ESTIMATION OF CONSOLIDATION PROPERTIES AND SHEAR PARAMETER OF REMOULDED SOIL: CASE STUDY OF DABHI VILLAGE, MEHSANA, GUJARAT

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Abstract: *A specialty of audit of the change and improvement in soil engineering has been displayed in straightforward and wide way. Recommendations are made in the matter of how best to deal with the dirt from a useful building angle. The coefficient of solidification, shear parameters and some dirt properties have been figured to better comprehend the dirt. Assurance of coefficient of solidification and Direct shear tests have been performed on unsaturated bothered and undisturbed examples of a compacted territory. Union test has been executed according to Seems to be: 720-15 (1965). A traditional direct shear device was adjusted so as to utilize the hub interpretation strategy for coordinate shear tests on unsaturated soils. The testing technique and some run of the mill comes about are introduced. Conceivable outcomes of potential utilization of soil for the development of private structures, buildings have been recognized for the improvement of zone.*

Key Words: *Consolidation, Shear strength, Soil, Soil Engineering.*

INTRODUCTION: Soil engineering is a bigger term which refers to the study of study and behaviour of soils, its types, properties, characteristics etc. Technically soil mechanics and engineering is an applied science which deals with the applications of soil mechanics to practical problems in day to day life. It has a bigger and vast scope than soil mechanics. The later two comes under the category of Voids. Voids should be as less as possible to improve the properties of soil and to increase maximum dry density.

Some times one more term is used i.e. Geotechnical engineering which is one more term which includes soil mechancis, rock mechanics and geology. All these terms are used synonymously viz. Soil Engineering, Soil mechanics and foundations and Geotechnical engineering. Soil Engineering has very huge scope in civil constructions such as Retaining structures, Stability of slopes, Foundations, Underground structures, Dams, Pavement designing. Also the properties of soil which is very significant for further planning and construction of sub structure is studied under soil engineering.

In this paper, endeavors have been made not exclusively to survey the advancement in phases of soil designing yet in addition one live contextual investigation of Dabhi Village, Mehsana District, Gujarat's dirt have been tried. The outcomes and finishes of the dirt testing for solidification tests and shear paramenters have been done to survey the potential utilization of the dirt for establishment of private structures and group buildings.

DEVELOPMENT IN SOIL ENGINEERING: AN ART OF REVIEW: The improvement and development and the soil engineering can be trace to the ancient periods also. Even before 2000 B.C. soil engineering was applied in the constructions. Development in Soil Engineering can be aggregate under four periods. (1) Past and Ancient Developments which has been happened before 2000 B.C. (2) From constructions, monuments after B.C. (3) From the Era of Coulomb till the Terzaghi's Era. (4) After the Contributions of Dr. Karl Terzaghi. In the first and former era, the constructed pavements in India and Egypt can be traced as an example. Also soil excavators, researchers and geologists have revealed in Mohanjodaro & Haddappa civilization that soil is used as a material for foundations. Heavy structures, aqueducts, brisges were constructed during the periods of Roman. The leaning tower at Pisa is also one example. Rialto Bridge (Venice), London Bridge (Londan) and Mousoleum Taj Mahal (Agra) were constructed.

The third Era can be depicted from the Coulomb's theory of earth pressure in 1773 till the contributions of Dr. Terzaghi. The fourth era of soil mechanics development starts from year 1923-1925 when Dr. Karl Terzaghi, the Father of Soil Mechanics and Engineering published a book named Erdbaumechanic in 1925.

In the 1773, Coulomb, a French Engineer gave theory of earth pressure on retaining walls, then he has also contributed in research work of shear parameters (c and Ø, phi) and wedge theory (1776). In 1856, Darcy gave the law of permeability of soils. Rankine (1857) gave the theory of soil pressure considering plastic equilibrium. Culmann (1866) gave general graphical solution for the earth pressure. O Mohr (1871) gave rupture theory of soils. In 1874, Rehbann (Poncelett) gave graphical method for computation of earth pressure based on Coulomb's theory. In 1885, Boussinesq gave theory of stress distribution. In 1906, Muler Breslau principle was developed. Martson (1908) gave theory for load carried by underground conduits. In 1911, Atterberg categorized consistency. Fellinius (1913) studied stability of slopes. In 1916, Patterson gave friction circle method for the stability of slopes. L Prandtl gave theory on plastic equilibrium which becomes base for soil bearing computations. This covers the third era of soil engineering development. After this era the modern era starts where Dr. Karl Terzaghi has mentioned that it is the effective stress which governs the bearing capacity and stability of slopes not the total stress.

The Fourth and Modern Era of soil engineering development starts from the year 1923-1925 when Dr. Karl Terzaghi, the father of Soil Mechanics published his books *Erdbaumechanic* in year 1925. In 1933, Proctor did pioneering work in compaction of soil. In 1948, Taylor worked on Consolidation, shear strength and stability of slopes. Weavwe (1934) and Khosla (1934)

solved some practical soil problems. Casagrande (1948) Classified soils, and also worked on earth masses and consolidateion. Skempton (1942, 1954) worked on pore pressure, effective stress, bearing capacity etc., Meyerhoff G. G. (1951) studied the bearing capacity of shallow and deep foundation. Hvorslev (1949) worked on subsurface exploration and shear strength of remoulded clay. Pech in 1967, 1974) worked on overburden SPT corrections. Also the work on overburden SPT Correction was done by Bazarra in 1974. Even after this the researchers and geologists are trying to come out with the soil problems and try to solve with the available theories and also some theories have been developed too.

DETERMINATION OF CONSOLIDATION PRESSURE OF DISTURBED SOIL

THEORY:

The test has been executed according to IS:2720 (Part XLI)- 1977 and IS:2720-15 (1965). Follwing parameters can be gotten by this test.

1. Voids proportion and coefficient of volume change.
2. Coefficient of solidification.
3. Coefficient of porousness.

System:

a) Preparation of example from agent soil test.

Soil is compacted at the coveted w.c. what's more, thickness, in a different substantial shape and after that the example is cut by embeddings the example ring into the form by squeezing with hands and deliberately evacuating the material around the ring. Trim the specimen smooth and flush with the best and base of the ring from outside and weight . Keep three examples from the dirt trimmings for w.c. assurance.

b) Preparation of shape get together and test immersion.

1. Saturate the permeable stone either by bubbling in refined water for around 15 minutes or by keeping them submerged in refined water for 4 to 8 hours.

2. Assemble the consolidometer with tile soil example and permeable stone at best and base of the example, giving a channel paper between the dirt example and the permeable stone. Position the weight cushion midway on tile top permeable stone.

3. Mount the shape get together on the stacking casing and focus it to such an extent that the heap connected is hub.

4. Connect the shape get together to the water supply and the example is permitted to soak.

5. The level of water in the repository ought to be at about an indistinguishable level from the dirt example.

6. Apply an underlying seating burden to the gathering. The greatness of this heap ought to be permitted to remain until there is no adjustment in dial gage perusing for two back to back hours, or for most extreme of 24 hours.

c) Consolidation test:

1. Note the last dial perusing under the underlying seating load. Apply first heap of force 10 KN/m2 and begin the stop observe all the while with stacking. Record the dial gage readings at different time interims showed in perception table 1. The dial gage readings are taken until the point when 90% solidification is come to. Essential solidification will by and large came to inside 24 hours.

2. At the finish of the period , determined above , take the dial perusing and time perusing. Apply stack addition and take dial perusing at different time interims. Rehash this system for progressive load increases..

3. After the last stacking is finished. Decrease. the heap to half of the estimation of the last load and enable it to remain for 24 hours. Decrease the heap advance in ventures of 1/fourth of past force till a power of 10 KN/m2 is come to. Take the last readings of the dial gage.

4. Reduce the heap to the underlying setting load. Keep it for 24 hours and note the last dial perusing.

5. Quickly disassemble the example gathering and expel the abundance surface water on the dirt example by smudging. Measure the ring with solidification example. Dry the dirt example in broiler and decide its dry weight.

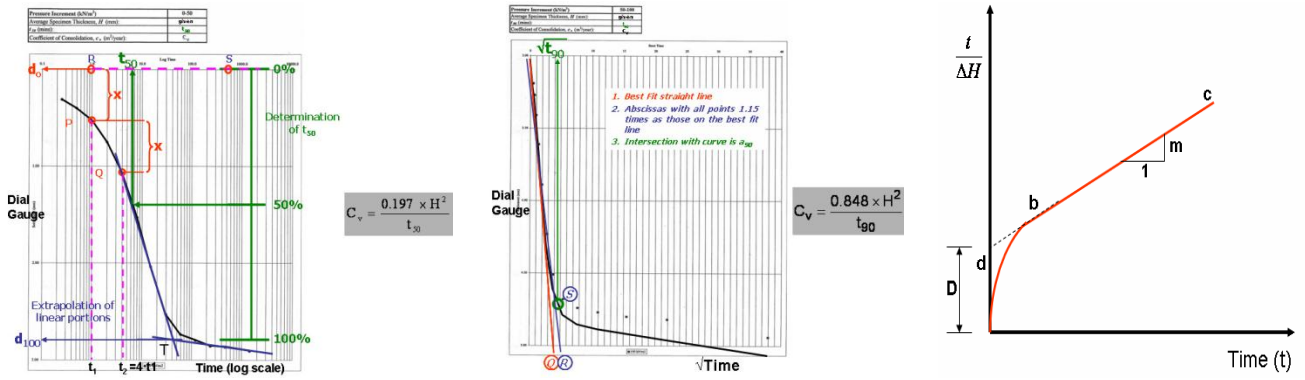
Assurance of coefficient of combination (C) from research center information

The coefficient of three graphical method are utilized

1. Logarithm of time strategy

2. Square base of time strategy

3. Hyperbola strategy (Sridharan and Prakash, 1985)



(a) **(b)** **(c)**

Figure:1- (a) Logarithm of time method, (b) Square root of time method, (c) Hyperbola method

Diameter of ring is 60 mm, Height of the ring is 20 mm, Area of ring = 2827.43 mm^2. Volume of ring is 56548.66 mm^3.

Table:1- Observation Table for Consolidation test using consolidometer.

		Dial Gauge Reading			Dial Gauge Reading
Pressure Intensity	**Kg/m^2**		**Pressure Intensity**	**Kg/m^2**	
Elapsed Time (min)	**$(t)^{0.5}$**	**1.2**	**Elapsed Time (min)**	**$(t)^{0.5}$**	**1.2**
0	0	100	25	5	46.05
0.25	0.5	90	30.25	5.5	45.8
1	1	82	36	6	45.1
2.25	1.5	75	42025	6.5	45.05
4	2	70	49	7	44.95
6.25	2.5	69	64	8	43.9
9	3	58	81	9	41.5
12.25	3.5	51.5	100	10	40.9
16	4	48.7	121	11	39.9
20.25	4.5	47.1	1440	37.94	38

1. Logarithm of time method

$C_v = (0.197\ d^d)/t_{50}$

The value of Cv obtained by this method has been been found out equal to 0.0447.

2. Square root of time method

$C_v = (0.848\ d^d)/t_{90}$

The value of Cv obtained by this method has been been found out equal to 0.03504.

3. Hyperbola method (Sridharan and Prakash, 1985)

$C_v = 0.3 (m H^2_{dr}/d)$

The value of Cv obtained by this method has been been found out equal to 0.0457.

Time rate of consolidation:

$T = (C_v * t)/ H^2$ or $t \alpha H^2 / C_v$

In this way the time required for a given level of union is corresponding to the length of the waste way If the time required to achieve a specific level of solidification is measured in the research center on a specimen acquired from the field. The time taken by the field store of known thickness can be anticipated by utilizing

$t_f = (H_f^2 / H_L^2)*t_L$

t_f = Time required for field consolidation
t_L = Time required for laboratory consolidation
H_f = Thickness of soil in the site
H_L= Thickness of laboratory sample

DETERMINATION OF SHEAR PARAMETER OF THE SOIL

Shear box test is used to estimate the direct shear.

MATERIAL AND EQUPMENT:

1. 1. Shear box hardware comprising of (a) shear box 60× 60 × 24 × mm possibly tried. The crate ought to be separated into two sections on a level plane, with appropriate dispersing screws, (b) holder for shear box (c) brace plates, two sets, one plane and other punctured: profundity of serrations to be 1.5mm permeable stones, one sets, 6mm thick, (e) base plate, with cross – grooves on its best into the shear box, (f) stacking cushion, with a steel ball on its best.
2. Loading casing, to disseminate the heap from the burden over the example, typical to the shear plane.
3. Set of weights for typical load.
4. Proving ring with dial gage precise to 0.002 mm to quantify the shear constrain.
5. Micrometer dial gage, two nos precise to 0.001mm measure even and vertical removals amid shear.Spatula, straight edge, sample trimmer etc.
6. Stop watch.

PREPARATION OF SPECIMEN:

1. The undisturbed example is set up by driving a cutting ring of size 10 cm in measurement and 2cm high, in the undisturbed soil test got from field. The square example of size 6cm 86cm is then cut from the roundabout example so acquired.

2. In request to get remolded example of firm soil, the dirt might be compacted to the required thickness and trimmed to the required size. Then again, the dirt might be compacted at the required thickness and water content specifically into the shear box in the wake of settling two parts of the shear box together by implies, of the settling screws.

3. Non – strong soil might be packed in the shear box itself with the base plate and network plate or permeable stone as required set up at the base of the container.

4. In all the three cases specified above, water substance and dry thickness of the dirt compacted in the shear box ought to be resolved.

Procedure:

1. The shear box with the example plain matrix plate over the base plate at base of example, and plain brace over the highest point of the example, ought to be fitted into position. The serration of the network plates ought to be set at right points to the course of shear .As the permeable stone are not utilized as a part of the untrained tests, plain plates of equivalent thickness ought to be put, one at the base and other a best of the two lattices, in order to keep up the shear plane in the example amidst its thickness. Place the stacking cushion on the highest point of the plain network plate. Both the parts of the container ought to be fixed by the settling screws.

2. Put water inside the water coat with the goal that the example does not get dried amid the test.

3. Mount the shear box gathering on the heap edge (or shearing machine). Set the lower some portion of the crate to shoulder against the heap jack and the upper piece of the container to tolerate against the giving ring. Set the dial of the demonstrating ring to zero.

4. Put the stacking burden on the highest point of the stacking cushion, and change the dial gage to zero to quantify the vertical dislodging in the dirt example. Put appropriate ordinary weight on the holder of the stacking burden, with the goal that this weight in addition to the heaviness of the holder approaches the required typical load. Note the perusing of the vertical relocation dial gage.

5. Remove the locking screw so the parts are liberated to move against each other. By turning the dividing screw, raise the upper part marginally over the lower parts by around 1mm.

6. Conduct the test by applying flat shear load to disappointment or to 20 for each penny longitudinal uprooting, whichever happen first. The rate of stain may shift from 1 to 2.5 mm for

every moment. Begin stop observe quickly toward the begin of the use of the shear stack. Take the readings of demonstrating ring dial gage, longitudinal removal gage and the vertical dislodging gage at standard time interim.

7. At the finish of the test, expel example from the crate and decide its last water content. Rehash the above strides on three or four indistinguishable example, under changing typical burdens.Size of the bos (cm) 6 by 6cm, Tickness of the sample 6 cm, Area of the box, A (cm^2) = 36 cm^2. Proving ring constant (kg/div) = 0.318 kg.

Table:2- Observation table for box shear test.

Sr. No.	Normal Stress (kg/cm^2)	Shear force = Proving Ring	Shear strain = S.F./A*P.C.(kg/cm^2)
(1)	(2)	(3)	(4)
1	0.7	12	0.106
2	1	18	0.159
3	1.3	24	0.212

After the examination and experimentation, C (Attachment block) has been figured as 0. I t specifically uncovers that the dirt isn't strong and does not have cohesiveness. The estimation of edge of shear protection has been seen as 70 degree which is under the classification of strong or phi soils. It can be inferred that the dirts of the examination zone (Town Dabhi) is totally union less.

More extensive and minute examinations on the dirts have been additionally done to uncover the properties and attributes of the dirt, for example, water content, fluid utmost, grain estimate conveyance (utilizing strainer investigation). It was acquired subsequently that the got soil does not have much pliancy and soil can be arranged as GP implies ineffectively or consistently evaluated rock. The coefficient of consistency was gotten as 2.6. What's more, the coefficient of arch discovered to be almost 1. The fineness was watched under 5 percent.

As the dirt is union not as much as shrinkage and swelling isn't a major issue yet leakage and pore weight may make an issue.

RESULTS AND CONCLUSION

Following discoveries can be compressed as a result of the present investigation,

(1) A whole audit of the dirt designing exploration from the old time to the advanced time has been finished. The advancement in soil mechanics has been partitioned in four time's and every time has been clarified. A specialty of audit of advancement in soil building has been exhibited in basic, intense and expansive way.

(2) Assurance of coefficient of solidification and Direct shear tests have been performed on unsaturated irritated and undisturbed examples of a compacted region. Solidification test has been executed according to IS:2720-15 (1965). A customary direct shear mechanical assembly was altered keeping in mind the end goal to utilize the hub interpretation strategy for coordinate shear tests on unsaturated soils. The testing system and some run of the mill comes about are exhibited.

(3) The coefficient of combination has been assessed to be 0.0447, 0.03504, 0.0457 according to the three strategies i.e. Logarithm of time strategy, Square base of time technique, Hyperbola strategy, shear parameters and some dirt properties have been figured to better comprehend the dirt. After trials and investigation the dirt has been delegated GP implies ineffectively evaluated rock or consistently reviewed rock. The dirt is attachment less and appropriate for the establishment.

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