Evaluation of indicators for the implementation of road preservations in the national road implementation centre of west nusa tenggara

B O Sowolino¹ and W Santosa¹

¹Faculty of Engineering, Parahyangan Catholic University, Ciumbuleuit 94 Bandung, Indonesia.

Email: 91020001005@student.unpar.ac.id

Abstract. Road preservation is a road handling activity starting from prevention, maintenance and repairs needed to maintain road conditions to function optimally to serve traffic. Preservation activities include routine maintenance work, rehabilitation, reconstruction, and widening to standards. The purpose of this study is to evaluate the indicators used in the implementation of road preservation activities based on the level of importance and satisfaction of the perceptions of stakeholders involved in road conservation activities in the West Nusa Tenggara National Road Implementation Agency. The indicators used in this study are structural indicators and functional indicators. The hole parameter in the structural indicator is an important parameter in the implementation in the implementation of preservation activities in the West Nusa Tenggara National Road Implementation Center with the satisfaction level in handling of very satisfied.

1. Introduction
Efforts to realize a national road service that is stable, reliable, safe, efficient, and effective are certainly not easy. There are many obstacles and challenges that must be resolved in order to realize a reliable and quality and safe national road as required in the Law of the Republic of Indonesia Number 38 of 2004 concerning Road [1]. Reliable means that the road can truly serve vehicle traffic with the assurance of safety for road users. That means damage to the road surface, both functional and structural, is not allowed. Thus, reliable means that want to create a stable road building, both in surface performance and on the pavement structure. Road preservation is an activity of road handling, in the form of prevention, maintenance and repair, which is needed to maintain a reliable, steady, strong, safe and sustainable road condition, so that it continues to function optimally to serve traffic, so that the defined plan life can be achieved. Preservation activities include rehabilitation, and reconstruction [2]. In the implementation of road preservation in the field, there are often differences in perceptions between existing stakeholders, including contractors, consultants, or owners about what causes road damage, road conditions survey methods, technologies that can be used, and several things that affect road performance. This study was conducted to find out the perceptions of each stakeholder on the level of importance and level of satisfaction of the indicators used in the implementation of road preservation activities.

2. Objective
The objective of this study is to evaluate the indicators used in the implementation of road preservation activities based on the level of interest and satisfaction of stakeholders involved in road conservation activities. The West Nusa Tenggara National Road Implementation Agency was chosen as the location to conduct this study.

3. Literature Review

3.1. Road Preservation Program

Pavement preservation is a pro-active approach in maintaining the condition of the existing road network. Its application makes it possible to reduce the implementation of rehabilitation and reconstruction projects that are expensive, long and disrupt traffic smoothness. By implementing preservation activities in a timely manner, road coaches can provide road network service performance, with high mobility, better road safety, reduced congestion, and better and longer life pavements. This should be the goal that must be achieved from road pavement preservation activities. A pavement preservation program basically consists of 3 components, namely: preventive maintenance, minor rehabilitation / non-structural, and several other routine maintenance activities. An effective pavement preservation program will provide several benefits, namely preserving investment funds in the built road network, improving pavement service performance, ensuring efficient allocation of road financing funds, extending the service life of road pavements, reducing travel barriers, increasing mobility of people and goods, as well as improving travel safety [3]. The characteristics of road pavement preservation activities are to restore the function of the existing road network system and extend its service life but not activities aimed at increasing the road capacity or the strength of the road pavement structure.

3.2. Performance Indicators

Road performance indicators using the results of the study from the final report of the national road minimum standards manual [4]. The indicator group in this study is divided into 2 types, namely:

1. Structural Indicators; namely the performance of pavement structures against traffic loads and environmental conditions.
2. Functional Indicators; namely the characteristics of the road pavement that directly affect the safety and comfort of road users and road services.

In the final report of the National Road Minimum Service Standards Manual [4], screening was carried out through the distribution of questionnaires and the output of the questionnaire was a short list of several indicators and their parameters. Furthermore, these indicators and parameters are used in the questionnaire to get the perception of the level of importance and the level of satisfaction of the officials involved in the Road Preservation activities in the West Nusa Tenggara National Road Implementation. The number of respondents who filled out the questionnaire was 18 people consisting of structural officials, project owner, Supervisory Consultants and Contractors for Road Preservation activities in the West Nusa Tenggara National Road Implementation. Tables 1 to 5 show a list of indicator groups contained in the questionnaire based on the level of importance and level of satisfaction. Table 3.1 and Table 3.2 display the indicators and their parameters as well as the values at each level of importance. Table 3.3 and Table 3.4 display the indicators and their parameters as well as the scores for each level of satisfaction. Table 3.5 display the indicator groups and parameters in the questionnaire.

| Table 1. List of Structural Indicator Groups based on Level of Interest. |
|---------------------------------------------------------------|
| **Structural Indicators**                                   |
| No. | Parameter | Very unimportant | Not important | Neutral | Important | Very Important |
|-----|-----------|------------------|---------------|---------|-----------|----------------|
| 1   | Groove    | 1                | 2             | 3       | 4         | 5              |
2 Cracked
3 Holes
4 Road Pavement Surface Drainage

Table 2. List of Groups of Functional Indicators based on Level of Interest.

| No | Parameter                          | Level of Importance |
|----|------------------------------------|---------------------|
|    |                                    | Very unimportant    | Not important | Neutral | Important | Very Important |
| 1  | Roughness                          | 1                   | 2             | 3       | 4         | 5              |
| 2  | Flatness                           | 1                   | 2             | 3       | 4         | 5              |
| 3  | Maximum slope                      | 1                   | 2             | 3       | 4         | 5              |
| 4  | Median Width                       | 1                   | 2             | 3       | 4         | 5              |
| 5  | Lane Width                         | 1                   | 2             | 3       | 4         | 5              |
| 6  | Shoulder Width                     | 1                   | 2             | 3       | 4         | 5              |

Table 3. List of Structural Indicator Groups Based on Satisfaction Level.

| No. | Parameter                             | Level of Satisfaction |
|-----|---------------------------------------|-----------------------|
|     |                                       | Very dissatisfied     | Not satisfied | Neutral | Satisfied | Very satisfied |
| 1   | Groove                               | 1                     | 2             | 3       | 4         | 5              |
| 2   | Cracked                              | 1                     | 2             | 3       | 4         | 5              |
| 3   | Holes                                | 1                     | 2             | 3       | 4         | 5              |
| 4   | Road Pavement Surface Drainage       | 1                     | 2             | 3       | 4         | 5              |

Table 4. List of Functional Indicator Groups Based on Satisfaction Level.

| No | Parameter  | Level of Satisfaction |
|----|------------|-----------------------|
|    |            | Very dissatisfied     | Not satisfied | Neutral | Satisfied | Very satisfied |
| 1  | Roughness  | 1                     | 2             | 3       | 4         | 5              |
| 2  | Flatness   | 1                     | 2             | 3       | 4         | 5              |
| 3  | Maximum slope | 1                  | 2             | 3       | 4         | 5              |
| 4  | Median Width | 1                   | 2             | 3       | 4         | 5              |
| 5  | Lane Width  | 1                     | 2             | 3       | 4         | 5              |
| 6  | Shoulder Width | 1                   | 2             | 3       | 4         | 5              |

Table 5. List of Indicator Groups and parameters in the questionnaire.

| Indicator and Parameter | Level of Importance | Level of Satisfaction |
|-------------------------|---------------------|-----------------------|
| Score                   | 1                   | 2                     | 3         | 4         | 5         | 1         | 2         | 3         | 4         | 5         |
| Structural              |                      |                       |           |           |           |           |           |           |           |           |
| Groove                  |                      |                       |           |           |           |           |           |           |           |           |
| Cracked                 |                      |                       |           |           |           |           |           |           |           |           |
Holes

Road
Pavement
Surface
Drainage

Functional

Roughness

Flatness

Maximum
slope

Median
Width

Lane
Width

Shoulder
Width

3.3. Important Performance Analysis
According to Tjiptono, the Importance Performance Analysis (IPA) method was introduced by Martilla and James in 1977 to measure the relationship between product / service quality improvement priorities, also known as quadrant analysis [5]. The IPA method has been generally accepted and used in various fields of research because of its ease of application and display of analysis results that make it easy to make recommendations for performance improvements.
IPA aims to display information related to service factors that greatly affect customer loyalty and satisfaction and service factors that need to be improved because current conditions have not satisfied customers. IPA brings together the measurement of the factors of performance level and importance level which is then depicted in a two-dimensional diagram or what is called an importance-performance diagram to obtain practical suggestions and facilitate explanation of the data. At the level of performance, measurement is done by measuring the level of customer satisfaction with the service that has been felt. The IPA graph is divided into 4 quadrants based on the results of the importance-performance measurement.

4. Methodology
This study was conducted using a quantitative approach. In the early part, a literature study was carried out related to road preservation activities and the indicators used in determining the performance of a road. By using a list of indicators and their parameters a questionnaire was created which was given to 18 respondents to obtain perceptions of the interests and levels of stakeholder satisfaction, in this case the work owner, supervisory consultants and implementing contractors in carrying out road preservation activities. Furthermore, the results of the questionnaire are analyzed to evaluate the level of importance and satisfaction of stakeholders with the indicators used.

5. Data Analysis
The analysis was conducted to determine the level of importance and level of respondent satisfaction with the indicators used in the implementation of road preservation activities. The results of the analysis of the average importance and satisfaction are shown in Table 6.

| Table 6. Average Interest and Satisfaction. |
To find out the order of the importance level and the level of satisfaction of the respondents with the indicators and their parameters, the analysis was carried out from the existing data to produce a sequence or ranking of the interests and levels of satisfaction of the respondents. Rank results are shown in Table 7 to Table 11.

| Indicator                              | Average Interests | Average Satisfaction |
|----------------------------------------|-------------------|----------------------|
| Groove                                 | 3.9               | 3.9                  |
| Cracked                                | 4.3               | 4.2                  |
| Holes                                  | 4.9               | 4.5                  |
| Road Pavement Surface Drainage         | 4.8               | 3.5                  |
| Roughness                              | 4.3               | 4.0                  |
| Flatness                               | 4.4               | 3.9                  |
| Maximum slope                          | 3.2               | 4.0                  |
| Median Width                           | 3.7               | 3.9                  |
| Lane Width                             | 4.2               | 3.9                  |
| Shoulder Width                         | 3.7               | 3.7                  |

Table 7. Importance Ranking of Structural Indicator Parameters.

| Structural Indicators | Interest Score | Rank |
|------------------------|----------------|------|
| Holes                  | 88             | 1    |
| Road Pavement Surface Drainage | 86 | 2    |
| Cracked                | 78             | 3    |
| Groove                 | 71             | 4    |

Table 8. Structural indicator parameter satisfaction ranking.

| Structural Indicators | Satisfaction Score | Rank |
|------------------------|---------------------|------|
| Holes                  | 81                  | 1    |
| Cracked                | 75                  | 2    |
| Groove                 | 71                  | 3    |
| Road Pavement Surface Drainage | 63 | 4    |

Table 9. Ranking of importance of parameters of Functional indicators.

| Fungsional Indicator | Interest Score | Rank |
|----------------------|----------------|------|
| Roughness            | 80             | 1    |
| Flatness             | 77             | 2    |
| Lane Width           | 76             | 3    |
| Shoulder Width       | 67             | 4    |
| Median Width         | 66             | 5    |
| Maximum slope        | 57             | 6    |

Table 10. Satisfaction ranking of the parameters of the Functional indicator.

| Indikator Fungsional | Satisfaction Score | Rank |
|----------------------|---------------------|------|
| Shoulder Width       | 66                  | 1    |
| Flatness             | 70                  | 2    |
Median Width  &  70 & 3  
Lane Width  &  71 & 4  
Roughness  &  72 & 5  
Maximum slope  &  72 & 6  

**Table 11. Summary of analysis.**

| Parameter                                  | Interest | Satisfaction |
|--------------------------------------------|----------|---------------|
| Grove                                      | 3,94     | 3,94          |
| Cracked                                   | 4,33     | 4,17          |
| Hole                                       | 4,89     | 4,50          |
| Road pavement surface drainage             | 4,78     | 3,50          |
| Roughness                                  | 4,28     | 4,00          |
| Flatness                                   | 4,44     | 3,89          |
| Maximum slope                              | 3,17     | 4,00          |
| Median Width                               | 3,67     | 3,89          |
| Lane Width                                 | 4,22     | 3,94          |
| Shoulder Width                             | 3,72     | 3,67          |

Quadrant of Interest Level and Satisfaction Level to determine the level of importance and level of respondent satisfaction with indicators and parameters in the implementation of preservation activities, data on the level of average importance and level of average satisfaction are plotted in quadrants of the level of importance and level of satisfaction. The results of this quadrant will show the level of importance and level of respondent satisfaction with the indicators and parameters.

![Figure 1. Quadrant of Interest Level and Satisfaction Level.](image)

**6. Conclusion**

Based on the analysis carried out on existing data and the results in the Quadrant of Importance and Satisfaction Level, the following conclusions can be drawn:

1. The hole parameter of the Structural indicator is a parameter that has the most important level of importance in the implementation of preservation activities in the West Nusa Tenggara National Road Implementation Center with the level of satisfaction in handling it is very satisfied.
2. The parameters of the median width and shoulder width of the functional indicators have a level of importance that is not too important in the implementation of preservation activities in the West Nusa Tenggara National Road Implementation Center with a sufficient level of satisfaction in handling.

References
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