

Study of Flexible Pavement Damage In Military Housing Using Pavement Condition Index (PCI)

AGUNG PRAPSETYO, SUSILO ADI P, HELDA RISMAN

ABSTRAK

Jalan aspal (perkerasan lentur) di Kompleks Perumahan Panca Arga I Desa Banyurojo Kec. Mertoyudan Kab. Magelang telah mengalami kerusakan dikarenakan umur jalan sistem yang dibuat dengan aspal curah/siram dan telah lebih dari 10 tahun. Kerusakan jalan tersebut dapat membahayakan pengguna yang melintas, sehingga perlu diadakan penelitian sebagai dasar saran rekomendasi untuk pengusulan program perbaikan. Analisis kerusakan jalan menggunakan metode pavement condition index (PCI), karena ekonomis dan membutuhkan waktu yang singkat. Adapun tujuan penelitian ini adalah untuk mengetahui jenis dan tingkat kerusakan serta saran penanganan kerusakan Jalan, Cara pengumpulan data dengan studi pustaka dan survey serta observasi lapangan, dari data yang terkumpul diaplikasikan dan dianalisis dengan menggunakan metode PCI. Hasil penelitian menggunakan metode pavement condition index (PCI) menunjukkan tingkat kerusakan: 1) sangat jelek pada Jalan Kelud dan Malabar; 2) jelek pada manyar dan pandu; 3) sedang Gelatik, Merak, Kasuari; dan 4) baik jalan Utama dan Jalak. Adapun penanganan kerusakan perkerasan lentur tersebut bergantung tingkat kerusakan yang terjadi, baik dilakukan penambalan parsial, penambala keseluruhan, bahkan rekonstruksi pada kondisi jalan yang terjelek.

Kata kunci: perkerasan lentur, perumahan militer, metode PCI

ABSTRACT

Asphalt road (flexible pavement) in the Panca Arga I Housing Complex, Banyurojo Village, Kec. Mertoyudan Kab. Magelang has suffered damage due to the life of the system roads made with bulk asphalt / flush and has been more than 10 years. Damage to the road can endanger passing users, so it is necessary to conduct research as a basis for recommendations and recommendations for proposing improvement programs. The road damage analysis uses the pavement condition index (PCI) method, because it is economical and requires a short time. The purpose of this study was to determine the type and level of damage and suggestions for handling road damage, data collection methods using literature study and surveys and field observations, from the collected data applied and analyzed using the PCI method. The results of the study using the pavement condition index (PCI) method showed the level of damage: 1) very bad on Jalan Kelud and Malabar; 2) bad on the weaver and pandu; 3) being Wren, Peacock, Cassowary; and 4) both Main and Starling roads. The handling of the flexible pavement damage depends on the level of damage that has occurred, whether it is partial patching, whole patching, even reconstruction in the worst road conditions.

Keywords: flexible pavement, Housing Military, PCI method

INTRODUCTON

One of the state building installation buildings (Permen PUPR No. 22/Prt/M/2018) is a military building, and what is not special/confidential is a housing complex. Panca Arga is a military housing complex that

was inaugurated on 11 November 1957 that consisting of housing, schools, parks, shops and road infrastructure facilities. Housing road is asphalt pavement (flexible pavement), which is made to connect between the housing complex with the Akmil Headquarters, where good road conditions will help the circulation of personnel to their assignments. According to

manager Zeni Akmil, data on the construction of the last Panca Arga housing complex in 2007 was based on priorities adjusted to the condition of the road damage (Suswandi et al., 2008).

As for the current condition of the Panca Arga housing road, condition of the pavement structure some have begun to experience a decline in road quality or damage (Dinata et al., 2017). The pavement condition (Byrne et al., 2013) cause of road damage that occurs, is because the road infrastructure is burdened by high and / or repetitive traffic volumes and the life span that has been passed causes a decline in the quality of the road, as indicators can be known from the condition of the road surface, both structural and functional conditions who suffered damage. Another factor that allows the cause of damage to the pavement is the water drainage system is one factor that must be taken into account in the construction of roads (Singh et al., 2018). Water that collects on the road surface after rain will not only endanger road users, it will even erode and damage the road structure .

One of the factors causing damage to the road because the amount of repetition of the load that exceeds the plan, so that the road will experience fatigue cracking and rutting damage before the planned life runs out if there is no good maintenance (Dinata et al., 2017).

To repair damaged roads will require significant costs and must be carried out according to procedure. The initial stage of the mechanism for repairing damage to the Panca Arga Housing road is to prepare a Report on the Conditions of Damage to the Panca Arga Housing Road as a basis for submitting an application for road damage repair (Mahmudah et al., 2019). The report identifies and analyzes the damage that occurs in order to get the right solution for handling and maintaining the road. One way of handling or maintenance based on the damage that occurs is the Pavement Conditional Index (PCI) method (Yulita, 2017) and other reasons for using PCI are economical and time and budget efficient (Karim et al., 2016).

Pavement Conditional Index (PCI) method is a road pavement condition evaluation system based on the type, extent and extent of damage and is one way to find solutions and maintenance of the flexible pavement (Karim

et al., 2016). With the PCI method is estimated with a relatively short time and the cost is relatively inexpensive, can be obtained high levels of asphalt road damage and the solution handling efforts (Giyatno, 2016).

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As for the issues that will be discussed in the study of the flexible pavement damage study using the Pavement Condition Index method to prediction of pavement performance (Sidess et al., 2020), with a case study in the Panca Arga I Military Housing Complex, are characteristics of asphalt road damage (flexible pavement) in Panca Arga I Military Housing using Pavement Condition Index (PCI) method and the proper way of handling or maintaining the flexible pavement damage.

RESEARCH METHOD

1. Tools and Materials

- a. Tools, equipment used in this research work are: calculator, digital camera; measuring instrument; and office stationary.
- b. Material, The material used in this study is the survey form and Panca Arga I housing map.

2. Research Sites

Based on field observations (Mujabuddawat & Handoko, 2018), the road conditions that appear to have been damaged in the Panca Arga I Military Housing Complex in Banyurojo Village, Mertoyudan District, Magelang Regency, especially on the environmental roads are as follows: a) Utama Street; b) Pandu Street; c) Kasuari Street; d) Merak Street; e) Kelud Street; f) Malabar Street; g) Merapi Street; h) Merbabu Street; i) Manyar Street; j) Manyar Street; and k) Jalak Street.



FIGURE 1. Panca Arga I Housing Military Complex Research Location.

3. Research Stages

a. Stages of Preparation, in this stage, there are two things done to start the research process, including: 1) Preparation of research proposals with literature studies relating to research material; 2) Initial survey to determine the location of the study; and; 3) Preparation of data collection framework in the field: Arrange the library; and preparation of research equipment and supplies.

b. Stages of Data Collection, data collection was obtained by direct field observation, regarding matters that became internal and external factors in road damage at the study site. Record and collect data obtained.

c. Stages of Analysis, data is grouped according to the name of the road. The stage of analyzing data obtained from primary and secondary surveys, from damage that occurred in the object of research. Data were analyzed using PCI to obtain the level of road damage.

d. Handling Problems, starting from the conclusion based on the study findings and then followed up with recommendations for proposals that contain measures for handling road damage based on the type and type of road damage.

RESULT AND DISCUSSION

Damage Data

The conditions of flexible pavement damage can be seen in Table 1. Type of Damage the Object of Research in Panca Arga I Military Housing Complex

PCI Calculation

The Pavement Conditional Index (PCI) is calculated on the basis of the area of road damage conditions in the field compared to the area of the road, so that the types of road damage and type of damage and extent of damage are obtained in each of the road segments surveyed (Bolla, 2012).

Determine Density.

Furthermore, after knowing the type, level and extent of damage is to determine the density or percentage of each damage. The density value is obtained by the following formula:

$$DENSITY = \frac{L \text{ type road damage} \times 100 \%}{Road Area} \quad (1)$$

Based on survey results and density calculations, the results of the type of damage obtained for each road segment are detailed and can be seen in Table 2.

a. *Determine the CDV (Correct Deduct Value)*

























CDV is obtained by patching the q value that has been obtained on the CDV (Correct Deduct Value) graph as in Figure 2.

b. *Determine PCI Values*

After the CDV value is obtained, the PCI (Pavemen Conditons Index) value can be seen in Table 2, based on the formula:

After the PCI value is obtained, the next step is to determine the rating of the level of damage to the existing road in the Panca Arga I Housing Complex, especially the surveyed location by plotting the PCI value on the PCI rating in Figure 3. Overall, get the PCI value of each segment can be seen in Table 3.

TABLE 1. Type of Damage the Object of Research in Panca Arga I Military Housing Complex

| Street Name | Survey Results on The Level of Flexible Pavement Damage | | |
|----------------|--|--|--|
| 1 | 2 | | |
| Utama |  <i>Low Crocodile Crack</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edge Crack</i> |
| Pandu |  <i>Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Block Crack</i> |
| Kelud |  <i>Edge Cracking dan Potholes</i> |  <i>Edge dan Crocodile / Alligator Crack</i> |  <i>Block Crack</i> |
| Kasuari |  <i>Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edge Crack</i> |
| Jalak |  <i>Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edges Crack dan Block Crack</i> |
| Malabar |  <i>Edge Cracking dan Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edge dan Block Crack</i> |
| Kelud |  <i>Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edges Crack dan Block Crack</i> |
| Merapi |  <i>Low Potholes</i> |  <i>Crocodile / Alligator Crack</i> |  <i>Edges Crack dan Block Crack</i> |

Source: Observation Result

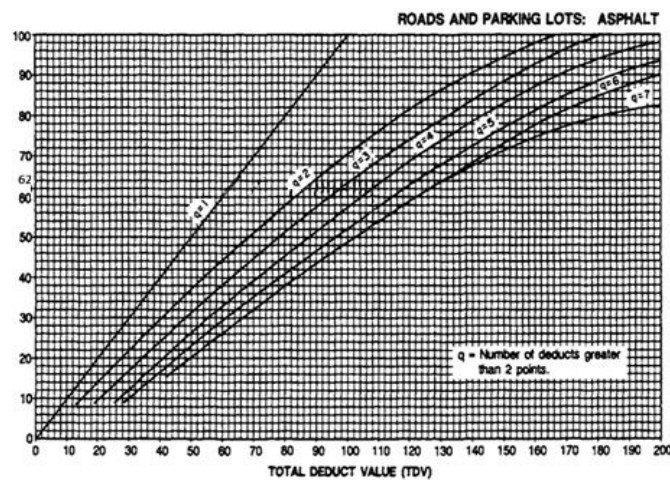


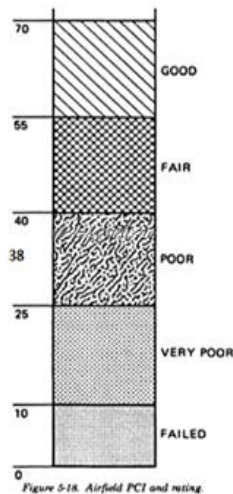
FIGURE 2. CDV (Correct Deduct Value) Graph

Based on the data on the type of damage to flexible pavement and the area of damage, faced with the formula for density values,

deduct values and q values, the data obtained are in Table 2. Density Values, Deduct Values and q Values.

TABLE 2. Density, Deduct Values and q Values

| No. | Street Name | Density | Deduct Values | q Values |
|-----|-------------|---------|---------------|----------|
| 1 | Utama St | 0,36 | 49 | 2 |
| 2 | Pandu St. | 1,73 | 84 | 2 |
| 3 | Kasuari St. | 1,39 | 78 | 2 |
| 4 | Merak St. | 2,34 | 74 | 2 |
| 5 | Kelud St. | 6,59 | 97 | 2 |
| 6 | Malabar St. | 3,53 | 75 | 2 |
| 7 | Merbabu St | 1,46 | 44 | 2 |
| 8 | Gelatik St. | 2,15 | 79 | 2 |
| 9 | Manyar St | 3,75 | 88 | 2 |
| 10 | Jalak St. | 2,14 | 59 | 2 |



5-4. Feature PCI. The PCI's of all sample units in a feature are compiled into a feature summary, as shown in figure 5-19. The overall condition rating of the feature is determined by using the mean PCI and figure 5-18.

FIGURE 3. PCI Rating Graph

TABLE 3. PCI Value of Each Segment

| No | Street Name | Corect Deduct Value | PCI | Damage Rate Rating |
|----|-------------|---------------------|-------|--------------------|
| 1 | Utama St. | 36,00 | 64,00 | Good |
| 2 | Pandu St. | 62,00 | 38,00 | Poor |
| 3 | Kasuari St. | 56,00 | 44,00 | Fair |
| 4 | Merak St. | 52,00 | 48,00 | Fair |
| 5 | Kelud St. | 76,00 | 24,00 | Veery Poor |
| 6 | Malabar St. | 75,00 | 25,00 | Veery Poor |
| 7 | Merapi St. | 52,50 | 47,50 | Fair |
| 8 | Merbabu St. | 32,00 | 68,00 | Good |
| 9 | Gelatik St. | 58,00 | 42,00 | Fair |
| 10 | Manyar St. | 65,00 | 35,00 | Poor |
| 11 | Jalak St. | 42,00 | 58,00 | Good |

Source: Data Analysis

TABLE 4. Damage Management

| No | Type Damage | Quality | Handling |
|----|----------------------------|--------------|--|
| 1 | 2 | 3 | 4 |
| 1. | Potholes | L M H | Patched Partial or complete patching Patched entirely |
| 2. | Edge Cracking | L M/ H | No patching is done, patching if crack width > 3mm A partial patch is made on the cracked part |
| 3. | Crocodile/ Alligator Crack | M H | Partial fillings, or throughout depth, additional layers, reconstruction Partial fillings, or throughout depth, additional layers, reconstruction |
| 4. | Block Crack | M H | Seal cracks, restore surface; marketed with heaters and additional layers Seal cracks, restore surface; marketed with heaters and additional layers |

Source: Data Analysis

Causes and Treatment of Damage

1. Causes of Damage

- a) Alligator cracking/crocodile crack is caused by fatigue due to repetitive traffic loads and caused by pavement material/ material quality that is not good, causing weathering on the asphalt, lack of asphalt use, high ground water.
- b. Potholes, caused by low asphalt levels, so that thin asphalt and aggregates are easily separated, weathering occurs on asphalt, use of dirty/bad aggregate, mixture temperature does not meet the requirements.
- c. Edge cracking, caused by lack of lateral support (from the shoulder of the road), poor drainage, the shoulder of the road descending against the pavement surface, heavy traffic concentration on the edge of the pavement.
- d. Block cracking, caused by the propagation of shrinkage cracks that occur in the underlying pavement layers, cracks in the old pavement layers are not repaired properly before overlaying is done.

Seeing damage to flexible pavement in the Panca Arga I, which is dominated by damage to crocodile cracks, pits, side cracks, cracked blocks, the dominant cause of damage is due to traffic load that is not in accordance with the class of the road ie primary local, absence of

drainage channels, possible material the material used is not good and the maintenance budget has not been allocated from the Upper Unit.

2. Damage Handling

Handling damage to roads in Panca Arga I housing Military Complex is implemented according to the level of damage, more details can be seen in Table 4.

CONCLUSIONS

The results of the PCI (Pavement Conditions Index) at the survey location of each segment, based on the results of the PCI analysis are; 1) Good: Merbabu St. Utama St. Jalak St; 2) Fair: Merak St, Kasuari St, Gelatik St; 3) Poor: Pandu St. Manyar St; and 4) Veery Poor: Kelud St, Malabar St, and Merapi St. The handling of the flexible pavement damage depends on the level of damage that has occurred, whether it is partial patching, complete patching, and even reconstruction in the worst road conditions (Bianchini et al., 2018).

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AUTHORS :

Agung Prapsetyo

Defense Doctoral Program, Faculty of Defense Technology, Indonesia Defense University, IPSC Complex, Sukahati Village, Citeureup District, Bogor Regency, West Jawa Province, Indonesia.

Email: agung.prapsetyo@idu.ac.id

Susilo Adi Purwantoro

Faculty of Defense Technology Indonesia Defense University, IPSC Complex, Sukahati Village, Citeureup District, Bogor Regency, West Jawa Province, Indonesia.

Email: susilo.purwantoro@idu.ac.id

Helda Risman

Defense Doctoral Program, Faculty of Defense Strategy, Indonesia Defense University, IPSC Complex, Sukahati Village, Citeureup District, Bogor Regency, West Jawa Province, Indonesia.

Email: helda.risman@idu.ac.id