

Suez Canal University
Faculty of Engineering & Technology

CHARACTERISTICS OF SUBMERGED UNEQUAL FLOW UNDER SLUICE GATES

By

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B.Sc. Civil Engineering - Suez Canal University

A THESIS

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For The Degree of M. Sc. in Civil Engineering

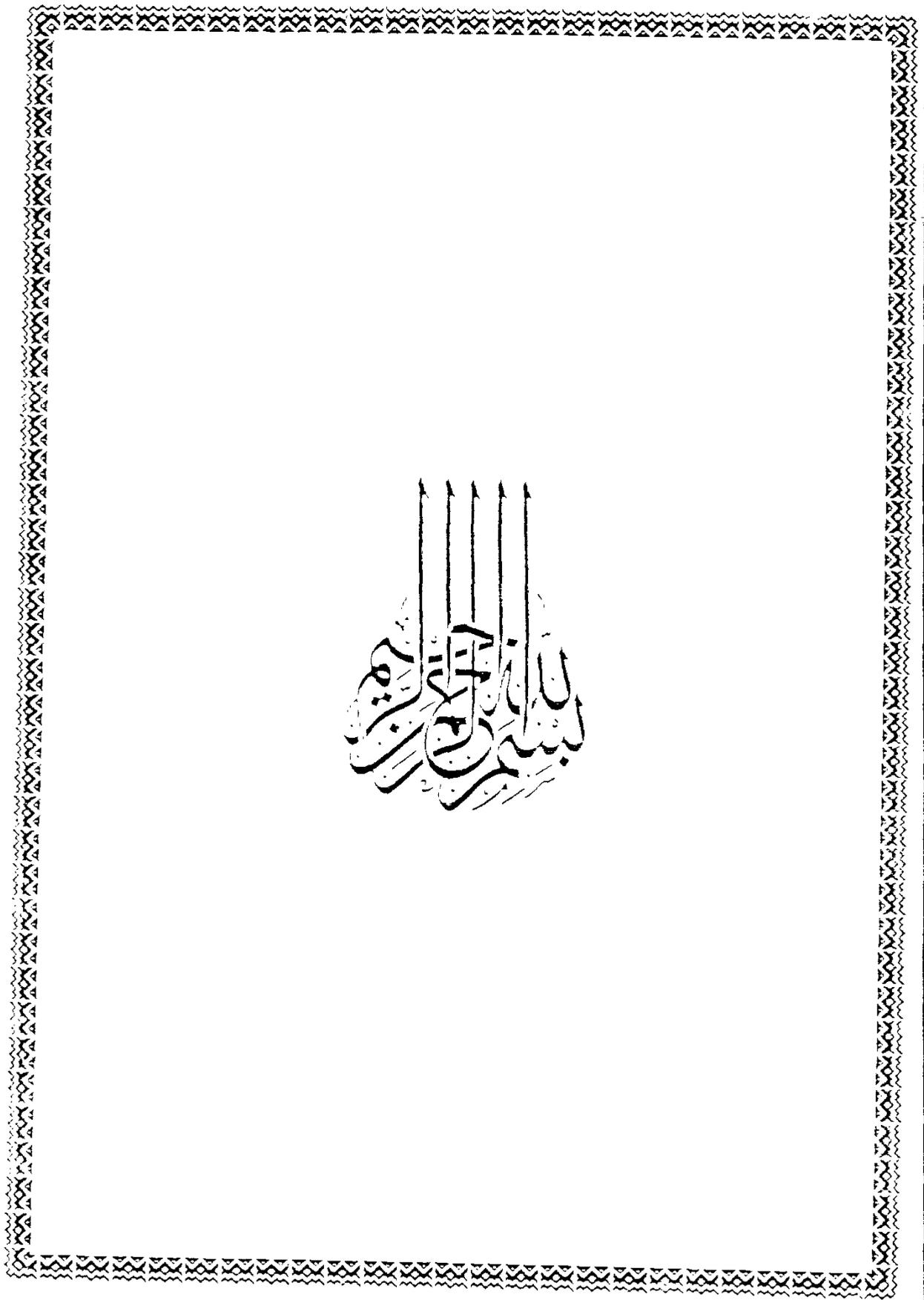
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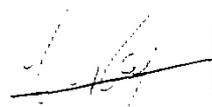
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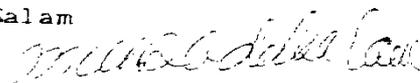
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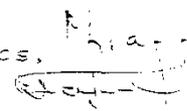
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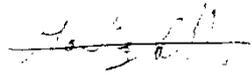
STATEMENT

This Thesis is submitted 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 author 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.

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TABLE OF CONTENTS

SUBJECT =====	PAGE -----
ACKNOWLEDGMENTS	v
ABSTRACT	vi
LIST OF FIGURES	viii
LIST OF PLATES	x
LIST OF TABLES	x
LIST OF SYMBOLS	xi
CHAPTER ONE : INTRODUCTION	
1.1 BACKGROUND	1
1.2 ORGANIZATION OF THE THESIS	1
CHAPTER TWO : LITERATURE REVIEW	
2.1 INTRODUCTION	4
2.2 STUDIES CONCERNING FREE FLOW UNDER SLUICE GATES	4
2.3 STUDIES CONCERNING SUBMERGED FLOW UNDER SLUICE GATES	22
2.4 STUDIES CONCERNING CONTROL GATES OVER SILLS	37
CHAPTER THREE : THEORETICAL APPROACH	
3.1 INTRODUCTION	41
3.2 THE FLOW EQUATION (THE ORIFICE EQUATION)	41
3.3 THE SPECIFIC ENERGY EQUATION	42
3.4 THE MOMENTUM EQUATION FOR SUBMERGED FLOW	45
3.5 THE DIMENSIONAL ANALYSIS	48
3.5.1 INTRODUCTION	48
3.5.2 DYNAMIC SIMILARITY OF FLOW UNDER SLUICE GATES	49

CHAPTER FOUR : EXPERIMENTAL WORK

4.1 INTRODUCTION	53
4.2 EXPERIMENTAL SET UP	53
4.3 METHODS OF MEASUREMENTS	53
4.3.1 DISCHARGE MEASUREMENTS	53
4.3.2 WATER DEPTH U.S. MODEL	53
4.3.3 WATER DEPTH D.S. MODEL DIRECTLY	61
4.3.4 TAIL WATER DEPTH	61
4.4 THE EXPERIMENTAL MODELS	61
4.5 SERIES OF TESTS	62
4.6 EXPERIMENTAL PROCEDURES	62

CHAPTER FIVE : EXPERIMENTAL RESULTS

5.1 INTRODUCTION	69
5.2 THE MEASURED RAW DATA	69
5.3 RELATIONSHIP BETWEEN (C_{d_2}) and (H_1/a)	70
5.4 RELATIONSHIP BETWEEN (C_{d_2}) and (V_1/a)	70
5.5 RELATIONSHIP BETWEEN (C_{d_2}) and $(\sqrt{(H_1 - H_2)/a})$	71
5.6 RELATIONSHIP BETWEEN (C_{d_2}) and (F_{d_2})	71
5.7 RELATIONSHIP BETWEEN (F_{d_2}) and $(\sqrt{\Delta H/a})$	72
5.8 RELATIONSHIP BETWEEN (C_{d_2}) and (a/b)	72
5.9 RELATIONSHIP BETWEEN (C_{d_2}) and (b/H_1)	73
5.10 RELATIONSHIP BETWEEN (a_x/b_x) and (C_{d_2}/C_{d_1})	73

CHAPTER SIX : ANALYSIS OF RESULTS AND DISCUSSION

6.1 INTRODUCTION	81
6.2 RELATIONSHIP BETWEEN THE DISCHARGE COEFFICIENT (C_{d_2}) AND THE RELATIVE UPSTREAM WATER DEPTH (H_1/a)	81

6.2.1 NON SILLED GATE CASE	82
6.2.2 SILLED GATE CASE	83
6.3 RELATIONSHIP BETWEEN THE DISCHARGE COEFFICIENT (C_{d2}) AND THE RELATIVE TAIL WATER DEPTH (y_2/a)	84
6.3.1 NON SILLED GATE CASE	84
6.3.2 SILLED GATE CASE	100
6.4 RELATIONSHIP BETWEEN THE DISCHARGE COEFFICIENT (C_{d1}) AND THE RELATIVE DIFFERENTIAL HEAD $\sqrt{(H_1 - H_2)/a}$	100
6.4.1 NON SILLED GATE CASE	100
6.4.2 SILLED GATE CASE	101
6.5 RELATIONSHIP BETWEEN THE DISCHARGE COEFFICIENT (C_{d2}) AND THE FROUDE NUMBER UNDER GATE (F_2)	107
6.5.1 NON SILLED GATE CASE	107
6.5.2 SILLED GATE CASE	108
6.6 RELATIONSHIP BETWEEN THE FROUDE NUMBER UNDER GATE (F_2) AND THE RELATIVE DIFFERENTIAL HEAD $\sqrt{(H_1 - H_2)/a}$	108
6.6.1 NON SILLED GATE CASE	114
6.6.2 SILLED GATE CASE	115
6.7 RELATIONSHIP BETWEEN THE COEFFICIENT OF DISCHARGE (C_{d1}) AND THE RELATIVE GATE OPENING HEIGHT (a/b)	115
6.7.1 NON SILLED GATE CASE	115
6.7.2 SILLED GATE CASE	115
6.8 RELATIONSHIP BETWEEN THE COEFFICIENT OF CONTRACTION (C_c) AND THE RELATIVE GATE OPENING WIDTH (b/H_1)	127
6.8.1 NON SILLED GATE CASE	127
6.8.2 SILLED GATE CASE	127

6.9 RELATIONSHIP BETWEEN THE RELATIVE DISCHARGE PASSING THROUGH RIGHT AND LEFT GATE OPENING ($\frac{Q_r}{Q}$) AND ($\frac{h_c}{h_0}$) AND THE RELATIVE RIGHT GATE OPENING HEIGHT (a_r/b_r) . . .	130
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CHAPTER SEVEN : CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS	137
7.2 RECOMMENDATIONS FOR FUTURE STUDIES	138

APPENDICIES

APPENDIX A

REFERENCES	139
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APPENDIX B

LABORATORY MEASUREMENTS	147
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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 imperial formulae for the main characteristics of the flow.

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
B 1	SECTION THROUGH VERTICAL SLUICE GATE	1
B 2	SLUICE GATE CONTRACTION COEFFICIENTS	1
B 3	COMPARISON BETWEEN CALCULATED AND MEASURED CONTRACTION COEFFICIENTS OF VERTICAL SLUICE GATE	1
B 4a	FOUR DIFFERENT TYPES OF SEATING BEARDS	6
B 4b	THE RELATION BETWEEN C_d AND a/H_1	6
B 5	RELATION BETWEEN C_{d1} , C_d AND H_1/a	6
B 6	VARIATION OF C_d WITH a/H_1	7
B 7	CURVES FOR SOLVING FREE FLOW PROBLEMS	7
B 8	SLUICE DISCHARGE COEFFICIENTS	10
B 9	VARIATION OF C_d WITH a/H_1	10
B 10	RELATIONSHIP BETWEEN C_d AND a/H_1	11
B 11	RELATIONSHIP BETWEEN C_d AND H_1/a	11
B 12	SCALES FOR SLUICE GATE FLOW PROFILE	12
B 13	DISCHARGE COEFFICIENT FOR VERTICAL SLUICE GATES	13
B 14	DEFINITION SKETCH FOR SLUICE GATE	13
B 15	CHARACTERISTICS OF THE SURFACE EDGE	13
B 16	RELATIONSHIP BETWEEN F_2 AND $\sqrt{gH_1}$	14
B 17	RELATIONSHIP BETWEEN F_2 AND F_1	14
B 18	SUBMERGED FLOW UNDER SLUICE GATE	18
B 19	COMPARISON OF EXPERIMENTAL DATA BY PULJATKAR WITH HEWLEY'S DIAGRAM	18
B 20	RELATIONSHIP BETWEEN F_2 AND F_1	18
B 21	RELATIONSHIP BETWEEN F_2 AND C_d AT CONSTANT C_d	19
B 22	PIER CONTRACTS FOR SUBMERGED FLOW	19
B 23	SUBMERGED FLOW UNDER SLUICE GATE	19
B 24	C_d VALUES FOR DIFFERENT PIER SHAPES	19
B 25	RELATIONSHIP BETWEEN F_2 AND C_d AT CONSTANT C_d VALUES	19
B 26	RELATIONSHIP BETWEEN F_2 AND C_d AT CONSTANT C_d VALUES	19
B 27	RELATIONSHIP BETWEEN F_2 AND $\sqrt{gH_1}$ FOR BOTH KOEHL'S	19
B 28	RELATIONSHIP BETWEEN H_1/a AND C_d FOR BOTH KOEHL'S	19
B 29	RELATIONSHIP BETWEEN F_2 AND C_d FOR BOTH KOEHL'S	19
B 30	RELATIONSHIP BETWEEN $\sqrt{gH_1}$ AND C_d FOR BOTH KOEHL'S	19
B 31	RELATIONSHIP BETWEEN F_1 , F_2 AND F_3	19
B 32	U.S. ARMY DESIGN CHARTS FOR TAINIER GATED	19
B 33	THE TESTED MODELS OF STILLS UNDER SLUICE GATE BY DALAMA	19
B 34	VARIATION OF C_d WITH H_1/a FOR SUBMERGED FLOW	19
B 35	VARIATION OF C_d WITH H_1/a	19

LIST OF FIGURES (CONT.)

FIGURE NO.	TITLE	PAGE
2.36	DESIGN CHART FOR CALCULATING THE ADJUSTMENT FACTOR (C _d)	40
3.1	SUBMERGED FLOW UNDER SLUICE GATE	52
3.2	SUBMERGED FLOW UNDER SILLED SLUICE GATE	52
4.1	GENERAL ARRANGEMENT OF THE APPARATUS	54
4.2	TEST MODELS (D. S. SIDED)	55-56
4.3	WATER CIRCLE DIAGRAM	57
5.1 TO 5.5	MEASURED VALUES OF Q AND (H ₁ , H ₂ AND Y ₀) (NO STILL CASE)	74-76
5.6	MEASURED VALUES OF Q AND H ₁ FOR DIFFERENT GATE HEIGHTS (NO STILL CASE)	76
5.7	MEASURED VALUES OF Q AND H ₁ FOR DIFFERENT GATE WIDTHS (NO STILL CASE)	77
5.8 TO 5.12	MEASURED VALUES OF Q AND (H ₁ , H ₂ & Y ₀) (STILL CASE)	77-79
5.13	MEASURED VALUES OF Q AND H ₁ FOR DIFFERENT GATE HEIGHTS (STILL CASE)	80
5.14	MEASURED VALUES OF Q AND H ₁ FOR DIFFERENT GATE WIDTHS (STILL CASE)	80
6.1 TO 6.10	VARIATION OF C _d WITH H ₁ /a	88-93
6.11 TO 6.20	VARIATION OF C _d WITH Y ₀ /a	95-99
6.21 TO 6.30	VARIATION OF C _d WITH $\sqrt{(H_1 - H_2)/a}$	102-106
6.31 TO 6.40	VARIATION OF C _d WITH F ₀	108-113
6.41 TO 6.52	VARIATION OF F ₀ WITH $\sqrt{(H_1 - H_2)/a}$	116-121
6.53 TO 6.55	VARIATION OF C _d WITH a/b	125-126
6.56 TO 6.58	VARIATION OF C _d WITH b/H ₁	126-128
6.59 TO 6.68	VARIATION OF Q ₁ /Q AND Q ₂ /Q WITH a/b	132-136