سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

سامية محمد مصطفى

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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سامية محمد مصطفى

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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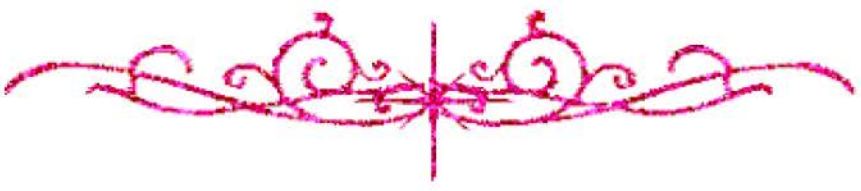

سامية محمد مصطفى

شبكة المعلومات الجامعية

بالرسالة صفحات لم ترد بالأصل

DYNAMIC BEHAVIOUR OF PILE- SUPPORTED ELEVATED TANKS DURING EARTHAQUAKES

A Thesis

Submitted to the Faculty of Engineering, Elmonofia University,

in Partial Fulfillment of the Requirement of the

MASTER OF SCIENCE

IN

IN CIVIL ENGINEERING (STRUCTURAL)

BY

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2002

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2002

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ABSTRACT

This thesis aimed to investigate the seismic behavior of elevated water tanks supported on piles taking into consideration the effect of the foundation system for different motion characteristics into consideration. Using previous earthquake records, the frequency contents of each record is classified to Low, Medium and High categories. It was assumed that the peak ground acceleration for all records is normalized to 0.15 of ground acceleration which was accepted by many researchers for average seismic activities in Egypt.

Deep foundations, such as piles, are used to support heavily loaded structures. Dynamic behavior of elevated water tanks may be affected by its foundation stiffness. Static and dynamic structural analysis of pile-supported structures requires the stiffness and damping constants of piles.

Dynamic stiffnesses (impedance functions) of a single pile driven in a layered soil have been presented. The approach makes the computation of pile's impedance functions possible using available structural analysis programs such as Sap2000. The mathematical model is based on soil reactions of individual layers calculated according to any assumption such as the plane strain one, or any soil reactions. The approach compares very well with the finite element approaches and experiments. The analytical model of the whole tank is based on the stiffness matrix method with lumped mass system. The water is simulated by two masses one is the Impulsive mass that is to be attached to the tanks walls, the second mass is the Convective mass that is to be connected to tanks walls by means of imaginary springs. A well designed elevated water tank is used to demonstrate the effects of the frequency content of the earthquake excitations, the foundation system , the height of tank and the height of water in the tank.

Keywords: Elevated-tanks, impedance-functions, Ground motion, frequency content,

LIST OF SYMBOLS

All symbols are defined as they first appear. The following list contains the most frequently used symbols

k_w = Vertical soil reaction per unit length of pile,

k_u = Horizontal soil reaction per unit length of pile,

k_ψ = Rocking soil reaction per unit length of pile,

k_ζ = Torsion soil reaction per unit length of pile,

k_{wt} = Vertical soil reaction at pile tip,

k_{ut} = Horizontal soil reaction at pile tip,

$k_{\psi t}$ = Rocking soil reactions at pile tip,

$k_{\zeta t}$ = Torsion soil reactions at pile tip,

S_{w1}, S_{w2} = Vertical stiffness and damping parameters,

S_{u1}, S_{u2} = Horizontal stiffness and damping parameters,

$S_{\psi 1}, S_{\psi 2}$ = Rocking stiffness and damping parameters,

$S_{\zeta 1}, S_{\zeta 2}$ = Torsion stiffness and damping parameters,

G_s = Shear modulus of soil,

r_o = Pile radius,

ω = Angular frequency,

v_s = Shear wave velocity of soil,

ρ = Soil specific weight,

K^1_{w1} = Vertical stiffness constant of the pile,

K^1_{uu1} = Horizontal stiffness constant of the pile at head,

$K^1_{u\psi 1}$ = Horizontal stiffness constant of the pile at head,

K^1_{w2} = Vertical damping constant of the pile,

K^1_{uu2} = Horizontal damping constant of the pile at head,

$K^1_{u\psi 2}$ = Horizontal damping constant of the pile at head,

Δ_1 = Vector of real displacement along pile shaft, and

Δ_2 = Vector of imaginary displacement along pile shaft,

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To My Family