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Compression behaviour of reconstituted organic soils: effect of sample preparation and organic content

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Abstract. Organic soils are considered problematic in geotechnical engineering due to their low bearing capacity and high compressibility. Since field samples usually exhibit great heterogeneity, the use of reconstituted samples provides a reasonable alternative for systematic investigations. Hence, oedometer tests on reconstituted organic soils composed of peat and kaolin at varying proportions were conducted to investigate the effect of sample preparation and organic content on the compression behaviour. Different preparation methods were used: moist peat in one case and dried peat with added water in the other. Previous studies have shown that the compression behaviour of organic soils is strongly influenced by prior drying and re-saturation. The reason given for this is the change in structure as a result of drying. Initial tests at both institutions confirm these results. The duration of the compression phases differed markedly, with samples prepared from dry peat showing a shorter primary compression phase and an increased creep rate, indicating tertiary compression. Additional oedometer tests confirmed that pure clay does not exhibit tertiary compression, whereas the creep rate increased with higher peat content. Performed statistical evaluations reveal correlations between oedometric parameters, void ratio, and organic content, which are consistent with previously proposed equations for natural peats.

1 Introduction

Organic soils and peat are generally considered as problematic geomaterials due to their highly heterogeneous structure and complex mechanical behaviour compared with typical mineral soft soils. Their response is governed not only by the soil skeleton but also by a significant organic fraction, high water content, and evolving microstructure, which together lead to pronounced nonlinearity, time dependency, and variability of engineering properties. In their natural state, peat deposits typically exhibit very low shear strength and bearing capacity combined with extremely high compressibility. Consequently, foundations constructed on peat are prone to large primary settlements as well as substantial long-term deformations driven by secondary compression and creep processes [1].

Driven by rapid urban expansion and the increasing demand for residential, industrial, and transportation infrastructure, construction projects are progressively expanding on sites with unfavourable subsoil conditions. As a result, it is often no longer practical to avoid problematic ground such as organic soils and peat deposits, and structures must be designed to perform reliably under these challenging conditions. Considering the widespread global occurrence of such soils and their complex, highly time-dependent mechanical behaviour, continued advanced research into their constitutive response, deformation mechanisms, and long-term performance is essential to support safe, economical, and sustainable geotechnical design [2].

Peat is characterized by an exceptionally high void ratio relative to inorganic soils, which is a primary factor governing its pronounced compressibility. This high void ratio originates from the organic microstructure, which consists of loosely arranged, partially decomposed plant fibres forming an open, anisotropic, and highly porous fabric. This allows them to store large amounts of water, which is why peat generally has a very high natural water content [3,4]. Accordingly, index properties such as void ratio, natural water content, and fibre content are key state variables controlling the compressibility and compression mechanisms of peat.

In addition to primary consolidation, time-dependent deformation processes play a particularly significant role in organic soils. Creep, commonly referred to as secondary compression, contributes a substantial portion of the total settlement and may continue over extended periods under constant effective stress conditions [5,6].

A further distinctive feature reported for peat is the occurrence of tertiary compression, described by Dhowian and Edil [7]. This phenomenon is characterized by a renewed increase in strain rate following the secondary compression phase, indicating an accelerating deformation process.

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The compressibility of soils under one-dimensional loading conditions is commonly quantified by the compression index ($C_c = -\Delta e/\Delta \log\sigma'_v$), which represents the slope of the virgin compression line in the e-logσ_v' space [8]. Empirical studies have shown that the compression index increases with increasing void ratio, water content, and organic content [9–11].

On the other hand, creep is expressed by the creep coefficient ($C_{\alpha} = \Delta e/\Delta \log t$)), which corresponds to the slope of the void ratio-log time relationship under constant effective stress [8]. For organic soils exhibiting both secondary and tertiary compression phases, two distinct creep coefficients may be defined to describe the respective deformation regimes. Experimental evidence further indicates that the creep coefficient also tends to increase with increasing organic content [12].

The engineering properties of peat are highly sensitive to desiccation and may undergo irreversible changes upon drying. Experimental investigations, including those reported by Zhao and Jommi [13], demonstrate that drying leads to a pronounced collapse of the organic soil structure and a substantial reduction in void ratio, which is not fully recovered upon subsequent re-saturation. Drying causes fragmentation and degradation of peat fibres, leading to irreversible changes in volume and liquid limit, and consequently to a reduction in both primary and secondary compressibility. At the same time, the reduction in fibre content due to drying itself leads to a decrease in compressibility and reduces the impact of the fibres on the material behaviour [13].

For the reliable prediction of construction-induced settlements, accurate knowledge of the relevant soil parameters is essential. Although these parameters can be determined from field samples through laboratory testing, these procedures are time consuming and costly. In contrast, index properties such as natural water content, void ratio, and liquid limit can be obtained with comparatively low effort and expense. If robust correlations between these index properties and compressibility parameters are available, simplified site investigations may be used to estimate the compression behavior of organic soils with reasonable confidence [14].

Due to the strong spatial variability and inherent heterogeneity of organic soils in situ, obtaining comparable undisturbed samples is often difficult. Reconstituted samples therefore represent a suitable alternative for conducting controlled and systematic investigations.

This study presents an experimental investigation into the influence of sample preparation procedures and organic content on oedometer test results of reconstituted organic soils. Particular emphasis is placed on the characterization of creep behaviour. To assess test reproducibility, the experimental program is conducted in two independent laboratories. A statistical evaluation of the oedometer data is performed, including an analysis of correlations between compression index, organic content, water content, and void ratio, and a comparison with correlations reported in previous studies.

2 Materials and methods

2.1 Materials used in this study

Highly decomposed raised bog peat from Germany (product: "Humus-Torf" from the supplier Plantaflor) and Amberg kaolin clay, used as the mineral component, were employed for the preparation of the reconstituted soil samples. The relevant material properties are summarized in Table 1. It should be noted that the natural water content of peat can vary significantly. The value reported here corresponds to the period during which the experiments were conducted.

Table 1. Index and physical properties of peat and kaolin used in this study.

Material	Loss on ignition [%]	Water content [%]	Grain density [g/cm³]
Peat	92	390	1.30
Kaolin	9	1	2.67

2.2 Sample preparation

To ensure the production of homogeneous samples, the peat (wet or dried, see explanations below) is passed by hand through a 4 mm sieve using light pressure. Prior to sieving, the peat is dried at 60 °C until a constant mass is reached leading to a loose and friable state of the peat. Since the influence of sample preparation is part of the investigation, some samples are prepared using undried material. Peat and kaolin are mixed with water to form a slurry, which is subsequently pre-consolidated in stages under vertical pressures of 12.5, 25, and 50 kPa in a cylindrical cell with a diameter of 13 cm and a height of up to 30 cm. During pre-consolidation the sample is able to drain at the top and bottom. To achieve the target organic content, the required component masses are calculated based on the water contents of the materials (with dried peat assumed as w = 0 %) and their loss on ignition (LOI). As kaolin is of purely mineral origin, its measured LOI of about 9 % is attributed to the release of structural water at high ignition temperatures (550 °C) [15,16]. Therefore, only the LOI of the peat is considered in the organic content calculations.

For the planned oedometer tests, specimens are taken from the pre-consolidated samples. The index parameters of the prepared specimens are summarized in Table 2. The actual organic content (OC) was calculated using Equation 1 based on the loss on ignition and the dry masses (m_d) used to pre-pare the samples. The measured loss on ignition of the specimen is corrected by subtracting the loss on ignition of the kaolin, since kaolin shows a loss on ignition of approx. 10 % due to the release of structural water at high temperatures [15,16].

$$\mathrm{OC} = \mathrm{LOI} - \frac{m_{d,Kaolin}}{m_{d,total}} \cdot LOI_{Kaolin}\ [\%] \qquad (1)$$

According to DIN EN ISO 14688-2:2020-11 [17], soil with an organic content exceeding 20 % is classified as highly organic. Varying levels of organic content in highly organic soils were to be analysed, so target OC values of 25 %, 50 % and 75 % were selected. The target organic contents of 50 % and 75 % were achieved with good accuracy and the target organic content of 25 % even with high accuracy with deviations of around ± 1 % being negligible. The differences resulting from sample preparation are already evident from the initial void ratio (e_0) and initial water content (w_0) of the individual specimens. The specimens prepared with dried peat all exhibit initial void ratios of around 2.0 and water contents of 80 – 90 %, whereas specimens prepared with moist peat show significantly higher values, with void ratios of approximately 3.0 and water contents exceeding 140 %. These differences are also visually apparent, as the specimens differ markedly in appearance despite having identical organic content (see Fig. 1). This is partly due to the lighter color of dried and re-saturated peat compared to moist peat, and partly because a substantially larger mass of moist peat is required during preparation to achieve the same dry-mass ratio $m_{d,Peat}$ / $m_{d,Kaolin}$.

Table 2. Index properties and derived organic content of the prepared specimens.

Specimen	Initial void ratio [-]	Initial water content [%]	Void ratio at load stage 1ii) [-]	Loss on ignition [%]	Organic content [%]
TUB 1	1.94	86.2	1.81	32.0	25.2
TUB 2	1.96	82.9	1.82	32.0	25.2
TUB 3	1.97	82.1	1.84	32.0	25.2
RUB 1	2.05	89.6	1.78	32.8	26.0
RUB 2	2.01	89.2	1.75	32.7	26.0
RUB m 1i)	3.06	144.8	2.69	32.7	26.0
RUB m 2i)	2.97	140.3	2.63	32.8	26.0
TUB 4	1.56	60.7	1.50	9.0	0.00
TUB 5	2.68	142.5	2.28	49.5	45.4
TUB 6	4.24	262.3	3.26	74.5	72.9

i) Prepared with moist peat
ii) Void ratio after load stage 0. (Reconsolidation), see Table 3

Fig. 1. Specimen prepared with dried peat (left, RUB 1) and moist peat (right, RUB m 1).

2.3 Oedometer test program

To investigate the compression behaviour of the organic mixed soils, oedometer tests were conducted in both laboratories. The load program was identical for all tests and is summarized in Table 3. The loading programme included a reconsolidation phase under the pre-consolidation stress of 50 kPa, due to the relaxation of the pre-consolidated samples caused by storage. This was followed by incremental loading and unloading stages, as well as two creep stages with durations of one week at 100 kPa and two weeks at 200 kPa. The specimens were prevented from drying out during the test by adding water.

Table 3. Oedometric load program used in all tests.

Load stage	Load [kPa]	Duration [h]
0. Reconsolidation	50	1
1. Unloading	25	24
2. Loading	50	24
3. Loading	100	24
4. Unloading	50	4
5. Loading	75	24
6. Loading	100	24
7. Loading	200	24
8. Unloading	100	4
9. Unloading	50	4
10. Unloading	25	4
11. Creep	100	168 (7 d)
12. Creep	200	336 (14 d)

3 Results and discussion

3.1 Influence of sample preparation

To assess the reproducibility and comparability of the oedometer tests, tests TUB 1-3 were conducted in the laboratory in Berlin and tests RUB 1-2 in the laboratory in Bochum. All samples were prepared using identical target parameters, with a specified organic content of 25 %. This target was achieved with high accuracy, yielding measured values of 25.2 % in the laboratory in Berlin and 26.0 % in the laboratory in Bochum. The initial water contents determined were also within a comparable range, varying between 82.1 % and 89.6 % (see Table 2).

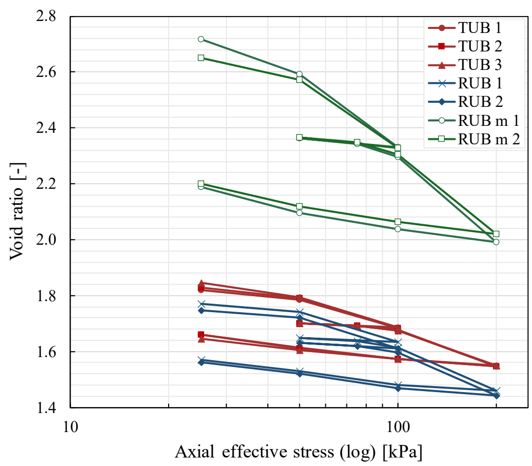

Fig. 2. Variation of void ratio versus axial effective stress for different sample preparations.

Fig. 2 shows the variation of void ratio versus axial effective stress. The results of tests TUB 1-3 and RUB 1-2 indicate a high level of consistency. The compression curves exhibit very similar values and trends. Minor differences are attributable to small variations in the initial void ratio (see Table 2), which cause a parallel shift in the curves, while the slope (and thus the compressibility) remains almost identical. This observation is supported by the compression indices listed in Table 4, which range from 0.41 to 0.51 and indicate only limited scatter. The test results within the laboratories also demonstrate excellent reproducibility: the curves from TUB 1-3 and from RUB 1-2 are almost identical.

Table 4. Compression, swelling and creep indices.

Specimen	C_c [-]	C_S [-]	C_α [-] (100 kPa)	C_α [-] (200 kPa)
TUB 1	0.42	0.06	0.005	0.007
TUB 2	0.43	0.06	0.006	0.008
TUB 3	0.41	0.05	0.004	0.007
RUB 1	0.51	0.04	0.004	0.010
RUB 2	0.51	0.07	0.005	0.013
RUB m 1	1.01	0.11	0.008	0.018
RUB m 2	0.94	0.12	0.007	0.016

A comparable pattern emerges from the time-strain relationships at vertical stresses of 100 kPa and 200 kPa (see Fig. 3 and 4). The test results again show close agreement, and the observed deviations are negligible. Overall, the results demonstrate a high degree of comparability between specimens produced and tested in different laboratories.

A different trend is observed when tests TUB 1-3 and RUB 1-2 are compared with tests RUB m 1 – m 2. For specimens RUB m 1 and m 2, the target organic content of 25 % was again specified and was closely achieved, with a measured value of 26.0 % (see Table 2). However, in contrast to the other specimens, these specimens were prepared using moist peat instead of dried and re-saturated peat. As a result, the initial water contents after pre-consolidation were substantially higher, amounting to 144.8 % and 140.3 %, respectively. The void ratios exhibited a consistent pattern (3.06 and 2.97; see Table 2). Due to these elevated initial void ratios, the void ratio–axial effective stress curves for tests RUB m 1 and m 2 in Fig. 2 are located significantly above those of the other specimens. The curves also show larger void ratio changes between load increments and steeper slopes, indicating substantially greater compressibility. This is confirmed by the compression indices of 1.01 and 0.94, respectively, which are approximately twice larger than those of the specimens prepared with dried and re-saturated peat. Similar to tests TUB 1-3 and RUB 1-2, tests RUB m 1 and m 2 show very close agreement with each other, demonstrating high reproducibility.

All specimens exhibited swelling during the unloading stages, which is quantified by the swelling index ($C_S = \Delta e/\text{-}\Delta\log\sigma'_v$) determined at the first unloading stage. The swelling indices listed in Table 4 follow the same trend as the compression indices: specimens RUB m 1 and RUB m 2, prepared with moist peat, show swelling indices approximately twice as high as those of the specimens prepared with re-saturated peat (TUB 1-3 and RUB 1-2).

The differences in compression behaviour between specimens prepared with moist peat and those prepared with re-saturated peat are also evident in the qualitative time-dependent strain response. Fig. 3 and 4 present the evolution of axial strains with time during the creep stages of the oedometer tests at vertical stresses of 100 kPa and 200 kPa, respectively.

All curves show a rapid increase in axial strain at the beginning of the loading stage, corresponding to primary consolidation. With increasing time, the curves progressively flatten and the rate of axial strain decreases, indicating the transition to secondary creep. After approximately 6.000 minutes at 100 kPa and about 2.000 minutes at 200 kPa, a renewed increase in strain rate is observed, which can be attributed to tertiary creep. This curvature change is only weakly pronounced at 100 kPa for the one-week creep stage, but becomes clearly visible during the substantially longer two-week creep stage at 200 kPa.

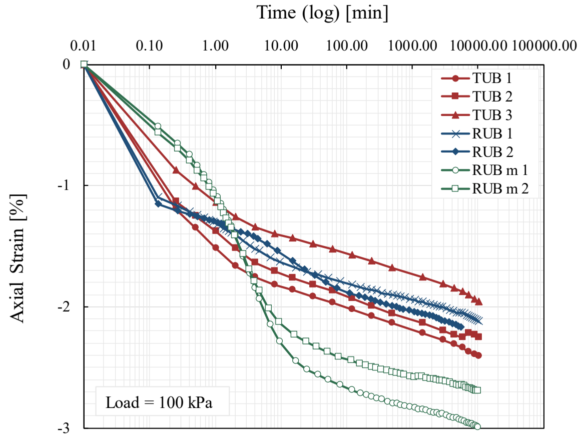

Fig. 3. Variation of axial strains versus time under a constant load of 100 kPa depending on sample preparation.

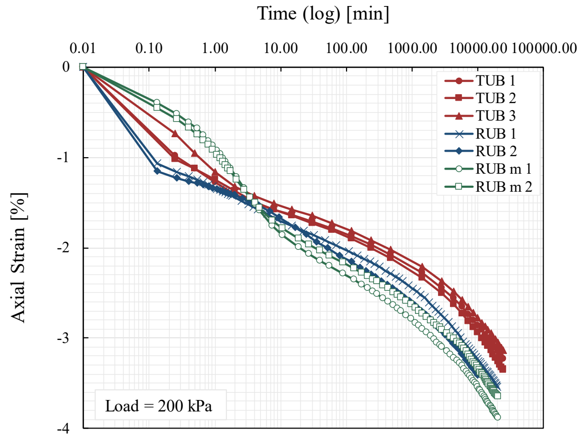

Fig. 4. Variation of axial strains versus time under a constant load of 200 kPa depending on sample preparation.

The specimens prepared with dried peat (TUB 1-3 and RUB 1-2) exhibit similar strain-time responses, with comparable durations of the primary and secondary compression phases. The end of primary consolidation (EOP) can be identified using the Casagrande method and occurs between approximately 3 and 11 minutes for both creep stages at 100 kPa and 200 kPa. Test RUB 2 represents an exception, with EOP values of about 75 minutes at 100 kPa and 30 minutes at 200 kPa, which is likely attributable to local specimen inhomogeneities.

In contrast, the specimens prepared with moist peat (RUB m 1 and RUB m 2) exhibit a characteristic S-shaped strain-time response during the primary and secondary compression phases in both diagrams. Primary consolidation is more pronounced in these specimens, as reflected by (i) larger axial strains accumulated during this stage and (ii) a slightly extended duration of primary consolidation, with EOP values between approximately 18 and 50 minutes at both 100 and 200 kPa, compared to the specimens prepared using re-saturated peat. It should also be noted that the duration of the secondary compression phase of RUB m 1 and RUB m 2 differs from the other specimens. This is evident when utilising the graphical method outlined by Casagrande to ascertain the end of the secondary compression phase (EOS) for a load of 200 kPa. For specimens RUB m 1 and RUB m 2, EOS times of 1.600 and 1.000 minutes can be determined. In contrast, the tertiary compression phase of the remaining specimens begins significantly earlier, at 400 to 850 minutes.

The results of the study align with initial findings by Zhao and Jommi [13], which demonstrate that drying and subsequent re-saturation significantly affect the engineering properties and compression behaviour of organic soils. Drying leads to a reduction in pore volume and water retention capacity due to irreversible microstructural changes. As a consequence, soil compressibility remains reduced even after re-saturation. This effect is reflected in both shorter primary consolidation phases and reduced secondary compression compared with specimens prepared without prior drying.

3.2 Influence of organic content

In order to investigate the influence of organic content on the compression behaviour of mixed soils, three additional tests were carried out: TUB 4 (OC = 0 %), TUB 5 (OC = 45.4 %) and TUB 6 (OC = 72.9 %) (see Table 2). The variation of the void ratio as a function of the axial effective stress is shown in Fig. 5, which shows the results of referenced tests TUB 4-6 in comparison with test TUB 3 (OC = 25.2 %).

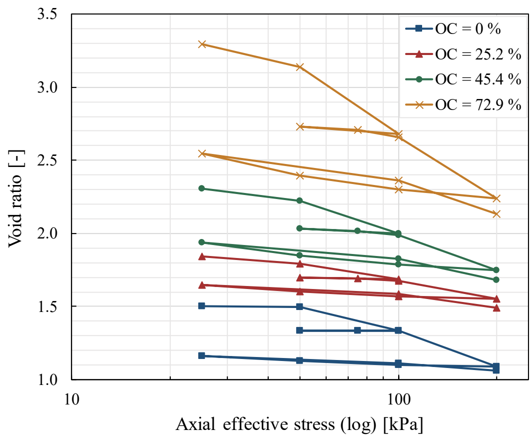

Fig. 5. Variation of void ratio with axial effective stress for different sample preparations depending on organic content.

It can be observed that higher organic content is generally associated with a more porous soil structure. As illustrated by specimen TUB 6, which has the highest organic content (OC = 72.9 %), the corresponding void ratio is also highest, indicating increased compressibility. However, the compression indices reported in Table 5 do not show a clear trend of increasing compressibility with increasing organic content. Tests TUB 4 (OC = 0 %) and TUB 5 (OC = 45.4 %) yield similar compression indices of 0.82 and 0.8, respectively, whereas test TUB 3 shows a substantially lower value of 0.4, approximately half of these values. In contrast the swelling indices (see Table 1) indicate a clearer trend, showing an increase with increasing organic content, which is consistent with previous studies on peat (e.g. [18,19]). However, earlier studies generally report increasing compressibility with higher organic content while also noting considerable scatter due to the additional influence of void ratio, water content, and soil structure (e.g. [19,20]). The deviations observed in the compression indices could be attributed to variations in the preparation of the specimens and execution of the oedometer tests. For instance, a pre-consolidation period that differed from the previous test series, to which TUB 3 belonged, resulted in the specimens being exposed to longer creep stresses during this phase.

Table 5. Compression and swelling indices.

Specimen	OC [%]	C_c [-]	C_s [-]
TUB 4	0.0	0.82	0.01
TUB 3	25.2	0.41	0.05
TUB 5	45.4	0.80	0.11
TUB 6	72.9	1.38	0.17

Fig. 6 illustrates the evolution of the axial strain for these tests in comparison to test TUB 3 (OC = 25.2 %) during the second creep stage at a vertical stress of 200 kPa. A clear dependence of the compression behaviour on organic content can be observed. Specimens with higher organic content exhibit greater settlements and thus higher overall compressibility. As expected, specimen TUB 4, with the lowest OC shows the smallest total axial strain (-2.04 %), whereas specimen TUB 6 with the highest organic content, exhibits the largest total axial strain (-5.14 %).

The organic content has a major influence, particularly on the individual compression phases: primary, secondary and tertiary. The pure clay specimen TUB 4 shows the characteristic 'S' shape. The EOP can be identified to 5 minutes. This is followed by the secondary compression phase (creep). A tertiary compression phase (creep) is not apparent. This changes when peat is added. The other three specimens (TUB 3, TUB 5 and TUB 6) contain varying amounts of peat and exhibit a distinct tertiary compression phase. The tertiary phase significantly determines the compression behaviour of the three specimens, so that a characteristic 'S-shape' in the primary and secondary phase becomes increasingly difficult to recognise with increasing OC. Nevertheless, the EOPs can be determined: TUB 3 at 3 minutes, TUB 5 at 2 minutes and TUB 6 at 1 minutes. This shows that the primary compression phase becomes shorter as OC increases. The creep phases (secondary and tertiary phases) increasingly determine the compression behaviour. That is also shown by the creep coefficients. Both the creep coefficient of the secondary phase ($C_{\alpha 1}$) and the creep coefficient of the tertiary phase ($C_{\alpha 2}$) increase with OC. The creep coefficients of the tertiary phase are four to six times greater than those of the secondary phase.

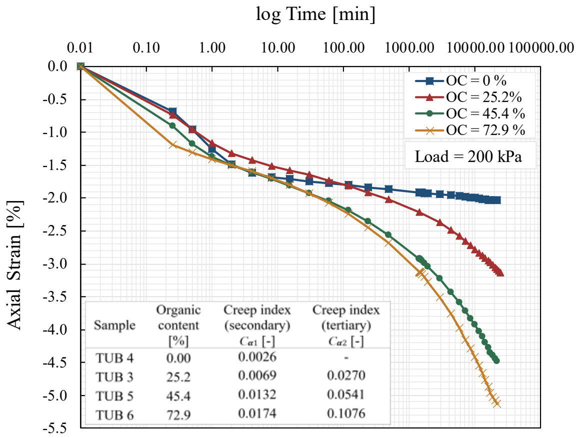

Fig. 6. Development of axial strains versus time during a constant load of 200 kPa depending on organic content.

3.3 Parameter correlations

Statistical evaluations were performed based on all the oedometer tests presented here (except TUB 4, 5 and 6) and previous experiments conducted at the laboratory in Bochum with varying organic content. The correlation matrix shown in Fig. 7 summarizes the relationships between the considered parameters. Correlation coefficients approaching 1 indicate a strong statistical dependence between the respective variables. The results show that the compression index C_c correlates most strongly with void ratio, followed closely by water content. As these parameters are strongly influenced by sample preparation, the effect of preparation is effectively taken into account. Based on these correlations, additional regression analyses were carried out to quantify the dependence of compressibility parameters on the most influential index properties.

	OC	w_0	e_0	C_c
OC	1			
w_0	0.905	1		
e_0	0.845	0.976	1	
C_c	0.776	0.945	0.984	1

Fig. 7. Correlation matrix of index properties and compression index.

Since the various input parameters OC, w_0, and e_0 are also strongly correlated with each other, resulting in multicollinearity, it is advisable to establish possible regression equations for the compression index based solely on one input variable. Organic content is excluded not only due to its comparatively weaker correlation, but also because the experimental results show that specimens with identical organic content can exhibit substantially different void ratios, water contents, and compression indices. Consequently, the following regression equations are developed using void ratio and water content as independent variables.

First, the linear relationship of C_C is formulated as a function of void ratio (Equation 2) and constrained to pass through the origin (see Fig. 8). Although this constraint slightly reduces the coefficient of determination R^2, it avoids limiting the domain of applicability. To increase the database, additional data from the literature [9–12,18,21–27] are incorporated to evaluate and, if necessary, recalibrate the relationship (see Fig. 9, 10 and 11). Including the literature data reduces the coefficient of determination of Equation 2 to $R^2 = 0.641$. Therefore, a new regression based on the combined dataset is performed, yielding Equation 3, with an improved coefficient of determination of $R^2 = 0.777$.

$$C_c = 0.332 \cdot e_0 \quad [\text{-}] \tag{2}$$

$$C_c = 0.430 \cdot e_0 \quad [\text{-}] \tag{3}$$

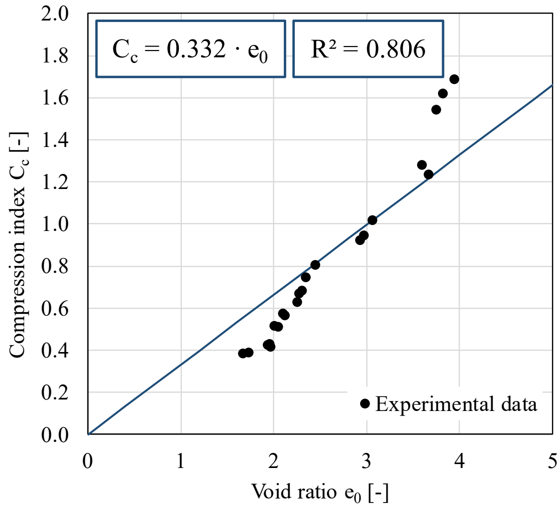

Fig. 8. Compression index versus initial void ratio (Eq. 2).

For the practical application of such predictive equations, it may be beneficial to estimate the compression index based on the water content present in the field, as determining the water content requires less time and effort. Based on the available data, Equation 4 was therefore additionally established as a function of water content for $w_0 > 15\,\%$ (min. w_0 adopted in regression analysis, see Fig. 10). R^2 is only slightly lower. In contrast to the first equation depending on the void ratio, no adjustment of the equation is necessary here after adding the literature data. Since the literature data includes experiments on both reconstituted and natural samples, there is good reason to believe that the equation established can be transferred to field conditions in the field.

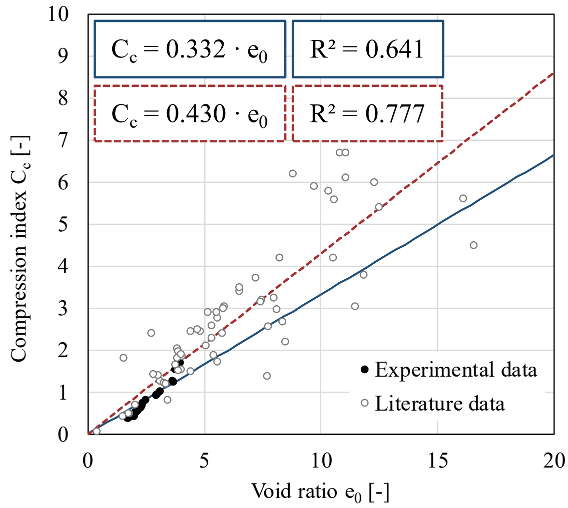

Fig. 9. Compression index versus initial void ratio (Eq. 2 and 3). [9–12, 18, 21–27].

$$C_c = 0.007 \cdot w_0 \quad [-] \tag{4}$$

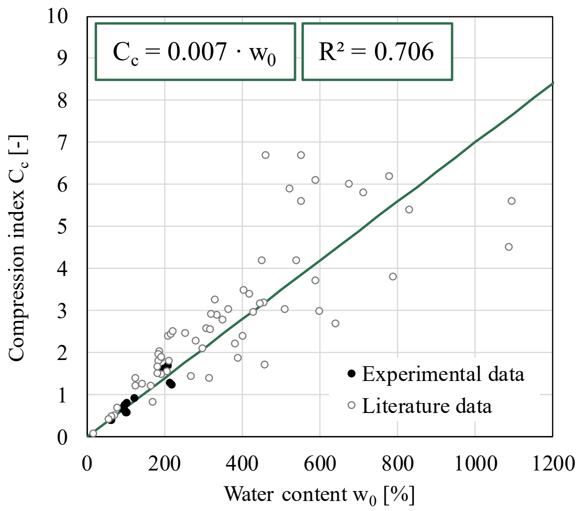

Fig. 10. Compression index versus initial water content (Eq. 3). [9–12, 18, 21–27].

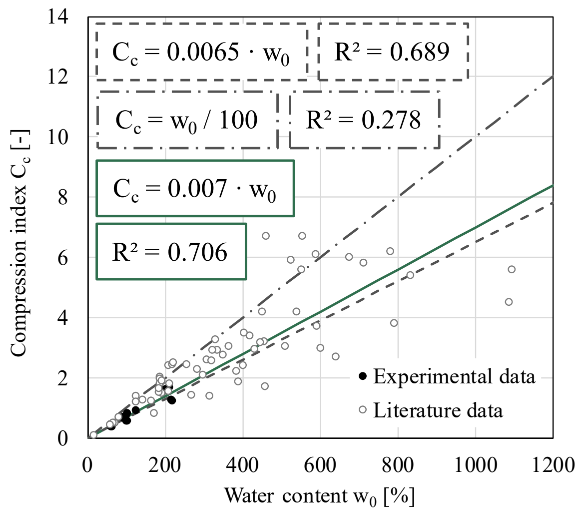

Fig. 11. Compression index versus initial water content (Eq. 4, 5 and 6). [9–12,18,21–27].

This conclusion is also supported by previously reported equations from the literature, which are shown in Fig. 11. In particular, the equation proposed by Hobbs [28] is extremely similar to Equation 4 presented here, which in turn supports the validity of the equation developed here. The equation established by Mesri and Ajlouni [5] tends to overestimate the compression index, especially with increasing water content. Both equations were established mainly based on natural samples.

$$C_c = 0.0065 \cdot w_0 \quad [-] \quad [28] \tag{5}$$

$$C_c = w_0 \,/\, 100 \quad [-] \quad [5] \tag{6}$$

4 Summary

This study investigated two factors influencing the compression behaviour of organic soils: i) effect of sample preparation, and ii) effect of organic content.

The oedometer test results of specimens produced using re-saturated peat demonstrated reproducibility and comparability within and between the two laboratories in Berlin and Bochum. The results obtained from specimens produced with moist peat were found to vary significantly from those produced with re-saturated peat. The drying and subsequent re-saturation of peat significantly altered the physical properties of the specimens and, consequently, their compression behaviour. Drying caused a reduction in pore volume and water absorption capacity, which resulted in decreased compressibility even after re-saturation. As a result, both the primary and secondary compression phases were noticeably shortened in comparison to specimens produced using moist peat.

The compression behaviour of the examined specimens is found to be significantly influenced by their organic content. An increased organic content in the specimen leads to a higher void ratio. Also, the swelling index increases with increasing organic content. However, this study does not show a clear trend of increasing compressibility with higher organic content.

Furthermore, the results show that the organic content has a major influence, particularly on the individual compression phases. The primary compression phase becomes shorter as organic content increases. The presence of organic components is accompanied by an additional creep phase (tertiary compression), which does not occur in the absence of organic matter. The creep phases (secondary and tertiary phases) increasingly determine the compression behaviour as the organic content increases and as evidenced by increasing creep coefficients.

The statistical evaluations performed reveal strong correlations between compression index and index properties. The organic content is inadequate for establishing predictive equations based on solely one input variable, as it not only exhibits a comparatively weaker correlation, but also the experimental results show that specimens with identical organic content can exhibit substantially different void ratios, water contents, and compression indices. The most accurate predictions are obtained using the void ratio, but for practical reasons, the compression index can also be estimated using the water content, whereby the accuracy is only slightly lower. With the help of data from the literature, the equations established could be validated and recalibrated. It has been shown that the equations established here can be most likely applied to field conditions, as the literature data include experiments on both reconstituted and natural samples. In addition, the previously proposed equations for natural peats are very similar to the equations established here, thus supporting the validity of the latter.

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