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Comparison of PCI (*Pavement Condition Index*) and SDI (*Surface Disstres Index*) in Identification of Urban Road Damage

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Abstract
The S. Parman road section is an access to two universities as well as access to the north of Jakarta using flexible pavement. Various heavy and light vehicles pass through these roads, causing road damage. Evaluation of the condition of road damage is very necessary to monitor the level of road damage that occurs on a road segment. This study aims to determine the level of damage that occurs, as well as determine the appropriate type of road damage handling. The method used in assessing the condition of road pavement damage is the PCI (Pavement Condition Index) and SDI (Suface Distress Index) method, which conducts a visual survey by viewing and analyzing the damage based on the type, level of damage and quantity of damage to be used as a basis for carrying out maintenance and repair activities. repair. How to analyze it by dividing the road into a sample of 100m. The results of the research on the condition of the Letjen S. Parman road (Grogol direction Slipi) with the PCI method obtained the overall average PCI value of the Letjen S. Parman road section is Perfect (Exellent) as much as 78.5%, Very Good (Very Good) as much as 16 .6%, and Good (Good) as much as 4.9% and the results of the research on the condition of the road section of Letjen S. Parman (Grogol direction of Slipi) with the SDI method, the overall SDI value of the road section of Letjen S. Parman is 65 for the score the highest score at stationing 3+900-3+800 and 0 for the lowest score at stationing 3+400-3+300.

Keywords
Road Damage, Pavement Condition Index, Surface Distress Index road section of Letjen S. Parman

1. Introduction
Roads are a means of transportation that is often used for Indonesian citizens to travel far and near and is very important in facilitating economic activities. Road conditions that are damaged will have a large traffic impact. The development of globalization also affects the level of mobility which has an impact on the increasing use of vehicles, resulting in vehicle volume loads exceeding the planned road class limits, so that the quality and age of the pavement decreases.

The road is a means of transportation that has a very important role in life, including facilitating the economy and culture, the flow of distribution of goods and services, as an access link between one region and another and can improve the economy and standard of living of the community. Road damage can be caused by several factors, including excessive vehicle loads (overloading), changing climate and environmental conditions, poor drainage systems that cause waterlogging, high traffic load, improper planning, implementation that is not in accordance with existing plans, and lack of supervision of road conditions.

The S. Parman road section is a class II road, which is a road in the city so that several types of vehicles are often passed from two-wheeled vehicles to four-wheeled vehicles (large). Damage to the S. Parman road, Pal Merah, West Jakarta makes motorcyclists have to be careful and cause traffic congestion and cause congestion

2. Research Methodology
2.1. General Description
This design was carried out on the Jalan S. Parman section at STA 4+200 – 0+ 000 which is located in West Jakarta, DKI Jakarta. In this design, several stages are needed in the process, such as calculating LHR (Daily Traffic), calculating PCI (*Pavement Condition Index*) and SDI (*Surface Distress Index*), and secondary data consisting of location maps and types of road construction, then data processing is carried out. . The design location map can be seen in Figure 1 below

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Figure 1. Location Map

2.2. Average Daily Traffic

Traffic data obtained first is calculated to determine the design age, traffic growth rate, with the formula:

$$LHR_{Plantedlife} = LHR_{Implementation}\ (1+i)^n$$

Keterangan :
i = Traffic Growth Rate
n = design life

2.3. Assessment of PCI (Pavement Conditition Index)

Pavement Condition Index (PCI) is a system for assessing road pavement conditions based on the type, level of damage that occurred and is used as a reference in maintenance. The Pavement Condition Index (PCI) value has a range of 0 (zero) to 100 (one hundred) with the criteria of perfect (excellent), very good (very good), good (good), moderate (fair), bad (poor), very bad. (very poor), and failed (failed). (Yunardhi et al., 2018).

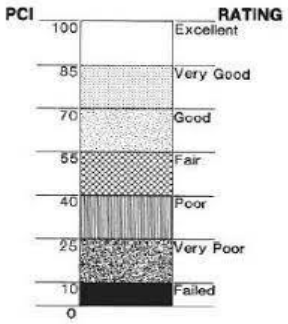

Figure 2. PCI Value
(Source : *Google Image*)

1. Severity Level

Severity Level is the level of damage for each type of damage. The level of damage used in the PCI calculation is a low severity level (L), medium severity level (M), and high severity level (H)

2. Density

Density or damage level is the percentage of the extent of a type of damage to the area of a segment unit which is measured in square meters or meters long. The density value of a type of damage is also distinguished based on the level of damage Density = (Ad/As) x 100%, or Density = (Ld/As) x 100%

3. Deduct Value (Value of Reduction)

Deduct value is the reduction value for each type of damage obtained from curve of the relationship between density and deduct value. Deduct value is also distinguished by the level of damage for each type of damage. One of them is longitudinal and transverse cracks

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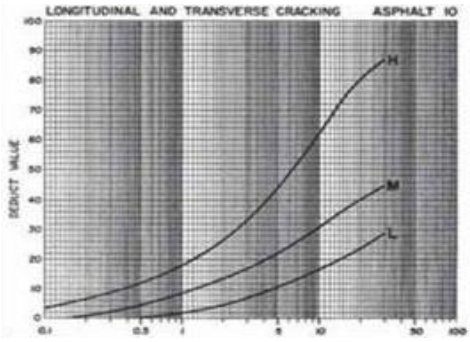

Figure 3. *Deduct Value* Longitudinal and Transverse Cracks
(Source : Hardiyatmo, 2007)

4. Total Deduct Value (TDV)

Is the total value of the reduction (*Deduct Value*) for each type of damage and the level of damage that exists in each segment unit.

5. Corrected Deduct Value (CDV)

Corrected Deduct Value (CDV) is obtained from the curve of the relationship between the TDV value and the DV value by selecting the appropriate curve for the number of individual deduct values that have a value greater than If the CDV value is known, then the PCI value for each units can be known PCI(s) = 100 – CDV For overall PCI values: PCI = PCI(s)/N

2.4. SDI (Surface Disstres Index)

According to Guide Number SDM-03 /RCS on road condition surveys in 2011 that Surface Distress Index (SDI) is a visual inspection with parameter data, namely the total area of cracks, width, average cracks, number of holes, and depth of vehicle ruts. These pavements are distinguished according to the type of pavement (asphalt road and gravel/soil road) and are divided by 100 meters for each segment, the results of the examination of these parameters are then calculated using the assessment standard set by Bina Marga, which results in a Surface distress index value (SDI). In determining the SDI value of a road segment, it is necessary to know the influencing factors of damage, these factors include cracking, bleeding, depression, edge cracking, longitudinal and transverse cracking, patching and utility cut patching, polished aggregate, potholes. , rutting, shoving, slippage cracking, swell, weathering and raveling. The parameters used in determining the SDI value are in accordance with the standards set by Bina Marga. The calculation of the value of SDI doing by accumulation based on the damage to the road to then be determined road conditions were set as in the table below:

Tabel 1. Determination Value SDI

Road Condition	SDI
Good	<50
Medium	50 – 100
Heavy Light	100 – 150
Heavy	>150

(Source : Direktorat Jendral Bina Marga,1995)

In addition to calculating the SDI value, an analysis is also carried out on the sensitivity of the SDI value in road segmentation. This analysis aims to see the changes that occur in the SDI value when the length of the road segment unit changes. In the calculation in accordance with the guidelines used, data collection intervals are carried out for every 100 meters distance on a road segment or segment, so it can be said that for a kilometer road segment there will be 10 (Ten) data taken to be taken into account. (Yusup & Kartika, 2019).

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1. Road Condition Standards

Tabel 2. Road Condition Based on SDI

Kondisi Jalan	SDI
Good	< 50
Medium	50 - 100
Heavy Light	100 – 150
Heavy	> 159

Source : Bina Marga 2011

2. Determination type Handling

Tabel 3. Road Maintenance Type

SDI			
< 50 Maintenance Routine	50 - 100 Maintenance Routine	100 – 150 Maintenance Periodic	> 159 Improvment / Reconstruction

Source : Bina Marga 2011

Table 4. Assessment of Types of SDI Damage

Assessment of Types of Damage to SDI			
	Category	Value x	Value of SDI[ad]
	Area Crack Area		
Assessment of Crack	None	-	0
	< 10 %	-	5
	10% - 30 %	-	20
	Width		
	None	-	0
Crack Width Assessment Crack	Fine < 1mm	-	0
	Medium 1-3mm	-	0
	Width >3mm	-	SDI Result[a] x2
	Number of Holes		
	None	-	0
Assessment Number of Holes	<10 /100m	-	SDI Result[b]+15
	10 – 50 /100m	-	SDI Result[b]+75
	> 50 / 100m	-	Results SDI[b]+225
	Used Wheels		
	No	0	0
Rate Used Wheels	<1cm in	0.5	SDI results[c] + 5 x 0.5
	1-3cm within	2	Results SDI[c] + 5 x
	2>3	4	Results SDI[c] + 5 x 4

Source: Bina Marga 2011

3. Result and Analysis

1.1. Traffic Calculation

Average daily traffic data is required for pavement thickness planning and analysis road capacity. Traffic data is obtained from the results of a direct survey for 3 days in 2021 see table 5

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Tabel 5. Data Traffic

Time	Average Vehicle SMP/Hour			
	Vehicle Weight (HV)	Vehicle Light Car (LV)	Motorcycles (MC)	Total Vehicle
Tuesday, April 27th 2021	1047	10368	26607	38022
Thursday, May 20th 2021	996	11761	20635	33392
Thursday, May 27th 2021	929	14280	20458	35667

3.2. PCI (Pavement Conditition Index)

a. Calculation Result

Tabel 6. Data Pavement Condition on Segment 40

STA	Type Damage	∑Slab	Volume	L.Segmen	Width Road	Units
0+300 – 0+200	11 L	5	0,535	100	4	m²
	8 L	3	0,07	100	4	m²

Source: Author's, 2021

1. Calculating the Percentage of Damage (*Density)*

$$\frac{0,535}{4\ x\ 100} x\ 100\% = 0,133\ \%$$

$$\frac{0,07}{4\ x\ 100} x\ 100\% = 0,017\ \%$$

2. Calculating the *Deduct Value*
   a. Patch (11L) = 0,133%, Score *Deduct Value* = 0

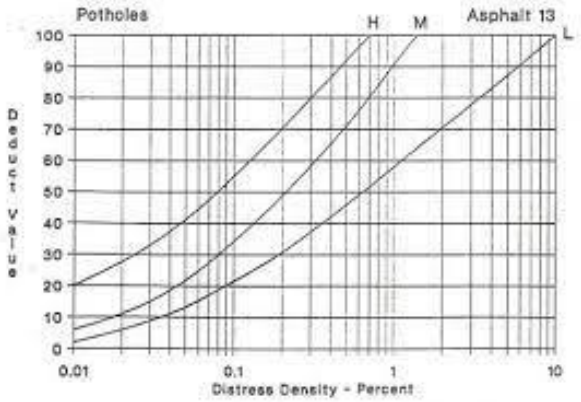

Figure 4. Calculating the *Deduct Value*

   b. Hole (8L) = 0,017 %, Score *Deduct Value* = 5

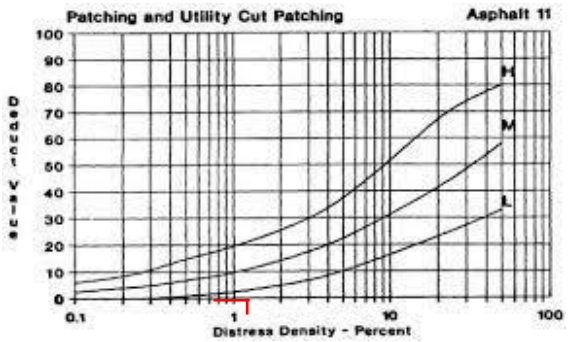

Figure 5. Calculating the *Deduct Value*

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3. Calculating *Total Deduct Value*
4. Calculating Maximum *Corrected Deduct Value*

Tabel 7. Calculating Result From Deduct Value and Total Deduct Value

STA	Deduct Value		Total	q
0+300 - 0+200	0	5	5	1

Source: Author's, 2021

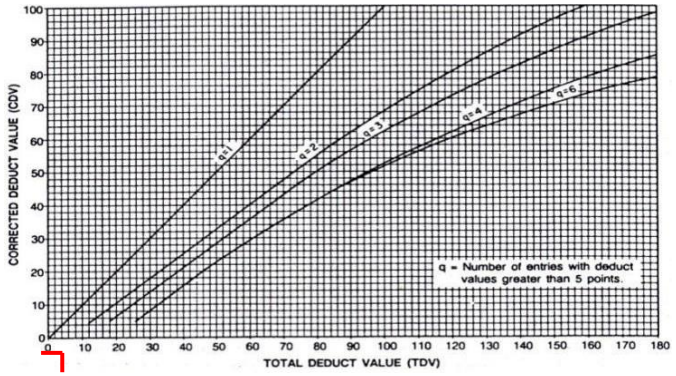

Figure 6. Maximum Corrected Subtraction Value *(CDV)*
Source: Author's, 2021

5. Calculatin PCI Value
   PCI = 100 – CDV
   = 100 – 5
   = 95 (Perfect)

b. Type of Road Damage

Based on the direct research survey on the Lieutenant General S. Parman road (Grogol direction Slipi) there are 8 types of damage, namely Patches, Holes, Edge Cracks, Joint Reflection Cracks, Crocodile Skin Cracks, Weathering and loose grains, Longitudinal and transverse cracks and grooves.

3.3. SDI (Surface Disstres Index)

1. Calculation Result

Tabel 8. Road Condition Data on Segment 25

STATIONING	CRACK WIDTH	% AREA	NUMBER OF HOLES	USED WHEELS
1+800 - 1+700	MEDIUM (1-5mm)	< 10%	1-5/100M	<1CM

Source: Author's, 2021

Tabel 9. Hasil Penilaian Kondisi Jalan

STA	CATEGORY	VALUE SDI	ROAD CONDITION	TYPE HANDLING
1+800 - 1+700	Area Assessment Cracks	5	GOOD	Maintenance Routine
	Assessment of Crack Width	5		
	Assessment of Number of Holes	20		
	Assessment of Wheel Depth	22,5		
	SDI Value	22,5		

Source: Author's, 2021

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3.4. Damage Management

Tabel 10. Types of Damage and Handling

Damage Type and Level	Management
Longitudinal and Transverse Crack	P3 Repair Method (Crack Coating) Mobilize equipment, workers and materials to the field. Clean the part to be handled with a water compressor, so that the road surface is clean and dry. Spray tack coat (0.2 liters/ m2 in the area to be repaired). Spread and flatten the concrete asphalt mixture on the entire marked area. Perform light compaction (1 - 2) tons until a flat surface and optimum density (density 95%).
Alligator Crack	P4 Repair Method (Crack Filling) Mobilize equipment, workers and materials to the field. Clean the part to be handled with a water compressor, so that the road surface is clean and dry. Fill the cracks with asphalt cut back 2 liters / m² using asphalt sprayer or with human power. Scatter coarse sand on cracks that have been filled with asphalt (10 mm thick) Compacts a minimum of 3 tracks with a baby roller.
Edge Cracking	P3 Repair Method (Crack Coating) Mobilize equipment, workers and materials to the field. Clean the part to be handled with a water compressor, so that the road surface is clean and dry. Spray tack coat (0.2 liters/ m2 in the area to be repaired). Spread and flatten the concrete asphalt mixture on the entire marked area. Perform light compaction (1 - 2) tons until a flat surface and optimum density (density 95%).
Rutting	P6 Repair Method (Alignment) Clean the part that will be handled with human power. Sprinkle a tack coat of 0.55 liters/m2. Sprinkle the concrete asphalt mixture then compact it until a flat surface is obtained. Compact with a baby roller (minimum 5 tracks).
Grain Release	P2 Repair Method (Local Asphalt Investment) Mobilize equipment, workers and materials to the field. Cleaning the part to be handled with the water compressor, the road surface should be clean and dry. Spray with hard asphalt as much as 1.5 kg / m2 and for cut back 1 liter / m^2 Scatter coarse sand or fine aggregates 5 mm to flat. Compacting pneumatic machines until a flat surface is obtained and has an optimal density (density of 95%).

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Hole	P5 Repair Method (Hole Patching) Dig the material until it reaches the bottom layer. Clean the part that will be handled with human power. Spray the prime coat fastening suction layer with a dose of 0.5l iter/m2. Scatter and compact the concrete asphalt mixture until a flat surface is obtained. Compact with a baby roller (minimum 5 tracks).
Patching	Repair or replacement of patches throughout the depth for permanent repair and surface patching is carried out for temporary repair.
Joint Rreflection Crack	P3 Repair Method (Crack Coating) Mobilize equipment, workers and materials to the field. Clean the part to be handled with a water compressor, so that the road surface is clean and dry. Spray tack coat (0.2 liters/ m2 in the area to be repaired). Spread and flatten the concrete asphalt mixture on the entire marked area. Perform light compaction (1 - 2) tons until a flat surface and optimum density (density 95%).

4. Conclusion

From the results of the analysis and calculation of the damage to urban roads on the S. Parman road (Grogol direction Slipi) STA 4+200 – 0+000, the following conclusions can be drawn:

Based on a direct research survey on the Lt. Gen. S. Parman road (Grogol direction Slipi) there are 8 types of damage, namely Patches, Holes, Edge Cracks, Joint Reflection Cracks, Crocodile Skin Cracks, Weathering and loose grains, Longitudinal and transverse cracks and grooves.

The results of the research on the condition of the road section of Letjen S. Parman (Grogol direction of Slipi) using the PCI method, obtained the overall PCI value of the Lt. Gen. S. Parman road section is Perfect (*Exellent*) as much as 78.5%, Very Good (*Very Good*) as much as 16.6%, and Good (*Good*) as much as 4.9%.

The results of the research on the condition of the Letjen S. Parman road (Grogol direction Slipi) using the SDI method, the overall SDI value of the Lt. Gen. S. Parman road section was 65 for the highest score at stationing 3+900-3+800 and 0 for the lowest score. at stationing 3+400-3+300.

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Biography

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Amar Mufhidin., born in Majalengka on June 16, 1991. Lecturer in several study programs: pavement planning, road geometry planning, and transportation planning. He obtained a Bachelor's degree in Civil Engineering from the Indonesian University of Education, and a Masters in Civil Engineering with a concentration in transportation from the Bandung Institute of Technology. He has a certificate of expertise in road pavement from the Construction Services Regulatory Agency. And he is still active in road planning projects in Indonesia.

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