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New Trends in Flexible Pavement Design

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بسم الله الرحمن الرحيم

(اقرأ باسمِ ربِّكَ الَّذي خلَق ۞ خلَقَ الإنسانَ من علَق ۞ اقرأ وربُّكَ الأكرم ۞ الَّذي علَّمَ بالقلَم ۞ علَّم الإنسانَ ما لم يعلم۞)

صدق الله العظيم

أهداء

الى من اعطاه الله الهيبة والوقار.. الى من علمني العطاء بدون انتظار.. الى من أحمل اسمه بكل افتحار.. أعدك بأن تبقى كلماتك نجوم اهتدي بها اليوم وغدا والى الابد.

ابي العزيز

الى ملاكي في الحياة.. الى معنى الحب والحنان والتفاني.. الى بسمة الحياة.. الى من دعائها سر نجاحي وحنانها بلسم جراحي.

امي الغالية

الى من اعطوني القوة.. الى من علموني الحياة.. الى من ساعدوني وساندوني بكل خطواتي.

عائلتي الكريمة

الى من قضيت معهم أيام وأيام.. الى من تذوقت معهم أجمل اللحظات.. الى من سافتقدهم ولن انساهم واتنمى أن لا ينسوني.

زملائي وزميلاتي

أحمد سعد الامير عبد الامير

الى سيدي و حبيبي ..... رسول الله (ص)

الى المعين الذي لم ينضب عطاؤه بكل ما ينبض من قلبه من حب وتسامح .....
لاجل تحقيق سعادتي و الذي كان في طريقي نورا و أملا .... **والدي العزيز**

الى التي زرعت في قلبي الآمال و سقتني من كأسها الحنان ....
و زرعت في نفسي روح الطموح والمثابرة .... **والدتي العزيزة**

الى أخي و أخواتي .... حبا و احتراما

الى من علمني الحرف و الكلمة .... **أساتذتي الافاضل**

الى كل من ساهم في بناء هذا الوطن الغالي.

اهدي جهدي المتواضع هذا.

محمد أسعد علي

New Trends in Flexible Pavement Design

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CHAPTER ONE

INTRODUCTION

In many civil engineering works, such as industrial structures, highway and airfields, the supporting soil is subjected to both monotonic and repeated external loadings, the supporting soil whether soft soil or loose sand will experience some kind of settlement which may exceed the tolerable settlement. There is always a need for improving the properties of these soils to increase their bearing capacity and control the expected generated settlement the major challenge with the available improving techniques is the cost benefit of these techniques and there is always a debate on what is the cheapest and more economical technique.

The present work is an attempt to investigate the bearing capacity of a model footing resting on abed of ballast layer of various thicknesses overlaying a layer of sand. The behavior of model footing was investigated under both monotonic and repeated loadings.

Two model tests were performed under monotonic loading with asphalt layer spread along the interface between this sand and the ballast layers, in other words along the interface between the two layers.

In each model tests in the monotonic series, the footing was subjected to stress increments up to failure. For each stress increment the corresponding generated settlement was recorded and presented as a ratio of the footing width. Failure was considered as the stress corresponding to 10% settlement of the footing width.

In the repeated model tests series, the applied stress represents a ratio of the stress at failure. Stress ratios 0.4, 0.6 and 0.8 were selected for each ballast thickness. Each stress ratio was applied at frequency of 1Hz and generated settlement was recorded with increasing number of cycles.

In spite limited number of test the model tests revealed some interesting results. There was a clear effect of the thickness of the ballast layer on the stress settlement relationship and on stress at failure.

The increase in failure stress was clearly pronounced due to the presence of the asphalt layer. The results are encouraging and further investigation is required for more fruitful results to be obtained at repeated loading.

The repeated model tests shed the light about required safety needed and gradual degradation of stiffness.