Review Paper On Study Of Cohesive Non-Swelling Soil

Rohit Tumane, Sanniv Shome, Nikita Janbandhu, Rupali Ramteke, Pooja Gadekar, Sandhya Suryawanshi

Student, Professor, Student,
Civil Department,
JDCOEM, Nagpur, India.

Abstract : as we known the large part of india is get covered by black cotton soils. The black cotton soil is expansive soil type and as the civil engineer, the structure mode on this type of soil get damaged due to strains caused in them by aiternate shrinkage and swelling. The black cotton soil contain the expansive clays. Due to if the water content increases then soil get swelling and vice versa. These type of soil have high shrinkage and swelling characteristics but the shear strength is very low. Therefore if we want to construct structure on such soil then we should have to improve the properties of soil.

Key words **- CNS, shrinkage, cohesion, shear strength, liquid limit (LL), Plasicity index(PI)**

1.INTRODUCTION

In 1978, Mr. Katti had proposed content of CNS layer to reduce effect of swelling and shrinkage. They studied that the cohesive forces develop up to the depth of 1m to 1.2m with saturation of expansive soil, which help to counter heave in the soil, which help to counter heave in the soil beneath even through the soil within the zone itself swells. It is necessary to conduct large scale tests to determine optimum thickness CNS layer with available CNS material.

The effects of cohesive non-swelling soil (CNS) layer of different shear strength on the behavior of underlying expansive soil are evaluated. The studies were conducted in CNS layer of different thickness and on expansive soil compacted at various initial void ratio. For controlling the vertical deformations and thus avoiding the swelling pressure being transmitted to structures, cohesive non-swelling soil technique has been developed by katti. The katti found that in an expansive soil stratum, development of cohesive bonds takes place upon saturation which helps to inhibits heave in the soil below the depth of 1m to 1.2m. however the, in the top 1m to 1.2m does swell. It was felt that if an environment is get similar to the one which exist over this thickness is produced similar to the one which exist over this thickness is produced and the soil is not allowed to swell, it should be possible to arrest heave in the expansive soil. By the replacement of the soil in the top 1-1.2m with CNS soil, this kind of environment can be produced.

2. SPECIFIATION OF CNS SOIL FOR IRRIGATION PROJECTS

2.1. Cohesive non-swelling (CNS) for treatment

(a) They are soils processing the property of cohesion of varying degree and non-expanding type clay minerals such as little and kaolinite and their combination with low plasticity with liquid limit not exceeding 50%.

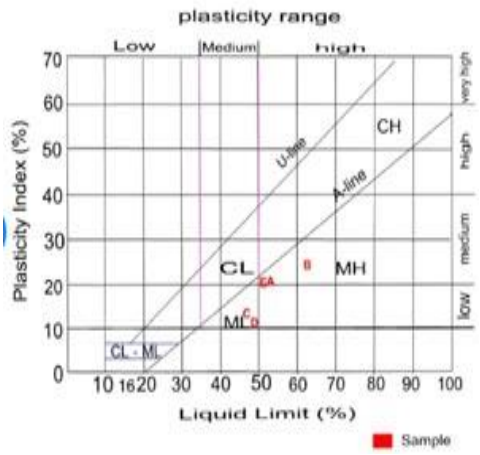
(b) some of the soils which may be considered as cohesive non-swelling soils are all adequately compacted clayey soils, silt clays, gravel sandy clay etc. exhibiting cohesive properties and constaining predominantly non-expanding type clay minerals.

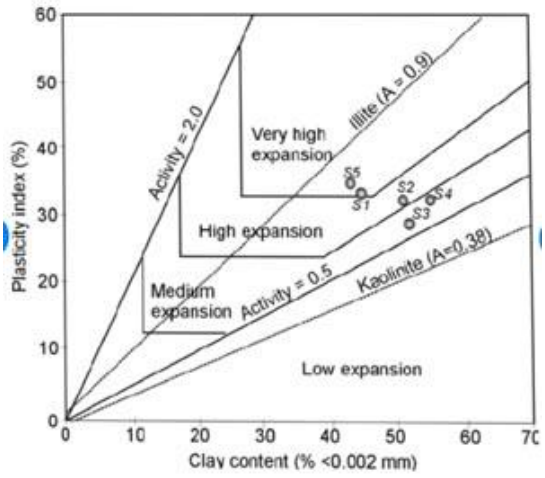
(c) CNS material should be non-swelling with a maximum swelling pressure of 10k/m2. when tested in accordance with IS2720 (part41):1992 at optimum moisture content and minimum cohesion should be 10kn/m2 when tested according to IS (part10):1991

(d) if gives CNS material is not available, designed mix to produce blended CNS may be used. The artificial CNS should satisfy all the requirements of CNS. If stabilized material is to be used, special mix designed needs to be evolved.

2.2 Identification of CNS material

(a) visual properties:
colour→ Red, Reddish, Yellow, Brown, White, Whitish, Grey, Whitish yellow, Green and Greenish Grey
land solpe→ Normal land slope are between 2 and 10, through on flatter slope they are many times encountered within 3m below the overtaking expansive soil.
Drainage→ Normally good





This chart classifies the soil into active, normal and inactive soils on basis of plasticity index and clay fraction present in soil. It is desirable to first check sample on this chart to see that the soil does not full into active zone.As per the suitability the soil sample identified on this chart i.e. not falling into active zone shall be checked on plasticity chart with below procedure.

1) Use to plasticity chart is made for general identification of CNS material.

2) In this method data required is only liquid limit (LL), plasticity index (PI)

3) The CNS soil has to resist internal erosion due to seepage and form suitable base for lining the soil with LL less than 30% and PI less than 15% is not considered suitable.

4) The zone covered between LL 30 to 50% and PI 15 to 30% is shown hatched.

5) Soil falling in this zone can be considered suitable to be used as CNS material.

6) However it is desirable to have a few representative sample tested for swelling pressure as cross check.

7) CNS soil normally should exhibit swelling pressure but exceptional cases swelling pressure less than 0.1kg/cm [10kn/m2]

3. PHYSICAL PROPERTIES OF CNS SOILS:

Most types of murums of laterite, laterite type and siliceous sandy clay exhibit CNS characteristics, however some murums may be of swelling type. Unlikely swelling soils, they do not exhibit cracking during summer, nor heaving and stickiness in rainy season. Structure constructed on such soil do not exhibit heave through they may sometimes settle. The CNS are generally reddish yellow, red, brown, yellow, white, whitish grey, whitish yellow, green and greenish grey in colour. Although several soil containing non-expanding type day mineral exhibit CNS properties, the following range helps in locating such types:

percent

Clay less than 2 micron → 15 to 20

Silt (0.6mm to 0.002mm) → 30 to 40

Sand (2mm to 0.06mm) → 30 to 40

Gravel (greater than 2mm) → 0 to 10

Liquid limit → greater than 30, but less than 50

Plasticity index → greater than 15 but less than 30

4. CRITERIA FOR FIXING THE THICKNESS OF CNS LAYER

Thickness of CNS material is related to swelling pressure and it resultant deformation. The permissible deformation in 2cm

Gudelines for choosing the thickness of CNS materials required for balancing the different swelling pressure is given in below table 1.A

Slope should accordance with IS 10430:1982

Discharge in cumecs	Thickness of CNS swell pressure 50-150kn/m2	Layer in cm (minimum swell pressure more than 150kn/m2
1) 1.4 – 2	60	75
2) 0.7 – 1.4	50	60
3) 0.3 – 0.7	40	50
4) 0.03 – 0.3	30	40

Table 1.A) A thicness of CNS layer discharge capacity less than 2 cumecs

Swelling pressure of soil [kn/m2]	Thickness of CNS materials cm (minimum)
1) 50 – 150	75
2) 150 – 300	85
3) 300- 500	100

Table 1.B) A thickness of CNS layer, discharge capacity less of 2 cumecs and more

Note : However, optimum thickness of CNS material needs to be find for different swelling pressures by actual experiments both in field and laboratory (if required)

5. RESULT :

The CNS soils should exhibit certain properties in order to quality for being used as CNS material for engineering construction at place like living of canals.

The properties of CNS soil sample is tested in the soil mechanics laboratory,

Tests	values
1) Gradation	Clayey soils, silt clay, sandy clay
2) Swelling pressure	10kn/m (max) ,

	cohesion 10kn/m (min)
3) Permeability	Good
4) consistency limit (LL,PI,PL)	Plasticity chart prepared and making done, LL (30-50%) PI (15-30%)
5) Clay minerology	Laterite, kaoline, illite

6. REFERENCES:

1. 0.IS 9451(1994): GUIDELINES FOR LINING OF CANALS IN EXPANSIVE SOILS [WRD 13: CANALS AND CROSS DRAINAGE WORKS], BUREAU OF INDIAN STANDARDS, NEW DELHI110002.
2. C. VENKATARAMAIAH, GEOTECHNICAL ENGINEERING, REVISED THIRD EDITION, NEW AGE INTERNATIONAL PUBLISHERS, NEW DELHI.
3. IS 2720-41 (1977): METHODS OF TEST FOR SOILS, PART 41: MEASUREMENT OF SWELLING PRESSURE OF SOIL [CED 43: SOIL AND FOUNDATION ENGINEERING], BUREAU OF INDIAN STANDARDS, NEW DELHI-110002
4. ARORA, SOIL MECHANICS AND FOUNDATION ENGINEERING.
5. IS 2720-17 (1986): METHODS OF TEST FOR SOILS, PART 17: LABORATORY DETERMINATION OF PERMEABILITY [CED 43: SOIL AND FOUNDATION ENGINEERING], BUREAU INDIAN STANDARDS, NEW DELHI-110002.
6. V.N.S MURTHY, GEOTECHNICAL ENGINEERING: PRINCIPLES AND PRACTICES OF SOIL MECHANICS AND FOUNDATION ENGINEERING.
7. IS 2720-5 (1985): METHODS OF TEST FOR SOILS, PART 5: DETERMINATION OF LIQUID AND PLASTIC LIMIT [CED 43: SOIL AND FOUNDATION ENGINEERING], BUREAU OF INDIA STANDARDS, NEW DELHI-110002
8. IS 2720-4 (1985): METHODS OF TEST FOR SOILS, PAR 4: GRAIN SIZE ANALYSIS [CED 43: SOIL AND FOUNDATION ENGINEERING], BUREAU OF INDIA STANDARDS, NEW DELHI110002.

.