الآيـــــه

قال تعالي:

بسم الله الرحمن الرحيم

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

صدق الله العظيم

سورة الانبياء

Dedication

This research is dedicated to:

my parents,

Brothers, sisters and friends

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Thanks are due to my supervisor ***Dr. Alia Osman Mohamed Ahmed*** *for encouragement, kind help and guidance, advice and professional wisdom and for invaluable suggestions, unlimited assistance and support. In this context.*

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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 إلي وقت طويل، الأمر الذي يتطلب قدراً كبيراً من الخبرة. كل الخزانات تصمم علي ان تكون آمنه ضد التشققات والتسريب.

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

تهدف هذة الدراسة الي التعرف علي التحليل و التصميمِ الآمن لخزانات ماء تحت الأرض في تربه قابلة للإنتفاخ نتيجه لتغيرات الرطوبة ويرجع ذلك لوجود مواد معدنية لها الخاصية الشعرية.

تم عمل تصميم للحوائط الساندة من غير قدم حيث وجدت انها غير آمنه. 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 الدراسه 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.

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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	$\frac{22}{2}$ 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)
Ø	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)
$A_{S\,Prov}$	Area of steel provide (mm^2)
LL	Liquid Limit
PL	Plastic Limit
PI	plasticity index