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Abstract. The main purpose of this research work is to identify the classification and strength of soil does it affected the road damages in Jeram, Kuala Selangor. The most factors influencing road damages in Jeram is an overloading vehicle using the main roads. To achieve the objectives of this paper soil laboratory testing has been done in justify the content of peat soil. Location of study can be categorizing as a plantation soil as there are a majority of land has been use in agricultural sector which are oil palm tree plantation. Besides, oil palm plantation suitable for peat soil land which has less soil strength. Sample of soil were collected in Jeram and bring it to soil mechanics and geotechnical laboratory in UMP. Few tests were being soil classification, particle size distribution, moisture content, density, specific gravity, Atterberg limit and direct shear test. Soil sample from three different roads were chosen which are Jalan Pantai Jeram, Jalan Simpang 3 Jeram and Jalan Tambak Tengah. The road has different criteria from the surface damages which no damages occur, less damage and most damages on road. From the data collected, Jalan Simpang 3 Jeram results the most damages road and the less strength of soil due to high content of peat soil. The soils criteria are located near trench and in the area of oil palm plantation. It also is the main road were used to collect the plantation yield to the factory.

Keywords: soil characteristic, road damage, geotechnical, palm plantation

1. Introduction

Malaysia is the country rich with plantation sources due to the suitable weather hot and humid all year long. Malaysia has a vital role to play in achieving the rising global need for oils and fats, as Malaysia is one of the bigger producer and exporter countries of palm oil plantation and palm oil products. In 2015, oil palm plantation in Malaysia turns into huge industry for an overwhelming contribution to world's palm oil production and export which is 39% and 44%, respectively [1]. The location of study in Jeram, can be observed that majority of the land use for agriculture such as oil palm plantation and the type of soil are peat soil which are very suitable for oil palm tree. Generally suitable peat for oil palm cultivation [2]. A soil sample were taken from the site and brought to soil mechanics laboratory to justify the soil types and condition.

Peatland with an area totaling approximately 2.6 million ha is considered a problematic soil in Malaysia, but it has potential for oil palm cultivation. The poor inherent physical properties of peat such as low bulk density, high water-table and rapid subsidence rate make its development for oil palm cultivation difficult and costly as compared to mineral soils. A study has stated that, peat contains high organic content more than 75% [3].

Peat composed of organic material and the component makes peat very spongy, highly compressible and combustible in characteristic according to [4]. Peat is defined as an organic soil with a thickness of

organic matter of more than 50 cm, mineral content not exceeding 35%, and covering an area of more than 1ha. [5]. The objectives of this study are to identify the soil characteristics of road damages in Jeram, Kuala Selangor. In Peninsular Malaysia, Selangor is the 2nd largest area of peat soil and oil palm plantation as shown in Table 1.

Table 1. Distribution of peat in peninsular Malaysia [6].

State	Approximate area under peat (ha)
Johor	216,000
Pahang	285,000
Selangor	182,000
Perak	69,000
Terengganu	46,000
Kelantan	11,000
Negeri Sembilan	4,000
Total	813,000

2. Methodology

The purpose of research methodology is to provide a sound platform for the researcher to achieve the aim and objectives of the study. This chapter highlights the chronological order of research methodology, discusses on how the research methodology will be conducted in order to achieve the objectives of this research. It is also important in obtaining relevant primary data from the selected group. From there, an analysis is conducted to study the data obtained from respondent and finally, based on the results obtained, a conclusion is derived.

In the location of study, three roads and point were chosen as the soil sample in this research. The selected area study is around Jeram, Kuala Selangor is because of the location of oil palm plantation, industrial of oil palm factory and building, accommodation and other developments. The road namely Jalan Tambak Tengah, Jalan Simpang 3 Jeram and Jalan Pantai Jeram. The details of road chosen are as listed in the Table 2 below. To determine the strength of soil test has been done are soil moisture content, particle size distribution, density, atterberg limits and direct shear test. The figure 1 shows the characteristics of soil sample taken if three roads.

Table2. Road details in Jeram.

Soil mark	Road name	Road damages	Road category	Color of soil
Soil A	Jalan Simpang 3 Jeram	Road cracking, settlement	Federal roads	Black brown
Soil B	Jalan Pantai Jeram	Potholes, settlement		Grey
Soil C	Jalan Tambak Tengah	Potholes		Brown

Figure 1. Soil sample in location of study.

The study area has been used for development purposes such as construction of residential area, oil palm factory and near to beach. In Malaysia, oil palm plantations are mainly established on old agricultural land or previously logged-over forest land. Coincides with the developments, there is increasing number of traffic volume in one time of period. Other than that, the study area is the main road for daily activities and the movements of the heavy vehicles such as lorry and heavy trucks make the damage road becomes worse. Classification of soil is needed as it can relate to identify the material can be used for construction of roads and other things.

3. Result and Discussion

3.1. Laboratory Soil Test

3.1.1. Test 1: Organic content

The value of moisture content in soil A, B and C is still categorized as a peat soil but with low natural moisture content. This is because the location of peat soil taken is far away from trench area and also during hot weather season and it has low moisture content.

The result and data analysis of moisture content test for soil sample A, B and C were shown in Table 3. Reference [7] stated that the natural water content of peat in West Malaysia ranges from 200% to 500% and with the organic content in the range of 50% to 95%. The average moisture content obtained for soil A is 41.83%, however for soil B and C are 13.33% and 13.90% itself.

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$$w = \frac{M_{SL} - M_{DSL}}{M_{SDL} - M_{DL}} \times 100 \quad (1)$$

$$w = \frac{M_S}{M_D} \times 100 \quad (2)$$

where w is moisture content (%), M_S is the moisture loss and M_D is dry soil.

Table3. Moisture content of soil.

Sample Soil		A	B	C
Container, g	M_{DL}	21.18	14.77	14.20
Wet soil and container, g	M_{SL}	32.35	32.95	32.99
Dry soil and container, g	M_{DSL}	26.97	30.78	30.70
Dry soil, g	M_D	12.85	16.01	16.49
Moisture loss, g	M_S	5.38	2.17	2.29
Average moisture content, %	W	41.83	13.33	13.90
Average moisture, %			23.02	

3.1.2. Test 2: Particle Density

Peat soils are considered as extremely soft, wet and unconsolidated deposits [8]. Particle density is the density of the solid particles that collectively make up a soil sample [9]. The value is commonly expressed in milligrams per meter cubic. The common range among soils is 2.55 to 2.70 mg/m ^{3}. A value of 2.65 were used generally except if some test need a great accuracy of particle density or soils are known to depart from it common range. However, from the test it results for soil sample A with 2.22, sample B 2.26 and sample C 2.28 mg/m^3.

Table 4. Determination of particle density soil.

Soil Sample (specimen reference)		A	B	C
Mass of Bottle		27.30	26.71	26.76
Mass of Bottle + Stopper, m_1	g	32.42	31.67	31.84
Mass of Bottle + Stopper + Dry Soil, m_2	g	42.78	41.97	42.12
Mass of Bottle + Stopper + Soil + Water, m_3	g	138.11	138.32	137.76
Mass of Bottle + Stopper + Water, m_4	g	132.41	132.57	131.99
Mass of Dry Soil, $(m_2 - m_1)$	g	10.37	10.31	10.28
Mass of Water In Full Bottle, $(m_4 - m_1)$	g	99.99	100.90	100.15
Mass of Water Used, $(m_3 - m_1)$	g	95.32	96.35	95.64
Particle Density, ρ_s $\rho_s = \frac{m_2 - m_1}{(m_4 - m_1) - (m_3 - m_1)}$	Mg/m^3	2.22	2.26	2.28
Average Particle Density,	Mg/m^3		2.25	

3.1.3. Test 3: Plasticity Index

There are three limits within Atterberg Limits which are Plastic Limit (PL), Liquid Limit (LL) and Shrinkage Limit (SL). All limits are tested on the three sample soil and repeated three times in order to get accurate description of the soil.

Plastic Limit is the boundary between non-plastic and plastic state of the soil sample. It is the limit in which it starts to act like plastic. This is done by rolling a thread of the soil sample. The moisture content can be simply adjusted by doing so and when it breaks about 1/8 inch in diameter which marks the Plastic Limit. The plasticity index result shows Soil A and Soil C has medium plasticity.

Table 5. Plasticity index result.

PI	Description	Soil A	Soil B	Soil C
0	Non-plastic			
1 – 5	Slightly plastic			
5 – 10	Low plasticity		✓	
10 – 20	Medium plasticity	✓		✓
20 – 40	High plasticity			
> 40	Very high plasticity			

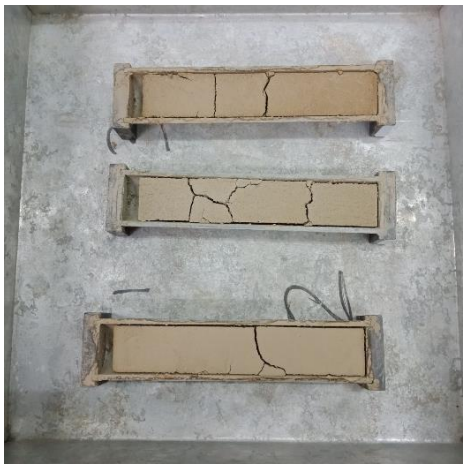
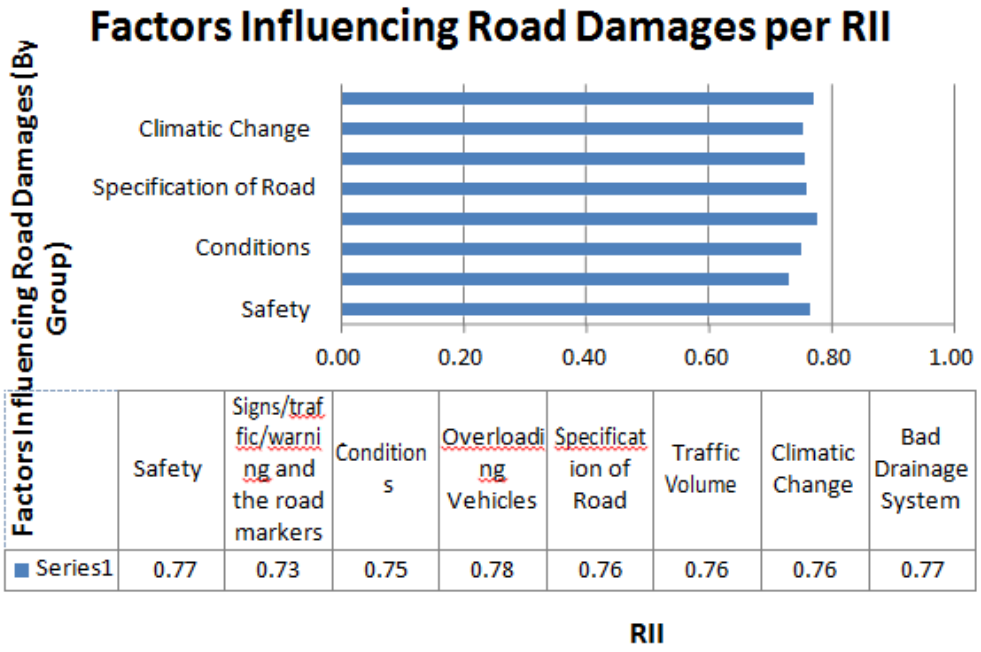


Figure 2. Shrinkage limit test.

Figure 3. Liquid limit.

3.2. Relative Important Index

The horizontal axis represents the RII value and the vertical axis represents the factors influencing road damages. In this study, it involves eight types of factors such as bad drainage system, climatic change, traffic volume, specification of road, overloading vehicles, conditions, sign, traffic, warning and the road markers and safety. From the bar chart it can be seen that the first ranking of factor influencing road damages is overloading vehicle with 0.78 RII value and following by bad drainage system and safety with 0.77 RII value.



Factors Influencing Road Damages (By Group)	Safety	Signs/traffic/warning and the road markers	Conditions	Overloading Vehicles	Specification of Road	Traffic Volume	Climatic Change	Bad Drainage System
Series1	0.77	0.73	0.75	0.78	0.76	0.76	0.76	0.77

Figure 4. Factors influencing road damages per RII.

4. Conclusion

From user's perspective it can be concluded that eight factors influencing the road damages case study in Jeram, Kuala Selangor. The eight factors are safety, signs/traffic/warning and the road markers, conditions, overloading vehicles, specification of road, traffic volume, climatic change and bad drainage system.

Based on the RII ranking, the factor contributing the most to road damages in Jeram are overloading vehicles, bad drainage system and safety. From table 4.3, it has been recorded that overloading vehicles have the first ranking of RII of 0.778, bad drainage system 0.775 and in the third ranking is safety with RII od 0.771.

With high level of moisture content, high organic content and the behavior of the soil samples used for this research can be classified as the peat soil. This research also proved that the location study affected the properties of the peat soil as they exposed to different environment.

Acknowledgments

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