Analysis Performance Evaluation of Measuring Building (BM1) and Cipoletti (BM3) Buildings in the Mambal Irrigation Network of the Ayung River Irrigation Area

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Abstract: The discharge canal in the Mambal irrigation area is a very important structure because it distributes water proportionally to the paddy fields. The results of field observations show that the current formula is no longer suitable for the canal characteristics due to changes in the physical shape of the building. Therefore, it is necessary to evaluate the performance of the Cipoletti measuring channel and measuring channel to obtain the actual flow coefficient. This research was conducted by testing the flow formula compared to factual discharge measurements to obtain the actual flow coefficient. Instantaneous discharge measurements are carried out with various variations of discharge in order to obtain a discharge coefficient that is truly in accordance with the characteristics of the measuring building. The results showed that for BM 1 the new formula was obtained $Q = 1.430\ Bh^{3/2}$. In BM 3 a new formula is obtained as follows $Q = 1.78\ b\ h^{3/2}$.

1 INTRODUCTION

The development carried out by the Government in increasing food self-sufficiency is to improve irrigation network services by revamping buildings and canals that are in the same area. Until now, the biggest water loss for irrigation water distribution is the loss of water in secondary and tertiary canals, which ranges from 20-30% of the water distributed (Nugroho 2014), (Perdana and Wiguna 2019). Improvement of buildings and canals from semi-technical irrigation to technical irrigation has a very positive effect in reducing water loss along the way. Irrigation in Bali departs from the traditional Subak irrigation agricultural system combined with a modern irrigation system that is more technical in nature to give a touch in the building management system. This combination provides a more technical farming system than previous farming (Prastyadewia, Susilowati, and Iskandara 2020), (Asmiwyati et al. 2015), (Budiasa et al. 2015)

Associated with the distribution of water to the plots of irrigated rice fields have been arranged through existing buildings along the network. Buildings on irrigation networks in primary and secondary canals were built by the government through relevant agencies while buildings on tertiary and quarter canals were built by farmers. Buildings located in the primary and secondary canals consist of several buildings such as share buildings, for tapping, crossing dives, mud bags, measuring buildings and other buildings. (Ahmed 2020), (Akkuzu, nal, and Karataş 2007). The measuring building is one of the important buildings in the irrigation network because it has a function related to the accuracy of the amount of water distributed to the rice fields. This measuring building provides the amount of water as needed by setting the water level in the measuring building.

The building measuring the width threshold and Cipoleeti in the Tukad Ayung irrigation area at the Mambal weir drainage condition has undergone many changes in shape as a result of the condition of the building undergoing several changes such as cracked walls, rusted sills and the presence of sediment upstream and downstream of the building. measuring. As a result of this condition, it is felt that there is a mismatch of water distributed to farmers' fields. This situation has a direct effect on the decline in optimal growth of rice plants which can reduce grain production at the farmer level. Condition. From the preliminary research conducted,

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it shows that the flow formula in the measuring building used today has been used since the building was built and has never been adjusted until now. In order to obtain the actual flow coefficient from the current condition of the measuring structure, it is very necessary to carry out an analysis of the flow in the existing measuring structure. The results of this study can be an important reference related to the actual flow coefficient so that the distribution of water by measuring structures is the same as that required by farmers for irrigating their fields. Thus, the results of this study can also be used as a guide for the operation and maintenance system of irrigation areas in the Mambal irrigation area. The problem in this research is what is the flow coefficient applied to the existing measuring building and what is the actual flow coefficient based on the test results? The purpose of this study is to determine the currently applied coefficient and compare it with the actual flow coefficient of the measurement results

2 METHOD

Calibration is one of the steps to determine the stability of a measuring object to get the actual measurement results. (Shock, Barnum, and Seddigh 1998), (Collectives n.d.), (Santos et al. 2021). The research was designed for six months by conducting research activities both in the field and analytically involving a research team of lecturers and students. Field research was carried out by coordinating with several parties including the Bali Provincial Public Works Service and irrigation observers based in Lukluk Kapal. Coordination is carried out to determine the timing of the implementation of the instantaneous discharge measurement so that it does not interfere with irrigation operations that are already running. While the analysis is carried out by analyzing the instantaneous discharge juxtaposed with the flow formula in a measuring building. Field surveys to determine the condition of the measuring building include: the location of the measuring building. difficulty level of measurement, temporary method of measurement, physical condition of measuring building, current flow formula and problem of measuring accuracy of building

Measurement of instantaneous discharge is carried out in several ways depending on the needs and field conditions, for example with a current meter, buoys and others (Setiawan and Purwanto 2018), (Indonesian National Standard 2015). Instantaneous discharge measurement requirements are carried out with the following requirements: in a straight location, not affected by trees or roots, evenly distributed and it is estimated that there is no circular velocity distribution, there are no other factors that can cause a sudden rise in water level, the measurement depth should be 3 times to 5 times the diameter of the propeller. Measurement personnel requirements: have experience in taking measurements at least in the same job and have received instructions on how to measure before and have a healthy body condition (Busscher 2009) (Jaiswal et al. 2012) (Kroc and Zumbo 2018), (Liu and Henze 2005)

Examination of the current meter includes that the battery used is new, the panel is visible when the measurement is taken, when taking the measurement, it is expected to wear a life jacket, there is a handle that can be used in an emergency and a measurement form is available

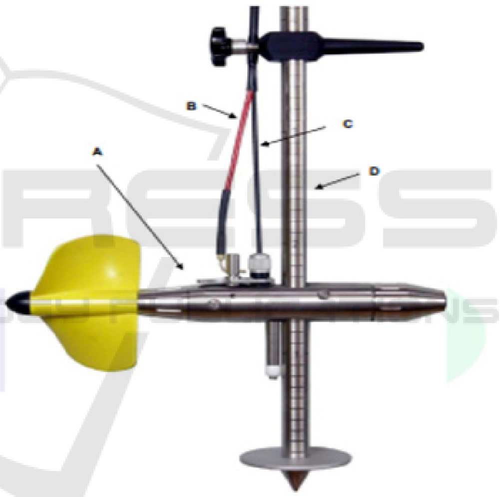

Figure 1: Current Meter.

Calibration is an activity to test the current ar flow formula by comparing the factual discharge with the theoretical discharge. The series of activities include determining the measurement point, measuring the cross-sectional width, determining the depth of the water, measuring the instantaneous discharge, analyzing the instantaneous discharge and calibration.

The steps of calibration activities start from building inventory, instantaneous flow measurement, discharge analysis and calibration. Instantaneous discharge measurements are carried out at least 10 times to obtain valid measurement data. Complete calibration steps as shown in Figure 2.

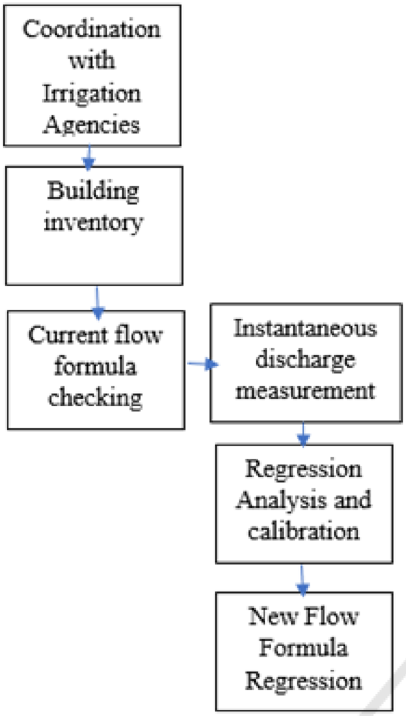

Figure 2: Research flow chart.

The Measurement Building DI Mambal is located in two locations, namely in Kapal BM1 Village. and BM3. In general, the condition of the building is very well maintained and can operate well. The problem, in general, is the presence of sediment in the channel which affects the flow. This sedimentation is caused by the remnants of the building downstream which enter the channel causing disturbances upstream. A complete picture of the condition of the building can be seen in the image below.

Building Measure BM1

This measuring building is in the form of a wide threshold with a masonry construction with a plunge downstream as shown in Figure 3 below:

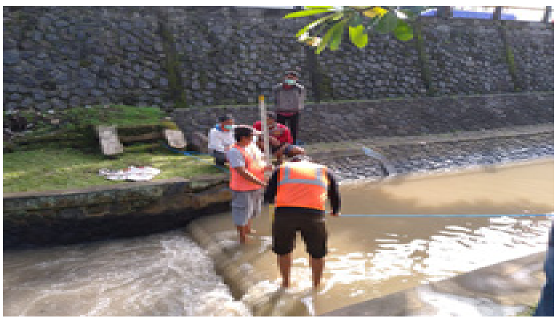

Figure 3: Measuring building BM1.

Building Measure BM3, This measuring building is a cipoletti measuring building whose threshold is a sharp threshold made of steel. More details can be seen in Figure 4 below.

Figure 4: Measuring Building BM3.

2.1 Inventory

Inventory is carried out to determine the current condition of the building and the planned measurement activities to be carried out. This inventory records the location of the building, the condition of the building, the current flow formula, as well as the current debit measurement technique plan that will be carried out.

2.2 Instantaneous Discharge Measurement

Instantaneous discharge measurements are carried out to determine the actual discharge conditions by measuring repeatedly for at least 10 trials. The instantaneous dbit measurement is carried out in the measuring building using the measurement form that has been provided with a calibrated current meter. Measurements were carried out with different variations in water height so as to produce varying discharges (Xu et al. 2021).

2.3 Analysis

The analysis was carried out after knowing the actual discharge data from the measurement results. This analysis was conducted to obtain the value of the flow coefficient (Cd and CV). After obtaining the Cd and CV values, a regression analysis was carried out to determine the actual magnitude of the coefficient.

3 RESULTS

Calibration shows that each water level has different Cv and Cd values. The higher the water, the higher the discharge as well as the values of Cv and Cd which show varying values. More details can be seen in Table 1 below:

Table 1: Calculation of the value of C (Cd,Cv) in BM 1. buildings.

Exp.	Discharge (m3/dt)	$h^{3/2}$ (m)	$1,705Bh^{3/2}$	C
1	0.04	0.01	0.09	0.43
2	0.28	0.06	0.39	0.72
3	0.43	0.08	0.52	0.82
4	0.49	0.09	0.59	0.84
5	0,89	0.16	1.07	0.84
6	1.24	0.21	1.45	0.86
7	1.48	0.25	1.71	0.87
8	1.87	0.34	2.33	0.80

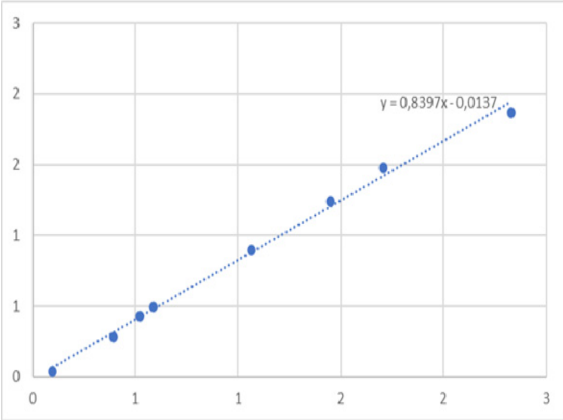

Figure 5: Relationship between Cv and Cd in BM 1.

Table 2: Comparison between H with Q and Cd, Cv.

Experiment	H average	Q	Cd,Cv
1	0.06	0.04	0.43
2	0.15	0.28	0.72
3	0.18	0.43	0.82
4	0.2	0.49	0.84
5	0.29	0.90	0.84
6	0.36	1.24	0.86
7	0.40	1.48	0.87
8	0.49	1.87	0.80
9	0.48	1.94	0.85
10	0.49	1.96	0.83

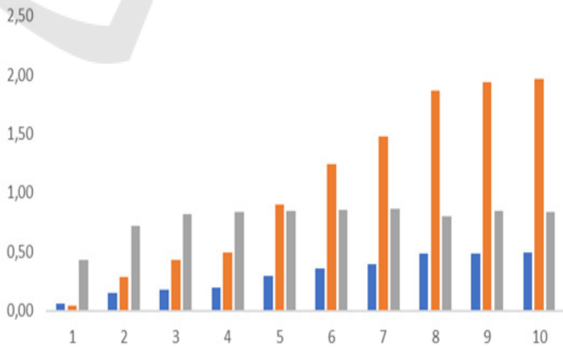

Figure 6: Relationship Between H, Q and Cd,Cv in BM 1.

Table 3: Calculation of the value of C (Cd,Cv) in BM 3. buildings.

Exp.	Discharge (m^3/dt)	h3/2 (m)	2.95 $Bh^{3/2}$	C
1	0.34	0.033	0.587	0.58
2	0.73	0.062	1.094	0.67
3	1.12	0.096	1.697	0.66
4	1.56	0.131	2.327	0.67
5	1.38	0.147	2.603	0.53
6	1.73	0.175	3.109	0.56
7	2.51	0.202	3.583	0.71
8	1.76	0.189	3.351	0.52
9	1.78	0.187	3.321	0.53
10	2.36	0.181	3.215	0.73

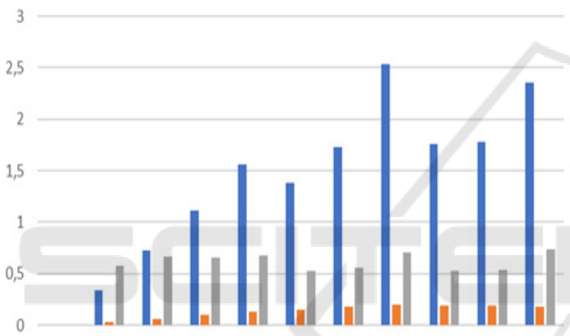

Figure 7: Relationship Between H, Q and Cd,Cv in BM 3.

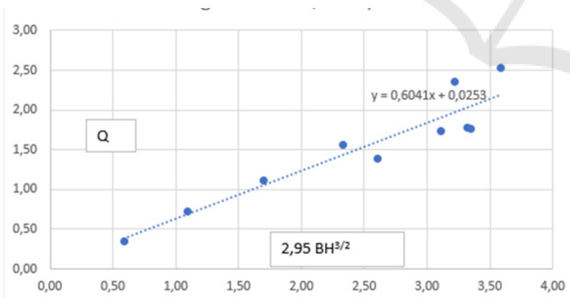

Figure 8: Relationship between Q and 2,95 BH3/2 in BM 3.

4 CONCLUSION

Based on the results of the discussion that has been carried out, several conclusions can be drawn as follows:

1. The formula for the drainage system in the building measuring BM1 A and BM 3 is currently Q = 1.71 B h1,5
2. Based on the results of observations made, it shows that the formula of the research results shows the formula for the drainage system as follows:
   a. In buildings measuring BM 1
   From the analysis results, the magnitude of Cd x Cv = 0.839 is obtained so that the calibration of the old formula Q = 1.71 B h0.5 becomes the new formula as follows: Q = 1.705 Cd Cv B $h^{3/2}$, so that it becomes: Q = 1.705 0.839 B $h^{3/2}$ or Q = 1,430 B $h^{3/2}$

   b. On Buildings Measure BM 3
   By entering the value of 2g 0.5, then Q = 2.95 Cd b $h^{3/2}$ based on the results of the analysis obtained a cd value of 0.604 so that the new formula is obtained as follows Q = 1.78 b $h^{3/2}$

Suggestion What can be suggested is when the instantaneous discharge measurement is carried out carefully so as to produce calibration results that are truly in accordance with field conditions.

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