



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم



**MONA MAGHRABY**



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكرو فيلم



# شبكة المعلومات الجامعية التوثيق الإلكتروني والميكرو فيلم



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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

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### يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



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**Ain Shams University  
Faculty of Engineering  
Department of Structural Engineering**

# **Investigation of the Bearing Capacity of Strip Footings on Sedimentary Jointed Rocks**

**A THESIS**

**Submitted in Partial Fulfillment of the Requirements of the Degree of  
MASTER OF SCIENCE IN CIVIL ENGINEERING**

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This dissertation is submitted to Ain Shams University for the degree of Master of Science in Civil Engineering (Structural Engineering). The work included in this thesis was carried out by the author in the Department of Structural Engineering, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

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

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*(To my mother, might you be proud)*

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## **Abstract**

Although the bearing capacity term is well known among the geotechnical engineers, when it comes to non-homogenous formation contains several features like the jointed rock, this term becomes a little harder to adequately estimated. The main feature highlighted in the jointed sedimentary rocks is how it formed in nature and how this formation caused weak planes implanted inside the rock mass. These weak planes are known as faults, beddings, and joints, which are weak shearing zones subjected to loading.

The loading direction concerning the joint orientation (dip angles), had a considerable effect on the bearing capacity of the whole mass, this effect can accurately be represented only when the rock mass studied as discrete formation, i.e., the intact rock and the joints separately simulated with their individual parameters. Also, the spacing between these joint what makes the rock behaves either as a sound rock when the spacing is widely spread within the mass or behaves as fracture material when the spacing is closed then, more joints exist under the footing.

To study the latter mentioned parameters, available results from the plate load test performed in the Bakhtiary Dam in Iran were utilized to investigate the Bearing Capacity of strip footings on a Limestone formation. A numerical model was developed using the finite element method to simulate and validate the Plate load test performed in the dam site. The numerical model was formed as a discrete model.

The predicted ratio between the shear strength parameters (cohesion), the modulus of elasticity of the intact rock, and the discontinuities gives a reasonable agreement with the measured field settlements and the results from

the numerical model. This result implemented in the parametric study along with different ratios to compare it with an analytical BC. The analytical approach's parameters were based on empirical rating system (RMR) as it is a simple system to use among engineers. Other approaches depended on the unconfined compressive strength ( $q_u$ ), which is similar to the Mohr Columb original solving method.

A further parametric study had been carried out with this different strength and stiffness ratios, to show the effect of these ratios with presence of inclined joints (30 and 45 degrees) on the allowable bearing capacity of the rock mass, also studied the effect of (S/B) joint spacing with respect to the footing width by changing the strip footing width. All the parameters stated above studied with their effect on the allowable bearing capacity and represented on bearing capacity – RMR curves mention the variant parameters.

Also, a study had carried out with constant famous number among engineers, 0.50 MPa (5.00 Kg/cm<sup>2</sup>) as allowable BC when shallow foundation lies on rock mass, implementing the different stiffness and cohesion ratios between intact blocks and joint, settlement – RMR curve was plotted.

Also, studying the differential settlement under the footings of one structure located on different rock conditions had carried out in this study.

**Keywords:** Sedimentary Rocks; Jointed Rock; Bearing Capacity; Finite Elements in rock mass; Mohr-Coulomb Criterion; Joint dip angles.

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