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SAMIRAN DAM PERFORMANCE ANALYSIS USING THE AHP METHOD IN PAMEKASAN REGENCY

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ABSTRACT
The purpose of the research as follows: (1) as a criterion for determining the condition of the existing weir and an assessment of the function of the weir according to the existence of the building, (2) to obtain the value of the components of the weir building, (3) analyze the results of the work of the dam on the Samiran Embankment located in Pamekasan Regency to the existence and function of its building. The current study raises the subject of the Samiran Dam which is located in Samiran, a remote village from one of the sub-districts located in the middle of Pamekasan Regency, East Java Province. This research used AHP. Method. From analyzing and then collecting weir data which aims to obtain work from the weir and the presence of damaged weir components in the form of discharge strength of 18.89%, presence of sediment 1.25%, lighthouse 0.19%, extraction building 2.56%, drainage building 4.26%, flushing buildings 1.88%, and mud bags 4.15%. The following are the results of analyzing the work of the weir according to the use of weir components, namely discharge 32.92%, sediment 3%, lighthouse 2.39%, intake building 14.29%, draining building 21.14%, flushing building 21.14%, and mud bag 9.86%. From the results above, it can be assumed that the component of the work of the dam on the Samiran reservoir is 33.18% damaged with the position of the weir being slightly damaged. Meanwhile, the usefulness of the weir work on the Samiran reservoir is 93.31% and the condition of the weir is fine.

Keywords: *Work from Dam, AHP, Samiran Reservoir.*

1. Introduction

Weirs are the first buildings that have use in the elevation of river water levels and also distribute and channel water so that it can flow in carrier channels with predetermined alternatives and choices [12]. Weir is a building composed of river stone, concrete, based on a certain position of the river that has uses for irrigation canals [9].

Embung Samiran is part of a dam building located in Madura, precisely in Samiran, which is a remote part of Proppo District right in the middle of Pamekasan Regency, East Java Province. This weir is a weir construction that has been built since 1901 with a service area of 2462 hectares and a planting area of 2600 hectares. To maintain the usefulness and long life of the dam and the network in it, it is necessary to analyze the work value of the weir.

Because it is part of the canal infrastructure construction, the weir is affected by the amount of river water and the discharge that affects irrigation [7]. Unstable discharge conditions are also external factors that are expected to damage the condition of the existing weir building [4]. With this condition, the thing that needs to be considered is the assessment of the weir of the building structure, so that it can be handled directly and appropriately when repairs are carried out and managed as well as possible before damage actually occurs to the existing weir [11].

Starting from the above, this research discusses the damage to several components of the dam building based on the usefulness of the existing building structure [13]. There are several important

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assessments of the damage to the Samiran reservoir building with 7 components, namely discharge conditions, sediment conditions, crest position, intake building conditions, flushing building conditions, mud bag position and draining building conditions [2]. Based on the 7 components of the weir structure, research can be carried out regarding damage related to leakage and some theoretical and visual peeling layers in order to produce several weir criteria [10].

To determine the assessment of the condition of the existing weir, it is necessary to make several assessment criteria which are then analyzed by the AHP method on the Samiran reservoir. Then the results obtained can be shown how the Samiran reservoir works from several criteria that have been made.

2. Material and Methods

The important thing in this writing is the Samiran Reservoir Work Analysis. In this research, the method used is descriptive research. What is meant by descriptive research is research that aims to determine the value of variables, either a few variables or many variables without comparison, or connecting one variable to another variable. In this research, a quantitative approach can be carried out, an approach by means of research on populations and samples, to collect data, research instruments are used, analysis of quantitative data or statistical data, which aims to test the established hypotheses.

The data needed for this research is divided into several groups, namely primary and secondary data categories. The data that has been collected can then be processed continuously, so that it can produce conclusions according to what is expected later.

2.1. Primary Data

a. The physical data of weir buildings include the size of the weir and the type of construction of the Samiran Embankment.
b. Physical data from the dam construction infrastructure which includes the visual condition of the Samiran Embung infrastructure building.

2.2. Secondary Data

a. Technical data on the Samiran Reservoir
b. Samiran Embung location map
c. Information about the construction quality of weirs is obtained from existing reference sources.

After the primary and secondary data are obtained, the next step is to process the data in order to obtain the components of the weir construction at the Embung Samiran. From some of these components, data processing is carried out in order to determine the usefulness and condition of the Samiran Reservoir, especially in weir work.

The following are the stages for data analysis, among others:

1. Pond survey
2. Determination of the value of the dam
3. Assessment of work, condition and function of the dam section

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Table 1. Dam Survey Calculation

Weir Component	Dimension		Total Area	Type of Damage		Damage	Damage Percantage	Damage Total	Percentage Assesment of Building Conditions
	Long	Wide							
(i)	(p)	(l)	(L)				(%)	KS	(%)
1	2	3	4 : (2*3)	5		6	7 : (6)/(4)*100	8 : K1+K2+K3	9 : 100-(8)
Lighthouse	25	2.5	62.5	Collapse	K1	-	-	6.95	93.05
				Leaked Out	K2	2.295	3.67		
				Peeling Layer	K3	2.048	3.28		
Building Taking	2.5	1.7	4.25	Collapse	K1	-	-	13.98	86.2
				Leaked Out	K2	0.054	1.27		
				Peeling Layer	K3	0.54	12.71		
Drainage Building	2	1.8	3.6	Collapse	K1	-	-	20.16	79.84
				Leaked Out	K2	0.026	0.72		
				Peeling Layer	K3	0.7	19.44		
Rinsing Building	2.5	1.5	3.75	Collapse	K1	-	-	19.33	80.67
				Leaked Out	K2	0.499	0.13		
				Peeling Layer	K3	0.72	19.2		
Mud Bag	1.5	2.5	3.75	Collapse	K1	-	-	42.13	57.87
				Leaked Out	K2	1.58	42.13		
				Peeling Layer	K3	-	-		

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Table 2. Dam Function Survey Calculation

Weir Component	**Function Indicator**	**Function (F)**				**Score F**	**Weight AHP**	**FxWeight**
		<20%	**±40%**	**±75%**	**>90%**			
(i)						**(Fi)**	**(Di)**	**(FixDi)**
-1	**-2**	**-3**				**-4**	**-5**	**(6) : (4)*(5)**
Debit	Abality to irrigate iigation areas				93.31	4	35.28	32.92
Sediment	Sediment Management ability				100	4	3	3
Lighthouse	The ability to raise the water level of the river			88.24		4	2.71	2.39
Building Taking	Arrangement of water entering the cannel			78.12		3	18.29	14.29
Drainage Building	Drainage of mud on the upper reaches of the lighthouse				100	4	21.14	21.14
Rinsing Building	Diposal of deposits in mud bag				100	4	9.71	9.71
Mud Bag	Sedimentation of river deposits				100	4	9.86	9.86
Total								
Component Condition : Σ (5) / Σ (4)						**F AHP**	**Description**	
						4	**GOOD**	

Table 3. Dam Condition Survey Calculation

Weir component Performance	**Component damage**	**Score KS**	**Weight AHP**	**KS xWeight AHP**
(i)	**(%)**	**(Ki)**	**(Ci)**	**(Ki x Ci)**
-1	**-2**	**-3**	**-4**	**(5) : (3)*(4)**
Lighthouse	53.55		35.28	18.89
Debit	41.67		3	1.25
Sediment	6.95		2.71	0.19
Building Taking	13.98		18.29	2.56
Drainage Building	20.16		21.14	4.26
Rinsing Building	19.33		9.71	1.88
Mud Bag	42.13		9.86	4.15
Total			100%	33.18%
Kondisi Komponen : Σ (5) / Σ (4)			K AHP	Description
			2	MEDIUM DAMAGE

2.3. Data Processing

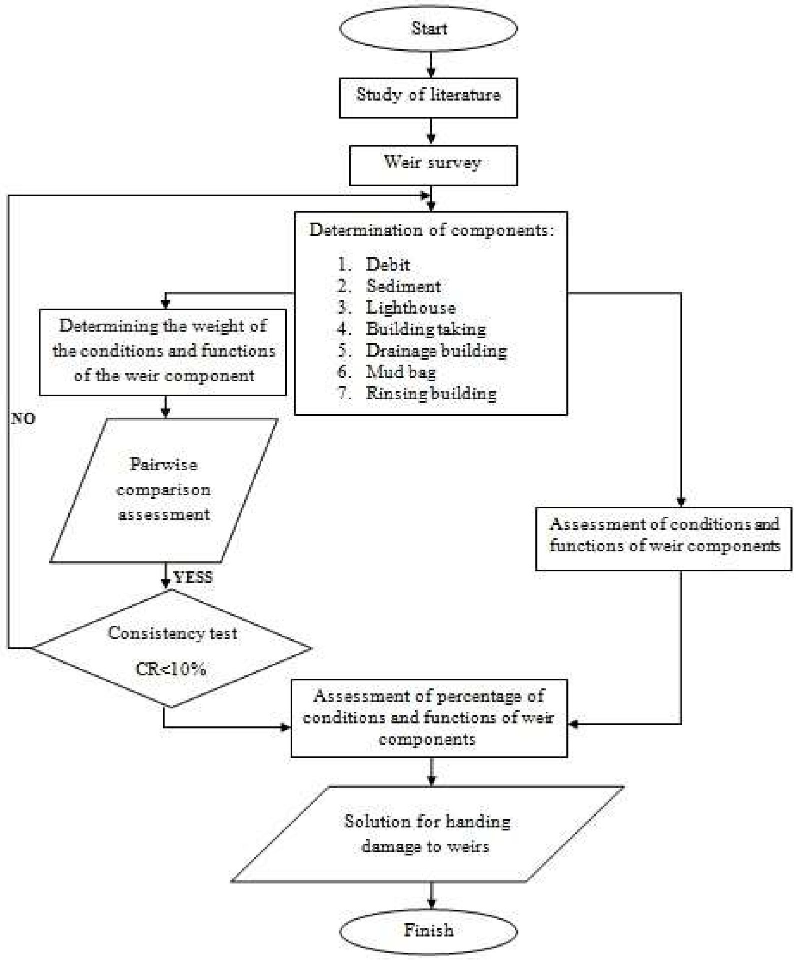

Figure 1. Research Flowchart

3. Result and Discussion

3.1. Component Dam

The working part of the weir is one of the important factors in the performance of the weir, which is useful in the system of setting, repairing and utilizing and maintaining a weir. The work component of the weir is an indication of the existence of the weir which is divided into 7 main components, namely discharge, sediment, crest, intake building, rinsing building, mud bag and draining structure [5].

In choosing several components, it must be based on factors that are more important to the work and condition of the weir, the ease of observation of data in the field and the condition of the weir which is often found in weirs throughout Indonesia.

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Table 4. Dam Performance Constituent Components

No.	Component
1	Debit
2	Sediment
3	Lighthouse
4	Building Taking
5	Drainage Building
6	Rinsing Building
7	Mud Bag

To determine the value of the state of the weir is made on each part of the weir with the selection of criteria. The criteria for the section of the dam must be grouped according to the review of the damaged section of the dam, which can be called indicators. Each indicator has a condition, then it is selected into several broken criteria [3].

Table 5. Criteria For Damage To The Dam Component Structure

Criteria	Uraian
Collapse	The structure of assets is not intact, in part regaldress of the assets structure.
Leaked Out	Intact assets structure, there is damage in the form of leaks in the assets structure.
Peeling Layer	The assets structure is intact, there are cracks of layers peeling of the assets structure.

In determining the assessment system for the existence of assets, it can be done by separating the components of the weir, and later the weir can be assessed for each asset. Then it can be applied in the observation of color photos. Then the photos can be described the state of the weir in each class, so as to minimize the subject in assessing the existence of assets [1].

Table 6. Classification Of The Condition Of The Assets Component

Condition	Score	Damage Percentage	Descriptions
Good	4	<10%	Assets show little damage, routine maintenance or small repairs are needed.
Lightly damage	3	10%-20%	Assets under severe average conditions, periodic maintenace or small repairs are required.
Medium damage	2	21%-40%	Assets in severe conditions, service can still be carried out, requires considerable maintenance work.
Heavily damage	1	>40%	Assets that have seffered severe damage,serious structural problems, service cannot be fully carried out. Major repairs of replacement required.

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3.2. Component Function

The function of the assets can be seen the results based on the stage of maintenance work. In assessing the function of assets, it is carried out in order to show that the assets can function according to the plan and the influence of the function of assets on the work system of the irrigation canal system [6].

Table 7. Classification Of Asset Component Function

Condition	Score	Damage Percentage	Descriptions
Good	4	>80%	Assets have more than 80% funtions, all areas of service are facilitated.
Enough	3	80%-40%	Assets have function between 40% to 80%, difficulties in distributing water, but can still be overcome by turn.
Less	2	20%-40%	Assets have a function of between 20% to 40%, the turn of the distribution of water is not sufficient.
Does not work	1	<20%	Assets do not function; service areas are not irrigated.

The first thing that can be done is to compare the interrelated parameters. The comparison system can be done left and right with a scale of 1-9, where the largest number on one side can determine a higher level on the existing parameters. If the ratio is 1, then both have the same desire [8].

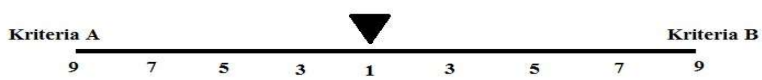

Figure 2. Pairwise Comparison Scale Between Two Criteria

From the dam work criteria, there are 7 parameters or components that can be calculated in Table 4. These parameters can be compared in pairs in order to obtain the percentage of each component that makes up the dam work [15]. In determining the Pairwise Comparison scale for this research, the authors collaborated with the Pamekasan Regional UPT and the Irrigation Mantri who had duties in the Samiran Dam.

Table 8. Result of The Pairwise Comparison Dam Performance

No	Comparison	Scale
1	D vs M	5 to D (Right)
2	D vs S	7 to D (Left)
3	D vs BA	7 to D (Left)
4	D vs BB	1 to D (Left)
5	D vs KL	9 to D (Left)
6	D vs BK	9 to D (Left)
7	S vs M	3 to M (Left)
8	S vs BA	9 to BA (Right)
9	S vs BB	7 to BB (Right)
10	S vs KL	5 to p KL (Right)
11	S vs BK	7 to BK (Right)
12	M vs BA	9 to BA (Right)
13	M vs BB	1 to M (Left)
14	M vs KL	7 to KL (Right)
15	M vs BK	9 to BK (Right)
16	BA vs BB	7 to BA (Left)
17	BA vs KL	7 to BA (Left)
18	BA vs BK	5 to BK (Right)
19	BB vs KL	5 to KL (Right)
20	BB vs BK	5 to BB (Left)
21	KL vs BK	7 to BK (Left)

Furthermore, the data from the pairwise comparisons can be included in the matrix calculation by adding up the relative values of the weir work [16].

Table 9. Summation Matrix of Dam Relative Weights

Criteria / Alternative	D	S	M	BA	BK	BB	KL
D	1.00	7.00	5.00	7.00	9.00	1.00	9.00
S	0.14	1.00	3.00	0.11	0.14	0.14	0.20
M	0.20	0.33	1.00	0.11	0.11	1.00	0.14
BA	0.14	9.00	9.00	1.00	0.20	7.00	7.00
BK	0.11	7.00	9.00	5.00	1.00	5.00	7.00
BB	1.00	7.00	1.00	0.14	0.20	1.00	0.20
KL	0.11	5.00	7.00	0.14	0.14	5.00	1.00
Σ	2.7	36.33	35.00	13.5	10.79	20.14	24.54

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Table 10. The Addition Weight Matrix is Normalized

Criteria / Alternative	D	S	M	BA	BK	BB	KL
D	0.37	0.19	0.14	0.52	0.83	0.05	0.37
S	0.05	0.03	0.09	0.01	0.01	0.01	0.01
M	0.07	0.01	0.03	0.01	0.01	0.05	0.01
BA	0.05	0.25	0.26	0.07	0.02	0.35	0.28
BK	0.04	0.19	0.26	0.37	0.09	0.25	0.28
BB	0.37	0.19	0.03	0.01	0.02	0.05	0.01
KL	0.04	0.14	0.2	0.01	0.01	0.25	0.04
Σ	1.00	1.00	1.00	1.00	1.00	1.00	1.00

In determining the Eigen value (Xn) can be obtained from the average in each row of the normalized matrix. The eigenvalue obtained can be changed in the form of a percentage and then multiplied by the value of the performance of the weir itself in order to get the weight of each criterion [14].

Table 11. Eigen Values and Weights of Dam Performance Component

Criteria / Alternative	D	S	M	BA	BK	BB	KL	*Eigen*	Component Weight
D	0.37	0.19	0.14	0.52	0.83	0.05	0.37	0.3528	35.28 %
S	0.05	0.03	0.09	0.01	0.01	0.01	0.01	0.0300	3 %
M	0.07	0.01	0.03	0.01	0.01	0.05	0.01	0.0271	2.71 %
BA	0.05	0.25	0.26	0.07	0.02	0.35	0.28	0.1829	18.29 %
BK	0.04	0.19	0.26	0.37	0.09	0.25	0.28	0.2114	21.14 %
BB	0.37	0.19	0.03	0.01	0.02	0.05	0.01	0.0971	9.71 %
KL	0.04	0.14	0.2	0.01	0.01	0.25	0.04	0.0986	9.86 %
Σ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	100 %

The next step is the WFS value is obtained by adding up the product of the values in the row of each component to the component eigenvalues.

Table 12. Values Weighted Sum Factor

No	Criteria / Alternative	WSF
1	D	4.87
2	S	0.24
3	M	0.26
4	BA	2.16
5	BK	2.79
6	BB	0.77
7	KL	1.02

Determination of consistent vector values is obtained by dividing the WSF value of each component by the component eigenvalues.

Table 13. Values Consistency Vector

No	Criteria / Alternative	*Consistency Vector*
1	D	13.8
2	S	8
3	M	9.59
4	BA	11.81
5	BK	13.20
6	BB	7.93
7	KL	10.34

In determining the Random Index, it can be obtained from a random consistent index table, to determine random consistency depending on the number of criteria planned in compiling the work of the weir. Weir criteria work obtained 7 parts, there are a number of existing parts then obtained Random Index (RI) 1.32 [17].

Table 14. Consistent Random Index

Order of matrix	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

In the AHP calculation section, it can be carried out, so that the preparation of the distribution of component values can be carried out. The distribution of component values in the criteria for assessing weir work on the usability and condition of weir construction can be seen in Figure 3.

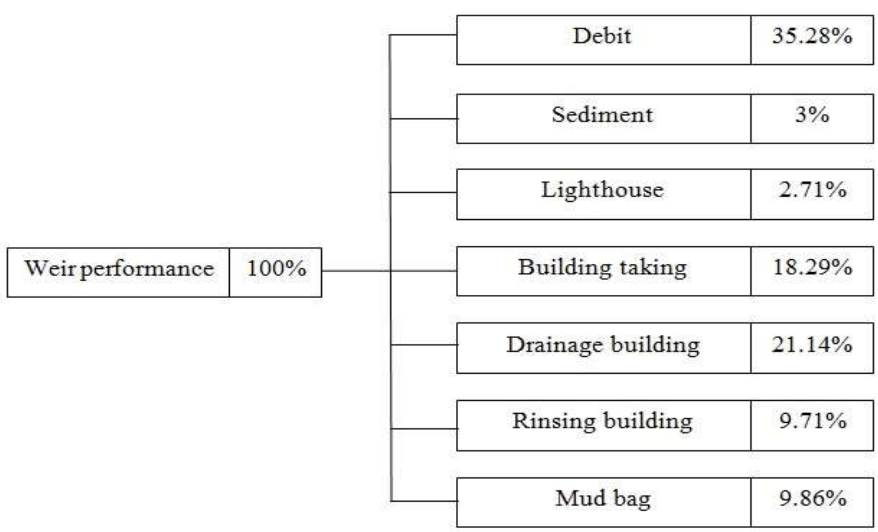

Figure 3. Component Weight Distribution

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To find the state value for each working component of the Samiran weir, it is obtained by multiplying the percentage of damage to the weir component to the working value of the weir component using the AHP method [18].

Table 15. Condition Of Performance Components of Samiran Dam

No	Component	Damage (%)	Weight AHP	Damage Weight
1	Debit	53.55	35.28 %	18.89 %
2	Sediment	41.67	3 %	1.25 %
3	Lighthouse	6.95	2.71 %	0.19 %
4	Building Taking	13.98	18.29 %	2.56 %
5	Drainage Building	20.16	21.14 %	4.26 %
6	Rinsing Building	19.33	9.71 %	1.88 %
7	Mud Bag	42.13	9.86 %	4.15 %
Total weight			**100 %**	**33.18 %**

In determining the function value of the working component of the Samiran Dam, it is obtained by multiplying the percentage of the function of the component of the Samiran Dam with the performance of the component of the weir using the AHP method [19].

Table 16. Function of Performance Components of Samiran Dam

No	Component	Function (%)	Weight AHP	Weight of function
1	Debit	93.31	35.28 %	32.92 %
2	Sediment	100	3 %	3 %
3	Lighthouse	88.24	2.71 %	2.39 %
4	Building Taking	78.12	18.29 %	14.29 %
5	Drainage Building	100	21.14 %	21.14 %
6	Rinsing Building	100	9.71 %	9.71 %
7	Mud Bag	100	9.86 %	9.86 %
Function of weir component performance			**100%**	**93.31 %**

4. Conclusions

Based on the explanation above, the conclusions that can be drawn are as follows:

a. The results of the assessment obtained that the weight of the discharge is 35.28%, the weight of the sediment is 3%, the weight of the lighthouse is 2.71%, the weight of the intake building is 18.29%, the weight of the drain building is 21.14%, the weight of the flushing building is 9.71%, and the weight of the mud bag is 9.86%.
b. The damaged dam components are discharge strength of 18.89%, presence of sediment 1.25%, lighthouse 0.19%, extraction building 2.56%, draining building 4.26%, flushing building 1.88%, and bag 4.15% mud. The following are the results of analyzing the work of the weir according to the use of weir components, namely discharge 32.92%, sediment

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3%, lighthouse 2.39%, intake building 14.29%, draining building 21.14%, flushing building 21.14%, and mud bag 9.86%.

c. The work of the Samiran Reservoir according to the criteria for the value of the function and condition of the building using the AHP method, in Pamekasan Regency based on the criteria for assessing the function and structure of the building using the AHP method, the dam work on the Samiran reservoir is 33.18% damaged with the position of the weir being slightly damaged. Meanwhile, the usefulness of the weir work on the Samiran reservoir is 93.31% and the condition of the weir is fine.

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