



**MODELLING THE FIELD APPLICATION OF  
ELECTRO-OSMOTIC CONSOLIDATION  
TO IMPROVE ENGINEERING PROPERTIES OF  
SOFT PEATY CLAYS**

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UNIVERSITY OF MORATUWA, SRI LANKA  
MORATUWA

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**BSc Eng. (Hons.)**

*This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Science in Geotechnical Engineering*

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## **DECLARATION**

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

***UOM Verified Signature***

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# Table of Content

Acknowledgement.....	i
Table of contents.....	ii
List of Figures.....	vii
List of Tables.....	xvi
Abstract.....	xix

## Chapter 1

### Introduction

1.0 Introduction.....	1
1.1 Problems due to peaty clays in Sri Lanka.....	1
1.2 Basis for selecting the most appropriate method.....	1
1.3 Methods for ground improvement .....	2
1.3.1 Replacement.....	3
1.3.2 Preconsolidation by preloading.....	3
1.3.3 Preloading by vacuum.....	5
1.3.4 Deep mixing method.....	6
1.3.5 Improvement by Electro-osmosis.....	6
1.4 Objectives and scope of the current research.....	7
1.5 Arrangement of thesis .....	7

## Chapter 2

### A Review Of Studies On Electro-Osmotic Consolidation

2.1 Electro-kinetic processes.....	9
2.2 Electro-osmosis process.....	11
2.3 Electro-chemical effects.....	14
2.4 Laboratory studies on Electro-osmotic consolidation.....	15
2.5 Field applications of Electro-osmosis.....	39

## Chapter 3

**Use of Electro-osmotic consolidation technique on Sri Lankan peaty Clays**

3.1	Introduction.....	52
3.2	Test series performed.....	55
3.3	Findings of the one-dimensional Electro-osmotic consolidation tests.....	58
3.3.1	Reductions in primary consolidation characteristics.....	58
3.3.2	Improvement of secondary consolidation characteristics.....	63
3.3.3	Improvement in undrained shear strength.....	64
3.3.4	Variation of water content and PH.....	65
3.4	Concluding comments from one-dimensional tests.....	66

## Chapter 4

**Electro-Osmotic Consolidation of Peaty Clay Under Three Dimensional Conditions**

4.1	Introduction.....	68
4.2	Formulation of the test programme.....	68
4.3	Test series 1.....	74
4.3.1	Test procedure.....	74
4.3.2	Observations during the test.....	74
4.3.3	Testing of specimens of treated peat.....	76
4.3.4	Evaluation of improvements in compressibility through specimen of treated peaty clay.....	83
4.3.4.1	Influence on coefficient of volume compressibility.....	83
4.3.4.2	Reduction of void ratios and $C_c$ .....	84
4.3.4.3	Influence on the coefficient of Secondary consolidation, $C_\alpha$ .....	86
4.3.5	Reduction in moisture content.....	87
4.3.6	Improvement in shear strength.....	87
4.3.7	Variation of pH.....	88
4.3.8	Variation of Liquid limit.....	88
4.3.9	Concluding comment on results of Test Series 1.....	89
4.4	Test Series 2.....	89

---

4.4.1	Test Procedure.....	89
4.4.2	Observations during the test.....	89
4.4.3	Testing of specimens of Treated peat.....	90
4.4.4	Evaluation of improvements in compressibility through specimen of treated peaty clay.....	95
4.4.4.1	Influence on coefficient of volume compressibility.....	95
4.4.4.2	Influence on void ratios and $C_c$ .....	96
4.4.4.3	Reduction in the coefficient of Secondary consolidation, $C_\alpha$ .....	97
4.4.5	Reduction in moisture content.....	98
4.4.6	Improvement in shear strength.....	99
4.4.7	Variation of pH.....	100
4.4.8	Deterioration of the electrodes.....	100
4.4.9	Increase in Liquid limit.....	101
4.3.10	Concluding comment on results of Test Series 1.....	101
4.5	Test Series 3.....	102
4.5.1	Test Procedure.....	102
4.5.2	Observations during the test.....	103
4.5.3	Testing of specimens of Treated peat.....	103
4.5.4	Evaluation of improvements in compressibility through specimen of treated peaty clay.....	108
4.5.4.1	Influence on coefficient of volume compressibility.....	108
4.5.4.2	Reduction of void ratios and $C_c$ .....	109
4.5.4.3	Reduction in the coefficient of Secondary consolidation, $C_\alpha$ .....	110
4.5.5	Reduction in moisture content.....	111
4.5.6	Improvement in shear strength.....	111
4.5.7	Variation of pH.....	102
4.5.8	Increase in Liquid limit.....	102
4.5.9	Concluding comment on results of Test Series 1.....	102
4.6	Test Series 4.....	113
4.6.1	Test Procedure.....	113
4.6.2	Observations during the test.....	114

---



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4.6.3	Testing of specimens of Treated peat.....	114
4.6.4	Evaluation of improvements in compressibility through specimen of treated peaty clay.....	122
4.6.4.1	Influence on coefficient of volume compressibility.....	122
4.6.4.2	Influence on void ratios and $C_c$ .....	123
4.6.4.3	Reduction in the coefficient of Secondary consolidation, $C_\alpha$ .....	120
4.6.5	Reduction in moisture content.....	125
4.6.6	Improvement in shear strength.....	127
4.6.7	Variation of pH.....	127
4.6.8	Increase in Liquid limit.....	128
4.6.9	Concluding comment on results of Test Series 4.....	128
4.7	Test Series 5.....	129
4.7.1	Test Procedure.....	129
4.7.2	Observations during the test.....	129
4.7.3	Testing of specimens of Treated peat.....	130
4.7.4	Evaluation of improvements in compressibility through specimen of treated peaty clay.....	136
4.7.4.1	Influence on coefficient of volume compressibility.....	136
4.7.4.2	Influence on void ratios and $C_c$ .....	137
4.7.4.3	Influence on the coefficient of Secondary consolidation, $C_\alpha$ .....	138
4.7.5	Reduction in moisture content.....	139
4.7.6	Improvement in shear strength.....	140
4.7.7	Variation of pH.....	140
4.7.8	Increase in Liquid limit.....	141
4.7.9	Concluding comment on results of Test Series 5.....	141
4.8	Test Series 6.....	142
4.8.1	Test Procedure.....	142
4.8.2	Observations during the test.....	142
4.8.3	Testing of specimens of Treated peat.....	143
4.8.4	Evaluation of improvements in compressibility through specimen of	

---

treated peaty clay.....	150
4.8.4.1 Influence on coefficient of volume compressibility.....	150
4.8.4.2 Influence on void ratios and $C_c$ .....	151
4.8.4.3 Influence on the coefficient of Secondary consolidation, $C_\alpha$ .....	152
4.8.5 Reduction in moisture content.....	153
4.8.6 Improvement in shear strength.....	153
4.8.7 Concluding comment on results of Test Series 5.....	154
<b>Chapter 5</b>	
<b>Development of An Experimental Set Up to Measure the Electro-Osmotic Permeability</b>	<b>155</b>
<b>Chapter 6</b>	
<b>Two Dimensional Modeling of Electro-osmotic Consolidation</b>	
6.1 Introduction.....	160
6.2 Two dimensional electro-osmotic consolidation.....	161
6.2.1 Average degree of consolidation and settlement.....	164
6.3 Two dimensional electro-osmotic consolidation in combination with applied loading.....	166
6.3.1 Average degree of consolidation.....	168
6.4 Modeling of the 2-D Electro-osmotic consolidation with and without surcharge load using a EXCEL programme. ....	169
<b>Chapter 7</b>	
<b>Conclusion</b>	
7.1 Summary of Results.....	180
7.2 Main concluding points.....	183
7.3 Recommendations.....	184
<b>References.....</b>	<b>185</b>





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## List of Figures

Figure 1.1	General arrangement of preloading with vertical drains and field monitoring arrangements .....	4
Figure 1.2	Vaccum consolidation arrangement (After Shang et al. 1998).....	5
Figure 2.1	Different types of Electro-kinetic phenomena (After Mitchell, 1991)....	10
Figure 2.2	Diffuse double layer .....	12
Figure 2.3	Variation in ion concentration with distance from the clay particle surface .....	12
Figure 2.4	Electro-osmotic flow in capillaries (after Casagrande) .....	13
Figure 2.5	Simplified representation of hydrated cations .....	13
Figure 2.6	Schematic arrangement of Reuss' experiment [ Reuss(1809)].....	16
Figure 2.7	Sketch of apparatus for investigations on parallel flow (Casagrande, 1949) .....	16
Figure 2.8	Electro-osmotic oedometer (Banerjee & Vitayasupakorn, 1984) .....	16
Figure 2.9	Electro-osmotic oedometer (Derek V. Morris, 1984) .....	18
Figure 2.10	Electro-osmotic cell (Lo et al.,1991a) .....	18
Figure 2.11	Electro-osmotic cell (Shang et al., 1996) .....	21
Figure 2.12	Schematic diagram of Rowe cell modified for Electro-osmosis (Nayar, 1997) .....	21
Figure 2.13	Large Consolidometer (Patawaran, 1998) .....	23
Figure 2.14	Modified oedometer cell for Electro-osmosis (Chaudhary, 1998) .....	24
Figure 2.15	Electro-osmotic testing experimental set up (Abiera et al., 1998) .....	24
Figure 2.16	Small cylindrical cell (Dinoy, 1998) .....	25
Figure 2.17	Settlement vs. time curve for undisturbed sample (Small cylinder cell)	26
Figure 2.18	Model tank ( S. Micic , 2001) .....	26
Figure 2.19	Modified oedometer for Electro-osmosis (T.M. Ling, 2000) .....	28
Figure 2.20	Figure 2.20: Modified electro-kinetic cell (Mohameldehaasan, 2001).....	29
Figure 2.21	Variation of pH values of water sample collected from cathode with treatment time (Lo et al., 1991) .....	32

---

Figure 2.22	Effect of salt concentration on Atterberg limits .....	33
Figure 2.23	Boundary conditions with corresponding steady state pore pressure (Hausmann, 1990).....	35
Figure 2.24	Variation of excess pore water pressure along sample length.....	36
Figure 2.25	Development of Electro-osmotic pore pressure .....	37
Figure 2.26	Effects of Electro-osmotic treatment on properties of Quick clay at As, Norway (Bjerrum et al., 1967) .....	41
Figure 2.27	Penetration resistance of a model pile for tests with and without Electro-osmosis .....	42
Figure 2.28	Cross sectional view of the Electrode arrangement, Trondheim Harbor ..	43
Figure 2.29	Field installation of electrodes, Trondheim Harbor Project .....	43
Figure 2.30	Increase in shear strength after field test, Oslo project .....	43
Figure 2.31	Decrease in sensitivity after Field Test, Gloucester Test Fill Site .....	45
Figure 2.32	Effective stress envelop Field Test, Gloucester Test Fill Site .....	45
Figure 2.33	Pictorial representation of electrically conductive geosynthetic drain .....	45
Figure 2.34	Field installation of electrically conductive geosynthetic drain .....	46
Figure 2.35	Use of electro-conductive PVD in Singapore .....	46
Figure 2.36	Details of Electrode for Electro-osmosis.....	50
Figure 2.37	Photograph showing water flowing from the cathode.....	50
Figure 3.1	Newly developed experimental set up .....	53
Figure 3.2	Arrangement of one setup .....	53
Figure 3.3	Cross sectional view .....	54
Figure 3.4	Electrical circuit .....	54
Figure 3.5	Electrodes .....	54
Figure 3.6	Comparisons of $m_v$ vs. $\log(\sigma)$ – series 1 .....	58
Figure 3.7	Comparisons of $m_v$ vs. $\log(\sigma)$ – series 2- (Stainless steel electrode) .....	59
Figure 3.8	Comparisons of $m_v$ vs. $\log(\sigma)$ – series 2- (Brass electrode) .....	59
Figure 3.9	Comparisons of $e$ vs. $\log(\sigma)$ – series 2- (Stainless steel electrode) .....	60
Figure 3.10	Comparisons of void ratio vs. $\log(\sigma)$ plots in series 4 .....	61
Figure 3.11	Comparison of void ratio vs. $\log(\sigma)$ plots in series 5 .....	62
Figure 3.12	Comparison of $C_\alpha$ vs. $\log(\sigma)$ – series 2 (Stainless steel electrode) .....	63

Figure 3.13	Comparison of $C_\alpha$ vs. $\log(\sigma)$ – series 2 ( Brass electrode)	64
Figure 4.1	Electro-osmotic testing apparatus	69
Figure 4.2	View of a line of electrodes	69
Figure 4.3	Plan view of electrodes	70
Figure 4.4	The electrical circuit	70
Figure 4.5	Location map of the sample collection area in CKE site	72
Figure 4.6	Location map of the Southern Highway site	73
Figure 4.7	Water discharged out vs. time plot	75
Figure 4.8	H <sub>2</sub> gas evolving around cathode	75
Figure 4.9	Crack pattern after two days	76
Figure 4.10	Crack pattern at the end of the test	76
Figure 4.11	Locations of sampling	77
Figure 4.12(a)	Settlement vs. time plot- Test Series 1- Anode Line 1	79
Figure 4.12(b)	Settlement vs. time plot- Test Series 1- Cathode Line 2	79
Figure 4.12(c)	Settlement vs. time plot- Test Series 1- Untreated peat	79
Figure 4.12(d)	Void ratio vs. time plot- Test Series 1- Untreated peat	79
Figure 4.13(a)	Void ratio vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 1(C1)	80
Figure 4.13(b)	$m_v$ vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 1(C1)	80
Figure 4.13(c)	$C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 1(C1)	80
Figure 4.14(a)	Void ratio vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 2(C2)	80
Figure 4.14(b)	$m_v$ vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 2(C2)	80
Figure 4.14(c)	$C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 2(C2)	80
Figure 4.15(a)	Void ratio vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 3(C3)	81
Figure 4.15(b)	$m_v$ vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 3(C3)	81
Figure 4.15(c)	$C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 1- Anode Line 3(C3)	81
Figure 4.16(a)	Void ratio vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 4(C4)	81
Figure 4.16(b)	$m_v$ vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 4(C4)	81
Figure 4.16(c)	$C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 1- Cathode Line 4(C4)	81
Figure 4.17(a)	Void ratio vs. $\log(\sigma)$ plot – Test Series 1- Untreated peat	82

Figure 4.17(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 1- Untreated peat.....	82
Figure 4.17(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 1- Untreated peat.....	82
Figure 4.18 Comparison of $m_v$ values – Test series 1 .....	84
Figure 4.19 Comparison of Void ratios – Test series 1.....	85
Figure 4.20 Comparison of $C_\alpha$ values – Test series 1 .....	86
Figure 4.21 Water discharged out vs. time plot .....	90
Figure 4.22 Crack pattern and the locations of sampling .....	90
Figure 4.23(a) Settlement vs. time plot- Test Series 2- Anode Line 2 .....	92
Figure 4.23(b) Settlement vs. time plot- Test Series 2- Cathode Line 3 .....	92
Figure 4.23(c) Settlement vs. time plot- Test Series 2- Untreated peat.....	92
Figure 4.23(d) Void ratio vs. time plot- Test Series 2- Untreated peat.....	92
Figure 4.24(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 2- Anode Line 2(C1) .....	93
Figure 4.24(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 2- Anode Line 2(C1) .....	93
Figure 4.24(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 2- Anode Line 2(C1) .....	93
Figure 4.25(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 2- Cathode Line 3(C2).....	93
Figure 4.25(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 2- Cathode Line 3(C2) .....	93
Figure 4.25(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 2- Cathode Line 3(C2).....	93
Figure 4.26(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 2- Untreated peat....	94
Figure 4.26(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 2- Untreated peat....	94
Figure 4.26(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 2- Untreated peat.....	94
Figure 4.27 Comparison of $m_v$ values – Test series 2 .....	95
Figure 4.28 Comparison of Void ratios vs. $\log(\sigma)$ plots – Test series 2.....	97
Figure 4.29 Comparison of $C_\alpha$ values – Test series 2 .....	98
Figure 4.30 Lines of anodes at the end of the test .....	100
Figure 4.31 Lines of cathodes at the end of the test .....	100
Figure 4.32(a) Electrode arrangement in stage 1 .....	103
Figure 4.32(b) Electrode arrangement in stage 2 .....	103
Figure 4.33 Locations of sampling .....	104
Figure 4.34(a) Settlement vs. time plot- Test Series 3- Cathode Line 1.....	105



Figure 4.34(b) Settlement vs. time plot- Test Series 3- Anode Line 2 .....	105
Figure 4.34(c) Settlement vs. time plot- Test Series 3- Untreated peat.....	105
Figure 4.34(d) Void ratio vs. time plot- Test Series 3- Untreated peat.....	105
Figure 4.35(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 3- Cathode Line 1(C1) .....	106
Figure 4.35(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 3- Cathode Line 1(C1).....	106
Figure 4.35(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 3- Cathode Line 1(C1) .....	106
Figure 4.36(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 3- Anode Line 2(C2).....	106
Figure 4.36(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 3- Anode Line 2(C2) .....	106
Figure 4.36(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 3- Anode Line 2(C2).....	106
Figure 4.37(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 3- Untreated peat....	107
Figure 4.37(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 3- Untreated peat....	107
Figure 4.37(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 3- Untreated peat.....	107
Figure 4.38 Comparison of $m_v$ values – Test series 3 .....	108
Figure 4.39 Comparison of Void ratios – Test series 3.....	109
Figure 4.40 Comparison of $C_\alpha$ values – Test series 3 .....	110
Figure 4.41 Cross sectional view of test arrangement .....	113
Figure 4.42 Top surface of the peat mass at the end of the test .....	114
Figure 4.43 Locations of sampling .....	115
Figure 4.44(a) Settlement vs. time plot- Test Series 4- Cathode Line 2(C2V).....	116
Figure 4.44(b) Settlement vs. time plot- Test Series 4- Anode Line 3(C3V).....	116
Figure 4.44(c) Settlement vs. time plot- Test Series 4- Cathode Line 2(C2H).....	116
Figure 4.44(d) Settlement vs. time plot- Test Series 4- Anode Line 3(C3H).....	116
Figure 4.44(e) Settlement vs. time plot- Test Series 4- Untreated peat.....	116
Figure 4.44(f) Void ratio vs. time plot- Test Series 4- Untreated peat.....	116
Figure 4.45(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 1(C1V).....	118
Figure 4.45(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 1(C1V).....	118
Figure 4.45(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 1(C1V).....	118
Figure 4.46(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2V).....	118
Figure 4.46(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2V).....	118
Figure 4.46(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2V).....	118

Figure 4.47(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3V).....	119
Figure 4.47(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3V).....	119
Figure 4.47(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3V).....	119
Figure 4.48(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 4(C4V).....	119
Figure 4.48(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 4(C4V).....	119
Figure 4.48(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 4(C4V).....	119
Figure 4.49(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2H).....	120
Figure 4.49(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2H).....	120
Figure 4.49(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Cathode Line 2(C2H).....	120
Figure 4.50(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3H).....	120
Figure 4.50(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3H).....	120
Figure 4.50(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Anode Line 3(C3H).....	120
Figure 4.51(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 4- Untreated peat.....	121
Figure 4.51(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 4- Untreated peat.....	121
Figure 4.51(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 4- Untreated peat.....	121
Figure 4.52 Comparison of $m_v$ values – Test series 4 .....	122
Figure 4.53 Comparison of $m_v$ values – Test series 4 .....	122
Figure 4.54 Comparison of Void ratios – Test series 4.....	124
Figure 4.55 Comparison of $C_\alpha$ values – Test series 4 .....	125
Figure 4.56 Moisture content variation between electrodes lines .....	126
Figure 4.57 Moisture content variation between cathode-Line2 and anode-Line 3 .....	126
Figure 4.58 Water discharged out vs. time plot .....	130
Figure 4.59 Crack pattern and Locations of sampling .....	130
Figure 4.60(a) Settlement vs. time plot- Test Series 5- Cathode Line 1(C1V).....	132
Figure 4.60(b) Settlement vs. time plot- Test Series 5- Anode Line 4(C4V).....	132
Figure 4.60(c) Settlement vs. time plot- Test Series 5- Anode Line 2(C2H).....	132
Figure 4.60(d) Settlement vs. time plot- Test Series 5- Cathode Line 3(C3H).....	132
Figure 4.60(e) Settlement vs. time plot- Test Series 5- Untreated peat.....	132
Figure 4.60(f) Void ratio vs. time plot- Test Series 5- Untreated peat.....	133
Figure 4.61(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 1(C1V).....	133

Figure 4.61(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 1(C1V).....	133
Figure 4.61(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 1(C1V).....	133
Figure 4.62(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 4(C4V).....	133
Figure 4.62(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 4(C4V).....	133
Figure 4.62(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 4(C4V).....	133
Figure 4.63(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 2(C2H).....	134
Figure 4.63(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 2(C2H).....	134
Figure 4.63(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 5- Anode Line 2(C2H).....	134
Figure 4.64(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 3(C3H).....	134
Figure 4.64(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 3(C3H).....	134
Figure 4.64(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 5- Cathode Line 3(C3H).....	134
Figure 4.65(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 5- Untreated peat.....	135
Figure 4.65(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 5- Untreated peat.....	135
Figure 4.65(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 5- Untreated peat.....	135
Figure 4.66 Comparison of $m_v$ values – Test series 5 .....	136
Figure 4.67 Comparison of Void ratios vs. $\log(\sigma)$ plots– Test series 5.....	138
Figure 4.68 Comparison of $C_\alpha$ values – Test series 5 .....	139
Figure 4.69 Water discharged out vs. time plot .....	143
Figure 4.70 Crack pattern and Locations of sampling .....	143
Figure 4.71(a) Settlement vs. time plot- Test Series 6- Anode Line 1(C1).....	145
Figure 4.71(b) Settlement vs. time plot- Test Series 6- Cathode Line 2(C2).....	145
Figure 4.71(c) Settlement vs. time plot- Test Series 6- Anode Line 3(C3).....	145
Figure 4.71(d) Settlement vs. time plot- Test Series 6- Untreated peat (Conv. 1).....	146
Figure 4.71(e) Void ratio vs. time plot- Test Series 6- Untreated peatb (Conv. 1).....	146
Figure 4.71(f) Settlement vs. time plot- Test Series 6- Untreated peat(Conv. 2).....	146
Figure 4.71(g) Void ratio vs. time plot- Test Series 6- Untreated peat(Conv. 2).....	146
Figure 4.72(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 1(C1).....	147
Figure 4.72(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 1(C1).....	147
Figure 4.72(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 1(C1).....	147
Figure 4.72(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 6- Cathode Line 2(C2).....	147

Figure 4.72(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 6- Cathode Line 2(C2).....	147
Figure 4.72(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 6- Cathode Line 2(C2).....	147
Figure 4.73(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 3(C3).....	148
Figure 4.73(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 3(C3).....	148
Figure 4.73(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 6- Anode Line 3(C3).....	148
Figure 4.73(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 1).....	148
Figure 4.73(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 1).....	148
Figure 4.73(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 1).....	148
Figure 4.74(a) Void ratio vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 2).....	149
Figure 4.74(b) $m_v$ vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 2).....	149
Figure 4.74(c) $C_\alpha$ vs. $\log(\sigma)$ plot – Test Series 6- Untreated peat( Conv. 2).....	149
Figure 4.75 Comparison of $m_v$ values – Test series 6 .....	150
Figure 4.76 Comparison of Void ratios vs. $\log(\sigma)$ plots– Test series 6.....	152
Figure 4.76 Comparison of $C_\alpha$ values – Test series 6 .....	153
Figure 5.1 Permeability measuring apparatus.....	156
Figure 5.2 Typical electrodes for the electro kinetic permeability test.....	157
Figure 5.3 Coefficient of Electro-kinetic permeability measuring apparatus (taken while proceeding the test) .....	157
Figure 6.1 Idealized configuration of two dimensional Electro-osmotic consolidation	161
Figure 6.2 Combined action of Electro-osmosis and surcharge preloading .....	166
Figure 6.3 Variation of excess pore water pressure with time at a point at mid depth near the anode - Test series 5.....	170
Figure 6.4 Variation of excess pore water pressure with time at a point at mid way between anode and cathode - Test series 5.....	170
Figure 6.5 Variation of Excess pore water pressure with depth from the top surface (At anode) – Test Series 5.....	171
Figure 6.6 Variation of Excess pore water pressure with depth from the top surface (At mid way between anode and cathode) – Test Series 5.....	171
Figure 6.7 Variation of excess pore pressure with horizontal distance from the cathode to anode (at mid depth).....	172



List of Figures

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Figure 6.8	Variation of average degree of consolidation with time (near anode)- Test series 5.....	172
Figure 6.9	Variation of surface settlement with time (at anode) - Test series 5.....	173
Figure 6.10	Variation of surface settlement with time (at midway between anode and cathode) - Test series 5.....	173



**Abstract**

In Sri Lanka, there are large areas underlain by soft peaty clays in and around Colombo and its suburbs. Soft peaty clay deposits are highly compressible and have very low shear strength. High primary and secondary consolidation settlement problems are associated with the low shear strength. Due to scarcity of land with good subsoil condition, Geotechnical engineers are compelled to use these grounds for new development works. Therefore, it is needed to improve the properties of peaty clay deposits before doing any construction works on them. As such, there is a need to find cost effective and efficient ground improvement techniques. The potential of electro-osmotic consolidation as a technique for improvement of Sri Lankan peaty clay was studied in this project. There are records in literature to indicate that this technique was successful with soft inorganic clays. But there are no records of the use of the method in organic soils. Sri Lankan peaty clays have very low organic contents in the range of 20% to 30%. The effectiveness of electro-osmotic consolidation technique with Sri Lankan peaty clay was studied at the University of Moratuwa first by performing a series of one dimensional electro-osmotic consolidation tests and the method was found to be quite successful.

In the field, electro-osmotic consolidation is done by driving parallel lines of electrodes, and by applying direct current potential difference and pumping from the cathode. This configuration cannot be considered as one-dimensional and this would be essentially three-dimensional. In this research, the field arrangement of electro-osmotic consolidation was closely simulated in a model tank filled with remoulded peaty clay and a series of tests were performed with the objective of understanding the aspects of electro-osmotic consolidation technique under three dimensional conditions.

Specimens were taken from the remoulded peat mass after it was subjected to consolidation tests and shear strength tests. For comparison purposes, tests were done on untreated peaty clay remoulded in the same manner.

The level of improvement achieved in compressibility characteristics in three-dimensional condition is less than that achieved with one-dimensional condition. But it shows a preconsolidation effect especially near anodes. A significant reduction in water content and significant increase in shear strength were observed near anode compared to near the cathode. pH tests confirm that electro-chemical changes take place in the soil. pH values increased at cathode and decreased at anode. Electro-osmosis treatment has caused an increase in the liquid limit. The coefficient of electro-osmotic permeability of Sri Lankan peaty clay found to be in the range of  $1 \cdot 10^{-9}$  to  $1 \cdot 10^{-8}$   $\text{m}^2/\text{sec.-V}$ , which was within the range suggested by Mitchell (1991) for fine-grained soils.