EVALUATION OF PAVEMENT CONDITION ON THE RUNWAY USING THE PAVEMENT CONDITION INDEX (PCI) METHOD AT DEPATI PARBO KERINCI AIRPORT, JAMBI PROVINCE

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ABSTRACT

Depati Parbo Airport features a runway measuring 1,600 meters in *Corresponding Author length and 30 meters in width with a PCN value of 22 F/C/Y/T. Regular maintenance and upkeep are required to support airside safety, documented through Pavement Management System (PMS) reports. This maintenance program is also driven by the increasing flight traffic expected in 2024, necessitating an analysis of the level of damage and appropriate repair methods. The analysis used is the PCI method to determine the condition of the runway surface. This method is adopted from the ASTM document about KP94, 2015 on Airport Pavement Construction Maintenance. Each total area of damage (quantity) found is used as a determinant of density to find the deduct value from the graph, then determine the correct deduct value from the correlation with the total deduct value and obtain the PCI value for each sample. The analysis resulted in a PCI value of96.2% with the "Good" category, indicating damages such as bleeding, longitudinal and transversal cracking, and potholes. A Cost Estimate Plan is prepared for maintenance work consisting of patching medium-level pothole damagesat STA 0+572 and several bleeding damages covering an area of 57,442 m², requiring repair costs amounting to Rp. 31,026,000.00.

Keywords: *Pavement, Runway, Pavement Condition Index, Pavement Management System, Budget Plan.*

1. INTRODUCTION

Depati Parbo Airport is the main airport serving Sungai Banyak City and Kerinci Regency, precisely in Angkasa Pura Hiang Village, Sitinjau Laut District, Kerinci Regency, Jambi. Depati Parbo Airport is a class III airport managed by the Directorate General of Civil Aviation, geographically located at coordinates 02°05'28" S 101°27'46" E. This airport is equipped with supporting facilities in the form of a runway which was previously 1,400 m long then extended to 1,800 m with a width of 30 m and has a surface layer, namely hotmix with a strength of 20 F/C/Y/T. At the beginning of the establishment of Depati Parbo Airport in 1978, the first aircraft to operate was SMAC, and then Merpati, Riau Airline, Sky Aviation on June 6, 2011, and Pacific Royale on April 1, 2012. Until now, the largest aircraft that can operate at Bandar Air Depati Parbo Kerinci is an ATR 72-600 aircraft.

However, in 2021 flight activities at Depati Parbo Airport had decreased due to the COVID-19 pandemic which required all Indonesians to go into lockdown, thus having an impact on flight activities throughout Indonesia, including Depati Parbo Airport. However, Depati Parbo Airport continues to serve flights from charter aircraft in the form of the Luxo-Jets Embraer Phenom 300 which flies approximately once a month and will increase in 2024 with pioneer flights in the form of a Cessna Caravan 208 aircraft belonging to Susi Air airline which is scheduled once a week, namely on Monday and Friday.

Referring to the Letter of the Directorate General of Civil Aviation Number: AU.106/9/4/DBU, 2023 concerning the obligation to Report on the Implementation of the Pavement Management System in attachment point B regarding annual maintenance including the Pavement Condition Index (PCI) survey. Meanwhile, in the airport, APMS documents that in

previous years no pavement surveys were carried out considering the limited Human Resources (HR) at Depati Parbo Kerinci Airport.

runway pavement using the Pavement Condition Index (PCI) method is very necessary for maintaining runway pavement. Through a survey in the field, several problems were found in the flexible runway layer at Depati Parbo Airport, such as bleeding of asphalt material onto the surface (bleeding), block cracking, there are holes (potholes) which cause water ponding when it rains, for this reason the author is of the view that it is necessary to carry out an analysis of the damage that has occurred so that an appropriate evaluation and approach can be carried out to deal with the problem.

Bearing in mind that the condition of the runway always experiences a decline in quality every year due to increasingly high flight intensity and based on the 2023 APMS, the runway pavement has reached 5 years of age since the overlay was carried out in 2019, so this condition is one of the causes of damage to the runway surface. Evaluation of runway pavement using the Pavement Condition Index (PCI) method is very necessary in maintaining runway pavement. Through a field survey, several problems were found on the flexible runway layer at Depati Parbo Airport such as asphalt material coming out to the surface (bleeding), block cracking, there are holes (potholes) that cause puddles (water ponding) when it rains, for that the author thinks that it is necessary to analyze the damage that occurs so that an evaluation and appropriate approach can be carried out to deal with these problems.

Based on the existing conditions on the flexible pavement on the Depati Parbo Airport runway, several problems can be formulated, namely:

1. Runway pavement surface conditions using the Pavement Condition Index (PCI) method?
2. To the runway at Depati Parbo Airport handled?
3. What is the estimated cost of repairing the damage?

2. LITERATURE REVIEW

2.1 Runways

The definition of runway according to the Decree of the Director General of Civil Aviation Number: PR 21 of 2023 concerning Technical and Operational Standards for Civil Aviation Safety Regulations Part 139 (CASR Manual of Standards Part 139) Volume 1 Mainland Aerodrome, the runway is a square area that has been determined at the Mainland Aerodrome for landing or taking off an airplane.

Based on ICAO 2022 Annex 14 Aerodrome Vol.1 chapter 1 point 1.7: Runway. “A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.” Essentially, runways are designed to:

a. Meet the requirements for managing air traffic by separating aircraft from each other.
b. Reduce disruption caused by aircraft operations and reduce landing delays.
c. Provide the shortest possible travel distance from the surrounding area to the runway.

2.2 Runway Pavement

According to KP 94, 2015 pavement is infrastructure that consists of several layers with different strengths and bearing capacities. In general, pavement construction is divided into 2 types, namely flexible pavement and rigid pavement.

2.2.1 Flexible Pavement

This flexible pavement is made from a mixture of asphalt and aggregate, laid on a surface of high-quality granular material or pavement that has elastic properties, meaning that the pavement will bend when loaded.

2.2.2 Rigid Pavement

Rigid pavement is concrete pavement consisting of aggregate mixed with cement as a binder. Considering that the nature of the concrete plate is quite stiff, the load can be spread over a wide area, resulting in lower stresses in the layers below.

2.3 Runway Maintenance

Meeting security, safety, and flight operational needs to comply with minimum requirements. So in SKEP/78/VI/2005 concerning Guidelines for the Implementation of Construction Maintenance for Runways, Taxiways and Parking Lands (Aprons) and Supporting Facilities at Airports, it is explained that construction maintenance is carried out by technical provisions based on periodic observations and systematically to find out the causes of damage, the consequences of damage, and how to repair damage.

2.3.1 Maintenance Objectives

Inspection is carried out to eliminate the causes of damage to the runway pavement so that preventive measures can be taken. Inspection is intended so that the location of damage can be identified as early as possible temporary handling can be carried out at the point of damage or permanent repairs can be planned as soon as possible.

2.3.2 Pavement Management

An effective pavement maintenance management program can determine the procedures to be followed to ensure that implementation is carried out properly as prevention, recovery, and improvement of pavement performance. The condition of the pavement on a runway is an important factor so a systematic, objective, and periodic evaluation system for the condition of the runway pavement surface is needed to determine priorities and scheduling in runway pavement

maintenance. The importance of evaluating runway pavement as explained in FAA AC 150/5335-5C, 2009 "Standardized Method of Reporting Airport Pavement Strength - PCN" Pavement management can be used as a record of the condition of a pavement and a reference in providing specific recommendations for actions that may be needed when carrying out pavement maintenance according to the level of condition that meets the requirements at minimal cost.

2.4 Types of Flexible Pavement Damage

The worsening condition of the pavement and the reduced strength quality are caused by the non-durable forming material or the shrinkage swelling process to the reaction of the alkali aggregate. Damage can occur if the pavement construction begins to weaken so that it is unable to withstand excessive loads, the emergence of water seepage in the structure (pumping), and others. The following are damages that often occur in flexible pavements according to the 2009 Asphalt Surface Airfields along with the steps taken in the repair of KP 94 in 2015:

1. Alligator Cracking

Repeated traffic loads connect and form multi-sided, sharp-angled cracks that form a pattern resembling chicken wire or alligator skin.

2. Bleeding

Bleeding is an asphalt material that appears on the surface of the pavement and is caused by excessive amounts of asphalt or tar in the mixture or due to low air cavity content.

3. Block Cracking

Interconnected, rectangular cracks in blocks can range in size from approximately 1 foot by 1 foot to 10 feet by 10 feet (0.3 by 0.3 meters to 3 by 3 meters).

4. Corrugation

Corrugation is a series of ridges and valleys (ripples) that are perpendicular to the direction of traffic are closely spaced and occur at fairly regular intervals, usually less than 5 feet (1.5 m) along the pavement.

5. Depression

A localized area of pavement surface that has a slightly lower elevation than the surrounding pavement, usually seen after rainfall.

6. Jet Blast Erosion

The jet blast causes the surface area of the pavement to darken as the bitumen binder is burned or carbonized. The burned area can vary in depth up to 0.5 inches (13 mm).

7. Joint Reflection Cracking from PCC

This damage is not related to the load, but traffic loading can cause damage to the AC near the crack which has the potential to become spalling and FOD.

8. Longitudinal and Transverse Cracking

Longitudinal cracks parallel to the pavement centerline or laydown direction are caused by poor construction of paving joints and low temperatures.

9. Oil Spillage

Oil spills can cause damage due to softening of the pavement surface caused by fuel or other solvent spills.

10. Patching and Utility Cut Patch

Patching is the result of a fix but can be said to have failed, regardless of how well it performed.

11. Polished Aggregate

Polished aggregate caused by repeated traffic and this type of stress is also indicated when the slip resistance rating test number is low or drops significantly from the previous rating.

12. Raveling

Damage is caused by the release of coarse aggregate particles from the pavement.

13. Rutting

A surface depression in the tire track occurs along the side of the track, but in many cases ruts are only visible after rain when the tyre track fills with water.

14. Shoving of Asphalt Pavement

PCC pavement can usually grow longer at the ends that border the flexible pavement (pavement growth) and then push the asphalt surface until it swells and cracks.

15. Slippage Cracking

Crescent-shaped cracks with both ends facing traffic usually occur due to braking or wheel rotation causing the pavement surface to slip and deform.

16. Weathering

Weathering or surface wear is the loss of asphalt binder and fine aggregate matrix from the pavement surface.

17. Potholes

Potholes are a result of previous damage, generally starting from cracks that are not immediately treated.

2.5 Sample Calculation of Pavement Condition Index

In determining the sample to be surveyed and to determine the data value from the Pavement Condition Index (PCI) analysis, the author refers to regulations ASTM D-5340, 2005 concerning Standard Test Method for Airport Pavement Condition Index Survey as a guide for this research by carrying out the following steps:

2.5.1 Determining Sample Units

The sample unit is determined at an early stage before starting the research which aims to determine the number of segments that are included in the research implementation.

Total Runway Area : 1,800 m x 30 m = 54,000 m²
Area of 1 sample unit: 450 + 180 m2, taken as 450 m2
So the total number of samples we have is:
Total sample = Total Area: Area of Sample Unit
= 54,000 m² : 450 m²
= 120 sample units

2.5.2 Determination of Minimum Sample Size

The overall number of sample units will have a significant impact on the research process because it will be one of the factors taken into account in determining

the minimum number of samples that must be surveyed by the researcher.

$$n = \frac{Ns^2}{\frac{e^2}{4}(N-1) + s^2} \quad (1)$$

$$n = \frac{120.10^2}{\frac{5^2}{4}(120-1) + 10^2}$$

$$n = \frac{12.000}{843{,}75} = 14{,}2$$

Known:
n = Total number of sample units in one pavement section
e = Allowable error in the estimation of the PCI section (±5)
s = Standard deviation of PCI between sample units (Asphalt Concrete = 10)

2.5.3 Damage Level (Density)

Density is a level of damage in the form of a percentage of the area of a type of damage to the area of a sample unit area measured in square meters.

$$\frac{Ad}{As} \text{ x } 100\% \text{ atau } \frac{Ld}{As} \text{ x } 100\% \quad (2)$$

Information :
Ad : total area of damage types for each level of damage (m^2)
Ld : Total length of damage type for each level of damage (m)
As : total area of segment units

2.5.4 Deduct Value

Deduct Value is obtained by adjusting the value obtained from the graph for each damage according to the level of damage.

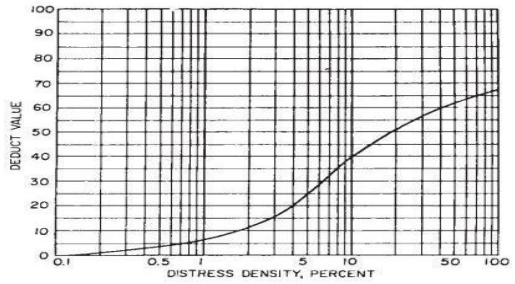


Figure 1. Bleeding Chart

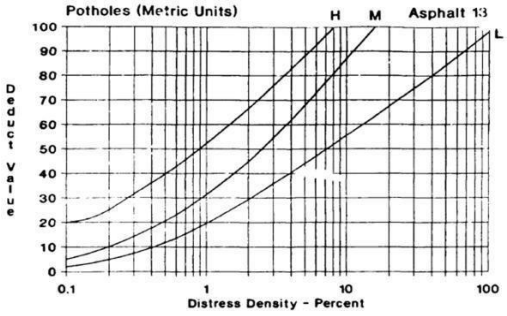


Figure 2. Potholes Chart

Figure 3. Longitudinal Transversal Cracking Graph

2.5.5 Determine the Allowable Number of Deduct Value

The allowable Number of deductions is the minimum deductible value for each type of pavement that is permitted to be taken into account in determining the assessment of pavement condition. The "mi" value is influenced by the largest deductible value in a sample unit. The allowable Number of Deduct is calculated using the following formula:

$$mi = 1 + (\tfrac{9}{95})(100 - HDVi) \quad (3)$$

information :
mi = Allowable Number of Deducts for each sample unit.
HDVi = Highest Deduct Value, the largest deduct value in each sample.

2.5.6 Total Deduct Value (TDV) Reduction Value

Total Deduct Value (TDV) is the sum of all deduct values which becomes the total deduct value or TDV.

2.5.7 Corrected Deduct Value (CDV)

Corrected Deduct Value (CDV) is a value obtained from the curve of the relationship between the TDV value and the CDV value by selecting the curve of the curve according to the number of individual deduct value values that have a value of more than 5. Based on the deduct value, it is seen how many values are above 5, which will later be called the value "q".

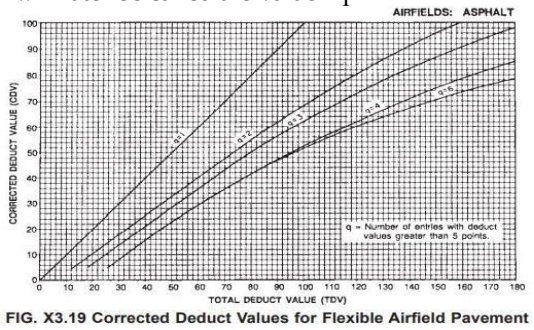


Figure 4. CDV Chart

2.5.8 Determination of Pavement Condition Values

In determining the condition of the pavement for each sample unit, if the CDV value is known, the PCI value can be formulated as:

$$PCI_{(S)} = 100 - \text{Max CDV} \quad (4)$$

Information :
$PCI_{(S)}$= Pavement Condition Index for each unit
CDV = Corrected Deduct Value for each unit

Meanwhile, the overall PCI value can be calculated using the following formula:

$$PCI = \frac{\sum PCI_{(S)}}{N} \quad (5)$$

Information :
$PCI_{(S)}$= overall PCI value for each sample unit
N = number of sample units

2.6 Damage incurred

Damage can occur if the pavement construction begins to become weak so that it is unable to withstand excessive loads, water seepage occurs in the structure (pumping), and so on. The following are the damages that often occur on flexible pavement following the 2009 Asphalt Surface Airfields along with the steps taken to repair KP 94, 2015. Through surveys carried out directly in the field, it was found that the condition of the flexible pavement on the Depati Airport runway experienced several damages such as bleeding, cracks, longitudinal and transversal cracking, and even potholes.

2.7 Damage Level

Data found in the field is then identified according to the level of each damage, depending on the type of damage. The level of damage is calculated based on the dimensions and severity of the damage, the damage value is determined in terms of light (low), medium (medium), and high (high). Determining the level of damage can influence the treatment that will be carried out to deal with the damage.

2.8 Maintenance and Maintenance Planning

Based on the results of monitoring the condition of the runway, appropriate steps are needed to deal with damage because if the damage is not repaired immediately, it is feared that it will become more serious, this could have an impact on increasing costs that will be incurred.

2.8.1 Routine Checkup

Routine activities in the form of aerodrome serviceability inspections need to be carried out every day, following the circular letter of the Directorate General of Civil Aviation Number: AU.106/9/4/DBU, 2023 in attachment point B regarding routine inspections (drive-by inspection). Inspections can be carried out by airport personnel in charge of airside infrastructure, in this case, building units and runways. Maintenance can be effective if it is carried out periodically, namely before and after flight activities, then reporting the results of inspections by attaching documentation, recording monitoring results, and any follow-up actions that need to be carried out.

2.8.2 Local Cutting/ Patching

In anticipation of increasingly severe damage, a maintenance program is needed to deal with the damage that has occurred. Based on the results of monitoring in the field, medium level potholes were found that required maintenance in the form of local cutting/ patching perpendicularly according to the thickness of the surface layer and filled using hot mix asphalt (AC-ATB) according to technical specifications and implementation methods.

2.8.3 Recoating/ Overlay

Referring to the FAA AC 150/5320-6E, 2009 method, overlay treatment can be carried out with several considerations, including:

- The age of the pavement that has been or will be exceeded; or
- Damage occurs and there are changes in design assumptions so that reconstruction is necessary, this is more due to the use of airside infrastructure that exceeds capacity so it needs to be restored and upgraded.

3. METHODOLOGY

This research uses a quantitative method by analyzing a problem based on standard theories described in the field. This method is included in descriptive analysis, which means that the information in the analysis is collected based on symptoms at the time of research. The stages carried out in this research process are described through a flowchart as follows :

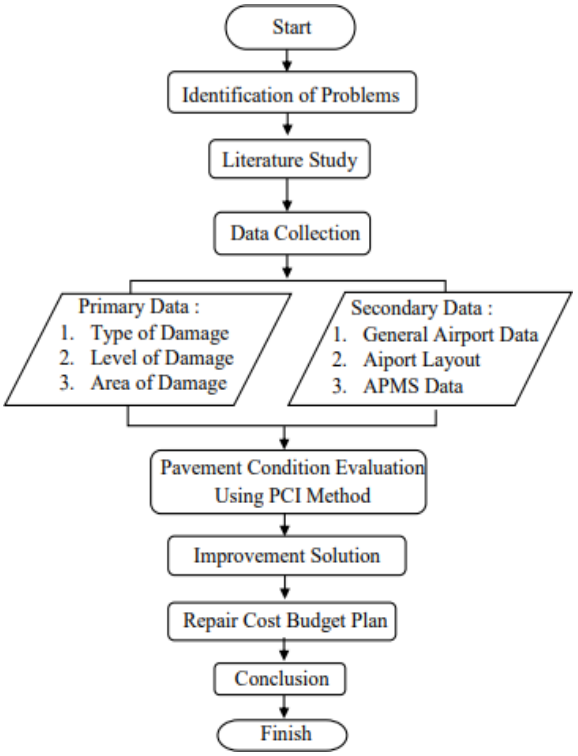


Figure 5. Flowchart

This research uses the following writing method:

1. Literature study is a series of processes of collecting data related to the topic to be discussed, by studying and processing various data materials using various sources as assistance. Sources can usually be taken from documents, archives, books, journals, articles, magazines, and so on. This source can later help researchers find answers to the problems being evaluated.
2. The research was conducted at Depati Parbo Airport in Angkasa Pura Hiang Village, Sitinjau Laut District, Kerinci Regency, Jambi. To be precise in October 2023.
3. Collect supporting data in evaluating the Pavement Condition Index, such as primary data collected through field surveys, namely by determining the type of damage, dimensions, and level of damage, and secondary data which includes general data, layout, and other documents related to runway pavement maintenance.
4. Calculate the PCI value based on the amount of damage found on the Depati Parbo Airport runway to determine planning and maintenance that is appropriate to the conditions that occur.
5. Calculate the Planned Cost Budget (RAB) for damage that requires action in the form of patching, accompanied by an S-Curve as a control in carrying out the work.

4. RESEARCH RESULT

4.1 Runway Surface Condition Data

Based on the results of the survey in the field, several samples of damage were found in different segments. The damage contained in this segment is considered to represent several types of damage that occurred on the pavement surface of runway 12-30

Table1. Damage Data

Segmen	STA	Distress	Quantity	Density
1	0+000-0+120	Bleeding	1,904	0,053
		Long.& Trans Cracking (L)	0,9	0,0025
		Block Cracking (L)	0,3	0,0083
2	0+120-0+240	Bleeding	14,385	0,3996
3	0+240-0+360	Bleeding	0,636	0,0177
4	0+360-0+480	Bleeding	7,0202	0,1950
5	0+480-0+600	Bleeding	13,2895	0,3692
		Potholes (L)	1,2	0,033
6	0+600-0+720	Bleeding	4,9675	0,1380
		Patching (L)	5	0,1389
7	0+720-0+840	Bleeding	0,8025	0,0223
8	0+840-0+960	Bleeding	0,1825	0,0051
9	0+960-1+080	Bleeding	1,6725	0,0465
		Potholes (L)	0,01	0,00003
10	1+080-1+200	Bleeding	0,355	0,0099
		Patching (L)	17,5	0,4861
		Potholes (L)	0,03	0,0008
11	1+200-1+320	-	-	-
12	1+320-1+440	Bleeding	1	0,0278
		Patching (L)	58	1,61
13	1+440-1+560	Bleeding	5,7175	0,1588
		Long.& Trans Cracking (L)	4,5	0,1250
		Patching (L)	31,145	0,8651
14	1+560-1+680	Bleeding	0,56	0,0156
		10 L	18	0,5
		Potholes (L)	0,0065	0,0002
15	1+680-1+800	Bleeding	3,75	0,1042
		Patching (L)	58	28

4.2 Pavement Condition Index (PCI) Calculation Stage

Pavement Condition Index (PCI) method is carried out through a visual survey by determining the distress severity in the field to obtain the quantity of each damage which will be processed through graphs and the Pavement Condition Index (PCI) calculation formula according to the stages set out in ASTM D-5340, 2005.

In carrying out pavement maintenance, several methods are usually used to determine the surface conditions of pavement in the field, one of which is the Pavement Condition Index (PCI) method. According to SKEP/77/VI, 2005, it is explained that the Pavement Condition Index (PCI) method is a visual study in the field on both flexible and rigid pavement surfaces with the minimum value requirement for flight operations > 45%.

The Federal Aviation Administration (FAA) has adopted the Pavement Condition Index (PCI) method to determine pavement conditions with FAA AC 150-5380-6C, 2014 Guidelines and Procedures for Maintenance of Airport Pavements. This method has also been developed by the Construction Engineering Research Laboratory of the U.S. Army Corps of Engineers. This evaluation begins by dividing the runway based on the minimum sample calculation, namely 14.2, which is fulfilled into 15 sample units with each sample measuring 120 x 30 meters.

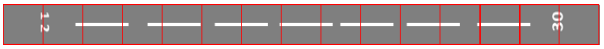


Figure 6. Illustration of Runway Segment Division

The following is an example of a sample unit surveyed precisely at STA 0+480 – 0+600 which can be seen in the table below.

Table 2. Segment Survey 5

PAVEMENT CONDITION SURVEY DEPATI PARBO AIRPORT										
1. Alligator Cracking 2. Bleeding 3. Block Cracking 4. Corrugation	5. Depression 6. Jet Blast Erosion 7. Join Reflection Cracking 8. Long.& Trans Cracking			9. Oil Spillage 10. Patching 11. Polish Aggregate 12. Raveling		13. Rutting 14. Shoving 15. Slippage 16. Swell		17. Potholes		
STA	Distress	Quantity	Density	DV	mi	q	TDV	CDV	PCI	Keterangan
0+480-0+600	2	13,2895	0,3692	4	10,09	1	9	9	91	Good
	17 L	1,2	0,033	5	10,00					

- bleeding damage with a total area of 13.29 m.

Density = $\frac{Ad}{As}$ x 100% = $\frac{13.29}{3600}$ x 100% = 0.369 = 0.37

Bleeding damage with a density of 0.37 has a deduct value of 4.

Figure 7. Graph of Deduct Value Bleeding Segment 5

- Medium level damage to potholes with a total area of 1.2 m.

Density = $\frac{Ad}{As}$x 100% = $\frac{1,2}{3600}$ x 100% = 0.033 = 0.03

Medium level Pothole damage with a density of 0.03 has a deduct value of 5.

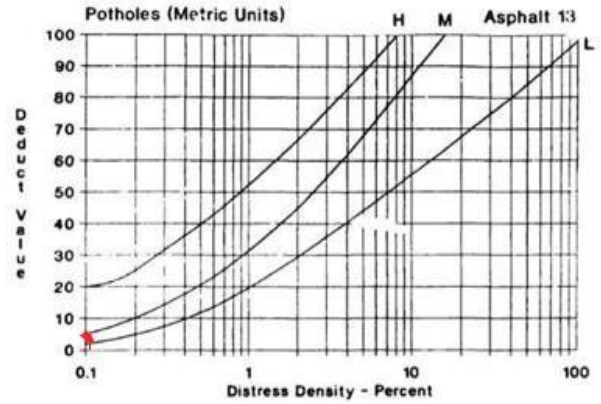


Figure 8. Graph of Deduct Value Potholes Segment 5

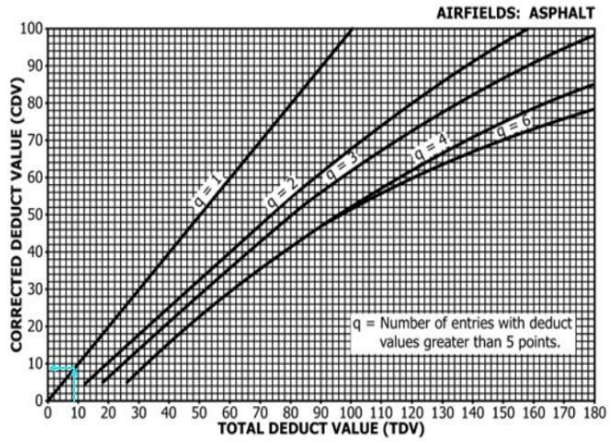


Figure 9. Correlation of TDV with CDV

Based on Figure 4.19, from the correlation relationship between the total deduct value of 9, we get the correct deduct value = 9

PCI = 100 – CDVmax = 100 – 9 = 91

Table 3. PCI Segment 5 Values

SEGMEN 5					
No	Distress	Severity	Quantity	Density (%)	Deduct Value
1.	2	-	13,28	0,37	4
2.	17	M	1,2	0,03	5
			Total Deduct Value		9
			Corrected Deduct Value		9
			Pavement Condition Index		91

4.3 Calculation Results

The Pavement Condition Index (PCI) value obtained on one runway is the result of the average Pavement Condition Index (PCI) value of all sample units that have been surveyed. In this evaluation, the Pavement Condition Index (PCI) values were obtained as follows:

Table 4. PCI Value Results

PAVEMENT CONDITION SURVEY DEPATI PARBO AIRPORT										
1. Alligator Cracking 5. Depression 9. Oil Spillage 13. Rutting 17. Potholes 2. Bleeding 6. Jet Blast Erosion 10. Patching 14. Shoving 3. Block Cracking 7. Join Reflection Cracking 11. Polish Aggregate 15. Slippage 4. Corrugation 8. Long.& Trans Cracking 12. Raveling 16. Swell										
STA	Distress	Quantity	Density	DV	mi	q	TDV	CDV	PCI	Keterangan
0+000-0+120	2	1,904	0,053	1	10,38					
	8 L	0,9	0,0025	0	10,47	1	6	6	94	Good
	3 L	0,3	0,0083	5	10,00					
0+120-0+240	2	14,385	0,3996	4	10,09	1	4	4	96	Good
0+240-0+360	2	0,636	0,0177	1	10,38	1	1	1	99	Good
0+360-0+480	2	7,0202	0,1950	2	10,28	1	2	2	98	Good
0+480-0+600	2	13,2895	0,3692	4	10,09	1	9	9	91	Good
	17 L	1,2	0,033	5	10,00					
0+600-0+720	2	4,9675	0,1380	2	10,28	1	5	5	95	Good
	10 L	5	0,1389	3	10,19					
0+720-0+840	2	0,8025	0,0223	1	10,38	1	1	1	99	Good
0+840-0+960	2	0,1825	0,0051	0	10,47	0	0	0	100	Good
0+960-1+080	2	1,6725	0,0465	1	10,38	1	1	1	99	Good
	17 L	0,01	0,00003	0	10,47					
1+080-1+200	2	0,355	0,0099	0	10,47					
	10 L	17,5	0,4861	4	10,09	1	4	4	96	Good
	17 L	0,03	0,0008	0	10,47					
1+200-1+320	-	-	-	-	-	-	-	-	100	Good
1+320-1+440	2	1	0,0278	1	10,38	1	6	6	94	Good
	10 L	58	1,61	5	10,00					
1+440-1+560	2	5,7175	0,1588	2	10,28					
	8 L	4,5	0,1250	3	10,19	1	9	9	91	Good
	10 L	31,145	0,8651	4	10,09					
1+560-1+680	2	0,56	0,0156	0	10,47					
	10 L	18	0,5	4	10,09	1	4	4	96	Good
	17 L	0,0065	0,0002	0	10,47					
1+680-1+800	2	3,75	0,1042	1	10,38	1	6	6	94	Good
	10 L	58	28	4	10,09					
							NILAI PCI		96,2	Good

4.4 Maintenance and Maintenance Planning

Based on the results of monitoring runway conditions, there was damage that required special attention, namely medium level pothole damage and some bleeding damage. Therefore appropriate steps are needed to deal with this damage. If the damage is not repaired immediately, it is feared that it will become worse, this could result in increased costs.

4.4.1 Routine Checkup

Routine activities in the form of aerodrome serviceability inspections need to be carried out every day, according to the circular letter of the Directorate General of Civil Aviation Number: AU.106/9/4/DBU, 2023 in attachment point B regarding routine inspections (drive-by inspection). Inspections can be carried out by airport personnel in charge of airside infrastructure, in this case, building units and runways. Maintenance can be effective if it is carried out periodically, namely before and after flight activities, then reporting the results of inspections by attaching documentation, recording monitoring results, and any follow-up actions that need to be carried out.

4.4.2 Local Cutting/ Patching

According to KP 94, 2015, it is stated that medium level bleeding and pothole damage can be treated in the form of patching using a hot mix asphalt (AC) according to technical specifications and implementation methods. The following are the steps for implementing patching following the 2011 Highways and Highways Construction and Building Manual :

a. Step 1
- Prepare equipment such as jack hammer, asphalt sprayer, tandem roller, wheel loader, tire roller, generator set, and dump truck as tools to support patching work.
- Place safety signs in the repair area.

b. Step 2
- Determine the location where patching will be carried out by marking lines around the damaged area.
- Clean the area with an air compressor.
- Dig out the asphalt surface material using a jack hammer.
- Check the optimum water content of existing pavement materials. If conditions are dry, add water until optimum conditions (OMC), while if it is too wet, leave it to dry.

c. Step 3
- Compact the existing layers of material.
- Add class "A" aggregate with max thickness in OMC condition.
- Compact the class "A" aggregate layer.
- Spread the tack coat material using an asphalt sprayer (0.5 L/m2 for cutback or 0.8 L/m2 for emulsified asphalt). The composition used depends on field conditions.

d. Step 4
- Stir the aggregate for a cold mixture with a ratio of 1.5 coarse aggregate and 0.1 fine aggregate.
- For cold mixes add all aggregate approximately 0.1 m3 before asphalt.
- Add asphalt and stir for 4 minutes. Prepare enough cold asphalt mix for the entire job.

e. Step 5
- Sprinkle the cold asphalt mixture over the surface.
- Compact with a baby roller (minimum 5 passes).
- Clean the work site and check the flatness of the existing surface.

4.5 RAB Patching Calculation

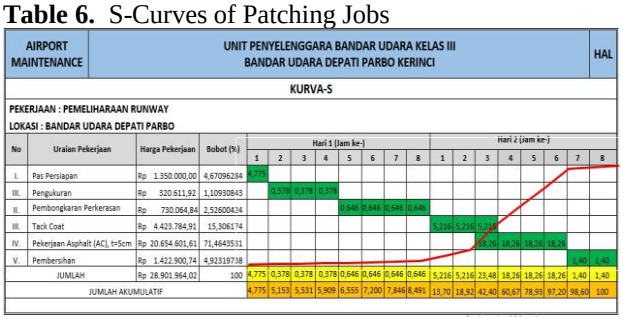
The following RAB calculations are prepared based on HSPK Pemerintah Kota Padang, 2024 as a reference for determining the unit price of materials and wages in work, while determining the work coefficient uses PM 78, 2015.

Table 5. Patching Cost Budget Plans

AIRPORT MAINTENANCE	UNIT PENYELENGGARA BANDAR UDARA KELAS III BANDAR UDARA DEPATI PARBO KERINCI				HAL
RENCANA ANGGARAN BIAYA (RAB)					
PEKERJAAN : PEMELIHARAAN RUNWAY					
LOKASI : BANDAR UDARA DEPATI PARBO					
NO	URAIAN PEKERJAAN	VOLUME	SATUAN	HARGA SATUAN	JUMLAH
I	PEKERJAAN PERSIAPAN				
a	Pas Persiapan	1,00	ls	Rp 1.350.000,00	Rp 1.350.000,00
				Jumlah I	Rp 1.350.000,00
II	PEKERJAAN PERBAIKAN ASPAL RUNWAY				
a	Pekerjaan Pengukuran	57,44	m2	Rp 5.581,47	Rp 320.611,92
b	Pembongkaran Perkerasan	2,87	m3	Rp 254.191,11	Rp 730.064,84
c	Tack Coat	57,44	m2	Rp 77.012,80	Rp 4.423.784,91
f	Pekerjaan Asphalt (AC), t=5cm	57,44	m2	Rp 359.571,91	Rp 20.654.601,61
				Jumlah II	Rp 25.808.451,36
III	PEKERJAAN AKHIR				
a	Pembersihan	57,44	m2	Rp 13.800,00	Rp 792.702,36
				Jumlah III	Rp 792.702,36
REKAPITULASI					
I	PEKERJAAN PERSIAPAN				Rp 1.350.000,00
II	PEKERJAAN PERBAIKAN ASPAL RUNWAY				Rp 25.808.451,36
III	PEKERJAAN AKHIR				Rp 792.702,36
				JUMLAH	Rp 27.951.153,72
				PPN 11%	Rp 3.074.626,91
				JUMLAH TOTAL	Rp 31.025.780,63
				DIBULATKAN	Rp 31.026.000,00
Terbilang : Tiga Puluh Satu Juta Dua Puluh Enam Ribu Rupiah					

As a control in the implementation of the work, an activity flow plan is made in the form of an s-curve with the aim that the work runs in sequence and on time. The following is the s-curve of patching activities carried out within one working day:

Table 6. S-Curves of Patching Jobs



5. CLOSING

5.1 CONCLUSION

From the results of the evaluation of the runway pavement at Depati Parbo Airport, the following conclusions can be drawn:

1. Based on the survey results of runway pavement conditions using the Pavement Condition Index (PCI) method, the percentage of each type of damage was obtained as follows:

Table 7. Percentage of Damage

Kerusakan	Tingkat	Persentase (%)
Bleeding	-	0,1042
Patching	*Low*	0,2919
Potholes	*Medium*	0,0022
Potholes	*Low*	0,0001
Long. & Trans. Cracking	*Low*	0,0085
Block Cracking	*Low*	0,0006

So it can be seen that the overall average score for the surface runway evaluation at Depati Parbo Airport is 96.2% in the "Good" category.

Figure 10. Average PCI Value

2. According to KP 94, 2015 concerning Operational Technical Guidelines for Civil Aviation Safety Regulations Part 139-23 {Advisory Circular Casrpart 139-23), Guidelines for the Airport Pavement Construction Maintenance Program (Pavement Management System) that the type of treatment required based on the evaluation results there are 2 methods, namely carrying out Routine repair inspections in the form of patching of medium level bleeding and pothole damage using work methods that refer to the 2011 Highways and Highways Construction Manual.

3. Cost Budget Plan for patching repairs covering an area of 57,442 m² which consists of damage to potholes and bleeding, it is estimated that it will cost around Rp. 31,026,000.00 (says Thirty-One Million Twenty-Six Thousand Rupiah)

5.2 SUGGESTION

From the research results, there are several suggestions from the author as follows. The inspection is expected to be carried out according to standards and to carry out reporting in the form of a Pavement Management System (PMS) document, by attaching the annual inspection in the form of the Pavement Condition Index (PCI).

1. Runway maintenance must be carried out routinely, especially before and after flight activities, so that you can find out as soon as possible if new damage occurs. Maintenance is carried out when the damage is still on a light scale so that damage can be handled immediately to prevent the condition from becoming more severe which could cost much more to repair.

2. Future research can take into account other factors such as pavement damage due to pavement layer structure, subgrade, and rainfall.

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