Contents

	List of content	
	Acknowledgement	Iv
	List of figures	V
	List of tables	Vii
	Notation	Vii
	Abstract	Ix
	الملخص	Xi
	Chapter One: Introduction	
1.1	Aims of the study	1
1.2	Scope of the study	1
	<u> Chapter Three : Literature Review11</u>	
	Soil Treatment	
31	Introduction	14
3.2	Treatment of expansive soils	14
3.2.1	Chemical additive	15
3.2.1.1	Lime stabilization	15
3.2.1.1.1	Soil factors	15
3.2.1.1.2	Soil stabilization index system	16
3.2.1.2	Cement stabilization	18
3.2.1.3	Salt treatment	18
3.2.2	Pre-wetting	19
3.2.3	Surcharge	21
3.24	Heat treatment	22
3.25	Remolding and compaction	23
3.3	Effects of inclusions properties	23
3.3.1	Introduction	23
3.3.2	Forms of inclusions	23
3.3.3	Frictions and adhesions	24
3.3.4	Enviromental stability	24
3.3.5	Load deformation behavior	25
3.3.6	Fundamental behavior of soil inclusion systems	26
3.3.7	Unit cell test	27
3.4	Reinforced Earth	29
3.5	Summary	33

	<u>Chapter Two: Literature Review1</u>				
	Expansive Soils				
2.1	Definition of expansive soil	3			
2.2	2.2 Origin and distribution of expansive soil				
	worldwide				
2.3	Expansive soil in Sudan	6			
2.4	Clay Mineralogy				
2.5	Factor affecting swelling				
2.6	Factors influencing the mechanism of swelling				
2.7	Free swell				
2.8	Soil classification methods				
2.8.1	Classification using Engineering index properties	11			
	Chapter Four: Laboratory tests on Soils Samples				
	4.1The sand samples				
4.1.2	Porosity of sand	35			
4.1.3	Shear strength of sand	36			
4.2	Clay Soils used	36			
4.2.1	Atterberg limit	36			
4.2.2	Compaction	37			
4.2.3	1 0 5	38			
4.2.4	0	38			
4.2.5	0	39			
4.2.6	Free swell	39			
4.2.7	1	40			
4.2.8	Conclusions	41			
	Chapter five: Mineralogical Analysis				
5.1	The clay minerals	49			
5.2	Basic structures of the clay minerals	49			
5.2.1	The Koalinite group	49			
5.2.2	Stacking of sheet	50			
5.2.3	Clay mica	50			
5.2.4	Montmorillonite group	50			
5.2.5	3 1				
5.3	Mineralogical method				
5.3.1					
5.4	5.4 Sample preparation				
5.5	Data collection	54			
551	Air-dried treatment	54			

. 5.5.2 5.5.3 5.6	Ethylene glycol treatment Heat treatment X-ray analysis of clay minerals	55 55 55
5.7	Conclusions	57
	Chapter Six: Treatment by soil reiforcement	
6.1	Introduction	67
6.2	Objectives of the study	67
6.3	Apparatus	68
6.3.1		68
6.4	Material used	68
6.4.1		68
6.4.2 6.4.3	5	69 69
6.4.4		70
6.4.5		70
6.5	Experimental program	70
6.6	Measurements	71
6.7.1	Test (1)	72
6.7.2	Test (2)	73
6.7.3	• •	73
6.7.4	Test (4)	73
6.7.5	Test (5)	73
	Chapter Seven: Rresults Analaysis and Discussions	<u>S_</u>
7.1	Make up results	88
7.2	Observations	88
7.3	Effect of age time	89
7.4	Effect of thickness of layers	89
7.5	Correlation between heave vs time, and time vs	90
	thickness of reinforced layers	
7.6	Discussions	91
7.6.1	Age time effect	91
7.6.2	Effect of thickness of layers	92
7.7	Conclusions	94

Chapter Eight: Conclusions and Recommendations

8.0	Conclusions a	Conclusions and Recommendations		
	References			97
	Appendix A	X (18)		102