

الآية

قال تعالى:

بسم الله الرحمن الرحيم

(29) أَوْلَم يَرَ الَّذِينَ كَفَرُوا أَنَّ السَّمَاوَاتِ وَالْأَرْضَ كَانَتَا رَتْقًا فَفَتَقْنَاهُمَا^ط
وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ^ط أَفَلَا يُؤْمِنُونَ (30)

صدق الله العظيم

سورة الانبياء

Dedication

This research is dedicated to:

my parents,

Brothers, sisters and friends

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ABSTRACT

The need for a water tank is as old as civilization, to provide storage of water for use in many applications. Design of water tanks is a time consuming task, which requires a great deal of expertise. All tanks are designed as crack free structure to eliminate any leakage.

An underground water storage tanks used for underground storage of drinking water, wastewater & rainwater collection. The study includes the design of rectangular tank in expansive soil that how the shape deflected and what are the actions will be produced when tank empty or full.

This study aims to give idea for safe analysis and design of underground reservoirs in a scalable soil due to moisture changes due to the presence of metal materials with a poetic characteristics.

Design has been made for the supported walls first without toe and found it unsafe, this led to consider toe with width $B/3$, it found the walls exposed to a tensile strength, this could be prevented by increasing toe width from 1.066 m to 1.733 m which gave good result when checked.

The study helps in understanding the design philosophy for the safe design of ground water tank, in which wall of tanks subjected to pressure and the base is subjected to weight of water. In this study tank made of reinforced concrete and resting on ground monolithic with the base are designed, and showed good results when checked for design.

المستخلص

تخزين المياه حضارة قديمة لتوفير المياه للاستخدامات المختلفة. يحتاج تصميم خزانات المياه إلى وقت طويل، الأمر الذي يتطلب قدراً كبيراً من الخبرة. كل الخزانات تصمم علي ان تكون آمنة ضد التشققات والتسريب.

الخزانات الأرضية تستخدم لتخزين مياه الشرب، مياه الصرف الصحي ومياه الامطار. تشمل الدراسة تصميم خزان مستطيل في تربة قابله للانتفاخ ومدى تاثير شكل الخزان ونوع الانفعالات التي تحدث عندما يكون الخزان فارغاً وممتلئاً.

تهدف هذه الدراسة الي التعرف علي التحليل و التصميم الآمن لخزانات ماء تحت الأرض في تربه قابله للانتفاخ نتيجة لتغيرات الرطوبة ويرجع ذلك لوجود مواد معدنية لها الخاصية الشعرية.

تم عمل تصميم للحوائط الساندة من غير قدم حيث وجدت انها غير آمنة. هذا ادي إلي اعتباراستخدام قدم بطول $B/3$. وجد ان الحائط معرض لقوة شد، تم التغلب عليها بزيادة عرض القدم من 1.066 متر إلي 1.733 متر وأعطت نتائج جيدة عندما تم اختبارها .

ساعدت الدراسة في فهم فلسفة التصميم الآمن لخزانات المياه الأرضية التي تتعرض حوائطها للضغط وقاعدتها لوزن الماء. في هذه الدراسة نجد ان الخزانات التي تصنع من الخرسانه المسلحة والتي تستند علي الارض في اعماق محددة عند قاعدتها تم تصميمها واعطت نتائج جيدة عند عمل مراجعات التصميم.

LIST OF CONTENTS

الآية القرآنية	I
DEDICATION	II
ACKNOWLEDGEMENTS	III
ABSTRACT.....	IV
ABSTRACT ARABIC	V
LIST OF CONTENTS	VI
LIST OF TABLES.....,	VIII
LIST OF FIGURES.....	IX
LIST OF SYMBOL.....	X
Chapter One: Introduction	
1.1 General Introduction	2
1.2 Significance of the Study.....	2
1.3 Statement of the problem	3
1.4 Research Question and Hypotheses.....	3
1.5 Objectives of the study.....	3
Chapter Two: Review on water tanks	
2.1. Definition of Underground Tanks	4
2.2 Classification of tanks	4
2.3 Types of underground tanks	7
2.4 Determination of storage capacity required Water Demand.....	8
2.5 Construction of underground tank	10
2.6 Water quality	18
2.7 Operation and maintenance.....	19
Chapter Three: Expansive soil	
3.1 General	21

3.2 Literature Review and Problem Discussion.....	21
3.3 Identification of Expansive Soils.....	25
3.4 Predicting Potential Volume Change.....	25
3.5 Investigation and assessment.....	26
3.6 Expansive Soil Treatment Methods.....	27
3.7 General Design Requirements (I.S.I).....	27
3.8 Water Quantity Estimation.....	31
3.9 General Design Requirements (I.S.I).....	33
3.10 Minimum Reinforcement	35
3.11 Minimum Cover to Reinforcement	35
3.12 Types of retaining wall.....	35
Chapter fore: Design Of Under Ground R.C Rectangular Tank	
4.1 General	39
4.2 Earth pressure on retaining walls.....	39
4.3 Design steps.....	44
Chapter Five: Results and Discussion	
5:1 Laboratory Results	45
5:2 Design Procedure	45
5:3 Design wall	56
5.4 Design s slab.....	62
Chapter six: Conclusion and Recommendations	
6:1 Conclusion	66
6.2 Recommendations.....	66
Reference.....	69
Appendix	72

LIST OF TABLES

Table 3 .1—Relation between Plasticity Index and Potential Swell.....	23
Table3.2—Relation between Volume Change and Swelling Pressure versus Potential Damage	24
Table 3.3 Permissible concrete stresses in calculations relating to resistance to cracking.....	28
Table 3.4 Permissible stresses in steel reinforcement for strength	
Calculations.....	30
Table 5.1 The resisting moments	54
Table 5.2 The overturning moments	54

LIST OF FIGURES

Figure 3.1 Distribution of expansive soils (gazira state).....	21
Figure 3.2 Expansive soil with polygonal patterns cracks.....	22
Figure 3.3 Types of retaining wall.....	37
Figure4.1 Section of cantilever wall.....	41
Figure4.2 The primary dimension of the wall.....	43
Figure4.3 Treatment of soils if stresses are unsafe.....	43
Figure4.4 The net pressure on the base,.....	45
Figure5.1 Loads on the wall	50
Figure5. 2 Loads on wall with toe	51
Figure5. 3 The pressure distribution under the wall	53
Figure5. 4 Loads and earth pressures acting on the wall	53
Figure 5.5 Cross section of wall reinforcement	61
Figure 5.6 Cross section slab reinforcement	64

LIST OF Symbol

Symbol	
v	Volume (m ³)
A	Top area of excavation (area of water surface when full m ²)
B	Bottom area of excavation (area of floor m ²)
M	Area at ½ depth(m ²)
d	Depth of water from surface to floor (m).
R	Radius of water surface (m)
r	radius of floor (m)
π	$\frac{22}{7}$ or 3.14159
L	length of water surface (m)
W	Width of water surface (m)
lf	length of floor (m)
wf	width of floor (m)
γ	Density of soil (KN/m ³)
∅	Angle of internal friction
Ea ₁	The horizontal force from surcharge load(KN)
Ea ₂	The horizontal force from back fill load (KN)
P _{max}	Maximum pressure (KN/mm ²)
P _{min}	Minimum pressure (KN/mm ²)
e	Electricity (mm)
X	Depth of the neutral axis (mm)
a	Distance from the compression face to the level at which Crack Width is calculated (mm)
h	When the crack width is calculated at the soffit (mm)

b	Width of the rectangular zone (mm)
d	Effective depth of the longitudinal reinforcement (mm)
A_S	Area of non-prestressed reinforcement (mm ²)
A_P	Area of prestressed steel (mm ²)
E_S	Modulus of elasticity of non-prestressed steel
E_P	Modulus of elasticity of prestressed steel
ϵ_1	Strain at the selected level based on a cracked sectional analysis (mm)
a_{cr}	Shortest distance from the selected level on the surface to a Longitudinal bar (mm)
C_{min}	Minimum clear cover to the longitudinal bar(mm)
h	Total depth of the member(mm)
ϵ_m	Average strain at the level where the cracking is being considered
ϵ_s	Strain at the level considered
DL	Dead load (KN)
LL	Live load (KN)
A_{req}	Area of steel requirement (mm ²)
$A_{S\text{ Prov}}$	Area of steel provide (mm ²)
LL	Liquid Limit
PL	Plastic Limit
PI	plasticity index