REDESIGN OF DRAINAGE CHANNELS ON THE RUNWAY STRIP AT ATUNG BUNGSU AIRPORT, PAGAR ALAM

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ABSTRACT
Atung Bungsu Airport has experienced an increase in water discharge in the runway-side drainage channel due to changes in the catchment area from the runway extension project. The airport is also classified as category 3C according to PR 21 of 2023, which requires a runway strip width of 140 meters on each side, thus necessitating the redesign of the drainage system outside the runway strip. This study aims to evaluate the capacity of the existing channel and redesign the drainage dimensions for the next 10 years. The methods used include rainfall data analysis with the Log Pearson III distribution, rainfall intensity calculation, and maximum runoff discharge determination. The results show that the projected runoff discharge for the next 10 years exceeds the capacity of the existing channel. Therefore, a redesigned drainage channel using precast concrete in the form of a u-ditch with dimensions of 1 meter in width and 1 meter in height is proposed.

Keywords: *Drainage system, Catchment area, Rainfall intensity, Log Pearson III distribution, Runoff discharge*

INTRODUCTION

In this modern era, aviation in Indonesia holds significant importance. As a developing country consisting of numerous islands, Indonesia is endowed with abundant natural beauty. With the high enthusiasm of the people for exploring natural attractions and the advancement of air transportation, the demand for air travel has become increasingly essential. Air transportation serves as the most efficient means of connection between regions and countries. Therefore, continuous efforts have been made to develop and improve various aspects in order to enhance service quality. One crucial element that must be prioritized in improving service quality is the availability of adequate facilities and infrastructure that meet operational requirements. In 2020, a development project was carried out at Atung Bungsu Airport. This project involved extending the runway from 1,340 meters to 1,500 meters, with a 100-meter extension on Runway 24 and a 60-meter extension on Runway 06. The extension was implemented to improve services and facilities at Atung Bungsu Airport.

The main issue at Atung Bungsu Airport is the change in the catchment area of the side drainage channels as a result of the runway extension project. This change has caused an increase in water discharge into the side drainage channels. Atung Bungsu Airport is classified as a code 3C airport, which, according to PR 21 of 2023, requires a runway strip width of 140 meters on both sides along the entire runway strip. Currently, Atung Bungsu Airport has a runway strip width of only 75 meters, which does not comply with these regulations. With a runway length of 1,500 meters and the largest aircraft operated being the ATR 72, the airport qualifies as a code 3C reference airport. Therefore, the required runway strip width is 140 meters on both sides along the runway strip.

Based on the above issues, it is necessary to redesign the dimensions of the drainage channels outside the runway strip to accommodate rainwater runoff resulting from the runway extension. Therefore, the author conducted a study entitled:

"REDESIGN OF DRAINAGE CHANNELS ON THE RUNWAY STRIP AT ATUNG BUNGSU AIRPORT, PAGAR ALAM"

The research problems of this study are formulated as follows:

1. What is the design discharge of the drainage channel on the runway strip at Atung Bungsu Airport, Pagar Alam?
2. What are the required dimensions of the drainage channel at Atung Bungsu Airport, Pagar Alam?

METHOD

This research applies a writing method with the following stages:

1. This stage is carried out to review the fundamental theories and equations used in planning the drainage channel dimensions, adjusted to the regulations of the Directorate General of Civil Aviation.
2. Conducting direct observations during the On the Job Training activities at Atung Bungsu Airport, Pagar Alam, South Sumatra.

The sequence of steps in this research is illustrated through a research flowchart, which will be presented in the figure below.

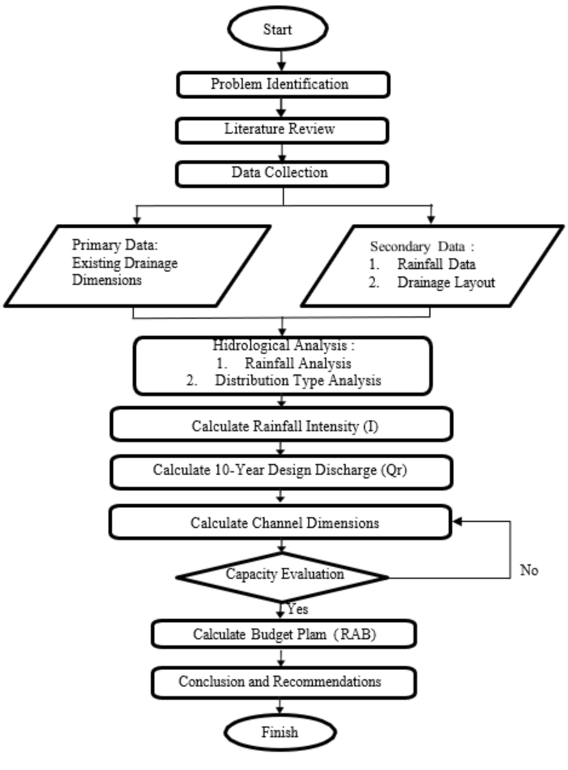

Figure 1 Research Flow Chart

RESULT AND DISCUSSION

Site Plan Airport

The drainage channels at Atung Bungsu Airport, Pagar Alam, South Sumatra, which serve the runway area and its surroundings, function as the main channels designed in accordance with specific technical requirements. Several considerations that form the basis for planning the airport drainage system are as follows:

1. The airport surface area is predominantly covered with hard materials such as concrete and asphalt, causing rainwater to flow directly over the surface without infiltrating into the ground.
2. The airport drainage system must be designed in such a way as to prevent waterlogging in the runway area.

The runway at Atung Bungsu Airport has a length of 1,500 meters with a runway strip of 75 meters from the centerline of the runway. The following is the layout of Atung Bungsu Airport, Pagar Alam, South Sumatra.

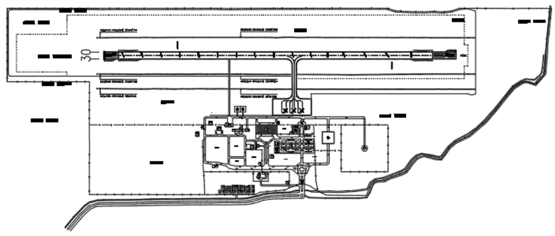

Figure 2 Layout of Atung Bungsu Airport, Pagar Alam
(Source: Atung Bungsu Airport, Pagar Alam)

Catchment Area Calculation

To determine the volume of rainfall, it is necessary to calculate the catchment area using rainfall data from at least the last five years. In this study, the author utilized monthly rainfall data that was processed into annual rainfall data, obtained from the BMKG Observation Post at Atung Bungsu, Pagar Alam, South Sumatra.

Table 1 Rainfall Data (BMKG)

Month	Rainfall (mm)									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
January	212.8	493	138.1	50.9	38	114.1	241.3	284.5	338.9	298.4
February	452	391.7	320	113	234.5	298.5	214	230.7	226.4	254
March	395.3	585.8	254.6	104.5	136	367.9	405	304	331.4	286.2
May	303.1	418.4	293	89.4	183.1	396.5	356.7	417.9	198.1	309.9
June	135.3	302	264	63.3	72.6	264.7	305.4	247.5	264.8	251.5
July	146	178.4	37.5	46.8	58	133	167	135.7	53.2	50.7
August	48.2	182.1	157.8	24.9	32.7	73.4	83.8	133.1	151.4	47
September	56.4	217.9	138	81.3	23.3	48.6	97	170.9	18.9	102.1
October	1	278	185.1	28.9	5.4	136.3	279.5	163.1	2.5	158.9
November	10	368.6	207	57.2	65.2	251.1	272.1	578.1	14.7	236.5
December	397	313.2	220	121.8	112.1	333.6	247	250.1	325.5	323.5
Maximum Rainfall	**452**	**585.8**	**320**	**121.8**	**234.5**	**396.5**	**405**	**578.1**	**338.9**	**323.5**
Total	**2552.1**	**3792.1**	**2327.5**	**834.5**	**1131.1**	**2645.7**	**2723.8**	**3250.2**	**2218.9**	**2607.9**

(Source: BMKG Observation Post, Atung Bungsu, Pagar Alam)

The catchment area is calculated to determine the amount of rainfall at the drainage planning site. This calculation aims to determine rainfall intensity and estimate runoff discharge, which will serve as the basis for the comprehensive and sustainable planning of the drainage system. The calculation of the catchment area is carried out to identify the distribution of rainfall that influences the design of the drainage system. The main objective of this calculation is to determine rainfall intensity and runoff discharge, which will be used in hydrological planning.

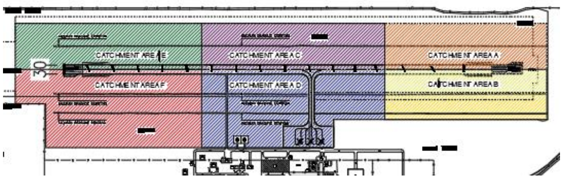

Figure 3 Catchment Area Layout of Atung Bungsu Airport, Pagar Alam
(Source: Atung Bungsu Airport, Pagar Alam)

In the planning of the runway strip drainage system, the catchment area is divided into several sections. The division of the catchment area at Atung Bungsu Airport, Pagar Alam, is presented in the following table:

Table 2 Division of Catchment Area at Atung Bungsu Airport, Pagar Alam

Catchment Area	m^2	Percentage
A	67504	12%
B	61560	10%
C	75013	13%
D	144320	26%
E	76250	13%
F	143800	26%
Total	568430	100%

(Source: BMKG Observation Post, Atung Bungsu, Pagar Alam)

Based on the table above, the total catchment area used for the redesign of the drainage system is 62%. This percentage is the result of the summation of catchment areas B, D, and F. Subsequently, this value is applied in the calculation using the following formula:.

Catchment Area = Total Annual Rainfall × 62%..........(1)

Based on the calculation using the above formula, the results are summarized in the following table:

Table 3 Rainfall Data Based on Catchment Area

Month	Rainfall (mm)									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
January	131.9	305.7	85.6	31.6	23.6	70.7	149.6	176.4	210.1	185.0
February	280.2	242.9	198.4	70.1	145.4	185.1	132.7	143.0	140.4	157.5
March	245.1	363.2	157.9	64.8	84.3	228.1	251.1	188.5	205.5	177.4
May	187.9	259.4	181.7	55.4	113.5	245.8	221.2	259.1	122.8	192.1
June	83.9	187.2	163.7	39.2	45.0	164.1	189.3	153.5	164.2	155.9
July	90.5	110.6	23.3	29.0	36.0	82.5	103.5	84.1	33.0	31.4
August	29.9	112.9	97.8	15.4	20.3	45.5	52.0	82.5	93.9	29.1
September	35.0	135.1	85.6	50.4	14.4	30.1	60.1	106.0	11.7	63.3
October	0.6	172.4	114.8	17.9	3.3	84.5	173.3	101.1	1.6	98.5
November	6.2	228.5	128.3	35.5	40.4	155.7	168.7	358.4	9.1	146.6
December	246.1	194.2	136.4	75.5	69.5	206.8	153.1	155.1	201.8	200.6
Maximum Rainfall	**244.9**	**39.1**	**69.7**	**32.6**	**105.5**	**141.4**	**34.1**	**207.5**	**181.7**	**179.3**
Total	**280.2**	**363.2**	**198.4**	**75.5**	**145.4**	**245.8**	**251.1**	**358.4**	**210.1**	**200.6**

(Source: BMKG Observation Post, Atung Bungsu, Pagar Alam)

Evaluation of Existing Channel

The existing drainage channel on the runway strip at Atung Bungsu Airport has the following dimensions:

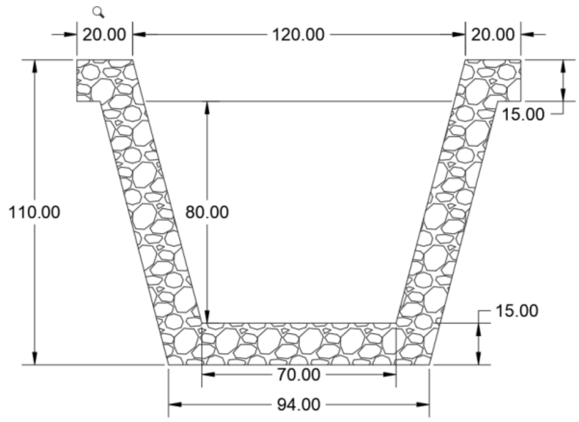

Figure 4 Dimensions of the Existing Drainage Channel at Atung Bungsu Airport, Pagar Alam
(Source: Atung Bungsu Airport, Pagar Alam)

From the figure above, the following specifications are obtained:

T = Channel top width (1.2 m)
B = Channel bottom width (0.7 m)
H = Channel height (1.1 m)
h = Flow depth (0.8 m)
m = Channel side slope
A = Wetted cross-sectional area
P = Wetted perimeter
R = Hydraulic radius
V = Average velocity
Q = Flow discharge
S = Channel bed slope

The following calculations can then be carried out:

1. Calculation of Channel Cross-Section Slope

m = $(T - B)/2$…………..................(2)

= $(1.2 - 0.7)/2$

= 0.25 m

2. Calculation of the Wetted Perimeter Cross-Sectional Area

Fs $= (B + m.h)h$ ……………………..(3)

$= (0.7 + 0.25 \text{ x } 0.8) \text{ x } 0.8$

$= 0{,}72 \text{ m}^2$

3. Calculation of the Wetted Perimeter

Ps $= B + 2h\sqrt{1.m^2}$…………………...(4)

$= 0.7 + 2\,x\,0.8\sqrt{1\,x\,0.25^2}$

$= 2.35$ m

4. Calculation of the Hydraulic Radius

Rs $= Fs/Ps$…………………………....(5)

$= 0.72/2.35$

$= 0.306$ m

5. Channel Bed Slope

S $= \frac{\Delta H}{L}$

$= \frac{25}{1590}$

$= 0.0157$ m

$= 1.57\%$

6. Calculation of the Average Flow Velocity

V $= \frac{1}{n}\ R^{\frac{2}{3}}\ x\ S^{\frac{1}{2}}$………...……………....(6)

$= \frac{1}{0.025} \text{ x } 0.306^{\frac{2}{3}} \text{ x } 0.0157^{\frac{1}{2}}$

$= 2.28\ ^{m^3}/_{sec}$

7. Calculation of the Existing Channel Discharge

Qd $= V \text{ x } Fs$…………………………....(7)

$= 2.28\ x\ 0.72$

$= 1.64\ ^{m^3}/_{sec}$

Calculation of the Maximum Design Discharge

The calculation of the design discharge is the initial step in determining rainfall intensity. To obtain an accurate intensity value, maximum discharge data derived from the design rainfall is required. In this process, rainfall data from at least the last five years is utilized. The rainfall values were obtained from the previously calculated catchment area and are presented in the following table:

Table 4 Calculation of the Maximum Design Discharge

Year	Rainfall X (mm)	$(Xi - \bar{X})$	$(Xi - \bar{X})^2$	$(Xi - \bar{X})^3$	$(Xi - \bar{X})^4$	LogX
2015	280.24	0.1119990	0.0125438	0.001560	0.0001810	2.4475301
2016	368.196	0.28986	0.0839821	0.0191460	0.0027970	2.565016
2017	198.4	-0.2938751	0.0863653	-0.025348	0.0074319	2.2978416
2018	76.154	-0.453500	0.2056625	-0.093972	0.0419413	1.8813808
2019	145.83	-0.1690064	0.0285624	-0.00482	0.0009521	2.1638883
2020	245.83	0.0169904	0.0002883	0.0000048	2.11E-07	2.390543
2021	251.11	0.0396475	0.001571	0.0000624	0.0000024	2.3994617
2022	258.421	0.0228754	0.0005236	0.0000120	0.0000002	2.4126066
2023	210.118	-0.0927592	0.0086075	-0.007406	0.0006849	2.3224059
2024	200.107	-0.0987709	0.0097529	-0.008485	0.0007431	2.3015093
Total	**2328.782**	5.77316E-15	0.395856	-0.0730601	0.0485274	**23.315919**
Avarage	**232.878**					**2.331591**

The table above presents the results of the normal design discharge calculation based on rainfall data from the last 10 years. From this calculation, the discharge value to be used as the basis for the drainage system design is obtained:

X = Maximum Rainfall Value

$\bar{X}$ = Average Maximum Rainfall (10-Year Period)

$\bar{X} = \frac{\sum X}{n} = \frac{2328.8}{10} = 232.88$ mm

Next, the calculation proceeds to determine the average rainfall in logarithmic form ($\log\bar{X}$) using the following equation:

Log $\bar{X} = \frac{23.28}{10} = 2.33$ mm

Subsequently, the values of the Mean (x), Standard Deviation (Sd), Coefficient of Skewness (Cs), and Coefficient of Kurtosis (Ck) are used to determine the type of rainfall distribution at Atung Bungsu Airport.

1. Standard Deviation (Sd)

The formula for the standard deviation (Sd) can be expressed as follows:

Sd $= \frac{\sqrt{\sum(x-xbar)^2}}{n-1}$……………………..(8)

Sd $= \frac{\sqrt{0.359}}{10-1} = 0.2$

2. Coefficient of Skewness (Cs)

The formula for the coefficient of skewness (Cs) is expressed as:

Cs $= \frac{\sum(x-xbar)^3}{Sd^3}\ \frac{n}{(n-1)(n-2)}$……………..(9)

Cs $= \frac{-0.073}{0.2^3}\ \frac{10}{(10-1)(10-2)}$

$= -1.269$

3. Coefficient of Kurtosis (Ck)

The coefficient of kurtosis (Ck) is calculated using the following formula:

Ck $= \frac{\sum(x-xbar)^4}{Sd^4}\ \frac{n^2}{(n-1)(n-2)(n-3)}$………(10)

Ck $= \frac{0.0485}{0.2^4}\ \frac{10^2}{(10-1)(10-2)(10-3)}$

$= 6.022$

From the calculation, the value of the Coefficient of Skewness (Cs) is –1.269, and the value of the Coefficient of Kurtosis (Ck) is 6.022. Referring to the requirements and conditions presented in Table 2.1, it is found that Cs ≠ 0. Therefore, it can be concluded that the type of rainfall distribution used is the Log-Pearson Type III distribution.

Calculation of Log-Pearson Type III

After determining the type of rainfall distribution based on the previous criteria, the next step is to calculate the rainfall using the Log Pearson Type III (LP3) method. The table below shows the K values used in the Log Pearson Type III calculations.

Table 5 K Values in the Log Pearson Type III Calculation Method

Kemencengan (CS)	Periode Ulang							
	2	5	10	25	50	100	500	1000
	Peluang (%)							
	50	20	10	4	2	1	0.5	0.1
3.0	-0.396	0.420	1.180	2.278	3.152	4.051	4.970	7.250
2.5	-0.360	0.518	1.250	2.262	3.048	3.845	4.652	6.600
2.2	-0.330	0.574	1.284	2.240	2.970	3.705	4.444	6.200
2.0	-0.307	0.609	1.302	2.219	2.912	3.605	4.298	5.910
1.8	-0.282	0.643	1.318	2.193	2.848	3.499	4.147	5.660
1.6	-0.254	0.675	1.329	2.163	2.780	3.388	3.990	5.390
1.4	-0.225	0.705	1.337	2.128	2.706	3.271	3.828	5.110
1.2	-0.195	0.732	1.340	2.087	2.626	3.149	3.661	4.820
1.0	-0.164	0.758	1.340	2.043	2.542	3.022	3.489	4.540
0.9	-0.148	0.769	1.339	2.018	2.498	2.957	3.401	4.395
0.8	-0.132	0.780	1.336	1.998	2.453	2.891	3.312	4.250
0.7	-0.116	0.790	1.333	1.967	2.407	2.824	3.223	4.105
0.6	-0.099	0.800	1.328	1.939	2.359	2.755	3.132	3.960
0.5	-0.083	0.808	1.323	1.910	2.311	2.686	3.041	3.815
0.4	-0.066	0.816	1.317	1.880	2.261	2.615	2.949	3.670
0.3	-0.050	0.824	1.309	1.849	2.211	2.544	2.856	3.525
0.2	-0.033	0.830	1.301	1.818	2.159	2.472	2.763	3.380
0.1	-0.017	0.836	1.292	1.785	2.107	2.400	2.670	3.235
0.0	0.000	0.842	1.282	1.751	2.054	2.326	2.576	3.090
-0.1	0.017	0.836	1.270	1.761	2.000	2.252	2.482	3.950
-0.2	0.033	0.850	1.258	1.680	1.945	2.178	2.388	2.810
-0.3	0.050	0.853	1.245	1.643	1.890	2.104	2.294	2.675
-0.4	0.066	0.855	1.231	1.606	1.834	2.029	2.201	2.540
-0.5	0.083	0.856	1.216	1.567	1.777	1.955	2.108	2.400
-0.6	0.099	0.857	1.200	1.528	1.720	1.880	2.016	2.275
-0.7	0.166	0.857	1.183	1.488	1.663	1.806	1.926	2.150
-0.8	0.132	0.856	1.166	1.488	1.606	1.733	1.837	2.035
-0.9	0.148	0.854	1.147	1.407	1.549	1.660	1.749	1.910
-1.0	0.164	0.852	1.128	1.366	1.492	1.588	1.664	1.800
-1.2	0.195	0.844	1.086	1.282	1.379	1.449	1.501	1.625
-1.4	0.225	0.832	1.041	1.198	1.270	1.318	1.351	1.465
-1.6	0.254	0.817	0.994	1.116	1.166	1.200	1.216	1.280
-1.8	0.282	0.799	0.945	1.035	1.069	1.089	1.097	1.130
-2.0	0.307	0.777	0.895	0.959	0.980	0.990	1.995	1.000
-2.2	0.330	0.752	0.844	0.888	0.900	0.905	0.907	0.910
-2.5	0.360	0.711	0.771	0.793	0.798	0.799	0.800	0.802
-3.0	0.396	0.636	0.660	0.666	0.666	0.667	0.667	0.668

(Source: Wijaya, 2017)

Table 5 presents the Kt factor values used in the calculation of design rainfall based on a specific return period. The Kt values play an important role in estimating the magnitude of design rainfall in logarithmic form (Log Xt). Subsequently, these logarithmic values are converted back to actual (non-logarithmic) values to obtain the design rainfall corresponding to the analyzed return period. This process is carried out using the following formula:

$$XT = Log\ (\bar{X} + Kt\ x\ Sd) \qquad (11)$$

From the results of the annual return period calculations using the Log Pearson Type III formula, the conclusions can be summarized in the following table.

Table 6 Maximum Rainfall Calculation Using the Log Pearson Type III Method

Annual Return Period	Xt	Log X̄	Kt	Sd	Log X̄ + Kt × Sd
2 Year	235.83	2.3315391	0.205374	0.200	2.372602
5 Year	315.85	2.3315391	0.839846	0.200	2.499474
10 Year	351.22	2.3315391	1.070433	0.200	2.545583
25 Year	382.01	2.3315391	1.252948	0.200	2.582087
50 Year	397.87	2.3315391	1.341304	0.200	2.599743
100 Year	409.47	2.3315391	1.403699	0.200	2.612227

Maximum Design Discharge Calculation

The results of this rainfall intensity calculation are then used to evaluate whether the current runway strip drainage channel dimensions are still adequate. If they do not meet the required capacity based on the planned rainfall intensity, new channel dimensions must be determined to optimally accommodate the flow discharge. The formula used is as follows:

Given :

Xt	= *R10* = 351.22
A	= 0.349 Km^2
L	= 1590 m
S	= 1.57 %
Transverse Distance	= 175 m
Vo	= 0.4
Vd	= 0.6
α	= 0.25
β	= 1

From the data above, the value of **tc** can be calculated using the following formula:

$$to = \frac{Transverse\ Distance}{Vo} \qquad (13)$$

$$= \frac{175}{0.4}$$

to = 437.50 second

$$td = \frac{L}{Vd} \qquad (14)$$

$$= \frac{1590}{0.6}$$

td = 2650 second

$$tc = to + td \qquad (15)$$

= 437.50 + 2650

tc = 3087.5 second

= 0.86 hour

Once the value of tc is obtained, I10 can be calculated using the following equation:

$$I10 = \left[\frac{R10}{24}\right]\left[\frac{24}{tc}\right]^{\frac{2}{3}} \qquad (16)$$

$$I10 = \left[\frac{351.22}{24}\right]\left[\frac{24}{0.86}\right]^{\frac{2}{3}}$$

I10 = 134.88 mm/hour

The design runoff discharge for the next 10-year period (Qr) can be calculated using the following equation:

Qr = α x β x I x A..(17)

Qr = 0.25 x 1 x 134.88 x 0.349

Qr = 3.27 $^{m3}/_{second}$

Based on the calculations, the existing channel discharge at Atung Bungsu Pagar Alam Airport is 1.64 m³/s, while the design discharge (Q10) calculated for a 10-year return period is 3.27 m³/s. The channel requirements are as follows:

Jika Qd < Qr = Not Sufficent
Jika Qd > Qr = Sufficent
1.64 $^{m3}/_{second}$ > 3.27 $^{m3}/_{second}$
(Not Sufficent)

Based on the evaluation results, it can be concluded that the existing drainage channels at Atung Bungsu Pagar Alam Airport are insufficient to accommodate the design discharge for a 10-year return period rainfall. Therefore, the proper and efficient approach is to redesign the runway strip drainage channels so that the channel dimensions can adequately handle the discharge for a 10-year return period rainfall.

Design Calculation of Channel Dimensions

The capacity of the U-ditch channel is calculated through a series of trial-and-error processes, taking into account variations in width, height, and the planned diameter, fabricated according to the following specifications:

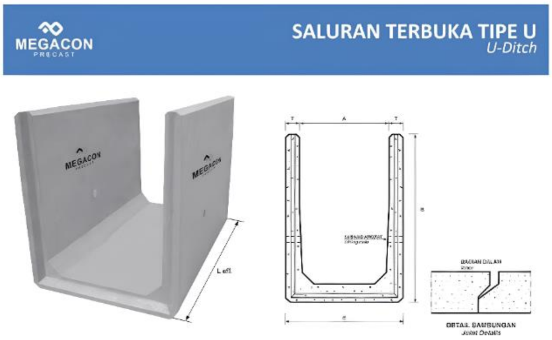

Figure 5 U-Ditch Channel Layout
(Source: PT. Megacon Bangun Persada, 2025)

Table 8 Precast U-Ditch Concrete Specifications

Width (mm)	Depth (mm)	A (mm)	B (mm)	C (mm)	T (mm)	L (mm)	Weight (Kg)
600	800	870	740	740	70	1200	522
700	600	694	700	840	73	1200	520
700	700	800	840	840	70	1200	564
700	800	900	840	840	70	1200	601
700	900	1000	840	840	70	1200	642
700	1000	1100	840	840	70	1200	698
800	600	794	700	940	73	1200	575
800	700	798	800	940	71	1200	616
800	800	900	940	940	70	1200	657
800	1000	1100	940	940	70	1200	738
800	1200	1300	940	940	70	1200	839
1000	1000	1000	1210	1180	100	1200	1124
1000	1100	1000	1210	1180	90	1200	1128
1000	1200	1000	1310	1180	90	1200	1259
1000	1400	1000	1510	1180	90	1200	1398
1100	1000	1166	1130	1390	112	1200	1108
1100	1100	1100	1210	1280	90	1200	1160
1200	1200	1200	1330	1390	95	1200	1629
1200	1400	1200	1530	1390	95	1200	1790
1200	1600	1200	1730	1390	95	1200	1962

(Source: PT. Megacon Bangun Persada, 2025)

Notes :
L = Length of the U-Ditch channel
b = Width of the U-Ditch channel
H = Height of the U-Ditch channel
W = Height of the U-Ditch curb
h = Height of the U-Ditch wetted cross-section
n = Manning's roughness coefficient
S = Slope of the U-Ditch base soil

For a planned width of 1 m and a planned height of 1 m, the discharge is obtained from the following calculation:

$$Qs = b\ x\ h\ x \left[\frac{1}{n}\ x \left(\frac{b.h}{b+2h}\right)^{\frac{2}{3}} x\ S^{\frac{1}{2}}\right] \text{......................(18)}$$

$$Qs = 1\ x\ 1\ x \left[\frac{1}{0.015}\ x \left(\frac{1\ x\ 1}{1+2x1}\right)^{\frac{2}{3}} x\ 0.0157^{\frac{1}{2}}\right]$$

Qs = 4.01 $^{m3}/_{second}$

3.27 $^{m3}/_{second}$ < 4.01 $^{m3}/_{second}$ (Sufficent)

Drainage Channel Construction

The concrete used meets the provisions of the Director General of Civil Aviation Decree Number 14 of 2021, which specifies medium-strength concrete with a compressive strength of fc < 45 MPa. In this project, medium-strength K-350 concrete is used, which is known for its excellent durability and strength.

Taking all these aspects into consideration, the drainage channel design for Atung Bungsu Pagar Alam

Airport is planned with a width of 1 meter and a height of 1 meter, as shown in the following figure.

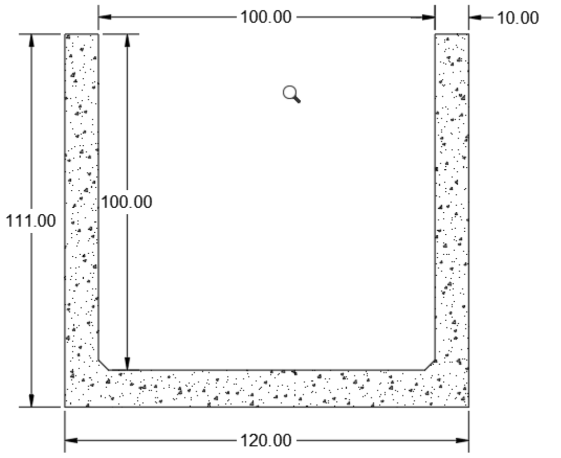

Figure 6 Planned Dimensions of the U-Ditch Channel

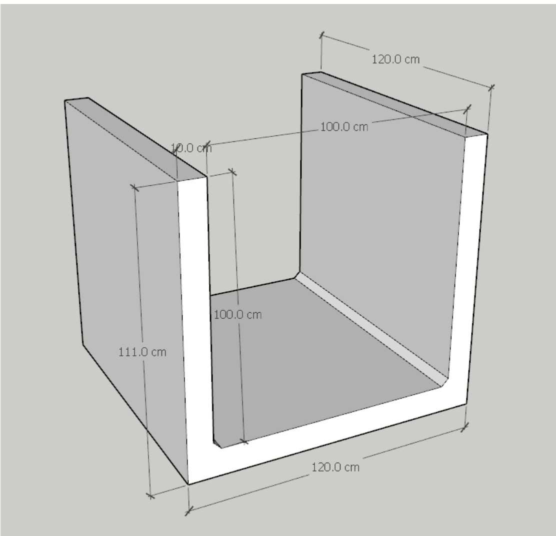

Figure 7 Planned U-Ditch Channel Dimensions in 3D

CLOSING

Conclusion

Based on the calculations and analyses carried out, the following conclusions can be drawn:

1. Based on the calculations using the rational method, which considers the design rainfall intensity, catchment area, and runoff coefficient, it was found that the design discharge of the drainage channel in the runway strip area of Atung Bungsu Airport is 3.27 m^3/s.
2. Based on the results of the design discharge calculations and the hydraulic analysis conducted, the most suitable dimensions for the drainage channel to convey rainfall runoff in the runway strip area of Atung Bungsu Pagar Alam Airport were determined to be a channel height of 1 meter and a channel width of 1 meter. These dimensions are considered capable of effectively accommodating the design discharge while meeting the technical standards for airport drainage system planning.

Advice

From the above conclusions, the following suggestions are provided:

1. Future research can incorporate a Method of Working Plan to support the implementation of tasks and ensure workplace safety at the airport.
2. In future planning, it is recommended to include systematic calculations of channel elevations to ensure the continuity of gravity flow and prevent potential backflow, especially in downstream areas or outlet channels.

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