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Peat stabilization using cement, polypropylene and steel fibres

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Abstract. This article describes a laboratory research on stabilizing tropical peat using ordinary Portland cement (OPC) as a binding agent, and polypropylene and steel fibres as chemically inert additives. California bearing ratio (CBR) and unconfined compressive strength (UCS) tests were carried out to evaluate the increase in the strength of the stabilized samples compacted at their optimum moisture contents and air cured for up to 90 days. The results show that the UCS values of stabilized peat samples increased by as high as 748.8% by using OPC (5%), polypropylene fibres (0.15%), and steel fibres (2%). The CBR values of the samples stabilized with OPC (5%), polypropylene fibres (0.15%), and steel fibres (4%) showed an increase of as high as 122.7%. The stabilized samples showed a shrinkage in volume upon air curing and this shrinkage was measured by an index called, volume shrinkage index (VSI). The highest VSI recorded was 36.19% for peat without any additives; and the minimum was 0% for the sample containing 30% OPC, 0.15% polypropylene fibres and 2% steel fibres. The technique of stabilizing peat with OPC, polypropylene and fibres, coupled with air curing, appears to be cost-effective compared with other frequently used techniques.

Keywords: peat; cement; polypropylene fibres; steel fibres; optimum moisture content; California bearing ratio; unconfined compressive strength; volume shrinkage index.

1. Introduction

Peats are considered as extremely soft, wet, unconsolidated materials with high organic matter. Their engineering properties are worse than those of other soft soils; and are generally associated with high compressibility, unsatisfactory strength characteristics and large settlements (Woods *et al.* 1960). It is among the softest soils with a very low bearing capacity and California bearing ratio (CBR) is generally less than 2% (Holtz and Kovacs 1981, O'Mahony *et al.* 2000). One of the commonly used strength parameters in the design of roads is the CBR of the subgrade. In order that peat can be used as a subgrade for the road construction, it needs to be stabilized for improving its strength and CBR.

Chemical stabilization using cement has been used by many researchers for improving the performance of soft soils (Aiban 1994, Basha *et al.* 2005, Huang and Airey 1998, Ismail *et al.*

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2002, Kolias *et al*. 2005, Munro 2004, Tremblay *et al*. 2002); but usually the chemical additives, if used alone, result in a high stiffness and brittle behavior (Al Wahab and El-Kedrah 1995, Basha *et al*. 2005). This drawback in the behavior of the chemical stabilized soils has been overcome with some success by incorporating randomly oriented fibres (reinforcement) within the soil which help by limiting the potential planes of weakness that develop with parallel oriented reinforcement (Gray and Al-Refeai 1986, Krishnaswamy and Isaac 1994, Prabakar and Sridhar 2002, Ranjan *et al*. 1996, Tang *et al*. 2007, Yetimoglu and Salbas 2003, Yetimoglu *et al*. 2005).

An increase in the compressive strength of the samples, due to the addition of fibres, has been reported by many researchers (Al Wahab and El-Kedrah 1995, Chauhan *et al*. 2008, Consoli *et al*. 1998, 2002, 2003, 2009, Kumar and Tabor 2003, Maher and Ho 1993, Nataraj and McManis 1997, Park and Tan 2005, Tang *et al*. 2007). Ramesh *et al*. (2010) have used fibres processed from the husk of coconuts to improve the strength behavior of black-cotton soil. The authors have reported that 1% fibres (by weight) gives the maximum strength. Chauhan *et al*. (2008) have observed that the performance of subgrades can be improved by reinforcing with fibres. It has been observed from the previous studies that the inclusion of fibres significantly improved the strength of the soil; and at the same time, the ductility of the soil was found to increase and a higher post-peak strength was observed. Leelavathamma *et al*. (2005) have reported that the CBR of fly ash can be improved by stabilizing with cement; thus solving its strength problem. Kumar and Singh (2008) have reported an improved strength and CBR of fly ash stabilized with polypropylene fibres.

Although a lot of work has been carried out on clay and other soils, literature on fibre inclusion in peat is very limited. Hence, it is felt that there is a necessity for some more work to understand the influence of randomly oriented fibres on the mechanical behavior of cemented and uncemented peat.

The objective of this paper is to study the mechanical behavior of cemented and uncemented peat admixed with randomly distributed fibres. A series of UCS and CBR tests were carried out on soil samples with different percentages of cement and fibres.

2. Test materials

The basic materials used in this study are peat, ordinary Portland cement (OPC), polypropylene fibres, and steel fibres.

Undisturbed and disturbed samples of peat were collected, according to AASHTO T86-70 and ASTM D420-6, from Kampung Jawa, Malaysia.The basic properties of peat were determined and are shown in Table 1. The binding agent was OPC and its main components are shown in Table 2. The additives used to prepare the mixture of peat and OPC were polypropylene fibres (Fig. 1) and steel fibres (Fig. 2). These additives are chemically inert materials and their properties are shown in Tables 3 (polypropylene fibres) and 4 (steel fibres) respectively.

3. Experimental program

In order to evaluate the engineering properties of peat, a series of tests were performed on the undisturbed and disturbed peat samples. The tests included classification, organic content, pH, compaction, UCS, CBR, permeability, consolidation (Rowe cell) and triaxial tests. The results of the

Table 1 Properties of peat

Properties	Standard specifications	Values
Depth of sampling		0.05-1.0 m
Moisture content	ASTM D2216	198-417%
Bulk density (in-situ)		1.02-1.04 Mg/m^3
Classification	ASTM D5715	Fibrous
Liquid limit	BS EN 1997-2: 2006	160%
Plastic index	ASTM D424-59	Non-Plastic
pH	BS EN 1997-2: 2006	6.81
Organic content	ASTM D2974	80.23%
Optimum moisture content	AASHTO T 180-D	130%
Maximum dry density	AASHTO T 180-D	0.489 Mg/m^3
Permeability	ASTM D2434-68	0.423 m/day
Initial void ratio, e_o	BS EN 1997-2: 2006	12.55
Compression index, C_c	BS EN 1997-2: 2006	4.163
Recompression index, C_r	BS EN 1997-2: 2006	0.307
UCS (undisturbed)	ASTM 2166-6	28.5 kPa
CBR (undisturbed)	ASTM D1883-73	0.80%
Sensitivity (St)		1.30
Cohesion (undrained), c_u'	ASTM D 4767-04	0.10 kPa
Friction angle (undrained), φ_u'		36.64^o

Table 2 Main components of ordinary Portland cement*

Name of component	Oxide	Abbreviation
Tricalcium silicate	$3CaO\ SiO_2$	C_3S
Dicalcium silicate	$2CaO\ SiO_2$	C_2S
Tricalcium aluminate	$3CaO\ Al_2O_3$	C_3A
Tetracalcium aluminate ferrite	$4CaSO_4$, Al_2O_3, Fe_2O_3	C_4AF
Calcium sulphate	$CaSO_42H_2O$ or $CaSO_4$	Gypsum

*Neville (1999)

tests are also presented in Table 1.

Peat samples were prepared by mixing various dosages of OPC, polypropylene fibres and steel fibres. Unreinforced and fiber reinforced peat specimens were prepared by using a moist tamping technique (Ladd 1978). This fabrication method is commonly used in laboratory studies of fiber reinforced soils and it has the advantage of a good control of specimen density while preventing the segregation of fibres.

The compaction tests were carried out for determining the moisture-density relationship of the samples. Tests were also performed to determine the time required for 100% saturation of the samples upon soaking. The UCS and CBR tests were performed for evaluating the mechanical strength of the unsoaked and soaked samples after curing for up to 90 days. Finally, the volume shrinkage index of the samples was also determined.

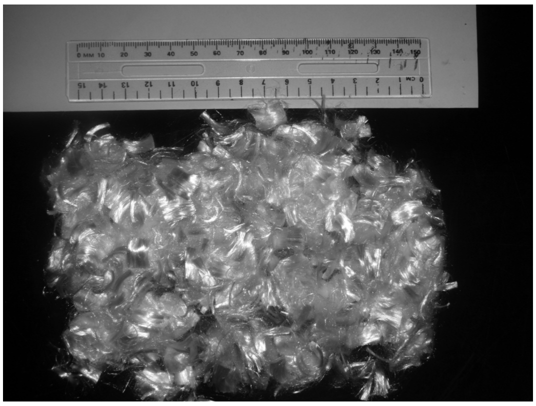

Fig. 1 Photograph of polypropylene fibres

Fig. 2 Photograph of steel fibres (Timuran Engineering 2005)

Table 3 Polypropylene fibres specifications*

Property	Specification
Color	Natural
Specific gravity	0.91
Fibre length	12 mm
Fibre diameter	18 micron-nominal
Tensile strength	300-440 MPa
Elastic modulus	6000-9000 (N/mm^2)
Water absorption	None
Softening point	160°C

*Sika fibres (2005)

3.1 Dosages of cement, polypropylene and steel fibres

The amount of OPC used for stabilizing peat samples for the CBR and UCS tests ranged from 0 to 30% (0, 5, 15 and 30%) by weight of wet peat. The amount of polypropylene fibres was 0.15% by weight of wet peat; and was kept constant for all the samples. Kalantari and Huat (2008) have also used 0.15% polypropylene fibres for stabilizing peat using OPC and polypropylene fibres, and this amount of polypropylene fibres was observed to be the optimum dosage to achieve the maximum unconfined compressive strength. This finding was also confirmed by the results obtained from the CBR tests on samples stabilized with OPC and fibres and air cured for up to 90 days (Fig. 3). Further, the amount of steel fibres used was 2% and 4% by weight of wet peat.

Modified compaction tests were performed on peat as a control measure sample, and also on peat stabilized with different amounts of cement, with or without polypropylene and steel fibres, based on AASHTO T 180 D and the results are presented in Table 5. The results obtained from the compaction tests were used to prepare the samples at optimum moisture contents (OMC) for performing the CBR and UCS tests.

UCS tests were carried out on peat samples (as control samples), under soaked and unsoaked

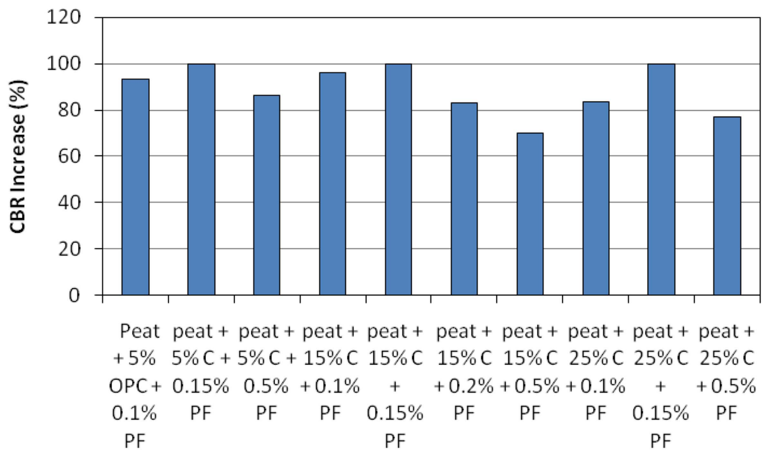

Fig. 3 Percentage increase in CBR of peat, stabilized with OPC, polypropylene (PF) and steel (SF) fibres and air cured for 90 days

Table 4 Steel fibres specifications*

Property	Specification
Fibre length	60 mm
Equivalent diameter	0.75 mm
Aspect ratio (Length/Diameter)	80
Tensile strength	1100±100 N/mm^2
Number of pieces/kg	4600

*Timuran Engineering (2007)

Table 5 Dry density and OMC of stabilized peat

Description	Dry density (Mg/m^3)	OMC (%)
Peat	0.49	129.9
Peat + 5% OPC	0.56	106.9
Peat + 5% OPC + 0.15% PF	0.58	110.1
Peat + 15% OPC	0.66	87.5
Peat + 15% OPC + 0.15% PF	0.68	90.8
Peat + 30% OPC	0.67	81.0
Peat + 30% OPC + 0.15% PF	0.78	81.9
Peat + 5% OPC + 0.15% PF + 2% SF	0.63	105.0
Peat + 5% OPC + 0.15% PF + 4% SF	0.54	108.0
Peat + 5% OPC + 4% SF	0.67	107.1
Peat + 15% OPC + 0.15% PF + 2% SF	0.76	85.0
Peat + 15% OPC + 0.15% PF + 4% SF	0.84	84.3
Peat + 15% OPC 4% SF	0.79	90.6
Peat + 30% OPC + 2%SF	0.85	84.7
Peat + 30% OPC +0.15% PF + 2%SF	0.87	92.3

conditions, after curing for 90 days. This test was also carried out on peat samples stabilized with cement (5% and 15%), with or without additives [polypropylene fibres (0.15%) and steel fibres (2%)]. For this test, the samples were prepared in 101.2 mm (4") diameter standard compaction molds in three layers and each layer was compacted by giving 25 blows by a 2.2 kg (5 lb) hammer.

CBR tests were carried out on peat samples (as control sample), and also on samples with 0.15% polypropylene fibres (control measure sample), under soaked and unsoaked conditions. Further, this test was also carried out on stabilized peat, under soaked and unsoaked conditions, containing OPC (5%, 15% and 30%), polypropylene fibres (0.15%) and steel fibres (2% and 4%).

The samples were soaked for seven days for CBR and UCS tests under soaked condition; and the tests were carried out as per the procedure described by Kalantari and Huat (2008). Based on this procedure, the sample gaining the maximum strength during the curing period was kept submerged in water and monitored for weight gain to achieve 100% saturation. The minimum number of days required by the sample to reach a constant weight was taken as the soaking period, for all the samples, for testing under soaked condition.

The peat samples chosen for CBR test, under soaked condition, were prepared by adding 30% cement, 0.15% polypropylene fibres, and 2% steel fibres. This combination has resulted in the maximum strength value after 90 days of curing, for all the samples containing different amounts of cement and additives. The peat sample, with this combination, could attain a constant weight after seven days while kept submerged in water. Therefore, all the samples were submerged in water for seven days before performing the CBR and UCS tests, under soaked condition.

In order to cure the samples, air curing technique has been used. In this technique, the samples were kept in normal air temperature and no water was added during the curing period. The samples were cured for 90 days for the UCS test; and 1, 28, and 90 days for the CBR test.

During the curing process, the stabilized samples for the CBR test were observed to shrink in their mold. Therefore, in order to carry out the test, molds were prepared from flexible plastic sheet and wrapped around the samples with steel clamps. With this arrangement, it was possible to keep the samples wrapped perfectly in its mold by adjusting the steel clamp. Laboratory prepared flexible size mold, made of double thick plastic layers and steel clamps were used to perform the CBR tests on the samples, instead of using standard CBR molds.

3.2 Volume shrinkage index

Due to the hydration process and evaporation of moisture during the air curing, a gradual reduction in dimensions (diameter and height) of the stabilized peat samples were observed. To make an assessment of this reduction, an index called, Volume Shrinkage Index (VSI) has been proposed.

In order to calculate the VSI of the stabilized peat samples, the mixtures of peat with cement and additives, at its OMC, were compacted in the CBR molds, in accordance with AASHTO T180-D. The molds were then kept in an oven at a temperature of 70±2°C for 120 hours for drying. The samples were then removed from the molds and the dimensions (diameter and height) were measured to the nearest 0.1 mm. The VSI (%) of the samples were calculated using the following relationship

$$\text{VSI}(\%) = 100\text{-}\left(\frac{\text{Final Volume}}{\text{Initial Volume}}\right) \times 100$$

This index gives us an idea concerning the reduction in volume of peat after stabilization.

4. Results and discussion

4.1 UCS test

The results of UCS test (soaked and unsoaked conditions) on peat samples with 5% OPC, different percentages of polypropylene and steel fibres, compacted at their OMC and then air cured for 90 days, are presented in Fig. 4. The results for samples with 15% OPC and different percentages of polypropylene fibres and steel fibres are presented in Fig. 5.

It is observed that the UCS of peat, under unsoaked condition is 210.2 kPa and it reduces to 41.8 kPa upon soaking (Fig. 4). With the addition of 5% OPC, the UCS of peat increases by 50.3% (210.2 to 316 kPa). Further, when 0.15% polypropylene fibres are added along with 5% OPC, the increase in UCS is 74.6% (210.2 to 367 kPa). Similarly, with 2% steel fibres, the increase in UCS is 57.9% (210.2 to 332 kPa); but when 0.15% polypropylene fibres and 2% steel fibres are added together, it increases by 267.5% (210.2 to 772.5 kPa). Further, the increase in UCS under soaked

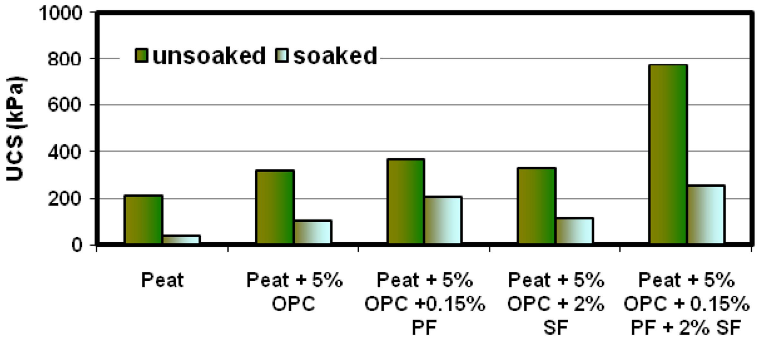

Fig. 4 UCS (unsoaked and soaked) of peat stabilized with 5% OPC, polypropylene (PF) and steel (SF) fibres and air cured for 90 days

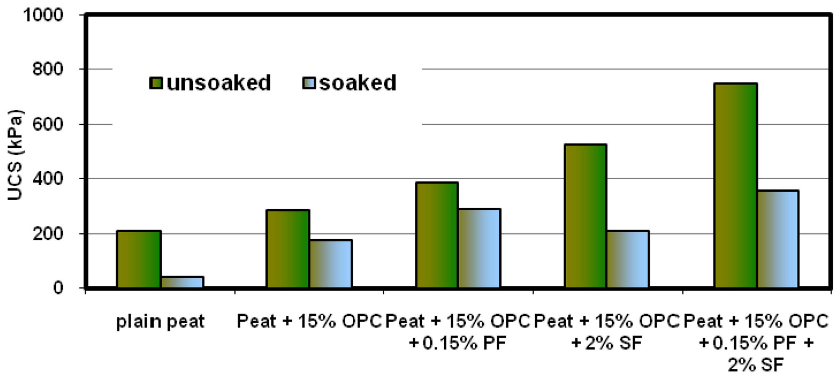

Fig. 5 UCS (unsoaked and soaked) of peat stabilized with 15% OPC, polypropylene (PF) and steel (SF) fibres and air cured for 90 days

condition, when polypropylene and steel fibres are added together is 514.4% (41.8 to 256.8 kPa).

Similarly, the results of the UCS of the samples with 15% OPC and polypropylene and steel fibres show that it increases by as high as 254.9% (210.2 to 746 kPa) under unsoaked condition, and 748.8% (41.8 to 354.8 kPa) under soaked condition (Fig. 5). The use of 0.15% polypropylene fibres gives a higher UCS compared with 2% steel fibres. The UCS is greatly enhanced when 0.15% polypropylene fibres and 2% steel fibres are used together. The reduction in UCS of the stabilized peat samples was very large when tested under soaked condition, as compared with unsoaked condition. There is less decrease in the UCS (soaked condition) of samples stabilized with higher OPC content; and also for the samples containing polypropylene fibres, when compared with UCS under unsoaked condition. Further, the samples with 5% OPC result in higher UCS than with 15% OPC. This is due to the fact that the samples with small amount of OPC (5%) loose their moisture during the curing period and gain strength, not because of bonding among the peat particles or hydration products, but rather because of drying of the fibres of peat. Hence, as the fibres of stabilized peat samples loose their moisture, the stabilized samples show a higher UCS, but show a very small UCS as soon as they are soaked.

The increased UCS of the stabilized peat appears to be due to the interaction between the fibre surface and the hydrated products. This may also be due to fact that the fibres serve as ‘bridges’, preventing the formation and propagation of cracks in the sample upon loading (Tang *et al.* 2007). The results with polypropylene fibres are more encouraging than with steel fibres. It appears that the number of such bridges is more in samples stabilized with polypropylene fibres than those stabilized with steel fibres.

The reduction in the UCS of samples upon soaking is less for samples with a higher OPC content. This may be due to the presence of higher hydration products, resulting in higher friction at the interface between peat particles and hydration products. The reduction in UCS of the samples, with polypropylene and steel fibres, along with OPC is still lower; and it appears that the increased friction at the fibre surface, hydration products and peat particles is the reason.

The amount of the binders required to strengthen the highly organic soils or peats is a minimum of about 15% OPC (Alwi 2007, Axelsson *et al.* 2002, Hebib and Farrel 2003). Whereas, in the

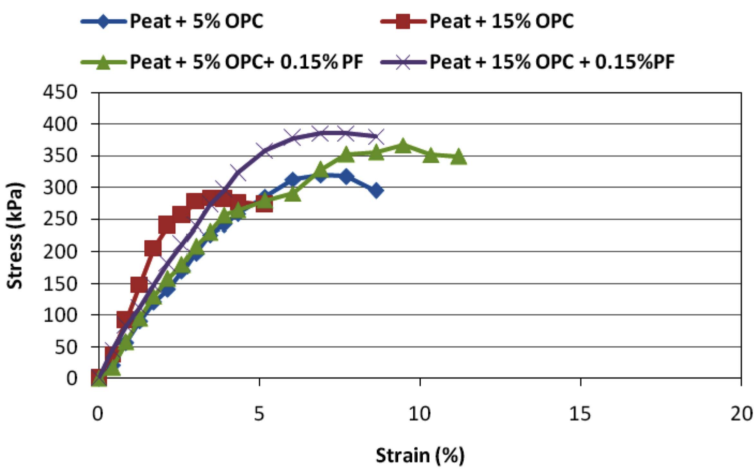

Fig. 6 Stress-strain curves of peat stabilized with OPC, polypropylene (PF) and steel (SF) fibres (unsoaked condition)

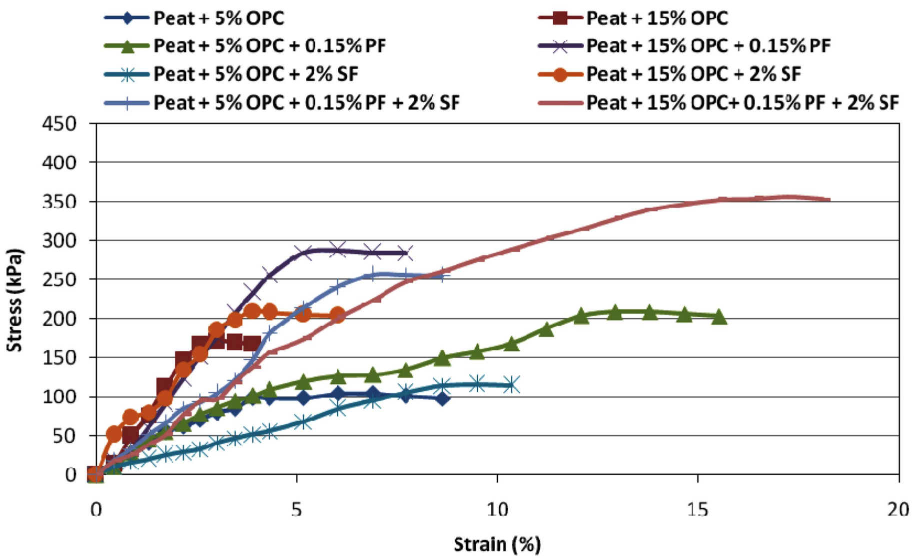

Fig. 7 Stress-strain curves of peat stabilized with OPC, polypropylene (PF) and steel (SF) fibres (soaked condition)

present study, it was possible to achieve a comparable result with only 5% OPC combined with 0.15% polypropylene fibre, and 2% steel fibre.

Some typical stress-strain curves, for the samples under unsoaked and soaked conditions, are shown in Figs. 6 and 7 respectively. From the results presented in Fig. 6, it is observed that the peak stress of peat at failure is 276.2 kPa at a strain of 2.8%. The peak stress of peat stabilized with 15% OPC and 0.15% polypropylene fibres increases by 39.5% (276.2 to 385.4 kPa) at a higher strain of 7.3%. In general, the samples were observed to show a brittle behavior, but the samples with polypropylene fibres showed a less brittle behavior. A similar behavior was also reported by Consoli *et al.* (2009) and Kumar and Singh (2008).

Similarly, from the results of tests under soaked condition (Fig. 7), it is observed that the peak stress of peat sample stabilized with 15% OPC and 0.15% polypropylene fibres reduced by 25.7% (385.4 to 286.4). The highest peak stress of 355.6 kPa was shown by the sample with 15% OPC, 0.15% polypropylene fibres and 2% steel fibres.

4.2 CBR test

The results of the CBR test carried out on stabilized peat samples compacted at their OMC with 5% OPC, polypropylene fibres and steel fibres, and air cured for 1, 28, and 90 days are presented in Fig. 8. Similarly, the results with 15% and 30% OPC and polypropylene fibres and steel fibres are presented in Figs. 9 and 10 respectively.

It is observed (Fig. 8) that the CBR of peat, under unsoaked condition and 90 days of curing, is 32.6%. It increases by 63.5% (32.6 to 53.3%) when 5% OPC is added. The increase is highest at 122.7% (32.6 to 72.8%) when the samples are stabilized with 5% OPC, 0.15% polypropylene fibres and 4% steel fibres. As expected, the CBR of peat reduces upon soaking. The trend of increase or decrease in CBR of samples with 15% OPC (Fig. 9) and 30% OPC (Fig. 10) are same as those

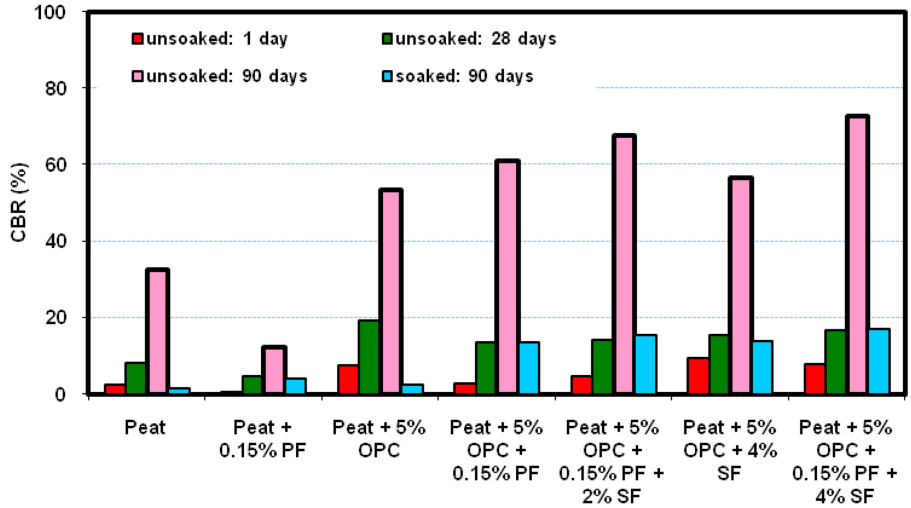

Fig. 8 CBR (unsoaked and soaked) of peat stabilized with 5% OPC and polypropylene (PF) and steel (SF) fibres and air cured for 1, 28, and 90 days

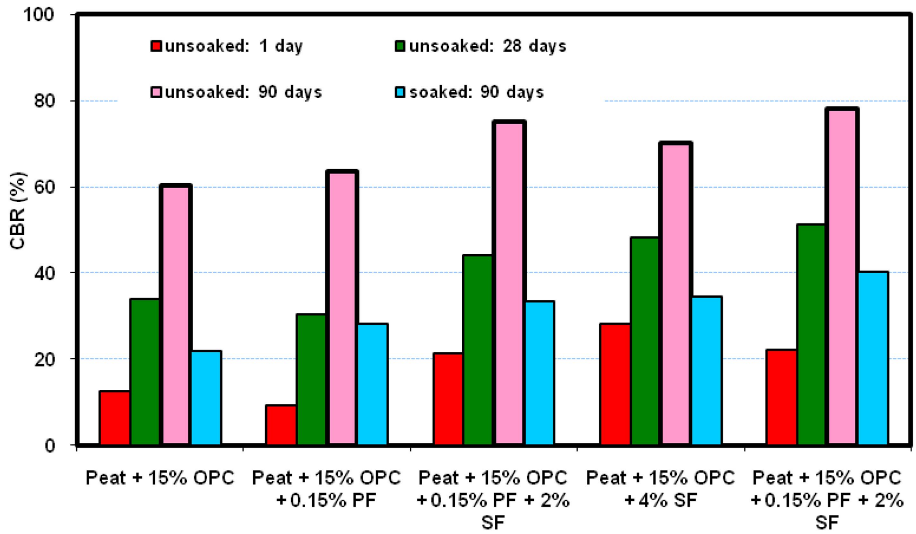

Fig. 9 CBR (unsoaked and soaked) of peat stabilized with 15% OPC and polypropylene (PF) and steel (SF) fibres and air cured for 1, 28, and 90 days

presented in Fig. 8 for 5% OPC.

Further, the CBR under unsoaked condition were observed to increase with an increase in the OPC content and curing period, for all the stabilized samples. It also increased when polypropylene or steel fibres were used, and showed a further increase when these two fibres were used together. There was a large reduction in the CBR of samples upon soaking, but the percentage reduction was less for samples with a higher OPC content. The reduction was small when polypropylene fibres or steel fibres were used. The results also show that the samples stabilized with 4% steel fibres have a

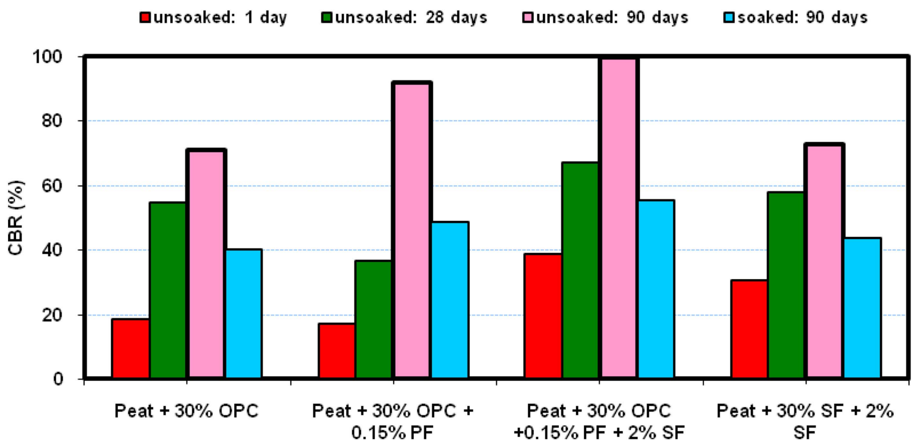

Fig. 10 CBR (unsoaked and soaked) of peat stabilized with 30% OPC and polypropylene (PF) and steel (SF) fibres and air cured for 1, 28, and 90 days

higher CBR than with 2% steel fibres, under both unsoaked and soaked conditions.

The increase in CBR of stabilized samples is due to the resistance offered by the hydration products, when OPC alone is used. In cases where propylene and/or steel fibres are used along with OPC, the CBR increase is higher because of the increased resistance to penetration by the fibres present in the sample. Munro (2004) has also reported an improvement in the CBR when OPC is added to peat. An improvement in CBR of fly ash, upon addition of cement, has also been reported by Leelavathamma *et al.* (2005).

The CBR of all the samples were observed to decrease upon soaking, however, the decrease is less for samples with a higher OPC content. The reason for this, as explained earlier, is due to the presence of higher hydration products resulting in higher friction at the interface between peat particle and hydration products. Also, the reduction in the CBR of the samples, with polypropylene and steel fibres, along with OPC is still lower; and probably it can be attributed to the increased friction at the fibres surfaces, hydration products and peat particles.

The maximum dry density (MDD) of cement and fibres reinforced samples showed an increase compared with untreated peat samples (Table 5). The water content and void ratio of natural peat is very high, and probably this is the reason for an increase is MDD upon addition of cement and fibres, although Kumar and Singh (2008) have reported a decrease in MDD upon addition of the fibres.

Kalantari and Huat (2008) have used 15% OPC to stabilize peat at its natural moisture content and have observed that the unsoaked CBR increased from 0.8 to 19%. In the present study, the unsoaked CBR increased from 0.8 to 23% when peat, at its natural moisture content, was stabilized with 15% OPC and 0.15% polypropylene fibres.

4.3 Volume shrinkage index

The results of volume shrinkage index for the samples stabilized with OPC, polypropylene fibres and steel fibres are shown in Fig. 11. It is observed that VSI decreases with an increase in OPC content. The addition of polypropylene fibres causes a further decrease in VSI and the decrease is

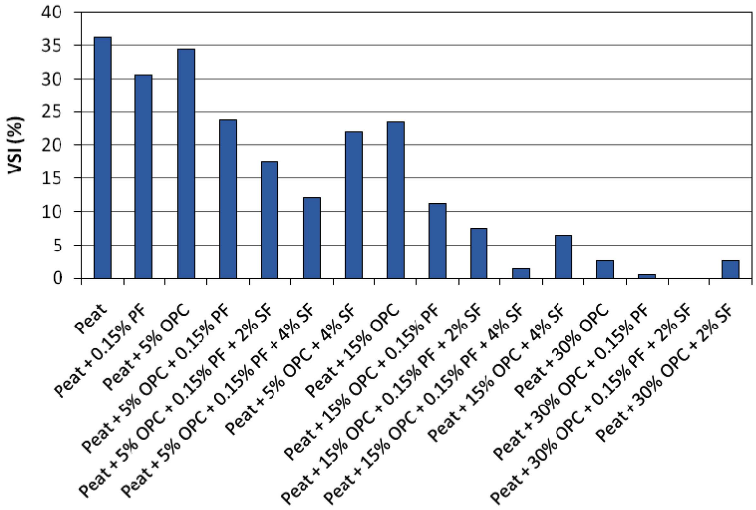

Fig. 11 Volume shrinkage indices of peat stabilized with OPC, polypropylene (PF) and steel fibres (SF)

higher with steel fibres. The VSI was the highest (36.19%) for untreated peat, and it was the lowest (0%) for the sample stabilized with 30% OPC, 0.15% polypropylene fibre and 2% steel fibres.

Also, a visual inspection of samples, after each test, showed that the samples containing polypropylene fibres were more intact with fewer cracks, than the samples with no polypropylene fibres. These findings agree well with the findings of Kalantari and Huat (2008) and Tang *et al.* (2007).

Table 6 Cost analysis of various materials used by some researchers to stabilize peat

Researchers	Test		OPC	Additives					Total cost of materials (US$)	Field applica-bilty (Level of ease)
	Type	Value (kPa)	Amount, kg/m^3 (Cost, US$)	Blast furnace slag Amount (Cost)	Sodium bentonite Amount (Cost)	Poly-propylene fibres Amount (Cost)	Steel fibres Amount (Cost)	Sand Amount (Cost)		
Axelsson et. al. (2002)	UCS	325	125 (8.3)	125 (5.4)	–	–	–	–	13.7	Difficult
Hebib & Far-rell (2003)	UCS	210	150 (10)	–	–	–	–	–	10	Difficult
Alwi (2007)	UCS	60	170 (11.1)	–	30 (11.1)	–	–	280 (4.8)	22.2	Difficult
Wong et al. (2008)	UCS	100	225 (14.9)	75 (4.9)	–	–	–	800 (13.7)	19.8	Very diffi-cult
Authors	UCS CBR	173 22%	200 (13.1)	–	–	2.4 (2)	30 (4.9)	–	20	Easy

4.4 Cost analysis

A comparison of the cost of stabilizing peat with various additives, attempted by different researchers has been made and the results are presented in Table 6. The results indicate that peat can be stabilized to various degrees of success depending upon several factors namely; strength achieved, total cost, and the degree of ease in application of the technique in the field. Among the various techniques to stabilize peat, the method proposed by the authors seems to be the easiest to practice in the field (by lowering the GWT below the stabilized depth during curing period), although the strength obtained is lower; it must be realized that the method adopted in this study is relatively simple without any surcharge load as used by others.

5. Conclusions

In this study, peat with very low CBR and UCS values of 0.8% and 28.5 kPa respectively has been stabilized using OPC as the binding agent, and polypropylene and steel fibres as the chemically inert additives. The stabilization of peat was achieved by adding different amounts of binder and additives to peat, compacting at their OMC and air curing the stabilized samples for up to 90 days. Based on the results, it can be concluded that the UCS and CBR of peat can be improved by stabilizing with OPC. The polypropylene fibres and steel fibres can be used separately or together with OPC to stabilize peat to achieve the desired UCS and CBR values. The optimum dosage of polypropylene fibres was found to be 0.15%. The amount of steel fibres to get the highest UCS and CBR values was found to be 4%. It was observed that the UCS and CBR values of stabilized peat increase with an increase in the air curing period. A new index called, VSI has been proposed to calculate the reduction in volume of the stabilized peat. This index will give an idea on the reduction in volume of peat upon stabilization. A cost-analysis of the various techniques available was carried out and it was observed that this technique of stabilizing peat using OPC, polypropylene and steel fibres, and air curing the samples, are more cost effective compared with other popular methods of peat stabilization.

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