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Rigid Pavement Planning and Road Retaining Wall

Telly Rosdiyani[1], Dasa Aprisandi[2] and Julfika Fauzi[3]
[1]Programe of Civil Engineering, Universitas Banten Jaya, Jl Ciwaru II No 73 City Serang Banten, tellyrosdiyani004@gmail.com
[2]Programe of Civil Engineering, Universitas Banten Jaya, Jl Ciwaru II No 73 City Serang Banten, mahesadepsong@gmail.com
[3]Programe of Civil Engineering, Universitas Banten Jaya, Jl Ciwaru II No 73 City Serang Banten, julfikafauzi7@gmail.com

ABSTRACT

Road development infrastructure from year to year continues to be increased, this is made to be an important role in economic, socio-cultural, political, tourism and defense and security aspects. Cisadane Street which is for promenade, location of the road beside the Cisadane River MH. Thamrin includes the development of an area in Jabodetabek which is in demand by the developers of commercial and residential activities. Road pavement planning was examined in advance but in the planning this time in addition to discussing the rigid pavement planning of the Promenade Cisadane section but also discussed the land retaining wall planning. The condition of exsisting the road is that there are several segments that have begun to crack and there are shifting layers of land that have potential to cause landslides, to be able to interfere with the function of the road. Based on these conditions the planning aims to know the thick of the reinforced concrete piping plates with reinforcement used to withstand the burden of vehicles passing through the road, and can design a retaining wall of land. Quantitative deskriftip method used in the preparation of this paper, thick concrete plates are connected with reinforcement (BBDT) Based on the Highways Pd-T-14 2003 While retaining walls based on Concrete Sheet pile structure. Collection of primary data conducted with related party interviews, observations, and vehicle survey data while the secondary data of plan image data, CBR, location map. The planning data on the section with a length of 4000 m or 4 km is analyzed resulting in a thick planning of rigid perdrection layer by 20 cm using the quality of concrete K-350, while the design of the retaining wall of soil using the structure Concrete Sheet pile, adjusted to the elevation difference of more than 4.5 m using W350B1000, K500, L 13 m, M crack 17 tm at a depth of 8 m, elevation of 2-4 m using W350A1000, K500, L 8 m M crack 11.4 tm, elevation less than 2 m using stone Talud with b_{limit} of 30 cm, b_{under} 30 cm tread b = 2 m and H = 2 m.

Key words: rigid pavement, retaining wall, cisadane promenade section.

1. INTRODUCTION

Cisadane Promenade Street MH Thamrin is an arterial road located in the town of Tangerang Province Banten. The location of the street precisely by the river Cisadane. Along with the increase in the number of road users, of course, the load conditions received by the road are very large, resulting in the strengthening of some segments of the can interfere with the functioning of road segments so that it requires a road facility that can accept the loading action on the road and the retaining walls of the ground.

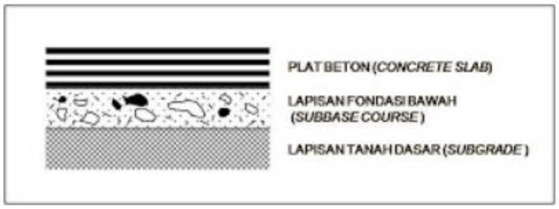
Based on the above conditions, planning is necessary to determine the thickness, the type of rigid road piping is suitable for holding or channeling heavy vehicle load and resistant to puddle water, and the maintenance process is easy. In addition to supporting road construction, the planning of land retaining walls is needed so as Not to happen to landslide from the land of roadside cliffs with construction selection suitable to the elevation of the road.

Then the problem in this planning is how the thickness of rigid pavement using the method of Highways (Pd-T-14-2003), How to design the retaining wall of soil to maintain the stability of slopes.

2. ROAD AND RETAINING WALL

The road is a land transportation infrastructure that includes all parts of the road, including the building is reserved for traffic that is on the ground and/or water, and above the water level except the Railway, Road Truck and Cable Road [9].

Thus the passage of the road includes a street border which is a mixture between the aggregate and the connective material used to serve the traffic burden. Rigit pavement is a structure consisting of a continuous concrete plate, which is a continuous and without reinforcement lies above the layers of the lower podasi, without or with layers as the surface layer. Can be illustrated in Figure 1 below the composition of the rigid coating layer consists of subgrade(ground soil), Subbase (bottom foundation layer) and Concrete slab (concrete plate) [19,20].



Source: Pd-T-14-2003

Figure 1: Rigid Piping Coating

Reinforced cement concrete compounded with reinforcement is intended type of piping made with reinforcement that the size of the rectangle is rectangular, where the length of the platform is limited by the presence of transverse connections [7].

In the rigid Pavement planning should establish the necessary data for example the basic soil carrying power is determined with CBR testing in accorandce with CBR laboratory, the planning of long- CBR value of small 2% then must be installed bottom foundation is made of thin concrete (Lean Mix Concrete) as thick as 15 cm which is considered to have a value CBR base land effective 5%. Then the determination of the traffic load plan expressed in the number of axes of commercial vehicles divided against 4 types of groups: single-wheel sole axis (STRT), double-wheel single-axis (STRG), double-wheeled tandem axis (STdRG), double-wheel Tridem axis (STrRG) [4,14].

Traffic Volume is defined as the number of vehicles passing through one observation point during a time unit (day, hour or minute) [11].

This traffic data is known to be two types:

a. Annual Average daily traffic

LHRT = Number of vehicles in 1 year /365 ....(1)

LHRT expressed in vehicle/day/2 way for 2directional Road without median or vehicle/day/direction for road 2 lanes with median

LHR = Number of vehicles during observation /

Number of observation days.........................(2)

LHR expressed in vehicle/day/2 way for 2directional Road without median or vehicle/day/direction for road 2 lanes with median

The growth of traffic to be able to know the traffic Volume according to the plan age:

$R = \frac{(1+i)^{UR}-1}{i}$ ....(3)

Where:

R = Traffic growth factors, ; I = The growth rate of annual traffic in%; UR = Age Plan (years)

Traffic plan can be obtained with the following formula:
JSKN = JSKNH x 365 x R x C ....(4)

Where:

JSKN = Total Number of Axis commercial vehicles during plan life

JSKNH = Total axis number of commercial vehicles per day when the road is opened

365 = Number of days in 1 year
R = Comulative growth factor
C = Vehicle distribution coefficient

As the basis of this planning, the authors review some research on rigid Pavement planning, which is about the rigid pavement planning (rigid field) on Karang Anyar-Solo toll road. Manual design of the 2013 pavement year using the AASHTO method differs from the analysis results using the method.The 2002 Highways produces rigid alignment planning using a thickness of 300 mm or 30.0 cm that is adjusted to the calculation of thick planning calculations of manual pavement design of the road, 2013 gets a thick yield of 28 cm with Using the foundation layer lean Mix Concrete 10 cm and also the foundation of the aggregate A class A 15 cm. This difference occurs because of differences in the methods used and increasing traffic Volume annually.[1]. Then planning the rigid pavement on the streets of Padang-Intersection Haru city limits This planning aims to get a redesign of the rigid pavements and the existing road repatriation with the method of building guided in Pd T-14-2003 so that data obtained with traffic growth 6%, daily traffic Plan 6300 vehicle/day for 2 lines 2 way. CBR Land Base 6%, CBR effective 43%, thick plate on the trade plan 22 cm, percentage damaged Fatik (13,83% < 100%), the presentation of damaged erosion (21.15% < 100%), thick foundation used a thin mixture of 10 cm. Connection using dowel reinforcement Ø 33 mm, length 700 mm, distance 750 mm. Reinforcement wire Mesh ø8 mm-150 mm [12].

From the two planning above there is a similarity in using the calculation thickness rigid but in the research is planned on the different locations of the location there are also different cases of rigid Pavement planning. This has added a discussion about land retaining wall planning based on differences in its elevation [16].

The ground retaining walls are structures to maintain and maintain two distinct land elevation faces. The building is used to withstand the lateral ground pressure inflicted by the hoard land [6,13].

Type of ground retaining wall classification:

1. External stability system is the ground retaining wall system to the lateral load by using the weight and rigors.

Internal stability System is a system that strengthens the soil to achieve the needed stability.

In planning this land retaining wall is planned with the structure of Concrete sheet well intended a permanent building plaster concrete [10]. This concrete Plaster is chosen more efficiently because the wall can be manufactured in a fabrication and quick operation in addition to the condition of the depth wall 4 m still Not safe against landslides with a difference of elevation 3 meters [15]. However, these types of structures have disadvantages that often leak. Then construction planning must take into account the stability and safety by checking [3,5]:

1. The stability of sliding (Sliding)
2. Stability of bolsters (Over turning)
3. Has the capacity to support land under the ground retaining wall.

Figure 2 below displays the following Sheet Pile depth analysis:

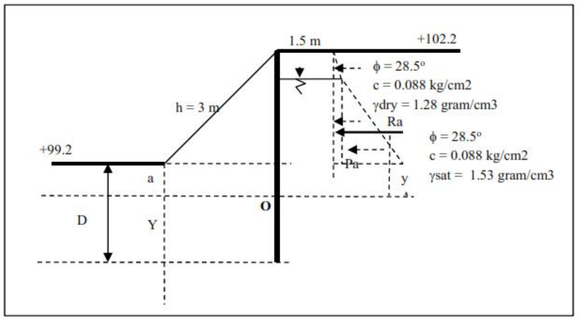


Figure 2: Sheet Pile Depth Analysis

3. RESEARCH METHOD

3.1 Data collection technique

The rigid planning and retaining walls are focused on the Cisadane Promenade road section, the 4000-metre MH Thamrin, with the implementation of data retrieval conducted interviews, direct observation of the relevant parties, as well as vehicle surveys for Know the volume of the vehicle as the primary data while data secondary the California Bearing Ratio (CBR) image data plan, as well as other data to know the reference in the calculation and reference book NSPM (Norm Standard Manual Guidelines).

3.2 Analysis Method

As mentioned above, this plan involves the thick planning of rigid piping plates, and the planning, the design of the retaining wall of the ground. Thus the steps of planning calculations are adjusted to the method applied. As for the general steps researchers made. In thickness planning, analyzing vehicle data conducted by vehicle survey conducted on weekdays as reason of the day that get the number of vehicle fluctuations, while in the planning wall retaining walls of land , analyzing data Investigation of land.

To find out the ground data shown in table 1 below:

Table 1: Land Data Recapitulation

Testing						
Sondir	STA	ω-%	CBR	γdry	Gs	PI %
S.01: STA 0+050	0+000	44.38	3.32	1.28	2.60	21.5
MAT – 1.5	0 + 500	39.4			2.71	29.4
On -22.4	1+000					
Q_c = 200 kg/cm^2	1+500					
F=4.425 kg/cm^2	2+000	48.71	2.73	1.27	2.69	21.3
H_p=88.496 kg/cm	2+500	44.52			2.76	8.7
	3+000	47.72	2.44		2.68	22.5
S.02.STA 1+500	3+500	54.86			270	32.9
MAT-2.0	4+000	55.43	4.1	1.32	2.68	37.5
On -19.8 m	4+500	57.86			2.63	29.4
Q_c = 200 kg/cm^2						
F=4.425 kg/cm^2						
Hp=88.496 kg/cm						
S.03:STA 3+500						
MAT-3.0 m						
On -16.8 m						
Qc =200 kg/cm^2						
F=4.425 kg/cm^2						
Hp=88.496 kg/cm^2						

Source: Bowless,2017

Where:

ϖ = Moisture content

γdry = Weight Test Contents

Gs = Spesipik Grafity

STA = Stasioning

CBR= California Bearing Ratio

IP= Indeks Plastisitas

4. RESULTS AND DISCUSSION

4.1 Rigid Pavement Planning

Rigid Pavement Planning and ground retaining wall on the road segment Cisadane M. H Thamrin City of Tangerang, Data includes survey data. Survey data for rigid piping planning, the volume of traffic can be roughly calculated by calculating the Volume of vehicles crossing the road for four hours, performed on weekdays to represent the other day that will be Shows fluctuations in vehicles.

The parameters of data planning thickness plate as follows:

Table 2: Total Number of Vehicle Data

No	Vehicle type	Weight	Group	Average
1	Passenger car	2T	2	1152
2	Bus	8T	5b	46
3	Truck 2 small axle	6T	6a	280

4	Truck 3 big axle	20T	7a	0
5	Collaborative Truck	20 + 10 T	7b	0
6	Truck 2 big axle	13 T	7c	96

Source: Survey Result

According to Table 3 it is known that the number of vehicles crossing the road Passengers and light trucks that have crossed the most from other pitters.

Table 3: Recapitulation of Vehicle Count and Load Configurations

No	**Load Axis Configuration (ton)**				**Number of vehicles (bh)**	**The number of axes of each vehicle (bh)**	**Number of axes (bh)**	**STRT**		**STRG**		**STdRG**	
	RD	**RB**	**RGD**	**RGB**				**BS**	**JS**	**BS**	**JS**	**BS**	**JS**
(1)	**(3)**				**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
1	1	1	-	-	1152	-	-	-	-	-	-	-	
2	3	5	-	-	46	2	92	3	46	5	46	-	-
3	2	4	-	-	280	2	560	2	280	-	-	-	-
			-	-	-	-	-	4	280	-	-	-	-
4	5	8	-	-	96	2	192	5	96	8	96	-	-
5	6	1	-	-	0	2	0	6	0	-	-	14	0
		4	-	-	0		0	-	0	-	-	-	-
6	6				0	4	0	6	0			14	0
		1	**5**	**5**	0	-	-	-	-	5	0	-	-
		4				-	-	-	-	5	0	-	-
Total							**844**		**702**		**142**		**0**

Source: Survey Result

Where:
RD = Front wheels
RB = Rear Wheel
BS = Load axis
JS = Number of axes
STRT = Single-Wheel sole axis
STRG = Double Wheel single axis
STDRG= Dual Wheel Tandem axes

Based on Table 3 on the total vehicle amounting to 844 pieces, consisting of the number of axes STRT 702 BH, the number of STRG of 142 BH and STdRG amounted to 0 pieces.

The number of commercial vehicles (JSKN) axis during the plan:

JSKN = 365 x JSKNH x R ....(5)
= $3{,}61 \times 10^7$

Where :

JSKN is the axis number of commercial vehicles R is the growth rate. For 5% in the table in the manual Pd T-14 2003 was obtained 33.07 while the JSKN plan obtained by:

JSKN Plan = CxR xJSKNH x 365............................(6)
= $0{,}85 \times 10^7$

Table 4: Calculation of the Axis Reps Plan

Axis type	**Load axis (ton)**	**Number of axes**	**Proportion of loads**	**Proportion of axes**	**Traffic Plan**	**The Reps Are Happening**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)=(4)x(5)x(6)**
STRT	6	0	0,00	0,83	$0{,}85 \times 10^6$	0
	5	96	0,14	0,83	$0{,}85 \times 10^6$	$0{,}99 \times 10^5$
	4	280	0,40	0,83	$0{,}85 \times 10^6$	$0{,}29 \times 10^6$
	3	46	0,07	0,83	$0{,}85 \times 10^6$	$0{,}50 \times 10^5$
	2	280	0,40	0,83	$0{,}85 \times 10^6$	$0{,}29 \times 10^6$
Total		**702**	**1**			
STRG	8	96	0,67	0,17	$0{,}85 \times 10^6$	$0{,}97 \times 10^5$
	5	46	0,32	0,17	$0{,}85 \times 10^6$	$0{,}46 \times 10^5$
Total		**142**	1			
STdRG	14	0	0	0	$0{,}85 \times 10^6$	0
Total						
			Cumulative			$\mathbf{8{,}72 \times 10^5}$

Source: Survey Result

According to Table. 4 above can be Noted that the value:

The proportion of the load in column 4 is derived by a division equation between the number of axes and the total number of STRT, STRG, or STdRG with the following examples:

$$\frac{\text{Number of axes}}{\text{Total STRT}} \quad \text{...(7)}$$

= 96/702 = 0,14

The proportion of axes in column 5 is obtained with division equation between total number of axis with axis amount based on load by example as follows:

STRT Proportion of axes = 702/844= 0,83

Value JSK Charge of 8,72 x 105with Strong tensile Concrete 4.0 MPA, CBR land base 4%, CBR effective at 11% so that it is taken a thick estimate of concrete plate of 20cm the value is seen that the total phatic that occurs < 100% then it can be concluded that the calculation is sufficient and a thickness of 20 cm plate can be used.

Reinforced concrete planning with reinforcement (BBDT) is used based on data obtained:

Plate friction coefficient with foundation (μ) = 1,3

Connection distance between connections (L) = 5 m To lengthen 3,5 m

Thick Plate (h) = 0,20 m

Tensile Voltage Steel (fs) = 240 MPa

Concrete type Weight = 2400 kg/cm^2

Strong tensile Concrete (f_{ct}) 0,4-0,5 = 20 kg/cm^2

MR Modulus Elastic Steel (Es) = 20000 kg/cm^2

Steel Melt Voltage (fy) = 3900 kg/cm^2

Modulus Elastic Concrete (Ec) = 1400 √fc

Transverse Reinforcement

$$As_{Need} = \frac{\mu\, W.N.g.h}{2.fs} \quad \text{..(8)}$$

Elongated Reinforcement

$$Ps = \frac{1.fc\,(1{,}3-0{,}2\,\mu)}{fy-n.fs} \quad \text{..(9)}$$

Where the US is the area of reinforcement based on the data above it is obtained as transverse reinforcement = 44.635 mm2 with as $_{min}$ = 0.1% x 200 x 1000 = 200 mm2

As $_{needed}$ = Ps x 100 x thick plate can then be determined diameter of the reinforcement by looking at the table [3]. So used iron diameter 10 mm distance 30 cm, to facilitate the work while the reinforcement elongated As = 63.765 mm2 with As $_{min}$ = 200 mm 2 Then the repatriation used diameter 10 with a distance of 350 mm.

4.2 Retaining Wall Planning

The planning of the ground retaining walls is a significant difference in land elevation that will cause a literal style of land where a construction is needed to achieve a stability [8,2]. Based on soil data in figure 3 above the soil retaining structure analysis is done as follows:

Without structural alignment:

H $_{mak}$ = 4c/γ/√Ka ; ß = 0

Ka =(1-√1-cos2(28.5)/(1 +√cos2(28.5) = 0.395

Thus acquired H_{mak} = 206.7 cm = 2.07 < 5 Shows a difference of height up to 5 m hence the need of soil retaining structure Analysis of Strengthening the system & the stability of the avalanche and bolsters :

A.Elevation Difference 4-6 m

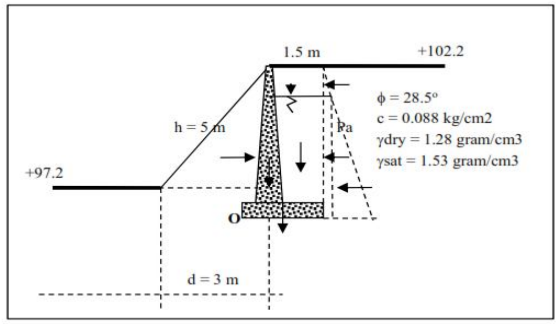


Figure 3: Soil Retaining Wall Structure E. 4-6m

Used ground retaining wall structures:

High Retaining wall (H)= 5,5 m ; b_{limit}= (30 cm-H/12)

Taken 40 cm ; b_{under}= 100 cm ; b_{feet} = 0,5 – 0,7H = 3 m ; t = 70 cm

and active pressure coefficient ($K_{a\,)}$ = 0,395 So Ground style behind the walls of:

Own weight style (W)

= (3-0,3-1)x(1,5x1,28+4x1,53)

= 13,668 ton

Upright Wall Weight Wd1 = 0,5(0,4+1)x5,5x2,4 = 9,24 ton

Wall Foot Weight Wd2 = 3x0,7x1x2,4 = 5,04 ton

Sliding retaining style = Base of the Wall foundation of R and Ø

= (Wd1+Wd2+W)tan 2/3(28,5º) + cB

=27,948x0,344 + 0,088x3 = 9,878 ton

Active ground pressure(Pa1)= $1/2\gamma_{dry}\, h_1^2$ = 1,44 ton

Active ground pressure(Pa2)= $1/2\gamma_{dry}\, h_2^2$ = 9,18 ton

Active ground pressure (Pa3) = $1/2\gamma_{dry}\, h_3^2$ = 12,44 ton

Active ground pressure (PP1) = $1/2\gamma_{dry}\, h_4^2$ = 12,96 ton

Passive ground pressure wall stability analysis is reviewed against security stability:

Silding driving force = P_h =∑Pa x (Ka)

= (1,44 + (13.668x18.24)x0,395 = 9,03 ton

Safety factor against sliding = FS = fr/Ph

Where:

Fs= Sliding factor

Fr= Sliding retaining force (ton)

Ph = Sliding driving force (ton)

Fs = 9,878/9,03 = 1,09 < 1,5 Then the wall has Not been strong withstand horizontal style

Bolster moment (Mr)

Mr = Wx1,95+Wd1x0,7+Wd2x1,25

= 53,43 tm

Moment of bolsters (Mo);

Mo = (Pa1x4,75+Pa2x2+Pa3x1,83) ka

= 20.93 tm

So that the wall to the bolsters (FG)
FG = 53,43/20,93 = 2,55 >2 The walls are safe against bolsters. Theoretically sheetpile low ground elevation so it is safe against landslides and a bolster [17,18]
Y + a = D
Where:
a = Pa/γK and Y is a reaction force factor for soil retaining walls.:
Pa = (1,5(1,28)+3,5(1,53)(0,395) = 2,874 t/m^2
K = Kp-Ka = 2,531-0,395 = 2,136
A =2,874/(1,53)(2.136) = 0,879 m and
Y = 5,118 m So the value D In Get:
D = 5,118 + 0,879 = 5,997 m That in practice plus 30% then D = 7.8 m Long total sheetpile = 13 m
Mo = Ra.y = 8,1882 ton x 2,017 = 16,53 = 17 tm
So used sheet pile type W350B1000,Mcreack 17 tm, L 13 m FPC Material quality K500

B. H = 3 m Elevation difference 2-4 m

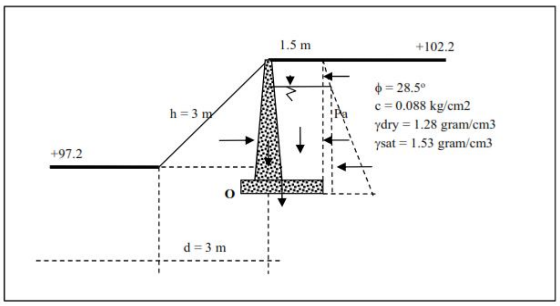


Figure 4: Ground Retaining Wall Structure E. 2-4 m

High Retaining wall (H)= 4 m ; b_{batas} = (30 cm-H/12) diambil 40 cm ; b_{bawah} = 80cm ; b_{kaki} = 0,5 – 0,7H = 2,5m ; t = 50
cm and active pressure coefficient (K_a) = 0,395 So that the land behind the wall was:
Own weight style back wall (W)
= (1,4)x(1,5x1,28+2,5x1,53) = 8,043 ton
Upright Wall Weight Wd1 = 0,5(0,4+0,8x3,5x2,4 = 5,04 ton
Wall Foot Weight Wd2 = 2,5x0,5x1x2,4 = 3 ton
Sliding retaining style = Base of the Wall foundation of R and Ø
= (Wd1+Wd2+W)tan 2/3(28,5º) + cB
= 5,75 ton
Active ground pressure (Pa1)= $1/2\gamma_{dry} h_1^2$ = 1,44 ton
Active ground pressure (Pa2) = $1/2\gamma_{dry} h_2^2$ = 3,84 ton
Active ground pressure (Pa3)= $1/2\gamma_{dry} h_3^2$ = 4,78 ton
Active ground pressure (PP1)= $1/2\gamma_{dry} h_4^2$ = 4 ton
Passive ground pressure wall stability analysis is reviewed against security stability:
Silding driving force = P_h =∑Pa x (Ka)
= (1,44 + (3,84x4,56)x0,395 = 3,974 ton
Safety factor against sliding = FS = fr/Ph

Fs = 5,75/3,974 = 1,45 < 1,5 Then the wall has Not been strong withstand horizontal style

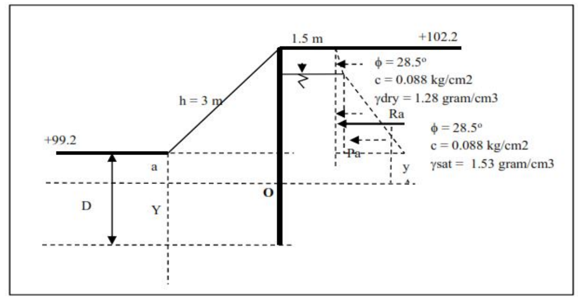


Figure 5: Sheet Pile Depth Analysis

Calculating sheet pile depth below ground elevation
Y + a = D
Where:

Pa = (1,5(1,28)+1,5(1,53)(0,395) = 1,665 t/m^2
K = Kp-Ka = 2,531-0,395 = 2,136
A =1,665/(1,53)(2.136) = 0,509 m and
Y = 3,048 m :
D = 3,048 + 0,509 = 3,557 m In practice in plus 30% then D = 5 m
Long total sheetpile = 8 m
Mo = Ra.y = 2,811 ton x 1,313 = 3,7m = 3,7 tm
So used sheet pile type W325A1000,Mcreack 11,4 tm, L 8 m FPC Material quality K500

C. H<2,5 m For elevation difference 1-2 m

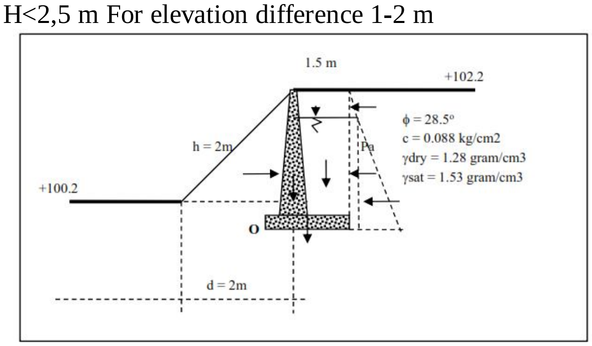


Figure 6: Ground Retaining Wall Structure E. 1-2m

High Retaining wall (H)= 2 m ; b_{batas} = (30 cm-H/12) Taken 30 cm ; b_{bawah} = 60 cm ; b_{kaki} = 0,5 – 0,7H = 2m ; t = 30 cm and Active pressure coefficient (K_a) = 0,395 So that the land behind the walls is:

Own weight style (W)
= (1,1)x(1,5x1,28+0,5x1,53) = 2,9535 ton
Upright Wall Weight Wd1 = 0,5(0,3+0,6)x1,7x2,4 = 1,836 ton
Wall Foot Weight Wd2 = 2x0,3x1x2,4 = 1,44 ton
Sliding retaining style = Base of the Wall foundation of R and Ø
= (Wd1+Wd2+W)tan 2/3(28,5º) + cB
=6,2295x0,344 + 0,088x3 = 2,319 ton
Active ground pressure (Pa1)= $1/2\gamma_{dry} h_1^2$ = 1,44 ton
Active ground pressure (Pa2) = $1/2\gamma_{dry} h_2^2$ = 0,96 ton
Active ground pressure (Pa3)= $1/2\gamma_{dry} h_3^2$ = 0,1913 ton
Active ground pressure (PP1) = $1/2\gamma_{dry} h_4^2$ = 1,28 ton
Passive ground pressure wall stability analysis is reviewed against security stability:

Where force Silding driving force
= $P_h = \sum Pa \times (Ka)$
= (1,44 + (0,96x0,1913)x0,395 = 1,023 ton
Safety factor against sliding Safety factor against sliding = FS = fr/Ph
Where:
Fs = Sliding factor Sliding factor
Fr = Sliding retaining force (ton)
Ph = Sliding driving force (ton)
Fs = 2,319/1,023 = 2,26 < 2 Then safe against landslides Withstand horizontal styles
Bolster moment (Mr)
Mr = Wx1,45+Wd1x0,6+Wd2x1
= 6,824 tm
Moment of bolsters (Mo);
Mo = (Pa1x4,75+Pa2x2+Pa3x1,83) ka
= 0,68 tm
So that the wall to the bolsters (FG)
FG = 6,824/0,68 = 10 >2 Wall Safe against bolsters Mmax = Mo = 0,68 So that the stone wall can be used with a maximum height of 2 m.

5. CONCLUSION

The results of data analysis planning rigid and retaining wall on the road of the street Promenade MH Thamrin 4000 meters based on the guidelines Pd – T-14-2003 and the retaining wall of the sheet pile structure can be concluded as follows:

a. Thickness of concrete plate used to withstand the burden of vehicles passing through Cisadane Promenade Road, MH Thamrin is 20cm using K-350
b. Transverse joints using iron dowel diameter 10 mm (plain) distance 30 cm, elongated joints or iron binder tie bar using iron diameter 10 mm (screw), distance between rods 35 cm
c. Determination of the thick planning of concrete plates and the diameter of concrete plate reinforcement has been in accorandce to the directive Pd – T-14-2003

The design of the retaining wall of the soil adapted to its elevations for the elevation difference of more than 4.5 using Concrete sheet pile W350B1000, K500, L13 m, M crack 17 TM, difference elevsi 2-4 m using Concrete sheet pile W350A1000, K500, L8m M crack 11.4 TM, and elevation difference of less than 2 m using stone talud times with a limit of 30 cm, Bunder 30 cm tread B = 2m and H 2 m.

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