Assessment of the Jati Besar Highway of the City of South Ternate Uses Pavement Condition Index (PCI)

Sabaruddin\textsuperscript{1}, Arbain Tata\textsuperscript{1}

\textsuperscript{1}Department of Civil Engineering, Faculty of Engineering Universitas Khairun, Ternate - Indonesia
sabarudin@unkhair.ac.id

Abstract. Jati Besar Ternate road has a width of 7.00 m a type of road with 1/2 UD which has function which functions as a secondary gathering path. To determine the condition of pavement of the Great Jati road used Pavement Condition Index (PCI) assessment method. The results showed that the overall condition of road pavement in both good and perfect categories. Types of damage that found in the was road consists of alligator cracking 0.83 %; shoving 0.17%; edge cracking 0.06 %; longitudinal cracking 0.27 %; patching 0.39%; potholes 0.18 %; The average PCI value of Segment total was 97.85 with excellent condition. The type of maintenance required on road of Jati Besar was routine maintenance.

Keywords: pavement distress types, PCI

1. Introduction

Triggers for traffic congestion in the city of South Ternate are the number of vehicles, the knowledge of driving drivers and the damaged road conditions. Road damage includes: peeling, wear, holes, obesity, distortion, cracks, deformation. The aforementioned damage was caused by various factors, for example, planning errors, improper implementation time, weak supervision during implementation, vehicle overloading and over dimensions, heavy vehicle wheel loads (repetitive), Changing groundwater conditions. [1]

Along with the movement of people, goods from one place to another and the findings of building materials and materials technology related to road pavement. Where theoretical and empirical road pavement was expected to function to provide convenient, safe and sustainable transportation services to realize the improvement of people's lives in various sectors of life, and it was hoped that the pavement will not be damaged during use. Because it needs knowledge about the causes of damage and how to maintain road pavement. [2]

There was something less than ideal on the Jati Besar road, which was a number of holes and waves on the road surface, due to the excavation work for water pipes, making the road not conducive anymore. To ensure this, identification and assessment of the type of damage that occurs on the road was carried out, so that it can be determined what needs to be done to repair the damage. Such damage will affect the surrounding environment, and can cause things that are not desirable, such as minor accidents, moderate and severe.

In order to be right on target, it was deemed important to use the pavement condition index as one of the efforts / input to road operators regarding the appropriate handling strategy to be applied.
2. Literature review

2.1. The meaning of the road

All parts of the road, including buildings and auxiliary equipment designated for traffic, which are on the surface of the land, above the surface, below the surface of the land and / or water, and above the surface of the water in land transportation are called roads [3].

The road in accordance with its designation, consists of special roads and public roads, both of which play an important role in human life in developing national and state life. The meaning mentioned above was according to Law No. 38 of 2004 concerning roads, [4].

2.2. Pavement Condition Index (PCI)

Pavement condition index (PCI) was a road pavement condition evaluation system by type, level of damage that occurs and can be used as a reference for road maintenance. [5],[6],[7],[8]. The PCI method only informs the pavement conditions during the survey, not for future predictions. However, the results of the periodic survey will provide detailed pavement conditions that can be used to estimate pavement performance in the future. [7].

2.3. Damage Rate

The level of damage is the level of damage for each type of level of damage. The level of damage used in calculating PCI was low level (L), medium level (M) and high level (H) [9].

2.4. Density

Density = Amount of pressure in m2 / unit sample units in m2 x 100. where the density equation shows that the percentage of the total area or length of one type of severity to the area or total length of the measured road section.

2.5. Deduct Value (DV)

To determine the value of the deduction used curve value cuts for each type and severity.

2.6. Total Deduct Value (TDV)

By adding up all the individual deduction values, the total deduction value (TDV) was obtained.

2.7. Corrected Deduct Value (CDV)

The corrected reduction (CDV) value can be determined from the correction curve, see Figure 1 below. When determining CDV, if the individual reduction value was higher than the CDV, the CDV was set equal to the highest individual reduction value.

2.8. Value PCI

The Pavement Condition Index assessment for each sample unit was calculated following Equations 2 and 3 below, this was done after adjusting the corrected deduction value.:

\[
PCI(s) = 100 - CDV
\]
Where:

\[ PCI(s) = \text{Pavement Condition Index of pavement section}; \]

\[ CDV = \text{Corrected Deduct Value of pavement section}. \]

For PCI values as a whole on certain road segments shown by the following equation:

\[
PCI = \frac{\sum PCI (s)}{N}
\] (2)

Where:

\[ PCI = \text{PCI value for the entire pavement}. \]

\[ PCI(s) = \text{PCI values for some pavements} \]

\[ N = \text{Number of units} \]

See the PCI Value Table used to assess the pavement conditions under this, suggested by [10],

![Figure 1. Reduction value corrected for flexible pavements, source Shahin 1994 [10]](image)

| Value PCI | Rating          | Treatments       |
|-----------|-----------------|------------------|
| 0 – 10    | (failed)        | Reconstruction   |
| 11 – 25   | (very poor)     | Reconstruction   |
| 26 – 40   | (poor)          | Reconstruction   |
| 41 – 55   | (fair)          | Periodic         |
| 56 – 70   | (good)          | Routine          |
| 71 – 85   | (very good)     | Routine          |
| 86 – 100  | (excellent)     | Routine          |
2.9. Flexible Pavement Distresses

Classification of types of damage to the surface of the flexible pavement, according to the Series of district road maintenance guidelines regarding bending pavement maintenance techniques can generally be classified as follows: [11]:

- Deformation/distorsion: corrugation, rutting, shoving, depression and upheaval
- Cracking: transverse, longitudinal, diagonal, block, reflective, alligator crack, crescent/slipage cracks.
- Surface defect: bleeding, polishing, ravelling, peeling and stripping
- Potholes, patches, crossing of railroad tracks.
- Edge defect: edge drop and edge break.

3. Research Methods

3.1. Study area

The study was conducted on the Jalan Jati Besar, South Ternate city

3.2. Data Processing

Data processing was done to ensure the type of damage and it was coverage in accordance with the results of the survey of road conditions. According to the literature it was found that the steps to conduct a condition survey and determine the PCI rating are as follows: [12]:

- Examine the sample unit, determine the type and extent of damage and then measure it was density;
- Determination of the Deduction Value was directed to the deduction value curve for each type and degree of damage;
- Determine the total deduction value (TDV) by adding up all individual deduction values;
- After TDV was calculated, the corrected reduction (CDV) value can be determined from the correction curve. When determining CDV, if the individual reduction value is higher than the CDV, the CDV was set equal to the highest individual reduction value;
- PCI was calculated ie (PCI = 100 - CDV).

4. Results and Discussion

There are seven results and discussion as follows:

4.1. Identification of Damage Types

The type of damage that occurs on the Jati Besar road segment was dominated by crack type damage.

4.2. Density

The value of the density of each type of damage is crocodile crack 0.83%; patch 0.39%; longitudinal cracks 0.27%; holes of 0.18% pushing 0.17%; 0.06% crack edges are obtained by dividing the total damage area for each level of damage by the sample unit area.
4.3. Deduct Value

Deduction value for each type of damage, for hole density of 14% with damage 5.3, alligator cracking 0.83% with damage 4, patching 0.39% with damage 0, longitudinal cracking 0.27 with damage 0, pushing density 0.17% with damage 3, edge cracking density 0.06% with damage is 0. Everything is obtained by adjusting the density value obtained into each graph of damage in accordance with the level of damage.

4.4. Total Deduct Value

The sum of all reduced values obtained was 62.00. called the total reduction value.

4.5. Corrected Deduct Value

Correction of the deduction value produces a total value of deduction of 21.5.

4.6. Value Pavement Condition Index

After recap, the PCI value on the Jati Besar road is \((100 - 21.50) / 1\) which was 97.85.

4.7. Type of Handling

From the PCI value, it was stated that the pavement assessment was very good so it requires routine maintenance.

5. Conclusion

The type of care needed on Jalan Jati Besar was only routine maintenance because the condition was very good according to the evaluation results with a value of 97.85, where the type of damage was dominated by crack damage.

References

[1] I. Wirnanda, R. Anggraini, and M. Isya, “Analisis Tingkat Kerusakan Jalan Dan Pengarunya Terhadap Kecepatan Kendaraan (Studi Kasus: Jalan Blang Bintang Lama Dan Jalan Teungku Hasan Dibako),” *J. Tek. Sipil*, vol. 1, no. 3, pp. 617–626, 2018.
[2] C. Luchini, “Stemming the crisis: World leaders forge Global Jobs Pact From the right to ‘ combine ’ to the right to organize,” 2009.
[3] P. B. Tarigan, “済無 No Title No Title,” *J. Chem. Inf. Model.*, vol. 53, no. 9, pp. 1689–1699, 2013.
[4] S. Lee et al., “済無 No Title No Title,” *J. Chem. Inf. Model.*, vol. 53, no. 9, pp. 1689–1699, 2012.
[5] Y. Ramli, M. Isya, and S. M. Saleh, “Evaluasi Kondisi Perkerasan Jalan Dengan Menggunakan Metode Pavement Condition Index (Pci) (Studi Kasus Ruas Jalan Beureunuen – Batas Keumula),” *J. Tek. Sipil*, vol. 1, no. 3, pp. 761–768, 2018.
[6] - Sabaruddin, - Sabaruddin, and R. Awaludin, “Application of Pavement Condition Index (PCI) on The Assessment of The Kalumata – Fitu Highway Section of Southern of Ternate City,” 2018.
[7] Sabaruddin and A. Deni, “Application of pavement condition index (PCI) on the assessment of the Kalumata highway section of the City of South Ternate,” *IOP Conf. Ser. Earth Environ. Sci.*, vol. 419, no. 1, 2020.
[8] M. Y. Shahin and J. a. Walther, “Pavement Maintenance Management for Roads and Streets Using the PAVER System No. CERL-TR-M-90/05,” *US Army Corps Eng. Constr. Eng. Res.*
Acknowledgments

The authors thank the Unkhair Rector, Dean of the Faculty of Engineering, for the funding and opportunities provided. For the ICST Committee the authors also thank you for the receipt of this article.