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PLANNING TO REPAIR THE APPROACH SLABS BRIDGE MUARA TABIRAI, RANTAU – KANDANGAN

Ade Nafis Prawira

Department of Civil Engineering, Faculty of Engineering, Lambung Mangkurat University

Abstract: Muara Tabirai Bridge is on the border between Rantau and Kandangan District ,which is precisely is on the street of Kalumpang-Margasari, the village of Paci, Kalumpang subdistrict. Increasing economic growth has led to the economy of the population being affected by the development of the city, gradually increasing in economic sectors as a result of global economic growth. The increase in this economy is due to the growing industry in the area. This is accompanied by the increase and needs of the population in the area that resides in the region. Unfortunately, after one year of construction of Muara Tabirai Bridge, the approach slabs bridge in the direction Kandangan on the right side suffered a decrease in the soil to damage the asphalt, due to the possibility of a landslide on the side of the road, then the implementers make alternative repairs by using a bronjong which makes the load heavier than before so that the ground that supports the burden of the heap, bronjong and traffic load can not withstand and So in this final task is done repair on the ground soil and design a retaining wall that is more suitable for the condition of the land

The basic soil repair method used is by a phased heap (Preloading) combined with the Prefabricated Vertical Drain (PVD) ,which serves as a water and air release on the soil, thus experiencing a consolidated degree of 90%. And for retaining wall against the side of the heap is used sheet pile with the type of free-standing ,which is suitable for the location of the pile located in the river. After that, the calculation of budget plan (RAB) on the Land, improvement Project,

From the result of calculation obtained, a gradual heap (Preloading) carried out 0.2 m/week ,and ,a high critical heap (HCR) obtained on the high end of the plan (HR) 3.14 m obtained a security figure (SF) of 1.148 so that the heap used the soil reinforcement that is Mini pile erection so that the safety number (SF) reaches more than equal to 1.5 Prefabricated Vertical Drain (PVD) is used specification of the product PT. Teknindo Superior System installed when before done the filling is on the ground ground, planning Prefabricated Vertical Drain (PVD) using a triangular mounting pattern with a distance between PVD 1.25 m, depth 28 m and the time required is 21 weeks. Planning of soil retaining structure used is cantilever sheet pile type, obtained a total length of sheet pile of 20.938 m at STA 0 + 275 on the left and right side of the bridge. The budget plan for this basic land improvement project is Rp. 30,886,527,167

Keywords: ground soil repair, Approach slabs bridge, Preloading, Prefabricated Vertical Drain (PVD), Sheet pile (Sheet Pile)

CHAPTER I

INTRODUCTION

1.1 Background of the Study

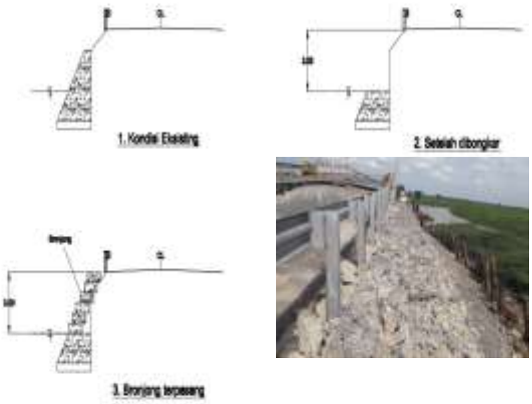
Increasing economic growth has made the economy of the population residing in the Kalumpang – Margasari region, which is also the border between Rantau and Kandangan, affected by the development of the city gradually increasing in the economic sector as a result of economic growth globally. The increase in this economy is due to the growing industry in the area. This is accompanied by the increase and needs of the population in the region that resides in the region

With this above, the increase in traffic through the Jalan Kalumpang-Margasari needed a path used as access to pass through the river Tabirai, so the need for bridge planning. The bridge has the position of stone pairs (ground retaining walls) designed using a long-lasting 7m pile. Because in the direction Kandangan on the left is in the river (the end) so that the implementation of the concrete plate as the feet of the retaining walls previously planned ground mini pile 7m

After one year of completion of the construction project, the wall of retaining ground on the side of Kandangan decreased

Picture 1.1 Degradation of ground retaining walls

The results of the soil investigation, the failure of the approach slabs occurs because the hard soil is at a depth of 15 m, so it takes a deeper foundation for the retaining wall of the land. Based on the visual field, the settlement is very small, so it is considered the settlement has been final, then the provider filed an alternative trial handling (agreed with the Bronjong), with the record if in the future if there is damage will be repaired again



Picture 1.3 Bronjong Mounting

Shortly after the wall retaining ground handlers used bronjong, the Tabirai Approach slabs Bridge in the direction of Kandangan decreased.

In this planning will be planned ground soil repair method for approach slabs bridge is Preloading combined with Prefabricated Vertical Drain (PVD), then it will be re-planned ground retaining wall sheet pile on the left and right side.

1.2 Formulation of the Problem

From the background above, it can be formulated that:

1. How to plan the improvement of the approach slabs bridge in decline/settlement?
2. What is the estimated cost of repairs and planning?

1.3 Significance of the Planning

The benefit of this planning is to provide input that is an alternative improvement to the project agencies in handling problems that occur in the approach slabs bridge Muara Tabirai, Rantau – Kandangan and as the development of science and technology.

1.4 The Objective of the Planning

The purpose of this writing temple is to look for alternatives to improvements in the approach slabs bridge. This research has 2 (two) main objectives, namely

1. Know how to plan to repair the approach slabs bridge declining/Settlement
2. Know the cost analysis on the planning of the improvement

1.5 Scope and Limitation

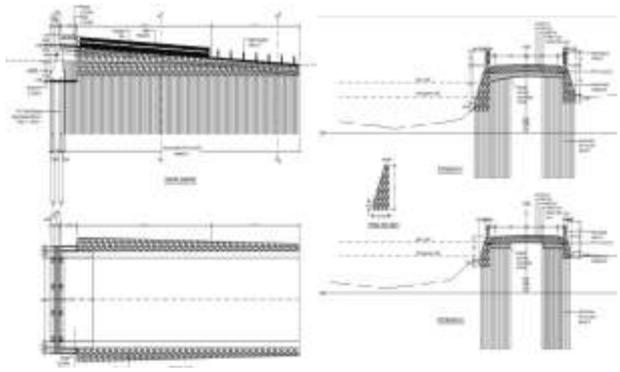
Some limitations on the issues defined in this end task are:

1. Do not discuss structure calculations over bridges
2. Not discussing the abutments calculation of bridges
3. Not discussing road drainage calculations
4. Data used is secondary data
5. Improvement of the planned Approach slabs is the left (Kandangan) River Muara Tabirai
6. Vehicle load according to standard load

1.6 Location

Location of improvement of the decline of the approach slabs bridge Muara Tabirai, which is located in the village of Karangan Paci, District Kalumpang, South Hulu Sungai District. Here are the pictures of repair location and cut the approach slabs bridge

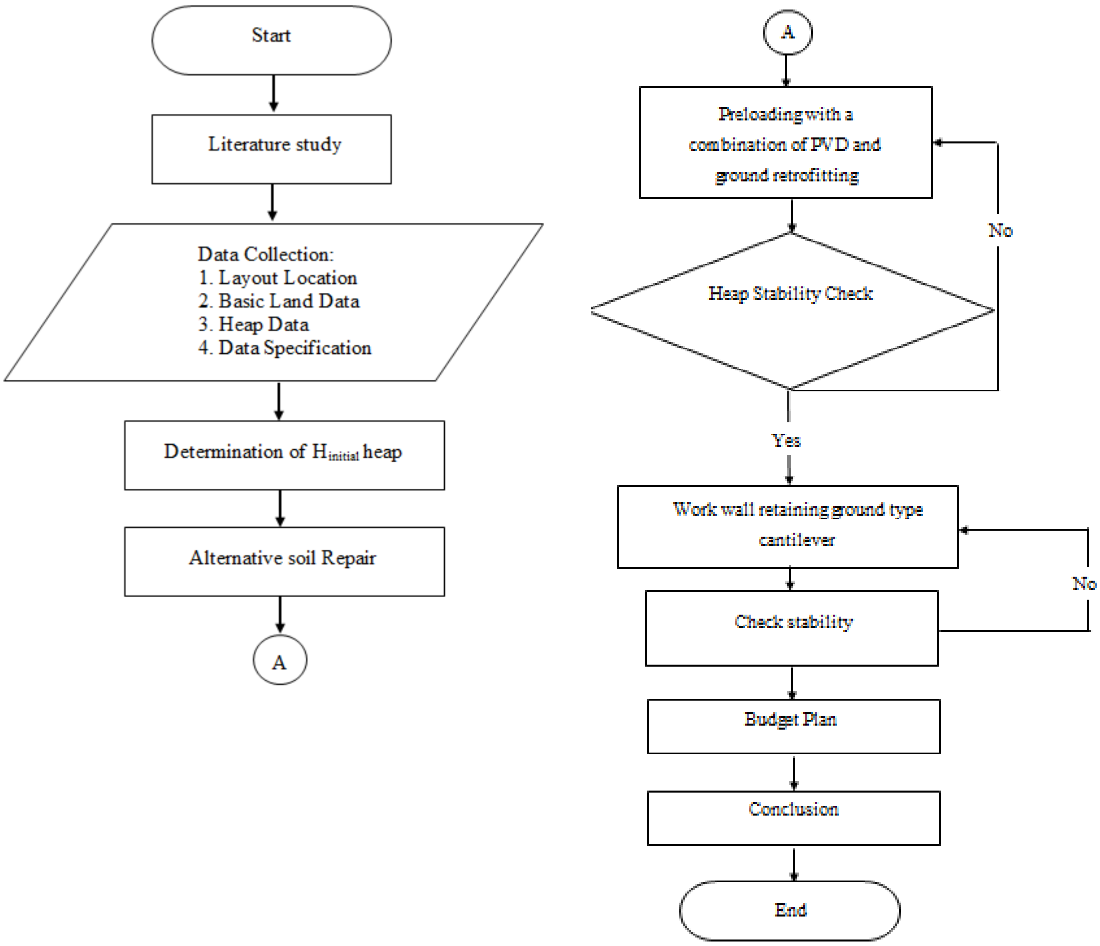
Picture 1.6 Improvement Location



Picture 1.7 (a) Elongated pieces, (b) F-F and G-G Pieces

CHAPTER III

METHOD OF RESEARCH



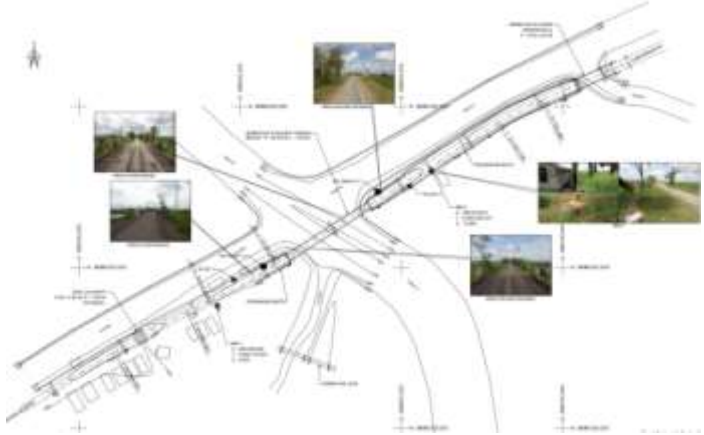
Picture 3.1 Final task work Flow diagram

CHAPTER IV

PLANNING DATA ANALYSIS

4.1 Layout Muara Tabirai Bridge

Layout Plan Muara Tabirai Bridge presented in Figure 4.1. The location that was reviewed on this final task on the east side of Tabirai River is Approach slabs Bridge on STA 0 + 250



Picture 4.1.
Layout Muara Tabirai Bridge

4.2 Ground Data Base

4.2.1 Soil Data Retrieval Location

Picture 4.2
Location of Ground Improvement Planning

Soil Data used is from the result of soil investigation in the form of the Standart Penetration Test (SPT) in the location that was built by Muara Tabirai Bridge, which can be seen in Figure 4.2. This data is then used as the basic soil improvement plan data on the bridge. Data Standart Penetration Test (SPT)

Based on the results of the SPT test that has been done, the results can be seen in Figure 4.3. This Data will later be used as the calculation of soil correlation per layer. Land data available on this project are BH-01 and BH-02, but in this planning will only use the land data BH-02 because the drilling point is in the area of problematic approach slabs

- Soil Data Correlation

Correlation Data obtained from calculation results

Kedalaman (m)	N-SPT	γ (kN/m³)	ϕ (°)	cu (kPa)	e_0	Cc	Cs	Cv (cm²/det)	LL	PI
0 - 2	0	14,700	0	8	2,620	0,705	0,141	0,00015	95%	54%
2 - 4	0	14,700	0	8	2,620	0,705	0,141	0,00015	95%	54%
4 - 6	0	14,700	0	8	2,620	0,705	0,141	0,00015	95%	54%
6 - 8	0	14,700	0	8	2,620	0,705	0,141	0,00015	95%	54%
8 - 10	0	14,700	0	8	2,620	0,705	0,141	0,00015	95%	54%
10 - 12	11	17,111	28	0	1,390	0	0,067	0,00063	0%	0%
12 - 14	14	17,778	28	0	1,200	0	0,056	0,00073	0%	0%
14 - 16	13	17,556	28	0	1,263	0	0,060	0,00069	0%	0%
16 - 18	10	16,889	17	65	1,455	0,355	0,071	0,00060	44%	18%
18 - 20	12	17,333	12	78	1,326	0,317	0,063	0,00066	44%	18%
20 - 22	17	16,444	17	110,5	1,640	0,411	0,082	0,00052	48%	21%
22 - 24	22	18,667	22	143	0,963	0,208	0,042	0,00088	38%	14%
24 - 26	25	20,000	28	0	0,734	0,139	0,028	0,00100	34%	11%
26 - 28	21	18,222	28	0	1,074	0,241	0,048	0,00080	38%	14%
28 - 30	26	>20	28	0	<0,734	-	-	-	NP	NP
30 - 32	29	>20	28	0	<0,734	-	-	-	NP	NP
32 - 34	33	>20	28	0	<0,734	-	-	-	NP	NP
34 - 36	30	>20	28	0	<0,734	-	-	-	NP	NP
36 - 38	33	>20	28	0	<0,734	-	-	-	NP	NP
38 - 40	37	>20	30	0	<0,734	-	-	-	NP	NP
40 - 42	40	>20	30	0	<0,734	-	-	-	NP	NP
42 - 44	43	>20	43	279,5	<0,734	-	-	-	NP	NP
44 - 46	50	>20	50	325	<0,734	-	-	-	NP	NP
46 - 48	50	>20	50	325	<0,734	-	-	-	NP	NP
48 - 50	50	>20	50	325	<0,734	-	-	-	NP	NP

Table 4.10
Recapitulation of soil Data parameters

4.2.2 Data Penetration

Data penetration used for the erection of soil reinforcement is mini pile

4.3 Heap Material Data

In this planning, the heap is planned using stone sand material with the parameters are:

Volume weight γ = 1,8 t/m^3

Sliding corners in the ground ϕ = 25°

Cohesion c = 0

The dimensions of the heap are planned according to the final height of 2.19 m at STA 0 + 275 and 1.44 m at STA 0 + 290 with a heap width of 9.2 m and tilt 1:2 S/d 2:3

4.4 Plan Load Determination (q)

Expense plans in planning analysis will use

1. Heap Load

   The heap load used is a examples load of 2 t/m2, 3 t/m2, 4 t/m2, 5 t/m2, 6 t/m2, 7 t/m2 and 8 t/m2. The burden is distributed to the depth of land being reviewed as a load evenly trapezoidal
2. Burden of Labour

   Road pavement load used is rigid
3. Traffic load

   Traffic loads use the assumption that q traffic is correlated with a planned heap (Japan Road Association, 1986)

4.5 Soil Repair and Refinement Material Data

Planning to repair and strengthen the soil using materials to be used according to planning and available in the market. Soil improvement materials and soil refinement in this planning include:

A. Prefabricated Vertical Drain (PVD)

Prefabricated Vertical Drain used as a vertical drain planning is a brand of CeTeau-Drain CT-D812. The brochure used is from PT. Teknindo Geosistem Unggul

B. Prefabricated Horizontal Drain (PHD)

Prefabricated Vertical Drain used as a vertical drain planning is a brand of CeTeau-Drain CT-SD100-20. The brochure used is from PT. Teknindo Geosystem Unggul

C. Mini pile

Mini pile used is concrete piling with dimensions 30 cm x 30 cm, length 15 m

4.6 Job Unit Analysis Price Analysis Data

Job Unit price analysis refers to the work unit price Analysis (AHSP) year 2012 of the public works compiled by the Ministry of Public Works and the price of Geosystem units. The Basic price of materials, wages ,and leasing using the standard of provincial government unit of South Kalimantan year 2019

BAB V

HEAP PLANNING AND GROUND SOIL IMPROVEMENT

5.1 Heap Calculation

This planning is determined in advance the burden on the heap consisting of heap load, road pavement ,and traffic load. Specifications of the heap to be used are:

γ heap : 1,8 t/m^3

H Final : 2,19 m (STA 0+290)

1,44 m (STA 0+275)

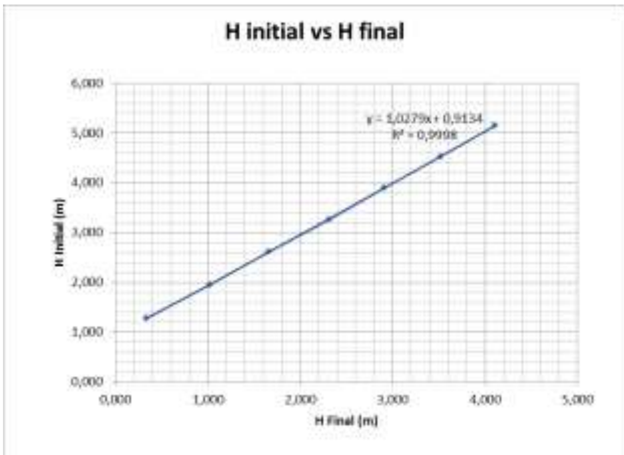
Heap width : 37,49 m

5.1.1 Hinitial and Hfinal Heap planning

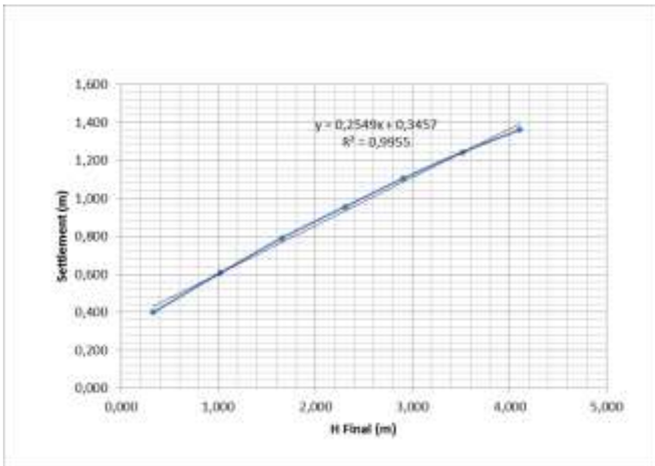
The decline of ground land due to planned load needs to be sought high heap against the load to be planned. From the magnitude of the decline will be adjusted high plan of the heap implementation (HR) so that the final elevation of the heap to be planned by the final elevation of + 11.69 at STA 0 + 290, therefore, need to be planned high initial heap (Hinitial) and high variation of the heap to know the magnitude of the soil decline occurs

No	Beban q timbunan (t/m²)	Sc beban timbunan (m)	Hinitial (m)	H bongkar traffic (m)	Tebal pavement (m)	Sc beban pavement (m)	Tinggi final (m)
1	2	0,307	1,282	1,000	0,450	0,0926	0,332
2	3	0,513	1,952	0,778	0,450	0,0930	1,018
3	4	0,697	2,610	0,611	0,450	0,0931	1,658
4	5	0,862	3,257	0,444	0,450	0,0931	2,307
5	6	1,011	3,895	0,333	0,450	0,0933	2,907
6	7	1,149	4,527	0,222	0,450	0,0934	3,513
7	8	1,277	5,154	0,139	0,450	0,0836	4,105

Table 5.8
Results of HInitial and Hfinal calculations



Picture 5.2



Picture 5.3
Hfinal vs. Settlement Chart

Thus, it can be calculated interpolation or draw lines for Hfinal plans are:

- Hfinal 1.44 m on STA 0 + 290:
  - ➢ High planned plan:

    Hinitial = 1.748 m
  - ➢ Load plan against planned heap:

    Q = 2.690 T/m2
  - ➢ Decreased consolidation is occurring:

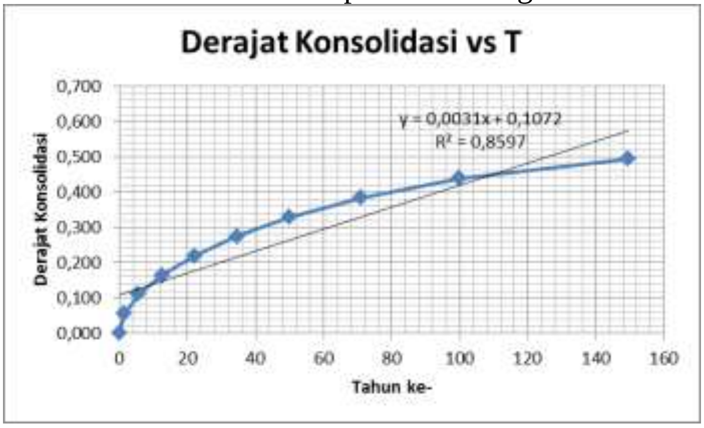
    Sc = 0.548 m

5.2 Calculation of Ground-less Compression Time

The compression speed of the soil layer depends on the value of consolidation coefficient (Cv) on each type of land. Because CV values vary every layer of land, then Cv can be counted ,ie combined Cv with the equation 2.23

Uv	Tv	t (tahun)	Sc (m)
0%	0	0	0,000
10%	0,008	1,409	0,055
20%	0,031	5,459	0,110
30%	0,071	12,502	0,165
40%	0,126	22,187	0,220
50%	0,196	34,513	0,274
60%	0,283	49,832	0,329
70%	0,403	70,963	0,384
80%	0,567	99,841	0,439
90%	0,848	149,321	0,494
100%	-	-	0,549

Table 5.10
Relationship time and degree



Picture 5.4
Chart of degrees of relations and time of consolidation without improvement of soil (STA 0 + 290)

Because the time to finish the compression is 150 years, it is necessary to accelerate the basic ground Peampatan by using Prefabricated Vertical Drain (PVD).

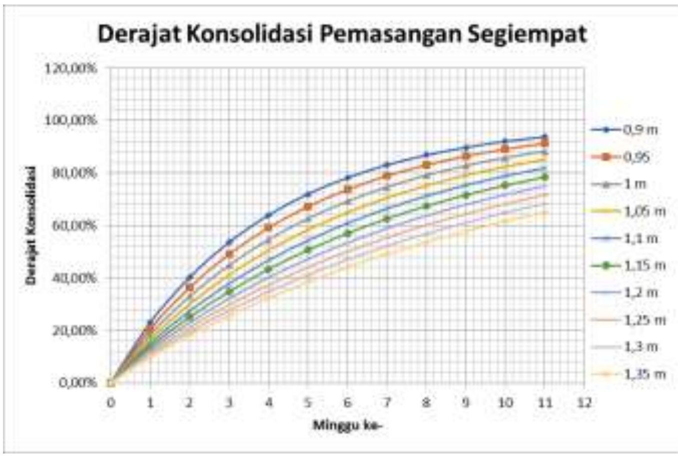
5.3 Planning Prefabricated Vertical Drain

In planning, PVD is calculated using the pattern of mounting triangle and rectangular with the variation of the mounting distance between PVD is 0.9; 0.95; 1.00; 1.05:1.1; 1.15; 1.2; 1.25; 1.30; and 1.35 meters. The planned PVD depth is as deep as the soft soil depth.

The PVD specification data used is

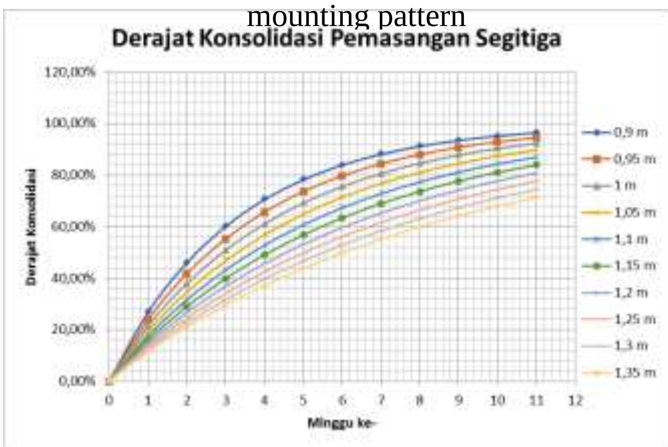
A = 100 mm

b = 4 mm



Picture 5.8

Graph of time relationships and degrees of consolidation of average PVD triangular mounting pattern



Picture 5.9

Graph of time relationship and degree consolidation of average PVD rectangular mounting pattern

From the calculations above, the planned PVD mounting distance for 4-6 months is the mounting distance of 1.25 m with the PVD pattern of the rectangular mounting with the reason:

- Quadrilateral mounting patterns are easier to perform in the field compared to triangular patterns,
- With quadrivalent pattern and mounting distance of 1.25 m. degree of consolidation reaches 90% within 21 weeks. PVD that reaches the age of more than six months tends to have blockages so ineffective

5.4 Planning Prefabricated Horizontal Drain (PHD)

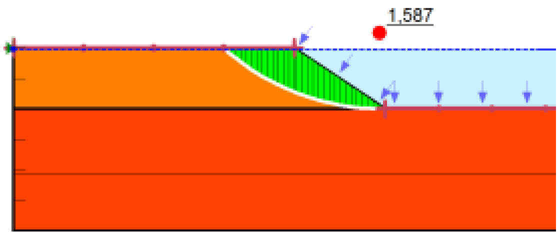
Prefabricated Horizontal Drain (PHD) serves to receive aqueducts from the PVD to the river. The purpose of the PHD planning is to the safety factor of the water flow that occurs in the PHD according to the planned specifications. From the above calculation results, a PHD installation with a planned spesification can be used because SF > 1

5.5 Gradual Heap Planning

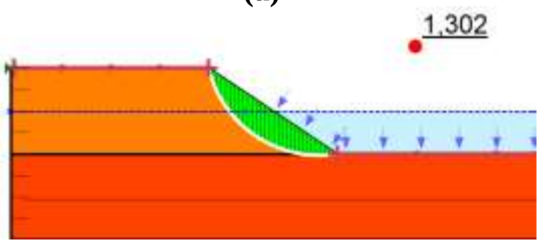
The implementation of the heap is carried out in the field gradually with the speed of stockpile according to plan. In this final task is reviewed the high heap implementation (HR), which is 3.14 m at STA 0 + 275 and 1.74 m at STA 0 + 290. The pending speed is 0.2 m/week.

In determining the schedule need to be analyzed in advance a critical heap height (HCR) to know the height of the maximum execution that can be borne by the base land using the GeoSlope auxiliary program by looking for a safety factor (SF) for high heap with an interval of 1.

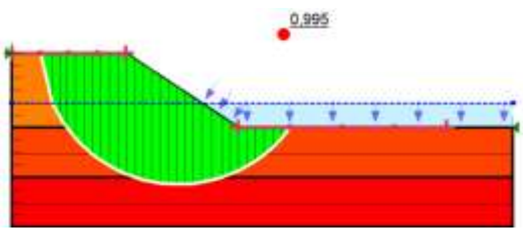
Example result of GeoSlope stability analysis for HR heap height = 1-3 m



(a)



(b)



(c)

Picture 5.11
Results of GeoSlope stability analysis for heap height: (a) HR = 1 m; (b) HR = 2 m; (c) HR = 3 m

From 5.11 Images obtained safety numbers for each height of the heap

H_R (m)	SF
1	1,587
2	1,302
3	0,995

To get SF = 1 then used the interpolation formula Interpolated results = $2 + \left(\frac{(1-1{,}302)}{(0{,}995-1{,}302)}\right) x\ (3-2)$ = 2,98 m

The critical heap height (HCR) is 2.98 m, so the gradual stockpile needs to be performed a stability analysis first when critical high heap height (HCR) is achieved.

5.6 Gradual Heap Distribution and Change Due to

To calculate the increase in the base land support should be calculated the voltage received by the base land due to the heap per phase of voltage distribution due to stage 1 ($\Delta\sigma_1$) When U = 100%:

B1 = 4,6 m

B2 = 0,3 m

α1 $= tan^{-1}\left(\frac{B1+B2}{z}\right) - tan^{-1}\left(\frac{B1}{z}\right)$

$= tan^{-1}\left(\frac{4{,}6+0{,}3}{0{,}5}\right) - tan^{-1}\left(\frac{4{,}6}{0{,}5}\right)$

= 0,007

α2 $= tan^{-1}\left(\frac{B1}{z}\right)$

$= tan^{-1}\left(\frac{4{,}6}{0{,}5}\right)$

= 1,463

$\Delta\sigma_1$ $= \frac{q}{\pi}[\left(\frac{B1+B2}{B2}\right)(\alpha1+\alpha2) - \frac{B1}{B2}\alpha2]$

$= 0{,}180$ t/m^2

$2\Delta\sigma_1$ $= 2 \times 0{,}499$

$= 0{,}360$ t/m^2

Voltage changes due to Phase 1 (σ_1') When U = 100%:

σ_n' $= \sigma_{n-1}$'+ $\Delta\sigma_n$'

σ_1' $= \sigma_o$' + $\Delta\sigma_1$

$= 0{,}235 + 0{,}360$

$= 0{,}595$ t/m^2

Voltage distribution due to Phase 1 ($\Delta\sigma_1$) When U < 100%

$$\Delta\sigma_1 = \left[\left(\frac{\sigma1'}{\sigma o'}\right)^{U1} x\ \sigma o'\right] - \sigma o'$$

$$= \left[\left(\frac{0{,}595}{0{,}235}\right)^{0{,}1155} x\ 0{,}235\right] - 0{,}235$$

$= 0{,}026$

Voltage changes due to Phase 1 (σ_1') When U < 100%

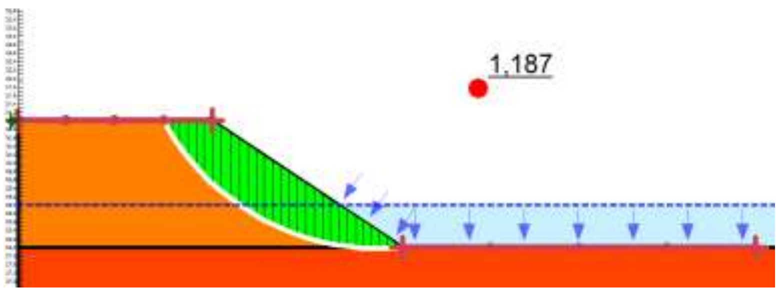
σ_1' $= \sigma_o$' + $\Delta\sigma_1$

$= 0{,}235 + 0{,}026$

$= 0{,}261$

5.7 The Calculation to Support Increase in Ground Land

Because of the increase in the voltage received by the base land, there is an increase in the carrying capacity (CU). After obtaining the changes in voltage per week can be a calculated increase in the ground support capacity (CU). Calculation of the supporting power increase using equations 2.29 or 2.30



Picture 5.12
Results of GeoSlope stability Analysis
for a Hcr-tall heap = 2.98 m after
changes in price CU

From the results of the analysis obtained a security number (SF) 1.187 and referring to SNI 8460 2017 with a minimum security number (SF) 1.5 Then for the landfill is used the soil retrofitting mini pile

5.8 Mini pile Planning

Mini pile is used as an alternative to the alignment on the left and right side heap pile. Mini pile is planned to increase the ground shear strength. Planned Mini pile:

Dimension = 30 x 30 cm

Fc' = 52 Mpa

Modulus of elasticity (E)= 4700 x $\sqrt{fc'}$ =

4700 x $\sqrt{52}$

=33892,182 Mpa

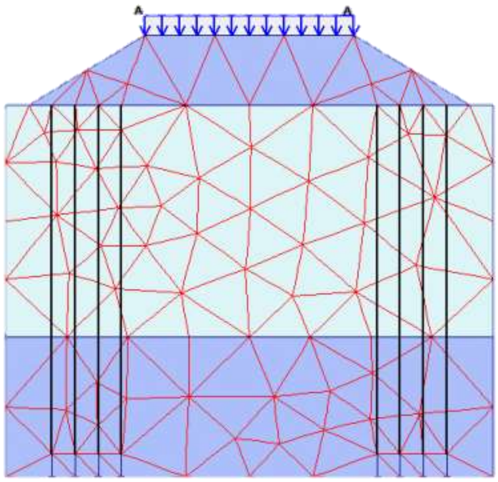
Moment of inertia (I) = $\frac{1}{12}\ x\ 300\ x\ 300^3$

= 6,75 x $10^8\ mm^4$

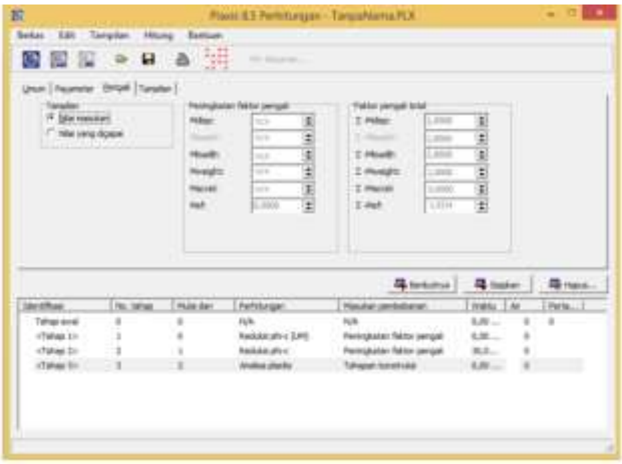
Cracked moment (Mcr)= 3,64 tm

Ultimate Moment (Mu)= 5,19 tm

Length (L) = 15 m



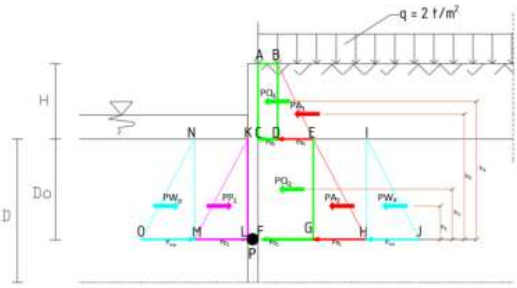
(a)



(b)

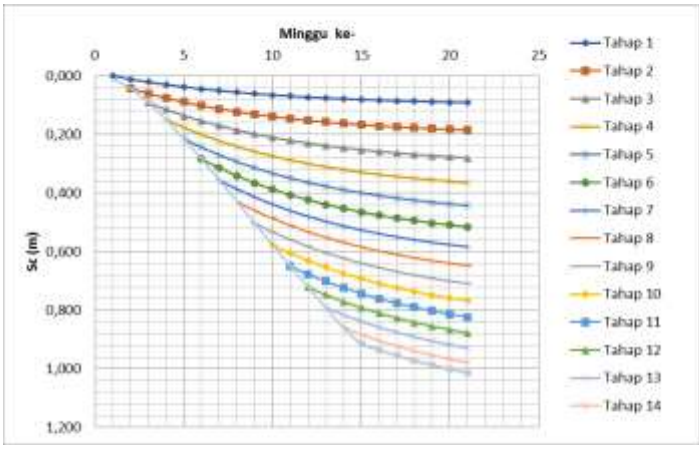
Picture 5.15
(a) Geometry; (b) Safety Number Value

From the result of heap stability analysis obtained a security number of 1.5234 so it can be deduced safe.



5.9 Gradual Heap Compression Calculation

To calculate, the consolidation has occur using one of the equations of 2.29, 2.30, and 2 changes due to each stage of the heap. The com heap shown in Figure 5.16



Picture 5.16
Gradual heap Compression chart

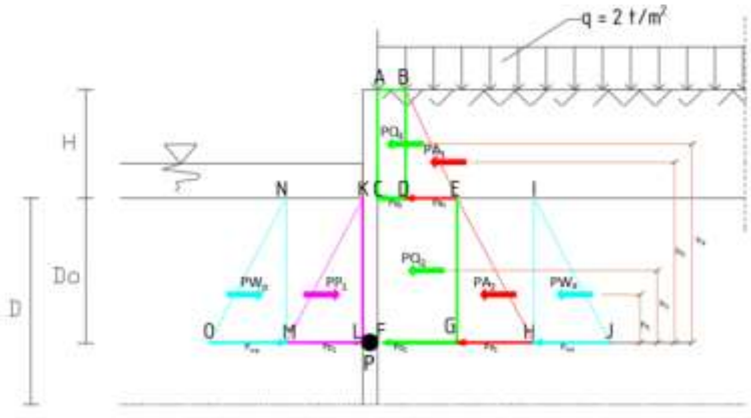
5.10 Soil Retaining Structure Planning

The heap soil magnification is planned to keep the stability of the heap on soft ground so that no looseness occurs. The soil retaining wall used is cantilever sheet pile type

- **Sheet Pile Planning**

Sheet pile planning will be used as a soil retaining wall structure to reduce horizontal ground pressure due to heap loads and plans. In planning the depth of sheet pile, the calculation is done horizontal soil pressure as in sub chapters 2.30. Calculation of horizontal soil voltage using equations 2.45 and 2.46 to find horizontal ground voltage obtained from vertical ground voltage consisting of overburden voltage (σ_0') Voltage distribution ($\Delta\sigma$)

Calculation of overburden voltage (σ_0') Done for each ground layer of voltage distribution ($\Delta\sigma$)Due to deposits and load plans should be taken into account as it affects horizontal ground pressure.



Picture 5.17
Diagram Sketch

No	Name	Description	Force unit (kN/m²)
1	pq1	q x σHa'	4,588
2	pa1	γm x Hr x σHa'	115,318
3	pq2	(Q + γm x Hr) σHa'	327,134
4	pa2	(γsat-γw)Do x σHa'	33,238 Do
5	pwa	γw x Do	9,807 Do
6	pp1	(γsat-γw)Do x σHp'	-101,194 Do
7	pwp	γw x Do	-9,807 Do

(a) Force unit calculations

No	Name	Description	Force (kN)
1	PQ1	pq1 x Hr	14,406
2	PA1	1/2 x pa1 x Hr	181,050
3	PQ2	pq2 x Do	327,134 Do
4	PA2	1/2 x pa2 x Do	16,619 Do²
5	PWA	1/2 x pwa x Do	4,904 Do²
6	PP1	1/2 x pp1 x Do	-50,597 Do²
7	PWP	1/2 x pwp x Do	-4,904 Do²

(b) Force calculations

No	Force (kN)	Range	Moment (kNm)
1	14,406	1/2 x 3,14 + Do	22,617 + 14,406 Do
2	181,050	1/3 x 3,14 + Do	189,499 + 181,050 Do
3	327,134 Do	1/2 x Do	163,566 Do²
4	16,619 Do²	1/3 x Do	5,539 Do³
5	4,904 Do²	1/3 x Do	1,635 Do³
6	-50,597 Do²	1/3 x Do	-16,865 Do³
7	-4,904 Do²	1/3 x Do	-1,635 Do³

(c) Moment calculations

Table 5.17
(a) Force unit calculation, (b) Force calculations, (c) Moment calculations

Then,

ΣM (In point P) = 0

0 =Mactive–Mpassive

0 = 22,617 + 14,406 Do
+189,499 + 181,050 Do
+163,566 Do^2 + 5,539
Do^3 + 1,635 Do^3 –
16,856 Do^3 – 1,635 Do^3

0 = -11,326 Do^3 + 163,567
Do^2 + 195,455 Do
+ 212,116

Do = 15,623 m

In the planning of sheet pile is used sheet pile-free type cantilever obtained a length of the depth of sheet pile Do = 15.623 m. The Do value is then multiplied by the security number of 1.2 so that it becomes D = 1.2 x 15.623 = 18.748 m. With a value of Hfinal = 2.19 m, the total length of the sheet pile is D + H = 18.748 + 2.19 = 20.938 m. After obtaining the length of the sheet pile depth, then calculated the number of moments occurring and the determination of sheet pile profile

The sheet pile to be used is a steel sheet pile with Larssen profile, determination of size and geometry and sheet pile steel profile based on Widerstand Moment with available in Larssen profile table.

Refer to the sheet pile image above with the same moment diagram, then to determine the ΣM_{total} is to replace "do" with "X" used equation 2.48

ΣM_{total} = ΣM_{aktive} + $\Sigma M_{passive}$
= 22,617 + 14,406 Do
+189,499 + 181,050 Do
+163,566 Do^2 + 5,539
Do^3 + 1,635 Do^3 –
16,856 Do^3 – 1,635 Do^3
= -11,326 Do^3 + 163,567

Do^2 + 195,455 Do +
212,116

The maximum moment can be obtained by deferrizing the equation of the total moment above the X.

$\frac{d\Sigma Mtotal}{dx}$ = 0 , then;

-33,978 Do^2 + 327,133 Do + 195,455 = 0 , or

33,978 Do^2 + 327,133 Do - 195,455 = 0

By using the ABC formula, it can be factored as follows:

$x_{1,2} = \frac{-327,133 \pm \sqrt{327,133^2 - 4 \times 33,978 \times (-195,455)}}{2 \times 33,978}$, Obtained

x_1 = 0,560 m (fulfill)

x_2 = -10,194 m (not fulfill)

then ΣM_{total} = -11,326 Do^3 + 163,567 Do^2 + 195,455 Do + 212,116

= -11,326 $(0,560)^3$ + 163,567 $(0,560)^2$ + 195,455 (0,560) + 212,116

= 370,876

Used sheet pile steel with the profile of Larssen with σt = 210 MN, Used Equation 2.49

W $= \frac{\Sigma Mtotal}{\sigma t}$

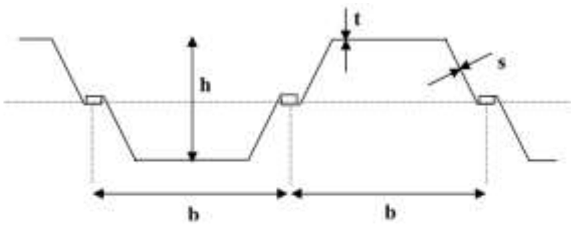
$= \frac{370,876}{210x10^3}$

= 0,001766077 m^3 = 1766 cm^3

From the sheet pile table profile Larssen used the profile of Larssen 23 with W = 2000 cm^3 > 1766 cm^3

Profil	wy cm³	weight kg/linear metres	Width mm (b)	Heigt mm (h)	Web thickness mm (s)	Back thickness mm (t)	Weight kg/m²
LARSSEN 703	1210	67.5	700	400	8	9.5	96.5
LARSSEN 703 K	1300	72.1	700	400	9	10	103
LARSSEN 703 K/10/10	1340	75.6	700	400	10	10	108
LARSSEN 704	1600	80.5	700	440	9.5	10.2	115
LARSSEN 600	510	56.4	600	150	9.5	9.5	94
LARSSEN 600 K	540	59.4	600	150	10	10	99
LARSSEN 601	745	46.3	600	310	6.4	7.5	77
LARSSEN 602	830	53.4	600	310	8	8.2	89
LARSSEN 603	1200	64.8	600	310	8.2	9.7	108
LARSSEN 603 K	1240	68.1	600	310	9	10	113
LARSSEN 603 K/10/10	1260	69.6	600	310	10	10	116
LARSSEN 604	1620	74.5	600	380	9	10.5	124
LARSSEN 605	2020	83.5	600	420	9	12.5	139
LARSSEN 605 K	2030	86.7	600	420	10	12.2	144
LARSSEN 606	2500	94.4	600	435	9.2	15.6	157
LARSSEN 606 K	2540	97.5	600	435	10	15.6	162
LARSSEN 607	3200	114.4	600	435	9.8	21.5	191
LARSSEN 607 K	3220	115.2	600	435	10	21.5	192
LARSSEN 607 n	3200	114	600	452	10.6	19.0	190
LARSSEN 22 10/10	1300	65	500	340	10.0	10.0	130
LARSSEN 2[illegible]	2000	77.5	500	420	10	11.5	155
LARSSEN 24	2500	87.5	500	420	10	15.6	175
LARSSEN 24/12	2550	92.7	500	420	12	15.6	185
LARSSEN 25	3040	103	500	420	11.5	20	206
LARSSEN 43	1660	83	500	420	12	12	166
LARSSEN 430	6450	83	500	420	12	12	235

Table 5.19
Larssen Profile



Picture 5.20
Sheet Pile Dimension

With the following dimensions:

b = 500

h = 420

t = 10

s = 11,5

- Calculate the sheet pile safety numbers

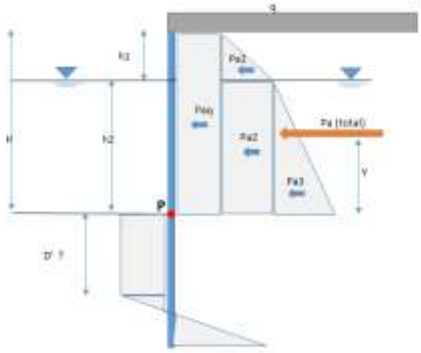
$$SF = \frac{\Sigma PP}{\Sigma PA} = \frac{PP1+PWP}{PQ1+PA1+PQ2+PA2+PWA}$$

$\geq 1{,}2$

SF = 1,409 ≥ 1,2 Aman!

- Comparator Sheet pile (flexible land) calculation

Calculations are used if soils behave flexibly to sheet piles, compared to rigid soils.



Picture 5.21
Sketch Diagram (alternate)

In this calculation, the active soil coefficient is considered to be close to zero so that active soil calculation is not inserted. The total sheet pile result is obtained: D ' + H = 8.2 m. Sheet pile profile used is a sheet pile steel type W-325 A 100

- Capping Beam Planning

Capping Beam only serves as a binder between sheet pile poles. Due to the planning of the calculation sheet pile using a single pole, so that in Capping Beam, there are no moments that occur. For the repetition of Capping Beam only use reinforcement just shrinkage calculation of the repatriation according to SNI 2847-2013 article 7.12.2.1

The planning data as follows :

b	= 0,5 m
h	= 0,25 m
fc’	=29,05Mpa
cover	= 40 mm
Diameter of reinforcement	= 19 mm

Acquired calculation of used reinforcement D13-400

BAB VI
IMPLEMENTATION METHOD AND BUDGET PLAN

6.1 Implementation Method

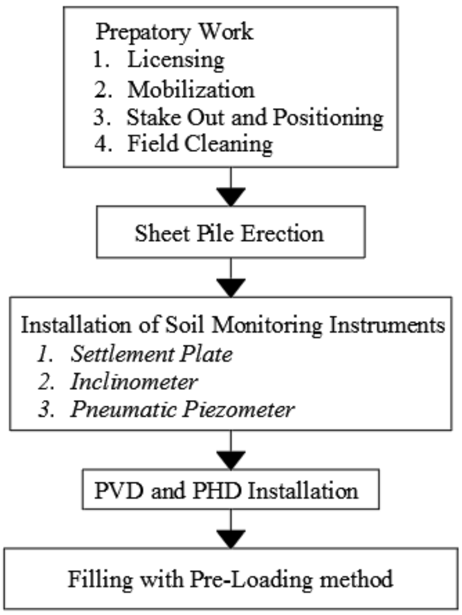
6.1.1 Scope of Work

The scope of work contained in this planning is shown in table 6.1. In this planning are considered land investigation work and surveys have been implemented

No	Lingkup Pekerjaan
1	Preparatory work
2	Sheet Pile Erection Work
2	Mini pile Erection Work
3	Soil Repair Jobs
4	Heap work
5	Soil Monitoring Jobs

Table 6.1
Scope of work

The scope of work above will be used for the implementation method in the field. After that can be created Work Breakdown Structure to calculate the volume of each work item so that it can be a calculated budget plan (RAB)



Picture 6.1 Flow Diagram of the Implementation method

6.2 Budget Plan Cost

Budget plan (RAB) is a cost that is roughly necessary for the work. In determining RAB required the calculation of job volume and unit price analysis.

No	Uraian Pekerjaan	Volume	Satuan	Harga Satuan	Total
1	**Pekerjaan Persiapan**				**15.836.119.436**
	1.1 Perijinan	1	ls	1.000.000.000	1.000.000.000
	1.2 Mobilisasi Peralatan dan Material	1	ls	13.850.000.000	13.850.000.000
	1.3 Fasilitas Sementara	1	ls	330.000.000	330.000.000
	1.4 Stake Out dan Positioning	1	ls	655.128.000	655.128.000
	1.5 Pekerjaan Pembersihan Lapangan	352,489	m3	2.813	991.436
2	**Pekerjaan Pemancangan *Sheet Pile***	2930,43	m'	2.515.931	**7.372.755.742**
3	**Pekerjaan Perbaikan Tanah**				**1.085.086.723**
	3.1 Pemasangan *Prefabricated Vertical Drain* (PVD)				
	- Mobilisasi dan Demobilisasi Alat Pancang	2	unit	500.000.000	1.000.000.000
	- Material	5768,59	m'	7.000	40.380.140
	- Pemasangan	5768,59	m'	3.500	20.190.070
	3.2 Pemasangan *Prefabricated Horizontal Drain (PHD)*				
	- Material	206,021	m'	117.000	24.104.471
	- Pemasangan	206,021	m'	2.000	412.042
4	**Pekerjaan Timbunan**				**1.542.285.307**
	4.1 Penimbunan	505,396	m3	1.610.978	814.180.876
	4.2 Pemadatan	505,396	m3	1.440.663	728.104.431
5	**Pekerjaan *Soil Monitoring***				
	5.1 *Settlement Plate*				**2.248.000.000**
	- Material (terpasang)	7	titik	2.500.000	17.500.000
	- Monitoring	12	bulan	18.500.000	222.000.000
	5.2 Inclinometer				
	- Read-out, standart tablet. Software	1	unit	132.000.000	132.000.000
	- Pipe L = 24 m (terpasang)	7	titik	42.000.000	294.000.000
	- Monitor	12	bulan	22.500.000	270.000.000
	5.3 Pneumatic Piezometer				
	- Read-out	1	unit	45.500.000	45.500.000
	- Material (terpasang)	7	titik	145.000.000	1.015.000.000
	- Monitor	12	bulan	21.000.000	252.000.000
Total Biaya					**28.084.247.207**

Table 6.5
Budget plan

CHAPTER VII
CONCLUSION

7.1 Conclusion

From the final task are the following conclusions :

1. DPT sheet pile is used because of the previous DPT using Gravity Wall where the condition of the construction is in the water of the river so that DPT using Gravity Wall is not effective in the condition
2. The reason for its use of PVD combined with Preloading is to accelerate the consolidation that occurs by removing water and air from the pore pores of the land and PHD the water to the river
3. The highest execution (HR) height is 3.14 of the base land
4. High critical at the time of the heap as high as 2.98 m after a change in the price of Cu newly obtained GeoSlope stability analysis with security numbers (SF) of 1.187 in Week 15 and requires one week to continue stockpile. And stability on the high-performance heap (HR) obtained security number 1.148. So it is necessary to strengthen the land is a mini pile and obtained security Number (SF) of 1.5234
5. A gradual heap or Preloading is done 0.2 m per week until it is carried up to the high heap execution
6. PVD installed when before the filling is done, planning PVD using a triangular mounting pattern with a distance between PVD 1.25 m, depth 28 m and the time required is 21 weeks
7. Planning of soil retaining structure of cantilever sheet pile (Free earth support method) obtained the total length of sheet pile of 20.938 m on the left and right side of the approach slabs bridge. Sheet pile Material used is steel type Larssen 23
8. The Budget plan for this project is Rp. 28,084,247,207

7.2 Advice

The suggestion I said in this final task is to use another method that is using the DPT sheet pile anchors to minimize the cost budget because it requires a Sheet pile material shorter than the cantilever sheet pile.

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