

Perencanaan Embankment / Timbunan Diatas Tanah Lunak Disungai Harus Kalimantan Selatan

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Abstract. The planning of embankment on soft soil at the Harus River, South Kalimantan, is an area owned by a mining company. This area is planned to be developed into a transportation route, which will later function as an alternative transportation route to accelerate the transportation of the company's mining products. The embankment planning is located directly on soft soil. According to Geotechnical guidelines 1, Pedoman Kimpraswil: Pt T-8-2002-B, soft soil refers to soil that, if not properly identified and investigated, may cause instability and long-term settlement problems that cannot be tolerated because it has low shear strength and high compressibility. Therefore, handling of settlement in soft soil is essential. One alternative for preventing failure in embankment soil is reinforcement. However, in this study, only the height of the embankment on the soil. The analysis of the safety factor is conducted by applying the finite element method with the help of PLAXIS 8.2 software. The data used in this study were obtained from literature and laboratory testing results from SI-ADORADO-GOLDER. Based on the stability calculation of the embankment on soft soil with a height of 1.5 meters per stage and a slope of 1:5, the results obtained from the analysis using the finite element method with PLAXIS 8.2 program is 1.441.

Keywords: Embankment, Planning, Plaxis.

Abstrak. Perencaan Embankment / Timbunan diatas tanah lunak di sungai Harus Kalimantan Selatan. Merupakan sebuah lokasi atau area yang dimiliki oleh perusahaan dibidang pertambangan dan direncanakan area tersebut akan dibangun menjadi jalur transportasi jalan yang nantinya akan difungsikan sebagai jalur alternatif transportasi guna mempercepat waktu pengangkutan hasil tambang perusaahan tersebut. Perencanaan embankment ini tepat berada diatas tanah lunak. Tanak Lunak berdasarkan panduan Geoteknik 1 Pedoman Kimpraswil : Pt T-8-2002-B, Tanah lunak adalah tanah-tanah yang jika tidak dikenali dan diselidiki secara berhati-hati dapat menyebabkan masalah ketidakstabilan dan penurunan jangka panjang yang tidak dapat ditolelir karena tanah tersebut mempunyai kuat geser yang rendah dan kompresibilitas yang tinggi. Oleh sebab itu, penanganan terhadap penurunan pada tanah lunak amat diperlukan. Salah satu alternatif perkuatan yang digunakan untuk menghindari terjadinya keruntuhan pada tanah timbunan adalah menggunakan perkuatan. Namun dalam penelitian ini hanya merencanakan tinggi timbunan tanpa perkuatan. Tujuan dari penelitian ini adalah untuk menentukan faktor keamanan timbunan pada tanah. Analisis faktor keamanan dilakukan dengan menerapkan konsep elemen hingga dengan bantuan software PLAXIS 8.2. Data yang digunakan dalam penelitian ini diperoleh dari literatur dan hasil uji laboratorium SI-ADORADO-GOLDER.Berdasarkan hasil perhitungan stabilitas timbunan pada tanah lunak dengan ketinggian 1,5 m tiap tahap dan kemiringan 1: 5, hasil yang didapat dari analisa menggunakan metode elemen hingga dengan bantuan program PLAXIS 8.2. timbunan memenuhi kriteria dari faktor keamanan sebesar 1,4 . Lereng timbunan yang diperoleh dari hasil bantuan program Plaxis 8.2 yaitu sebesar 1,441.

Kata Kunci: Embankment, Perencanaan, Plaxis.

1. PENDAHULUAN

Dewasa ini banyak sekali pengembangan dan pendirian perusahaan yang bertempat dipelosok desa maupun yang berada di tengah hutan belantara. salah satu contohnya yaitu perusahaan yang bergerak di bidang pertambangan batu bara yang berada di Provinsi Kalimantan Selatan.

Sesuai dengan kebutuhan kerjanya perusahaan pertambangan tersebut memerlukan jalur transportasi yang dapat menunjang kelancaran pekerjaan dalam kesehariannya, yang berupa kegiatan pengangkutan hasil tambang dari tambang Paringin ke pelabuhan Kelanis. Meskipun sudah tersedia jalan existing yang sudah ada, dinilai belum maksimal karena ada sebagian jalur jalan yang terpisah oleh sungai yang membentang di daerah tersebut. Sehingga perjalanan pengangkutan hasil tambang tersebut memerlukan waktu yang lebih lama untuk mencapai ketempat yang dituju. Oleh karena itu pihak pertambangan berencanaan akan membangun jembatan penyebrangan didaerah tersebut.

Salah satunya akan dibangun jembatan di sungai Harus yang berfungsi untuk menyambungkan wilayah yang terbatasi oleh sungai didaerah tersebut serta memaksimalkan kelancaran pekerjaan dalam pengangkutan hasil tambang dan mempercepat waktu sampai ketempat tujuan. Oleh karena itu untuk memenuhi kebutuhan tersebut memerlukan perencanaan jembatan yang sesuai dengan kebutuhannya.

Dalam perencanaan struktur tersebut dibagi kedalam dua bagian, yaitu struktur atas dan struktur bawah. Dalam tugas akhir ini akan meninjau tentang perencanaan embankment / timbunan di sungai Harus Kalimantan Selatan yang berada sebelum jembatan yang akan dibangun.

Dengan adanya perencanaan embankment / timbunan diharapkan, embankment/timbunan yang dihasilkan nanti dapat memikul beban dan gaya-gaya yang bekerja selama masa oprasional. Beban dan gaya yang bekerja terhadap embankment / timbunan didapatkan dari data yang ada , serta berat sendiri tanah. Dimana perhitungan embankment / timbunan dilakukan menggunakan plaxis.Untuk itu dilakukan berbagai macam upaya untuk menanggulangi permasalahan tersebut. Dengan metode yang dapat menghasilkan suatu nilai kestabilan tanah agar dapat menahan suatu struktur yang berada di atasnya.

2. KAJIAN PUSTAKA

Definisi dan Pengertian Tanah

Tanah adalah kumpulan tubuh alam yang menduduki sebagian besar daratan planet bumi, yang mampu menumbuhkan tanaman dan sebagai tempat mahluk hidup lainya dalam melangsungkan kehidupannya. Menurut pandangan da pengertian yang diberikan oleh para ahli tanah sebagai berikut :

- Tanah adalah bentukan alam, seperti tumbuhan-tumbuhan, hewan dan manusia yang mempunyai sifat tersendiri serta mencerminkan hasil pengaruh berbagai faktor yang membentuknya di dalam.
- 2) Tanah adalah sarana produksi tanaman yang mampu menghasilkan berbagai tanaman.

Tanah mempunyai lapisan-lapisan yang berbeda warna, serta tanah mempunyai beberapa sifat yang menentukan kualitas tanah, seperti sifat biologi, sifat fisik, dan sifat kimia. Tanah bagian paling atas sering disebut top soil, selanjutnya ada lapisan-lapisan dibawahnya sehingga terbentuk profil tanah.

Komposisi Tanah

Tanah menurut Braja M. Das didefinisikan sebagai material yang terdiri dari agregat (butiran) mineral- mineral padat yang tidak tersementasi (terikat secara kimia) satu sama lain dari bahan-bahan organik yang telah melapuk (yang berpartikel padat) desertai dengan zat cair dan gas yang mengisi ruang-ruang kosong diantara partikel partikel padat tersebut. Tanah berfungsi juga sebagai pendukung pondasi dari bangunan. Maka diperlukan tanah dengan kondisi kuat menahan beban di atasnya dan menyebarkannya secara merata.

Tanah Lunak

Berdasarkan panduan Geoteknik 1 Pedoman Kimpraswil No : Pt T-8-2002-B, Tanah lunak adalah tanah-tanah yang jika tidak dikenali dan diselidiki secara berhati-hati dapat menyebabkan masalah ketidakstabilan dan penurunan jangka panjang yang tidak dapat ditolelir karena tanah tersebut mempunyai kuat geser yang rendah dan kompresibilitas yang tinggi.

Konsolidasi dan Settlement

Konsolidasi adalah tingkat perubahan volume dalam suatu proses pemadatan dan histori dari proses ini biasanya diberikan oleh diagram hubungan waktu - pemadatan, yang ditandai dengan tiga zona kompresi yaitu *initial compression zone, primary consolidation zone, secondary consolidation zone. Settlement* atau penurunan merupakan nilai reduksi dari ketebalan lapisan tanah akibat suatu proses pemadatan yang dialami oleh lapisan tanah tersebut.

Tegangan Total dan Tegangan Efektif

Tegangan tekan (σ) yang bekerja pada massa tanah sebagian akan ditanggung oleh partikel tanah dan sebagian lagi oleh tekanan air pori. Gabungan dari keduanya disebut dengan tegangan total, sedangkan tegangan yang ditanggung oleh partikel tanah disebut tegangan efektif (σ ').

Metode Elemen Hingga

Metode elemen hingga merupakan suatu metode penyelesaian numerik dengan cara membagi kontinum menjadi bagian-bagian yang lebih kecil. Konsep dasar metode elemen hingga adalah apabila suatu sistem dikenai gaya luar, maka gaya luar tersebut diserap oleh sistem tersebut dan akan menimbulkan gaya dalam dan perpindahan. Besarnya gaya dalam dan perpindahan akibat gaya luar tersebut dapat diketahui dengan pembentukan suatu persamaan yang mewakili sistem tersebut. Metode ini memungkinkan untuk mengubah sistem dengan derajat kebebasan tak terhingga menjadi derajat kebebasan terhingga sehingga mempermudah proses perhitungan. MEH merupakan metode pendekatan, semakin kecil pembagian elemen-elemen, maka perhitungan akan semakin akurat. MEH dapat digunakan untuk menghitung distribusi beban yang terjadi pada elemen seperti deformasi dan tegangan.

3. METODE PENELITIAN

Penelitian ini merupakan penelitian kuantitaif melalui pengumpulan data sekunder serta pemodelan dengan analisis elemen hingga untuk mengetahui hasil penelitian yang meliputi nilai safety factor, settlement, dan tegangan tanah.

Alat yang digunakan pada penelitian ini berupa software yang mampu mendukung proses analisis perhitungan dengan cepat dan akurat. Alat-alat tersebut antara lain,

a. Sistem analisis : Metode Elemen Hingga

b. Penyusunan laporan : Microsoft Office Word 2010 c. Menggunakan software Plaxis
 8.2

Bahan-bahan yang digunakan pada penelitian ini adalah sebagai berikut ini:

- a. Jurnal penelitian
- b. Literatur penelitian terdahulu yang membahas tentang timbunan
- c. Buku tentang topik terkait
- d. Aturan dan pedoman yang dapat dijadikan acuan pelaksanaan skripsi
- e. Data tanah sekunder berupa data tanah di area sungai Harus Kalimantan Selatan Penelitian dilakukan di Jembatan Sungai Harus merupakan jembatan yang

terletak di Provinsi Kalimantan Selatan. Analisa data pada penelitian menggunakan analisa metode elemen hingga (MEH) dengan memodelkan sesuai dengan kebutuhan penelitian. Hasil utama pada penelitian ini adalah nilai *safety factor, settlement,* dan tegangan tanah dengan pemodelan MEH yang telah ditetapkan.

4. ANALISIS DAN PEMBAHASAN

Analisis

Material tanah pada pemodelan disajikan pada Tabel 1 dan 2 berikut ini :

	γ (kN/	′m3)	Erof						
jenis tanah	γ wet (unsat)	γ (sat)	(kN/m2)	c (kN/m2)	φ (°)	kx	ky	v	psi (Ψ)
Sand	17.000	20.000	3000.000	1.000	32.000	1.000	1.000	0.300	0.000
Clay	16.000	18.000	1000.000	2.000	24.000	0.001	0.001	0.330	0.000
Deep Clay	16.000	18.500	10000.000	4.000	25.000	0.010	0.010	0.330	0.000

Tabel 1. Parameter Tanah Eksisting

Tabel 2. Parameter Tanah Timbunan

	γ (kN/	′m3)	Erof						
jenis tanah	γ wet (unsat)	γ (sat)	(kN/m2)	c (kN/m2)	φ (°)	kx	ky	v	psi (Ψ)
Compacted fill	18.000	20.000	8000.000	75.000	0.000	1.000	1.000	0.300	0.000

Tabel 1 dan 2 menunjukkan parameter tanah pemodelan berupa parameter tanah *Mohr Coloumb* yang didapat melalui pengumpulan data sekunder.

Pembahasan

Input Data

1) Pertama saat membuka program Plaxis Input, akan tampil kotak / box creat / open project. Pilih Open / New Project lalu tekan OK.

C Existing chart	New chart		
<<< More files >>>	Existing chart		
	vlore files >>>		
<	FII.		,

Gambar 1. Create / Open Project

2) Langkah selanjutnya akan muncul kotak *General Setting*, pada lembar Project di biarkan saja lalu tekan *next*.

Project		General		
Filename	214.plx	Model	Plane strain	-
Directory Title	E:\data lama2\PERSIAPAN TA\Semir 01	Elements	15-Node	•
Comments		Accelerat	ion	
		Gravity ar x-accelera	ngle: -90 ° 1.0 ation: 0.000	G [G
		y-accelera	ation : 0.000	G
		Earth gran	vity : 9.800 🖨	m,s ²

Gambar 2. Langkah General Setting

3) Masih di General Setting, pada lembar *Dimensions* di sisi kolom *Geometry dimensions* dan *Grid* sesuai kriteria yang akan dimodelkan

Units	Geometry dimensions	
Length m	Left: 0.000 🖨 m	
Force kN 💌	Right: 60.000 🚖 m	
Time day 💌	Bottom : 0.000 🚖 m	
	Top: 45.000 🚖 m	
Stress kN,m ² Weights kN,m ³	Grid Spacing 0.500 (★) m Number of intervals 1 (★)	

Gambar 3. Langkah General Setting

4) Untuk memulai pemodelan pertama kita bisa menggambar garis kerja pada koordinat garis X dan Y dengan menekan pojok kiri atas *Geometry line* yang diberi tanda warna kuning. Lalu gambarkan lapisan tanah pada koordinat X dan Y sesuai kriteria yang di tentukan.



Gambar 4. Langkah Memulai Penggambaran

5) Untuk membentuk kondisi batas pada model geometri, klik standard fixities yang di lingkari merah.



Gambar 5. Langkah Membentuk Kondisi Batas pada Model

6) Klik *material sets*, dan klik *global*, set type : *soil & interface*, membuat material baru timbunan.

roject Database Set type: Soil & Interfaces 💌]	Global Databas Set type:	e Soil & Inter	faces 👻
Group order: None		Group order:	None	•
I. timbunan 2. Sand 3. Clay Lesson 6 - Deep Clay	~ ~ ~ ~	Lesson 2 Lesson 3 Lesson 3 Lesson 3 Lesson 4 Lesson 4 Lesson 4 Lesson 5 Lesson 5 Lesson 5	- Clay - Sand - Clay - Peat - Sand - Fill - Loam - Sand - Clay - Clay - Peat - Sand - Sand - Clay - Sand -	E
New Edit Copy Del		Open	Del	Dreate

Gambar 6. Langkah Membuat Material Sets

The second second

Material Set	Genera	properties	 ,	
Identification:	1.timbunan	⁹ unsat	18.000	kN/m ³
Material model:	Mohr-Coulomb	▼ ⁷ sat	20.000	kN/m ⁻²
		k _x : k _y :	1.000	m/day m/day
				Advanced

Gambar 7. General Timbunan

Stiffness			Strength		
E _{ref} :	8000.000	kN/m ²	c _{ref} :	75.000	kN/m ²
v (nu) :	0.300		φ (phi) :	0.000	•
			ψ (psi):	0.000	•
Alternatives			Velocities	~	
G _{ref} :	3076.923	kN/m ²	V _s :	40.930	🚖 m/s
E _{oed} :	1.077E+04	kN/m ²	v _p :	76.570	🚖 m/s

Gambar 8. Parameter Timbunan

General Parameters Interfaces		
Strength		
ō-inter : 0.000		

Gambar 9. Interfaces Timbunan

8) Lapisan Sand

Material Set			General	properties	
Identification:	2. Sand		⁷ unsat	17.000	kN/m ³
Material model:	Mohr-Coulomb	-	^γ sat	20.000	kN/m ³
Material type:	Drained	•			
			×.	11.000	m/day
			k _y :	1.000	m/day
					Advanced

Gambar 10. General Sand

kN/m ²
•
P
ı/s
ı/s
ı/s ı/s

Gambar 11. Parameter Sand

Strength			
Rigid			
C Manual			
R _{inter} : 1.000			
Real interface thickness			
δ-inter : 0.000			

Gambar 12. Interfaces Sand

9) Lapisan Clay

Aaterial Set			General	properties	
Identification:	3 - Clay		⁷ unsat	16.000	kN/m ³
Material model:	Mohr-Coulomb	•	γ_{sat}	18.000	kN/m ³
Material type:	UnDrained	-			
			K _x :	1.000E-03	m/day
			k _y :	1.000E-03	m/day
					Advanced

Gambar 13. General Clay

Stiffness E _{ref} :	1000.000	kN/m ²	Strength C _{ref} :	2.000	kN/m ²
v (nu) :	0.330	-	ç (phi) :	24.000	•
			ψ (psi) :	0.000	•
Alternative	s		Velocities		
G _{ref} :	375.940	kN/m ²	V _s :	15.170	✿ m/s
E _{oed} :	1482.000	kN/m ²	v _p :	30.120	\$ m/s

Gambar 14. Parameter Clay

Scherar rarameters	erfaces	
Strength		
Rigid		
C Manual		
R _{inter} : 1.000		
Real interface thickness		
δ-inter: 0.000		

Gambar 15. Interface Clay

10) Lapisan Deep Clay

Material Set	-	. Genera	l properties	
Identification:	Lesson 6 - Deep Clay	⁷ unsat	16.000	kN/m ³
Material model:	Mohr-Coulomb	⁷ sat	18.500	kN/m ³
Material type:	Drained 👻	I		
		×	10.010	m/day
		k _y :	0.010	m/day
				Advanced

Gambar 16. General Deep Clay

Stiffness			Strength		
E _{ref} :	1.000E+04	kN/m²	c _{ref} :	4.000	kN/m²
v (nu) :	0.330		<mark>ç (phi)</mark> :	25.000	۰
			ψ (psi) :	0.000	•
Alternative	s		Velocities		
G _{ref} :	3759.398	kN/m ²	V _s :	47.990	🗢 m/s
E _{oed} :	1.482E+04	kN/m ²	V _p :	95.260	🔹 m/s

Gambar 17. Parameter Deep Clay

Strength	0.0		
Rigid			
C Manual			
R _{inter} : 1.000			
Real interface thickness			
δ-inter : 0.000			

Gambar 18. Interfaces Deep Clay

■ ■ ★ # 1.1.1.1.1.1.1 ○ トーポー 4 / / 5.00 0.00 5.0 40.00 35.00 . . 30.00 25.00 Sand Oay 20.0 15.00 10.0 5.0 0.00 QK Apply Help nits : 105.500 x -15.500 m

11) Lalu lapisan yang dibuat tadi di drug sesuai lapisan yang ditentukan.

Gambar 19. Penempatan Lapisan Sesuai Keadaan Lapangan

12) Selanjutnya masukan beban jalan dan beban lalu lintas yang berlaku sesuai peraturan



Gambar 20. Penambahan Beban Jalan dan Beban Lalu Lintas

13) Klik generate mesh lalu di update.



Gambar 21. Generate Mesh

Menentukan Tekanan Air

1) Klik *initial conditions*, desain akan berubah lalu klik (1) *phreatic level* untuk menentukan garis tekanan air sesuai data tanah.



Gambar 22. Initial Conditions

 Lalu klik (2) generate water pressure lalu update, maka keluar hasil tekanan air. Setelahnya klik update



Gambar 23. Generate Water

 Lalu klik (2) generate water pressure lalu update, Maka keluar hasil tekanan air. Setelahnya klik update



Gambar 24. Generate Water Pressure

4) Lalu akan muncul langkah selanjutnya langsung klik OK.

ΣM-W	e cht :	.000	\$	
Cluster	Material	OCR	POP	ко
1	MC	N/A	N/A	0.577
2	MC	N/A	N/A	0.593
3	MC	N/A	N/A	0.470
4	MC	N/A	N/A	1.000
5	MC	N/A	N/A	1.000

Gambar 25. KO-Procedure

5) Hasil *initial soil stresses*, lalu di update.



Gambar 26. Hasil Effective Stresses

Calculation

Timbunan tahap pertama tinggi 1,5 m waktu proses 5 day

- Klik *calc* di pojok kiri, lalu di isi data sesuai desain, membuat initial phase, klik dua kali sampai muncul panah biru.
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Consolidation timbunan tahap pertama t = 1,5 m selama 200 day

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Timbunan setelah 1,5 m 5 day

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Beban Jalan dan Lalu lintas

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Consolidation Till P = 1 / Konsolidasi akhir

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Safety Factor tahap pertama t = 1,5 m

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Safety Factor timbunan tahap ke 2 t = 3 m

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Safety Factor Akhir Phi – Consolidation

- 1) Klik general
- 2) Lalu klik parameter, klik define

- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

SF (Safety Factor)

- 1) Klik general
- 2) Lalu klik parameter, klik define
- 3) Lalu klik multipliers, langsung klik calculate
- 4) Hasil calculate

Output

 Setelah semua phase diset kedalam program seperti pada Gambar 4.54 dibawah ini, klik parameter, define dan klik calculate.

e Edit View Calcula International Control	te Help	s 90	Calculate			
General Barameters Mult Control parameters Additional Steps:	ipliers Previe		teset displacements to a grone undramed behavio	ero 02		
Iterative procedure G Standard setting Manual setting		Loadr (* St (* M (* In Time	ng input aged construction nimum pore pressure ji oremental multiplier interval : 5.00	Pstop] : [1.0000 🚖 Miµm 2 00 ♀ day _ @W Plow]		
_	Qofr	e	nated end time : 5.00	0 文 day		
Identification	<u>Orfr</u>	Start from	Calculation	day	rt Re De	ete
identification	Orfr Phase no. 0	Start from	Calculation	00 😧 day	rt _ 🙀 Del	ete Wat
Identification Initial phase	Defr Phase no. 0	Start from	Calculation	00 Image: Construction	rt _ 🙀 Del Time 0.00	ete Wat
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identification Initial phase ETITISUNAT 1,5m 5 Gay 2. Consolidation 200day 3. Timbunan seteleh	Phase no. 0 1 2 3	Start from N/A 1 2	Anated end time : 5.00	0 dayetne	rt De De Time 0.00 500 5.00	ete Wat
dentification Initial phase LTImbunns 1,5m 5 day 2. Consolidation 200day 3. Tmbunan setalah 9 Beban Jain dan lalu k	Phase no. 0 1 2 3 9	Start from N/A 1 2 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation	20 œ Qefne Qefne Leading input Main Inse	rt Def Time 0.00 200 5.00 0.32	ete Wat
Identification Initial phase Initial phase Initial phase 2. Consolidation 200day 3. Trabunan seteleh # Beban Jalan dan Ialu Ji 4. Consolidation til p=1	 Phase no. 0 1 2 3 9 4	Start from N/A 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	20 day brie Leading input KiA Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction	rt Def Time 0.00 5.00 0.32 1705	ete Wat
dentification Initial phase 1. Timbunan 1,5m 5 day 4. Considiation 200day 4. Considiation 10 p+1 4. Consolidation 10 p+1 4. Consolidation 10 p+1 5. Pitx< 1,5 m	 Phase no. 0 1 2 3 9 4 5	Start from N/A 0 1 2 3 9 1	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Consolidation Ph/C reduction	20 Gay Qefree Image: A standard of the standar	rt Del Time 0.00 200 5.00 0.32 1705 -1.76,	ete Wati C C C C C C C C C C C C C C C C C C C
Identification Initial phase Initial phase Initial phase Initial phase Initial phase Initial phase Initial phase I Consolidation 10 p=1 S. Phi-C 1,5 m 6. Phi-C 3 m	<u>Phase no.</u> 0 1 2 3 9 4 5 6	Start from N/A 1 2 3 9 1 3	Calculation N/A Canceldation N/A Consolidation Consolidation Consolidation Consolidation Phily reduction Phily reduction	20 day generation 4 day generation 4 day generation 4 day generation 4 day 4 day	rt Del Time 0.00 5.00 0.32 1705 -1.76 0.00	ete Wati C C C C C C C C C C C C C C C
Identification Initial phase Initial phase Initial phase Initial phase I Consolidation 200day I Consolidation 110 p-1 I Consolidation 110 p-1 I Consolidation 110 p-1 I S. Phi-C Sim 6. Phi-C Similar I Consolidation	 Phase no. 0 2 3 9 4 5 6 7	Ester Start from N/A 0 1 2 3 9 1 3 4	Anted end time : 5.00 Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phyle reduction Phyle reduction	Average Section 2012 Secti	rt Epe Del Time 0.00 5.00 5.00 0.32 1705 0.00 -1.76 0.00 -715	ete Wat 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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Gambar 27. Semua Data Phase

2) Phase di output lalu akan muncul seperti ini.

	at the end of p	previous l	oading step	r	Ca	alculation progres	s
Σ -Mdisp;	1.000	PMax	¢	25.437	PIS	ы	
Σ -MloadA:	1.000	Σ-Ma	area:	1.000			
∑ -MloadB:	1.000	Force	e-X:	0.000		7	
Σ -Mweight:	1.000	Force	e-Y:	0.000		/	
Σ -Maccel:	0.000	Stiffr	ess: 7	447E-10			
Σ-Msf:	1.536	Time:		210.000			
∑ -Mstage:	0.000	Dyn.	time:	0.000		U Node A	-
Iteration proces	as of current ste	ep				,	
Current step:	150	Max.	steps:	151	Eleme	ent	245
Iteration:	8	Max.	iterations:	60	Deco	mposition:	100 %
Global error:	9.709E-04	Toler	ance:	0.010	Calc.	time:	19 s
Plastic points in	current step						
	oints:	183	Inaccurat	e	30	Tolerated:	21
Plastic stress p	a sector back	0	Inaccurat	e	0	Tolerated:	3
Plastic stress p Plastic interfac	e points:						

Gambar 28. Phase saat di Output

 Jika sudah selesai maka phase akan berubah menjadi ceklis hijau yang artinya phase sudah sesuai dengan data.

le Edit View Calcular	te Help							
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					Br	rameters		
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Identification Initial phase f 1.Timbunan 1,5m 5 day	Phase no. 0 1	Start from N/A 0	Calculatio N/A Consolide	n Bon	Loading input N/A Staged Constru	ction	Time 0.00 5.00	elete Wate C
Identification Initial phase ✓ 1.Timbunan 1,5m 5 day ✓ 2. Consolidation 200day	Phase no. 0 1 2	Start from N/A 0 1	Calculatio N/A Consolida Consolida	n tion tion	N/A Staged Constru Staged Constru	ction	Time 0.00 5.00 200	elete Wate C
Identification Initial phase ✓ 1.Timbunan 1,5m 5 day ✓ 2. Consolidation 200day ✓ 3. Timbunan setelah	Phase no. 0 1 2 3	Start from N/A 0 1 2	Calculatio N/A Consolida Consolida Consolida	n tion tion	N/A Staged Constru Staged Constru Staged Constru	Linsert	Time 0.00 5.00 5.00	elete Wate C
Identification Initial phase ✓ 1.Timbunan 1,5m 5 day ✓ 2. Consolication 200day ✓ 3. Timbunan setelah ✓ Beban Jalan dan lalu I	Phase no. 0 1 2 3 9	Start from N/A 0 1 2 3	Calculatio N/A Consolida Consolida Consolida Consolida	n tion tion tion tion	N/A Leading input N/A Staged Constru- Staged Constru- Staged Constru- Staged Constru- Staged Constru-	ction action action action	Time 0.00 5.00 5.00 0.32	elete Wate C C C C C
Identification Initial phase ✓ 1.Timbunan 1,5m 5 day ✓ 2. Consolidation 200dby ✓ 3. Timbunan setelah ✓ Beban Jalan dan laki k ✓ 4. Consolidation til p=1	Phase no. 0 1 2 3 9 4	Start from N/A 0 1 2 3 9	Calculatio N/A Consolida Consolida Consolida Consolida Consolida	n tion tion tion tion tion	NA Loading input N/A Staged Constru Staged Constru Staged Constru Staged Constru Staged Constru	ction action action action action ressure	Time 0.00 5.00 5.00 0.32 1205	elete Wate C C C C C C C C C C C C C C C C C C C
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Gambar 29. Hasil Setelah di Calculate

Penurunan / Settlement

Analisis nilai *settlement* ditinjau pada saat pola pembebanan beban dan dapat dilihat di Tabel 1 Node Number. Dibawah ini,

1) Klik *select points for curves* titik merah, klik sembarang akan muncul huruf lalu di update.



Gambar 30. Points For Curves

2) Apabila sudah di update klik output, lalu klik deformations, deformed mesh.



Gambar 31. Deformed Mesh

3) Klik deformations, vertical displacement.



Gambar 32. Vertical Displacement

4) Klik deformations, horizontal displacement



Gambar 33. Horizontal Displacement

5) Klik deformations, total displacement



Gambar 34. Total Displacement

6) Klik geometry area longsoran lalu. beri tanda ceklist pada tulisan node number



Gambar 35. Node Number

NO	X [m]	Y [m]	Ux [m]	Uy [m]	ΔUx [10 ⁻³ m]	ΔUy [10 ⁻³ m]
208	0.000	39.500	0.000	0.000	0.000	0.000
1539	42.194	44.000	0.005	-0.006	1.182	-1.160
1693	43.556	44.000	0.032	-0.035	7.694	-8.253
1697	47.639	44.000	2.679	-2.719	677.801	-686.920
1698	46.278	44.000	1.279	-1.323	320.695	-331.46
1699	44.917	44.000	0.280	-0.247	68.563	-60.232
1842	49.000	44.000	3.595	-2.520	912.540	-638.91
1843	51.250	42.875	3.511	-0.253	888.039	-63.523
1844	50.500	43.250	3.707	-0.688	938.757	-173.42
1845	49.750	43.625	3.906	-1.375	991.233	-347.70
1937	52.000	42.500	2.963	-0.209	748.142	-52.405
1941	54.250	41.375	2.105	0.494	529.014	123.775
1942	53.500	41.750	2.649	0.372	667.950	94.648
1943	52.750	42.125	2.941	0.108	742.078	28.065
2003	55.000	41.000	0.787	0.314	192.685	75.458
2016	58.000	41.000	0.004	0.004	0.835	0.948
2017	57.000	41.000	0.072	0.086	16.997	20.859
2018	56 000	41 000	0 307	0.262	74 713	63 867

7) Klik gambar table bertujuan untuk mengetahui penurunan tiap node number

Tabel 36. Node Number

Dilihat dari tabel diatas, penurunan di node number yang diberi warna kuning mengalami penurunan sebesar -0.006 m. dengan data tersebut Maka perencanaan timbunan masih aman dari batas yang telah dianjurkan. Batas penurunan tanah yang diisyaratkan yaitu < 25 mm sesuai dengan data (SNI Geoteknik) dan penurunan mutlak setelah pelaksanaan perkerasan sebesar 100 mm (Salinan Bina Marga Rev.2017. Tentang batasan penurunan / settlement pada timbunan diatas tanah lunak).

Tegangan Efektif / Effective Stresses

Analisis nilai tegangan efektif dapat dilihat dari hasil pemodelan program plaxis berikut ini,

1) Klik stresses, Effective stresses.



Gambar 37. Effective Stresses

2) Klik stresses, total stresses



Gambar 38. Total Stresses



3) Klik Stresses, pilih extreme active pore pressure

Gambar 39. Active Pore Pressure

Safety Factor / Agka Aman

Analisis nilai *safety factor* yang ditinjau adalah *safety factor* global pemodelan yang dilakukan pada tinjauan pertama dan tinjauan kedua. Hasil dari analisa tersebut ditampilkan pada Tabel 2 berikut ini,

1) Klik curve , chart 1



Gambar 40. Curve Char

15. Klik ok , setelah klik ok akan muncul hasil curve-nya



Gambar 41. Safety Factor

Tabel 3.	Hasil	Analisis	nilai	safety	factor
----------	-------	----------	-------	--------	--------

No	Notasi	Safety Factor pada Pmax	Safety Factor pada 200 hari
1	Timbunan 1 (1,5 m)	1.430	1.433
2	Timbunan 2 (3 m)	1.536	1.441

Dilihat dari hasil pemodelan tersebut besar *safety factor* yang dihasilkan telah memenuhi batas standar nilai faktor keamanan untuk lereng tanah yaitu sebesar 1,441 (Tabel 4.4) > dari 1,25 (SNI 8460 : 2017. Hal 134 dari 303).

Selisih Safety Factor / Agka Aman Tanah Sebelum dan Sesudah Terjadi Gempa

A. Tanah Asli & Timbunan (Tanah Awal)

1) General Tanah Asli & Timbunan (Tanah Awal)

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identification Initial phase I.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setledh 1,5m Beban Jalan dan laku lintas	Phase no. 0 1 2 3 9	Start from N/A 0 1 2 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Errameters Errameters Loading input N/A Staged Construction Staged	Time 0.00 5.00 200 5.00 0.32
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3.Timbunan setelah 1,5m Beban Jalan dan laku lintas 4. Consolidation tili p=1	Phase no. 0 1 2 3 9 4	Start from N/A 0 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Parameters Loading input N/A Staged Construction	Delete.
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dentification Initial phase 1. Timbunan J.S.m S day 2. Consolidation 200day 3. Timbunan setsiah 1,15m Debaha Jakin data kui Intsa 4. Consolidation till p=1 5. Phirc 1,15m 6. Phirc 3 m	Phase no. 0 1 2 3 9 4 5 6	Start from N/A 0 1 2 3 9 1 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/C reduction	Barameters Loading insurt Nad Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multipliers Incremental multipliers	Delete. Time 0.00 5.00 0.02 1705 0.00 0.00
dentification Initial phase 1. Timburan 1,5m 5 day 2. Consolidation 200day 3. Timburne setsikh 1,5m Beban Jakin dinaki Initas 4. Consolidation til p=1 5. Priv: L,5m 6. Priv: 3. m 7. Priv: Consolidation	Phase no. 0 1 2 3 9 4 5 6 7	Start from N/A 0 1 2 3 9 1 3 4	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/C reduction Phi/C reduction Phi/C reduction	Baraneters Leading input N/A Staged Construction Staged Construction	Time 0.00 5.00 0.32 1705 0.00
dentification Initial phase 1. Timbuna 1. Sin 5 day 2. Consolidation 200day 3. Timbunen setelah 1. Sin Beban Jalin dan Ikal Initis 4. Consolidation till p=1 5. Phir cl. 3m 6. Phir cl. 3m 7. Phir C. Consolidation 5F	Phase no. 0 1 2 3 9 4 5 6 7 8	Start from N/A 0 1 2 3 9 1 3 4 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction	Baraneters Looding insut TV/A Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum pole pressure Incremental multiplers Incremental multiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 0.00
Antification Initial phase 1. Timburnan 1,5m 5 day 2. Consolidation 200day 3. Timburna resultsh 1,5m Beban Jakin ritsa 4. Consolidation til p=1 5. Rhiv C. 1,5m 6. Rhiv; 3. m 7. Rhiv Consolidation 5 ⁶ 9 (Straha and	Phase no. 0 1 2 3 9 4 5 6 7 8 8	Start from N/A 0 1 2 3 9 1 3 4 7 5	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction Phil(reduction) Phil(reduction)	Baraneters Leading input N/A Staged Construction Staged Science State Incremental multiplers Incremental multiplers Incremental multiplers	Delete. Time 0.00 5.00 200 0.32 1705 0.00 0.00 -179 -210
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Gambar 42. General Tanah Asli & Timbunan (Tanah Awal)

2) Parameter Tanah Asli & Timbunan (Tanah Awal)

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dentification Initial phase	Phase no. 0	Start from N/A	Calculation N/A	Loading input N/A	Time 0.00
dentification Initial phase 1.Timbunan 1,5m 5 day	Phase no. 0 1	Start from N/A 0	Calculation N/A Consolidation	Loading input N/A Staged Construction	Time 0.00 5.00
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day	Phase no. 0 1 2	Start from N/A 0 1	Calculation N/A Consolidation Consolidation	Loading input N/A Staged Construction Staged Construction	Time 0.00 5.00 200
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m	Phase no. 0 1 2 3	Start from N/A 0 1 2	Calculation N/A Consolidation Consolidation Consolidation	Loading input N/A Staged Construction Staged Construction Staged Construction	Time 0.00 5.00 200 5.00
dentification Initial phase J.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan lalu lintas	Phase no. 0 1 2 3 9	Start from N/A 0 1 2 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction	Time 0.00 5.00 200 5.00 0.32
Initial phase 1. Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan lalu lintas 4. Consolidation til p=1	Phase no. 0 1 2 3 9 4	Stort from N/A 0 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Leading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure	Time 0.00 5.00 200 5.00 0.32 1705
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolication 200dey 3. Timbunan setelah 1,5m Beban Jalan dan lak lintas 4. Consolication til p=1 5. Phi-< 1,5 m	Phase no. 0 1 2 3 9 4 5	Stort from N/A 0 1 2 3 9 1	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction	Leading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum prore pressure Incremental multipliers	Time 0.00 5.00 200 5.00 0.32 1705 0.00
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200dey 3. Timbunan setelah 1,5m Beban Jalan dan lalu Intas 4. Consolidation till p=1 5. Phri-c 1,5m 6. Phi-c 3 m	Phase no. 0 1 2 3 9 4 5 6	Start from N/A 0 1 2 3 9 1 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction	Leading input N/A Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplens Incremental multiplens	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00
Initia phase 1.Timbunan 1,5m 5 day 2. Consolication 200dey 3. Timbunan setelah 1,5m Beban Julen dan lalu intas 4. Consolication til p=1 5. PH-c 1,5m 6. PH-c 3 m 7. PH-c Consolication	Phase no. 0 1 2 3 9 4 5 6 7	Start from N/A 0 1 2 3 9 1 3 4	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction	Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers Incremental multiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 -179
dentification Intelliphase 1.Timbunan 1,5m 5 day 2. Consolidation 2004ay 3. Timbunan setelah 1,5m Beban Jalan dan lalu Intas 4. Consolidation til p=1 5. Phirk-1.3 m 6. Phirk-3 m 7. Phirk-Consolidation 5F	Phase no. 0 1 2 3 9 4 5 6 7 8	Start from N/A 0 1 2 3 9 9 1 3 4 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction	Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers Incremental multiplers Incremental multiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 -179 0.00
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dentification Initial phase 1. Timburan 1.5m 5 day 2. Consolidation 200day 3. Timburan settikh 1.5m Beban Jalan dan lalu lintae 4. Consolidation 31 p=1 5. Phil < 1.5m 6. Phil < 3 m 7. Phil < Consolidation 55 9 Januari and 9 Jeban gempa	Phase no. 0 1 2 3 9 4 5 6 7 8 10 11	Start from N/A 0 1 2 3 9 1 3 4 7 6 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Consolidation Phi/c reduction Phi/c redu	Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers Incremental multiplers Incremental multiplers Staged construction Total multiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 1705 0.00 0.00 10.00 s

Gambar 43. Parameter Tanah Asli & Timbunan (Tanah Awal)

3) Multipliers Tanah Asli & Timbunan (Tanah Awal)

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eneral Parameters Multiplier	9 Previ	ew						
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		Million .	11/A	2 940800	1.0000			
		Mweight:	N/A	2 -Mweigh	1.0000	2		
		Maccel:	N/A	∑ -Maccel:	0.0000			
		Msf:	0.0000	Σ-Msf:	1,5357	÷		
				6	Next	🛺 Insert	Br Delet	e.,
entification	Phase n	io. Star	t from Calculation	6	Next	t Insert	Delet	e
entification Initial phase	Phase n 0	io. Star N/A	t from Calculation	 	Next	_ 🚑 Insert	Delet	e
entification Initial phase 1.Timbunan 1,5m 5 day	Phase n 0 1	io. Star N/A O	t from Calculation N/A Consolidation	6 1 1	Next	t Insert	Delet	e
entification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day	Phase n 0 1 2	no. Star N/A 0 1	t from Calculation N/A Consolidation Consolidation	6	Next	t Insert	Delet	e
entification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m	Phase n 0 1 2 3	no. Star N/A 0 1 2	t from Calculation N/A Consolidation Consolidation Consolidation	6	Next	t Insert	Delet	e
entification Initial phase 1.Timbunan 1,5m 5 day 2. Consoldation 200day 3. Timbunan settleh 1,5m Beban Jalan dan lalu lintas	Phase n 0 1 2 3 9	10. Star N/A 0 1 2 3	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation		Next	The Insert	Time 0.00 5.00 200 5.00 0.32	e
entification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelet 1,5m Beban Jalan dan lalu initas 4. Consolidation dl p=1	Phase n 0 1 2 3 9 4	ro. Star N/A 0 1 2 3 9	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Next	t struction struction struction struction e pressure	Time 0.00 5.00 200 5.00 0.32 1705	e
entification Initial phase 1.Timbunen 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan lalu lintas 4. Consolidation dil p=1 5. Phirc 1,5 m	Phase n 0 1 2 3 9 4 5	10. Star N/A 0 1 2 3 9 1	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reducts	6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Next	t Insert at struction struction struction e pressure multiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00	e
entification Initial phase 1. Timburan 15,65 day 2. Consolidation 200day 3. Timburan settelah 1,5m Sebun Jahn dan Jula Jimas 4. Consolidation III p=1 5. PHi < 1,5m 6. PHi < 1,5m	Phase n 0 1 2 3 9 4 5 6	no. Star N/A 0 1 2 3 9 1 3	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reducti Phi/c reducti		Next	t Insert at struction struction struction e pressure multipliers multipliers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00	e
Intification Intifications 1,5m 5 day 2. Consolidation 200day 3. Trabunan settleh 1,5m Bebm Jalan dan Ialu Intas 4. Consolidation III p=1 5. PHic 1,5m 6. PHic 3 m 7. PHic 2 modiation	Phase n 0 1 2 3 9 4 5 6 7	no. Star N/A 0 1 2 3 9 1 3 4	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reductii Phi/c reductii Phi/c reductii	n 5 n 5 n 5 n 5 n 7 n 7 n 7 n 7 n 7 n 7 n 7 n 7 n 7 n 7	Next .oading inpu (/A staged Cons staged Cons staged Cons staged Cons staged Cons fininum por incremental incremental	t struction struction struction struction struction e pressure multiplers multiplers multiplers	Time 0.00 5.00 5.00 0.32 1705 0.00 0.00 1795 0.00	e
Initia phase Initia phase I.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan esteliki 1,5m 5ebin Jahl dan bia Intas 4. Consolidation III p=1 5. Phirc 1,5m 6. Phirc 3 m 7. Phir C.Consolidation ge	Phase n 0 1 2 3 9 4 5 6 7 8	10. Star N/A 0 1 2 3 9 1 3 4 7	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reducti Phi/c reducti Phi/c reducti Phi/c reducti	5 1 1 1 1 1 1 1 1 1 1 1 1 1	Next	the treest at struction struction struction struction e pressure multipliers multipliers multipliers multipliers	Time 0.00 5.00 200 0.32 1705 0.00 1705 0.00 1705 0.00 0.00 0.00	e
Intification Intificial phase 1. Timbunan 1, 5m 5 day 2. Consolidation 300day 3. Timbunan settien 1, 5m Beban Jakin dani Ialu Intaa 4. Consolidation III) == 1 5. Pili-c 1, 5m 6. Pili-c 3m 7. Pili-c Consolidation 5P [Forch ense]	Phase n 0 1 2 3 9 4 5 6 7 8 10	no. Star N/A 0 1 2 3 9 1 1 3 4 7 7 6	t from Calculation N/A Consolidation Consolidation Consolidation Consolidation Phylic reductio Phylic reductio Phylic reductio Phylic reductio Phylic reductio	5 1 1 1 1 1 1 1 1 1 1 1 1 1	Next	t t struction struction struction struction e pressure multipliers multipliers multipliers multipliers multipliers multipliers	Time 0.00 5.00 200 5.00 32.00 0.32 1705 0.00 0.00 0.00 0.00 -170 0.00 -210	E

Gambar 44. Multipliers Tanah Asli & Timbunan (Tanah Awal)

B. Tanah Setelah Terjadi Beban Gempa

1) General Tanah Setelah Terjadi Gempa

Japot Ougur Curves 🕞		*	Calculate		
General Parameters Multiplier	s Preview				
Phase			Calculation type	e	
Number / ID.: 11	Beban cempa		Dynamic anal	vsis 👻	
Charles Street and Street			-		
Start from phase: 7 - 7, Ph	-c Consolidatio	n .	-	Advanced	
Log info			Comments		
OK					
			-		
				Barameters	
				Barameters	elete
Identification	Phase no.	Start from	Calculation	Barameters	Delete
Identification	Phase no.	Start from	Calculation	Parameters	Time
Identification Initial phase 1.Timbunan 1,5m 5 day	Phase no. 0	Start from N/A	Calculation N/A Consolidation	Barameters	Delete
Identification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day	Phase no. 0 1 2	Start from N/A 0	Calculation N/A Consolidation Consolidation	Esrameters	Delete
Identification Initial phase 1. Trebunan 1,5m 5 day 2. Cansoldation 200day 3. Trebunan settlah 1,5m	Phase no. 0 1 2 3	Start from N/A 0 1 2	Calculation N/A Consolidation Consolidation Consolidation	Esrameters Escaling input IvA Staged Construction Staged Constructio	Delete Delete Dolog Time D.00 S.00 200 S.00
Identification Initial phase I. Timbunan 1,5m 5 day 2. Canaeldaton 2006ay 3. Timbunan setiah 1,5m Beban Jalen dan labu Intas	Phase no. 0 1 2 3 9	Start from N/A 0 1 2 3	Calculation N/A Consolidation Consolidation Consolidation	Exampters	Delete
Identification Initial phase 1. Trabunan 1, 5m 5 day 2. Canselidation 200day 3. Timbunan setelah 1,5m Reban Jalan dan laki Initas 4. Canselidation 18 p=1	Phase no. 0 1 2 3 9 4	Start from N/A 0 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Esrameters Esameters Loading input IV/A Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure	Delete
Identification Initial phase 1. Timbunan 1,5m 5 day 2. Consolidation 2004ay 3. Timbunan settleh 1,5m. Beban Jalan dan lalu intas 4. Consolidation till p=1 5. Phir c 1,5 m	Phase no. 0 1 2 3 9 4 5	Start from N/A 0 1 2 3 9 1	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	Braneters Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multipliers	Delete Time 0.00 5.00 200 0.32 1705 0.00
Identification Initial phase I.Tributunan 1,5m 5 day 2. Consolidation 200day 3. Tributunan acticitin 1,5m Bebari Jalan dan laki Initias 4. Consolidation 81 pc 1 5. Pilvic 1,5m 6. Pilvic 3 m	Phase no. 0 1 2 3 9 4 5 6	Start from N/A 0 1 2 3 9 1 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phylic reduction Phylic reduction	Branetes Leading inst. NA Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers	Expedience Time 0.00 5.00 0.32 0.00 0.00
Identification Initial phase 1. Thinkunan J, fan S day 2. Consolidation 200day 3. Timburan setsish 1, Sin Beban Jakin dan Jaki J, Sin Beban Jakin dan Jaki Jakas 4. Consolidation 18 p=1 5. Phire L, Sim 6. Phire 3 m 7. Phire Consolidation	Phase no. 0 1 2 3 9 4 5 6 7	Start from N/A 0 1 2 3 9 1 3 4	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phylic reduction Phylic reduction	Branctes Loading irput 11/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multipless Incremental multipless	Time 0.00 5.00 5.00 0.32 1705 0.00 0.00 1.705 0.00 1.705
Identification Initial phase 1. Tribunan 1. Sin 5 day 2. Consideration 200day 3. Tribunan estable 1. Sin Beban Jalan dan Ialu Initia 4. Consideration 31 pe 1 5. Piler 1. Sin 6. Piler 2 m 7. Piler Consolidation 5F	Phase no. 0 1 2 3 9 4 5 6 7 8	Start from N/A 0 1 2 3 9 1 3 4 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phylic reduction Phylic reduction Phylic reduction	Branctos Next Pret Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum por pressure Incremental multiplers Incremental multiplers	Delete Delete 0.00 5.00 200 0.02 0.02 0.00 0.00 0.00 0.00
Identification Initial phase 1. Timburan J, lim S day 2. Consolidation 200day 3. Timburan esticibil, Jam Bebra Jain dao laki Initias 4. Consolidation 18 (===================================	Phase no. 0 1 2 3 9 4 5 6 7 8 10	Start from N/A 0 1 2 3 9 1 3 4 7 6	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Consolidation Phile reduction Phile reduction Phile reduction Phile reduction	Branctos Loading input IVA Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minisum poro presure Incremental multipless Incremental multipless Incremental multipless Incremental multipless Incremental multipless	Image Delete Time 0.00 5.00 200 100 1705 0.00 0.00 -179 0.00 -210 -210

Gambar 45. General Tanah Setelah Terjadi Gempa

2) Parameter Tanah Setelah Terjadi Gempa

ngur Curpur Currer	. 8	-	Calculate		
Control parameters Multipler Control parameters Additional Steps: 250	rs Preview	∏ Rese	t displacements to zero e undrained behaviour e intermediate steps		
Iterative procedure		Coading in Costao Costao Costao Time inte	put ed construction i multipliers erval : 10.0000 (\$	Advanced	
	Deutle	Comate	d end time : [1697.00(]	GW HOW	
dentification	Phase no.	Start from	Calculation		Delete
lentification	Phase no.	Start from	Calculation	N/A	Delete.
Jentification Initial phase 1. Timbunan 1,5m 5 day	Phase no. 0	Start from	Calculation	Very <u>OVE HOW</u> Loading input N/A Staged Construction	☐ Delete. Time 0.00 5.00
lentification Initial phase 1.Timbunan 1,5m 5 day 2. Correctidution 200day	Phase no. 0 1 2	Start from N/A	Calculation N/A Consolidation Consolidation	Key <u>Wr How</u> Aust <u>R</u> Insert Loading input N/A Staged Construction Staged Construction	Time 0.00 5.00 200
Initial phase 1.Timbunan 1,5m 5 day 2. Considiation 200day 3. Timbunan steleh 1,5m	Phase no. 0 1 2 3	Start from N/A	Calculation N/A Consolidation Consolidation Consolidation	Hext Distriction Key GW How Leading input N/A Staged Construction Staged Construction	Delete.
kentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 2004ay 3. Timbunan setelah 1,5m Bebah Jalan dan Jalu Inta	Phase no. 0 1 2 3 9	Start from N/A 1 2 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	Korr How Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction	Time 0.00 5.00 200 5.00 0.32
Initial phase 1.Timbunan 1,5m 5 day 2. Consolitation 200day 3. Timbunan setelah 1,5m Beban Jalan dari lalu lintas 4. Consolitation 101 p=1	Phase no. 0 1 2 3 9 4	Start from N/A 0 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	Construction Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum prior pressure	Delete.
Sentification Initial phase 1. Timburan 1,5m 5 day 2. Consolidation 2004ay 3. Timburan setelah 1,6m Beban Jalan dari falu lintas 4. Consolidation till p=1 5. Phirc 1,5 m	Phase no. 0 1 2 3 9 4 5	Start from N/A 0 1 2 3 9 1	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Ph/C reduction	Kong Prov Loading Input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum price pressure Incremental inul/plens	Delete. Time 0.00 5.00 200 5.00 0.32 1705 0.00
kntificaton Initial phase I. Timbunan I., Sm S day 2. Consolidation 200day 3. Timbunan setelah I., Sm. J. Eebah Jalin dari Juli Hata 4. Consolidation till p=1 5. PHrc J.Sm 6. PHrc J.Sm	Phase no. 0 1 2 3 9 4 5 6	Start from N/A 0 1 2 3 9 1 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Consolidation Ph/C reduction Ph/C reduction	Construction Staged Construction Incommutal inulgalers Incommutal inulgalers	Delete.
kentification Initial phase 1. Tribunon 1,5m 5 day 2. Consilidation 200day 3. Tribunon setteh 1,5m Beban Jakin dan laki Initas 4. Consolidation til p=1 5. Pric 1,5m 6. Pric 3 m 6. Pric 3 m	Phase no. 0 1 2 3 9 4 5 6 7	Start from N/A 0 1 2 3 9 1 3 4	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Ph/C reduction Ph/C reduction	Konger How Konger How Konger How Konger Konger How Konger Konstruction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers Incremental	Delete.
Antification Prild phase 1.Trebunn to Se S day 2. Canadidation 200day 3. Trebunna tetkish 1.5m Beban Jalan dari Islai Intar 4. Consolisition 01 p=1 5. PH-c J.5m 6. PH-c J.m 5P 5P	Phase no. 0 1 2 3 9 4 5 6 7 8	Start from N/A 0 1 2 3 9 1 3 4 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction	yerread y	Delete. Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 0.00 0.00
Antification Initial phase 1. Tribunen 1.5m 5 day 2. Caracildation 200day 3. Tribunen steath 1.5m Beban Julan dan laki Initia 4. Caracildation III p=1 5. PH=C 1.5m 6. PH=G 3m 7. PH=C Consolidation SP 9. Tanah avail	Phase no. 0 1 2 3 9 4 5 6 7 8 10	Start from N/A 0 1 2 3 9 1 3 4 7 6	Catalation NA Consolidation Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction	yerread y	Delete. Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 1795 0.00 -179 0.20

Gambar 46. Parameter Tanah Setelah Terjadi Gempa

3) Multipliers Tanah Setelah Terjadi Gempa

Input Curver 🗠			-	alculate				
General Parameters Multiple	Preview	E						
Shon	ing	remental n	ultiplers		Total multi	niers		
Input values			IN /A	14	T-Miler	DI/A		
C Beached values	M	and A:	100		E Monda	1.0000		
		in.	nya Inga		E 10000	1.0000		
	1980	DECE:	N/A	<u> </u>	2 1910308	1.0000	I	
	Phy	veight:	N/A	•	Σ -Mineight	t: 1.0000		
	Ma	iccel:	N/A	\$	Σ -Maccel:	0.0500	\$	
	Ms	if:	0.0000	\$	Σ-Msf:	1.4332	•	
					2	Next	Insert	Delete.
Identification	Phase no.	Star	t from	Calculation	-	Next	🜉 Insert	Time
identification Initial phase	Phase no.	Star	t from	Calculation N/A	-	Next	🔍 Insert	Time 0.00
dentification Inital phase 1. Timbunan 1,5m 5 day	Phase no. 0 1	Star N/A 0	t from	Calculation N/A Consolidation		Next	Insert	Time 0.00 5.00
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day	Phase no. 0 1 2	Star N/A 0 1	t from	Calculation N/A Consolidation Consolidation		Next	Insert uction	Time 0.00 5.00 200
dentification Inital phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m	Phase no. 0 1 2 3	Star N/A 0 1 2	t from	Calculation N/A Consolidation Consolidation Consolidation		Next	Insert Insert	Time 0.00 5.00 5.00 5.00
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan lalu Intas	Phase no. 0 1 2 3 9	Star N/A 0 1 2 3	t from	Calculation N/A Consoldation Consoldation Consoldation Consoldation	_	Next	Insert uction ruction ruction ruction	Time 0.00 5.00 200 5.00 0.32
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 2004y 3. Timbunan setelah 1,5m Beban Jalan dan lalu Initas 4. Consolidation til p=1	Phase no. 0 1 2 3 9 4	Star N/A 0 1 2 3 9	t from	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation		Next	Insert Insert	Time 0.00 5.00 200 5.03 0.32 1705
Identification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 2004ay 3. Timbunan setelah 1,5m Beban Jalan dan lalu Intas 4. Consolidation til p=1 5. Phi-c 1,5 m	Phase no. 0 1 2 3 9 4 5	Star N/A 0 1 2 3 9 1	t from	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction		Next	Linsert nuction nuction nuction pressure ultipilers	Time 0.00 5.00 200 5.00 0.32 1705 0.00
Identification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan settelah 1,5m Beban Jalan dan lalu Intas 4. Consolidation til p=1 5. Privc 1,5m 6. Privc 3 m	Phese no. 0 1 2 3 9 4 5 6	Star N/A 0 1 2 3 9 1 3	t from	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction		Next	Linsert uction uction ruction pressure ultpilers ultpilers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00
Initi chose Initi chose I.Timbunan 1,5m 5 day 2. Cansoldation 200day 3. Tribunan setelah 1,5m Beban Jalan dan laiu lantas 4. Consoldation til p=1 5. Pirk-1,5m 6. Pirk-2 Jm 7. Pirk-Consolication	Phase no. 0 1 2 3 9 4 5 6 7	Star N/A 0 1 2 3 9 1 3 4	t from	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction		Next .oading input V/A Staged Constr Staged	Linsert nuction nuction pressure nutplens nutplens nutplens nutplens	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 179
Identification Initial phase I. Tritebuna J.Sm 5 day 2. Consolidation 2006ay 3. Tritebuna settaliki 1. J.Sm Beban Jalin dari Jalu Intsa 4. Consolidation III p=1 5. Privt. 1. J.Sm 6. Privt. 2 m 7. Privt. Consolidation SF	Phase no. 0 1 2 3 9 4 5 6 7 8	Ster N/A 0 1 2 3 9 1 3 4 7	t from	Calculation N/A Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction		Next	Insert uction uction ruction pressure ultplers ultplers ultplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 0.00
Identification Initial phase 1. Timbunan 1.5m 5 day 2. Cansoldation 2006ay 3. Timburan setsiki 1.5m Beban Jalan dan lalu Initia 4. Consoldation 18 jun 1 5. Pirk- 1.5m 6. Pirk-3 m 7. Pirk-Consoldation 5 ⁶ 9. Tanah awal	Phase no. 0 1 2 3 9 4 5 6 7 8 10	Ster N/A 0 1 2 3 9 1 3 4 7 6	t from	Calculation N/A Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction		Next	Insert uction ruction ruction pressure ultiplers ultiplers ultiplers ultiplers ultiplers	Time 0.00 5.00 200 5.00 0.32 1705 0.00 -179 0.00 -210
Identification Initial phase Limburan J.Sm 5 day 2. Consolidation 200day 3. Timburan settih J.Sm Beban Jatin dan lalu lintas 4. Consolidation till p=1 5. Phi-c 1,5 m 6. Phi-c 3 m 7. Phi-c Consolidation 5 ⁶ Tanah avail § Joban genga	Phase no. 0 1 2 3 9 4 5 6 7 8 10 11	Star N/A 0 1 2 3 9 1 3 4 7 6 7	t from	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction		Next	Insert uction uction uction uction pressure ultpilens ultpilens ultpilens ultpilens ultpilens ultpilens ultpilens ultpilens uction I	Time 0.00 5.00 200 5.00 0.32 1705 0.00 0.00 0.00 0.00 0.00 0.00 1795 0.00 129 10.00 210

Gambar 47. Multipliers Tanah Setelah Terjadi Gempa

C. Calculate

1) Priview



Gambar 48. Priview

2) Update





3) Hasil Calculate

Input Output Ourses			> Output		
2eneral Parameters Multiplier	s Preview		Cala Jalian han		
riase			- Calculation typ	e	
Number / ID.: 11	Beban gempa		Dynamic ana	ilysis 💌	
Start from phase: 7 - 7. Phi-	-c Consolidatio	n	•	Advanced	
Log info			Comments		
lox.					
C.C.					
				Parameters	
				Rext 🔍 Insert	Delete
dentification	Phase no.	Start from	Calculation	Loading input	Time
dentification	Phase no.	Start from N/A	Calculation N/A	Loading input	Delete
dentification Initial phase 1.Timbunan 1,5m 5 day	Phase no. 0 1	Start from N/A 0	Calculation N/A Consolidation	Loading input N/A Staged Construction	Time 0.00 5.00
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day	Phase no. 0 1 2	Start from N/A 0 1	Calculation N/A Consolidation Consolidation	Loading input N/A Staged Construction Staged Construction	Delete Time 0.00 5.00 200
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m	Phase no. 0 1 2 3	Start from N/A 0 1 2	Calculation N/A Consolidation Consolidation Consolidation	Next Insert Loading input N/A Staged Construction Staged Construction Staged Construction	Time 1 0.00 5.00 5.00 5.00
dentification Initial phase 1. Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan laku lintas	Phase no. 0 1 2 3 9	Start from N/A 0 1 2 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation	Next Insert Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction	Time 1 0.00 5.00 200 5.00 0.32
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalan dan laku lintas 4. Consolidation till p=1	Phase no. 0 1 2 3 9 4	Start from N/A 0 1 2 3 9	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation	Next Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure	Time 1 0.00 5.00 200 5.00 0.32 1705
dentification Initial phase 1.Timbunan 1,5m 5 day 2. Consolication 200day 3. Timbunan setelah 1,5m Beban Jalan dan lalu lintas 4. Consolidation till p=1 5. Phi<1,5 m	Phase no. 0 1 2 3 9 4 5	Start from N/A 1 2 3 9 1	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Ph//c reduction	Next Insert Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiplers	Time 1 0.00 5.00 200 5.00 0.32 1705 0.00
dentification Initial phase 1. Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setelah 1,5m Beban Jalen dal Julintas 4. Consolidation til p=1 5. Phil-c 1,5 m 6. Phil-c 3 m	Phase no. 0 1 2 3 9 4 5 6	Start from N/A 0 1 2 3 9 1 3	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/C reduction Phi/C reduction	Loading input N/A Loading input N/A Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incremental multiples Incremental multiples	Time 1 0.00 5.00 200 5.00 0.32 1705 0.00 0.00
Intel phase Intel phase I. Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan setlah 1,5m Beban Jalen dan lalu lintas 4. Consolidation til p=1 5. Phi-C 1,5 m 6. Phi-C 3 m 7. Phi-C consolidation	Phase no. 0 1 2 3 9 4 5 6 7	Start from N/A 0 1 2 3 9 1 3 4	Calculation N/A Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction	Avert A	Time 1 Time 1 0.00 5.00 200 5.00 0.32 1705 0.00 1705 0.00 1705 1705
Identification Initial phase 1. Timbunan 1,5m 5 day 2. Consolidation 200day 3. Timbunan estelah 1,5m. Beban Jalen dan laku Intas 4. Consolidation till p=1 5. Phil-(1,5m 6. Phil-(3m 7. Phil-(Consolidation SF	Phase no. 0 1 2 3 9 4 5 6 7 8	Start from N/A 0 1 2 3 9 1 3 4 7	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/Jr eduction Phi/Jr eduction Phi/Jr eduction	NA NA Leading input NA Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum pore pressure Incomental multiples Incomental multiples Incomental multiples	Time 1 0.00 5.00 200 0.32 1705 0.00 0.00 1705 0.00 0.00 179 0.00
dentification Initial phase 1.7mbrunn 1,5m 5 day 2. Consolidation 200day 3. Tmbrunn estellikh 1,5m Beban Jakin Idal Initsa 4. Consolidation III p=1 5. Pirk-1,5 m 6. Pirk-3 m 5F - Pirk-6 m 5F - Tanch and	Phase no. 0 1 2 3 9 4 5 6 7 8 10	Start from N/A 0 1 2 3 9 1 3 4 7 6	Calculation N/A Consolidation Consolidation Consolidation Consolidation Consolidation Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction Phi/c reduction	NA Leading input NA Staged Construction Staged Construction Staged Construction Staged Construction Staged Construction Minimum proc pressure Incremental multiplers Incremental multiplers Incremental multiplers Staged construction	Time 1 0.00 5.00 5.00 0.32 1705 0.00 0.00 0.00 0.00 0.00 179

Gambar 50. Hasil Calculate





Gambar 51. Deformed Mesh

Besar Angka Keamanan / Safety Factor yang dihasilkan yaitu sebesar :

-	Beban Tanah Awal	= 1,5357
-	Beban Setelah Gempa	= 1,4332
_	Selisih Beban	= 0,1025

D. Curva Dynamic

1) Curva Dynamic A



Gambar 52. Curva Dynamic A

2) Curva Dynamic B



Gambar 53. Curva Dynamic B

3) Curva Dynamic C



Gambar 54. Curva Dynamic C

4) Gabungan Curva Dynamic A, B dan C



Gambar 55. Gabungan Curva Dynamic A, B dan C

5. KESIMPULAN DAN SARAN

Kesimpulan

Kesimpulan yang dapat diambil dari penelitian ini diantaranya adalah :

- 1) Dari hasil pemodelan *Deformed mesh, nilai Settlement*/ Penurunan yang dihasilkan dari pemodelan menggunakan Plaxis 8.2 yaitu sebesar: -0,006 m.
- 2) Tegangan Tanah / Effective stresses
 - a. Nilai Effective stresses, extreme effective stress sebesar -420,01 kN/m²
 - b. Nilai Total stresses, extreme total stress sebesar -827,64 kN/m²
 - c. Nilai Active pore pressure, extreme active pore pressure -408,35 kN/m²
- 3) Nilai Safety factor yang didapat dari pemodelan ini sebesar 1,441. Pemodelan ini masih aman apabila digunakan karena nilai sefty factor masih lebih besar dari nilai peraturan yang diharuskan sebesar 1,25 (SNI 8460 : 2017. Hal 134 dari 303).

- 4) Nilai Safety factor beban tanah sebelum dan sesudah terjadi gempa yaitu :
 - Beban Tanah Awal = 1,5357
 - Beban Setelah Gempa = 1,4332
 - Selisih Beban = 0,1025

Saran

Saran yang dapat diberikan untuk penelitian yang akan datang adalah sebagai berikut :

- Peninjauan beban gempa dan pengaruh muka air terhadap analisis pemodelan MEH.
- 2) Peninjauan konsolidasi jangka panjang terhadap pemodelan untuk mengetahui efektifitas pada timbunan di atas tanah lunak.
- Analisis perubahan tekanan air pori selama masa konstruksi dan konsolidasi berlangsung.
- Analisis pemodelan MEH dengan jenis input model tanah hardening soil, soft soil atau soft soil creep yang lebih relevan dengan sifat tanah lunak.

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