

Analysis Of The Level Of Road Damage Using The Pavement Condition Index (PCI) Method: A Case Of Jalan Laswi Majalengka

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ABSTRACT

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In Majalengka Regency, the Laswi road is an access road that connects the Tonjong Roundabout with the Tonjong Kecap Monument. The pavement on Jalan Laswi uses flexible pavement. The road was damaged due to the large number of heavy and light vehicles that passed through it. It is anticipated that the assessment of road damage conditions will be able to assess the degree of road damage on a section of the road. The purpose of this study is to determine the appropriate method of handling road damage and the level of damage that occurs. The PCI method (Pavement Condition Index) is used to assess the condition of road pavement damage. This method involves a visual survey of the damage and evaluating it according to type, extent, and amount. The damage can be used as a basis for performing maintenance and repair tasks. By using the PCI method, research on road conditions in Laswi (Majalengka Regency) found that the average PCI value for all Laswi road sections was 82,38% (Very Good).

1. Introduction

Roads are an important part of land transportation infrastructure because good roads make it easier for people to move around, increase productivity at work, and participate in other social activities. Roads also make it easier for people's economic activities to continue. For the road to continue to meet development needs with a certain level of implementation, it is important to try to adjust to the nature of road management, where one of these ways is to reassess the condition of the road so that the road has quality and thickness that will not be harmed by piles of vehicles. In addition, the pavement must be resistant to traffic erosion, climate change, and other negative factors [1].

Roads facilitate economic activity and are another mode of transportation that Indonesians frequently use to travel both far and near. The state of the road will have a significant impact on traffic. The development of globalization likewise affects the degree of versatility which thus affects the development of transportation use. The transport volume load, therefore, exceeds the planned road class limit, lowering the pavement's quality and life expectancy [2] [3] [4] [5] [6].

The Tonjong Roundabout and the Tonjong Kecap Monument T-junction are connected by a road known as Jalan Laswi in Majalengka Regency, West Java. This road section is very densely traversed by various types of light vehicles and heavy loads. Starting from Bus Transportation, Urban Public Transportation (Angkot), and Garbage Trucks [7] [8] [9] [10] [11]. With high action and tracking the many hazards of the asphalt surface in the Jalan Laswi area, it is important to dissect the surface damage on the asphalt surface of Jalan Laswi which is indicated based on the type of damage [12].

Laswi Street in Majalengka Regency will be the focus of this research. The PCI pavement analysis method was used in this study to find out how to use the damage quality and effectiveness.

2. Literature Review

2.1 Road Pavement

Pavement is a road construction part consisting of several layers or layers, located on a foundation or subgrade that is intended for traffic lanes. And must be strong enough to meet the two main requirements as follows: Traffic conditions such as the road surface is not wavy, not deflected, not hollow, fairly stiff, and not shiny. In addition, the road must be able to withstand the friction or wear and tear of the vehicle's wheels. The strength/structural requirement is that the overall pavement must be strong enough to carry and spread the traffic load that crosses it. In addition, it must be watertight, the surface easily circulates air and has sufficient thickness [13].

2.2 Road Damage

By the Indonesian Constitutional Law No. According to Section 38 of 2004 on road infrastructure, roads play a crucial role in the country's development. Because the community relies on the road to carry out its day-to-day activities, a road plan is expected to fulfill the road's fundamental function. Increased traffic, water from poor drainage, poor material, a climate with high air temperature and rainfall, unstable soil, and poor soil compaction can all cause damage to road pavement construction. The harm was brought about by different variables including high traffic volume and the weight of passing vehicles. Damage to the road will affect the safety and comfort of motorists, which could lead to accidents, traffic jams, and other problem [14]

2.3 Method PCI

Pavement Condition Index (PCI) is an estimate of road conditions that uses a rating system and objective, reliable data to convey the actual pavement condition. This strategy helps in distinguishing and focusing on the essential street upgrades. PCI evaluation depends on visual perception and estimation of street harm utilizing laid-out standard strategies. Because accurate data is obtained by the initial conditions in the field, this method is used to monitor highway damage. The criteria for PCI levels are Excellent, Very Good, Good, Fair, Poor, and Failed. PCI levels are written in a range of 0 to 100 [15].

3. Method

a. General Description

Information is one of the primary qualities in assembling research and logical demonstrate [16]. Primary, secondary, and additional supporting data are used in this investigation. Primary data was collected from field surveys and measurements. The survey conducted in the study area produced actual conditions and field data. The research location on Jalan Laswi, Majalengka Regency is quite interesting. As depicted in Figure 1, the research area is in Cigasong District, Majalengka Regency. Meanwhile, additional information gathering was carried out in a joint effort with key offices and prior checks [17]. This information is in the form of a location map obtained from Google Maps. Problem identification is the first step in a systematic scientific research process [18]

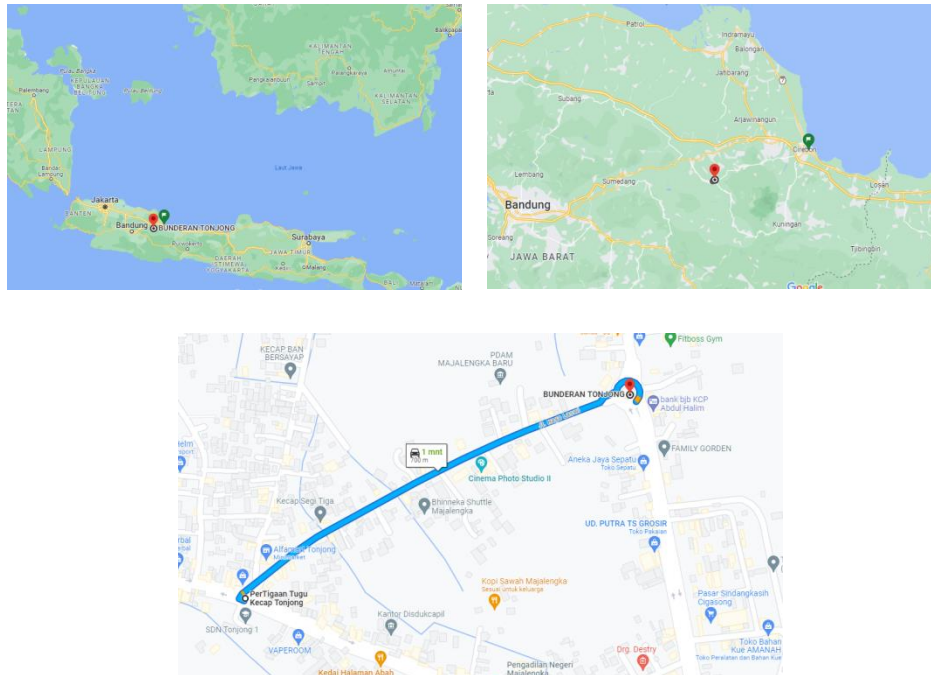


Figure 1. Research Locations
(Source: Google Maps)

b. Assessment of PCI (Pavement Condition Index)

In determining the PCI value, this study uses the following steps:

1. Severity Level

Determine the level of damage by categorizing the type of damage to a certain level according to the provisions of the PCI method. There are three levels of damage types, including Low (L), Medium (M), and High (H).

2. Density

In the density calculation step, use the formula: $(Ad/As) \times 100\%$, Ad is the result of calculating the type of damage. While as is the area of the road segment.

3. Deduct Value

In the step of determining the deduct value, a calculated density value is required, as well as a graph according to the type of damage determined.

4. Total Deduct Value

In the step to get the TDV value, it is generated by adding up all the Deduct Value values of the road segment units.

5. Corrected Deduct Value

To obtain the CDV value to connect the graph curve. The data needed to determine the CDV value include the TDV of the segment unit and the Q value or amount of damage from the road segment.

6. PCI value Determination

The PCI value is obtained by the formula: $100 - \text{Max CDV value}$. Once the PCI value is known, the value is determined according to the category. The Determination is in Figure 2.

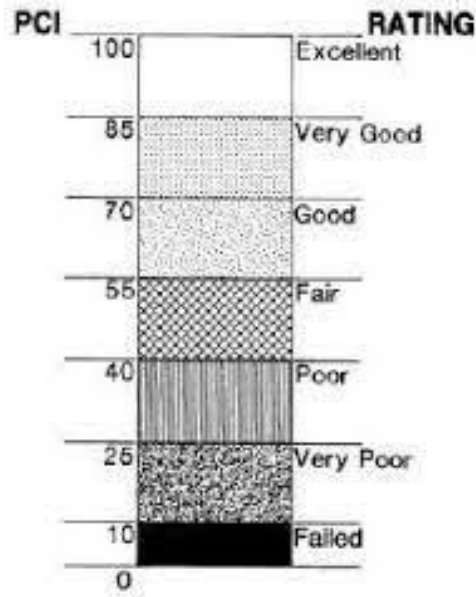


Figure 2. Graph PCI Value
(Source: Google Image)

4. Result and Discussion

Data collection was carried out on Monday, from 06.00 to 18.00 WIB. The schedule was chosen because Monday is the peak of the crowd at the research location. Laswi Street has a total width of 9 meters and a pavement width of 7 meters. The length of the road is 650 meters. The road damage survey was carried out from 12 June to 14 June 2023. Data on road damage can be seen in Figure 3.



Figure 3. Photo of Road Damage Types on Jalan Laswi

Table 1. STA sample unit data collection 0+200 to 0+250

No.	Type Damage	Destress Severity	Density	DV	HDV	TDV	CDV	PCI	Information
1	Longitudinal Cracking	L	0,004571	0	58	92	48	52	Fair
		M	0,015429	0					
2	Alligator Cracking	M	0,314286	13	58	92	48	52	Fair
		L	0,114286	21					
3	Potholes	L	0,114286	21	58	92	48	52	Fair
		M	0,314286	58					

Course:

Table 1 is a sample unit of calculations in finding PCI values, calculating all segments in road stationing, and graphing costs performed in Excel. To produce the PCI value in Table 2.

Table 2. PCI Value

No.	STA	PCI	Information
1	STA 0+000 to 0+050	100	Excellent
2	STA 0+050 to 0+100	100	Excellent
3	STA 0+100 to 0+150	100	Excellent
4	STA 0+150 to 0+200	91	Excellent
5	STA 0+200 to 0+250	52	Fair
6	STA 0+250 to 0+300	86	Excellent
7	STA 0+300 to 0+350	22	Very Poor
8	STA 0+350 to 0+400	70	Good
9	STA 0+400 to 0+450	80	Very Good
10	STA 0+450 to 0+500	70	Good
11	STA 0+500 to 0+550	100	Excellent
12	STA 0+550 to 0+600	100	Excellent
13	STA 0+600 to 0+650	100	Excellent
Total		1071	

Course:

Based on these data, calculating the overall PCI value on Jalan Laswi, Majalengka Regency, it can be done by adding up the total value and dividing by the total number of roads.

Formula:

$$PCI = \frac{PCI_{total}}{Total\ Segment}$$

$$PCI = \frac{1071}{13} = 82,38 \text{ (Very Good)}$$

5. Conclusion

The following conclusions can be drawn from the analysis and calculation of urban road damage to Jalan Laswi (Majalengka Regency) STA 0+000 - 6+500: Longitudinal Cracking, Alligator Cracking, and Potholes are the three types of damage found in a direct survey conducted on Laswi road (Majalengka Regency). The PCI method was used to research the condition of the Laswi road (Majalengka Regency). The findings show that the overall PCI score for the Laswi road section is 82,38 (Very Good).

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