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ANALYSIS OF PAVEMENT DISTRESS LEVEL USING THE PAVEMENT CONDITION INDEX (PCI) METHOD

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Abstract

Road pavement distress is one of the major problems that can affect the level of service, user comfort, and road safety. This study aims to analyze the level of pavement distress on the RA Basyid–Fajar Baru Road Section, South Lampung Regency, using the Pavement Condition Index (PCI) method. The study was conducted through a pavement condition survey along a 2,500-meter road section by identifying the type, extent, and severity of pavement distress in each observation segment. The survey data were subsequently analyzed using the PCI procedure to determine the pavement condition value for each segment and the average PCI value of the entire road section. The results identified four major types of pavement distress: potholes, patches, depressions, and alligator cracking. Based on the measured distress areas, patches accounted for the largest proportion at 58.64%, followed by alligator cracking at 36.39%, potholes at 4.64%, and depressions at 0.33%. The assessment results indicate variations in pavement conditions among the observed segments. The highest PCI value was recorded at STA 0+800–0+900, with a value of 55.00, which falls into the **Good** category. Meanwhile, STA 0+100–0+200 and STA 1+100–1+200 recorded PCI values ranging from 2 to 7 and were classified as **Failed** . Other segments were categorized from Poor to Failed. Overall, the average PCI value of the RA Basyid–Fajar Baru Road Section was **29.92** , indicating a **Poor** pavement condition. These findings demonstrate that parts of the pavement have experienced significant deterioration and require appropriate treatment based on the severity and characteristics of distress in each segment. The results can serve as a basis for establishing more targeted pavement maintenance and rehabilitation priorities.

Keywords: pavement distress, road pavement, Pavement Condition Index , PCI, road maintenance.

INTRODUCTION

Roads are land transportation infrastructure that play a vital role in supporting public mobility, the distribution of goods and services, and regional economic growth. A good road network improves accessibility and connectivity between regions, thereby supporting social and economic development. In road maintenance, good pavement conditions are a key factor in ensuring safety, comfort, and smooth traffic flow in accordance with technical road regulations. South Lampung Regency is a strategic area in Lampung Province with high transportation activity. The growing number of vehicles and increased economic activity have led to a continuous increase in traffic loads on roads. This condition has the potential to cause various types of pavement damage, such as alligator cracking, longitudinal cracks, transverse cracks, potholes, depressions, raveling, and degraded patches. If not promptly addressed, these damages can reduce the level of road service and increase future maintenance costs.

One of the roads that plays a crucial role in supporting community mobility in South Lampung Regency is the RA Basyid–Fajar Baru road. This road connects residential areas, education, commerce, and social activities. High road usage and environmental factors can lead to pavement deterioration, characterized by various forms of damage to the road surface. Road pavement condition evaluation is necessary to objectively determine the level of damage so that appropriate treatment priorities can be determined. One method widely used in assessing road pavement conditions is the Pavement Condition Index (PCI). The PCI method is a pavement condition assessment system based on the type of damage, severity level, and extent of damage, resulting in an index value between 0–100. A higher PCI value indicates better road conditions, while a lower value indicates the need for maintenance or rehabilitation. This method is considered effective because it can provide a quantitative and systematic picture of road conditions.

Various studies have shown that the PCI method can be used as a basis for decision-making in road maintenance programs. Research by Wira et al. (2022) demonstrated that the PCI method can effectively identify the level of damage to flexible pavement, allowing for appropriate treatment alternatives. Research by Zaid et al. (2021) on Jalan P. Tirtayasa, Bandar Lampung, also concluded that PCI values can be used as indicators of road condition to determine maintenance priorities. Thus, this research is important to be conducted to support more effective and efficient planning and management of road infrastructure in South Lampung Regency.

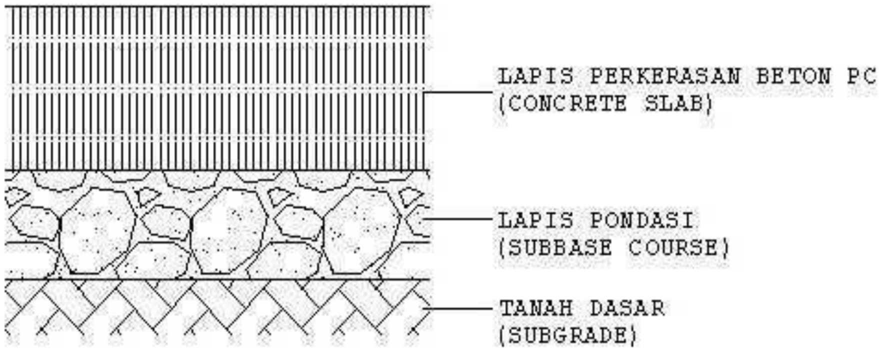
LITERATURE REVIEW

Roads are a vital form of land transportation infrastructure that plays a crucial role in supporting human mobility, the distribution of goods and services, and the economic growth of a region. Adequate roads are a key factor in improving accessibility between regions and facilitating social and economic activities. Based on Law Number 2 of 2022 concerning the Second Amendment to Law Number 38 of 2004 concerning Roads , roads are defined as land transportation infrastructure that includes all parts of the road, including complementary buildings and equipment intended for traffic, which are on the surface of the land, above the surface of the land, below the surface of the land, and/or water and above the surface of the water, except for railways, lorry roads, and cable roads. In road management, the government establishes various technical requirements to ensure optimal road function in serving traffic and road transportation. These provisions are stipulated in Minister of Public Works and Public Housing Regulation Number 5 of 2023 concerning Road Technical Requirements and Road Technical Planning, which emphasizes that road technical requirements are technical provisions to ensure optimal road function in serving traffic and road transportation.

Pavement condition evaluation is a crucial step in a road maintenance management system. Regular condition assessments enable road management agencies to prioritize appropriate and efficient repairs. One widely used pavement condition evaluation method is the Pavement Condition Index (PCI), developed by the US Army Corps of Engineers. This method provides a numerical index value that describes the actual condition of the pavement based on visual surveys of the type, severity, and extent of damage. In general, the concept of pavement condition evaluation in this study is based on systematic damage identification, severity measurement, and quantitative analysis using the PCI method. This approach is expected to provide an objective picture of pavement conditions that can serve as a basis for determining road maintenance and repair strategies.

Road pavement is a composition of layers of material built on the subgrade to withstand and distribute traffic loads so that the stress transmitted to the subgrade does not exceed its capacity. Each layer of pavement has a specific function: the surface (wearing course) provides anti-slip ability and resistance to wear; the binder distributes the load; the base and subbase layers provide structural support and load distribution; while the subgrade is the supporting base of the entire structure. Modern design principles emphasize the balance between the structural and functional functions of these layers to achieve the design life and performance of the pavement. The primary goal of road pavement construction is to provide a safe, comfortable, and economical road surface for road users. Well-designed pavements are capable of maintaining the road's service level throughout its designated design life.

Construction of a rigid construction (rig i dpa v e m e n t) is a layer of hard work that uses the structure as a bonding material for the material surface . Concrete slabs with or without reinforcement will be placed on top of the base with no foundation layer underneath .B eads of traffic bags are distributed directly to tb eton players .My work experience has characteristics that are quite different from the work of flexible work .In the case of road work , the main support for road work is made from concrete slabs . This is due to the nature of the concrete slab which is quite stiff , so that it does not cause a significant load on the surface and results in low pressure on the layers . below n y a . This construction is rarely used because it is quite expensive , but it is usually used in existing operational processes .In concrete cement construction , the main construction is in the form of a single layer of high - quality concrete .Meanwhile , the bottom foundation layer (subbase can be either treated subbase or granular subbase) functions as a supporting construction or a top support for the foundation .



Picture P a g e P a r t i o n P a r t i o n
Source : Reference Data, A.Thariq , 2026

Composite Pavement Construction is a layer of pavement which is a combination of flexible pavement and rigid pavement . Flexible work is located on a flexible body , or a combination of various types of work on a flexible body , where these two types of work work together in their own right .kul b e b a nl a traffic flow . For this , there is a need to have sufficient thickness requirements as well as to prevent unreflective reflection from the work of the ton below .yeah

This construction generally has a better level of comfort as a construction material as a surface layer without asphalt .

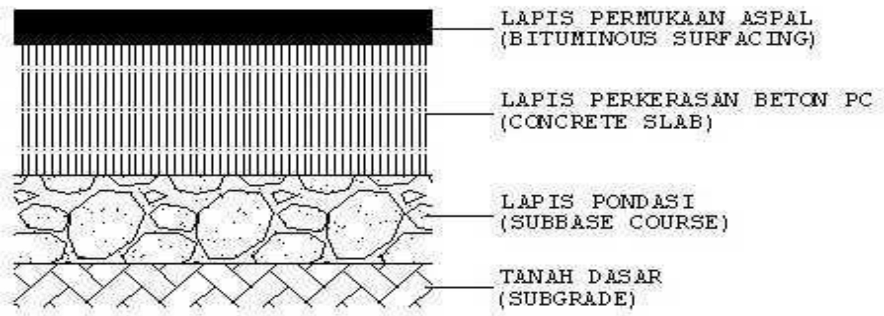


FIGURE OF COMPOSITE PAINTING CONSTRUCTION PIECE
Source : Bina Marga No. 03 /MN/ B /1983

Pavement Condition Index (PCI) is one of the system evaluation condition pavement road based on type, level damage that occurs and can used as reference business maintenance. PCI values have range 0 (zero) to 100 (one hundred) with criteria excellent, very good, good, fair, poor, very poor, and failed (Shahin, 1994).

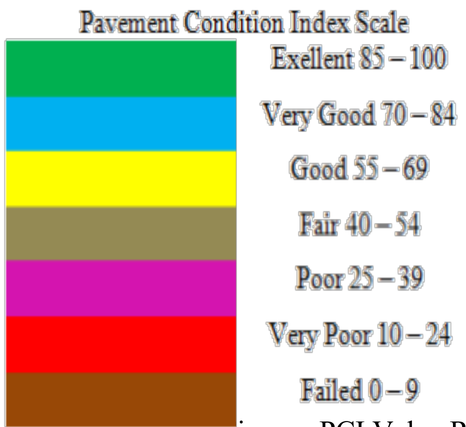


Figure . PCI Value Rating

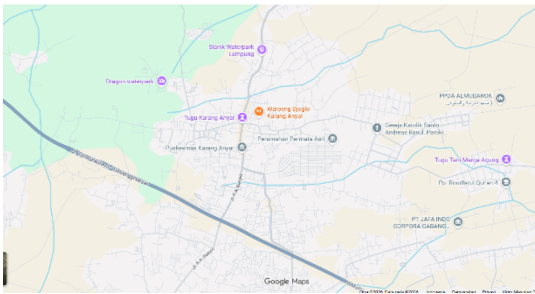
METHOD

The research method is the stage used to obtain the data and information needed to achieve the research objectives. The method used in this study is a quantitative descriptive method , namely research that aims to describe

the condition of the road pavement based on the results of a field survey and analyze the level of damage using the Pavement Condition Index (PCI) method according to the ASTM D6433-20 standard .
The study was conducted through a visual survey of the pavement condition of Jalan RA Basyid–Fajar Baru in South Lampung Regency. The survey data was then analyzed to obtain a PCI score, which allowed for the determination of the pavement condition level and appropriate treatment recommendations.

This research was conducted on the Marga Agung 2 road section, located in Marga Agung Village, Jati Agung District, South Lampung Regency, Lampung Province. Marga Agung Village is one of the villages within the administrative area of Jati Agung District and also serves as the district's administrative center. Geographically, Marga Agung Village is located at coordinates around 5°19′ South Latitude and 105°19′ East Longitude. This area is located in the northern part of South Lampung Regency and adjacent to Bandar Lampung City.

Jalan Marga Agung 2 serves as a connecting access route between residential areas and a distribution route for local economic activities. It is also used by both two-wheeled and four-wheeled vehicles, thus experiencing a significant traffic load.



Map of the Research Location
Source: ... q , 202 6

Picture at Km.1+600 to Km.1+700
Source: Research Doc . Brother Thoriq , 202 6

S... 6

RESULTS AND DISCUSSION

On RABasyid - Fajar Baru Road Section , South Lampung Regency s e p a njang 2500 m (2.5 km), pavement width 3.00 m and road shoulder width 1.00 m, and road type 1 (one) lane, 2 (two) directions . This activity done s eca r a visual and assisted by using equipment that is appropriate to the needs of the research survey. And the survey method is by dividing ru a s road into several segments And every The segment is 100 m in distance. And recorded as the initial and final stationing (STA) as a benchmark for data collection . research (description in the attachment)

Road Pavement Condition Using the Pavement Condition Index (PCI) Method

Observation result visual in field dip e rol e h extent of damage , depth a t a u pun wide r e tak , broken, collapsed, cracked, etc. which is a tool that is used as a tool For Determine damage class points j a lan. i inventory identity (density) damage This influenced by ku a nt i tas t i a p type of damage And wide s e gmen road y a n g di t in j a u. Determination d e du c t v alue d a p a ts e g e ra dih i tu n g s e a t a h k e k e r d e r d e n s t y is per ed b y appropriately and correctly .

At the time of taking the Total damage survey D e duct Value (T D V) d a n Corre c ted D e d u c t Value (CD V) can be calculated immediately after t a p a n - t a p a n in on Already diket a hui this is another . And in the end an analysis was obtained mark condition hardness is to determine the value Pave m e nt Condi t ion Ind e x (P C I), what 's next is what you can do used For determine priorities p a n a n d e r d e a r . So in p e r h i t u n g a n d e n g a n PCI method , several work steps , namely:

1) Road Damage Map
   D i m b u a t based on walkro u nd survey i s e to di p e r by area damage , k e d a la m a n a taupun wide cracked Which Then it is used to determine the class damage .
2) Note the condition and damage to the road
   Made in various forms tab e l which contain type, di m e n t i o n, t i n g a t And location it can be damaged . condition And road damage me r up a k a n documentation from condition road on masi n g - masi n gs e g m e nd a n useful For more memuda a hk a n on moment enter d a t a - d a t a t e damage road the to in T a b e l PC I .

T a b e l 4.1. Records of Conditions and Results of Road Damage Measurement RA, Basyid - New Dawn , Jati Agung District, South Lampung

AIRFIELD ASPHALT PAVEMENT SKETCH : CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT		SKETCH : 100 M
1. Retak buaya (m^2)	9. Pinggir Jalan Turun Vertikal (m)	17. Patah Slip
2. Kegemukan (m^2)	10. Retak Memanjang/Melintang (m)	18. Mengembang Jembul (m^2)
3. Retak Kotak-Kotak (m^2)	**11. Tambalan (m)**	19. Pelepasan Butir (m^2)
4. Cekungan (m)	12. Pengausan Agregat (m)	
5. Keriting (m^2)	**13. Lubang (count)**	
6. Amblas (m^2)	14. Perpotongan Rel (m^2)	
7. Retak Pinggir (m)	15. Alur (m^2)	
8. Retak Sambung (m)	16. Sungkur (m^2)	

DISTRESS SEVERITY	QUANTITY								TOTAL	DENSITY	DEDUCT VALUE
13L	4	1	4	2	4	5			20,0		
11M	14	18	2						34,0		
1M	25								25,0		

Akhi Thoriq's Research Data , 202 6

M e enter the l a i values the area of damage from ca ta t a n kondisi And measurement results into the f o rmulir survey i which can in l see on ta b e l 4 . 2 fo r mu l ir survey i y a n g di si is as b e rik u t. P e r utung g a n In addition , when it is shown to him attachment .

T a b e l For m u l i r sur v e y PC I

	A I RF I E L D A S P H ALT P A V EM ENT S KE T CH :	SKETCH : 100 M
	CO N D ITI O N SURVEY D A TA SHEET FOR S A M PL E UN IT	3,0 M
	RA. BASYID - FAJAR BARU Road Section South Lampung Regency	

1. Retak Kulit Buaya (m2) 9. Pinggir Jalan Turun Vertikal (m) 17. Patah Slip (m2)
2. Kegemukan (m2) 10. Retak Memanjang/Melintang (m) 18. Mengembang Jembul (m2)
3. Retak Kotak-Kotak (m2) 11. Tambalan (m2) 19. Pelepasan Butir (m2)
4. Cekungan (m2) 12. Pengausan Agregat (m2)
5. Keriting (m2) 13. Lubang (m2)
6. Amblas (m2) 14. Perpotongan Rel (m2)
7. Retak Tepi (m) 15. Alur (Rutting) (m2)
8. Retak Sambung (m) 16. Sungkur (m2)

STA	D istr e ss Se v er i ty	QUA N TITY				TOTAL	DEN S I TY (%)	D E D UCT V A L UE	TOTAL (D V)
0 + 000 – 0 + 100									169
	13L					20.00	6.67	92	
	1 1 M					34.00	11.33	32	
	1 M					25.00	8.33	45	

Source: Field Data Analysis of Akhi Thoriq's Research , 2026

Determining the value of the results to t a l quantity i ty
J u m lahk a n t i pe damage on every level severity damage which was noticed , and noted the damage to it column " to t a l".

Example on sta 0 + 000 to 0 + 100 can be damaged as follows :

Table 4.3 Total Quantity Result Value

1. Hole (L) = 20.00
2. Patch (M) = 3 4.00
2. Crocodile Crack (M) = 2 5.00

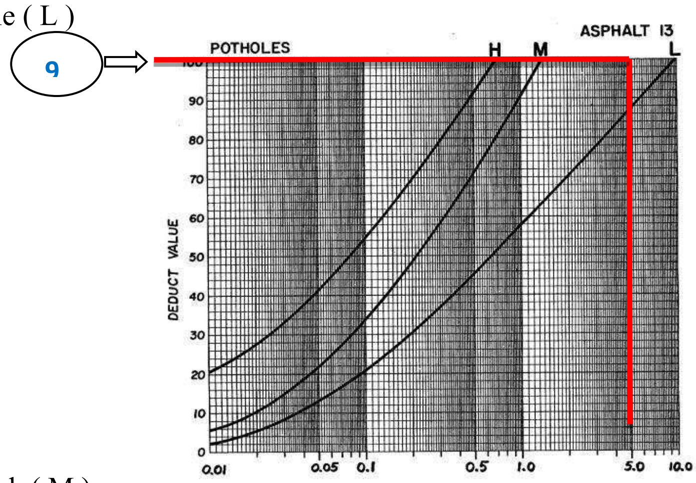
a) Count Capacity (dénsi ty) .
D e n si ty (%) = (L u a s a tau long Damage / Area P e r v e r a s a n) × 10 0 %

Table 4.4 Calculating Density

1.	Hole (L)	= (20/ 3x100) x 100% = 6.67
2	Patch (M)	= (34/ 3x100) x 100% = 11.33
3.	Crocodile Crack (M)	= (25/ 3x100) x 100% = 8.33

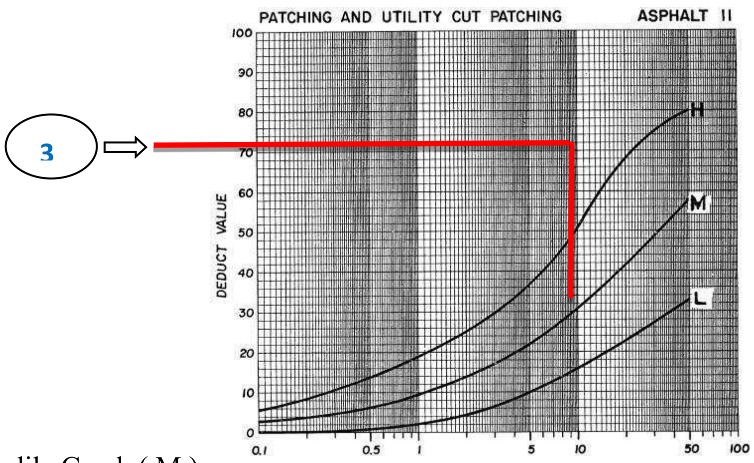
b) Search for the value of reduction (de du c t v alue).
Look for d e d u c t v alue (D V) y a n gb e ru p a g rafik types damage . There are any ways For determine D V , that is with s u p p e r s e n t a s ed e n s i t i o n s on g rafik m a sing - masi n g jenis damage Then men a rik g a ris v e rtik a l s a mp a t m e m o t ong t i n g k a t damage (lo w , medium , h i g h), s e ke n y a on t i t i k p cut t e rs e but in ta rik line h ori z ontal And will be obtained DV .

1. Hole (L)

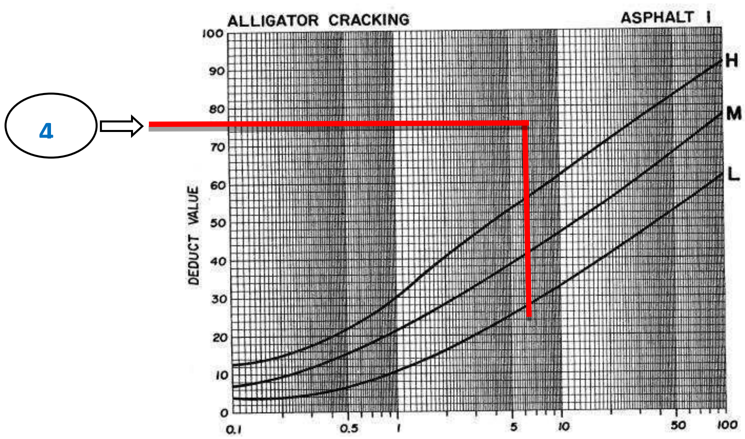


otholes)

2 . Patch (M)



2. Crocodile Crack (M)



Picture G r a f i c D e d u c t value (Crocodile Crack)

c) Total number d e du c t value
D e du c t v alue which is played by su a tu s e gmen road which are reviewed in total s e hing s ipe r by to t a l d e du c t v alue (T D V). For example, for segments 0 + 000 to 0 + 100, the total d e du c t is obtained value is 169

d) Searching for Correc ted (Corrected) Reduction Values Deduct Value)
D a ri h a sil D e du c t v alue (D V) for get mark CDV with how to enter the DV value Which more than 5 gr a fik C DV with method draw a line v e rtik a l p a d a ni l a i DV s a mpai cut line q Then at the pull line hori z ontal. Mark q me r up a k a n amount d e d u c t v alue which are more from 5 . For example, for the segment 0 + 000 to 0 + 100 there are 3 d e d u c t value but the value of d e d u c t There are only 3 values greater than

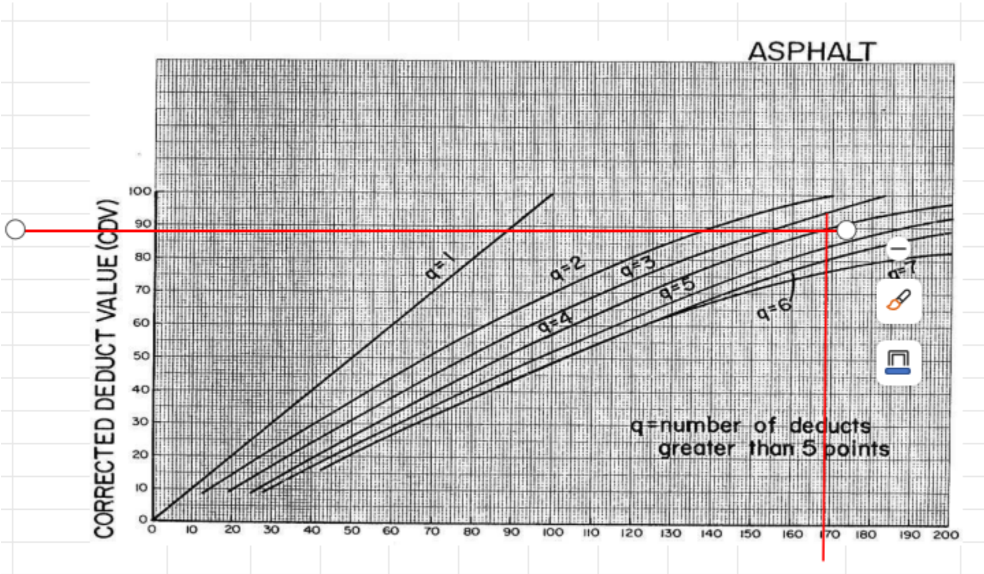
5 , so the value used for q is 3. Total d e d u c t The value is 169 q = 3 then based on the graph the total d e d u c t v alue obtained a value of CDV = 89 .

T a b e l Example of Calculation C orre c ted De d u c t Value

STA	D E D UCT V A L UE (D V)				TOTAL	Q		C D V
0 + 0 0 0 to 0 + 1 0 0	92	32	45		169	3		**89**

Source: Research Data Analysis by Akhi Thoriq , 2026

Then from the results of the Corrected d e d u c t table values entered into the graph Total D e d u c t V alue (TDV) as in Figure 4. 4 below.



Picture G r a f i c Corre c t D e d u c t Value S TA 0 + 000 to/d 0 + 100

Source: Research Data Analysis by Akhi Thoriq , 2026

e) Count value of the condition of the violence

Mark condition work with reduce one hundred with mark C DV y a n g in p e roll e h. The complete formula for this is a are as follows :

PC I = 100 – CDV

With :

PC I = Assess the p e rk e r a s a n condition

CDV = Corre c ted D e d u c t Value

PC I = Assess the p e rk e r a s a n condition

Mark which is obtained the can show condition hardness p a d as e g men y a n g di t in ja u , a p a k a h Good , very Good or even very bad idea with a n use PCI parameter . For example , for STA segment 0 + 000 to 0 + 100, with CDV value = 89 , then PCI = 100 - 89 = 11 very poor (very bad)

Discussion of Road Condition Recapitulation Based on the PCI Method

Based on results analysis Which has done in on , so got a t ni l a i r a ta - ra ta p e r 100 m condition violence which is being researched like on Appendix I Calculation of value PC I S TA 0 + 000 to 2 + 5 00 which is then added up for each unit divided by the total number of units .

Mark PC I work s e ca ra overall on Margo Agung 2 Road Section, Natar District , South Lampung , can be seen in the following table:

Recapitulation Table Corre c t D e d u c t Value S TA 0 + 000 to/d 3 + 0 00

NO	STA.			Distress SEVERITY	TOTAL	DENSITY (%)	Deduct VALUE (DV)	TOTAL CDV	PCI
1	0+000	-	0+100	13L	20.0	6.67	92.0		
				11M	34.0	11.33	32.0	89	11
				1M	25.0	8.33	45.0		
2	0+100	-	0+200	11M	104.0	34.67	52.0		
				6H	7.0	2.33	22.0	98	2
				1M	4.0	1.33	24.0		
3	0+200	-	0+300	13L	22.5	7.50	94.0		
				11M	100.5	33.50	51.0	93	7
				1M	10.5	3.50	35.0		
4	0+300	-	0+400	13L	4.7	1.57	66.0		
				11M	30.5	10.17	32.0	79	21
				1M	8.5	2.83	32.0		
5	0+400	-	0+500	13L	6.0	2.00	70.0	78	22
				11M	87.5	29.17	48.0		
6	0+500	-	0+600	13L	9.0	3.00	78.0	76	24
				11M	40.0	13.33	34.0		
7	0+600	-	0+700	13L	7.0	2.33	73.0		
				11M	17.5	5.83	24.0	78	22
				1M	33.0	11.00	34.0		
8	0+700	-	0+800	11M	19.0	6.33	25.0	50	50
				1M	21.0	7.00	43.0		
9	0+800	-	0+900	11M	18.0	6.33	24.0	45	55
				1M	17.0	7.00	40.0		
10	0+900	-	1+000	11M	22.0	7.33	26.0	53	47
				1M	27.0	9.00	46.0		
11	1+000	-	1+100	11M	58.0	19.33	41.0	68	32
				1 M	60.0	20.00	56.0		

12	1+100	-	1+200	13L	8.0	2.67	76.0		
				11M	74.0	24.67	46.0	93	7
				1M	19.0	6.33	42.0		
13	1+200	-	1+300	11M	46.0	15.33	36.0	64	36
				1 M	50.0	16.67	54.0		
14	1+300	-	1+400	13L	6.0	2.00	70.0		
				11M	22.0	7.33	37.0	91	9
				1M	47.0	15.67	52.0		
15	1+400	-	1+500	11M	18.0	6.00	24	48	52
				1 M	19.0	6.33	42		
16	1+500	-	1+600	11M	55.0	18.33	39	66	34
				1 M	50.0	16.67	54		
17	1+600	-	1+700	13L	9.0	3.00	76		
				11M	126.0	42.00	55	95	5
				1M	106.0	35.33	48		
18	1+700	-	1+800	13L	3.0	1.00	58		
				11M	25.0	8.33	28	75	25
				1M	10.0	3.33	34		
19	1+800	-	1+900	11M	54.0	18.00	39	50	50
				1 M	6.0	2.00	28		
20	1+900	-	2+000	11M	71.0	23.67	44	56	44
				1 M	10.0	3.33	34		
21	2+000	-	2+100	11M	31.0	10.33	31	56	44
				1 M	32.0	10.67	48		
22	2+100	-	2+200	11M	123.0	41.00	55	59	41
				1 M	74.0	1.90	28		
23	2+200	-	2+300	11M	11.0	3.67	19	53	47
				1 M	48.0	16.00	53		
24	2+300	-	2+400	13L	3.0	1.00	58		
				11M	18.0	6.00	24	84	16
				1 M	71.0	23.67	59		
25	2+400	-	2+500	11M	36.0	12.00	33	55	45
				1 M	22.0	7.33	43		

	AMOUNT	748
	AVERAGE	**29.92**

Akhi Thoriq's Research Data Analysis , 2026

(Details of each segment can be seen in the attachment)

$$= \frac{\sum PCI}{\text{Jumlah Segmen}}$$

= 748 / 25

= 29.92 % Bad / Poor

Pavement Quality Classification Based on Pavement Condition Index (PCI)

The lowest damage value is found in STA 0 + 8 00 to 0 + 9 00 with a value of 55.00 % which is included in the Good category and STA. 0 + 1 00 to 0 + 2 00, STA. 1 + 1 00 to 1 + 2 00 with a damage value of 2 -7 % Failed . In other segments, it shows a bad to failed category or in other words, the average overall quality value of the pavement layer of the RA. Basyid - Fajar Baru Section, South Lampung is 29.92 % in the Bad/Poor category (Poor) as can be seen in Figure 4.5.

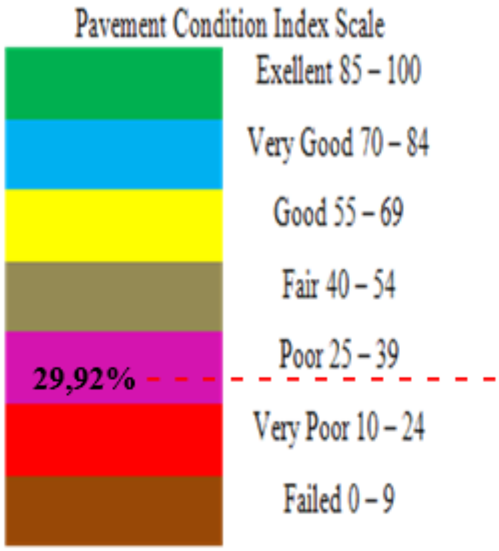


Figure 4.4 Pavement Quality Qualification According to PCI Value
Source: Field Data Analysis of Akhi Thoriq's Research 202 6

CONCLUSION

After conducting a survey of field data collection and conducting calculation analysis on this research using the PCI Method , it can be concluded as follows: There are 4 types of damage on the RA. Basyid - Fajar Baru Road Section , namely Potholes, Patches, Collapses and Crocodile Skin Cracks, with the highest percentage of the area of the Patch type of damage being 5.8 , 64 % and Crocodile Skin Cracks being 3.6 , 39 % , Potholes being 4.64 % an Collapses being 0.33 %, according to the length of the survey research segment of 25.00 meters. the RA. Basyid - Fajar Baru road section which was studied using the Pavement Condition Index (PCI) method, there are several segments that are classified as having the lowest damage value. The lowest damage value is found in STA 0 + 8 00 to 0 + 9 00 with a value of 55.00 % which is included in the Good category and STA. 0 + 1 00 to 0 + 2 00, STA. 1 + 1 00 to 1 + 2 00 with a damage value of 2 -7 % Failed . In other segments, the category shows bad to failed .
The road pavement condition value on the RA. Basyid - Fajar Baru road section in South Lampung district using the Pavement Condition Index (PCI) method is 29.92 %, which is poor .

Based on the results of the discussion and conclusions, the following suggestions can be given.The use of the Pavement Condition Index (PCI) method does not review the value of road slope conditions and LHR vehicle traffic volume in analyzing data, so it would be better if the damage review was increased and expanded in scope or in detail the type of damage. For further research comparing road pavement conditions, it is advisable to use more than two methods (SDI, RCI, BM, etc.) to obtain more results and to be able to choose which results are more accurate and effective. The causes of road damage can be included from the results of existing observations and surveys conducted at that time, and adjusted to the handling of the Bina Marga method.

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