PAVEMENT PLANNING OF ACCESS ROAD FOR DPPU PERTAMINA VEHICLES FROM THE POST TO THE APRON AT H. HASAN AROEBOESMAN ENDE AIRPORT

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ABSTRACT

H. Hasan Aroeboesman Ende Airport is in Tetandara village, South Ende sub-district, Ende Regency, East Nusa Tengara Province. One of the facilities at H. Hasan Aroeboesman Ende Airport is Pertamina's DPPU. Currently, the access road for DPPU vehicles is not suitable for use and does not have pavement. This access road is 90m long and 4m wide, until now Pertamina's DPPU vehicles going to the apron still pass through the runway.

The method used in the Pertamina DPPU Vehicle Access Road Planning is the component analysis method to determine the thickness of the layer to be used. While the determination of the budget plan uses the reference Unit Price Analysis of East Nusa Tenggara Province in 2023.

Based on the calculation results of the component analysis method, the thickness of the road surface planned for Pertamina DPPU vehicles is 40 cm, the thickness of the surface layer is 5 cm, the top layer is 15 cm, and the bottom layer is 20cm. Based on the regulations contained in SKEP 347 of 1999, the calculation of the thickness of the pavement is selected in accordance with the regulations. then for the total Budget Cost required for the planning work of the Pertamina DPPU vehicle access road is Rp 190,000,000 (spelled out: one hundred ninety million rupiah).

Keywords: Airport, Access Road, Component Analysis, Pavement Thickness.

INTRODUCTION

H. Hasan Aroeboesman Ende Airport was previously named ipi Airport because it is in ipi bay, more details are in Tetandara village, South Ende sub-district, Ende Regency, H. Hasan Aroeboesman Ende Airport is a class II airport in Indonesia. One of the technical facilities at H. Hasan Aroeboesman Ende Airport is Pertamina's DPPU. DPPU itself stands for Aircraft Filling Depot. DPPU is a facility that receives, stores, and distributes fuel oil and non-fuel oil at airport services to support the implementation of aircraft refueling services. There needs to be an access road for Pertamina's DPPU Technical and Operational vehicles from the DPPU post to the apron.
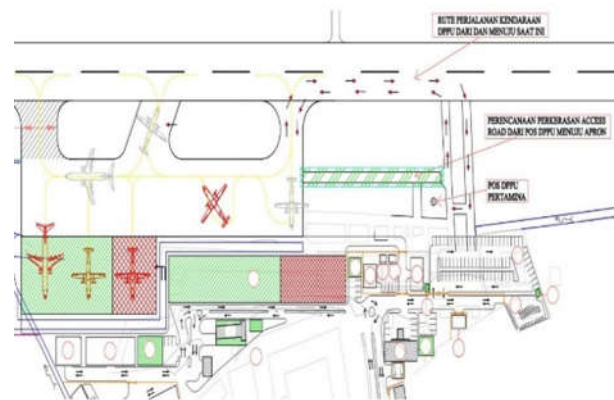
Gambar *1. 1 Layout planning*

Problem Formulation

Based on this background, the following problems can be formulated:

1. How thick is the pavement structure of the access road from the Pertamina DPPU post to the apron?
2. What is the Budget Plan for Pertamina DPPU vehicle access road pavement planning at H. hasan Aroeboesman Ende Airport?

Problem Objective

The purpose of writing this article is as a learning stage in calculating the design of flexible pavement layers using the Component Analysis Method. Planning objectives based on the formulation of the problem of making access roads can be described as follows:

1. Can calculate the thickness of the pavement structure of the Pertamina DPPU Vehicle access road to the apron at H. Hasan Aroeboesman Ende Airport.
2. Can calculate the estimated budget plan for planning access road for Pertamina DPPU vehicles at H. Hasan Aroeboesman Ende Airport.

METHODS

The research methodology used to plan the Pertamina DPPU vehicle access road at H. Hasan Aroeboesman Ende Airport is as follows.

1. Through a literature study which aims to become a theoretical basis based on existing regulations and rules, as well as from internet social networks that are used as references in the preparation of the Final Project.
2. Through observation aims to find out the situation directly in the field, know and understand the existing conditions so that the information needed for research is obtained. Observations were made directly during on the job training at H. Hasan Aroeboesman Ende Airport.

3. Through data collection provided by H. Hasan Aroeboesman Ende Airport on the issues raised. This data will then be used as a design calculation document or design planning.

The following is the sequence of research presented in the research flow chart as below:
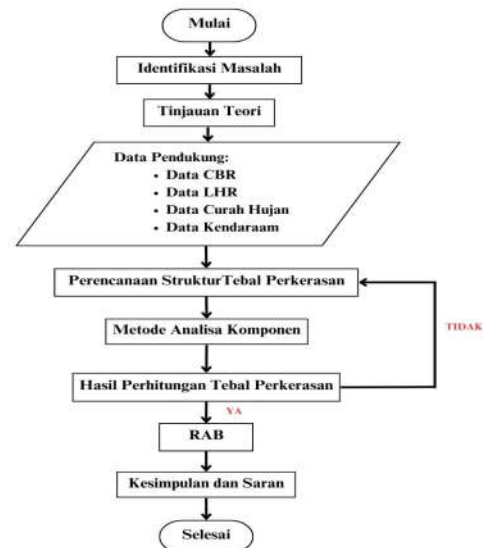

Figure 1 *Research flowchart*

Data Collection

In this secondary data collection process, there are several steps to obtain the desired data and data collection is carried out directly from the airport as follows:

1. Subgrade CBR
2. Rainfall data
3. Daily traffic data
4. Passing vehicle data

Data Analysis

Data analysis is the process of identifying data based on secondary data collected. The data analysis process is intended to obtain the desired and effective problem solving.

Component Analysis Method

According to the component analysis method when planning pavement thickness the following things should be considered:

1. Bearing Capacity of Subgrade

    Soil bearing capacity is the scale used in the graph to determine the pavement graph

to express the strength of the subgrade through the graph. Correlation of Soil Bearing Capacity (DDT) and California Bearing Ratio (CBR)
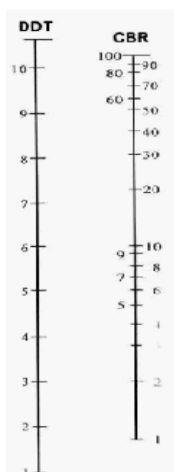

Figure 2. 1 Correlation Graph of DDT and CBR

2. Number of Lanes and Plan Coefficient

The lane designated for vehicles is one of the traffic lanes of a section with the highest traffic volume. The vehicle distribution coefficient (C) for light and heavy vehicles traveling on the planned:

3. Traffic Volume

Traffic volume is the number of vehicles passing through an observation point on a route in a unit of time to capture traffic volume. daily traffic volume is the average number of vehicle traffic volumes passing within 24 hours with the following formula:

$$LHR_{(permulaan/\,akhirUR)} = \sum LHR_{j(data)} \times (1+i)^n$$

Description:

LHR : average daily traffic (vehicle/day/direction)
J : Vehicle Type
N : plan life or development period
I : Traffic development factor

4. Equivalent Number (E)

The equivalent number shows the degree of damage to the track due to the axis load of each passing vehicle. To determine the equivalent number can be determined from the following table.

5. Initial Equivalent Traffic (LEP)

LEP is the daily equivalent cross-axis weight of vehicles traveling on the planned route at the beginning of the plan life or can be understood as the number of equivalent cross-vehicles when the road is newly opened (the beginning of the plan life). The formula is as follows:

LEP = LHR x C x E

Description:

- LEP : Initial equivalent traffic
- LHR : Average daily traffic
- C : Vehicle distribution coefficient
- E : Equivalent axle load plan

6. Final Equivalent Traffic (LEA)

LEA is the daily equivalent axle weight of vehicles traveling on the planned route at the planned life or can be understood as the traffic height at the end of the planning period.

LEA = LEP x C x E

Description:

- LEP : Equivalent Traffic
- C : Vehicle Distribution Coefficient
- E : Equivalent Axis Load Plan

7. Middle Equivalent Traffic

LET is the equivalent daily axle weight of a vehicle traveling on the plan route at the middle of the plan life, with the following formula:

LET=(LEP+LEA)/2

Description:

- LET : Center Equivalent Traffic
- LEA : Cross Equivalent End
- LEP : Initial Equivalent Crossing

8. Plan Equivalent Traffic (LER)

LER to determine the results used in the nomogram of road surface classification on the plan or the amount of equivalent traffic used in the road plan to be made.

The formula for determining the plan equivalent traffic:

LER = LET x FP

Formula for determining the value of the adjustment factor:

FP=UR/10

Description:

LER : Cross Equivalent Plan

LET : Center Equivalent Crossing

FP : Adjustment Factor

UR : Age of Plan

9. Regional Factor (FR)

Regional factors are factors of the surrounding area related to soil and climate conditions, which affect load conditions, bearing capacity of subgrade and pavement.

$$\frac{Number\ of\ Heavy\ Vehicles}{Total\ number\ of\ vehicles} x\ 100\%$$

10. Surface index

Surface index is the average value of a surface and how strongly it affects the service to the traffic passing over it. To determine the PI at the end of the design life, certain factors need to be considered, namely the road functional classification coefficient and the number of equivalent horizontal lines.

11. Relative Strength Coefficient (a)

The relative strength coefficient (a) of each material and its use as a surface layer, top foundation and sub-base layer is determined by correlation according to Marshall test values. The compressive strength or CBR for the lower foundation layer uses the relative strength coefficient table from the 1987 Manual on Flat Pavement Thickness Using Component Analysis.

12. Thickness of Pavement Layer

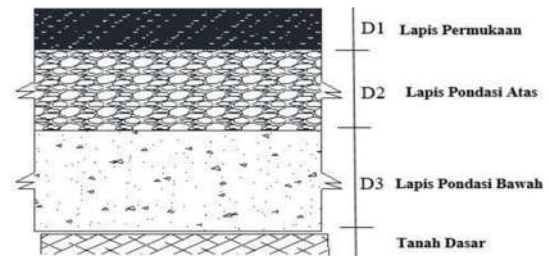The thickness of the pavement layer can be calculated using the equation below:

Figure *2. 2 Pavement Layer Arrangement*
(Source: *SKBI 2.3.26.1987*)

For the pavement layer arrangement will be

- Surface layer

  ITP = a1.D1

  D1 = ??

- Top foundation layer

  ITP = a1. D1+ a2.D2

  D2 =??

- Lower foundation layer

  ITP = a1. D1+ a2. D2+ a3.D3

  D_3 =??

From the calculation of the pavement thickness of each layer, it is necessary to make corrections to the minimum pavement thickness specified in **LIST VIII BINA MARGA, 1987.**

13. Vehicle Plan

Based on observations of the estimated number of vehicles passing through the planned road, the airport operational vehicles that will pass through the planned road are as follows:

- Isuzu Refueller Truck (12000 liters) (26 tons)
- Hino Refeuller Truck (12000 liters) (26 tons)
- Mower Tractor Grass Cutter (3 tons)
- Inspection Car (4 tons)

RESULT AND DISCUSSION
Component Analysis Method

Determination of Pavement Thickness When Planning Flexible pavement access road vehicle DPPU Pertamina at H. Hasan Aroeboesman Ende Airport Using component analysis method. "Bina Marga - 1987"

1. Determining the Plan Life

    Determine the planning period of the DPPU vehicle flexible access road is 20 years, starting from 2023 to 2043.

2. Determine the soil CBR.

    H. Hasan Aroeboesman Ende Airport uses soil with a CBR value of 7.5% in road flexural pavement planning.

3. Determining Traffic Development

    Because the growth factor of operational vehicles at H. Hasan Aroeboesman Ende Airport is very small, the traffic development factor on the access road is 3% per year.

4. Determine the planned vehicle

    Vehicles that are planned to pass on this access road are Isuzu refueller, Hino refueller, lawn mower, inspection car.

5. Determine average daily traffic

    The total number of average daily traffic (LHR) at H. Hasan Aroeboesman Ende Airport is 12 vehicles / day / direction.

6. Equivalent Number (E)

    The Equivalent Number (E) and the vehicle axle load of each wheel of this vehicle can be determined based on the weight of the operational vehicle axle load that operates and passes on the access road to be made is 7.061.

7. Determining the Path and Vehicle Distribution Coefficient (c)

    The value of the vehicle distribution coefficient is determined based on the percentage of vehicles in the planned lane and lane direction to the number of vehicles that will pass on the Pertamina DPPU vehicle access road. For H. Hasan Aroeboesman Airport, which is 4 lanes in 2 directions.

8. Setting the Initial Equivalent Traffic (LEP)

    From the results of the above calculations, the results obtained for the initial equivalent cross (LEP) are 6.4076476.

9. Determining the Final Equivalent Traffic (LEA)

    From the above calculations, the final equivalent cross (LEA) is: 7.6242888.

10. Determining the Mean Equivalent Cross (LET)

    From the above calculations, the result of the mean equivalent cross (LET) is: 8,7577733

11. Determining the Plan Equivalent Cross (LER)

    From the results of the above calculations, the results obtained from the cross equivalence are: 17,5155.

12. Determining the Regional Factor

    From Ende City rainfall data for access roads with slope I < 6% and percentage of heavy vehicles > 30% with an area factor of 2.0.

13. Determine the Index / Surface Weight at the beginning of the Plan (IP0)

14. Determination of the initial start-up index can be determined by selecting the type of access road pavement layer to be planned in table 2.6. The access road is planned to use LASTON surface layer with roughness > 1000 obtained IPo = 3.9 - 3.5 according to table 2.6.

15. Determine the area index at the end of the plan time IPt.

16. According to the calculation results of the Plan Equivalent Traffic (LER), the surface index obtained at the end of life is 2.

17. Determining Soil Supportability

    The soil bearing capacity is determined by the existing CBR value of 7.5, the DDT value is determined as follows.

$$DDT = 4.3 \log CBR + 1.7$$
$$4.3 \log (7.5) + 1.7$$
$$DDT = 5.50$$

18. Determining the Nomogram

    Correlate the ITP nomogram with the following data.

$$IPt = 2$$

IP0 = 3.9 - 3.5
CBR = 7.5
DDT = 5.50
FR = 2
LER = 14.03

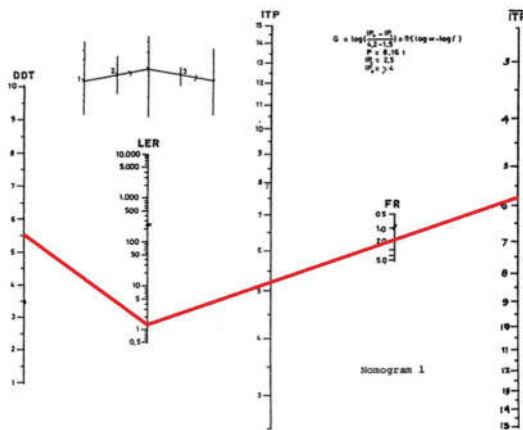To determine the ITP value from the data above, it can be determined using the nomogram as follows.

Figure *4. 1 Finding the ITP value using the nomogram*

By looking at the Pavement Thickness Index Nomogram below, the ITP value of 5.7 is obtained.

19. Access Road Pavement Structure Planning
  a) Pavement Layer Arrangement
    The arrangement of the planned access road pavement layers is determined from the coefficients in table 2.6 based on the calculation data obtained. The arrangement of the pavement is:
    - Surface Course (a1) used when planning is Laston (Concrete Asphalt Layer) MS 340 with a relative coefficient a1 = 0.30.
    - Base Course (a2) used in the planning is Class C crushed stone with a CBR value of 60% and a relative coefficient a2 = 0.12.
    - The Subbase Course used in the planning is C grade Sirtu (Sandstone) with a CBR value of 30% and a relative coefficient a3 = 0.11.
  b) Determining Pavement Thickness

The minimum pavement thickness of each pavement layer based on the ITP value obtained is:
- Surface Course (D1)
  Surface Course has a thickness that is determined based on the minimum thickness limit of the surface layer in table 2.8 according to the ITP value obtained of 5.7 and obtained the minimum thickness of the surface layer = 5 cm with Laston material (MS 340) relative coefficient a1 = 0.3.
- Base Course (D2).
  Base Course has a thickness determined based on the minimum thickness limit of the upper foundation layer in table 2.9 according to the ITP value obtained of 5.7 and obtained the minimum thickness of the upper foundation layer = 20 cm with class C crushed stone material relative coefficient a2 = 0.12.
- Subb Base Course (D3).
  The thickness of the Subbase Course layer has a minimum thickness of 10 cm for each ITP. The thickness of the foundation layer is planned with C grade sirtu material and relative coefficient a3 = 0.11. The following formula is used to determine the sub-base layer (D3) as follows:

$ITP = (a1. D1) + (a2. D2) x + (a3. D3)$
ITP = (0.3 x 5) + (0.12x 15) + (0.11 x D3)
5,5 = 1,5 + 1,8 + 0,11D3
D3 = (5.7-1.8) / (0.11) D3
  = 20 cm

Then the thickness of the access road pavement

  = D1 + D2 + D3
  = 5 + 15 + 20
  = 40 cm

The following is the design of the access road pavement structure layer from the calculation results obtained using the Component Analysis method.
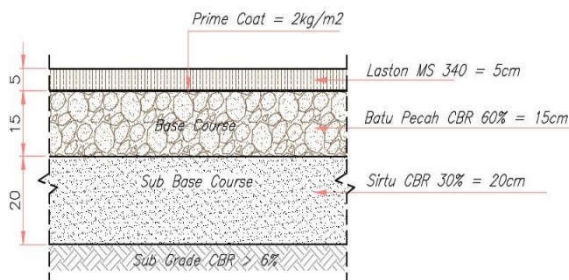

Figure *4. 1 Pavement layer thickness component analysis method*
(Source*: Component Analysis Calculation Results)*

Calculation Results

The following are the results of the calculation of the component analysis method and then validated with SKEP 374/XXI/99.

Coating	SKEP 374/XII/99	Component Analysis
Surface	5	5
Base Course	15	15
Subbase Course	20	20

Table *4. 2 calculation results*

Cost Budget Plan

The next step in access road planning is the preparation of a budget plan. The types of work listed in the RAB are preparatory work, excavation work, and paving work. The benchmark for the price of goods used is the Unit Price of East Nusa Tenggara Province in 2023. The following is the result of the recapitulation of the RAB for the planning of the H. Hasan Aroeboesman Ende Airport Access road amounting to Rp.190,000,000.00.

CLOSING
Conclusion

Based on the analysis and discussion of the research results entitled Access Road Pavement Planning for H. Hasan Aroeboesman Ende Airport, it can be concluded:

1. The Pertamina DPPU vehicle access road is planned based on the results of the comparison calculation of 2 methods. Access road pavement planning uses a type of flexible pavement using component analysis. because the structural results are valid with SKEP 347 Airport regulations. The specifications of the Access Road structure results with the component analysis method are as follows:

a. Component analysis method:

1. The type of material used is:
   - Surface Course: LASTON MS 340
   - Base Course: Class C crushed stone (CBR 60%)
   - Sub Base Course: C grade Sirtu (CBR 30%)

b. The thickness of each layer obtained in the calculation, as follows:
   - Surface Course: 5 cm
   - Base Course: 15 cm
   - Sub Base Course: 20 cm

2. Planning an Access Road with a length of 90 meters requires a total construction cost of Rp.190,000,000.00.

Suggestion

Based on the above conclusions, it is recommended that further research can use Primary Soil CBR data (the latest), so that the calculation results are more valid / updated.

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