

System Model For Physical Conditions of Road Components In Magetan District

Ferro Gadha Gilang Kencana
Universitas Sebelas Maret

Introduction

- The road is one of the most important infrastructures in supporting the economy and social activities of the people, connecting one city to another, between town and village, and between villages. In addition, roads can also increase access to potential areas (tourism, industry, agriculture, fisheries and crops), opening up remote areas and supporting the development of border areas. Another problem faced by local road operators is the absence of a database to accommodate current road condition data and its supporting components and unavailability of road condition assessments related to equipment and limited allocation of funds for road condition surveys.

Object research

Dr. Soetomo street

Ahmad yani street

Diponegoro street

Mungisidi street



In this study, selected 4 point road in Magetan regency, which is often used by society in driving,, that is :

1. Ahmad Yani Street
2. Dr. Soetomo Street
3. Diponegoro Street
4. Munginsidi Street

Weight Determination of Road Components

- The weighting of road component damage is determined based on its importance because until now there has been no weighting for each of the road components. Pairwise comparisons are often used to determine the relative importance of existing elements and criteria. For each paired comparison criterion and alternative (pairwise comparison) is to compare each other element at each level of the hierarchy in pairs so that the importance of the element in the form of qualitative opinion. For quantitative qualitative opinions the assessment scale is used so that the value of opinions will be obtained in the form of numbers (qualitative).

Values and Definitions of Qualitative Opinion on a Comparative Scale

level of importance	information	explanation
1	Both Elements are the same (same as Important)	Two elements have the same effect on purpose
3	is more important	One element is slightly more important than the other
5	important, stronger important	One element is clearly more important than the other elements
7	shows its importance	One element is clearly more important than the other
9	really more important	The absolute element is more important than the other elements
2,4,6,8	gray area	The value between the moment of doubt between two adjacent space values

Calculation of Physical Condition Analysis of Pavement

- **Pavement Condition Index (PCI)**

Pavement Condition Index (PCI) is an approximate road condition with a rating system to state actual pavement conditions with reliable and objective data. The PCI level is written in levels 0 - 100. According to Shahin (1994) the sidewalk conditions are divided into several levels such as

PCI Values and Definitions

PCI value	Pavement Conditions
0-10	Failed
10-25	Very Poor
25-40	Poor
40-55	Fair
55-70	Good
70-85	Very Good
85-100	Excellent

Calculate the PCI value for each sample unit of the road segment

Finding Percentage of Damage (Density)

- Density is the percentage of damage level in the sample area of the unit under review, the density obtained by dividing the level of damage by the unit sample area. The formula looks for density values:

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

Ad = Total damage area for each level of damage (m²)

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

US = Area of total segment units (m²)

- Looking for CDV Value

The CDV value can be sought after the value of q is known by summing the Deduct Value value and then subtracting the sum of the deductive values in the CDV graph according to the q value.

- Determining the PCI Value

After the CDV value is known, PCI value can be determined by using the following formula :

$$PCI = 100 - CDV$$

Nilai Dv	Nilai m	Nilai Dv terurut	Hitungan PCI untuk Jalan dengan permukaan Diperkeras												
			No.	DV						TDV	q	CDV	PCI	PCI terpakai	
57	4.95	57.00	1	57	21	19					97	3	62	38	38
21		21.00	2	57	21	2					80	2	58	42	
19		19.00	3	57	2	2					61	1	58	42	
Kesimpulan														Fair	

Calculation of Physical Condition Analysis Outside of the Pavement

Form Survey Data

Km.	Inventarisir Komponen								Survei Kerusakan Fisik Komponen															
	Trottoar (I)	Bahu Jalan (II)	Drainase Tepi (III)	Lereng (IV)	Perlengkapan Jalan (V)				Trottoar (I)	Bahu Jalan (II)					Drainase Tepi (III)				Lereng (IV)	Perlengkapan Jalan (V)				
					1	2	3	4		1	1	2	3	4	5	1	2	3		4	1	1	2	3
0,10	-	200	100	-	1	-	-	300	-	-	-	-	100	-	100	-	-	-	-	1	-	-	-	300
0,20	-	200	200	-	-	-	-	300	-	-	-	-	200	-	100	-	-	100	-	-	-	-	300	
0,30	-	200	100	-	-	-	-	300	-	20	-	-	80	-	100	-	-	-	-	-	-	-	300	
0,40	-	200	100	-	-	-	-	300	-	-	-	-	200	-	100	-	-	-	-	-	-	-	300	
0,50	-	200	100	-	1	-	9	300	-	-	-	-	100	-	-	-	-	100	-	-	-	-	300	
0,60	-	200	100	-	1	-	13	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	300	
0,70	-	200	100	-	-	-	7	300	-	25	-	-	75	-	-	-	-	100	-	-	-	-	220	
0,80	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	300	
0,90	-	200	200	-	-	-	-	300	-	-	-	-	100	-	-	-	-	200	-	-	-	-	300	
1	-	200	100	-	-	-	10	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	300	
1,10	-	200	100	-	-	-	-	300	-	-	-	-	100	-	100	-	-	-	-	-	-	-	220	
1,20	-	200	100	-	1	-	9	300	-	-	-	-	100	-	100	-	-	-	-	-	-	-	200	
1,30	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	200	
1,40	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	200	
1,50	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	200	
1,60	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	200	
1,70	-	200	100	-	-	-	-	300	-	100	-	-	-	-	-	100	-	-	-	-	-	-	200	
1,80	-	200	100	-	-	-	-	300	-	-	-	-	-	-	-	100	-	-	-	-	-	-	200	
1,90	-	200	200	-	-	-	-	300	-	-	-	-	-	-	-	-	-	100	-	-	-	-	200	
2	-	200	200	-	2	-	-	300	-	-	100	-	-	-	-	-	-	-	-	-	-	-	200	
Jumlah	0	4.000	2.400	0	6	0	48	6.000	0	145	100	0	1.055	0	600	200	0	1.300	0	1	0	0	4.940	

I. Trottoar

1. Berbahaya

II. Bahu Jalan

1. Erosi ringan
2. Erosi berat
3. Lebih tinggi dari jalan
4. Lebih rendah dari jalan
5. Dibutuhkan rabat

III. Drainase Tepi

1. Tersumbat
2. Tergerus
3. Runtuh
4. Dibutuhkan pasangan batu

IV. Lereng

1. Runtuh

V. Perlengkapan Jalan

1. Rambu (No.)
2. Pagar pengaman (m)
3. Patok pengarah (m)
4. Marka jalan (m)

Calculation Index of Physical Condition per Component

Sub Komponen	Jenis Kerusakan	Volume Kerusakan	Faktor Koreksi	Nilai Pengurang	Indeks Kondisi Fisik Sub Komponen
Saluran/ Drainase Tepi	Tersumbat	25,00%	0,44	50	$100 - ((0,44 \times 50) + (0,21 \times 25) + (0,24 \times 0) + (0,11 \times 100)) = 61,75$
	Tergerus	8,33%	0,21	25	
	Runtuh	0,00%	0,24	0	
	Dibutuhkan pasangan batu	54,17%	0,11	100	
Lereng Tepi	Runtuh	0,00%	1	0	$100 - (1 \times 0) = 100$
Trotoar	Berbahaya	0,00%	1	0	$100 - (1 \times 0) = 100$
Perlengkapan Jalan	Rambu Jalan	16,67%	0,44	25	$100 - ((0,44 \times 25) + (0,24 \times 0) + (0,16 \times 0) + (0,16 \times 100)) = 73,00$
	Pagar Pengaman	0,00%	0,24	0	
	Patok pengarah	0,00%	0,16	0	
	Marka Jalan	82,33%	0,16	100	

The grouping of roads based on their status aims to bring order and legal certainty of road operation in accordance with the authority of the government and local government.

- **Damage Volume and Subtracting Value**

Determination of component condition value begins by observing the condition of sub component. Observations were made on the type and volume of damage to each sub component. In the assessment of the condition of building components performed by Wijayanti (2013) used the value of the deduction of the amount depends on the percentage of damage volume. The reduced value (NP) for each volume range of sub component damage outside the pavement is divided into: minor damage (0% - <25%) with NP = 25, moderate damage (25% - <50%) with NP = 50 and a heavy workload ($\geq 50\%$) with NP = 100.

- **Correction Factor**

Each sub component has a maximum reduction value of one hundred, then for a sub component with more than one type of damage, the deduction value of the type of damage shall be multiplied by a correction factor in order that the total deductible value shall not exceed one hundred. The correction factor used is the weighted value of interest of each type of damage that occurs on each sub component

Conclusion

Based on the results of the analysis and discussion that have been done in the previous chapter, the following conclusions can be drawn:

- The assessment model of the national road component condition in Magetan district was developed by adopting a condition index system according to the weight and hierarchy of each road component. The weighting of road components using the Analytical Hierarchy Process (AHP) method through questionnaires resulted in the weight of pavement components 0.80 and for the components outside the pavement of 0.20. In the ponenic component outside the pavement , the road shoulder sub component has a weight of 0.37; drainage channel / edge 0.33; edge slopes 0.15; sidewalks 0.09 and 0.06

- Results of performance data, priority order and type of maintenance are as follows:

Name Of Street	PCI values	Outside Pavement Values	Total Physical Performance of the Road	List of Priority	Type of Maintanance
Munginsidi St.	31	87.8	42.3	1	Periodic
Diponegoro St.	32	94.5	44.5	2	Periodic
Dr. Soetomo St.	38	94.5	49.3	3	Periodic
Ahmad Yani St.	40	98.2	51.6	4	Periodic

Thank you