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

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Abstract: Muara Tabirai Bridge is on the border between Rantau and Kandangan District, which is precisely 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. 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

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
CHAPTER III

METHOD OF RESEARCH

Start

- Literature study

Data Collection:
1. Layout Location
2. Basic Land Data
3. Heap Data
4. Data Spécification

Determination of $H_{stable}$ heap

Alternative soil Repair

A

A

Preloading with a combination of FVD and ground retrofitting

Heap Stability Check

Yes

Work wall resisting ground type cantilever

Check stability

Budget Plan

Conclusion

End

No

No

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

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

![Layout Muara Tabirai Bridge](image)

Picture 4.1.
Layout Muara Tabirai Bridge

4.2 Ground Data Base

4.2.1 Soil Data Retrieval Location

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)

![Location of Ground Improvement Planning](image)

Picture 4.2
Location of Ground Improvement Planning
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

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<th>Depth (m)</th>
<th>N-SPT</th>
<th>T [kN/m²]</th>
<th>G [T]</th>
<th>CU [kPa]</th>
<th>Cc</th>
<th>Cs</th>
<th>Cv</th>
<th>LI</th>
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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
\[ \gamma = 1.8 \, t/m^3 \]

Sliding corners in the ground \( \phi = 25^\circ \)

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 an example 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.
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:

\[ \gamma_{heap} : 1.8 \text{ t/m}^3 \]

H Final: 2.19 m (STA 0+290)
1.44 m (STA 0+275)

Heap width: 37.49 m

5.1.1 H\text{Initial} and H\text{final} 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 (H\text{Initial}) and high variation of the heap to know the magnitude of the soil decline occurs.

<table>
<thead>
<tr>
<th>No</th>
<th>Beban q (t/m²)</th>
<th>Sc beban timbunan (m)</th>
<th>H\text{Initial} (m)</th>
<th>H longgar traffic (m)</th>
<th>Tebal pavement (m)</th>
<th>Sc beban pavement (m)</th>
<th>Tinggal final (m)</th>
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<tr>
<td>1</td>
<td>2</td>
<td>0.307</td>
<td>1.282</td>
<td>1.00</td>
<td>0.450</td>
<td>0.0925</td>
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Table 5.8
Results of H\text{Initial} and H\text{final} calculations
Thus, it can be calculated interpolation or draw lines for Hfinal plans are:

- **Hfinal 1.44 m on STA 0 + 290:**
  - High planned plan:
    - \( H_{\text{initial}} = 1.748 \text{ m} \)
  - Load plan against planned heap:
    - \( Q = 2.690 \text{ T/m}^2 \)
  - Decreased consolidation is occurring:
    - \( Sc = 0.548 \text{ m} \)

### 5.2 Calculation of Ground-less Compression Time

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

\[ A = 100 \text{ mm} \]
\[ b = 4 \text{ mm} \]
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 specification 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
From 5.11 Images obtained safety numbers for each height of the heap

<table>
<thead>
<tr>
<th>H_R (m)</th>
<th>SF</th>
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<tbody>
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<tr>
<td>2</td>
<td>1.302</td>
</tr>
<tr>
<td>3</td>
<td>0.995</td>
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</table>

To get SF = 1 then used the interpolation formula Interpolated results = 2 + \( \left( \frac{(1-1,302)}{(0,995-1,302)} \right) \times (3 - 2) = 2.98 \) 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%:

- \( B_1 = 4.6 \) m
- \( B_2 = 0.3 \) m

\[ \alpha_1 = \tan^{-1}\left(\frac{B_1+B_2}{z}\right) - \tan^{-1}\left(\frac{B_1}{z}\right) \]
\[ = \tan^{-1}\left(\frac{4.6+0.3}{0.5}\right) - \tan^{-1}\left(\frac{4.6}{0.5}\right) \]
\[ = 0.007 \]

\[ \alpha_2 = \tan^{-1}\left(\frac{B_1}{z}\right) \]
\[ = \tan^{-1}\left(\frac{4.6}{0.5}\right) \]
\[ = 1.463 \]
\[ \Delta \sigma_1 = \frac{a}{\pi} \left( \frac{B_1 + B_2}{B_2} \right) (\alpha_1 + \alpha_2) - \frac{B_1}{B_2} \alpha_2 \]
\[ = 0,180 \text{ t/m}^2 \]
\[ 2\Delta \sigma_1 = 2 \times 0,499 \]
\[ = 0,360 \text{ t/m}^2 \]

Voltage changes due to Phase 1 (\( \sigma'_1 \)) When \( U = 100\% \):
\[ \sigma'_n = \sigma_{n-1}' + \Delta \sigma_n' \]
\[ \sigma'_1 = \sigma_0' + \Delta \sigma_1 \]
\[ = 0,235 + 0,360 \]
\[ = 0,595 \text{ t/m}^2 \]

Voltage distribution due to Phase 1 (\( \Delta \sigma_1 \)) When \( U < 100\% \)
\[ \Delta \sigma_1 = \left[ \left( \frac{\sigma_1'}{\sigma_0'} \right)^{U_1} \times \sigma_0' \right] - \sigma_0' \]
\[ = \left[ \left( \frac{0,595}{0,235} \right)^{0,1155} \times 0,235 \right] - 0,235 \]
\[ = 0,026 \]

Voltage changes due to Phase 1 (\( \sigma'_1 \)) When \( U < 100\% \)
\[ \sigma'_1 = \sigma_0' + \Delta \sigma_1 \]
\[ = 0,235 + 0,026 \]
\[ = 0,261 \]

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

\( \text{Fc'} = 52 \text{ Mpa} \)

Modulus of elasticity (E) = \( 4700 \times \sqrt{f'c'} \)

\( 4700 \times \sqrt{52} \)

\( = 33892.182 \text{ Mpa} \)

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

\( = 6.75 \times 10^8 \text{ mm}^4 \)

Cracked moment \( (M_{cr}) = 3.64 \text{ tm} \)

Ultimate Moment \( (M_u) = 5.19 \text{ tm} \)

Length \( (L) = 15 \text{ m} \)

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 con heap shown in Figure 5.16

![Gradual heap Compression chart](image)

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 \((\sigma_0')\) Voltage distribution \((\Delta\sigma)\)

  Calculation of overburden voltage \((\sigma_0')\) 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

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

(a) Force unit calculations

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

(b) Force calculations

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

(c) Moment calculations

Table 5.17

(a) Force unit calculation, (b) Force calculations, (c) Moment calculations
Then,

\[ \Sigma M \text{ (In point P)} = 0 \]

\[ \Sigma M = M_{\text{active}} - M_{\text{passive}} \]

\[ = 22,617 + 14,406 \text{ Do} + 189,499 + 181,050 \text{ Do} + 163,566 \text{ Do}^2 + 5,539 \]

\[ \text{Do}^3 + 1,635 \text{ Do}^3 - 16,856 \text{ Do}^3 - 1,635 \text{ Do}^3 = -11,326 \text{ Do}^3 + 163,567 \]

\[ \text{Do}^2 + 195,455 \text{ Do} + 212,116 \]

\[ \text{Do} = 15,623 \text{ m} \]

In the planning of sheet pile is used sheet pile-free type cantilever obtained a length of the depth of sheet pile \( \text{Do} = 15.623 \text{ m} \). The \( \text{Do} \) value is then multiplied by the security number of 1.2 so that it becomes \( \text{D} = 1.2 \times 15.623 = 18.748 \text{ m} \). With a value of \( \text{H}_{\text{final}} = 2.19 \text{ m} \), the total length of the sheet pile is \( \text{D} + \text{H} = 18.748 + 2.19 = 20.938 \text{ m} \). 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 \( \Sigma M_{\text{total}} \) is to replace "do" with "X" used equation 2.48

\[ \Sigma M_{\text{total}} = \Sigma M_{\text{active}} + \Sigma M_{\text{passive}} \]

\[ = 22,617 + 14,406 \text{ Do} + 189,499 + 181,050 \text{ Do} + 163,566 \text{ Do}^2 + 5,539 \]

\[ \text{Do}^3 + 1,635 \text{ Do}^3 - 16,856 \text{ Do}^3 - 1,635 \text{ Do}^3 = -11,326 \text{ Do}^3 + 163,567 \]
Do^2 + 195,455 Do + 212,116

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

\( \frac{d\Sigma M_{total}}{dx} = 0 \), then;

\(-33,978 \text{Do}^2 + 327,133 \text{Do} + 195,455 = 0\), or

\(33,978 \text{Do}^2 + 327,133 \text{Do} - 195,455 = 0\)

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

\(x_1 = 0,560 \text{ m} \) (fulfill)

\(x_2 = -10,194 \text{ m} \) (not fulfill)

then \( \Sigma M_{total} = -11,326 \text{Do}^3 + 163,567 \)

\( \text{Do}^2 + 195,455 \text{Do} + 212,116 \)

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

\(= 370,876 \)

Used sheet pile steel with the profile of Larssen with \( \sigma t = 210 \text{ MN} \), Used Equation 2.49

\( W = \frac{\Sigma M_{total}}{\sigma t} \)

\(= \frac{370,876}{210 \times 10^3} \)

\(= 0,001766077 \text{ m}^3 = 1766 \text{ cm}^3 \)

From the sheet pile table profile Larssen used the profile of Larssen 23 with \( W = 2000 \text{ cm}^3 > 1766 \text{ cm}^3 \)
With the following dimensions:

- \(b = 500\)
- \(h = 420\)
- \(t = 10\)
- \(s = 11.5\)

- Calculate the sheet pile safety numbers

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

\[\geq 1.2\]

\[SF = 1.409 \geq 1.2 \quad \text{Aman!}\]

- Comparator Sheet pile (flexible land) calculation
Calculations are used if soils behave flexibly to sheet piles, compared to rigid soils.

![Sketch Diagram (alternate)](image)

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
- \( f_c' = 29.05 \) Mpa
- \( \text{cover} = 40 \) mm
- Diameter of reinforcement = 19 mm
- Acquired calculation of used reinforcement D13-400
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.

<table>
<thead>
<tr>
<th>No</th>
<th>Lingkup Pekerjaan</th>
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<tr>
<td>1</td>
<td>Preparatory work</td>
</tr>
<tr>
<td>2</td>
<td>Sheet Pile Erection Work</td>
</tr>
<tr>
<td>2</td>
<td>Mini pile Erection Work</td>
</tr>
<tr>
<td>3</td>
<td>Soil Repair Jobs</td>
</tr>
<tr>
<td>4</td>
<td>Heap work</td>
</tr>
<tr>
<td>5</td>
<td>Soil Monitoring Jobs</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>No</th>
<th>Uraian Pekerjaan</th>
<th>Volume</th>
<th>Satuan</th>
<th>Harga Satuan</th>
<th>Total</th>
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<td>1.5 Pekerjaan Pembersihan Lapangan</td>
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<tr>
<td></td>
<td>- Mobilisasi dan Demobilisasi Alat Pencang</td>
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<td></td>
</tr>
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<td>- Material</td>
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<td>5.2 Inclinometer</td>
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<td>- Read-out, standard tablet, Software</td>
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</tr>
</tbody>
</table>

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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SNI 8460 2017. Persyaratan Perancangan Geoteknik
