EFFECT OF SOIL CONDITIONS ON DAMAGE LEVELS TO SIDODADI ROAD, NGANTRU VILLAGE, NGANTANG DISTRICT, MALANG REGENCY

Rifky Aldila P[1], Andy Kristafi A[2]

[1]Civil Engineering Study Program, Faculty of Engineering, Tribhuwana Tunggadewi University Malang, Indonesia
[1]Civil Engineering Study Program, Faculty of Engineering, Tribhuwana Tunggadewi University Malang, Indonesia

e-mail: rifky.unitrimalang@gmail.com

ABSTRAK

Soil conditions as a foundation and greatly affect the quality of service and road construction conditions. This condition occurs in Ngantru Village, Ngantang District, Malang Regency which is the object of research. The research objectives include knowing the characteristics of the soil, knowing the effect of soil conditions on road damage and knowing the solution to the problem of road damage due to soil conditions. The data in this study include primary data and secondary data. The results of the study include the average value of the plasticity index of 0.60% <10% with silt soil type and the plasticity index value of 6% and the average moisture content value of 33.3%, the average CBR value of 8.20%. CBR average of 8.20%, so it can be concluded that the soil condition affects the road damage. The solution in this research is to repair the road by excavating the damaged part of the road.

Key Word: *Road Damage, CBR, DDT*

1. Introduction

Soil is a collection of minerals, organic matter, and relatively loose deposits that are located on the bottom rock [1] . The land is useful as a building material in civil engineering works , one of which is in highway construction .

The highway is a place that is usually used to carry out daily activities, because it is very important that the role of the road must be supported by good road conditions [2]. The stability of pavement construction will be directly affected by the ability of the subgrade to accept and continue the working load. However, not all subgrade layers can withstand the loads above them. The only land that has a good classification can function as carrying capacity. Subgrade (subgrade) is the base surface for the placement of other pavement parts

Soil conditions as a foundation and greatly affect the quality of service and road construction conditions. This condition occurs in Ngantru Village, Ngantang District, Malang Regency which is the object of research. Based on the results of monitoring at the research location, it is known that the road conditions along the Sidodadi road have many road damage conditions, including cracks, bumps, and even holes. When viewed from the condition of road damage with holes, cracks, due to poor soil bearing capacity stability so that the authors are motivated to conduct research with the title "The Effect of Soil Conditions on the Damage Level of Sidodadi Road, Ngantru Village, Ngantang District, Malang Regency"

The purpose of this research is to know the characteristics of the soil on the Sidodadi road, to determine the soil conditions that affect the road damage on the Sidodadi road, and to find out the solution to the problem of road damage due to soil conditions on the Sidodadi road, Ngantru Village, Ngantang District, Malang Regency.

2. Methods

Soil properties are determined in the field by looking at the morphological characteristics of the profile which are the result of soil genesis and the influence of soil-forming factors. According to [3] that the morphological characterization of the soil includes:

a) Soil color
b) Soil texture
c) Soil structure
d) Consistency
e) Pores

2.1 Road Surface Damages

The maintenance, support, improvement, or rehabilitation of pavement construction can be handled properly, after the damage arising on the pavement is evaluated regarding the causes and consequences of the damage. The magnitude of the effect of a damage and the next steps for handling it depends on the results of the evaluation. According [4] Damage to the pavement construction can be caused by:

1) Traffic, which can be in the form of increased loads and load reps.
2) Water, which can come from rainwater, poor road drainage system, rising water due to capillary action.
3) Pavement construction material. In this case, it can be caused by the nature of the material itself or it can also be caused by a poor material processing system.
4) Climate. Indonesia has a tropical climate, where the air temperature and rainfall are quite high, which can be one of the causes of road damage.
5) Unstable subgrade conditions. It may be caused by a poor implementation system, or it could also be caused by poor soil characteristics.
6) Poor soil compaction process

Damage to flexible pavement [5] can be:

1. Cracked
2. Distortion
3. Surface defects
4. Wear and tear
5. Overweight
6. Decrease in former utility planting

The two methods of calculating the characteristic CBR are described as follows [6] :

a) Standard normal distribution method
b) The percentile method

2.2 Research sites

The research location was carried out on the Sidodadi road, Ngantru Village, Ngantang District, Malang Regency.

The length of the road is planned to be 1000 m long and divided into five segments with each segment taken per 200 m. This segmentation of road segments aims to make it easier to identify any

damage to the road due to the length of the road that reaches 1000 m with different damage conditions and makes data processing easier.

2.3 Method of collecting data

- **Primary data**

  Primary data is a source of data obtained directly from the original source [7]. Primary data can be in the form of individual or group subject opinions, observations of an object, events or activities, and test results. The methods used to obtain primary data are observation, documentation and literature study.

- **Secondary Data**

  Secondary data is a source of research data obtained indirectly through intermediary media . Secondary data is generally in the form of evidence, historical records or reports that have been compiled in published and unpublished archives [8]. Secondary data include: road network data and road maps.

2.4 Data Analysis Method

Methods of data analysis in this study using quantitative methods [9]. The data analysis steps include:

1. Analysis of soil characteristics
   - a) The physical condition of the road
   - b) Liquid limit
   - c) Plastic limits
   - d) Plasticity index
2. Effect of soil conditions on road damage
   - a) CBR of land
   - b) Soil bearing capacity
3. Road damage solutions

3. Result Dan Discussion

3.1 Soil Characteristics

Analysis of soil characteristics includes road conditions, moisture content, plastic limit analysis, liquid limit analysis, and soil type. Soil conditions on the Sidodadi road are referred to in the classification of silt soil or soil conditions with low water content and high plastic limits. This study is planned on the Sidodadi road, Ngantru sub-district along 1000 m which is then divided into five segments with the length of each segment taken per 200 m.

3.2 Road physical condition

The physical condition of the road on the Sidodadi road, Ngantru sub-district, was damaged, including holes and cracks. The damaged roads have holes and cracks due to the subgrade structure which is saturated with water with an average moisture content of 33.3%.

The results of the analysis of water content an average of 33.3% with each segment's water content including segment one water content 37.9%, second segment 42.9%, third segment 22.4%, fourth segment 29.2% and segment five 34.2%. So that the high groundwater content greatly affects the carrying capacity of the soil.

3.3 Liquid Limit and Plastic Limit Analysis

The liquid limit is a condition in which the water content is in plastic to a liquid state while the plasticity index (PI) is a condition when the soil is in the range of the liquid limit and the plastic limit. The results showed that the liquid limit and plastic limits were as follows:

The results of the highest liquid limit analysis were in segment 3 of 0.649% and the largest plastic limit analysis was in segment 2 of 1.50%.

Tabel 1. Results of the Plasticity Index (IP) Calculation

Point	Plastic Limits	Liquid Limit	Plasticity Index
1	0,615	1,333	0,718
2	0,537	1,500	0,963
3	0,649	1,222	0,573
4	0,579	0,889	0,310
5	0,452	0,889	0,437
Rata-rata			**0,60**

Source: Analysis results, 2020

From the calculation results, the average value of the plasticity index is 0.60% <10% so that the soil condition is quite good and based on the table for determining the type of soil, it can be seen that the average soil type at the research location is silt soil type with a low plasticity index value between 0 up to 7%.

3.4 Analysis of Effect of Soil Conditions
Analysis of the influence of soil conditions on road damage includes soil CBR analysis and soil bearing capacity analysis.

3.4.1 Soil CBR Analysis

Table 2. Results of the CBR analysis summary

Point	CBR
Segment 1	15,0
Segment 2	7,0
Segment 3	4,0
Segment 4	8,0
Segment 5	7,0
Rata-Rata	8,20

Source: Analysis results, 2020

Based on the CBR value graph above, it can be seen that the average CBR value is 8.20% with the following details: in segment one, it is 15% <20% so that this result shows that the subgrade conditions are classified as poor, segment two is 7% and the condition The subgrade is classified as poor, the third segment is 4% and the subgrade is not good, the fourth segment is 8%. Based on the CBR value requirements for the sub-base layer, generally, the CBR value is a minimum of 20%. The CBR average value is 8.20%, so it can be concluded that soil conditions affect road damage.

3.4.2 Soil Bearing Capacity Analysis
The subgrade bearing capacity (DDT) is determined based on the following formula:

DDT   = 4,3 log (CBR) + 1,7
CBR   = 15 %
DDT   = 4,3 log (15) + 1,7
            = 6,76

Table 3. Analysis of Soil Carrying Capacity

Titik	CBR	DDT
1	15,00	6,76
2	7,00	5,33
3	4,00	4,29
4	8,00	5,58
5	7,00	5,33
Rata-Rata	8,20	5,46

Source: Analysis results, 2020

Based on the results of the soil bearing capacity analysis in the table above, it is known that the value of the soil bearing capacity for Segment one is 6.76, Segment two is 5.33, Segment three is 4.29, Segment four is 5.58 and Segment five is 5.33. It can be seen that the smaller the CBR value, the smaller the soil bearing capacity value obtained.

Based on the CBR value chart, it can be seen that the CBR average value is 8.20% with the following details: segment one is 15%, segment two is 7%, segment three is 4%, segment four is 8% and segment five is 7. %. Based on the CBR value requirements for the sub-base layer, generally, the CBR value is a minimum of 20%. The CBR average value is 8.20%, so it can be concluded that soil conditions affect road damage.

4. Solutions and Alternatives

Based on the results of the analysis above, it is known that soil conditions have an effect on road damage, and the road damage is caused by the low bearing capacity of the soil along the road and the subgrade strength which is known to have not reached the minimum standard of 20%. So that in providing solutions for handling damage including road maintenance in the form of road optimization.

From the results of problem identification, priority selection of problems to be resolved is carried out. To deal with road damage conditions, road repairs were carried out by digging back the damaged part of the road and re-compaction and asphalting according to the procedures for compiling the city road maintenance program number 018 / T / BNKT / 1990 [10]. In handling road damage, it is carried out by routine handling so that it is hoped that with routine road damage handling, road conditions will become normal.

5. Conclusion

1) From the calculation results, the average value of the plasticity index is 0.60% <10% so that the soil condition is quite good and based on the table for determining soil type, it can be seen that the average soil type at the research location is silt soil type with a low plasticity index value. between 0 to 7% and an average moisture content value of 33.3%.

2) Based on the above analysis, it can be seen that the CBR average value of 8.20% is as follows: segment one is 15%, segment two is 7%, segment three is 4%, segment four is 8% and segment five is 7%. Based on the CBR value requirements for the sub-base layer, generally, the CBR value is a minimum of 20%. The CBR average value is 8.20%, so it can be concluded that soil conditions affect road damage.

3) From the results of problem identification carried out, the priority selection of problems to be resolved for handling road damage conditions is carried out by road repairs by excavating the damaged section of the road and performing compaction and paving.

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