DEDICATION

To my Father,

Mother,

sisters and Brothers,

and colleagues.

ACKNOWLEDGMENT

First, of all I am grateful to Almighty Allah For his great blessing. My sincere thanks and gratitude to my Supervisor Dr.Elsadig Al-Mahdi Ahmed, for his encouragement help, guidance and continued support. More thanks to National Municipal Water Corporation. Due thanks are to the staff of the Department of Agricultural Engineering, College of Agricultural Studies, Sudan University of Science and Technology. Deep thanks to my family for their endless patience and continuous support. Thanks are also extended to all those who helped in a way or another to bring this to being.

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LIST OF ABBREVIATIONS

Symbols	Abbreviations
ASTM	American Society for Testing Material
Av.	Average
b	Gate Opening,
B	The gate width.
C.V.	Coefficient of variation
C_d.	Dimensionless discharge coefficient
Cf.	Coefficient of discharge
Cm	Centimeter
CRBD	Complete randomize block design
D	The gate height. (h)
D/S FSL	Downstream Full Supply level
E_d	Downstream specific energy
E_u	Upstream specific energy
FSL	Full Supply Level
g	Gravity acceleration
h	Upstream water depth above the notch
H	Head
ISO	International Organization for Standardization
L	Length
M	Mass flow
m	Meter
mm	Millimeter
NSW	Night Storage Weirs
PR	Pipe Regulators
Q	Discharge

q	Discharge per unit width of channel,
Q_{act}	Total actual discharge.
Q_g	Discharge through the gate.
Q_{theo}	Total theoretical discharge.
Q_w	Discharge through the triangular weir.
Rep	Replication
RSG	Roller Sluice Gate
Sec.	Second
T_0	Operating time
U/S FSL	Upstream Full Supply level
USBR	United States bureau of reclamation
V	Velocity
V_{fm}	Flow meter reading in volume
WHR	Well Head Regulators
y	Vertical distance
y_1	Upstream depth
α	Notch opening angle
Θ	V-notch angle. (Degree)

ABSTRACT

This study was conducted at the Department of Agricultural Engineering, College of Agricultural Studies (Shambat), Sudan University of Since and Technology (2013-2014).

This study was carried out with objective of testing the stability of coefficients of discharge for locally designed gate and weir operated separately and the coefficient of discharge for both openings operated simultaneously.

The combined rectangular gate under triangular weir was constructed so that the v-notch weir works over the rectangular gate. Three different

(7.5, 8.5, 10 cm) gate widths with maximum gate height of 10 cm. The V-notch weir angle is 90^{o}. The combined weir was installed on an open cement-lined-trapezoidal channel.

The stability of the gate coefficient of discharge was tested under three different gate widths (10, 8.5, 7.5cm) each at three different heads (5.5, 4.5, 3.5cm) the result showed the stability of the gate discharge coefficient tested at different gate widths and different heads as there is no significant difference. the coefficient value reported in previous works (0.61) is quite similar to that obtained in the test (0.611)

The v-notch weir (angle 90^{0}) discharge coefficient was tested under three different heads (7,11,12cm) the results showed no significant difference. The coefficient values reported in previous works (0.53) and those obtained in the test (0.55).

The combined weir coefficient of discharge is (0.502).is quite stable as proved by statistical analysis

The combined gate under v-notch weir coefficient of discharge reported in previous works is (0.694, 0.691and 0.665) for weir angles (30^0 ,45^0 ,60^0) respectively. Showing the decrease in coefficient value with the increase of v-notch angle, so the coefficient of discharge value (0.502) obtained in the test compares very well.

From the above result it could be concluded that a gate under v-notch weir 90^0 can be designed and constructed locally to measure discharge in open channels with high reliability.

الخلاصة

أجريت هذه الدراسة في قسم الهندسة الزراعية كلية الدراسات الزراعية (شمبات) جامعة السودان للعلوم والتكنولوجيا (2013 - 2014).

هذه الدراسة تهدف الى اختبار استقرار معامل التصرف للبوابة المنزلقة والهدار المثلثي المصمم محليا كل علي حدة ومعامل التصرف لهما بالهدار المركب.

صممت البوابة المستطيلة تحت الهدار المثلثي ذو الزاوية 90^0 بثلاثة ابعاد مختلفة للعرض وهى (8.5,10و7.5 سم) تم تركيب البوابة المركبة علي القناة المفتوحة المبطنة بالاسمنت ذات المقطع شبه المنحرف.

تم اختبار استقرار معامل التصرف للبوابة بثلاثة ابعاد مختلفة لعرض الفتحة وهى (10,8.5,7.5سم) وثلاثة ضواغط مختلفة (3.5,4.5,5.5 سم),عند تحليل التباين اظهرت النتائج عدم وجود فروقات معنوية بين قيمة معامل التصرف في الفتحات والضواغط المختلفة . في ادبيات البحوث السابقة (0.61) والقيمه التي تم الحصول عليها في التجربة (0.611). مما يظهر تطابقا في القيمة .

تم اختبار استقرار معامل التصرف للهدار المثلثى ذو الزاوية 90^0 عند ثلاثة ضواغط مختلفة وهي (7,11,12سم),عند تحليل التباين اظهرت النتائج عدم وجود فروقات معنوية بين قيمة معامل التصرف في التجربة. ادبيات البحوث السابقة (0.53) والقيمة التى تم الحصول عليها في التجربة (0.502).

أظهرت التجربة استقرارا لمعامل التصرف للبوابة المركبة وذلك حسب نتائج تحليل التباين.

قيمة معامل التصرف للبوابة المركبة تحت الهدار المثلثى فى الادبيات السابقة للبحوث هى (0.665, 0.691,0.694)عند الزوايا (30^0,45^0,60^0) علي التوالي.وتوضح بان قيمة معامل التصرف تقل بزيادة زاوية الهدار المثلث , وعليه قيمة معامل التصرف التى تم الحصول عليها في التجربة (0.502) عند زاوية الهدار 90^0 وهي تظهر مقارنة جيدة.

من النتائج أعلاه يمكن ان نخلص الى أن البوابة المركبة تحت هدار مثلثى ذو الزاوية 90^0 يمكن تصميمها وتنفيذها محليا لقياس التصرف في القنوات المفتوحة وتعطي نتائج ذات اعتمادية عالية.