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Estimation of Pre-Consolidation Stress of Compacted Fine-Grained Soils – By User Friendly Methods

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Abstract. Over consolidated natural soils exhibit characteristic stress, known as pre-consolidation stress (σ_p^1) which represents the maximum stress to which the soil has been subjected in the past. The soil used in various geotechnical mass applications like earthen embankments, dam etc., will be subjected to some specified compactive effort which is akin to over consolidation. Hence, compacted soils are also expected to possess a characteristic stress similar to pre consolidation stress of over consolidated natural soils. Compacted fine-grained soil application for civil engineering applications is becoming more vital role to non- availability of coarse grained soils at large. The engineering behaviour of fine-grained soils becomes more complex because of the presence of different clay minerals in various proportions.

The present experimental study aims to study the variation of pre consolidation stress of compacted fine-grained soils having same liquid limit, different plasticity characteristics and clay mineralogy subjected to light and heavy compaction energy levels. An attempt has been made for the detailed study of the variation of pre-consolidation stress by five user friendly methods documented in the literature with placement conditions, clay minerology and compaction energy levels. Very interesting observations were made with respect to variation of pre consolidation stress with clay mineralogy, compaction energy levels and placement conditions.

Useful correlations were also developed for the estimation of pre-consolidation stress with particular reference to the method of determination of σ_p^1 and engineering behaviour like compaction characteristics. The study also highlights the role of clay minerology on pre-consolidation stress and placement condition.

Keywords: Clay minerology compaction energy, pre-consolidation stress, placement condition, plasticity characteristics.

1 Introduction

Over consolidated natural soils exhibit a characteristic stress, known as preconsolidation stress ($\sigma p'$), which represents the maximum stress to which the soil has been subjected in the past. The soils used in various geotechnical mass applications like construction of earthen embankments, earth dams etc, will be subjected to some specified compactive effort, which is akin to over consolidation. Hence, compacted soils are also expected to possess a characteristic stress similar to preconsolidation stress of over consolidated natural soils. Literature review indicates that very limited such documentations of the studies related with preconsolidation stress of compacted soils is available Prakash et al, (2014). Among different methods of estimating pre-consolidation stress of fine grained soils, four user friendly methods were selected for comparative study i.e., Casagrande Method, Log-log Method, N-plot Method and Pacheo- silva's method.

2 Literature review

Over consolidated (OC) and normally consolidated (NC) soils exhibit widely varying compressibility behaviour. Compression index (Cc) is a parameter which helps in the settlement calculations while coefficient of consolidation is an useful parameter in analyzing the time-rate of consolidation behaviour of fine-grained soils.σ_p' is the important consolidation characteristics of OC soils. The over consolidation of soil mass can be attributed to many causes such as erosion/removal of previously existed overburden, desiccation of soil mass, change in the structure due to aging, chemical behaviour of the deposits and the internal pressures due to pore water. Various methods have been mentioned in the literature for the evaluation of σ_p' of OC soils. A brief description of each of these methods are given below.

1. Schmertmann method

Schmertamann (1955) proposed a method for obtaining σ_p', which also involved a trial and error process.

2. Janbu method

Janbu (1969) proposed a procedure for determining the pre-consolidation stress based on constrained modulus (M) v/s. σ' plot, where constrained modulus is the reciprocal of coefficient of volume compressibility (i.e., $M = 1/ m_v$).According to Jambu, the consolidation stress at which there is a drop marked in the modulus or the stress beyond which the constrained modulus levels out.

3. The void Index method: Burland (1990) proposed a method, known as the void index method, to assess the preconsolidation stress for soils for which σ_p' is not well defined in the conventional e-log σ' plot.

The e_{100} and C_c are to be determined from the laboratory tests, where e_{100} is the void ratio at σ'=100 kPa and C_c which is corresponding to virgin portion of the curve. However, for soils which plot above the A-line of the plasticity chart, Burland suggested that e_{100} and C_c could be calculated from the following empirical correlations.

$$e_{100} = 0.109+0.679\, e_L - 0.089\, e_L^2 + 0.016\, e_L^3 \quad (1)$$

$$C_c = 0.256\, e_L - 0.04 \quad (2)$$

Where e_L is the void ratio (The percentage of water content at liquid limit of the soil)

The value of void Index (I_v) is determine from the following equation

$$I_v = (e-e_{100})/C_c \quad (3)$$

4. Jacobsen's Method

Jabcobsen (1992), His evaluation of the stress- strain curves from consolidation tests on Danish over consolidated clays combined with the aspect of Casagrande and Terzaghi, projected an preconsolidation stress with reference to eq.4.

$$\sigma_p' = 2.5\, \sigma_k' \quad (4)$$

Where σ_k' is the consolidation stress corresponding to the point of maximum curvature on the e-logσ' curve defined by Casagrande (1936). This method appears to be very simple. Hence, the value of σ_p' depends upon the point of maximum curvature on the e-logσ' curve, that was judged by manual identification and in addition to this Jacobsen's method also not checked and that is limitation except for the Danish clays.

5. Pacheco Silva's method

This method is based on empirical constructions done on e-logσ' plot (Clementino, 2005)

The advantage climbed by this method is that the method does not give scope for any personal judgement.

6. n – $log_{10}\sigma'$ method

Allam and Robinson (1997) proposed the use of nv/s$\log_{10}\sigma'$plot, where n is the porosity of the soil sample corresponding to σ', to determine the value of preconsolidation stress, instead of conventional e-$\log_{10}\sigma'$ plot. They validated their method with experiments on soils of known stress-history and found that the results obtained were in agreement with those determined by Casagrande method. This method is very similar to the log-log method proposed by Sridharan *et.al* (1991). However, it is to be noted that n-$\log_{10}\sigma'$ method requires additional calculations to obtain the values of porosities at different consolidation stresses.

7. Onituska Method

Apart from these methods, the literature also documents the bilogarithmic approach by Onitsuka *et al* (1995). They suggested the use of $\log_n(1+e)$ with $\log_{10} \sigma'$ plot instead of conventional e-logσ' plot. It is to be noted here that this method is nothing but the log-log method proposed by Sridharan *et al* (1991) with the only difference that the logarithm to base 10 is replaced by natural logarithm.
The review of literature on procedures of determining the preconsolidation stress indicates that different methods discussed have their own merits and limitations. It has also been noted that limited work has been reported by the researchers on the preconsolidation stress of compacted fine grained soil having different clay mineralogy subjected to variation of different compaction energy levels for different placement conditions.

3 Materials and Methods

The engineering behaviour of fine-grained soils is largely dominated by the soil clay mineralogy. Thesoilsincludedtwotypesofclaymineralslike montmorillonite and kaolinite in different fraction, in addition to other clay and non-clay minerals. These clay minerals were responsible for the geotechnical engineering behaviour, especially in the fine-grained soils. The proportion of these minerals in natural soil concludes the relative activeness. In this context, itispreferredtoconductthepresentexperimental work on natural soils procured from the field, containing extreme clay minerals havingsame liquid limit and different plasticity characteristics

3.1 Materials

Selection of natural soils. Nearly thirty soils from different locations in Mysore and Chamarajanagar districts were subjected to preliminary laboratory investigation involving liquid limit and free swell tests. Their liquid limits were determined using Casagrande percussion method (IS: 2720 - Part 5, 1985), and the nature of their clay mineralogical composition was judged by the free swell index method (Prakash et.al, 2004). Finally, the following soils were identified, for the experimental investigation purpose.

It has been decided to conduct the experimental investigation on two field soils-one kaolinitic and the other montmorillonitic, having lower liquid limit rangei.e35< W_L< 50 and on two field soils-one kaolinitic and the other montmorillonitic, having higher liquid limit range i.e>50.

Group of soils having low liquid limit range (35< W_L< 50)

1. Field soil from Bogadi, Mysuru (passing 425 µm sieve), Chamarajanagar district, which contains kaolinite as the predominant clay mineral.

2. Field soil from Nanjangud, Mysuru District (passing 425 μm sieve), Chamarajanagar district, which is a montmorillonitic soil.

Group of soils having high liquid limit range (>50)

1. Field soil from Kollegala (passing 425 μm sieve), Chamarajanagar District, which contains Kaolinite as the predominant clay mineral.
2. Field soil from Kuderu (passing 425 μm sieve), Chamarajanagar District, which appears to contain Montmorillonitic as the predominant clay mineral.

Preparations of natural soils for investigation. The field soils from Bogadi and Nanjungud were wet analysis passing through 425 µm IS Sieve to remove the coarser. They were then oven dried and powdered to have soil dry analysis for determining the fraction finer than 425 µm size. Processed soils were batching separate in the bin. Similarly the process for field soils from Kollegala and Kuderu were wet sieved through 425 µm IS sieve. They were also oven dried, powdered and stored in separate plastic bins.

The below experiments were done on the prepared soil state as per Indian standards.

1. Specific gravity test: Specific gravity of the soils was done by the density bottle test with kerosene as the test liquid. (IS: 2720 – Part – 3 / Sec 1, 1980).

2. Particle size analysis: The particle size distributions of the bogadi, nanjanagud, kollegal and kuderu soil were determined by wet sieve analysis (retained on 425 micron sieve) and Hydrometer analysis (IS: 2720, Part 4, 1985) (passing 425 micron sieve).

3. Free swell ratio:(IS: 2720, Part 40, 1977) suggests that the free swell index of the soil be calculated as

$$\text{FSR}, \;=\left(\frac{V_d}{V_k}\right)$$

Determine the equilibrium sediment volumes of fine-grained oven dry soils passing 425 µm sieve using two 100 ml measuring jars with distilled water and carbon tetra chloride as the test liquids, the initial volumes of soil – liquid suspensions in the two jars being 100 ml.
Calculate the FSR as the ratio of V_d to V_k
Identify the soil as kaolinitic if FSR is less than unity or as montmorillonitic if FSR is more than 1.5.
If FSR is in between 1.0 and 1.5, the soil under consideration is of mixed clay mineral type.

4. Liquid limit test: The liquid limits of the soils were determined by the Casagrande percussion method (IS: 2720 – Part 5, 1985). In addition, liquid limit tests by fall cone penetration method (IS: 2720- part 5, 1985) were also conducted on soils from kollegal, with water and kerosene as test liquids in order to know the clay mineralogical dominance.

5. Plastic limit test: It was obtained by rolling the soil into 3 mm thread conventional 3 mm thread rolling method. (IS: 2720 – Part 5, 1985)

6. Shrinkage limit test: It was determined by the mercury displacement method (IS: 2720 – Part 6, 1972).

Classification of soil. The soils used in this experimental investigation have been classified according to Unified Soil Classification System as specified by IS: 1498-1970.

Fig.s1 and 2 illustrate the grain size distribution curves of the soils under study. Table 1 represents the physical properties of soils obtained as per the procedures indicated above, including the IS soil classification.

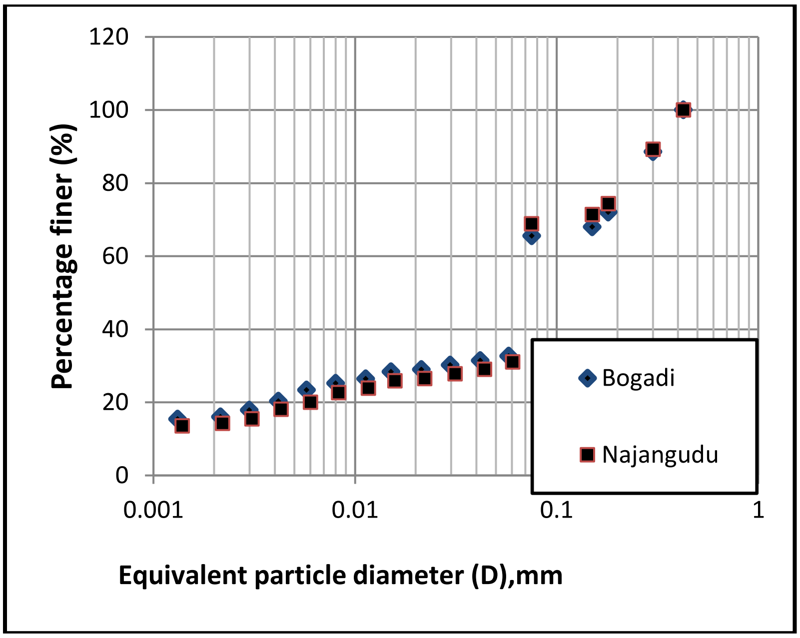

Fig. 1. Grain size distribution curves for Bogadi&Nanjangud soils

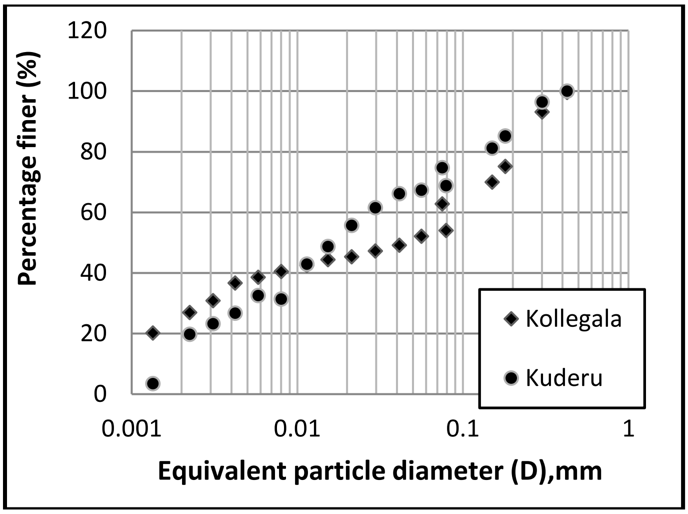

Fig. 2. Grain size distribution curves for Kollegala and Kuderu soils

Clay mineralogy of soils and soil expansivity. Plasticity chart is used in differentiating inorganic clays from inorganic silts. Figure 3 represents the plasticity chart indicating the position of all the soils of the present investigation on it. However, it should be noted that the plasticity chart cannot be classified by degree of expansiveness.

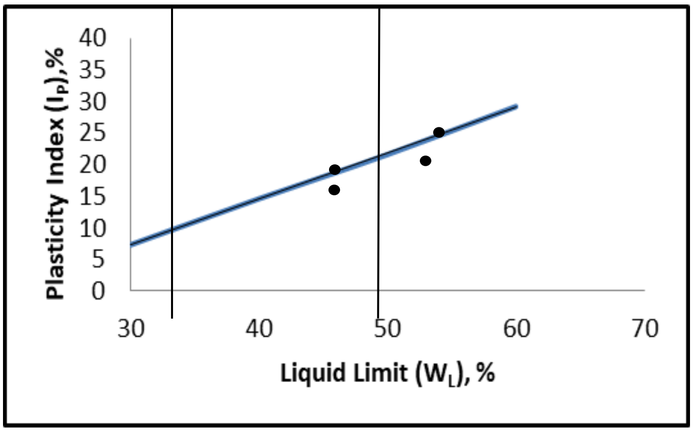

Fig. 3. Position of the soils under study on the plasticity chart

All geotechnical laboratories cannot afford to have sophisticated instruments such as X-ray diffractometer and the like for the qualitative identification of clay minerals present. In such cases, identification of clay mineral type by a simple method, which can serve the required purpose with a fair degree of accuracy is a welcome move. In this context, FSR has been shown to serve this purpose admirably well. Hence, following procedure is suggested IGC 2011 paper by Sridharan Prakash and Prasanna to classify the soils based on their degree of expansivity.In order to determine the predominant clay mineral present in the soil containing more than one clay mineral, Prakash and Sridharan (2004) suggested that the liquid limit percentage of soils determined by cone penetration/fall cone method with distilled water and CCl_4 as the pore liquids. If the fall cone liquid limit of a soil in distilled water is more than that in CCl_4, it indicates that the dominate clay mineral in the soil is montmorillonite. On the other hand, if the fall cone liquid limit of a soil in CCl_4 is more than that in distilled water, it indicates the dominance of kaolinite clay mineral in the soil.

3.2 Compaction tests

Standard and modified proctor compaction energy experiments were conducted on all soils under study (IS: 2720, Part-7, 1980; IS: 2720, Part-8, 1983). For each of these tests namely light and heavy compaction tests, about six to eight samples of mass 2.5 kg each, were mixed thoroughly with different percentages of moisture content and those samples were kept inside plastic or polythene bags, it is due to fact that the soil moisture equilibrium will be maintained. The duration of moisture equilibrium period depends upon type of soil i.e five to ten days. After this the compaction tests were conducted on prepared soil samples. From these tests the values of optimum water content and maximum dry density were determined.

3.3 Consolidation tests on compacted soils

Sample preparation for consolidation testing. Consolidation tests were conducted on compacted soils of same low liquid limit group (i.e. K-soil and M-soil) and on compacted soils of same high liquid limit group (i.e. K-soil, M-soil). The consolidation tests were done at three levels of initial moulding water contents – water contents corresponding to $\gamma_{d\ max}$(i.e. OMC), 0.95 $\gamma_{d\ max}$on dry side of optimum and 0.95 $\gamma_{d\ max}$on wet side of optimum.

For all these soils identified for the study were mixed with required moisture content and left for attaining equilibrium moisture content. After achieving equilibrium state, the matured soil sample was compacted into consolidation ring to achieve required dry density. This consolidation ring was then assembled in its position on the consolidation cell.
The consolidation cell used for the experimental work is of fixed ring type with double drainage and has the facility to conduct the variable head permeability test also on the soil sample. The dimensions of consolidation ring were 60mm (dia) x 20 mm (height).

Load – deformation - time measurements for compacted soils. Consolidation tests were conducted according to IS: 2720, Part 15 (1986). Next the consolidation cell was locatedinitslocationontheloadingcellwellequipped with minimum least count of 0.002

mm to measurethe vertical deflection of the soil sample, a initial consolidation stress of 6.25 kPa was loaded, and distilled water was added into the consolidationcell.

The soil samples were allowed to equilibrate underthe initial stress. Some soil samples revealed swelling on addition of water into the consolidation cell. In such cases, time-deformation readings were noted till the equilibrium was achieved. The samples were loaded from6.25kPato1600kPawithastressincrementratio of unity. Under each consolidation stress increment, time-compressionreadingswererecordedtillthenear equilibrium state wasreached.

After achieving the near equilibrium state under a consolidation pressure of 1600 kPa, the samples were unloaded in stages to the seating stress of 6.25 kPa (IS: 2720,Part15,1986).Then the samples were unloaded and weighed and their final heights were recorded.

Table 1. Physical properties of the soils under study

S.No	soil / Property	Bogadi Soil	N' gud soil	Kollegal soil	Kuderu soil
1	G	2.6	2.65	2.74	2.85
2	W_L (%)	46	46	55	54
3	W_P(%)	22	23	26	26
4	I_P(%)	24	23	29	28
5	W_S (%)	13.7	18.7	15.9	11.5
6	I_S(%)	32.3	37.3	39.1	42.5
7	FSR	1.3	1.3	1.11	1.42
8	Clay Minerology	Kaolinite	Montmorillonite	kaolinite	Montmorillonite
9	Clay (%)	13	7.5	37.0	39.0
10	Silt (%)	16	19.5	34.5	21.0
11	Sand (%)	71	60.5	28.5	40.0
12	Gravel (%)	-	12.5	-	-
13	IS Classification	CI	CI	CH	CH
14	Comments	K Soil	M Soil	K Soil	M Soil

Pre consolidation stress of compacted soils

General

Over consolidated (OC) natural soils exhibit a characteristic stress, known as preconsolidation stress (σ_p'), which represents the higher stress level to which the soil had experienced in the past. The soils used in various geotechnical mass applications like construction of earthen embankments, earth dams etc, will be subjected to some specified compactive effort, which is akin to over consolidation. Hence, compacted soils are also expected to possess a characteristic stress similar to preconsolidation stress of over consolidated natural soils. Literature review indicates that very limited such documentations of the studies related with preconsolidation stress of compacted soils is available (Prakash et al, 2014).

4 Results and Discussions

Table 2 through Table 4.4 shows the values of preconsolidation pressure for soils under study with different placement conductions by Casagrande, $\log_{10}(1+e)$, n-plot and Pacheo Silva's methods for both light and heavy compaction energy levels and placement condition respectively.

Table 2. Values of pre-consolidation pressure for soils having different placement condi tions and energy levels (Casagrande method)

Sample No	Type of Soil		Preconsolidation Pressure (σ_p') kPa					
			95 % of γ_{dmax} (Dry ofoptimum)		OMC		95 % of γ_{dmax} (wet of optimum)	
			Light	Heavy	Light	Heavy	Light	Heavy
1	Low Liquid Limit group soils	K Soil	45	46	125	90	120	86
2		M Soil	80	58	187	85	109	95
3	High Liquid Limit group soils	K Soil	61	84	200	360	380	150
4		M Soil	84	130	170	192	300	230

Table 3. Values of pre-consolidation pressure for soils having different placement conditions and energy levels ($\log10_{(1+e)}$ method)

Sample No	Type of Soil		Preconsolidation Pressure (σ_p') kPa					
			95 % of γ_{dmax} (Dry ofoptimum)		OMC		95 % of γ_{dmax} (wet of optimum)	
			Light	Heavy	Light	Heavy	Light	Heavy
1	Low Liquid Limit group soils	K Soil	43	49	88	95	66	39
2		M Soil	76	85	132	88	94	90
3	High Liquid Limit group soils	K Soil	51	74	205	250	330	500
4		M Soil	70	76	150	160	160	245

Table 4. Values of pre-consolidation pressure for soils having different placement condi tions and energy levels (n-plot method)

Sample No	Type of Soil		Preconsolidation Pressure (σ_p') kPa					
			95 % of γ_{dmax} (Dry ofoptimum)		OMC		95 % of γ_{dmax} (wet of optimum)	
			Light	Heavy	Light	Heavy	Light	Heavy
1	Low Liquid Limit group soils	K Soil	53	52	76	110	130	75
2		M Soil	78	75	160	92	105	76
3	High Liquid Limit group soils	K Soil	68	82	160	265	300	320
4		M Soil	90	125	160	170	240	245

Table 5. Values of pre-consolidation pressure for soils having different placement condi tions and energy levels (Pacheo Silva's method)

Sample No	Type of Soil		Preconsolidation Pressure (σ_p') kPa					
			95 % of γ_{dmax} (Dry ofoptimum)		OMC		95 % of γ_{dmax} (wet of optimum)	
			Light	Heavy	Light	Heavy	Light	Heavy
1	Low Liquid Limit group soils	K Soil	32	30	105	140	105	40
2		M Soil	70	44	230	88	105	86
3	High Liquid Limit group soils	K Soil	54	76	190	300	440	130
4		M Soil	81	98	168	170	280	250

Low liquid limit group soils (for both energy levels)
The variation of Pre-consolidation pressure values increases from dry of optimum to optimum state and decreases from optimum to wet of optimum state for both K& M soils. This trend was observed more in M-soils.

High liquid limit group soils (for both energy levels)
The variation of Pre-consolidation pressure values increases from dry of optimum towards the wet of optimum through the optimum state. This trend was observed more in K-soils than M-soils.

The above observations can be explained through the following proposed hypothesis.
Along the compaction curve, as the percentage of water content increases, the dry density increases up to OMC state and decreases on the wet of optimum side and this contribution towards the pre-consolidation pressure also increases along the compaction curve up to optimum moisture content state and then tends to achieve an equilibrium value of and may tend to decrease as well beyond the optimum compacted state.

The decrease in the value of preconsolidation stress value on the wet of optimum side can be attributed to the compacted soil fabric which results in the increase of water pressure in pores of soil (+ve) in case of K – soils and in case of M-soils, having combined effect of double layer repulsion and pore pressure.

All soils under study having different clay mineralogical compositions were subjected to same compactive energy levels (light compaction and heavy compaction) and it is reasonable to expect all of them to have in them the same value of preconolidation stress. On the contrary, the soils under study exhibit different values of preconsolidation stress. This unexpected behavior can be essentially attributed to the net (R-A) forces that are operative in the placement compacted soil-water system, which in turn depend upon clay mineralogical composition of the soil.

From the tables 2 through 5, it is observed that,

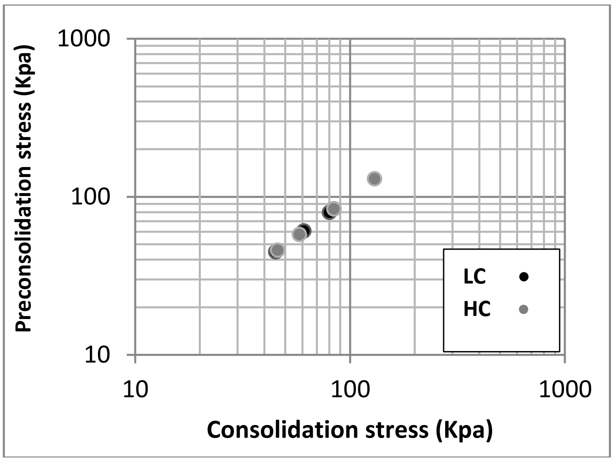

Fig. 4. Variation of Preconsolidation stress with consolidation stress (Dry Side)

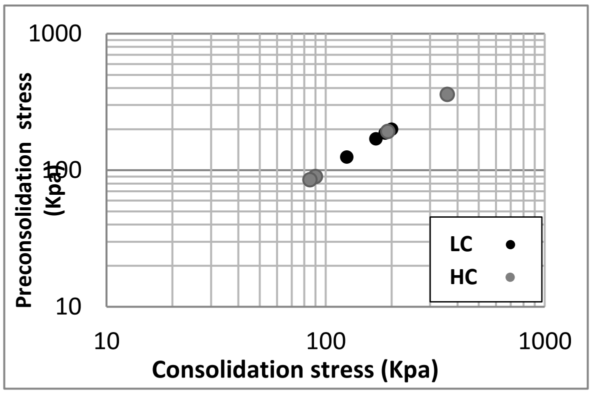

Fig. 5. Variation of Preconsolidation stress with consolidation stress (OMC)

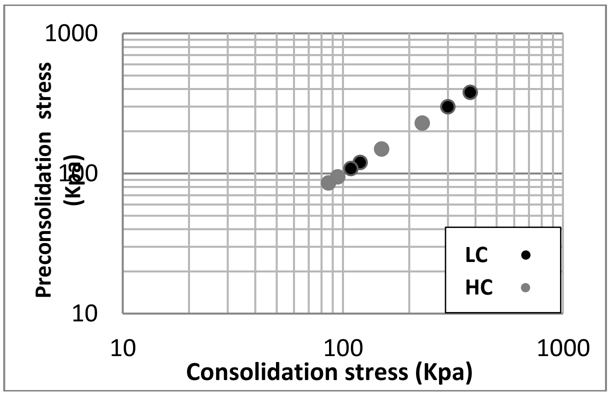

Fig. 6. Variation of Preconsolidation stress with consolidation stress (Wet Side)

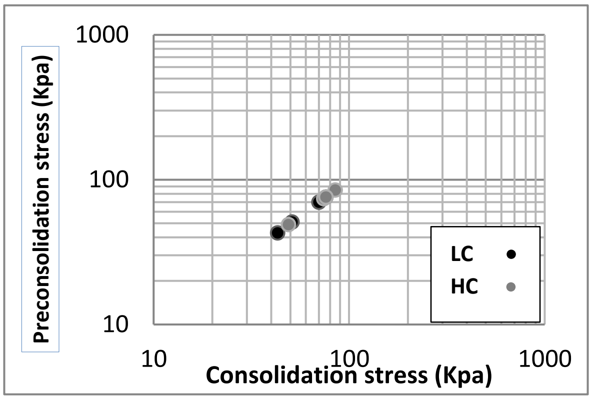

Fig. 7. Variation of Preconsolidation stress with consolidation stress (Dry Side)

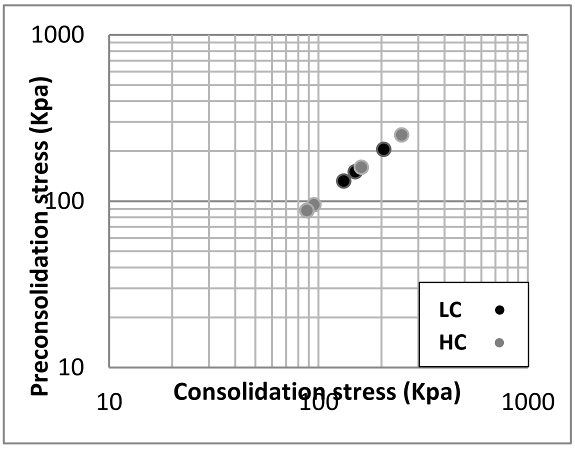

Fig. 8. Variation of Preconsolidation stress with consolidation stress (OMC)

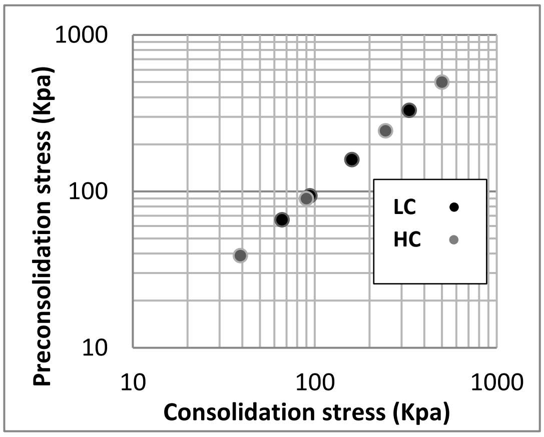

Fig. 9. Variation of Preconsolidation stress with consolidation stress (Wet Side)

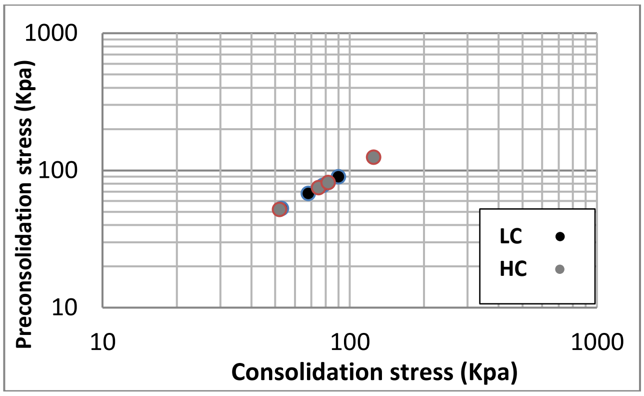

Fig. 10. Variation of Preconsolidation stress with consolidation stress (Dry Side)

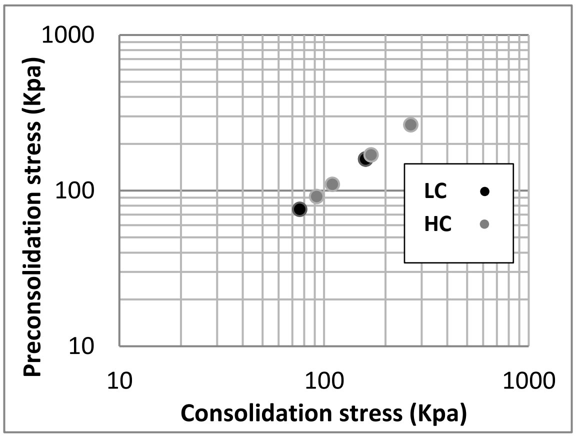

Fig. 11. Variation of Preconsolidation stress with consolidation stress (OMC**)**

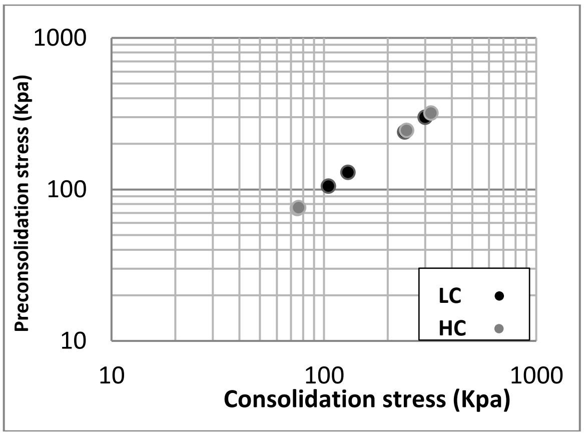

Fig. 12. Variation of Preconsolidation stress with consolidation stress (Wet side)

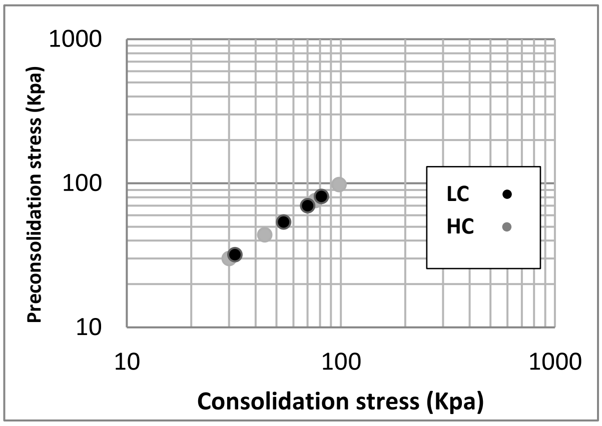

Fig. 13. Variation of Preconsolidation stress with consolidation stress (Dry side)

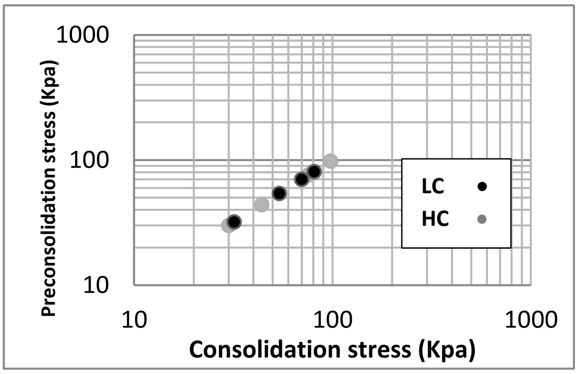

Fig. 14. Variation of Preconsolidation stress with consolidation stress (OMC)

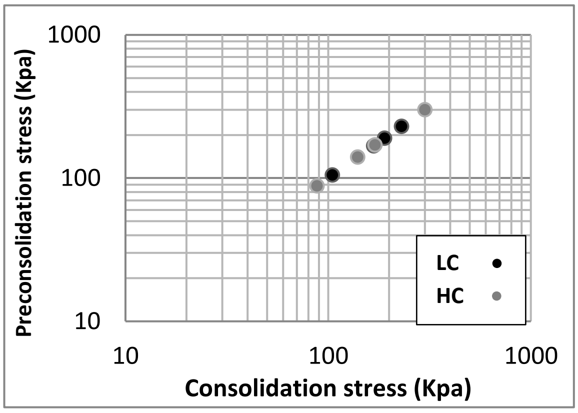

Fig.15. Variation of Preconsolidation stress with consolidation stress (Wet side)

Figures 4 through 15, shows the variation of preconsolidation stress with consolidation stress for Light and Heavy compaction energy level for different placement conditions for different methods.

Table 6. Casagrande Method

Soil No..	Soil	Tendency	
		LC	HC
S1	Soils of Low liquid limit group	Dry of optimum to OMC (Increases) and OMC to Wet of optimum(Decreases)	Dry of optimum to OMC (Increases) and OMC to Wet of optimum(Decreases)
S2		Dry of optimum to Wet of optimum (Increases)	Dry of optimum to Wet of optimum (Increases)
S3	Soils of high liquid limit group	Dry of optimum to Wet of optimum (Increases)	Dry of optimum to OMC (Increases) and OMC to Wet of optimum(Decreases)
S4		Dry of optimum to Wet of optimum (Increases)	Dry of optimum to Wet of optimum (Increases)

Table 7. $\text{Log}_{(1+e)}$ Method

Soil No..	Soil	Tendency	
		LC	HC
S1	Soils of Low liquid limit group	Dry of optimum to Wet of optimum (Increases)	Dry of optimum to OMC (Increases) and OMC to Wet of optimum(Decreases)
S2		Dry of optimum to OMC (Increases) and OMC to Wet of optimum(Decreases)	Dry of optimum to Wet of optimum (Increases)
S3	Soils of high liquid limit group	Dry of optimum to Wet of optimum (Increases)	Dry of optimum to Wet of optimum (Increases)
S4		Dry of optimum to Wet of optimum (Increases)	Dry of optimum to Wet of optimum (Increases)

Table 8. N – Plot method

Soil No..	Soil	Tendency	
		LC	HC
S1	Soils of Low liquid limit group	Increases from dry of optimum to wet of optimum	Increases from dry of optimum to OMC and then decreases
S2		Increases from dry of optimum to OMC and then decreases	Increases from dry of optimum to OMC and then decreases
S3	Soils of high liquid limit group	Increases from dry of optimum to wet of optimum	Increases from dry of optimum to wet of optimum
S4		Increases from dry of optimum to OMC and then decreases	Increases from dry of optimum to wet of optimum

Table 9. Pacheo Silva's Method

Soil No..	Soil	Tendency	
		LC	HC
S1	Soils of Low liquid limit group	Increases from dry of optimum to OMC and becomes constant	Increases from dry of optimum to OMC and then decreases
S2		Increases from dry of optimum to OMC and then decreases	Increases from dry of optimum to OMC and then decreases
S3	Soils of high liquid limit group	Increases from dry of optimum to wet of optimum	Increases from dry of optimum to OMC and then decreases
S4		Increases from dry of optimum to wet of optimum	Increases from dry of optimum to wet of optimum

5 Conclusions

1. The Preconsolidation stress value in Casagrande and Pacheosilva's method increases from dry of optimum to OMC and decreases. This tendency is observed in soils having low liquid limit having different Clay mineralogy subjected to light and heavy compaction energy levels.

2. The preconsolidation stress value in all methods increases from dry of optimum to wet side of optimum through omc for soils having different clay mineralogy and compaction energy levels .
3. Compaction process induces stress history effect in the compacted fine-grained soil. Compacted soils exhibit pre consolidation stresses, the values of which are strongly dependent upon the clay mineralogical composition of soils and also on the placement conditions, the compactive effort applied on the soils being the same.
4. Equilibrium void ratio at the seating consolidation stress of 6.25kPa of Kaolinitic and Montmorilloniticsoils for light compaction energy level is more for Kaolinitic soils in relative comparison to Montmorillonitic soils.
5. Higher equilibrium void ratio for M-soils at lower effective consolidation stresses are more than that of K-soils indicating dominance of double layer repulsion over the effect of flocculent fabric.
6. Higher value of cumulative change in void ratio at seating stress if 6.25kPa for M-soils are generally being observed than K-soils for both light and heavy compaction energy levels for soils of same low and high liquid limit group indicating dominance of double layer repulsion over the flocculent fabric exhibited by K-soil.
7. Pre consolidation stress values increases from dry of optimum to OMCand then decreases for OMC to Wet of optimumfor M-soils whereas has a tendency to increase beyond optimum state to wet side of optimum for K-soils which signifies the importance of placement condition and clay mineralogy.
8. Compression index values increase more rapidly with effective consolidation stress in a narrow band in the pre-yield zone and show a tendency to stabilize in the post yield region for soils under study for both light and heavy compaction energy levels which is a characteristic of over consolidated soil.

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