uniform breadth of around 3 mm. through its length.

IV. Alternate rolling and manipulating was proceeded until the point that the string disintegrates under the weight at around 3 mm. breadth.

V. Moisture substance of this disintegrated soil string is resolved.

2.7. Plasticity Index

The plasticity Index is defined as the numerical difference between Liquid Limit and Plastic Limit.

[Plasticity Index = Liquid Limit – Plastic Limit].

2.8. Liquidity Index

The liquidity index (LI) is used for scaling the natural water content of soil sample to the limits. It can be calculated as a ratio of difference between natural water content, Plasticity limit, and liquid limit; LI = (W - PL) / (LL - PL) where W is the natural water content. The effects of the water content on the strength of saturated remolded soils can be quantified by the use of the liquidity index.

2.9. Grain Size Distribution

This test is performing to decide the level of various grain sizes contained inside a dirt. The mechanical or sifter examination is performed to decide the circulation of the coarser, bigger – measured particles, and the hydrometer strategy is utilized to decide the dispersion of the better partials.

2.10. Sieve Analysis

I. Record the heaviness of each strainer and in addition the base container to be utilized in the investigation.

II. Record the heaviness of the given dry soil test.

III. Make beyond any doubt that every one of the strainers are perfect, and amass. Them in the climbing request of strainer numbers (#4 sifters at best and #200 strainers at base). Place the container roar #200 strainer. Painstakingly empty the dirt example into the best sifter and place the top over it.

IV. Place the sifter stacks in the mechanical shakes and Shake for 10 minutes).

V. Remove the stacks from the shaker and deliberately gauge and record the heaviness of each sifter with its held soil. Furthermore, make sure to gauge and record the heaviness of the base container with its held fine soil.

The outcome is recommended in a diagram of percent passing versus the sifter estimate. On the diagram the strainer estimate scale is logarithmic. To discover the percent of total going through each strainer, first fined the percent held in each sifter. To do as such, the accompanying condition is utilized,

[% Retained = ((W_{<\text{sieve}}/W_{total}) x 100 \%)]

[Where, W_{<\text{sieve}} is the heaviness of total in the sifter and W_{total} is the aggregate weight of total. The subsequent stage is to locate the combined percent of total held in each sifter, to do as such, include the aggregate sum of total that is held in each strainer and the sum in the past strainers. The total percent going of the total is found by subtracting the percent held from 100 \%].

[%Cumulative passing = (100 \% - % Cumulative Retained)].

The qualities are then plotted on a chart with total percent passing on the Y hub and logarithmic strainer estimate on the X pivot.

There are two renditions of the % passing conditions; the .45 control recipe is exhibited on .45 control degree outline. Form of the percent on a semi ling degree graph. Adaptation of the percent passing diagram is appeared on .45 control outline and by utilizing the .45 passing equation.

.45 control percent passing equation,

% Passing = Pi = [ SieveLargest/Aggregate (Max - sifter x 100 \%)]

[Where, Sieve Largest – Largest measurement strainer utilized in (mm.) Aggregate estimate - Larger bit of total in the example in (mm.)].

Percent passing recipe,

% Passing = [W_{below}/W_{total} x 100\%]

[Where, W_{below} = the aggregate mass of the total inside the strainer beneath the current sifter, excluding the current sifter's total. Also, W_{total} = the aggregate mass of the majority of the total in the sample].

2.11. Hydrometer Analysis (HA)

A hydrometer is an instrument used to quantify the explicit gravity (or relative thickness) of fluids; that is, the proportion of the thickness of the fluid to the thickness of water.

Hydrometer investigation is a broadly utilized strategy for getting a gauge of the circulation of soil molecule measure from the No. 200 (0.075 mm) strainer to around 0.01 mm. The information is introduced on a semi long plot of percent better versus molecule breadths and might be joined with the information from a sifter investigation of the material held (+) on the No. 200 sifter. The foremost estimation of the hydrometer examination has all the earmarks of being getting the mud part (for the most part acknowledged as the percent better than 0.002 mm). The hydrometer examination may likewise have an incentive in recognizing molecule estimate under 0.02 mm. in ice weakness checks for asphalt subgrades.
This test is done when more than 20 % go through No. 200 sifter and 90 % or more passes the No.4 (4.75 mm) Sieve.

The hydrometer examination depends on Stokes Law, which gives the connection among the speed of fall of circles in a liquid, the distance across of the circle, the explicit weights of the circle and of the liquid, and the liquid thickness. In condition shape this relationship is,

\[
V = \left( \frac{2}{9} \right) \times \left( \frac{(G_S - G_r)}{n} \right) \times (D/2)^2
\]

Where, \( V = \) Velocity of fall of the circles (cm/s), \( G_S = \) explicit gravity of the circle, \( G_r = \) explicit gravity of liquid (fluctuates with temperature), \( n = \) supreme, or dynamic, thickness of the liquid [g/(cm x s)], \( D = \) distance across of the circle (cm).

Fathoming the condition for \( D \) and utilizing the explicit gravity of water \( G_w \), we acquire

\[
D = \sqrt{\frac{18n}{(G_S - G_w)}} \\
V = \frac{L}{t} \\
A = \sqrt{\frac{18n}{(G_S - G_w)}} \\
D = A \sqrt{\frac{L(\text{cm})}{t(\text{min})}}
\]

Where 0.002 mm ≤ \( D \) ≤0.2 mm

Apparatus required for hydrometer test are as follows,

I. Hydrometer (152 H model preferable)
II. Quantity (about 2.5 L per test) of distilled water
III. Sedimentation cylinder (1000 ml cylinder) also

Treated a hydrometer jar

IV. Graduated 1000 ml cylinder for control jar

V. Semi-dispersion device (malt mixer or air-jet Dispersion)
VI. Dispersion agent (NaPO₃ or Na₂SiO₃)
VII. Hydrometer jar bath (optional, for temperature Control)
VIII. Thermometer.

2.11.2 Procedure

I. Setting up the control container by including 125 ml of 4 % Sodium metaphosphate (NaPO₃) arrangement and Refined water to create 1000 ml. (This arrangement can be made by blending 40 g of dry substance with enough water to make 1000 ml). Put the hydrometer in to the control barrel and record zero and meniscus rectification; at that point record the temperature by putting the thermometer in it.

II. Weighing out precisely 50 g of soil passing the No. 200 strainers. Blend the dirt with 125 ml of 4 % sodium metaphosphate (NaPO₃) arrangement. Enable the dirt blend to remain around 12 hours.

III. Toward the finish of the drenching time frame, exchange the blend to a scattering (or malt blender) container and include tap water until the point that the glass is around 66% full. Blend for 1 minute.

Subsequent to blending, deliberately exchange every one of the substance of the scattering container by utilizing a plastic crush bottle or including balanced out water and empty this into the sedimentation barrel. Presently add refined water to fill the chamber to the 1000 ml stamp.

IV. Top the sedimentation chamber with a No. 12 elastic plug and precisely foment from around 1 min. Fomentation is characterized as flipping around the chamber and back 60 turns for a time of 1 min. A topsy turvy and back development is 2 turns.

V. Put the sedimentation barrel alongside the control chamber and begin and stopwatch instantly. This is combined time \( t = 0 \). Embed the hydrometer into the sedimentation barrel.

VI. Taking hydrometer perusing at total time \( t = 0.25 \) min., 0.5 min., 1 min. what's more, 2 min. Continuously read the upper dimension of meniscus. Expel and place the hydrometer in the control container.

VII. Keep taking hydrometer and temperature perusing at surmised slipped by times of 8, 15, 30, 60 min. what's more, 2, 4, 8, 24 and 48 hr. For each perusing, embed the hydrometer into the sedimentation barrel around 30 sec before perusing is expected. After the perusing is taken, expel the hydrometer and set is back into the control chamber.

2.11.3. Calculation

I. Calculate corrected hydrometer reading for percent finer, \( R_{CP} = R + F_i + F_z \)

II. Calculate percent finer \( = \frac{A \times R_{CP} \times 100}{W_S} \)

[Where, \( W_S = \) dry weight of soil used for hydrometer analysis, \( A = \) correction for specific gravity (as hydrometer is calibrated for \( G_S = 2.65 \))]

Therefore, \( A = \left[ 1.65 \times G_S / \{(G_S - 1) \times 2.65 \} \right] \)

III. Calculated corrected hydrometer reading for determination of effective length, \( R_{CL} = R + F_m \)

IV. Determine \( L \) (effectiveness length) corresponding to \( R_{CL} \) given in Table 1.

V. Determine \( A \) from Table B.

VI. Determine \( D \) (mm.) \( = A \sqrt{L / t} \) [Where, \( L \) in cm. and \( t \) in min.]
Table 1
Variation of L with hydrometer Reading

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<th>L (CM)</th>
<th>Hydrometer Reading</th>
<th>L (CM)</th>
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Table 2
Variation of L with hydrometer Reading

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GS 24 25 26 27 28 29 30

2.11.4. Combined Analysis

I. The modified percent finer = percent finer for hydrometer method percent passing No. 200 sieve from Step 1.

II. The total modified percent finer for samples retained on No. 200 sieve and above would be the same as calculated in sieve analysis; for samples passing No. 200 sieve, the same as calculated in step 2.

2.11.5. Determination of Seepage Loss

Three quantities of trapezoidal diverts are exhumed in a lush field of Institute of Engineering and Industrial innovation, West Bengal, India.
I. Length of the Channels is 3 m.
II. Profundity of the channels is 25 cm.
III. Bed width of each Channel is 1.22:1.
IV. Two channels are developed utilizing morrum and morrum with rice husk fiery remains (92%-08% by dry weight) as coating materials utilizing 4 mm. covering of the examples on the surface of channel.
V. In one of the channel no coating is given.
VI. Each dry every one of channels is loaded up with water and the profundity is recorded.
VII. Consistently every one of channels is loaded up with water and the profundity is recorded following an interim of 24 hours.

3. Conclusion

In light of the outcomes acquired in the analyses it is seen that the estimations of explicit gravity and dry thickness are diminishing when morrum is balance out with 8 % rice husk fiery remains (by weight), Cohesion and establishing properties are expanded as measure of better molecule is expanded (decided from grain estimate circulation). If there should be an occurrence of morrum, yet the sum isn't so high like regular covering materials.

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