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Strengthening of the Basic Soil (Sub Grade) of the Road Using Galam Piles

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ABSTRACT

Banjarmasin City is situated on an alluvial soil type characterized by clay structures with a relatively low soil carrying capacity; hence, soil stabilization is required. The soil is stabilized using a variety of techniques. Stabilization techniques include using geotextiles, columns, sand stabilizing the soil itself, and stabilizing concrete mix. Implementation at the existing project site is stability stable pending catastrophe. In order the soil's carrying capacity, a depression is created at a predetermined distance beneath the soil, which is generally soft. The method of implementation utilized to assist in the preparation of this research includes data collecting and analysis of the obtained results. This evaluation's data sources consist of secondary data and data processing. By utilizing a static living load of 22.68 tons and the results of the calculation, it is determined that the load acting on the road construction is 33.2415 tons. The *Schmertmann- Nottingham* technique (1975) yielded a Qult Single of 1.245 and a Qgroup permit of 10.27 tonnes for the carrying capacity of the Galam woodGalam with a pile depth of 5 meters

INTRODUCTION

Road transportation plays an important role in regional development. In addition, the current road traffic conditions are needed as a link from one area to another. The transportation system greatly influences the progress and development of a region. Along with the increase in traffic, various efforts were also made to meet the need for good road infrastructure. When constructing the road itself, it is necessary to consider alternative construction systems to be used depending on the conditions of the construction site.

South Kalimantan, especially the City of Banjarmasin, is an alluvial soil type area dominated by clay/clay structures with a relatively low soil carrying capacity, so it must be increased or repaired. One of the ways is the stabilization method, by using chemical mixtures or mixing other materials. Various methods are also used to stabilize the soil, such as stabilization using geotextiles; stabilization of the soil itself (stabilization); stabilization with columns; stabilization with cement mixture. While the implementation at this research location is stable with the galam wood niche. Because the soil beneath or the base is soft soil, which must be stabilized using Galam wood hollows at a certain distance, to provide strength or increase the carrying capacity of the subgrade.

Implementation at the current project site is stable with a rock creek. So the soil underneath, which is soft, is given a depression at a certain distance, so it is hoped that it can increase the carrying capacity of the soil.

The problem that usually arises from clay soil is its too high water content sensitivity, so it needs to be stabilized, including using additional chemicals as a mixture. For research in this project, using the natural-rich rock as an alternative to increasing the carrying capacity of clay soil which is the subgrade of the road construction.

Galam wood or often called cerucuk galam wood, is still quite abundant in South Kalimantan Province, especially at the road project site where this research is carried out, or in the Barito Kuala district, so it is quite easy to get and the price is still quite cheap when compared to chemical stabilization. like Portland cement.

It is hoped that after stabilization or strengthening of the road construction subgrade, the carrying capacity of the clay soil against traffic loads will increase, as well as being able to increase the value of the properties of the clay soil and be able to meet the criteria or requirements as a construction sub base. highway on the project.

RESEARCH METHODS

These researches are located on Jl. Trans Kalimantan, Handil Bakti, Kec. Alalak, Kab. Barito Kuala, South Kalimantan. In the Road Development Package project to Add Lanes to Pasar Anjir (Bts. Prov. Kal-Teng)-Serapat-Bts. Banjarmasin City. on September 23, 2020.

The implementation approach employed as a supplement to the creation of this research includes data gathering and a review of the obtained results. Secondary data and data processing are the sources of information for this evaluation.

This research uses secondary data collected in the form of written information, including sondir data, hand-digging data, and soil inspection conclusion data.

Methods for data processing and calculation derived from pertinent literature include:

1. Determining carrying capacity using the *Schmertmann-Nottingham* Method based on sondir data (1975).
2. Conduct an assessment of the results for carrying capacity based on sondir data.
3. Calculate the loads operating on the soil used for road construction.
4. calculating the pile's permissible bearing capacity

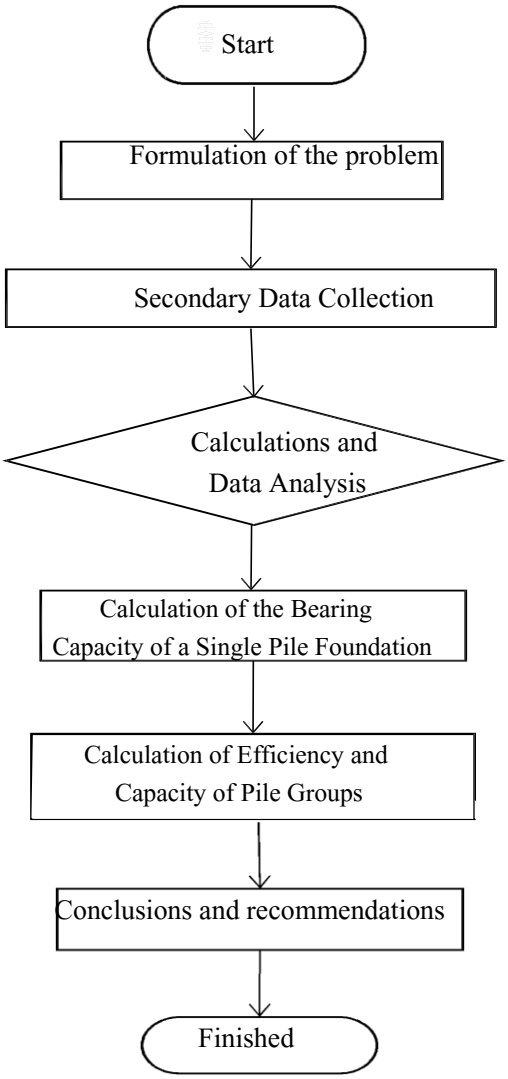


Figure 1. Water Diagram

DISCUSSION

The tests that were performed yielded the following results: moisture content, weight, specific gravity, liquid limit, plastic limit, plastic index, hydrometer, direct shear, free strong press, and consolidation.

Table 1. Soil Inspection Conclusion

KESIMPULAN PEMERIKSAAN TANAH

NO	MACAM PEMERIKSAAN			HASIL PEMERIKSAAN	METODE SNI
1	Kadar Air	Wn	(%)	103.29	(SNI 1965:2008)
2	Berat Isi	γn	(gr/cm3)	1.374	(SNI-03-3637-1994)
3	Berat Jenis	Gs		2.506	(SNI 1964:2008)
4	Batas Cair	LL	(%)	51.10	(SNI 1967:2008)
5	Batas Plastis	PL	(%)	36.04	(SNI 1966:2008)
6	Indeks Plastis	PI	(%)	15.06	
7	Hydrometer	Silt (M)	(%)	62.00	(SNI 3432:2008)
		Clay (C)	(%)	38.00	
8	Geser Langsung				(SNI 3420:2016)
	Kohesi Geser Langsung	C	(kg/cm2)	0.010	
	Sudut Geser	ø	(°)	4.9	
9	Kuat Tekan Bebas				(SNI 3638:2012)
	Modulus Elastisitas	E	(kg/cm2)	66.667	
	Kohesi Undrained	Cu	(kg/cm2)	0.004	
	Kuat Tekan Bebas Kondisi Undisturbed	qu	(kg/cm2)	0.008	
	Kuat Tekan Bebas Kondisi Remoulded	qr	(kg/cm2)	0.006	
	Sensitivity	St		1.333	
10	Konsolidasi				(SNI 2812:2011)
	Compression Index Laboratory	Cc lab		1.073	
	Compression Index Field	Cc field		1.552	
	Swelling Index	Cs		0.179	
	Koefisien Konsolidasi	Cv	(cm2/det)	0.000364	
	Koefesien Rembesan	k	(cm/det)	4.2525E-08	
	Angka Pori Awal	eo		2.719	
	Angka Pori Akhir	ef		1.142	

Sondir Data

Sondir data was gathered from soil samples taken at a depth of 32.60 meters on Jl. Trans Kalimantan, Handil Bakti, Kec. Alalak, and Kab. Barito Kuala in South Kalimantan.

Table 2. Sondir Data

Piston		Konus		Sleeve		Luas Piston / Sleeve	t
Diameter (cm)	Luas (cm2)	Diameter (cm)	Luas (cm2)	Diameter (cm)	Selimut (cm2)		cm
3.57	10.00	3.57	10.00	3.57	150.0	0.067	20.0

Kedalaman	Pembacaan		Konus	Cleef	HP	JHP	FR
(m)	Manometer 1	Manometer 2	(Kg/Cm2)	(Kg/Cm2)	(Kg/Cm)	(Kg/Cm)	(%)
0.00	Air						
20	Air						
40	Air						
60	3.0	5.0	3.0	0.133	2.67	2.67	4.4
80	2.0	4.0	2.0	0.133	2.67	5.34	6.7
1.00	2.0	4.0	2.0	0.133	2.67	8.00	6.7
20	1.0	2.0	1.0	0.067	1.33	9.34	6.7
40	1.0	2.0	1.0	0.067	1.33	10.67	6.7
60	1.0	2.0	1.0	0.067	1.33	12.01	6.7
80	1.0	2.0	1.0	0.067	1.33	13.34	6.7
2.00	1.0	2.0	1.0	0.067	1.33	14.67	6.7
20	2.0	3.0	2.0	0.067	1.33	16.01	3.3
40	2.0	3.0	2.0	0.067	1.33	17.34	3.3
60	2.0	3.0	2.0	0.067	1.33	18.68	3.3
80	2.0	3.0	2.0	0.067	1.33	20.01	3.3
3.00	2.0	3.0	2.0	0.067	1.33	21.35	3.3
20	2.0	3.0	2.0	0.067	1.33	22.68	3.3
40	2.0	3.0	2.0	0.067	1.33	24.01	3.3
60	2.0	3.0	2.0	0.067	1.33	25.35	3.3
80	2.0	3.0	2.0	0.067	1.33	26.68	3.3
4.00	2.0	3.0	2.0	0.067	1.33	28.02	3.3
20	2.0	3.0	2.0	0.067	1.33	29.35	3.3
40	2.0	3.0	2.0	0.067	1.33	30.68	3.3
60	2.0	3.0	2.0	0.067	1.33	32.02	3.3
80	2.0	3.0	2.0	0.067	1.33	33.35	3.3
5.00	2.0	3.0	2.0	0.067	1.33	34.69	3.3
20	2.0	3.0	2.0	0.067	1.33	36.02	3.3
40	2.0	3.0	2.0	0.067	1.33	37.35	3.3
60	3.0	5.0	3.0	0.133	2.67	40.02	4.4
80	3.0	5.0	3.0	0.133	2.67	42.69	4.4
6.00	2.0	4.0	2.0	0.133	2.67	45.36	6.7
20	2.0	4.0	2.0	0.133	2.67	48.03	6.7
40	2.0	4.0	2.0	0.133	2.67	50.70	6.7
60	2.0	4.0	2.0	0.133	2.67	53.36	6.7
80	2.0	4.0	2.0	0.133	2.67	56.03	6.7
7.00	2.0	4.0	2.0	0.133	2.67	58.70	6.7
20	2.0	4.0	2.0	0.133	2.67	61.37	6.7
40	2.0	4.0	2.0	0.133	2.67	64.04	6.7
60	2.0	4.0	2.0	0.133	2.67	66.70	6.7
80	2.0	4.0	2.0	0.133	2.67	69.37	6.7

Table 3. Sondir Data

Kedalaman (m)	Pembacaan		Konus (Kg/Cm2)	Cleef (Kg/Cm2)	HP (Kg/Cm)	JHP (Kg/Cm)	FR (%)
	Manometer 1	Manometer 2					
8.00	3.0	5.0	3.0	0.133	2.67	72.04	4.4
20	3.0	5.0	3.0	0.133	2.67	74.71	4.4
40	3.0	5.0	3.0	0.133	2.67	77.38	4.4
60	3.0	5.0	3.0	0.133	2.67	80.04	4.4
80	3.0	5.0	3.0	0.133	2.67	82.71	4.4
9.00	3.0	5.0	3.0	0.133	2.67	85.38	4.4
20	3.0	5.0	3.0	0.133	2.67	88.05	4.4
40	3.0	5.0	3.0	0.133	2.67	90.72	4.4
60	4.0	6.0	4.0	0.133	2.67	93.39	3.3
80	4.0	6.0	4.0	0.133	2.67	96.05	3.3
10.00	3.0	5.0	3.0	0.133	2.67	98.72	4.4
20	3.0	5.0	3.0	0.133	2.67	101.39	4.4
40	4.0	7.0	4.0	0.200	4.00	105.39	5.0
60	4.0	7.0	4.0	0.200	4.00	109.39	5.0
80	4.0	7.0	4.0	0.200	4.00	113.40	5.0
11.00	3.0	6.0	3.0	0.200	4.00	117.40	6.7
20	3.0	6.0	3.0	0.200	4.00	121.40	6.7
40	4.0	7.0	4.0	0.200	4.00	125.40	5.0
60	4.0	7.0	4.0	0.200	4.00	129.41	5.0
80	3.0	6.0	3.0	0.200	4.00	133.41	6.7
12.00	3.0	6.0	3.0	0.200	4.00	137.41	6.7
20	3.0	6.0	3.0	0.200	4.00	141.41	6.7
40	4.0	7.0	4.0	0.200	4.00	145.41	5.0
60	4.0	7.0	4.0	0.200	4.00	149.42	5.0
80	4.0	7.0	4.0	0.200	4.00	153.42	5.0
13.00	5.0	8.0	5.0	0.200	4.00	157.42	4.0
20	5.0	8.0	5.0	0.200	4.00	161.42	4.0
40	5.0	8.0	5.0	0.200	4.00	165.43	4.0
60	5.0	8.0	5.0	0.200	4.00	169.43	4.0
80	6.0	9.0	6.0	0.200	4.00	173.43	3.3
14.00	6.0	9.0	6.0	0.200	4.00	177.43	3.3
20	7.0	10.0	7.0	0.200	4.00	181.43	2.9
40	7.0	10.0	7.0	0.200	4.00	185.44	2.9
60	8.0	12.0	8.0	0.267	5.34	190.77	3.3
80	8.0	12.0	8.0	0.267	5.34	196.11	3.3
15.00	10.0	14.0	10.0	0.267	5.34	201.45	2.7
20	10.0	14.0	10.0	0.267	5.34	206.78	2.7
40	9.0	13.0	9.0	0.267	5.34	212.12	3.0
60	9.0	13.0	9.0	0.267	5.34	217.46	3.0
80	11.0	15.0	11.0	0.267	5.34	222.79	2.4

Source: PT. ADALAB FONDASI IDEAL

Tabel 4. Sondir Data

Kedalaman	Pembacaan		Konus	Cleef	HP	JHP	FR
(m)	Manometer 1	Manometer 2	(Kg/Cm2)	(Kg/Cm2)	(Kg/Cm)	(Kg/Cm)	(%)
16.00	11.0	15.0	11.0	0.267	5.34	228.13	2.4
20	10.0	14.0	10.0	0.267	5.34	233.46	2.7
40	10.0	14.0	10.0	0.267	5.34	238.80	2.7
60	9.0	13.0	9.0	0.267	5.34	244.14	3.0
80	9.0	13.0	9.0	0.267	5.34	249.47	3.0
17.00	10.0	15.0	10.0	0.334	6.67	256.14	3.3
20	10.0	15.0	10.0	0.334	6.67	262.81	3.3
40	8.0	13.0	8.0	0.334	6.67	269.48	4.2
60	8.0	13.0	8.0	0.334	6.67	276.15	4.2
80	9.0	14.0	9.0	0.334	6.67	282.83	3.7
18.00	9.0	14.0	9.0	0.334	6.67	289.50	3.7
20	8.0	13.0	8.0	0.334	6.67	296.17	4.2
40	8.0	13.0	8.0	0.334	6.67	302.84	4.2
60	9.0	14.0	9.0	0.334	6.67	309.51	3.7
80	9.0	14.0	9.0	0.334	6.67	316.18	3.7
19.00	10.0	15.0	10.0	0.334	6.67	322.85	3.3
20	8.0	13.0	8.0	0.334	6.67	329.52	4.2
40	8.0	13.0	8.0	0.334	6.67	336.19	4.2
60	8.0	13.0	8.0	0.334	6.67	342.86	4.2
80	9.0	14.0	9.0	0.334	6.67	349.53	3.7
20.00	9.0	14.0	9.0	0.334	6.67	356.20	3.7
20	9.0	14.0	9.0	0.334	6.67	362.87	3.7
40	8.0	13.0	8.0	0.334	6.67	369.54	4.2
60	8.0	13.0	8.0	0.334	6.67	376.21	4.2
80	8.0	13.0	8.0	0.334	6.67	382.88	4.2
21.00	8.0	13.0	8.0	0.334	6.67	389.55	4.2
20	9.0	14.0	9.0	0.334	6.67	396.22	3.7
40	9.0	14.0	9.0	0.334	6.67	402.89	3.7
60	8.0	13.0	8.0	0.334	6.67	409.56	4.2
80	9.0	14.0	9.0	0.334	6.67	416.23	3.7
22.00	10.0	15.0	10.0	0.334	6.67	422.90	3.3
20	10.0	15.0	10.0	0.334	6.67	429.57	3.3
40	9.0	14.0	9.0	0.334	6.67	436.24	3.7
60	9.0	14.0	9.0	0.334	6.67	442.91	3.7
80	10.0	15.0	10.0	0.334	6.67	449.59	3.3
23.00	10.0	15.0	10.0	0.334	6.67	456.26	3.3
20	9.0	14.0	9.0	0.334	6.67	462.93	3.7
40	9.0	14.0	9.0	0.334	6.67	469.60	3.7
60	11.0	16.0	11.0	0.334	6.67	476.27	3.0
80	12.0	17.0	12.0	0.334	6.67	482.94	2.8

Source: PT. ADALAB FONDASI IDEAL

Table 5. Sondir Data

Kedalaman (m)	Pembacaan		Konus (Kg/Cm2)	Cleef (Kg/Cm2)	HP (Kg/Cm)	JHP (Kg/Cm)	FR (%)
	Manometer 1	Manometer 2					
24.00	12.0	18.0	12.0	0.400	8.00	490.94	3.3
20	13.0	19.0	13.0	0.400	8.00	498.95	3.1
40	14.0	21.0	14.0	0.467	9.34	508.28	3.3
60	14.0	21.0	14.0	0.467	9.34	517.62	3.3
80	16.0	24.0	16.0	0.534	10.67	528.30	3.3
25.00	17.0	25.0	17.0	0.534	10.67	538.97	3.1
20	18.0	26.0	18.0	0.534	10.67	549.64	3.0
40	18.0	26.0	18.0	0.534	10.67	560.31	3.0
60	19.0	27.0	19.0	0.534	10.67	570.99	2.8
80	20.0	28.0	20.0	0.534	10.67	581.66	2.7
26.00	22.0	30.0	22.0	0.534	10.67	592.33	2.4
20	23.0	32.0	23.0	0.600	12.01	604.34	2.6
40	23.0	32.0	23.0	0.600	12.01	616.35	2.6
60	25.0	35.0	25.0	0.667	13.34	629.69	2.7
80	26.0	36.0	26.0	0.667	13.34	643.03	2.6
27.00	26.0	36.0	26.0	0.667	13.34	656.37	2.6
20	27.0	37.0	27.0	0.667	13.34	669.71	2.5
40	28.0	38.0	28.0	0.667	13.34	683.05	2.4
60	30.0	40.0	30.0	0.667	13.34	696.39	2.2
80	26.0	38.0	26.0	0.800	16.01	712.40	3.1
28.00	24.0	36.0	24.0	0.800	16.01	728.41	3.3
20	30.0	43.0	30.0	0.867	17.34	745.75	2.9
40	30.0	43.0	30.0	0.867	17.34	763.09	2.9
60	28.0	41.0	28.0	0.867	17.34	780.44	3.1
80	27.0	40.0	27.0	0.867	17.34	797.78	3.2
29.00	27.0	40.0	27.0	0.867	17.34	815.12	3.2
20	29.0	42.0	29.0	0.867	17.34	832.47	3.0
40	30.0	43.0	30.0	0.867	17.34	849.81	2.9
60	32.0	45.0	32.0	0.867	17.34	867.15	2.7
80	32.0	45.0	32.0	0.867	17.34	884.50	2.7
30.00	33.0	46.0	33.0	0.867	17.34	901.84	2.6
20	36.0	48.0	36.0	0.800	16.01	917.85	2.2
40	34.0	46.0	34.0	0.800	16.01	933.86	2.4
60	32.0	44.0	32.0	0.800	16.01	949.87	2.5
80	30.0	42.0	30.0	0.800	16.01	965.87	2.7
31.00	32.0	44.0	32.0	0.800	16.01	981.88	2.5
20	100.0	105.0	100.0	0.334	6.67	988.55	0.3
40	155.0	160.0	155.0	0.334	6.67	995.22	0.2
60	160.0	165.0	160.0	0.334	6.67	1001.89	0.2
80	175.0	180.0	175.0	0.334	6.67	1008.57	0.2

Source: PT. ADALAB FONDASI IDEAL

Table 6. Sondir Data

Kedalaman (m)	Pembacaan		Konus (Kg/Cm2)	Cleef (Kg/Cm2)	HP (Kg/Cm)	JHP (Kg/Cm)	FR (%)
	Manometer 1	Manometer 2					
32.00	185.0	190.0	185.0	0.334	6.67	1015.24	0.2
20	200.0	205.0	200.0	0.334	6.67	1021.91	0.2
40	225.0	230.0	225.0	0.334	6.67	1028.58	0.1
60	250.0	251.0	250.0	0.067	1.33	1029.91	0.0

Source: PT. ADALAB FONDASI IDEAL

Handboring

In this instance, boring is done to a depth of 3.50m to study the soil layer at the designated depth.

Tabel 7. Handboring

HANDBORING LOG			
Kedalaman	**Profil**	**Uraian**	**Keterangan**
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.60 2.80 3.00		Lempung Berorganik Sangat Lunak Abu-abu	Tanah Dasar
3.20 3.40 3.50	UDS	Lanau Berlempung	Tanah Dasar

Source: PT. ADALAB FONDASI IDEAL

According to the hand boring table above, a layer of gray, extremely soft organic clay is found up to a depth of 3 meters. Clay silt is found 3.5 meters beneath it in the striatum.

Calculation Data

Dead Load **Cross Section**

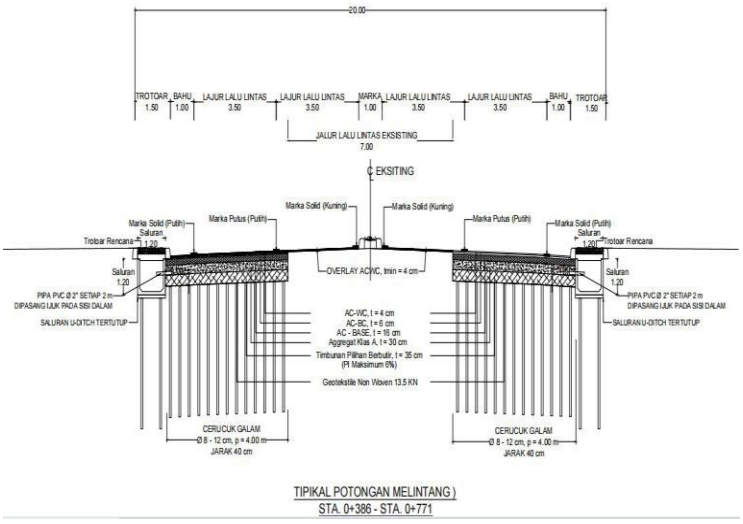


Figure 2. Cross Section

Source: Plan Drawing

Top View Image

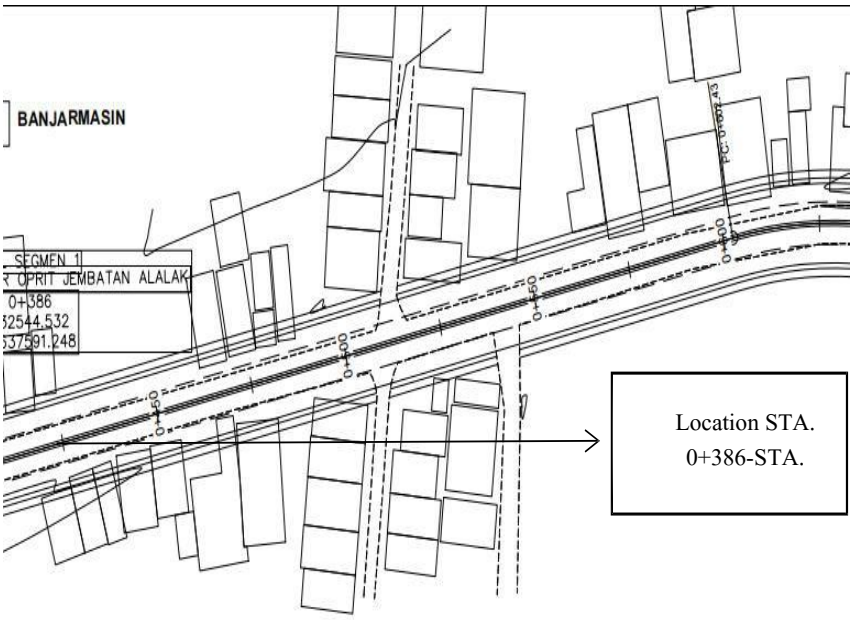


Figure 3. Top View Image
Source: Plan Drawing

The calculated load is based on a road length of one meter and a working width of 4.5 meters.

a. Grained Selection Heaps
   Stockpile volume = Road Width x Road Length x Thickness
   = 4,5 x 1 x 0,35
   = 1,575 m^3
   Piled Weight = Specific Gravity x Volume
   = 2,588 x 1,575
   = 4,0671 ton

b. LPA Class A
   LPA Volume = Road Width x Road Length x Thickness
   = 4,5 x 1 x 0.30
   =1,35 m^3
   LPA weight = Specific Gravity x Volume
   = 2,624 x 1,35
   =3,5424 ton

c. Asphalt
   Asphalt Volume AC-WC = Road Width x Road Length x Thickness x Specific Gravity
   = 4,5 x 1 x 0,04 x 2,5
   = 0,45 ton
   Asphalt Volume AC-BC = Road Width x Road Length x Thickness x Specific Gravity
   = 4,5 x 1 x 0.06 x 2,6
   = 0,702 ton
   AC Asphalt Volume -Base = Road Width x Road Length x Thickness x Specific Gravity
   = 4,5 x 1 x 0,16 x 2,5
   = 1,8 ton
   Asphalt Total Volume = ∑volume
   = 2,952 ton
   ∑ = embankment weight + LPA weight + total asphalt
   = 4,0671 +3,5424 +2,952
   = 10,5615 ton

Live Load

Table 8. Road Classes Based on Their Functions and Uses

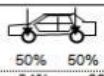
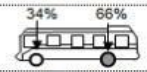
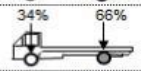
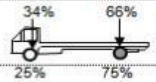
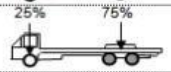
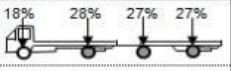
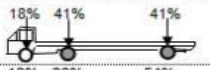
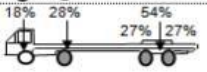
Kelas Jalan	Fungsi Jalan	Dimensi maksimum dan muatan sumbu terberat (MST)			
		Lebar (mm)	Panjang (mm)	MST (ton)	Tinggi (mm)
I	Arteri	2500	18000	> 10	4200 dan tidak lebih dari 1,7 x lebar kendaraan
II		2500	18000	≤ 10	
IIIA	Arteri atau kolektor	2500	18000	≤ 8	
IIIB	Kolektor	2500	12000	≤ 8	
IIIC	Lokal dan Lingkungan	2100	9000	≤ 8	

Source: PP No. 43/1993B, 1993.

The realization of a safe road transportation infrastructure is based on these provisions. Routes are constructed based on their intended usage, with arterial roads having strong pavement to support the type of cars they are required to carry. Similar adjustments are made to the road's dimensions and pavement strength for collector, local, and environmental routes depending on their intended purpose.

Based on Manual No. 01/MN/BM/83, the configuration of axle loads on various types of vehicles, together with vehicle equivalent numbers in empty (minimum) and loaded (maximum) situations

Table 9. Axle Configuration and Vehicle Type

KONFIGURASI SUMBU & TIPE	BERAT KOSONG (ton)	BEBAN MUATAN MAKSIMUM (ton)	BERAT TOTAL MAKSIMUM (ton)	UE 18 KSAL KOSONG	UE 18 KSAL MAKSIMUM	RODA TUNGGAL PADA UJUNG SUMBU / RODA GANDA PADA UJUNG SUMBU
1,1 HP	1,5	0,5	2,0	0,0001	0,0005	
1,2 BUS	3	6	9	0,0037	0,3006	
1,2L TRUK	2,3	6	8,3	0,0013	0,2174	
1,2H TRUK	4,2	14	18,2	0,0143	5,0264	
1,22 TRUK	5	20	25	0,0044	2,7416	
1,2+2,2 TRAILER	6,4	25	31,4	0,0085	3,9083	
1,2-2 TRAILER	6,2	20	26,2	0,0192	6,1179	
1,2-2,2 TRAILER	10	32	42	0,0327	10,1830	

Source: Bina Marga 1983

Referring to the load configuration table and road class, it is known that the road class in this research project is Class I arterial road with MST> 10 tons. Axle configurations and vehicle types for 1.2 to 2.2 trailers with a maximum weight of 42 tons can be found in the table of vehicles that can pass on class I highways. In light of this, the static live load used as a reference is

weight = maximum total weight x % heaviest axis= 42ton x 54% = 22, 68

Total Load

The static live load is 22.68 tons and the total load is 10.5615 tons according to the dead load calculation. The total burden is therefore 33.2415.

Calculation of the Bearing Capacity of the Cerucuk Galam Pole

In this research, the theoretical support will be calculated at a depth of 5 m utilizing sondir data and the *Schmertmann-Nottingham* method to determine its single-pile and group-bearing capacities (1975). Sondir Data Calculations at a 5 m Depth.

Loading Schematic Cut Image

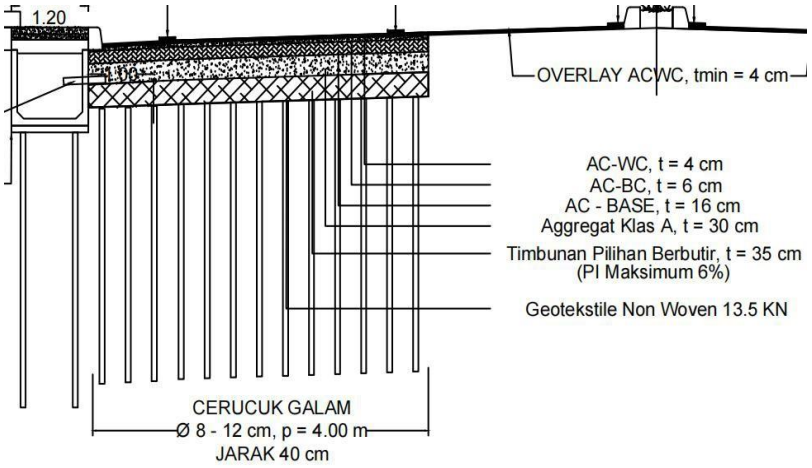


Figure 4. Cross-section

Source: Plan Drawing

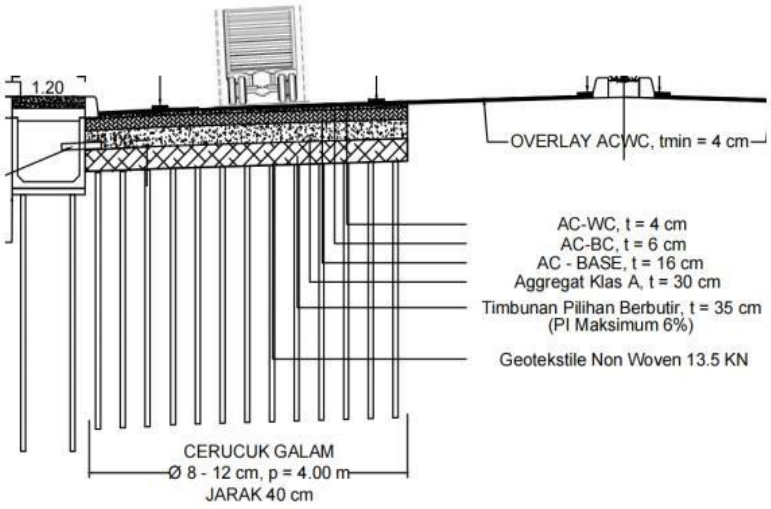


Figure 5. Illustration with a Load on it

Calculation of Bearing Capacity of the Cerucuk Pole

Table 10. Calculation of Pole Bearing Capacity Cerucuk

Diameter	:	10 cm	s (jarak tiang)	:	40 cm
4D	:	40 cm	Ap	:	78,5 cm3
8D	:	80 cm	As	:	31,4 cm3

Elevasi	Soil Depth	Qc	Fs	Hp	Cn1	Qc min	Cn2	Cn3	Qc Average	fr	S/C	Li/D, Ks	Kc.s	Qp	(0-8D)	(8D-L)	Qs	qult-single	qall
m	m	kg/ cm2		kg/cm	kg/cm2	kg/cm2	kg/cm2		kg/cm2										
Galian subgrade	0.0	0	0	0	0	0	0		0.00	0	-	0	0.0	0	- .0	0	0	0	0
	20	0	0	0	0	0	0		0.00	0	-	0	0.0	0	- .0	0	0	0	0
	40	0	0	0	0	0	0		0.00	0	-	0	0.0	0	- .0	0	0	0	0
	60	3	0	0	0	0	0		0.00	4.4	-	0	0.0	0	- .0	0	0	0	0
	80	2	0	0	0	0	0		0.00	6.7	-	0	0.0	0	- .0	0	0	0	0
0.0	1.00	2	0	0	0.00	0.00	0.00	0.00	0.00	6.7	Lempung	0.00	1.2	0.000	- .0	0.00	0	0	0
0.2	20	1	0.067	0.267	1.00	1.00	1.00	1.00	1.50	6.7	Lempung	0.25	1.2	0.118	0.025	0.00	0.03	0.14	0.04
0.4	40	1	0.067	0.267	1.00	1.00	1.00	1.00	1.50	6.7	Lempung	0.50	1.2	0.118	0.075	0.00	0.08	0.19	0.05
0.6	60	1	0.067	2.67	1.00	1.00	1.00	1.25	1.63	6.7	Lempung	0.75	1.2	0.128	0.151	0.00	0.15	0.28	0.07
0.8	80	1	0.067	1.33	1.00	1.00	1.00	1.50	1.75	6.7	Lempung	1.00	1.2	0.137	0.201	0.00	0.20	0.34	0.09
1.00	2.00	1	0.067	1.33	1.50	1.00	1.50	1.75	2.38	6.7	Lempung	1.25	1.2	0.186	0.201	0.05	0.25	0.44	0.11
1.2	20	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	1.50	1.2	0.236	0.201	0.10	0.30	0.54	0.14
1.4	40	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	1.75	1.2	0.236	0.201	0.15	0.35	0.59	0.15
1.6	60	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	2.00	1.2	0.236	0.201	0.20	0.40	0.64	0.16
1.8	80	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	2.25	1.2	0.236	0.201	0.25	0.45	0.69	0.17
2.00	3.00	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	2.50	1.2	0.236	0.201	0.30	0.50	0.74	0.18
2.2	20	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	2.75	1.2	0.236	0.201	0.35	0.55	0.79	0.19
2.4	40	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	3.00	1.2	0.236	0.201	0.40	0.60	0.84	0.2
2.6	60	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	3.25	1.2	0.236	0.201	0.45	0.65	0.89	0.21
2.8	80	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	3.50	1.2	0.236	0.201	0.50	0.70	0.94	0.22
3.00	4.00	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	3.75	1.2	0.236	0.201	0.55	0.75	0.99	0.23
3.2	20	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	4.00	1.2	0.236	0.201	0.60	0.80	1.04	0.24
3.4	40	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	4.25	1.2	0.236	0.201	0.65	0.85	1.09	0.25
3.6	60	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	4.50	1.2	0.236	0.201	0.70	0.90	1.14	0.26
3.8	80	2	0.067	1.33	2.00	2.00	2.00	2.00	3.00	3.3	Lempung	4.75	1.2	0.236	0.201	0.75	0.95	1.19	0.27
4.00	5.00	2	0.067	1.33	2.00	2.00	2.00	2.25	3.13	3.3	Lempung	5.00	1.2	0.245	0.201	0.80	1.00	1.25	0.28
4.2	20	2	0.067	1.33	2.00	2.00	2.00	2.25	3.13	3.3	Lempung	5.25	1.2	0.245	0.201	0.85	1.05	1.30	0.29

Source: Self Calculation Table

CONCLUSION

Clay soil characterizes the soil at the research site, resulting in a limited soil carrying capacity, Using deep ceurcuk piles driven directly into the subgrade to enhance the carrying capacity of the subgrade is one approach to strengthening the carrying capacity of the soil. The findings of the research.

As a consequence, utilizing 1,000 tons of free traffic, the load acting on the road body's construction is 33.24 tons.

By Having the calculation table of the bearing capacity of Galam wood cerucuk piles with a pile depth of 5 meters using the SCHMERTMANN-NOTTINGHAM technique (1975), *Qult Single* was determined to be 1.245 and *Qgroup* was permitted to be 10.27 tons.

According to the calculations, utilizing as many as 33 cerucuk galam piles with a load of 33.24 tons and dimensions of 3x11 feet, as well as a single Qizin pile weighing 0.28 tons.

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