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Research Article

Evaluation of shear strength, hydraulic conductivity, bearing capacity and settlement characteristics of soft clay for shallow foundations

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Abstract

Soft clay deposits pose major challenges in geotechnical engineering due to their low shear strength, high compressibility, and poor drainage characteristics. This study presents an integrated evaluation of the engineering behavior of soft clay by examining its shear strength, hydraulic conductivity, bearing capacity, and settlement response under the loading of shallow foundation. Laboratory investigations were conducted on five disturbed soft soil samples. The conducted tests include unconfined compressive strength (UCS), direct shear, consolidated undrained triaxial tests, and falling head permeability tests. Consolidation behavior was assessed through one-dimensional oedometer testing. Results indicated that the clay exhibits soft to medium consistency with undrained shear strength values ranging from 47 to 82 kPa and cohesion values between 22 and 34 kPa. Hydraulic conductivity was extremely low, within the order of 10^{-9} to 10^{-7} m/s, confirming restricted drainage and slow consolidation. Bearing capacity analysis using Terzaghi's approach showed limited allowable capacity (60–140 kPa), highlighting the unsuitability of untreated soft clay for heavy shallow foundations. Settlement analysis revealed moderate to high compressibility with consolidation settlements up to 68 mm. The findings emphasize the need for comprehensive assessment and ground improvement measures when designing shallow foundations on soft clay soils.

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1. Introduction

Poor drainage characteristics, high compressibility, and low shear strength of soft clay deposits are some of the greatest engineering issues, which present a challenge to engineers [1,2]. The soils can be found along the coast plains and river basins and reclaimed land areas [3]. Many infrastructure projects are constructed over weak or soft soil deposits, where the low shear strength and high compressibility of the foundation soil may adversely affect the bearing capacity and settlement performance of shallow foundations [4]. The performance of shallow foundations that have been built on soft clay is usually regulated by excessive settlement rather than ultimate failure, and hence, settlement prediction is a critical design characteristic. Studies of numerical modelling have demonstrated the fact that pad footings that are placed on the soft clay (even when moderately loaded) may be deformed significantly, and this is the reason why serviceability-based judgement is important [5]. The coupled strength deformation behavior of soft clay is, therefore, a factor that remains useful in safe and cost-effective foundation engineering. The mechanical response of soft clay is largely affected by stress path and loading history [6]. In the undrained scenario where ductile failure of soft clay occurs because of progressive strain build-up, it is natural, and there is a likelihood that cyclic or multi-directional shear stress may significantly influence the mobilization

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of strength. The experimental research of saturated soft clay has shown that the cyclic paths of stress, including shear components, could alter the reaction of the soil and create a complex pattern of deformations [7]. Undrained shear strength characterization can therefore be trusted in the determination of bearing resistance in cohesive soils. The undrained strength parameters of different geological deposits are not constant since empirical correlations that have been developed with the example of natural soft clays confirm them [8]. The most recent methods of modelling have been implemented in forecasting the variation of undrained shear strength of delicate soft clays [9]. Other than strength limitations, the hydraulic behavior of soft clay has a role in controlling long-term consolidation settlement [10].

The bearing capacity of soft clays is usually very low in terms of hydraulic conductivity, resulting in low levels of dissipation of excess porewater pressure during repeated loading. The changes in the structure of the pore can also be influenced by the constriction caused by the alteration of the soil fabric that can therefore influence permeability and compressibility during the loading stages. Microstructural processes have also revealed that microstructural rearrangement of soft clay under consolidation has a direct impact on deformation behavior with time [11]. These findings suggest that foundation performance cannot possibly be determined on a hydraulic basis or a mechanical basis only. The other significant parameter that restricts the adequacy of shallow foundations in soft clay is bearing capacity. Cohesive soils may contain very low ultimate bearing capacity, and the cyclic loading may reduce the foundation stability. The repeated actions of stress on the bearing capacity of shallow foundations under cyclic loads have demonstrated that the latter can be considerably reduced, which is particularly important in the case of transport infrastructure and offshore construction [12]. The numerical studies, which have reached a very advanced level, have shown that the effect of soil structure and drainage conditions on the foundation response is very strong at the unconsolidated and consolidated-undrained conditions [13].

Settlement behavior remains among the most dominant issues in soft clay engineering as well. The settlement process is protracted and endurable as soil used in construction is composed of clay soils that can hardly be permeable, and therefore, the settlement process can be protracted even after construction has been undertaken. As has been noted, the methods of numerical modelling are being embraced to predict processes of consolidation and deformation of soft soils that provide a clearer insight into the way the settlement processes change over time [14]. The compressibility of soil under secondary compressibility is also relevant in the long-term settlement, particularly on high liquid limit soils as well as sensitive structure soils. It has been observed that the study of soil structure and plasticity properties on secondary compression can be categorized as one of the key constituents to determine delayed settlement behavior of soft cohesive soils [15]. The recent research has also suggested the impact of soil structure on rate-dependent consolidation behavior [16]. The new infrastructure projects, which have been laid on soft ground, have further burdened the time-based analysis issue during the construction phase. The collective study of hydraulic structures on the foundation of soft soil has shown that deformation is slowly evolving during the construction, and settlement and stability must be continuously carried out [17]. Similarly, the loading on the soft soil has been observed to induce massive settlement by consolidation and long-term deformation trends that do substantiate the significance of thorough evaluation of soft soil in geotechnical engineering [18-20].

Although there are many studies that have been done to investigate the individual characteristics of soft clay behavior, such as shear strength, bearing capacity or settlement, there is still a need to study in detail all the major parameters that govern the behavior of shallow foundations. Many studies concentrate directly on one or all three factors, strength increase or settlement forecasting separately. But, the overall interplay between shear strength, hydraulic conductivity, bearing resistance and compressibility is not well integrated into a unitary framework. This displays a research gap about providing a single test of the behavior of soft clay during shallow foundation loading. Therefore, in the present study, it is feasible to provide a critical analysis of soft clay, which examines the nature of shear strength, behavior of hydraulic conductivity, evaluation of bearing capacity of shallow foundations and behavior of settlement and consolidation. These combined methods are necessary to devise the strategy of improvement with the help of alternative additives and binders in the engineering of soft clay [21]. Moreover, another area where mechanical and

compressibility enhancement techniques have been extensively studied is soft clay stabilization [22]. Such an approach is integrated, which contributes to the improved understanding of the performance of soft clay and provides the required baseline data regarding the safe design of the foundation within the environment with weak cohesive soil.

Although numerous studies have investigated isolated aspects of soft clay behavior such as shear strength characterization [8,9], hydraulic conductivity modelling [10], or settlement prediction [14]. Few studies integrate these coupled mechanical and hydraulic responses into a unified evaluation framework for shallow foundation design. Most existing works focus either exclusively on ground improvement methods or on individual parameter evaluations [21-23]. To bridge this gap, this study provides an integrated laboratory evaluation that simultaneously quantifies shear strength, hydraulic conductivity, bearing capacity, and consolidation settlement response of soft clay under shallow foundation loading. The contribution of this work lies in establishing a coupled mechanical-hydraulic baseline dataset that explicitly links low permeability to long-term settlement behavior, offering practical benchmark values (Su, k, qall, Cc) essential for geotechnical engineers when evaluating soft ground or designing sustainable ground stabilization schemes.

2. Materials and Methods

2.1 Soil Description

The soft clay used in the experiment was obtained by digging 1.5-2.0 m below the ground level with low bearing capacity and high compressibility. Five disturbed bulk samples were collected and brought to the laboratory in plastic containers to maintain the natural conditions of moisture. After being allowed to air dry, the dirt was finely powdered mush, which did not change the size of the particles, and then sieved through 4.75 mm. The classification of the soil samples was based on the Unified Soil Classification System (USCS) (ASTM D2487). The index properties were calculated based on ASTM D4318, i.e., liquid limit (LL), plastic limit (PL), and plasticity index (PI). The content of natural water was determined in accordance with ASTM D2216. The pycnometer test was used in determining specific gravity according to ASTM D854. The distribution of grain size was determined using sieve analysis (ASTM D6913) and hydrometer analysis (ASTM D7928) to measure the amount of sand, silt, and clay. To measure the maximum dry density (MDD) and the optimum moisture content (OMC), standard Proctor compaction tests (ASTM D698) were used. The average unit weight (γ) of compacted specimens used for bearing capacity analysis was determined from MDD results and ranged between 16 and 18 kN/m^3.

2.2 Sample Preparation

To ensure consistent and repeatable results, reconstituted samples were obtained. To get the soil near OMC to have the appropriate moisture level, distilled water was supplied. Specimens were compacted in cylindrical moulds using static compaction to achieve a consistent density corresponding to 95% of MDD. The specimens were made in a variety of layers and tamped with all necessary control to reduce the air entrapment and guarantee uniformity. The average size of the specimen was Diameter = 38 mm and Height = 76 mm (for UCS and triaxial tests). For consolidation tests, specimens were trimmed to: Diameter = 60 mm and Height = 20 mm. Prepared specimens were sealed and stored in a humidity-controlled chamber for 24 hours before testing to allow moisture equilibration.

2.3 Laboratory Testing Program

The program for laboratory testing was to test the systematic shear strength characteristics, hydraulic conductivity, bearing capacity and settlement behavior. The general experimental procedure taken in this study, the collection, preparation, shear strength testing, the hydraulic conductivity testing, the bearing capacity and the settlement of consolidation are represented in Figure 1.

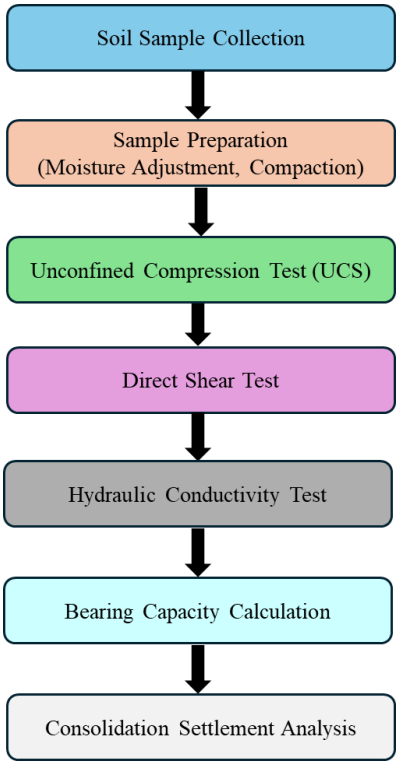


Fig. 1. Flowchart of the laboratory testing and analysis procedure

2.3.1 Shear Strength Tests

- Unconfined Compressive Strength (UCS): UCS tests were done according to ASTM D2166. Cylindrical specimens with a height-to-diameter ratio of 2:1 was loaded axially at a constant strain rate of 1% per minute until failure. The unconfined compressive strength (q_u) was the highest value of the axial stress. Stress–strain curves were plotted to assess stiffness, peak strength, and post-peak behavior. The undrained shear strength (S_u) was obtained as:

$$S_u = \frac{q_u}{2} \tag{1}$$

- Direct Shear Test: According to ASTM D3080, direct shear tests were conducted. The samples were consolidated under normal stresses of 50, 100 and 150 kPa, then sheared at a constant rate of 0.5mm/min until peak and residual strengths were achieved. Cohesion (c) and angle of internal friction (φ) were determined from the Mohr–Coulomb failure envelope constructed using peak shear stresses.
- Triaxial Test: As per ASTM D4767, consolidated undrained (CU) triaxial tests were used. Confining pressures of 50, 100 and 150 kPa were applied to the specimens. Stress parameters of deviator and pore pressures were measured to establish effective stress parameters.

2.3.2 Hydraulic Conductivity Test

Hydraulic conductivity was measured using a falling head permeameter as required by ASTM D5084. The saturation of the specimens was done under the pressure of the cap to make sure that they were saturated. The coefficient of hydraulic conductivity (k) was calculated using:

$$k = \frac{aL}{At} ln\left(\frac{h_1}{h_2}\right) \tag{2}$$

where a= cross-sectional area of standpipe, A= cross-sectional area of specimen, L= specimen length, t= elapsed time, and h_1, h_2= initial and final hydraulic heads.

Three repetitions were conducted for each specimen, and average values were reported.

2.3.3 Bearing Capacity Determination

The analytical method assessed the bearing capacity of shallow foundations with the parameters of shear strength that were measured in the laboratory. For analysis, a square footing with width (B) = 1.0 m and embedment depth (D_f) = 1.0 m was assumed. The ultimate bearing capacity was calculated using Terzaghi's equation:

$$q_{ult} = cN_c + \gamma D_f N_q + 0.5\gamma B N_\gamma \quad (3)$$

where c= cohesion, γ= unit weight of soil, and $N_c, N_q, and\ N_\gamma$= bearing capacity factors.

For undrained clay conditions (φ ≈ 0), the simplified expression was used:

$$q_{ult} = 5.14 S_u \quad (4)$$

The allowable bearing capacity was determined using a factor of safety (FS) of 3.0.

2.3.4 Settlement Analysis

One-dimensional consistency tests (ASTM D2435) were used to determine settlement properties. The specimens were incrementally loaded with stress of 12.5, 25, 50, 100, 200, and 400 kPa. All the load increments were kept at 24 hours or until primary consolidation was considerably finished. The void ratio-log effective stress curve was used to find the compression index (Cc). The square-root-of-time method of Taylor was utilized to ascertain the coefficient of consolidation (Cv). The consolidation settlement (Sc) was computed as:

$$S_c = \frac{C_c H}{1 + e_0} log\left(\frac{\sigma_f'}{\sigma_0'}\right) \quad (5)$$

where H= thickness of compressible layer, e_0= initial void ratio, and σ_0', σ_f'= initial and final effective stresses. The combination of the immediate and primary consolidation settlement components was considered the total settlement.

3. Results

3.1 Shear Strength Behavior

The unconfined compressive strength (UCS) and direct shear testing were identified to obtain the shear strength properties of tested soft clay. Results of UCS tests, including stress-strain curves, revealed ductile behavior with gradual softening of strain after peak stress, as is characteristic of cohesive soft clay. Figure 2 shows the stress-strain behavior that was determined using the UCS test. The UCS values measured made a range between 95 kPa and 165 kPa, and the mean value was about 128 kPa. Table 1 indicates the summary of shear strength parameters calculated from the UCS and direct shear tests.

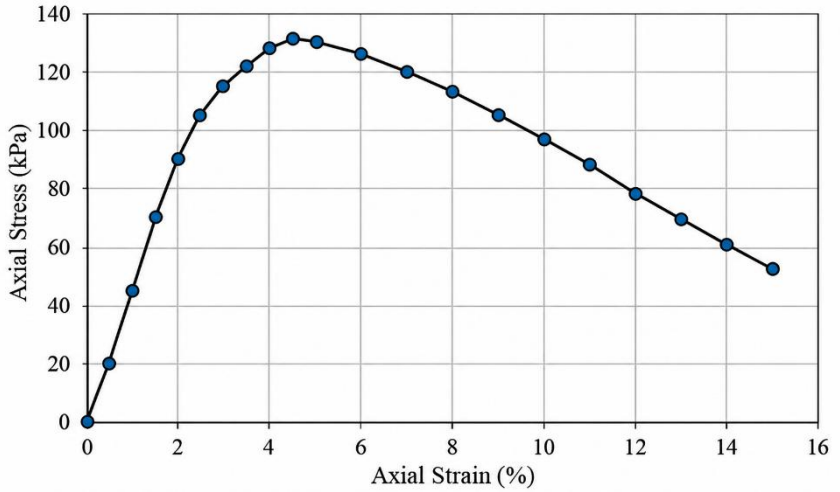


Fig. 2. Axial stress–strain curve obtained from UCS test

Table 1. Summary of shear strength parameters of soft clay

Test Type	Parameter	Minimum	Maximum	Average
UCS	q_u (kPa)	95	165	128
Undrained shear strength	S_u (kPa)	47	82	64
Direct shear	Cohesion, c (kPa)	22	34	28
Direct shear	Friction angle, φ (°)	16	21	18.5

The undrained shear strength (Su), which was determined as qu/2, was between 47 kPa and 82 kPa. These values indicate that the soil is soft to medium clay. Direct shear tests that were performed at normal stresses of 50, 100 and 150 kPa yielded consistent shear failure envelopes. The derived Mohr–Coulomb parameters indicated cohesion (c) values between 22 and 34 kPa, while the angle of internal friction (φ) ranged from 16° to 21°. The low angle of friction affirms that cohesive resistance dominates the structure of the soil. The failure mode in UCS specimens was later characterized by the bulging in a lateral direction and the direct shear samples had distinct planes of shear along the shear interface. These findings affirm that the soft clay has low shear resistance.

3.2 Hydraulic Conductivity

The values of hydraulic conductivity of the investigated soft clay are within the range of fine-grained soils. The saturated hydraulic conductivity (k) varied between: 1.2×10^{-9} to 6.4×10^{-7} m/s. Most specimens exhibited conductivity values within 10^{-8} to 10^{-7} m/s, confirming very low permeability behavior typical of cohesive clay deposits. The measured saturated hydraulic conductivity values for the tested specimens are summarized in Table 2.

Table 2. Saturated hydraulic conductivity values of soft clay specimens

Specimen	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
k (m/s)	1.2×10^{-9}	3.5×10^{-8}	8.2×10^{-8}	1.6×10^{-7}	6.4×10^{-7}

The values of the hydraulic conductivity are distributed log-normally and such a distribution is usually characteristic of the measurements of the permeability of natural soils. Smaller k values represent dense clay horizons that have less pore connectivity and more similar values relate to silty clay layers, which have slightly larger pore channels. The low hydraulic conductivity suggests that water hardly moves through the soil matrix and thus the drainage conditions are slow when subjected to loading. This hydraulic behavior is important as far as consolidation behavior and long-term settlement behavior of shallow foundations is concerned.

3.3 Bearing Capacity

Because of the laboratory testing, the bearing capability of shallow foundations was ascertained using shear strength measures. The final bearing capacity was calculated using the Terzaghi bearing capacity equation. The calculated ultimate and permissible bearing capacity of the soil is displayed in Table 3. The comparison between general Terzaghi equation and one from the simplified undrained expression was done to identify the methods employed and to demonstrate that the values calculated using the Terzaghi method are more conservative and, therefore, safer. Accordingly, the Terzaghi-based values are the ones adopted for design purposes.

Table 3. Calculated ultimate and allowable bearing capacity values

Parameter	Minimum	Maximum
Ultimate bearing capacity (Terzaghi) (kPa)	180	265
Ultimate bearing capacity ($5.14S_u$) (kPa)	240	420
Allowable bearing capacity (kPa)	60	140

For a square footing with width B = 1.0 m and embedment depth D_f = 1.0 m, the calculated ultimate bearing capacity ranged from 180 kPa to 265 kPa, depending on the variation in cohesion and friction angle. For undrained clay conditions ($\varphi \approx 0$), the simplified expression:

$$q_{ult} = 5.14S_u \quad (6)$$

Using Eq. 6 yields ultimate bearing capacities between 240 kPa and 420 kPa, corresponding to the measured undrained shear strength values. Using factor of safety equals 3, the allowable bearing capacity was determined to be within the range of 60 kPa and 88 kPa. Such low permissible values reveal that untreated soft clay has a limited load-carrying capacity of shallow foundations. The findings show that bearing capacity is highly dependent on parameters of cohesion and undrained shear strength.

3.4 Settlement Characteristics

The one-dimensional consolidation testing was used to evaluate settlement behavior. The compression index (Cc) was varied between 0.28 and 0.42, which indicates moderate or high compressibility. The parameters of the consolidation and settlement as received through the oedometer test are given in Table 4.

Table 4. Consolidation and settlement characteristics of soft clay

Parameter	Minimum	Maximum
Compression index	0.28	0.42
Coefficient of consolidation (m^2/s)	1.5×10^{-7}	$\mathbf{4} \times 10^{-7}$
Consolidation settlement (mm)	32	68

The coefficient of consolidation (C_v) varied between 1.5×10^{-7} and 4.0×10^{-7} m^2/s, reflecting relatively slow consolidation rates typical of low-permeability clay soils. Under shallow foundation loading conditions that generated net stress increments of 100-150 kPa, consolidation settlement in the calculated shows to be in the range of 32 mm to 68 mm, based on the initial void ratio and the layer's overall thickness. Time-settlement curves have shown that the initial 70-80% of the overall settlement was obtained in primary consolidation, and the rest was through secondary compression. Figure 3 presents the time-settlement response of the consolidation testing. The gradual rate of settlement development is consistent with low hydraulic conductivity of the soil. As summarized in Table 5, the experimental results from the present study align closely with published literature for similar soft clay conditions. The measured undrained shear strength (Su = 47-82 kPa) and allowable bearing capacity (q_{all} = 60-140 kPa) show slightly higher upper-bound values compared to reference values [8,25]. Meanwhile, the cohesion (c = 22-34 kPa), friction angle ($\varphi = 16^0$-21^0), hydraulic conductivity ($k = 1.2\times10^{-9}$-6.4×10^{-7} m/s), and compression index (Cc = 0.28-0.42) fall within typical ranges reported for similar clay barriers and high liquid limit clays [15, 24, 26]. Overall, these comparisons validate the reliability of the current experimental findings.

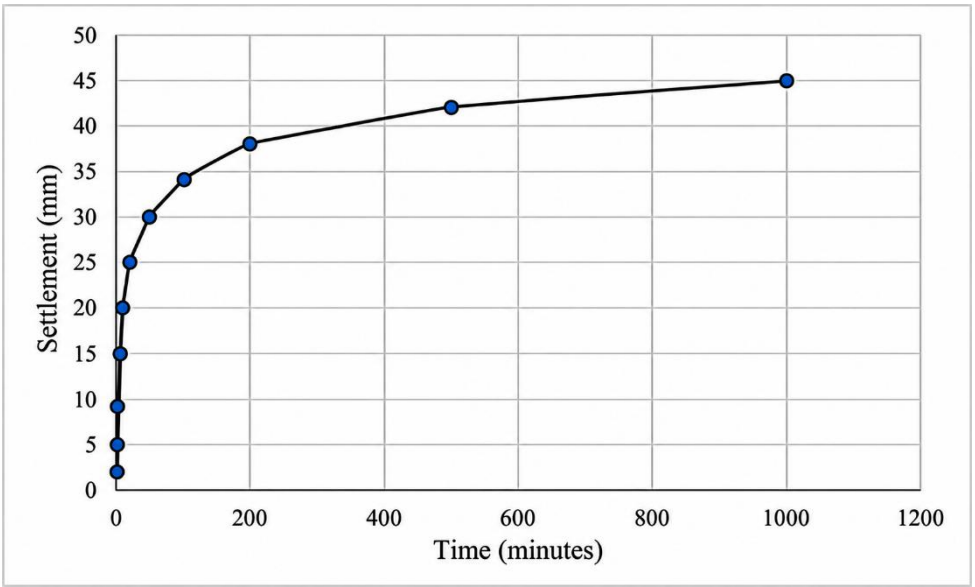


Fig. 3. Time–settlement curve from consolidation test

Table 5. Comparative summary with literature

Parameter/test	Present study results	Literature values (Similar soft clays)	Reference/soil condition
Undrained shear strength (Su)	47–82 kPa	20–75 kPa	[8] (Soft clays)
Cohesion (c) & friction (φ)	c=22–34 kPa, $\varphi=16^0–21^0$	c=15–35 kPa, $\varphi=12^0–22^0$	[26] (Unreinforced soft clay)
Hydraulic conductivity (k)	$1.2\times10^{-9}–6.4\times10^{-7}$ m/s	$10^{-9}–10^{-8}$ m/s	[24] (Compacted clay barriers)
Compression index (Cc)	0.28–0.42	0.25–0.50	[15] (High liquid limit soft clay)
Allowable bearing capacity (q_{all})	60–140 kPa	50–120 kPa	[25] (Untreated soft clay foundation)

4. Discussions

The current paper gives a combined analysis of shear strength, hydrolytic conductivity, bearing capacity, and settlement properties of soft clay. The findings affirm that soft clay deposits have low strength and compressibility, resulting in a major effect on their suitability in the construction of shallow foundations. The integrated explanation of the mechanical and hydraulic reactions is the key to the geotechnical overall performance of such soils, especially when both the strength and the serviceable parameters of the foundation design determine the foundation design. The obtained results of shear strength testing conducted using UCS and direct shear tests show that the tested soft clay belongs to the soft to medium consistency range. The values of relatively low undrained shear strengths point out the natural weakness of cohesive soils when placed in undrained loading conditions. The same observations have been made in relation to the poor strength development of untreated soft clay, and similar findings have been reported in studies relating to stabilization, where soil improvement is required in meeting the structural performance criteria [23]. The strength response characterized by cohesion, as was seen in the current research, is common to fine-grained soils of moderate to large plasticity. Patterns of failure that were noted during testing also justify the ductile behavior anticipated in soft clay deposits. These strength parameters are the basic basis of the assessment of bearing resistance and deformation behavior under applied loading.

The measurement of hydrolytic conductivity proved that the researched soft clay has very low permeability, and the conduction data is in the scale of 10^{-9} to 10^{-7} m/s. This is a property of cohesive soils, in which the low permeability is due to the limited pore connectivity that makes fluid flow through the soil matrix difficult. Predictive modelling methods have further stressed the fact that the hydrolytic conductivity in fine-grained soils under compact reflective conditions tends to have a log-normal distribution, which is also in line with the tendencies of the current findings [24]. The limited drainage potential implies that the additional pore water pressure has a long dissipation period during loading. As a result, the controlling factor in the behavior of consolidation and settling rate of shallow foundations is the hydrolytic conductivity. The relationship between compressibility and permeability makes it clear that it is necessary to consider hydraulic characteristics and the parameters of strength in evaluating the performance of the foundation on soft clay. The bearing capacity analysis shows that soft clay gives low ultimate and allowable resistance to shallow foundations [25]. The computed values of allowable bearing capacity of untreated soft clay show that it may not be safe to carry significant structural loads without any enhancement or other foundations. Past experimental and numerical studies have also indicated that the undrained shear strength and cohesion are the primary factors that control the bearing capacity of shallow foundations on the soft clay [25]. The reduced undrained bearing capacity further supports the predominant role of shear strength in governing foundation resistance. Modestly increasing the undrained shear strength can significantly affect the ultimate bearing capacity, underscoring importance of proper strength characterization in geotechnical design [26].

Settlement analysis, which was done on the sample soft clay, showed that the clay is of moderate to high compressibility, and therefore, it can settle a lot under normal loading conditions. The expected values of the settlements indicate that serviceability is a factor that can be even more critical in designing than ultimate bearing failure. Immediate and consolidation settlement behavior of shallow foundations has been identified as one of the biggest challenges in the engineering practice of soft clay [27]. Low-permeability soils exhibit a gradual decrease in excess pore water pressure, a phenomenon observed in the present study. The most recent developments in settlement predictions techniques have also incorporated the use of optimization-based and intelligent calculation techniques to improve the accuracy of the prediction of highly compressible clay deposits [28,29]. The consolidation properties determined herein thus give useful historical information on both the conventional computational methods and the new data-driven forecasting models.

The combined explanation of the findings proves that the soft clay deposits are marked by low shear strength, low hydraulic conductivity, low bearing capacity, and high settlement potential. The composite properties make building in shallow foundation risky in areas which are predominantly characterized by weak cohesive soils. Ground improvement methods are commonly used in real-life practice to strengthen and decrease compressibility by means of ground improvement, before installation of the foundation. Extensive literature about improvement efforts on soft clay has highlighted the growing significance of combined answers to extremely soft deposits, especially in the context of infrastructure development projects [30,31]. The current results are relevant to the wider knowledge on the coupled mechanical and hydraulic behavior of soft clay and highlight the importance of considering the whole family when providing shallow foundations on such soils.

5. Conclusions

The paper devoted for evaluation of the geotechnical behavior of soft clay through a combination of shear strength, hydraulic conductivity, bearing capacity, and settlement properties. The laboratory test outcomes validated the fact that soft clay has low undrained shear strength and cohesion-based resistance thus making it a weak foundation material when subjected to undrained loading conditions. The values of hydraulic conductivity measured were very low, which meant that it had an insufficient drainage capacity and sluggish release of surplus pore water pressures. Long-term strengthening settlement is highly contributed to by such hydraulic behavior. Calculation of bearing capacity revealed that superficial foundations based on untreated soft clay have low bearing capacity, and the allowable bearing pressures are between 60 and 140 kPa. This implies that the ultimate failure requirements are not the only factors that usually dictate the foundation design on soft clay; more importantly, the requirements are the serviceability, e.g. excessive deformation, settlement. In further consolidation tests, moderate to high compressibility was noted, and the settlement values up to 68 mm were recorded at normal stress increments, and the fact that the settlement is a sensitive phenomenon in the case of a soft clay deposit was confirmed. Overall, the findings reveal that soft clay is a significant challenge when laying foundations because of its low strength, excessive compressibility, and slowness in consolidation response. Consequently, ground improvement methods or other deep foundation systems tend to be required to guarantee the structural safety and the long-term performance. The unified model provided in the paper is a strong foundation of data to be used in foundation design within soft cohesive soil.

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