

# **Evaluation Of The Road Pavement Damage With Bina Marga Method And Pavement Condition Index Method**

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## **Abstract**

Evaluation of the road pavement damage with bina marga method and pavement condition indeks Assessment system of road pavation condition based on type, level and rate of damage occurring, and can be used as I reference in the maintenance efforts of street labour. High traffic loads cause a lot of damage occurring, thus disrupting comfort and safety of driving. The purpose of this research is to assess the condition of the labour of M.H. Thamrin Street. The research was conducted visually by the methods of Bina Marga and Pavement Condition Index. M.H. Thamrin Street divided into several segments with a size of 100 x 3.5 M per segment. Each segment is evaluated by measuring dimensions, identifying its type and damage level to obtain a breakdown value with the Bina Marga and PCI methods. The results of the analysis showed that the damage occurred, among others, transverse cracks, longitudinal cracks, plot cracks, random cracks, side cracks, and joint reflection crack. The damage value with the Bina Marga method shows to the routine maintenance program, while the average PCI value for M.H. Thamrin Street 70.8% is categorized in good condition, so it needs a routine maintenance to make repairs immediately

## **Keywords**

Assessment of road condition, Bina Marga, PCI

## **1. Introduction**

In Indonesia that has a high congestion problem is in DKI Jakarta. Based on data from DKI Jakarta Transportation office in 2010 losses Because of traffic congestion in DKI Jakarta has reached RP. 45,2 trillion per year, The main cause of traffic jams is that it is not as demand and Supply is the growing number of vehicles with transportation infrastructure capacity Network and public transport networks) as examples of road growth In DKI Jakarta amounted to 0.01% per year while the growth of motor vehicles Reaches 9.5% per year. Accompanied by an increase in the number of vehicles such as busses, trucks, passenger cars, and motor cycles also experienced a fairly high increase (Isradi, 2020). With that problem, we are from academics want to try to evaluate the cause of the condition.

Roads are a land transportation infrastructure that is important because if the road of an area is good, facilitate the economic activities of the Community, facilitate the mobility of people, increase productivity in working and increase Other social activities. In order for the road to continue to accommodate the needs of the movement with a certain level of service, it is necessary to do a business to maintain the quality of the road service, where one of these businesses is to revaluation the condition Good roads, Should have quality and thickness which will not be damaged by the load Vehicles. In addition, the pavement must have resistance to erosion Due to traffic, weather changes and other adverse influences.

Road pavement is a layer of construction that is placed on the ground (Subgrade) that has undergone compaction and has a function to support the burden of traffic which then spread it to the road so that the ground does not accept of the permitted land capacity. The purpose make a layer of the road pavement is to be achieved a certain force so as to support the load of traffic and can transmit and distribute the load of wheels-the wheels of the vehicle received to the ground (Sukirman, 1992).

One of the stages of evaluating road condition is to assess the condition of existing road. The value of this road condition will be used as reference to determine to do revaluation program is done, whether it is an upgrade program; periodic maintenance; or routine maintenance. Maintenance of routine or periodic roads needs to be done to maintain the safety and convenience of the way for the user and maintain durability/longevity until the age of the plan (Shahin, 1994). Selection of proper road maintenance Assessment of road surface conditions is based on the A visually defined breakdown. There are several approaches. methods that can Used in the assessment of road conditions, where two of them are Bina Marga methods and PCI methods. Pavement Condition Index is an evaluation system of road pavement condition based on the type, level, and the extent of damage that occurs (Isradi, 2020)

This research aims to evaluation M. H. Thamrin Street at Bundaran HI. Using methods in this research is the Bina Marga method and analysis of the pavement Using PCI methods to determine how to use the quality and efficiency of the damage incurred.

## **2. Research Methodology**

Basically, each road's pavement structure will undergo a progressive destruction process since the road was first opened to traffic. To overcome this, a method is required to determine road conditions in order to be prepared for the road maintenance program to be performed (Sulaksono, 2001).

### **2.1. Bina Marga method**

In the Bina Marga (BM) method, the type of damage that needs to be considered when conducting visual surveys is surface roughness, holes, patches, cracks, grooves, and udders. Specifying road condition values, see Table 1, is done by summing each number and value for each damage condition.

Table 1 Determination of condition number based on damage type (Binamarga, 1990)

<b>Cracking Type</b>	<b>Value Damage</b>
Aligator Cracking	5
Bleeding	4
Random Cracking	3
Transversal Cracking	2
Longitudinal Cracking	1
Nothing	0
<b>Width</b>	<b>Value Damage</b>
> 2 mm	3
1 - 2 mm	2
< 1 mm	1
Nothing	0
<b>Wide Damage</b>	<b>Value Damage</b>
> 30 %	3
10 - 30 %	2
< 10%	1
Nothing	0
<b>Ruttung Depth</b>	<b>Value Damage</b>
> 20 mm	7
11 - 20 mm	5
6 - 10 mm	3
0 - 5 mm	1
Nothing	0
<b>Patching and Utility Cut Patching</b>	

<b>Area</b>	<b>Value Damage</b>
> 30 %	3
20 – 30 %	2
10 - 20 %	1
< 10 %	0
<b>Surface Roughness Type</b>	<b>Value Damage</b>
Disintegration	4
Weathering or Raveling	3
Rough	2
Bleeding	1
Close Texture	0
<b>Depression</b>	<b>Value Damage</b>
> 5/100 m	4
2 - 5/100 m	2
0 – 2/100 m	1
Nothing	0

After summing every numbers, see Table 2, for all from the damage types and determine the values it will be in the get road condition.

Table 2 Determination of the road condition value based on total damage (Binamarga, 1990)

<b>Total Value of Damages</b>	<b>Value of road conditions</b>
26- 29	9
22- 25	8
19 -21	7
16 – 18	6
13 – 15	5
10 - 12	4
7 – 9	3
4 – 6	2
0 – 3	1

Calculation of the road condition priority (UP) is a function of the LHR class (average daily traffic) and the values of the path condition, which mathematically can be written as follows:

**Priority order = 17 – (LHR class + Road condition)**

- Order of priority 0-3, indicating that the path should be included in the upgrade program.
- Order of priority 4-6, indicating that the path should be included in the periodic maintenance program.
- Order of priority >7, indicating that the path should be included in the routine maintenance program.

## 2.2 Pavement Condition Index (PCI) Method

Pavement Condition Index (PCI) is an estimate of the road condition with a rating system to declare the real pavements condition with reliable and objective data. The PCI method was developed in the Americas by the U.S. Army Corp. of Engineers for the pavement of airports, highways and parking areas, because with this method obtained data and approximate conditions accurately according to the conditions in the field. The PCI level is written in the 0-100 level, see Table 3. According to Shahin (1994) The condition of the pavement road is divided into several levels.

Table 3 PCI dan Pavement condition (Shahin, 1994)

PCI Value	Pavement Condition
0-10	Failed
10-25	Very Poor
24-40	Poor
40-55	Fair
55-70	Good
70-85	Very Good
85-100	Excellent

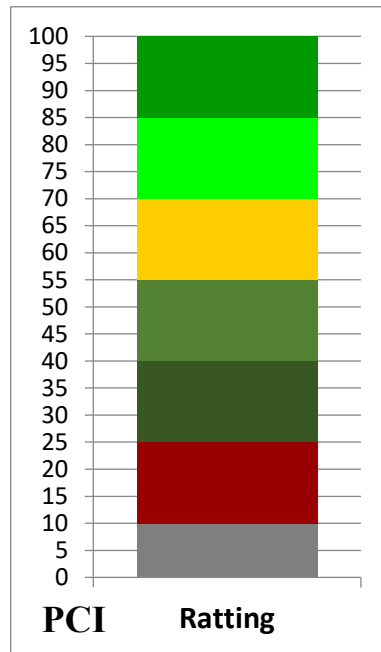


Figure 1 Rating road conditions based on PCI method

#### PCI Calculation Procedure

These steps and the examples have been summarized from the Annual book of ASTM Standards (2011). Index pavement Condition formula specifying (PCI), After completing the survey, the data obtained is then calculated broadly and the percentage of damage according to the level and, the damage. The next step is to compute the PCI values for each unit sample from the road segments, in Figure 1 will be presented how to determine the PCI value.

#### 2.2.1 Finding a percentage of damage(Density)

Density is a broad percentage of damage to the broad sample units reviewed, the density obtained by dividing the area of damage with the area of the sample unit. Formulas for a density values:

$$\text{Density} = \text{Ad/Ld} \times 100\%$$

Ad = Total area damage for each level of damage (m<sup>2</sup>)

Ld = Total length of damage type for each level of damage (m)

As = Total area unit segment (m<sup>2</sup>)

#### 2.2.2 Determine Deduct Value

After the density value is obtained, then each of the damage is be plotted to the chart according with the data.

#### 2.2.3 Determine Value Q

The requirement to find the Q value is the value of deduct value greater than 2 by using Interasi. The value of deduct value is sorted from large to small. Previously done checking value of deduct value with formula :

$$M_i = 1 + (9/98) \times (100 - HDV_i)$$

$M_i$  = Correction value for deduct value

HDV<sub>i</sub> = Value dispersed deduct value in one sample unit

If all value of deduct value is greater than the value of  $M_i$  it is deducted from the value of deduct value with  $M_i$  value but if the value of deduct value is smaller than the value of  $M_i$  then it is not deducted from the value of deduct value.

### 2.2.4 Determine CDV value

In Figure 2 CDV value can be searched after the value of Q is known by the number of values Deduct Value next to put the number of Deduct value in the chart CDV corresponds to the value Q. CDV.

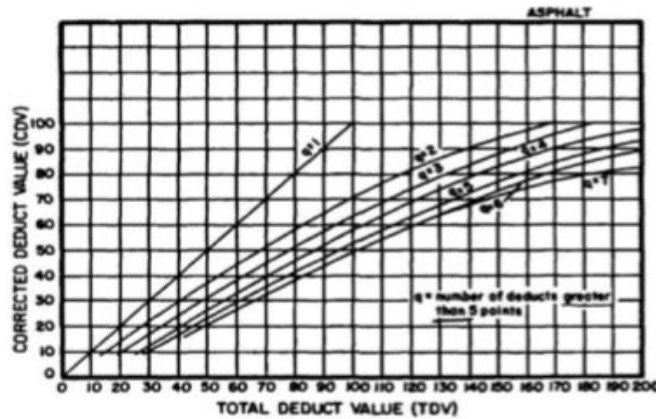


Figure 2 Corrected deduct value(CDV) graph (Shahin, 1994)

### 2.2.5 Determine PCI Value

after the CDV value is obtained, then it can be specified a PCI value with formula as follows :

$$PCI = 100 -$$

After the PCI value is obtained, can then be determined the rating of the sample units reviewed to plotted a graph.

## 3. Result And Analysis

Table 4 shows road and total number damage, measurement conditions and results

Table 4 Road damage

No.Segment	Segment Length	Location (STA)	Damage type
1	100	STA 0 - 100	Longitudinal cracking
2	100	STA 100 - 200	Longitudinal,transversal cracking
3	100	STA 200 - 300	Longitudinal cracking
4	100	STA 300 - 400	Longitudinal cracking
5	100	STA 400 - 500	Edge cracking
6	100	STA 500 - 600	transversal cracking
7	100	STA 600 - 700	Random cracking
8	100	STA 700 - 800	Angular cracking
9	100	STA 800 - 900	Joint Reflection Cracking
10	100	STA 900 - 1000	Transversal, Joint Reflection Cracking

Summing each number for any type of damage, see Table 4

Based on calculations using the Bina Marga and Pavement Condition Index (PCI) method, see Table 5, the average condition values for each segment are obtained

Table 5 Measurement conditions and results

No.	STA	Damages Classification	Measure				DV	PCI
			quantity(m <sup>2</sup> )		A(m <sup>2</sup> )			
1	0-100	10H	5,964	1,4	—	7,364	35	65
2	100-200	10H	2,8	—	—	2,8	22	78
3	200-300	10H,15L	9,09	—	—	9,09	32	68
4	300-400	6H,11H	7,28	0,84	—	8,12	29,5	70,5
5	400-500	6H,7M	11,36	7,28	—	18,65	29,5	70,5
6	500-600	7M,10H	5,964	11,3	—	17,33	33	67
7	600-700	8M	28,63	—	—	28,63	21	79
8	700-800	10H,8M	9,09	9,54	—	18,63	27	73
9	800-900	7M,12H	11,36	37,18	—	48,55	31	69
10	900-1000	16L,11M	12,72	5,425	—	18,151	32	68
Amount						<b>177,315</b>	<b>292</b>	<b>708</b>
$\Sigma$						<b>17,73</b>	<b>29,2</b>	<b>70,8</b>

Comparison of calculations between the Bina Marga and PCI methods can be seen in Table 6

Table 6 Comparison of bina marga methods and PCI methods

Bina Marga Method	PCI Method
1. Conduct a LHR-survey (Average daily traffic)	1. Do not conduct a LHR survei
2. In the analysis using a number table of damage condition and using the LHR grade value table	2. In the analysis using graphs according to type of damage
3. The final result in the order of road damage handling	3. The final result is the level of damage of road

#### 4. Conclusion

From the results of research and testing obtained the following results:

1. The types of damage that occur on the busway line in Jl. M.H. Thamrin are transverse cracks, longitudinal cracks, crack groove, random crack, crack edges, and reflection joint connection.
2. Assessment result of road damage based on Bina Marga method on M. H. Thamrin Street has an average value of 7 meaning road condition on the line in good enough and efficacy into routine maintenance program.
3. The calculation of the *Pavement Condition Index* (PCI) method of the segment obtained a value of 70.8%, including in the category of "good" condition.
4. The result of the assessment of M.H. Thamrin Road with the Bina Marga method and PCI method turned out to produce a relatively equal assessment, namely the road condition is still in fair condition but requires maintenance and repair.

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