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Assessment of Geotechnical Feasibility in Development of STIE BPD Semarang

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Abstract- Geotechnical studies are an early stage for planning an infrastructure. In general, the geotechnical parameter value of a region is determined by soil characteristics. To know the condition of the soil layer under the structure, it is necessary geotechnical investigation. Toptografi uneven shape and the value of the low bearing capacity causes the need for planning the reinforcement. The reinforcement used is soil nailing and retaining wall. In this feasibility test used analysis of soil bearing capacity with plaxis program. The results of the analysis show that the reinforcement at the construction site of STIE BPD raises the value of its Savety Factor reaching 5.83.

Keywords: Geotechnical investigation, soils bearing capacity, reinforcement.

1. Introduction

Geotechnical assessment is the first step in the formation of an infrastructure. Without a geotechnical study it is impossible for an infrastructure to stand firmly, because geotechnical science is a branch of civil engineering that studies soil science where in this science will be discussed about the ability of load-bearing ground, foundation design, soil mechanics, hydrological aspects, with the structure under the building so that infrastructure development can be planned as well as possible in order to stand strong and sturdy in accordance with the age that has been planned previously.

The most important aspects of this geotechnical assessment are the factors of slope stability, and settlement. In general, the geotechnical parameter value of a region is determined by the subsurface characteristics which includes the N-SPT value, cohesion, internal shear angle and so on. To know the condition of the soil layer and the soil bearing capacity of the soil under the structure of STIE BPD Semarang, a geotechnical investigation is required.

2. Method

To show the profile and bearing capacity of the soil, drilling is done to a depth of 45 m at specified points. Drill test results show soil profile consists of 4 types of soil are soft clay, rather soft clay, rather hard clay, and hard clay. As shown in Figure 1.

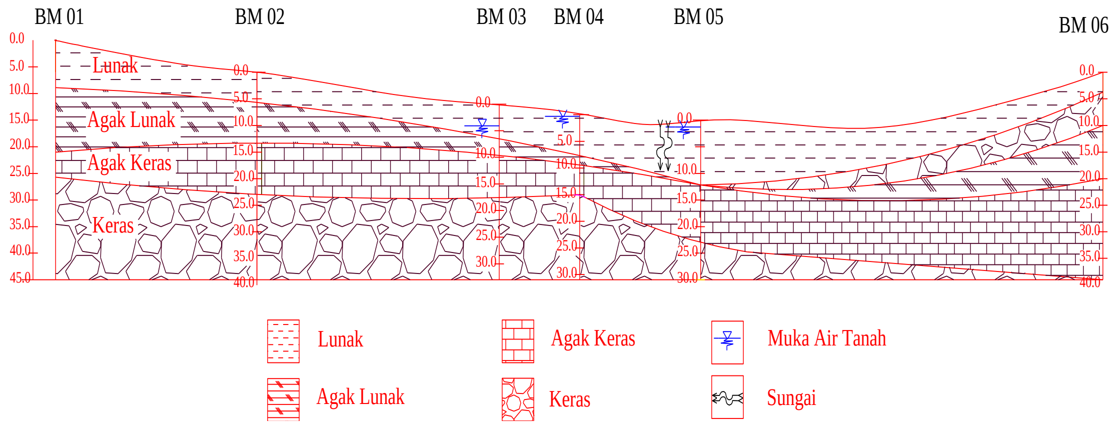

Figure 1. **Transverse Profile Of The Soil**

Laboratory test results such as soil properties test, Direct Shear test, Atterberg Limit and Sieve Analysis as the soil bearing capacity parameters to be included in the plaxis program. bearing capacity are analyzed by PLAXIS 8.6.

Model Analysis

Testing model on analysis using plaxis program 8.6. the values of the bearing capacity parameters are shown in Table 1 and the model of analysis is shown in Figure 2. The plaxis analysis is used with stage 1 without loading, stage 2 loading, stage 3 with an earthquake load.

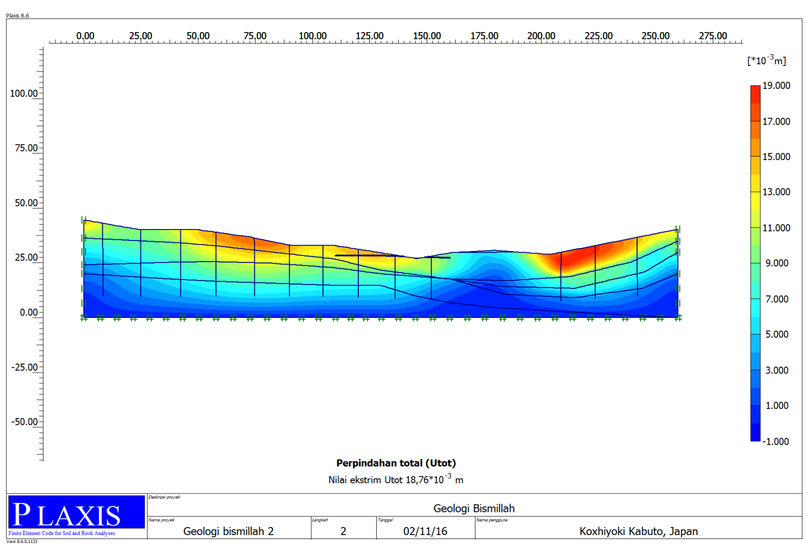

Figure 2. Soil Profile Model

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Table 1. Laboratory Test Parameters

Clay	c (kg/cm2)	ϕ (°)	γ_{sat} (gr/cm3)	γ_{dry} (gr/cm3)
Soft clay	0,638	28,480	1,696	1,290
Rather soft clay	0,681	28,680	1,696	1,317
Rather hard clay	0,686	28,473	1,638	1,262
Hard clay	0,693	28,151	1,740	1,350

3. The Result And Discussion

3.1. Slope Stability Original Soil

Plaxis results show the value of displacemet and the value of Savety Factor (SF). The first analysis of calculating displacement and the original soil savety factor obtained the following results (Figures 3 and 4):

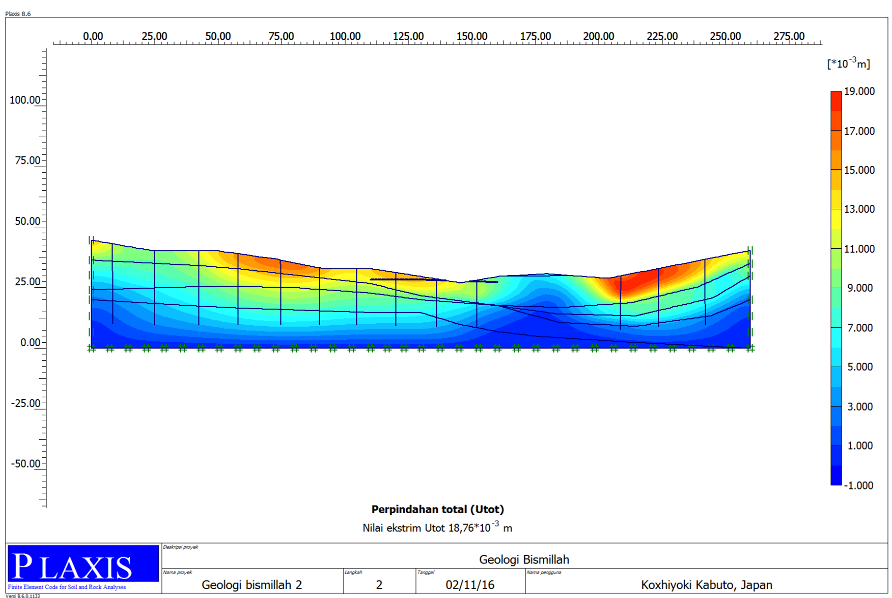

Figure 3. The Total Displacement Of Original Soil (Without Loading) 0.0188 M

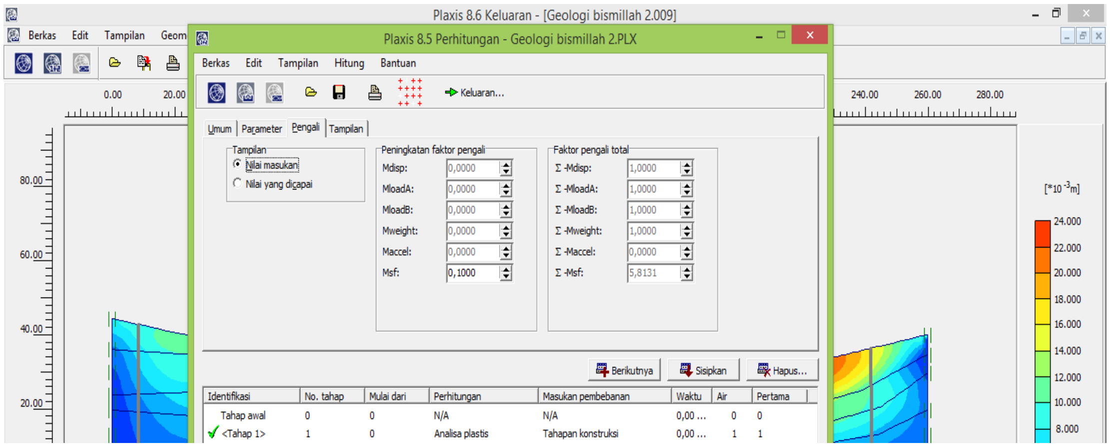

Figure 4. Savety factor (without loading) 5,81

3.2. Slope Stability with Loading

The next calculation is to calculate the displacement and the savety factor of the soil by giving uniform loading. The load is evenly simulated as a building load. Here the assumption used is a 3-storey office with a standard load of the floor is 1 ton / m2 or 10 kN / m2 with the assumption that the standard office building area is 50 x 50 m. The results of the analysis can be seen in Figure 5 and Figure 6.

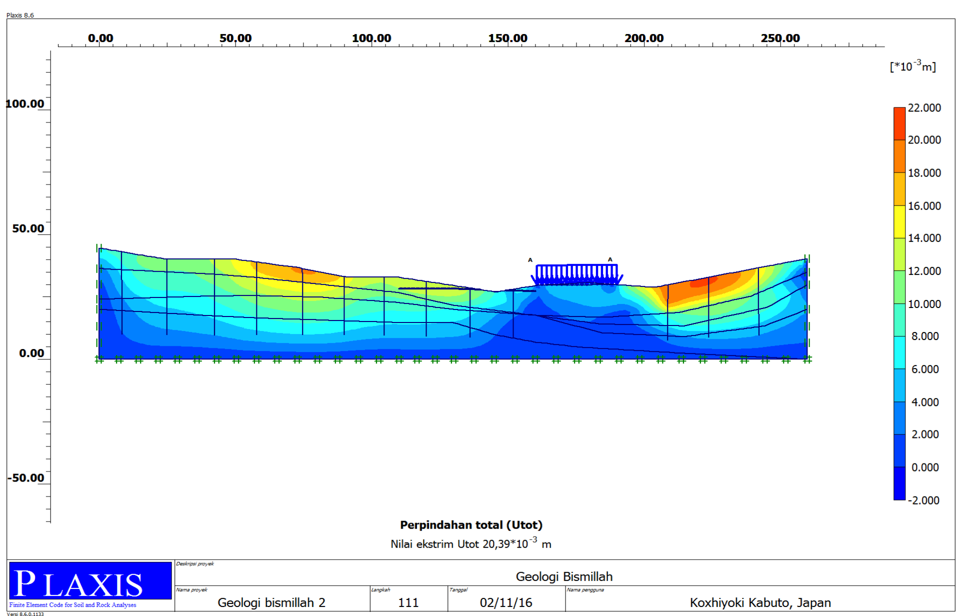

Figure 5. Displacement With Loading 0,0204 M

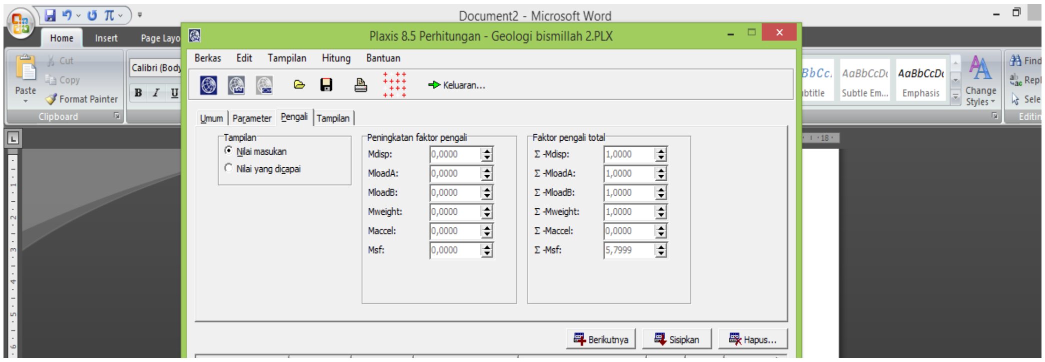

Figure 6. Savety Factor With Loading 5,790

3.3. Slope Stability with Loading and Reinforcement

From the above results in obtaining the soil bearing strength is considered strong to be built because the savety factor value is quite large. We need to consider whether the use of reinforcement that has significant influence. Here the appropriate reinforcement is the pile. Because the shape of landslides mostly move horizontally, then the need reinforcement that secures the horizontal direction. With the use of piles can withstand the horizontal movement that occurs. From result of plaxis analysis with pile with diameter 25 with parameter as shown in Figure 7. The result of calculation can be seen in Figure 8 and Figure 9

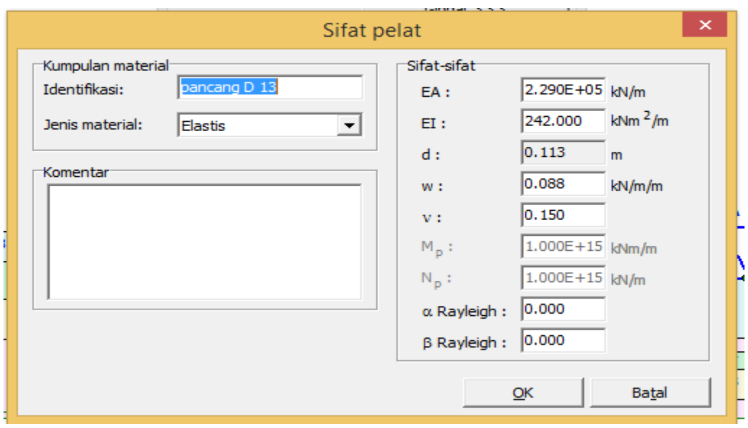

Figure 7. Parameter Pile Diameter 25 Cm

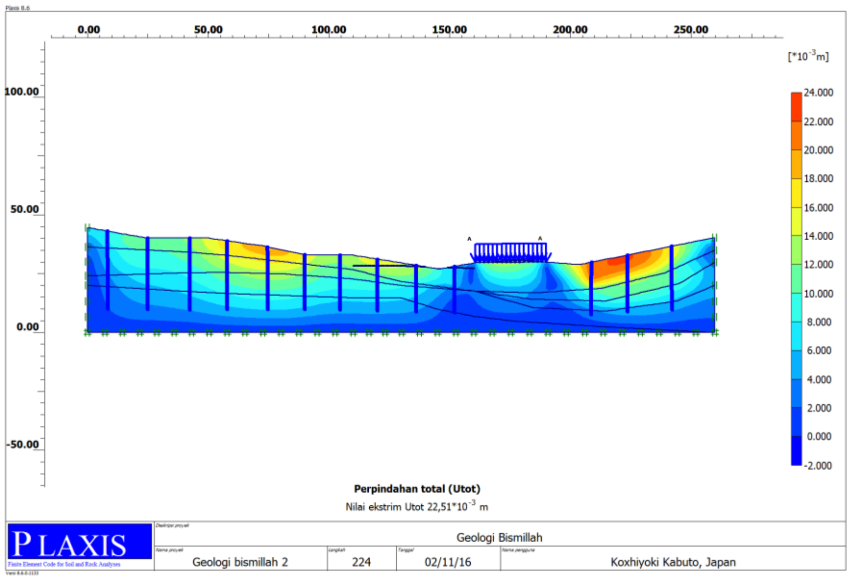

Figure 8. Displacement With Load And Reinforcement 0,0225 M

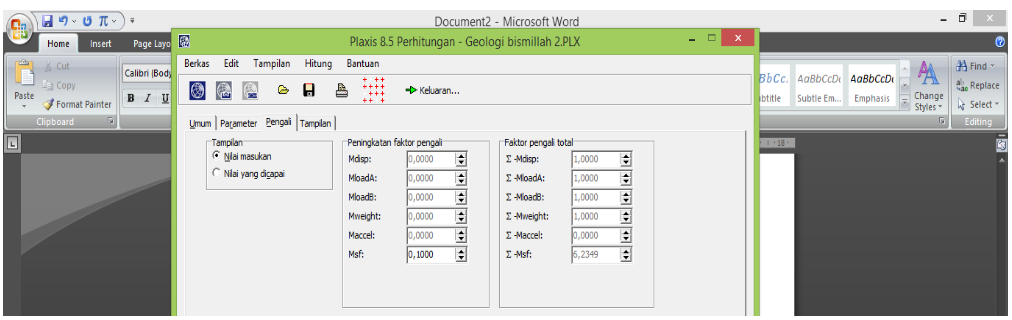

Figure 9. Savety Factor With Load And Reinforcement 6,23

From the results of the above analysis obtained a high safe factor value but still have the risk of collapse as shown in Figure 3 landslide area is the largest in BM 01, BM 02, BM 03 BM 04 and BM 05 area because in this area there is ground water and uneven geologic forms cause the trigger factor of sliding. With the provision of reinforcement in obtaining the value of the safety factor for the better..

3.4. Slope Stability with Earthquake Load

Soil and structures often receive not only static loads due to construction but also dynamic loads. If the load is strong enough like an earthquake can cause severe damage. The dynamic load consists of a harmonic load (the function equation of the frequency, amplitude, and initial angle in the sine function) and the load of the block is the load defined in the SMC (Strong Motion CD-ROM) file for the 225a.smc seismic model. The SMC format is used by U.S Geological Survey's National Strong Motion Program to record other powerful earthquakes and vibrations. So the value of 225a.smc is a global multiplier factor in dynamic programming (www.plaxis.com). For other parameters included in the calculation is a 10-second vibration time (standard). Here's the calculation of soil stability and construction due to dynamic load.

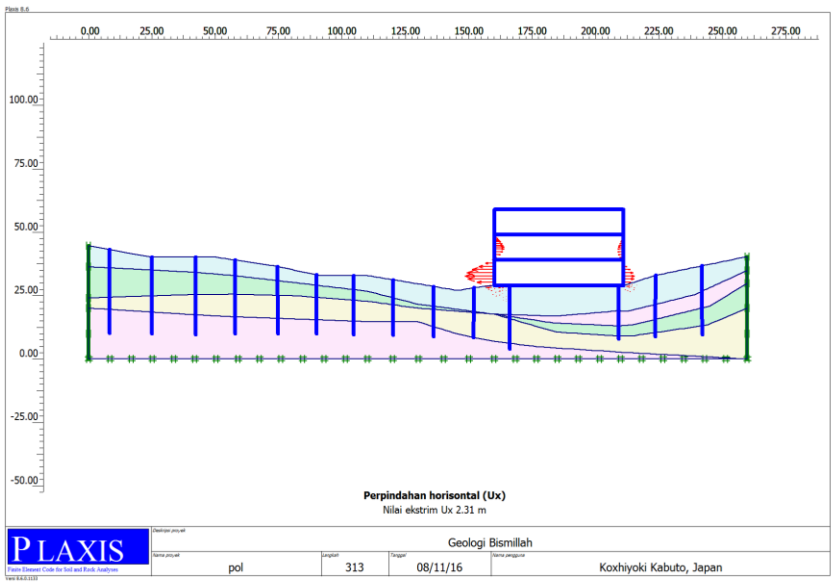

Figure 10. Horizontal deformation value u $_{ekstrem}$ 2,31 m

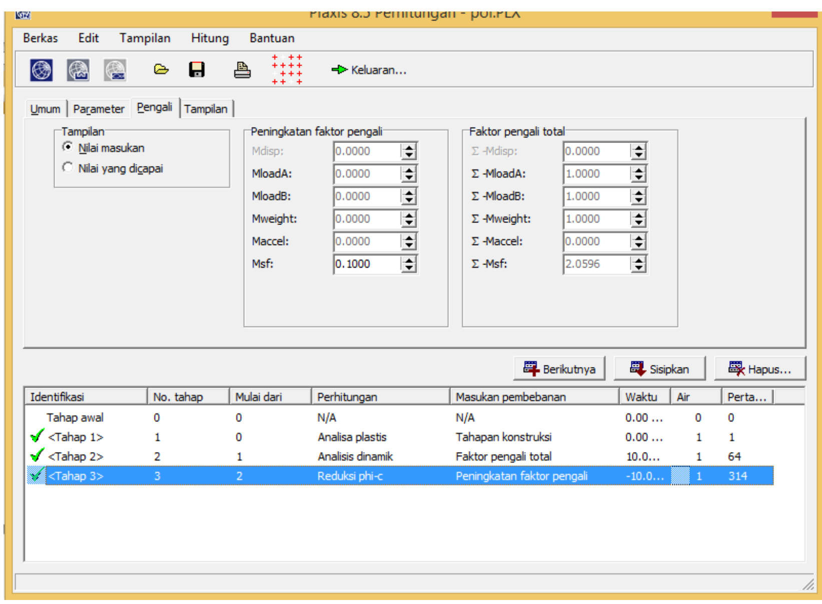

Figure 11. SF with dynamic load 2.1

From the results of calculations with plaxis obtained a considerable displacement occurs due to dynamic loads causing safety factorsnya dropped dramatically to 2.1 (shown in Figure 10 and Figure 11).

From the result of the horizontal deformation due to the dynamic load shown in Fig. 12 and Fig. 13, the maximum displacement occurs at 6.4 seconds with a displacement of 0.028 m.

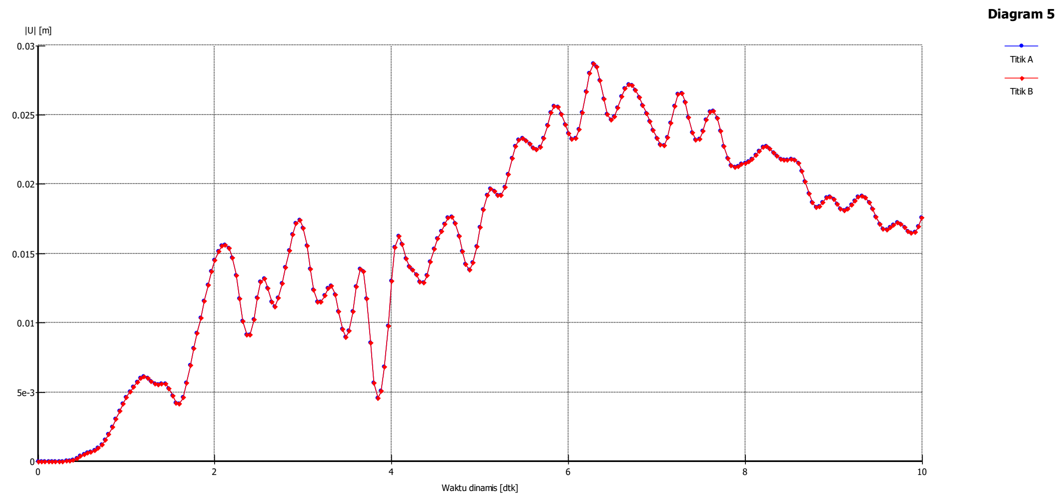

Figure 12. Horizontal deformation vs time at the top of the building t = 6.4 sec when u = 0.028 m

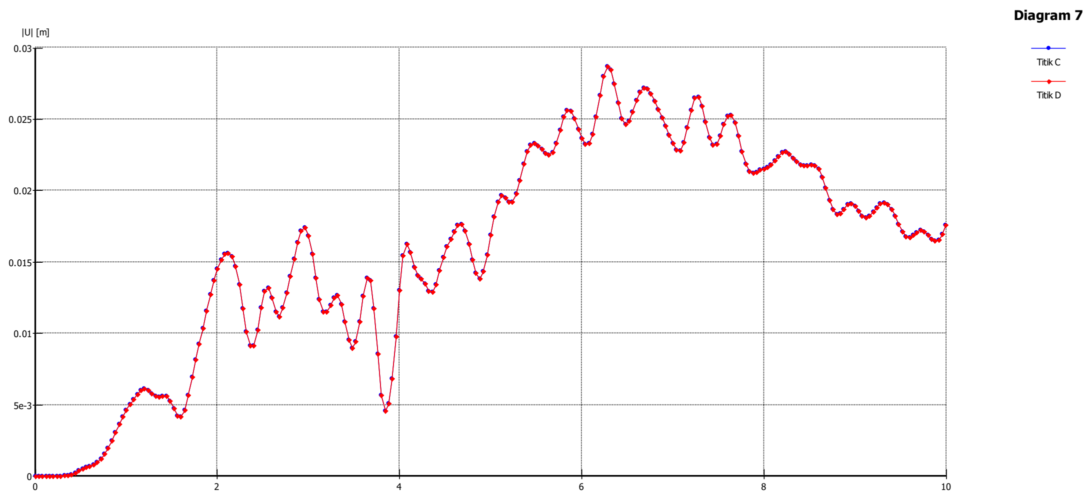

Figure 13. Horizontal deformation vs time bottom structure in t = 6,4 dtk saat u = 0,027 m

4. Conclusion

- High soil bearing capacity due to large shear strength (most dominant factor of cohesion and shear angle)
- Original soil savety factor value 5.84 and after loading 5.79, after pile strengthening to 6.23, and after being given dynamic load 2.1
- The maximum horizontal displacement after a dynamic load of 0.028 m at t = 6.4 seconds

- The total horizontal or extreme horizontal displacement reaches 2.31 m
- Buildings after being given dynamic loads are still safe (SF > 1,5)

References

Hardiyatmo, CH. 2010. *Fondasi II*. Gamma Press. Yogyakarta
Muntohar, Agus Setyo. 2009. *Modul Plaxis*. UMY : Yogyakarta
www.plaxis.com