

COIR - AN EFFECTIVE COMPONENT FOR CONSOLIDATION

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ABSTRACT:

Consolidation of soil, especially of soft clayey structure is being recognised as a problem that required effective and economical solution. Coir nonwoven geo-textile is one of the materials, used as horizontal blanket over vertical drains in the application of soil consolidation for geo textile applications. Coir is a renewable natural material available abundantly in India and produced at low cost. It is as such an economical answer to the problems related to primary consolidation of soft clay. Coir is Eco-friendly product and so its application never sustain any damages to environment and so is far free from resentments.

The paper deals with a case study on the usage of coir geo-textile in the formation of an embankment in NH-17, near Kozhikode, Kerala India where the above technique of “horizontal coir blankets over vertical drains “were experimented and is found to be an economical and successful solution

INTRODUCTION

Construction of high and heavy embankment directly over weak and soft, in slushy and marshy areas leads to long term settlement problems. They are likely to undergo shear failure. A primary solution in such areas is the removal of the soft soil, the thickness of such extraction depending upon the height of the embankment and other design considerations. The embankment materials have also to be compacted in thin layers using suitable mechanism at specified intervals, to the designed height. The stability of these embankment treacheries soils, like weak clays black cotton soils and very soft slushy soils can be ensured and enhanced with other shear strength improvement technique

The installation of the vertical drains is one method, which would reduce the time for the consolidation of the soft clay layer considerably. The process paves way for the water in the soft clay subjected to excess pore pressure under surcharge to permeate into the vertical drains and to dissipate as fact as possible, and so to achieve the desired degree of consolidation of the foundation soils. The pore water from the zone of influence of each drain gets collected in them and flows vertically upwards towards drains at the top. The consolidation takes place rapidly due to such radial and vertical movement of the pore water, which finally escapes through the previous layer at the top.

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A CASE STUDY

The National Highway by pass in NH17 on Calicut stretch from ch.20870 to ch.28127 runs through an embankment on soft soils and soft clay deposits. As per the data collected from the revelations of the soil characteristics, it was found that it is not possible to construct an embankment technique, for the foundation soils. More loading over the base would become disastrous, as per the findings from the design consideration.

Under the circumstances, it was proposed to provide vertical drains of dia 25cm, 8.00m depth, at 2.00 mtr C/C with a horizontal Coir drainage blanket, connected at the top level and covering the plan area of the embankment. The 1st 1.00-mtr height of the embankment was to be put up over this blanket. The second stage of construction of the embankment was taken up after ensuring that the soils have undergone primary consolidation with an enhancement in its sheer strength (See Figure: 1).

CONSTRUCTION PROCESS

VERTICAL PROCESS

The ground water table is found to be very high in this area, very near to the ground level at the location, where the high embankments are proposed. The top stratum of the soil, naturally found slushy, was removed first and the trenches replenished with the embankment material compacted. The sand drains are penetrated by means of screwauger. Vertical drains of 25cm diameter, and 8.00-m depth at 2.00 m C/C are made up of crushed stone aggregate. Vertical drains with an inner core of 6 mm size aggregates to 10 cm diameter and an outer layer of 7.5 cm shell thickness with 3 mm size and 0.75mm to 1.5mm size aggregates, in the ratio of 1/2:1/2(See figure: 2).

LAYING HORIZONTAL COIR DRAINING BLANKET

The site is then made level in the transverse and the longitudinal directions. The first draining layer consisting of a mixture of crushed stone aggregate of size 0.75mm and 1.50mm and particles size of 3 mm in a proportion of 1/2:1/2 was then spread to thickness of 20cm. It is then well compacted till it attained a density of 1.83t/m³. Over this layer Non-woven Coir Needled Felt (1000 grm/m²) was laid. The felt is to have double the width of the base of the embankment. And is laid with equal projections on both sides, so that when it is folded towards the center results in a second layers. As explained below, that 6mm size coarse crushed stone aggregate to a thickness of 20cm was then spread on this felt and compacted again to a density of 1.85 t/m³.

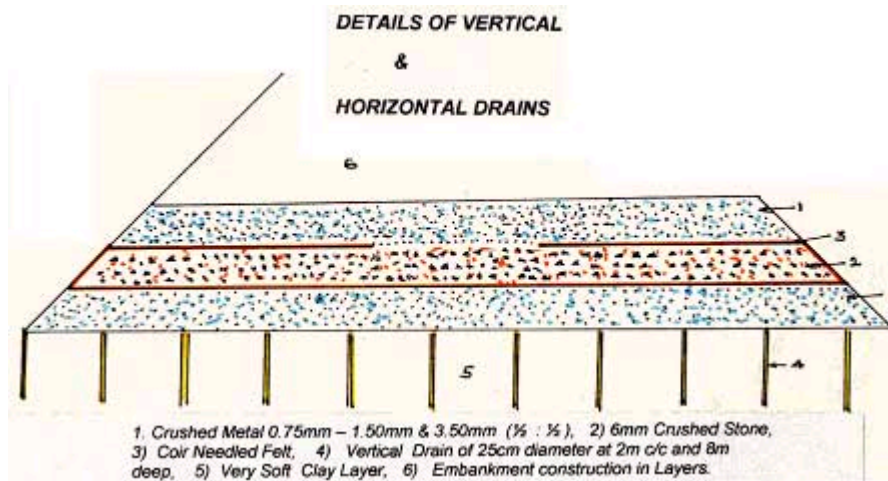
The projecting ends of the Coir Felt are then folded towards the center to cover the primary layer, except for a 2.00m width at the center. The ends of the Coir felt are kept unconnected with a gap in the middle, so as to allow for and to accommodate any deformation due to the possible settlement of the foundation layers, under the loads imposed by the embankments. Laying of the crushed stone aggregate layer compacted to a density of 1.85 t/m³, as laid earlier, is then repeated over the above Coir needled felt blanket .

CONSTRUCTION OF EMBANKMENT

The Construction of the embankment was undertaken in stages, after ensuring that the primary consolidation is over. Heave stakes were established at locations outside the toes of the embankment, to water for and to detect any heave or lateral movements of the natural grounds. Sufficient provisions for effective

drainage of the surface water from the sub-grade soils also were insisted to keep it free from soaking, which could only ensure long-term satisfactory performance of the embankment and the pavement, thereon.

COIR- A FILLER AND A FILTER



Coir is a versatile hard fibre obtained from the husks of coconut. The Coir fibre is one of the hardest natural fibres because of its high content of lignin, Coir is much more advantageous in different application for erosion control, reinforcement and stabilization of soil and is preferred to any other natural fibres. The fibre is hygroscopic, with moisture content of 10% to 12% at 65% humidity and 22% to 55% at 95% relative humidity. Of all natural fibers coir processes the greatest tearing strength, retained as such even in very wet conditions.

Chemical Composition Of Coir		Physical Properties Of Coir	
Lignin	45.84%	Length in inches	6-8
Cellulose	43.44%	Density (g/cc)	1.40
Hemi-Cellulose	00.25%	Tenacity (g/Tex)	10.0
Pectin's and related Compound	03.00%	Breaking elongation%	30%
Water soluble	05.25%	Diameter in mm	0.1 to 1.5
Ash	02.22%	Rigidity of Modulus	1.8924 dyne/cm ²
		Swelling in water (diameter)	5%
		Moisture at 65%RH	10.50%

BLANKET- THE FUNCTION

The above unique qualities of the coir contribute liberally to the functions of the blanket in different capacities and measures, as under.

The Coir Needled felt laid as blanket over the vertical drains allows the pore water, which gets collected and accumulated through and into the drain, to move freely to the sides. The Needled felt here acts as separator, filter, and filter reinforcement and facilitates drainage during the function.

While performing as a separator, the Coir Needled Felt at the same item will act as a filter allowing water to pass freely through or into the plane. Again, it tends to confine the supporting aggregate beneath the pressure aggregates able to retain a degree of reinforcement within itself. The installed Coir felt permits the water entering to be transmitted laterally, away from the areas of loading also.

As a barrier, the blanket prevents the inter mixing of materials from either Sides also.

CONCLUSION

The case study and the fieldwork revealed that significant reduction in time for primary consolidation of soft clay can be achieved by adoption of vertical drains, coupled with horizontal Coir blankets. Coir is a sufficiently Eco-friendly product and so its application will never sustain any damages to environment and so is far free from resentments. A versatile product, available abundantly throughout the country, produced at cheaper costs, it is, as such a sure and economical answer to the problems related to primary consolidation of soft and can be preferred to any other commodities available at present and experimented in the above area.

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