Suez Canal University
Faculty of Engineering & Technology

CHARACTERISTICS OF SUBMERGED UNEQUAL FLOW UNDER SLUICE GATES

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A THESIS

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For The Degree of M. Sc. in Civil Engineering

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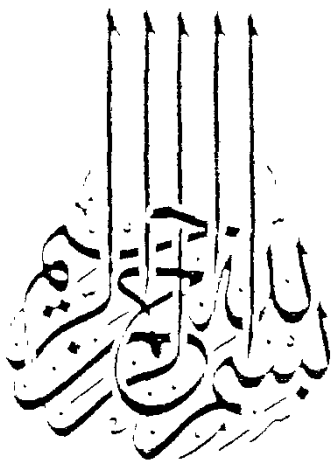

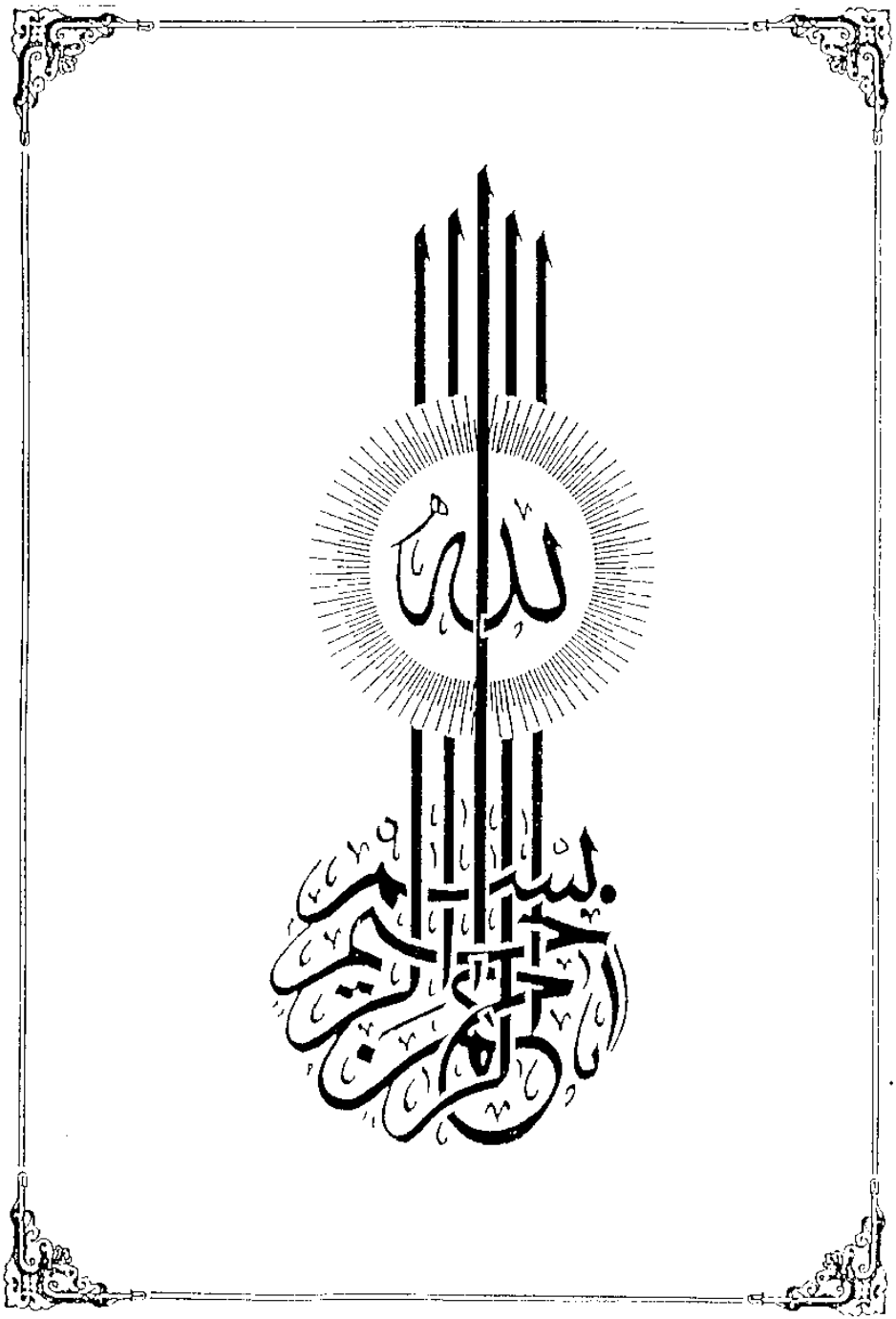

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STATEMENT

This Thesis is submetted to Suez Canal University for the degree of M. Sc. Degree in Civil Engineering.

The work included in this thesis was carried out by the auther in the Department of Civil Engineering, Suez Canal University, from October 1988 to 1991.

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

Date : / /1991

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ABSTRACT

Hydraulic structures constructed across open channels usually have control gates of different features. The dimensions (width and height) of those gates, in addition to the presence of sill under the gates and the condition of flow (free or submerged) affect the characteristics of flow through gate openings.

The present study aims at investigating the effect of changing gate width or gate opening height on the characteristics of submerged flow. The study focuses on the variation of the coefficient of discharge and Froude number under the gate with respect to other variables.

In the theoretical study, the dimensional analysis was employed to relate the different factors affecting the studied phenomena. Moreover, the specific energy equation, the impulse-momentum principle, and the orifice equation were used to get expressions relating the discharge coefficient to other parameters.

Experiments were conducted on a medium rectangular channel. Models with different gate opening widths (9.0, 13.5, 18.0, 27.0 and 30.0 cm) and of different gate opening heights (2.0, 4.0, 6.0, 8.0 and 10.0 cm) were tested using variable flow parameters.

Using the experimental data, relations were plotted describing the main characteristics of submerged flow. The experimental data was analyzed and the results of this analysis were presented graphically in a number of charts. These charts

provide the gate opening width which gives maximum discharge coefficient. Design charts were developed to calculate the discharge coefficient, the Froude number and the coefficient of contraction for silled and nonsilled gates if upstream water depth, downstream water depth and gate opening dimensions were known.

Statistical methods were used to predict imperical formulae for the main characteristics of the flow.

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LIST OF FIGURES (CONT.)