AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

BEHAVIOUR OF TUNNELS IN SOME EGYPTIAN SOILS

BY

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A Thesis
Submitted in partial fulfillment for the
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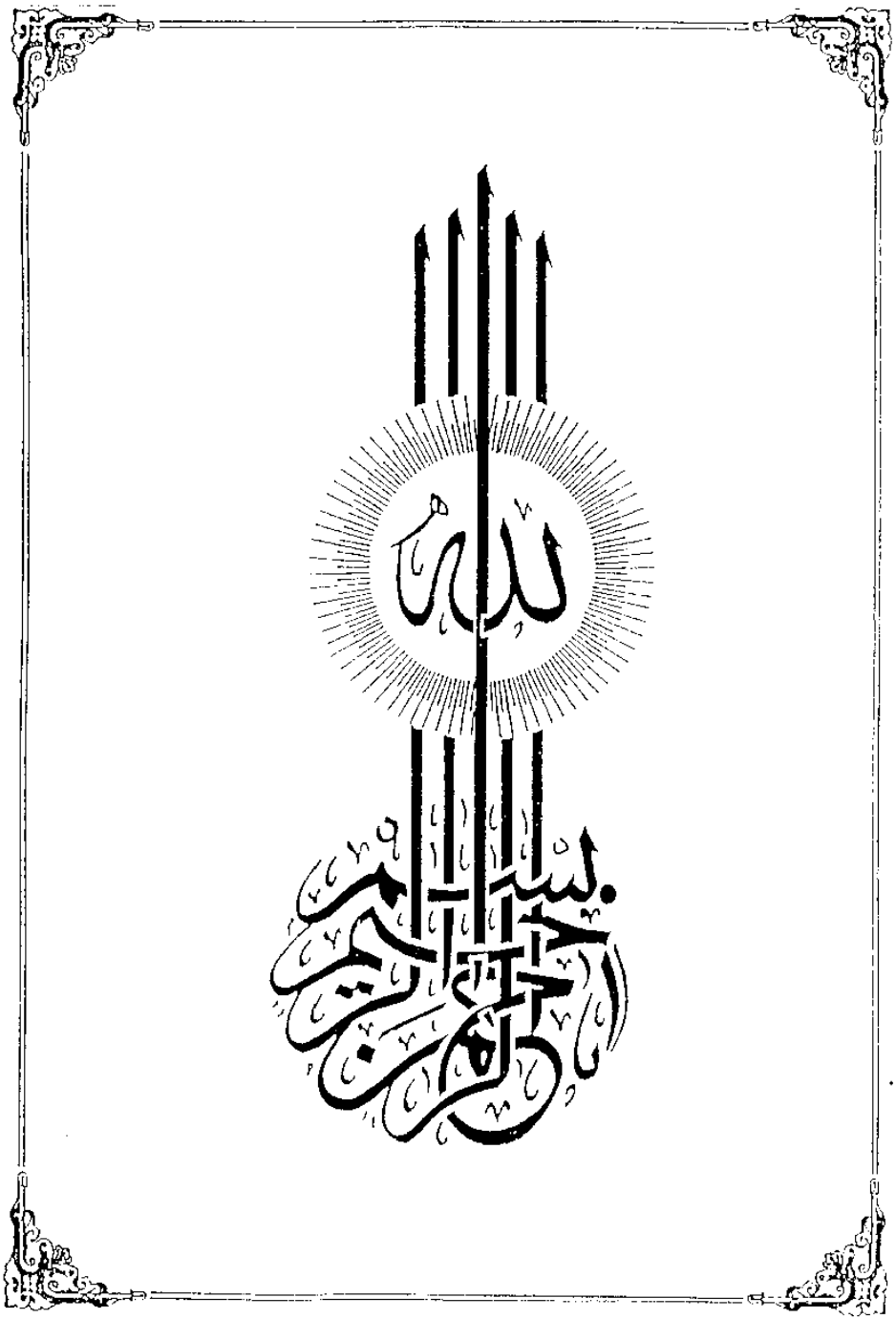

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of DOCTOR OF PHILOSOPHY in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University November 1984 to June 1990.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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ABSTRACT

Tunneling through soil deposits invitably leads to downward ground movements above the tunnel crown. Structures existing within the zone of ground movements are affected and may be damaged due to these movements. Prediction of ground disturbance associated with tunneling was the aim of several research works. These studies concluded that such ground movements depend on tunneling technology and surface and subsurfce conditions.

The main tunnel of the East Bank Wastewater Project is the first tunnel which has advanced in Cairo using two

different techniques. Full face bentonite slurry boring machines and open face shields advancing under compressed air were used for the construction of different stretches of this tunnel.

The present research was performed on a test area which was chosen where 5.15m shielded tunnel was advanced through water bearing alluvial soil under compressed air. Surface and subsurfaces subsidences were measured using a set of surface settlement points and magnetic multipoint extensometers respectively. Two standpipe piezometers were installed for monitoring the changes of groundwater level in the vicinity of the tunnel. Field measurements of ground and groundwater responses to tunneling provided a realistic tool for quantitative evaluation of the in-situ performance of this tunnel.

It was illustrated that the field data compiled from this research can be used to predict the behaviour of future similar tunnels constructed under different areas of Cairo and other cities having similar subsurface conditions.

Finite element techniques were used to calculate surface and subsurface ground movements before and after the release of compressed air taking into consideration different nonlinear stress-strain models. Measured ground movements were compared with the calculated values and some guidelines on the use of numerical models for prediction of soil subsidences above tunnels are offered.

KEYWORDS : Tunneling, Ground subsidence, Open face shields, Compressed air, Surface settlement points, Magnetic multipoint extensometers, Standpipe piezometers, Finite element different nonlinear models.

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