

PLANNING OF SERVICE ROAD THICK PAVEMENT FROM THE NEW TERMINAL TO THE CARGO TERMINAL AT H.HASAN AROEBOESMAN AIRPORT ENDE

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Abstract

H.Hasan Aroeboesman Ende Airport Class II is managed by the Ministry of Transportation which is located in Ende district, East Nusa Tenggara province. H.Hasan Aroeboesman Ende Airport has a runway dimension of 1650mx30m with the largest operating aircraft, namely ATR 72-600. At this time H.Hasan Aroeboesman Ende Airport does not yet have a Service Road that connects the new terminal with the old terminal which is now being converted into a terminal cargo. additional supporting facilities in the form of a Service Road using flexible pavement which functions as an operational road for the Ground Support Equipment team in order to improve the security and safety aspects of flight operations which are urgently needed at H. Hasan Aroeboesman Ende Airport. This Service Road planning study uses the component analysis method which refers to the calculations of SNI-1731-1989-F. to determine the width of the Service Road according to the needs to be planned. Then determine the thickness of the pavement design and the strength of the pavement required at the time of planning. And determine the budget plan that will be needed in the Service Road planning process at H. Hasan Aroeboesman Ende airport. The unit price of work refers to SNI and PM 78 of 2014. For the results of the analysis and calculations that have been carried out, the length of the inspection road is 150 m with a width of 4 meters, the thickness of the individual inspection road pavement is 45 cm with a surface course layer thickness of 5 cm, a base course of 20 cm, and a subbase course of 20 cm, and the total price for planning the construction of the inspection road is 390,1 million rupiah.

Key word: Airport, Service Road, component analysis method, Flexible Pavement Thickness

INTRODUCTION

H. Hasan Aroeboesman Ende Airport was previously named Ipi Airport because it is located in Ipi bay. In more detail, it is located in the Tetandara sub-district, South Ende subdistrict, Ende Regency. Geographically it is located at the coordinates 08°50' 52" S 121°39' 47" E which was built in 1974 and managed by the Regional Government of Ende Regency. In 1985 the Regional Government of Ende Regency handed over to the Directorate General of Civil Aviation the status of a class V Pioneer Airport with a runway length of 400 m x 30 m (Lapen Construction). Then in 1992 there was a name change from Ipi Airport to Haji Hasan Aroeboesman Ende Airport.

In order to optimize flight security and safety, it is necessary to have a Service Road as a security and safety facility in flight operations. For the time being, Ground Support Equipment activities themselves still use the old Service Road where the road is also used as a passenger access road from the terminal to the plane or vice versa, which does not rule out the possibility of disrupting

Ground Support Equipment (GSE) operations. Currently at Ende Airport, construction of a new terminal is being carried out. The work on the new terminal also includes work on creating a Service Road for the new terminal. Then the old terminal was converted into a Cargo terminal. By planning a Service Road facility that can connect the new terminal

with the Cargo terminal, it will have a big impact on passenger comfort. Especially in terms of safety during flight operational hours. and planning a Service Road that connects the new terminal to the Cargo terminal will make the job of Ground Support Equipment easier

The problem formulation of the problem is as follows:

1. What is the pavement structure and the calculation of the thickness of the Service Road pavement from the new terminal to the cargo terminal at H. Hasan Aroeboesman Ende Airport?
2. What is the required cost to plan the Service Road from the new terminal to the cargo terminal at H. Hasan Aroeboesman Ende Airport?

METHODS

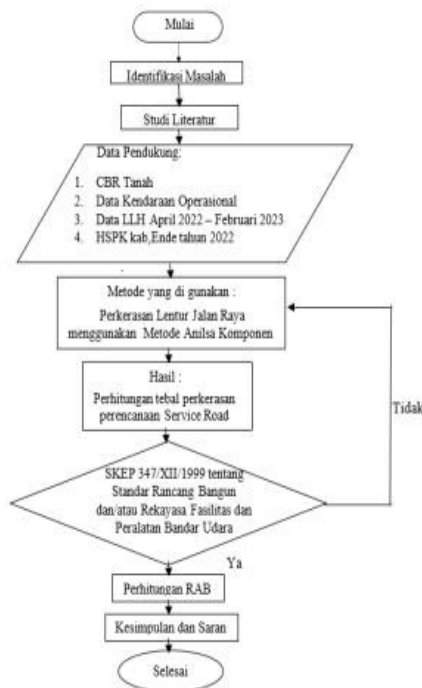


Figure 1 Research Flow Chart

Determine the life of the plan

This study also used data. For the service road planning age at H. Hasan Aroeboesman airport, it is planned for 20 years from 2023 to 2043. So the time needed for the planning and construction period is 1 year.

Determining Traffic Development

Due to the growth factor of vehicles at the H.Hasan Aroeboesman Ende airport is very small. So the traffic development factor is assumed to be 1% per year.

Determine the average daily traffic

The average daily traffic in 2022 that will pass through the Service Road at H.Hasan Aroeboesman Ende airport is in the table below:

Table 1 Daily traffic values for Service roads

No	Jenis Kendaraan	LHR per hari 2 arah
1	Mobil Inspeksi	4
2	Mobil BTT	8

Determining the Vehicle Distribution Coefficient

In planning the Service Road at H.Hasan Aroeboesman Ende Airport, the distribution coefficient for each vehicle in the form of small transport and large transport, so that the transport distribution coefficient (C) is 1,000 for small transport and large transport. This value is chosen based on the number of lanes and types of vehicles passing in accordance with the vehicle distribution coefficient

Calculating Equivalent numbers

Angka ekivalen (E) dan untuk beban The vehicle axes can be seen in the table below. From this table, an equivalent number can be determined based on the load of the vehicle which will later operate on the Service Road at H.Hasan Aroeboesman Ende airport which will be planned, calculated from the location of the vehicle's center of gravity when delivering to wheels (single axle) or rear (single/double axle).

Table 2 Equivalent Figures (E) Vehicle Axle Load

Beban Sumbu		Angka Ekivalen	
Kg	Lbs	Sumbu Tunggal	Sumbu Ganda
1000	2205	0,0002	-
2000	4409	0,0036	0,0003
3000	6614	0,0183	0,0016
4000	8818	0,0577	0,0050
5000	11023	0,1410	0,0121
6000	13228	0,2933	0,0251
7000	15432	0,5415	0,0466
8000	17637	0,9238	0,0794
8160	18000	1,0000	0,0860
9000	19841	1,4798	0,1273
10000	22046	2,2555	0,1940
11000	24251	3,3022	0,2840
12000	26455	4,6770	0,4022
13000	28660	6,4419	0,5540
14000	30864	8,6447	0,7452
15000	33069	11,4184	0,9820
16000	35276	14,7815	1,2712

Calculate LEP

The initial equivalent traffic calculation process uses the formula:

$$LEP = \sum LHR \text{ start} \times C \times E$$

Table 3 Initial Equivalent Path

KENDARAAN	LHR	E	C	LEP
Mobil Inspeksi	7.672,4	0.0002	1	3,461
Mobil BTT	15.344,7	0.0002	1	6,922
LEP				10,4

Computes the final equivalent path

To calculate the initial equivalent traffic, a formula is used:

$$LEA = \sum LHR \text{ end} \times C \times E$$

Table 4 Final Equivalent Path

KENDARAAN	LHR	E	C	LEA
Mobil Inspeksi	8475,1	0.0002	1	3,823
Ambulans	16950,1	0.0002	1	7,646
LEA				11,5

Calculating LET

$$LET = 1/2 (LEP + LEA)$$

$$LET = 1/2 (10,4 + 11,5)$$

$$LET = 11$$

Calculate LER

$$LER = LET \times FR$$

$$LER = 11 \times 0,5$$

$$LER = 5,5$$

Calculating the pavement thickness index (ITP)

Before determining the pavement thickness index, first determine the following:

- Determine the CBR of the base soil To plan the thickness of the Service Road pavement at H. Hasan Aroeboesman Ende Airport, embankment soil was used as the base soil with a CBR value of 7%. If it has not reached 7%, the soil must be stabilized by compaction until it reaches 7% CBR.
- Determining FR Regional Factors Regional factors are determined through evidence of annual rainfall, the slope at H. Hasan Aroeboesman Ende Airport, and the percentage of heavy vehicles passing on the planned Service Road. The following is rainfall by month and station in the

Province of East Nusa Tenggara, Ende in 2017, 2018 and 2022.

Table 5 East Nusa Tenggara Ende Rainfall

Bulan dan Jumlah	Curah Hujan (mm)		
	2017	2018	2022
Januari	229.80	206.10	192.00
Pebruari	328.80	153.20	94.30
Maret	132.40	196.40	54.60
April	316.00	45.50	19.30
Mei	27.10	13.80	0.40
Juni	63.70	5.60	36.10
Juli	110.10	50.10	-
Agustus	7.60	167.80	6.20
September	1.70	2.10	-
Oktober	96.90	-	6.30
November	18.60	347.30	132.61
Desember	106.20	111.60	26.70
Jumlah	1439.00	1299.50	568.51

Based on the regional factors in table 2.2, the regional factor obtained is 0.5 and for the results this value follows the annual rainfall data included in Climate I, the slope at H. Hasan Aroeboesman Ende Airport <6%

- Determination of IPT is determined from road classification and planned equivalent traffic (LER). The planned Inspection Road is classified as a local road because the Service Road is 4 m wide. Based on the calculation results, the LER value is 5.5. So that the surface index at the end of the design life (Ipt) = 1.0- 1.5 is obtained.
- ensure Initial Surface Index (IPO) Determination of the initial surface index can be determined in table 2.4. The inspection road planned using the LASTON surface arrangement with roughness (mm/km) > 1000 obtained Ipo = 3.9-3.5.
- Determining DDT The bearing capacity of subgrade soil (DDT) is determined based on the DDT and CBR correlation diagram. CBR of basic soil is 7%. From Figure 4.2, the correlation between CBR and DDT means that the DDT value = 5.2

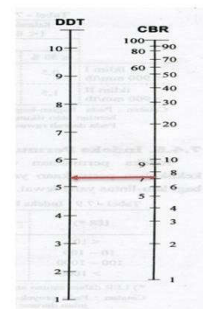


Figure 1 Correlation of CBR with DDT

f. Determining the Nomogram Determination of

the nomogram is obtained from:

$$ITP = 3.$$

$$IP_0 = 3,9$$

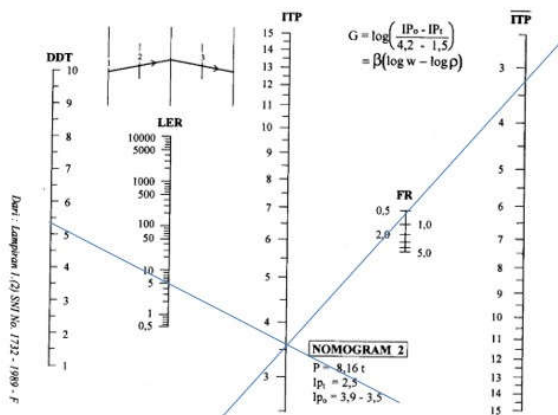
$$CBR = 7\%$$

$$DDT = 5,2$$

$$FR = 0,5$$

$$LER = 5,5$$

By looking at Nomogram 2, the IPT value is obtained = 3.8



Gambar 2 Nomogram 2

Establishing Service Road Pavement Structure Planning

Pavement Layer Arrangement

a. The pavement arrangement is determined from the relative coefficient. The pavement arrangement is as follows: Lapisan permukaan (Surface Course) digunakan Laston (Lapisan Aspal Beton) MS 340 dengan nilai $a_1 = 0,3$.

b. The top foundation layer (base course) used class B crushed stone with a value of $a_2 = 0.14$.

c. The sub base course is used for grade C sandstone with a value of and $a_3 = 0.11$.

a) Determine the thickness of the pavement

a. Surface Coating (D1)

The thickness of the surface layer (D1) is determined from the minimum thickness of the surface layer. Based on the ITP value of 3.7, the minimum thickness of the surface layer is obtained = 5 cm with Laston material (MS 340) and a relative coefficient of $a_1 = 0.3$.

b) Base course layer (D2)

The thickness of the base layer (D2) is determined from the minimum thickness limit of the foundation arrangement on. based on the ITP value of 3.7, it is obtained that the minimum thickness of the top foundation arrangement = 20 cm with class A crushed stone material and a relative coefficient of a 2 = 0.14.

c) Sub base Course Layer (D3)

The thickness of the sub base course layer (D3) is at least 2 cm for each ITP value with grade C sirtu material and a relative coefficient $a_3 = 0.11$. In addition, the thickness of the sub base course can be determined using the equation:

$$ITP = a_1.D1 + a_2.D2 + a_3.D3$$

$$3.7 = (0.3 \times 5) + (0.14 \times 20) + (0.11 \times D3)$$

$$D3 = -12 \text{ cm}$$

For each ITP value when using the subbase.

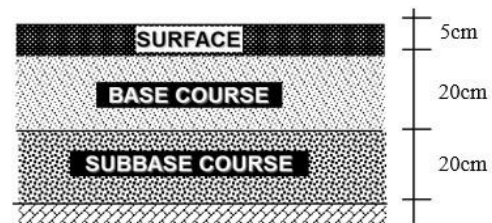
Minimum thickness is 10 cm

$D3 = 20 \text{ cm}$ So the thickness of the Service Road pavement

$$= D1 + D2 + D3$$

$$= 5 + 20 + 20$$

$$= 45 \text{ cm}$$



Gambar 3 Tebal Perencanaa Perkerasan Service Road

Calculation of Cost Budget Plan

Planning for service road pavement thickness is followed by calculating the budget plan after the road structure is planned. Preliminary work and road service work are types of work stipulated in the RAB. The prices of goods listed refer to the unit price of Pm 78 of 2014. The following are the results of the Budget Plan for Service Road and Back Up Volume planning costs which can be seen in the following table:

Table 3 Cost Budget Plan
NOURAIAN PEKERJAAN VOLUME SATUAN
HARGA (Rp.) JUMLAH

1	2	3	4	SATUAN	5	6
I	PEKERJAAN	600.	m		Rp	Rp
1	PERSIAPAN	00	2		16.000.00	9.600.000.00
	Pek. Pembersihan Lapangan dan Pembersihan					
2	Pek. Pengukuran dan Pemasangan Bowplank	308.	m	00	1	Rp 94.255.00 Rp 29.030.540.00
3	Papan Proyek	1.00	b	h	Rp 396.594.00	Rp 396.594.00
4	Mobilisasi Alat dan Bahan	1.00	ls		50000000.00	Rp 50.000.000.00
					SUBTOT AL	Rp 89.027.134.00
II	PEKERJAAN GALIAN					
1	Pek. Konvensi	600.	m		Rp	Rp
2	Pemadatan Tanah	00	3		64.980.00	38.988.000.00
	Pek. Galian Tanah	236.	m	25	2	Rp 50.705.00 11.979.056.25
					SUBTOT AL	Rp 50.967.056.25
I	PEKERJAAN	126.	m		Rp	Rp
I	BERBUTIR	84	3		533.796.00	67.706.680
1	Pek. Urugan Sirtu kelas C - Sub Base Course 20 cm					4.64
2	Pek. Pematatan Tanah Konvensional	126.	m	84	3	Rp 64.980.00 Rp 8.242.063.20
					SUBTOT AL	Rp 75.948.747.84
I	PEKERJAAN	126.	m		Rp	Rp
I	ASPAL	84	3		729.521.00	92.532.440
1	Pek. Urukan Batu Pecah Kelas B (AC-Base) -					3.64

	Base Course 20 cm					
2	Pek. Lapis Resap Pengikat Aspal Cair (prime coat)	634.	lt	20	Rp 4.031.00	Rp 2.556.460.20
3	Pek. Laston Lapis Aus (AC-WC) - Surface 5 cm	31.7	m	1	3	Rp 1.275.257.00 SUBTOT AL
						Rp 40.438.399.47
						Rp 135.527.303.31
					TOTAL	Rp 351.470.241.40
					PPN 11% TOTAL	Rp 38.661.726.55
						Rp 390.131.967.95
					DIBULATKAN	Rp 390.132.000.00

CLOSING Conclusion

according to the analysis and results of calculations carried out on the previous problem so that it can be concluded that:

1. Based on field observations of current conditions, connecting the new terminal with the old terminal which is now being converted into a cargo terminal at H. Hasan Arorbosman Ende Airport will have an important impact on safety and security in flight operations, especially the ground support equipment team. With this calculation we find the dimensions by thickness of each stack:

- 1) Surface Course: 5 cm
- 2) Base Course: 20 cm
- 3) Sub Base Course : 20 cm

For the costs required to build an inspection road at H.Hasan Aroeboesman Ende Airport amounting to 390,132,000.00 (Three hundred and ninety million one hundred thirty-two thousand)

Suggestion

Based on the conclusions that the author has written above, the following suggestions emerge:

1. Management of H.Hasan Aroeboesman Ende Airport should immediately carry out the construction of a Service Road for safety and security during flight operating hours, especially for the safety of the ground support equipment team.

2. Future research is also expected to use more sources to find references using all available techniques.
3. Further research can include geometric design calculations by considering the existing elevation.

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