REINFORCED CONCRETE OF ABUTMENT A-1 = A-2 KREO BRIDGE

File:RC-A1-3

REINFORCED CONCRETE OF ABUTMENT A-1:

The earth pressure under the normal condition (C	ase I):		
Height of Abutment	H= .	5.0	m
Width of footing Abutment	8 =	3.5	m
Length of footing Abutment	L=	2.7	m
Load	q =	1.0	t/m'
Pa1 = 1/2 * g * H^2 * Ka * L =		12.18	389 t
Pa2 = pa2 * H * L =		3.20)76 t
Pa1h = Pa1 * cos δ =	.*	10.55	556 t 💎
Paly = Pal * sin δ =		6.09	944 t
$Pa2h = Pa2 \cdot \cos \delta =$		2.77	778 t 🕝
$Pa2v = Pa2 \cdot \sin \delta =$		1.60	038 t

part	Weight of part	- X	Arm (m)	Moment ((on m.)
1	0.3*1.27*2.5*2.7 =	2.5718	0.965	2.4817
2	1.115'0.5'2.5'2.7 =	3.7631	0.5575	2.0979
3	(1.115+0.5)/2*0.53*2.5*2.7=	2.8888	0.8075	2.3327
4	((1+0.5)/2)*1.7*2.5*2.7 =	8.6063	0.75	6.4547
P	45	46.0000	0.25	11.5000
Paiv	6 09444	6.0944	1,1150	
	10.55557	10.5556	-1.3333	-14.0741
	1.69380	1.6038	1.1150	1,7882
	2 77778	2.7778	-2.0000	-5.5556
	Total : ΣFV =	84.8615	$\Sigma Mr =$	13.8210

Mdes = 1.2 * Mr = %

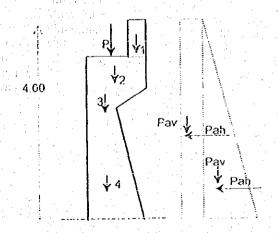
16.58518 ton m =

Normal Force N =

63.8300 ton =

638.3 kN

The concrete stress fo' = 22.05 Mpa
The yield stress of steel fy = 156.86 Mpa



REINFORCED CONCRETE OF ABUTMENT ON TOE AND HEEL:

```
Compute soil pressure:
          qmax = {SFv/B}^* {1 + (6^e)/B} =
                                                          53,700 ton / m
                                                          17.595 ton / m
           qmin = {SFv/B}^* {1-(6^e)/B} =
                         36.105 ton / m
                       12.37886 ton / m
           q2 =
                      29.97386 ton / m
           a2-2 =
                                             1.875 ton / m
           Berat sendiri q =
                             1.3 m
                                           13.283 ton m / m
Mmax1 = qmin * L1*L1/2 =
                                            3.487 ton m / m
Mmax2 = 1/2 \cdot q2 \cdot L1 \cdot 1/3 \cdot L1 =
                                           16.770 ton m / m
Mmax total =
                                           20.124 ton m/m
Mdes = 1.2 * Mmax =
                                            22.05 Mpa
The concrete stress fc' =
                                            156.86 Mpa
The yield stress of steel fy =
                                             1000 mm
Dimension of concrete
                             b =
                                             1000 mm
                             d =
                                               850 mm
                                                         0.08051
\rho b = [\{\beta 1^*fc'^*0.85\} / fy]^*[600 / 600 + fy] =
                                                         0.00893
\rhomin = 1.4/fy =
                                                           0.022
Coeficient k =
                                                         0.00177
\rho = k*\rho b =
                                                         1505.61 mm^2
As1 = \rho * b * d =
                                                       236169.47 N
T1 = As1'fy =
                                                           12.60 mm
a1 = T1/(0.85'fc''b) =
                                                          843.70 mm
Z = d - 0.5 a1 =
                                                      199256091 Nmm
Mr1 = T1 * Z =
                                                          199.26 KNm
                                                          201,24 KNm
Because Mmax > Mr1 , required double reinforced concrete
                                                             1.99 KNm
\Delta M = Mmax - Mr1 =
                                                            16.87 mm^2
As2 = \Delta M / fy(d-d') =
                                                         1522.48 mm^2
As= As1 + As2 =
                                                                    1889.23 mm<sup>2</sup>
                                     D 19 - 150
                                                    As terpsg =
tensile of steel bars:
                                                                     803.84 mm<sup>A</sup>2
                                     D 16 - 250
                                                    As' terpsg =
compressive of steel bars:
                                                                      304.50 mm<sup>2</sup>
Longitudinal steet bars : 20 % As =
                                                                      530.66 mm<sup>2</sup>
                                     D 13 - 250
                                                    As bagi =
```

REINFORCED CONCRETE OF ABUTMENT A-1=A-2

The earth pressure under the normal cond	dition:		
Height of Abutment	H=	5.0	m
Width of footing Abutment	8 = 12	3.5	∃ m
Length of footing Abutment	L=	. 2.7	m
Load	q =	1.0	t/m
	* 15 to 2	- 1 TV 1	* - 1 · ·
Pa1 = 1/2 *γ* H^2 * Ka * L =		8.298	34 t
Pa2 = pa2 * H * L =		4.610	02 t
Path = Pat * $\cos \delta$ =	1.0	7.800	05 t 🖖
Pa1v = Pa1 * sin δ =		2.838	30 t
Pa2h = Pa2 * cos δ =		4.333	36 t
P_{2} = P_{3} * $\sin \delta =$		1.576	37 t

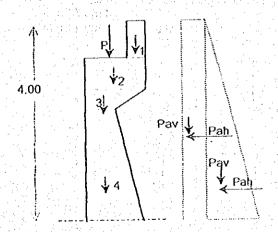
part	Weight of part	- : :-	Arm	Moment
port	((on)		(m)	(ton m)
1	03'1.27'2.5'2.7 =	2.5718	0.965	2.4817
2	1.115'0.5'2.5'2.7 =	3.7631	0.5575	2.0979
$-\frac{2}{3}$	(1.115+0.5)/2*0.53*2.5*2.7=	2.8888	0.8075	2.3327
4	((1+0.5)/2)*1.7*2.5*2.7 =	8.6063	0.75	6.4547
P	46	46,0000	0.25	11.5000
Paiv	2.83804	2.8380	1,1150	3.1644
	7.80045	7.8005	-1.3333	-10.4006
	1.57669	1.5767	1,1150	1.7580
	4.33358	4.3336	-2.0000	-8.6672
	Total: \(\Sigma\) Fv' = \(\frac{1}{2}\)	63.8300	∑ Mr =	10.7217

Mdes = 1.2 * Mr = Normal Force N = 12.866 ton m = 63.8300 ton =

128,661 kNm 638,3 kN

The concrete stress fc' =
The yield stress of steel fy =

22.05 Mpa 156.86 Mpa

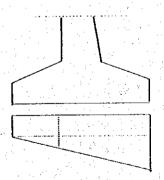


File:RC-A2-3

REINFORCED CONCRETE OF ABUTMENT ON TOE AND HEEL:

Compute soil pressure:

```
qmax = {\Sigma Fv/B}^* {1 + (6^*e)/B} =
                                                        29.809 ton / m
                                                        12.095 ton / m
          gmin = \{ \Sigma Fv/B \}^* \{ 1 - (6^*e)/B \} =
                      17.71391 ton / m
          q2 =
                      6.073341 ton / m
          q2-2 = 3 - 18.16852 \text{ ton / m}
                                                         1.875 Vm
          Weight of concrete q =
                            1.2 m
                                                        10.220 Vm
          qw = qmin - q =
                                            1.350 ton m / m
Mmax1 = qw * L1*L1/2 =
                                            1.458 ton m / m
Mmax2 = 1/2*q2*L1*1/3*L1 =
                                            2.808 ton m / m
Mmax total =
                                            3.369 ton m / m
Mdes = 1.2 * Mmax =
the concrete stress fc' =
                                            22.05 Mpa
                                           156.86 Mpa
the yield stress of steel fy =
                                            1000 mm
Dimension of concrete
                                            1000 mm
                                             850 mm
                             d =
\rho b = [\{\beta 1^* fc'^0.85\} / fy]^* [600 / 600 + fy] =
                                                       0.08051
                                                       0.00893
\rhomin = 1.4/fy =
                                                           0.02
Koefisien k =
                                                        0.0016
ρ = k*ρb =
                                                       1368.73 mm^2
As1 = \rho * b * d =
                                                      214699.5 N
T1 = As1'fy = . -
                                                         11.46 mm
a1 = T1 / (0.85'fc"b) =
                                                        844.27 mm
Z = d - 0.5 a1 =
                                                    181264872 Nmm
Mr1 = T1 * Z =
                                                         181.26 KNm
                                                         33.69 KNm
Mmax =
Because Mmax < Mr1, required single reinforced concrete:
                                                       1368.73 mm<sup>2</sup>
As = p^* b^* d =
                                                       1889.23 mm^2
                                    D 19 - 150
dipakai tulangan :
```



REINFORCED CONCRETE OF ABUTMENT A-1=A-2:

The earth pressure under the norn	rat condition:			
Height of Abutment		H =	5.0	m
Width of footing Abutment	1.5	8 =	3.5	m
Length of footing Abutment		l=	2.7	m
Load		q =	1.0	t/m
Pa1 = 1/2 * y1 * H1^2 * Kea	* L ==	•	19.3709	
Pa2 = pea2 * H1 * L =			5.0976	t .
Pa1h = Pa1 * cos δ =			18.7123	t
Pa1v = Pa1 * $\sin \delta$ =			5.0171	t ·
Pa2h = Pa2 * cos δ =			4.9243	t
Pa2v = Pa2 * sin δ =		4.11	1,3203	t .
	A contract of the contract of		A Company of the Comp	

part	Weight of part		Arm	Moment
P - 1	(ton)	11 141	(m)	(ton m)
1	0.3'1.27'2.5'2.7 =	0.9525	0.965	0.9192
2	1,115'0.5'2.5'2.7 =	1.3938	0.5575	0.7770
3	(1.115+0.5)/2*0.53*2.5*2.7=	1.0699	0.8075	0.8640
4	((1+0.5)/2)*1.7*2.5*2.7 =	3.1875	0.75	2.3906
Р	46	46.0000	0.25	
Palv	5.01706	5.0171	1,1150	
Path	18.71227	18.7123	-1,3333	
Pa2v	1,32028	1.3203	1.1150	1
Pa2h	4.92428	4.9243	-2.0000	-9.8486
ΚP		6.9000	-2.7800	-19.1820
Kw1		0.9906	-1.3650	-1.3521
Kv2		4.4961	-2.0000	-8.9922
	Total : ΣFv' ::	52.6037	$\Sigma Mr =$	-40.8076

46.0000 ton P =

6.6037 ton Wabutment =

29.9739 ton Wsoil =

 $KP = 0.15 \cdot P =$ 6.9000 ton

0.9906 ton KW1 = 0,15*Wabut =

4.4961 ton Kv/2= 0,15 Wsoil =

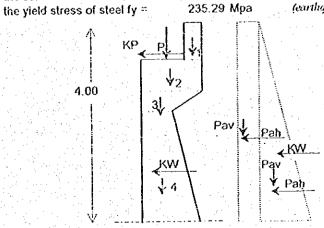
48.969 ton m = .Mdes = 1.2 * Mr = 52.6037 ton =

489,691 kNm 526.0 kN

Normal Force N = the concrete stress fc' =

33.075 Mpa

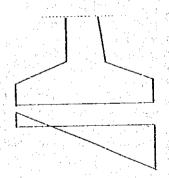
(carthquake condition fc' = 1.5xfc') (earthquake condition fv = 1.5xfv)



REINFORCED CONCRETE OF ABUTMENT ON TOE AND HEEL:

Compute soil pressure:

```
qmax = {\Sigma Fv/B}^* {1 + (6*e)/B} =
                                                       83.822 ton / m
          qmin = \{\Sigma \text{ Fv/B}\}^* \{1 - (6'e)/B\} =
                                                      -13.416 ton / m
                     3. 1.2 m
          L1 =
Mmax1 =1/2qmin * L1*L1*2/3 =
                                          6.439 ton m / m
                                          6.439 ton m / m
Mmax total =
                                          7.727 ton m / m
Mdes = 1.2 * Mmax =
                                         33.075 Mpa
the concrete stress fc' =
                     (earthquake condition fc=1.5*fc')
                                         235.29 Mpa
the yield stress of steel fy =
                     (earthquake condition fv=1.5*fy)
                           ht =
                                            1000 mm
Dimension of concrete
                                            1000 mm
                            b≖
                                             850 mm
                            d =
\rho b = [ \{\beta 1^* (c'^0.85) / fy \}^* [600 / 600 + fy] =
                                                        0.0730
                                                        0.0060
pmin = 1.4/fy =
                                                        0.0300
Koefisien k =
                                                        0.0022
ρ = k*ρb =
                                                       1860.32 mm^2
As1 = \rho \cdot b \cdot d =
                                                     437715.4 N
 T1 = As1*fy =
                                                         15.57 mm
a1 = T1 / (0.85*fc**b) = 100
                                                        842.22 mm
 Z = d - 0.5 a1 =
                                                    368650620 Nmm
 Mr1 = T1 \cdot Z =
                                                        368.65 KNm
                                                         77.27 KNm
 Mmax ≍
 Because Mmax < Mr1 required single reinforced
                                                       1860.32 mm^2
 As = \rho \cdot b \cdot d =
                                                       1889.23 mm^2
                                 D 19 - 150
 use reinforced:
```



```
The earth pressure under the earthquake condition (Case IV):
                                                            5.0
                                                                      m
     Height of Abutment
                                                            3.5
                                                                      m
                                                  8 =
      Width of footing Abutment
                                                            2.7
                                                                      m
                                                  L=
      Length of footing Abutment
                                                                      t/m
                                                  q =
                                                            1.0
      Load
      Coefficient of active earth pressure:
                                          0.472
                               Kea =
      Acting earth pressure:
      H1 = + 153 60 - 151 80 =
                                                 : 1.8 m
      H2 = H - H1 =
                                                  2.2 m
                                               3.5872 t/m^2
      pa1 = Kea * yl *H1 =
                                                0.472 t/m^2
      pa2 = Kea * q =
                                               4.0592 t/m^2
      pa3 = ( pa1 + pa2 ) =
                                              0.93456 t/m^2
      pa4 = Kea * γsub *H2 =
                                              3.92260 t
      Pa1 = 1/2 * y1 * H1^2 * Kea * L =
                                              2.29392 t
      Pa2 = pea2 * H1 * L =
                                             24.11165 t
      Pa3 = pea3*H2*L =
                                              2.77564 t
      Pa4 =pea4*H2/2*L =
                      cos 15 =
                                  0.96593
                                  0.25882
                       sin 15 =
                                                       length from bottom of footing
                                                                 h1 = 2.8
      Pa1h = Pa1 * cos δ =
                                  3.78896 t
      Pa1v = Pa1 * sin δ =
                                   1.01525 t
                                                                  h2 = 3.1
      Pa2h = Pa2 * cos δ =
                                  2.21577 t
      Pa2v = Pa2 * sin δ =
                                  0.59371 t
                                                                  h3 = 1.1
                                                                                 m
      Pa3h = Pa3 * cos δ =
                                   3.92090 t
      Pa3v = Pa3 * \sin \delta =
                                   1.05060 t
                                                                  h4 = 0.733
                                                                                  m
      Pa4h = Pa4 ^{\circ} cos \delta =
                                   2.68108 t
      Pa4v = Pa4 * \sin \delta =
                                   0.71839 t
```

	—————i	A	Moment
Weight of part			Moment
(ton)	1	(m)	(lon m)
0.3'1.27'2.5'2.7 =	2 5718	0.965	2.4817
1.115'0.5'2.5'2.7 =	3.7631	0.5575	2.0979
(1,115+0.5)/2*0.53*2.5*2.7=	2.8888	0.8075	2.3327
	8.6063	0.75	6.4547
46	46.0000	0.25	11.5000
1.01525	1.0152	1.1150	1,1320
3.78896	3.7890	-2.8000	-10.6091
0.59371	0.5937	1.1150	0.6620
	2.2158	-3.1000	-6.8689
1.05060	1.0506	1,1150	1.1714
	3.9209	-1.1000	-4.3130
	0.7184	1.1150	
	2.6811	-0.7333	
	6.9000	-2.7800	-19.1820
	2.6745	-1.3650	
	1.1421	-2.0000	-2.2841
J. 1. S. A. 18 J., 35 T. T.		97 . 73	and the second
Total: ΣFV =	63.8300	Σ Mr =	-20.2404
	(ton) 0.3'1.27'2.5'2.7 = 1.115'0.5'2.5'2.7 = (1.115+0.5)'2'0.53'2.5'2.7 = (1+0.5)'2)'1.7'2.5'2.7 = 46 1.01525 3.78896 0.59371 2.21577 1.05060 3.92090 0.71839 2.68108	0.3*1.27*2.5*2.7 = 2.5718 1.115*0.5*2.5*2.7 = 3.7631 (1.115*0.5)*2*0.53*2.5*2.7 = 2.8888 ((1+0.5)*2)*1.7*2.5*2.7 = 8.6063 46 46.0000 1.01525 1.0152 3.78896 3.7890 0.59371 2.2158 1.05060 1.0506 3.92090 3.9209 0.71839 0.7184 2.68108 2.6810 1.1421 2.6745	(ton) (m) 0.3°1.27°2.5°2.7 = 2.5718 0.965 1.115°0.5°2.5°2.7 = 3.7631 0.5576 (1.115+0.5)°2°0.53°2.5°2.7 = 2.8888 0.8075 ((1+0.5)°2)°1.7°2.5°2.7 = 8.6063 0.75 46 46.0000 0.25 1.01525 1.0152 1.1150 3.78896 3.7890 -2.8000 0.59371 0.5937 1.1150 2.21587 2.2158 -3.1000 1.05060 1.0506 1.1150 3.92090 3.9209 -1.1000 0.71839 0.7184 1.1150 2.68103 2.6811 -0.7333 6.9000 -2.7800 2.6745 -1.3650 1.1421 -2.0000

46,0000 ton

Wabutment ≃ 17.8300 ton

Wsoil = 7.6137 ton

KP = 0.15 * P =6.9000 ton

KW1 = 0,15*Wabut = 2.6745 ton

Kw/2= 0,15*Wsoil = 1.1421 ton

Mdes = 1.2 * Mr = Normal Force N =

24.288 ton m = 63.8300 ton =

242.884 kNm

638.3 kN

the concrete stress fc' =

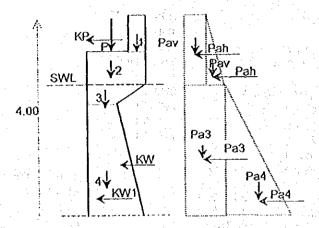
the yield stress of steel fy =

33.075 Mpa

235.29 Mpa

(earthquake condition fc' = 1.5xfc')

(earthquake condition fy = 1.5xfy)



REINFORCED CONCRETE OF ABUTMENT ON TOE AND HEEL

File:RC-A4-3

Compute soil pressure:

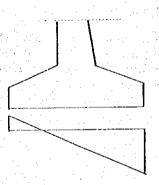
 $qmax = \{ \Sigma FV/B \}^* \{ 1 + (6^*e)/B \} = 64.9167 \text{ ton / m}$ $qmin = \{ \Sigma FV/B \}^* \{ 1 - (6^*e)/B \} = -12.3928 \text{ ton / m}$ L1 = 1.3 m $Mmax1 = 1/2qmin^* L1^*L1^*2/3 = 6.981 \text{ ton m / m}$ Mmax total = 6.981 ton m / m $Mdes = 1.2^* Mmax = 8.378 \text{ ton m / m}$

33,075 Mpa the concrete stress fc' = (earthquake condition fc'=1.5 x fc') 235.29 Mpa the yield stress of steel fy = (earthquake condition $f_y = 1.5 \times f_y$) ht = 1000 mm Dimension of concrete 1000 mm 850 mm **d** = $\rho b = [\{\beta 1*fc*0.85\} / fy \}*[600 / 600 + fy] =$ 0.0730 0.0060 ρ min = 1.4/fy = 0.015 Koefisien k = 0.00109 $\rho = k*\rho b =$ 930.16 mm² $As1 = \rho^*b^*d =$ 218857.7 N

As1 = p * b * d = 950.16 Mm 2
T1 = As1*fy = 218857.7 N
a1 = T1 / (0.85*fc*b) = 7.78 mm
Z = d - 0.5 a1 = 846.11 mm
Mr1 = T1 * Z = 185177183 Nmm
185.18 KNm

Mmax = 83.78 KNm
Because Mmax < Mr1 required single reinforced concrete

As = ρ * b * d = 930.16 mm²2 dipakai tulangan D 19 - 150 1889.23 mm²2



The earth pressure under the earthquake condition (Case V):

Height of Abutment	H=	5.0	m
Width of footing Abutment	B = .	3.5	m
Length of footing Abutment	L=	2.7	m
Load	q =	1.0	t/m'
Pa1 = 1/2 *γ*H^2*Kea * L =		19.37	'1 t
Pa2 = pa2 * H * L =		5.09	98 t 🦠
Paih = Pai * cos δ =		18.71	2 t
Pa1v = Pa1 * sin δ =		5.01	7 t
Pa2h = Pa2 * cos δ =		4.92	24 t
Pa2v = Pa2 * sin δ =		1,32	20 t

			the state of the s	
part	Weight of part	(1)	Arm	Moment
	(lon)		(m)	(ton m)
1	0.3'1.27'2.5'2.7 =	3.3338	0.965	3.2171
2	1.115'0.5'2.5'2.7 =	4.8781	0.5575	2.7196
3	(1.115+0.5)/2'0.53'2.5'2.7=	3.7448	0.8075	3.0239
4	((1±0.5)/2)*1.7*2.5*2.7 =	11.1563	0.75	8.3672
Ρ	46	46.0000	0.25	11.5000
Paiv	5.01706	5.0171	1.1150	5.5940
Path	18.71227	18.7123	-1.3333	-24.9497
Pa2v	1.32028	1.3203	1.1150	1.4721
Pa2h	4.92428	4.9243	-2.0000	-9.8486
Ŗ,	6.90000	6.9000	-2.7800	-19,1820
Kv/1	3.46694	3.4669	-1.3650	-4.7324
Kv/2	4,49608	4.4961	-2.0000	-8.9922
	Total: ΣFV=	69.1129	Σ Mr =	-31.8109

46.0000 ton

Wabutment = 23,1129 ton

Wsoil = 29.9739 ton

KP = 0,15 * P = 6,9000 ton KW1 = 0,15 Wabut = 3.4669 ton

Kw2= 0,15*Wsoil = 4.4961 ton

3₺

Mdes = 1.2 * Mr =

38.173 ton m =

381.731 kNm

Normal Force N =

69.1129 ton =

691.129 kN

the concrete stress fc' =

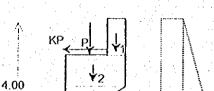
33.075 Mpa

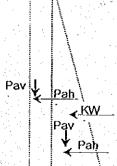
(earthquake condition fc' = 1.5xfc')

the yield stress of steel fy =

235.29 Mpa

(earthquake condition fy = 1.5xfy)



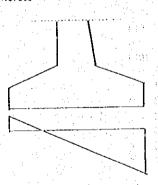


REINFORCED CONCRETE OF ABUTMENT ON TOE AND HEEL

File:RC-A5-3

Compute soil pressure:

```
qmax = \{ \Sigma Fv/B \}^* \{ 1 + (6*e)/B \} = qmin = \{ \Sigma Fv/B \}^* \{ 1 - (6*e)/B \} =
                                                         63.7590 ton / m
                                                          6.3680 ton / m
                           ∷ 1.3 m
           L1 =
                                             3.587 ton m / m
Mmax1 =1/2qmin * L1*L1*2/3 =
                                             3.587 ton m / m
Mmax total =
                                             4,305 ton m / m
Mdes = 1.2 * Mmax =
                                            33.075 Mpa
the concrete stress fc' =
                       (earthquake condition fc'=1.5xfc')
the yield stress of steel fy =
                                            235.29 Mpa
                       (earthquake condition fc'=1.5xfc')
                                              1000 mm
Dimension of concrete
                            ht =
                                              1000 mm
                                               850 mm
                              d =
\rho b = [ \{\beta 1^*(c'^0.85) / fy \}'[600 / 600 + fy] =
                                                          0.07295
                                                          0.00595
\rhomin = 1.4ify =
                                                            0.022
Koefisien k =
                                                          0.00160
ρ = k*ρb =
                                                          1364.24 mm^2
As1 = \rho \cdot b \cdot d =
                                                         320991.3 N
T1 = As1*fy =
                                                             11.42 mm
a1 = T1 / (0.85 fc"b) =
                                                           844.29 mm
Z = d - 0.5 a1 =
                                                       271010142 Nmm
Mr1 = T1 \cdot Z =
                                                           271.01 KNm
                                                             43.05 KNm
Mmax =
Because Mmax < Mr1required single reinforced concrete
                                                          1364.24 mm^2
As = \rho * b* d =
                                                          1889.23 mm<sup>2</sup>
                                   D 19 - 150
use reinforced concrete
```



REINFORCED CONCRETE OF UPPER ABUTMENT (cross section 1-1):

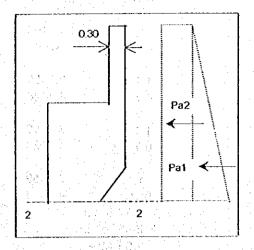
File:RC-Upper The subjected force on upper abulment: Case 1: Horizontal Force Arm (m) Moment : Total Moment (ton m) 0.56005 Pa2h = 0.881971 ton 0.635 0.423 0.45047 1.0105 Pa1h = 1.064098 ton Case II: 0.87342 Pa2h = 1.375464 ton 0.635 1.2062 0.33277 Pa1h = 0.786077 ton 0.423 Case III: 0.635 Pa2h = 1.563 ton 0.9927 1.885 ton 0.423 0.7985 1.7912 Path = Case IV: 0.635 1.563 ton 0.9927 Pa2h = 1.886 ton 0.423 0.7985 1.7912 Pa1h = Case V: Pa2h = 0.635 0.9927 1.5633 ton 0.7985 1.7912 0.423 Path = 1.8862 ton 1.7912 ton m Mmax total = Mdes = 1.2 Mmax= 2.1494 ton m the concrete stress fc' = 22.05 Mpa 156.86 Mpa the yield stress of steel fy = 300 mm Dimension of concrete ht = b = 1000 mm 200 mm ძ = 0.9525 ton Normal Force N = Eccentricities e : eo1 = Mu / Nu = 23.15 m 23149.61 mm ht = 300mm b = 1000mm Lk = 1270mm eo2 =1/30 ht>20 mm: 33.33 mm 23182.94 mm eo = eo1 + eo2 = 77.28 mm eo/ht= 7.00 Tabel: C1 = 1.00 C2 =e1 = C1'C2'[Lk/100h 0.00296 mm e2 = 0.15 * ht =45 mm eu = eo+e1+e2 = 23227.94 mm The cross section area of steel bars: Nu / {&*Ag*0.85*fc'} = 2.802E-08 Nu / {\phi^Ag^0.85^fc'}*{et/h} = 2.169E-06 0.001 from graphic obtained r = $\beta = 0.90$ Astot = $r \cdot \beta \cdot Ag =$ 270 mm^2 Total cross section: As1 = As2 = 0.5 As tot =135 mm² 945 mm² the principle steel bar D 19 - 300 Asterpasang = 27 mm⁴2 Longitudinal steel bars = 20 % As1 = use longitudinal steel D 13 - 300 As' = 442 mm^2

REINFORCED CONCRETE OF UPPER ABUTMENT (cross section 2-2): Fig. RC-Upper2

Case I : Horizontal Force Arm (m) Moment (ton m) Moment (ton m) Moment Total (ton m) Moment Path = 3.490036 ton 0.767 2.67569 4.5126	The subjected force on upper abutmen			646	vment	Total
Pa2h = 1.597271 ton	Case I: Honzontal Force	Ann (m)				
Path = 3.490036 ton			1 15	•		Monion
Case II: Pa2h = 2.490997 ton Pa1h = 2.578182 ton Case III: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa1h = 6.1863 ton Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa1h = 6.1863 ton Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa1h = 6.1863 ton Pa2h = 2.8312 ton Pa2h = 2.8312 ton Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa2h = 2.8312 ton Pa2				** **		4 5126
Pa2h = 2.490997 ton Pa1h = 2.578182 ton Case III: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Pa1h = 6.186 ton Pa1h = 6.186 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Pa1h = 6.186 ton O.767			0.707		2.01000	4.0120
Path = 2.578182 ton			1 15		2 86465	
Case III: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Case IV: Pa2h = 2.831 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa1h = 6.1863	• =:- :			100		4 8413
Pa2h = 2.831 ton			0.707		1.01001	1.0110
Path = 6.186 ton	· · · · · · · · · · · · · · · · · · ·		1 150	:	3 2550	
Case IV: Pa2h = 2.831 ton						7 9987
Pa2h = 2.831 ton			0.701	* .	7.1 120	
Path = 8.186 ton Case V: Pa2h = 2.8312 ton Pa1h = 6.1863 ton Pa1h = 6.1863 ton Mmax total = 7.9987 ton m Mdes = 1.2'Mmax= 9.5985 ton m the concrete stress fc' = 22.05 Mpa the yield stress of steel fy = 156.86 Mpa Dimension of concrete ht = 500 mm b = 1000 mm d = 400 mm Normal Force N = 3.4162 ton Eccentricities e: e01 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm ct = 2300 mm ht = 300 mm co / ht = 2843.03 mm e0 = e01 + e02 = 2843.03 mm e0 / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^22*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = e0+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\frac{4}{4}^{4}\0^{4}0.85^{4} fc'} = 7.148E-07 Nu / {\frac{4}{4}^{4}\0^{4}0.85^{4} fc'} = 7.148E-07 Nu / {\frac{4}{4}^{4}\0^{4}0.85^{4} fc'} = 7.148E-07 From graphic obtained (= 0.001			1 150		3 2559	
Case V : Pa2h = 2.8312 ton						7.9987
Pa2h = 2.8312 lon			0.707			
Path = 6.1863 ton			1 15		3 2559	
Mmax total =		:		•		7.9987
Mdes = 1.2'Mmax= the concrete stress fc' = 22.05 Mpa the yield stress of steel fy = 156.86 Mpa Dimension of concrete ht = 500 mm b = 1000 mm d = 400 mm Normal Force N = 3.4162 ton Eccentricities e: eo1 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm ck = 2300 mm ceo2 = 1/30 ht>20 mm= 33.33 mm eo = eo1 + eo2 = 2843.03 mm eo / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {*'Ag*0.85*fc'} = 7.148E-07 Nu / {*'Ag*0.85*fc'} = 7.148E-07 Nu / {*'Ag*0.85*fc'} = 6.881E-06 from graphic obtained T = 22.05 Mpa 150.86 Mp		*		ton m		
the concrete stress fc' = 22.05 Mpa the yield stress of steel fy = 156.86 Mpa Dimension of concrete ht = 500 mm						
the yield stress of steel fy = 156.86 Mpa Dimension of concrete ht = 500 mm b = 1000 mm d = 400 mm Normal Force N = 3.4162 ton Eccentricities e: e01 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm co = 1/30 ht>20 mm = 33.33 mm e0 = e01 + e02 = 2843.03 mm e0 / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 ht = 45 mm eu = e0+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\phi^4\Q^4\Q^4\Q^8\Q^8\S^5fc'} = 7.148E-07 Nu / {\phi^4\Q^9\Q^8\S^5fc'} = 7.148E-07 Nu / {\phi^4\Q^9\Q^8\S^5fc'} = 6.881E-06 from graphic obtained f = 0.001						
Dimension of concrete		. 1		-		
b = 1000 mm d = 400 mm Normal Force N = 3.4162 ton Eccentricities e: eo1 = Mu / Nu = 2.81 m						
d = 400 mm	Difficultion of concrete in -	<u>.</u>				
Eccentricities e : eo1 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm Lk = 2300 mm eo2 = 1/30 ht>20 mm 33.33 mm eo = eo1 + eo2 = 2843.03 mm eo / ht = 9.48 mm Tabel : C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars : Nu / {\dangle^*Ag*0.85*fc'} = 7.148E-07 Nu / {\dangle^*Ag*0.85*fc'}^*{et/h} = 6.881E-06 from graphic obtained f = 0.001					1.5	
Eccentricities e: eo1 = Mu / Nu = 2.81 m						
eo1 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm kk = 2300 mm eo2 = 1/30 ht>20 mm= 33.33 mm eo = eo1 + eo2 = 2843.03 mm eo / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\dot{\dot{\dot{\dot{\dot{\dot{\dot	Nothial Police IV 2	2 1011				4
eo1 = Mu / Nu = 2.81 m 2809.70 mm ht = 300 mm b = 1000 mm kk = 2300 mm eo2 = 1/30 ht>20 mm= 33.33 mm eo = eo1 + eo2 = 2843.03 mm eo / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\dot{\dot{\dot{\dot{\dot{\dot{\dot	Ecceptricities a					\$ 1
2809.70 mm ht = 300 mm b = 1000 mm Lk = 2300 mm eo2 = 1/30 ht>20 mm= 33.33 mm eo = eo1 + eo2 = 2843.03 mm eo / ht = 9.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\phi^A\g^0.85*fc'} = 7.148E-07 Nu / {\phi^A\g^0.85*fc'}^{\ext{c'}} = 6.881E-06 from graphic obtained r = 0.001		2.81		m		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	601 - Maria)			
$b = 1000 \qquad mm$ $Lk = 2300 \qquad mm$ $e0 = 1/30 \text{ ht} > 20 \text{ mm} = 33.33 \text{ mm}$ $e0 = e01 + e02 = 2843.03 \text{ mm}$ $e0 / \text{ht} = 9.48 \text{ mm}$ $Tabel: C1 = 1.00$ $C2 = 7.00$ $e1 = C1^*C2^*[Lk/100\text{ht}]^2^*\text{ht} 0.00537 \text{ mm}$ $e2 = 0.15 \text{ ht} = 45 \text{ mm}$ $eu = e0^+e1^+e2 = 2888.04 \text{ mm}$ The cross section area of steel bars: $Nu / \{\phi^* Ag^* 0.85^*fc^*\} = 7.148E^-07$ $Nu / \{\phi^* Ag^* 0.85^*fc^*\}^* = 6.881E^-06$ from graphic obtained	hi:				٠.	
Lk = 2300 mm					•	
eo2 = 1/30 ht>20 mm= eo = eo1 + eo2 = 2843.03 mm eo / ht = 3.48 mm Tabel: C1 = 1.00 C2 = 7.00 e1 = C1*C2*[Lk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars: Nu / {\darphi^AQ^40.85*fc'} = 7.148E-07 Nu / {\darphi^AQ^40.85*fc'}^{\darphi} = 6.881E-06 from graphic obtained T = 0.001			*** · · · · · · · · · · · · · · · · · ·	mm		
$\begin{array}{llllllllllllllllllllllllllllllllllll$			33,33	mm		
eo / ht = 9.48 mm Tabel: C1 = 1.00 c2 = 7.60 e1 = C1*C2*[kk/100ht]^2*ht 0.00537 mm e2 = 0.15 * ht = 45 mm eu = e0+e1+e2 = 2888.04 mm The cross section area of steel bars : Nu / { $\frac{4}{3}$ *Ag*0.85*fc'} = 7.148E-07 Nu / { $\frac{4}{3}$ *Ag*0.85*fc'}*{et/h} = 6.881E-06 from graphic obtained 1 = 0.001		2	843.03	mm		
Tabel: $C1 = 1.00$ C2 = 7.00 $e1 = C1^*C2^*[Lk/100ht]^2^*ht$ 0.00537 mm $e2 = 0.15^*ht = 45 \text{ mm}$ $eu = e0^+e1^+e2 = 2888.04 \text{ mm}$ The cross section area of steel bars: $Nu / \{ \frac{4}{7} Ag^*0.85^*fc' \} = 7.148E-07$ $Nu / \{ \frac{4}{7} Ag^*0.85^*fc' \}^* \{ et/h \} = 6.881E-06$ from graphic obtained $r = 0.001$			9.48	mm		
$C2 = 7.00$ $e1 = C1^*C2^*[Lk/100ht]^2^*ht $		=	1.00			
$e1 = C1^*C2^*[Lk/100ht]^2^*h! \qquad 0.00537 \text{ mm}$ $e2 = 0.15^*h! = \qquad 45 \text{ mm}$ $eu = e0+e1+e2 = \qquad 2888.04 \text{ mm}$ The cross section area of steel bars : $Nu / \{ \frac{4}{7} Ag^*0.85^*fc' \} = \qquad 7.148E-07$ $Nu / \{ \frac{4}{7} Ag^*0.85^*fc' \}^4 \{ et/h \} = \qquad 6.881E-06$ from graphic obtained \(r = 0.001			7,00			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$						
eu = eo+e1+e2 = 2888.04 mm The cross section area of steel bars : Nu / { ϕ^* Ag*0.85*fc'} = 7.148E-07 Nu / { ϕ^* Ag*0.85*fc'}*{et/h} = 6.881E-06 from graphic obtained r = 0.001			45	mm		
The cross section area of steel bars : Nu / {∳*Ag*0.85*fc'} = 7.148E-07 Nu / {∳*Ag*0.85*fc'}*{et/h} = 6.881E-06 from graphic obtained r = 0.001		2	2888.04	mm		
Nu / {φ*Ag*0.85*fc'} = 7.148E-07 Nu / {φ*Ag*0.85*fc'}*{et/h} = 6.881E-06 from graphic obtained r = 0.001				÷		
Nu / {φ*Ag*0.85*fc'} = 7.148E-07 Nu / {φ*Ag*0.85*fc'}*{et/h} = 6.881E-06 from graphic obtained r = 0.001	The cross section area of sleel bars :	·. :	1.			
Nu / {\\$^Ag^0.85^fc'}^{et/h} = 6.881E-06 from graphic obtained r = 0.001				- 1 - 1 -	7.148E-07	
from graphic obtained r = 0.001	the state of the s	=		(6.881E-06	
			f =		0.001	
			β =	:	0.90	1.

270 mm^2 $Astot = r * \beta * Ag =$ Total cross section: 135 mm² As1 = As2 = 0.5 As tot =945 mm² the principle steel bars: D 19 - 300 Asterpasang =

Longitudinal steel bars = 20 % As1 = 27 mm^2 use longitudinal steel bars: D 13 - 300 **As**' = 442 mm^2



```
0.065
  Koefisien k =
                                                         0,00523
ρ = κ*ρb =
  As1 = \rho * b * d =
                                                         1831.69 mm^2
                                                       287318.47 N
  T1 = As1*fy =
                                                          : 15.33 mm
  a1 = T1 / (0.85*fc'*b) =
                                                           342.34 mm
  Z = d - 0.5 a1 =
                                                        98359199 Nmm
  Mr1 = T1 * Z =
                                                            98.36 KNm
                                                           103.60 KNm
  Mmax =
  Because Mmax > Mr1 required double reinforced concrete:
                                                             5.24 KNm
  \Delta M = Mmax - Mr1 =
                                                           111.33 mm^2
  As2 = \Delta M / fy(d-d') =
                                                         1943.02 mm^2
  As= As1 + As2 =
                                      D 19 - 140
                                                    As terosg =
                                                                       2024 mm<sup>2</sup>
  the tensile of steel bars:
                                                                       2024 mm<sup>2</sup>2
                                                    As' terpsg =
  the compressive of steel bars
                                                                        389 mm^2
  Longitudinal steel bars : 20 % As =
                                                     4 790 Y 1 6 19 1
                                                                         442 mm^2
                                      D 13 - 300
                                                    Asbagi ≈
  The earth pressure on wingwall of abutment: ( look at cross section 3-3)
             qmax = pa1 + pa2
             qmax = 1.087 Vm
L1 = 4.0 4.0 m
                                              H = 1.4 \text{ m}
                                             8.696 ton m / m
  Mmax = gmax * L1*L1/2 = 3
                                             8.696 ton m / m
  Mmax total = -
  Mdes = 1.20 * Mmax =
                                             10.435 ton m / m
                                             22.05 Mpa
  the stress concrete fc' =
  the yield stress of steel fy = 1
                                            156.86 Mpa
                                               400 mm
  Dimension of concrete ht =
                                              1000 mm
                             d =
                                             🏅 350 mm :
   \rho b = [\{\beta 1^* fc'^* 0.85\} / fy]^* [600 / 600 + fy] = 0.00
                                                    0.080514
                                                        0.008925
   omin = 1.4/fy = 1
                                                             0.06
   Koefisien k =
                                                          0.00483
   ը = k*ቦb =
                                                 🕍 🖖 . 1690.79 mm^2
   As1 = բ * b * d = 🛁
   T1 = As1*fy =
                                                       265217.05 N
                                                          > 14.15 mm :
   a1 = T1 / (0.85 \text{ fc}' \text{ b}) =
                                                           342.92 mm
   Z = d - 0.5 a1 =
                                                        90949481 Nmm
   Mr1 = T1 * Z =
                                                            90.95 KNm
                                                           104,35 KNm
   Mmax ₹
   Because Mmax > Mr1 required double reinforced concrete:
                                                            13.40 KNm
   \Delta M = Mmax - Mr1 = 1
                                                           284.85 mm<sup>2</sup>
   As2 = \Delta M / fy(d-d') =
                                                          1975.64 mm<sup>2</sup>
   As= As1 + As2 = ...
                                                                        2024 mm^2
   the tensile of steel bars:
                                    D 19 - 140
                                                    As terpsg =
                                   D 19 - 140
                                                    As¹ terpsg =
                                                                        2024 mm<sup>2</sup>2
   the compressive of steel bars
                                                                      : 395 mm^2
   Longitudinal steel bars : 20 % As =
                                                                         442 mm<sup>2</sup>
                                      D 13 - 300
                                                    Asbagi =
```

REINFORCED CONCRETE OF WING WALL ABUTMENT

File;RC-WINGNormal

```
The earth pressure on wingwall of abutment: (look at cross section 1-1)
          qmax = pa1 + pa2
                      3.119 Vm
          qmax =
                            1.8 m
                                           H = 5 \, \text{m}
          L1 =
                                           5.052 ton m / m
Mmax = qmax * L1*L1/2 =
                                           5.052 ton m / m
Mmax total =
                                           6.062 ton m/m
Mdes = 1.2 * Mmax =
                                           22.05 Mpa
the stress concrete fc' =
the yield stress of steel fy =
                                          156.86 Mpa
Dimension of concrete ht =
                                             400 mm
                                          ≟ 1000 mm
                           d =
                                            350 mm
                                                     0.080514
\rho b = [\{\beta 1^*fc'^*0.85\} / fy]^*[600 / 600 + fy] =
\rho min = 1.4/fy = -1
                                                     0.008925
                                                          0.03
Koefisien k =
                                                      0.00242
\rho = k*\rho b =
As1 = \rho^*b^*d =
                                                        845.39 mm<sup>2</sup>
                                                   132608.52 N
T1 = As1*fy =
a1 = T1 / (0.85*fc'*b) =
                                                     7.08 mm
                                                        346.46 mm
Z = d - 0.5 a1 =
Mc1 = T1 * Z =
                                                     45943862 Nmm
                                                         45,94 KNm
                                                         60.62 KNm
Mmax =
Because Mmax > Mr1 required double reinforced concrete:
                                                         14.68 KNm
\Delta M = Mmax - Mr1 = .
                                                        374.34 mm<sup>A</sup>2
As2 = \Delta M / fy(d-d') =
                                                       1219.74 mm^2
As= As1 + As2 =
the tensile of steel bars :
                                   D 19 - 225
                                                 As terpsg =
                                                                     1259 mm<sup>2</sup>
the compressive of steel bars ----
                                   D 19 - 225 4
                                                 As' terpsg =
                                                                    1259 mm<sup>2</sup>
                                                                      244 mm^2
Tulangan bagi: 20 % As =
                                   D 13 - 300
                                                 Asbagi =
                                                                      442 mm^2
The earth pressure on wingwall of abutment: ( look at cross section 2-2)
          qmax = pa1 + pa2 -
                         2.554 Vm
          omax =
                                                4.0 m
Mmax = qmax * L1*L1/2 =
                                         8.633 ton m / m
                                          8.633 ton m/m
Mmax total =
Mdes = 1.20 * Mmax =
                                          10.360 ton m / m
the stress concrete fc' = 100
                                       22.05 Mpa
the yield stress of steel fy =
                                          156.86 Mpa
Dimension of concrete ht =
                                             400 mm
                                           1000 mm
                                            350 mm
                            d =
\rho b = [\{\beta 1^* (c'^* 0.85) / fy \}^* (600 / 600 + fy)] =
                                                     0.080514
                                                     0.008925
pmin = 1.4/fy =
```

REINFORCED CONCRETE OF WING WALL ABUTMENT

File:RC-WINGgempa

```
The earth pressure on wingwall of abutment: ( look at cross section 1-1)
           gmax = pa1 + pa2
                           4.956 Vm
           e xemp
                                             H≃ 5 m
                              1.8 m
           L1 =
                                             8.029 ton m / m
Mmax = qmax * L1*L1/2 =
                                             8.029 ton m / m
Mmax total =
                                             8.430 ton m / m
Mdes = 1.05 * Mmax =
                                                                  (earthquake condition fc'=1.5xfc')
                                            33,075 Mpa
the stress concrete fc' =
                                                                  (earthquake condition fy=1.5xfy)
                                            235.29 Mpa
the yield stress of steel fy =
                                               400 mm
Dimension of concrete ht =
                                              1000 mm
                                               350 mm
                              q =
                                                        0.072954
\rho b = [\{\beta 1 \text{ fc'*0.85}\} / \text{ fy }]^{*}[600 / 600 \text{+fy}] =
                                                        0.005950
\rhomin = 1.4/fy =
                                                             0.04
Kcefisien k =
                                                         0.00292
ρ = k*ρb =
                                                          1021.35 mm<sup>2</sup> :
As1 = \rho * b * d =
                                                       240314.35 N
T1 = As1*fy =
                                                           : 8.55 mm
a1 = T1 / (0.85*fc'*b) =
                                                           345.73 mm
 Z = d - 0.5 a1 =
                                                        83082928 Nmm
 Mr1 = T1 * Z =
                                                            83.08 KNm
                                                            84.30 KNm
Mmax =
 Because Mmax > Mr1 required double reinforced concrete:
                                                            1.22 KNm
 ΔM = Mmax -Mr1 =
                                                            20.72 mm<sup>2</sup>
 As2 = \Delta M / fy(d-d') =
                                                          1042.07 mm^2
 As= As1 + As2 =
                                                                        1134 mm<sup>2</sup>
                                      Ď 19 - 250
                                                    As terpsg =
 the tensile of steel bars:

    1134 mm<sup>2</sup>

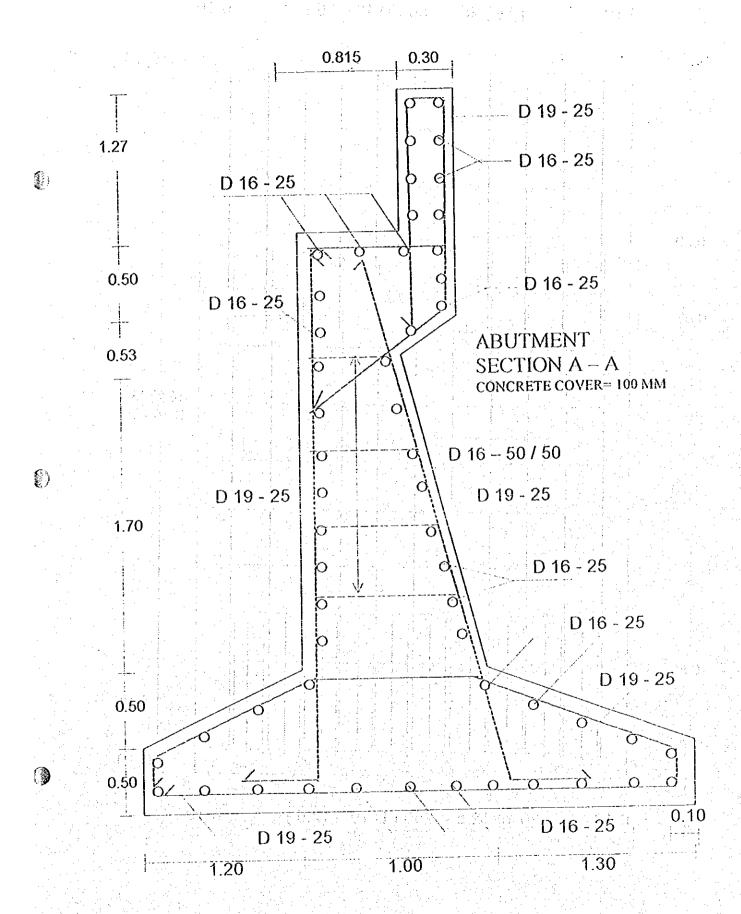
                                                    As terpsg = --
                                      D 19 - 250
 the compressive of steel bars
                                                                         208 mm<sup>2</sup>
 Tulangan bagi: 20 % As =
                                                                         442 mm^2
                                                    Asbagi =
                                      D 13 - 300
 The earth pressure on wingwall of abutment: (look at cross section 2-2)
            qmax = pa1 + pa2
                            4.059 Vm
                                              H = 4.0 \, \text{m}
                              2.6 m
            L1 =
                                             13.720 lon m / m
 Mmax = qmax * L1*L1/2 =
                                             13.720 ton m / m
 Mmax total =
                                             14.406 ton m/m
 Mdes = 1.05 * Mmax =
                                             rakiang salah ters
                                                                   (earthquake condition fc'=1.5xfc')
                                             33,075 Mpa
 the stress concrete fc' =
                                                                   (earthquake condition fy-1.5xfy)
                                             235.29 Mpa
 the yield stress of steel ty =
 Dimension of concrete ht =
                                                400 mm
                                               1000 mm
                                                350 mm
                                                         0.072954
 \rho b = [\{\beta 1^*fc^{**}0.85\} / fy \}^*[600 / 600 + fy] =
                                                        0.005950
 \rho min = 1.4/fy =
```

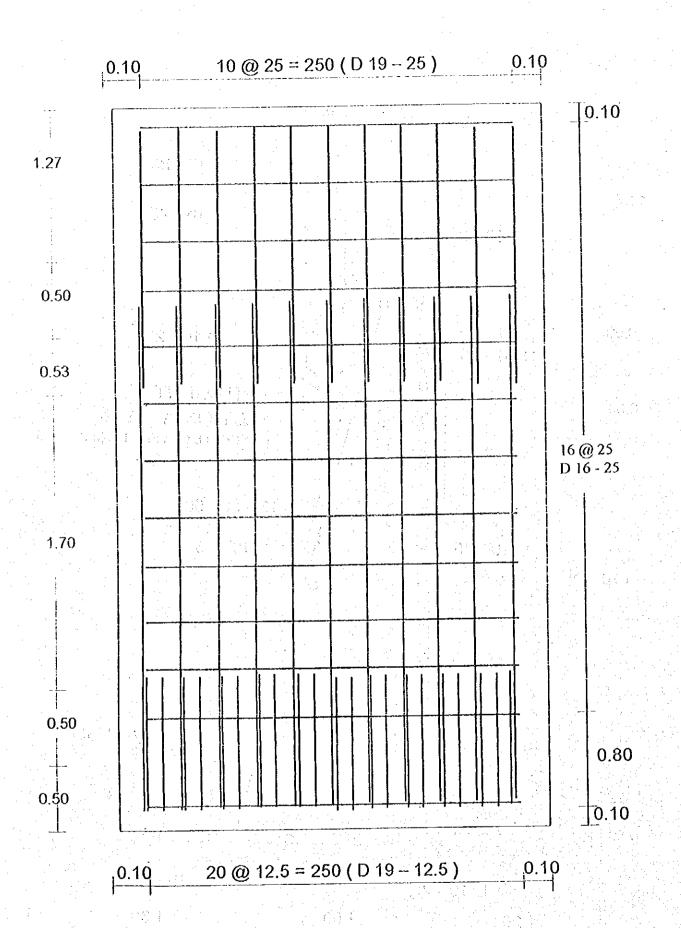
```
Koefisien k =
                                                                0.06
                                                            0.00438
ր = k*pb =
                                                            1532.03 mm<sup>2</sup>
As1 = \rho * b * d =
                                                         360471.53 N
T1 = As1*fy =
                                                              12.82 mm
a1 = T1 / (0.85 \text{ fc}^*b) =
                                                             343.59 mm
Z = d - 0.5 a1 =
                                                         123854071 Nmm
Mr1 = T1 * Z =
                                                             123.85 KNm
                                                             144.06 KNm
Mmax =
Because Mmax > Mr1 required double reinforced concrete:
                                                              20.21 KNm
\Delta M = Mmax - Mr1 = 0.00
                                                             286.27 mm<sup>2</sup>
As2 = \Delta M / fy(d-d') = \Delta \Delta \Delta
                                                            1818.30 mm^2
As= As1 + As2 =
                                       D 19 - 150
                                                      As terpsq =
                                                                           1889 mm<sup>2</sup>
the tensile of steel bars:
                                       D 19 - 150
                                                      As' terpsg =
                                                                           1889 mm<sup>2</sup>2
the compressive of steel bars
Longitudinal steel bars : 20 % As =
                                                                             364 mm<sup>2</sup>
                                       D 13 - 300
                                                      Asbagi =
                                                                             442 mm^2
The earth pressure on wingwall of abulment: (look at cross section 3-3)
            qmax = pa1 + pa2 ....
            qmax =
                           √ 1.728 t/m
                                               H = \frac{1.4 \text{ m}}{1.4 \text{ m}}
            L1 ≔
                               4.0 m
                                              13,820 ton m / m
Mmax = qmax * L1*L1/2 =
                                              13.820 ton m / m
Mmax total =
                                              14.511 ton m / m
Mdes = 1.05 * Mmax =
                                              33.075 Mpa
                                                                      (earthquake condition fc'=1.5xfc')
the stress concrete fc' =
the yield stress of sleel fy =
                                              235.29 Mpa
                                                                      tearthquake condition fv=1.5xfv)
                                                 400 mm
Dimension of concrete : ht = ::
                                                1000 mm
                               d = 0.0 (0.5)
                                                 350 mm
 \rho b = [\{\beta 1 \text{ fc'' } 0.85\} / \text{ fy }] \text{ } [600 / 600 + \text{fy}] =
                                                           0.072954
                                                           0.005950
 omin = 1.4/fy ∺
                                                                0.05
 Koefisien k = 3
                                                            0.00365
ր = k*րb =
                                                            1276.69 mm^2
As1 = \rho^* b^* d =
                                                          300392.94 N
T1 = As1*fy =
                                                               10.68 mm
a1 = T1 / (0.85 \text{fc}^{*}b) =
                                                             344.66 mm
Z = d - 0.5 a1 =
                                                         103532693 Nmm
Mr1 = T1 * Z =
                                                             103.53 KNm
                                                             145,11 KNm
Mmax ≃.
Because Mmax > Mr1 required double reinforced concrete:
                                                               41.58 KNm
\Delta M = Mmax - Mr1 =
As2 = \Delta M / fy(d-d') =
                                                             589.05 mm<sup>2</sup>
                                                            1865.74 mm^2
As= As1 + As2 =
the tensile of sleel bars:
                                       D 19 - 150
                                                      As terpsg =
                                                                           1889 mm^2
the compressive of steel bars
                                        D 19 - 150
                                                      As' terpsg =
                                                                           1889 mm<sup>2</sup>
Longitudinal steel bars : 20 % As =
                                                                             373 mm<sup>2</sup>
```

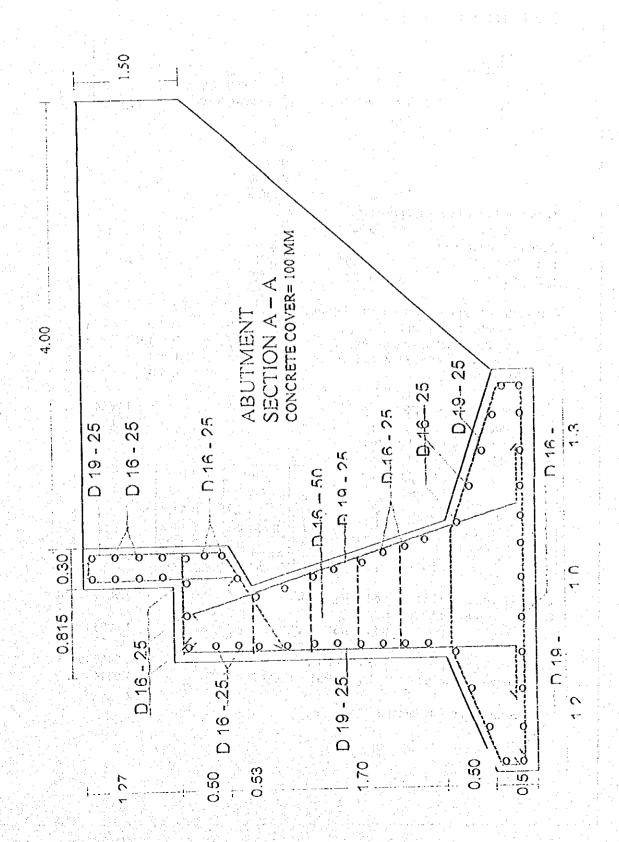
Asbagi =

442 mm^2

D 13 - 300







DESIGN OF ABUTMENT FROM MASONRY MATERIAL

File:Mosonry-1

(NORMAL CONDITON) Case I: Water is empty + 147.60

Parameter of soil for bank fill:

$$\phi = 30$$

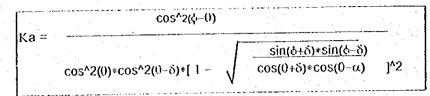
$$\gamma = 1.9$$

degree

$$C=0$$

1/m/3 t/m^2

Coefficient of active earth pressure:



ֆ ≕ 30

degree

 $\delta = 0$

degree

u = 0

degree

0 = 0

degree

Coefficient of active earth pressure:

Ka = Acting earth pressure: 0.333

t/m^2

pa1 = Ka * y *H = pa2 = Ka * q =

1.2654 0.333

t/m^2

The earth pressure under the normal condition:

Height of Abulment

H = 2B = 1.6

m

Width of footing Abutment Length of footing Abutment

L = 1

m

Load

q = 1

tIm

Pa1 = 1/2 * y * H^2 * Ka =

Pa2 = pa2 * H =

1.2654 Vm 0.666 t/m

Compute overturning stability:

part	Weight of p (ton/m)	ent	Arm (<i>m</i>)	Moment (lon m)
1	0.3*1.7*2.2 =	1.1730	0.45	0.5279
	0.51,7'0.7'2.3 =	1.3685	0.833333	1.1404
3	0.3'1.6'2.3	1.1040	8.0	0.8832
	Total : ΣFv'=	3.6455	ΣMr=	2.5515

Sum of Moments to Resist Overturning: \(\Sigma \) Mr =

2.5515 ton m

Sum of Overlurning Moments:

Σ.Mo=Pa1'1/3'H+Pa2'H/2=

1,5096 lon m

Total Vertical Force:

 $\Sigma F_V = \Sigma F_V' + Pa_1V + Pa_2V =$

3,6455 ton

Total Horizontal Force:

ΣFh = Pa1 + Pa2 =

1.9314 ton

The overturning safety factor is:

FS =Σ Mr /Σ Mo =

1.690161 > 1.5

Ok

Compute Sliding Force:

Use hase soil parameter

Parameter of soil:

3)

degree ф = 36 t/m^3 $\gamma = 2$ t/m^2

C = 18

 $Fr = C * B*L + \Sigma Fv * tan \phi$

31.4486 ton

The sliding safety factor is:

FS = Fr/SFh =

16.2828 > 1.5

Located the resultant on the base of footing. From rigid body static and moment summation can be taken at any location. Using the toe, as we already have most of the moments computed:

 $\Lambda M = \Sigma Mr - \Sigma Mo =$

1.042 lon m

 $x = \Delta M / \Sigma Fv =$

0.28580 m (from toc)

 $e = \{ B/2 \} - x$

0.51420 m

B/6=

0.26667 m

e < (B/6)0.51420 <

OK 0.26667

OK

Compute soil pressure:

 $qmax = { \Sigma Fv/B } ^{*} { 1 + (6*e)/B } =$ $qmin = \{ \Sigma Fv/B \}^* \{ 1 - (6*e)/B \} =$

6.67188 ton / m

-2.11500 ton / m

Qmax = qmax * L =

Qmin = qmin * L =

6 671875 ton

-2.115 ton

Checking of Bearing Capacity on soil:

 $Qu = A' \cdot [\alpha \cdot k \cdot c \cdot Nc + 0.156 \cdot k \cdot q \cdot Nq + 0.5 \cdot \gamma i \cdot B' \cdot \beta' \cdot N\gamma]$

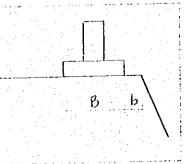
b = 1.5

R = 6

B = 1.6

m

0.156 Rx B



where:

Qu = ultimate bearing capacity

= effective loading area on footing

 α , β = coefficient depending on shape of footing

= cohesion of foundation ground (ton/m/2)

= ground surface surcharge (t/m^2)

 $q = \gamma * Df$

```
= unit weight of soil on front of abutments (t/m^3) = 1.8 t/m^3
     = unit weight of soil of ground foundation (t/m^3) = 2.0 t/m^3
γl
B',L' = width and length of effective loading area
     = distance from entrance of footing to acting point of resultant force on footing (m)
Df = depth from ground surface on front of abutment to bottom of footing (m)
Df = height of toe (m) = 0.3 m
                                  \rightarrow k = (1 + 0.3 * Df / B')
    = coefficient
Nq, Nc, Ny = bearing capacity factors
A' = L' * B' = (B - 2eb) * (L - 2el)
          A' = (B - 2^eb) \cdot (L - 2^el) = 0.571591 \text{ m}^2
                    \alpha = (1 \pm 0.3 \text{BYL}^{\circ}) = 1.17148
                      \beta = (1 - 4*BVL') = -1.28636
                                                        Vm^2
                                                3.6
                            q = y2 * Df =
                k = (1 + 0.3 * (Df/B')) = 1.1575
For \tan \theta = \Sigma Fh / \Sigma Fv = 0.530
                                                  Nc= 15
                      \phi = 36
                                                  Nq = 10
                                                  Ny = 4
                                   211.29 ton
                    Qu =
                    FS = 3
                                    70.43 ton
     Qsafe = Qu / FS =
 Checking the bearing capacity is :
                                                                                         OK
                                                                          70.43 ton
                                      6.67 ton <
                                                        Qsafe =
                 Qmax =
```

```
Category of .
Name of
                                                                        Page
                                      calculation
Structure
  REINFORCED CONCRETE OF WING WALL ABUTMENT
                                                                      File:RC-WINGNormal
  The earth pressure on wingwall of abulment : ( look at cross section 1-1)
            qmax = pa1 + pa2 .
                       3.119 t/m
            gmax =
                                          H = 5 m
                           1.8 m
                                          5.052 ton m / m
   Mmax = qmax * L1*L1/2 =
                                          5.052 ton m / m
  Mmax total =
                                          6.062 ton m / m
  Mdes = 1.2 * Mmax =
                                         - 22.05 Mpa
   the stress concrete fc' = 1000 miles
  the yield stress of steel fy =
                                         156,86 Mpa
   Dimension of concrete ht =
                                         400 mm
                             b = 1000 \text{ mm}
                         - : d = --;---:
   \rho b = [ \{\beta 1^* fc'^* 0.85\} / fy ]^* [600 / 600 + fy] =
                                                0.080514
                                                    0.008925
   ρmin = 1.4/fy =
                                                        0.03
   Koefisien k =
                                                     0.00242
   ր = k*pb =

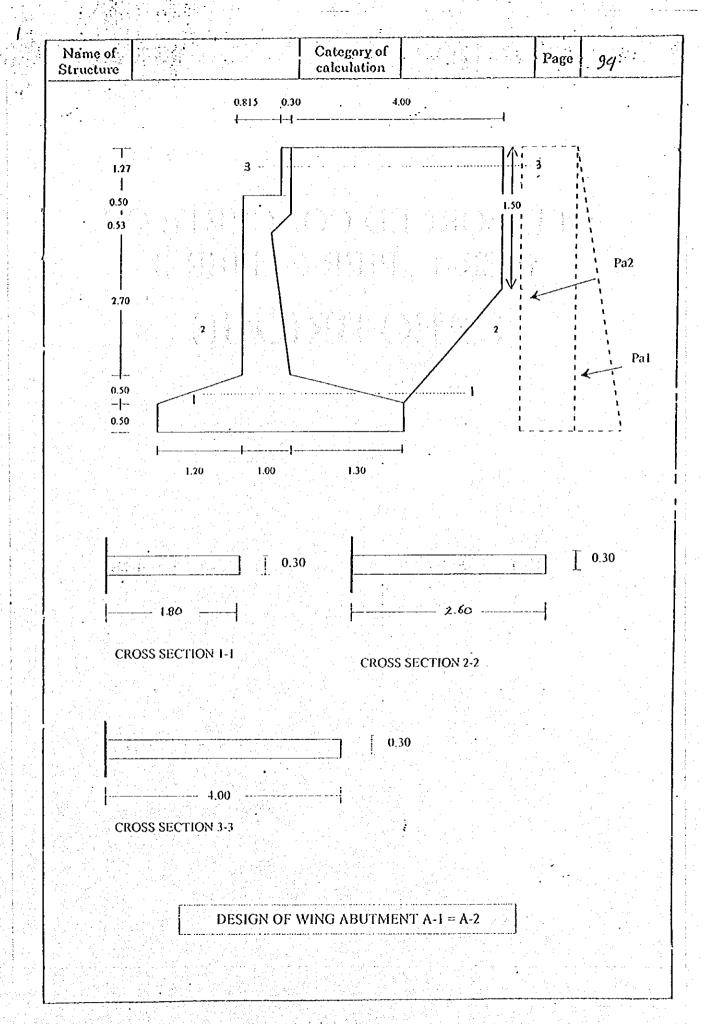
 845.39 mm<sup>2</sup>

   As1 = \rho * b * d =
                                                   132608.52 N
   T1 = As1*fy =
                                                       7.08 mm
   a1 = T1 / (0.85*(c'*b) = \frac{1}{2}
                                                      346.46 mm
   Z = d - 0.5 a1 =
                                                   45943862 Nmm
   Mr1 = T1 * Z = 
                                                       45.94 KNm
                                                       60.62 KNm
   Mmax =
   Because Mmax > Mr1 required double reinforced concrete :
                                                     14.68 KNm
   ΔM = Mmax -Mr1 =
                                                      374.34 mm<sup>2</sup>
   As2 = \Delta M / fy(d-d') =
                                                     1219,74 mm^2
   As= As1 + As2 =
                                                As terpsg =
                                                                  1259 mm<sup>2</sup>
                                   D 19 - 225
   the tensile of steel bars:
                                                                  1259 mm^2
                                                As' terpsg =
   the compressive of steel bars D 19 - 225
                                                                   244 mm^2
   Tulangan bagi : 20 % As =
                                                                   442 mm^2
                                    D 13 - 300
                                                Asbagi =
   The earth pressure on wingwall of abutment : ( look at cross section 2-2)
             qmax = pa1 + pa2
             e xsmp
                       2.554 Vm
                                          H = 4.0 \, \text{m}
                        2.6 m
             L1 =
   Mmax = qmax * L1*L1/2 = ______
                                        > 8.633 ton m / m
                                          8.633 ton m / m
   Mmax total =
   Mdes = 1.20 * Mmax =
                                          10,360 ton m / m
                                         22.05 Mpa
   the stress concrete fc' =
   the yield stress of steel fy =
                                          156.86 Mpa
                                         400 mm
   Dimension of concrete tht =
                                            1000 mm -
                         b =
                             d = 350 mm
                                                    0.080514
   pb = [\{\beta 1^*fc'^*0.85\} / fy \}^*[600 / 600 + fy] =
                                                    0.008925
    pmin = 1.4/fy = 1.4/fy
```

Name of Structure	Category calculatio			Fage	
		0.065	L	l	
Koefisien k =		0.00523		1,500	
ρ = k*ρb =		the state of the s	om\^2		
$As1 = \rho * b * d =$		1831.69 п		7 19	The english
T1 = As1*fy =		287318.47 N	A CONTRACTOR OF THE CONTRACTOR	1.7	
a1 = T1 / (0.85*fc'*b) =		15.33 n		44.5	•
Z = d - 0.5 a1 = 0.00		342.34 n		: f	
Mr1 = T1 * Z =		98359199 N		Ar Fee	
		98.36 k		1 11	13-1-12
Mmax =		103.60 k	NM		
Because Mmax > Mr1 required double	e reinforced c	oncrete :			
ΔM = Mmax -Mr1 =		5.24 k	and the second second second		ode bri.
$As2 = \Delta M / fy(d-d') =$		111.33 ሰ		2000	Marine Service
As= As1 + As2 =		1943.02 n		<u> 1148 (</u>	1,11
		As terpsg =	2024 mr		
the compressive of steel bars	D 19 - 140	As terosg =	2024 mr		
Longitudinal steel bars : 20 % As =	45 to 100 to	内区 医肋切除的	389 mr		
	D 13 - 300	Asbagi =	442 mr	ກ^2 🕺	Salar Salar
	er der Miller				
The earth pressure on wingwall of abo	utment : (look	at cross section	n 3-3)		
qmax = pa1 + pa2			$(1,2,\ldots,n) \in \mathbb{N}$	11	
qmax = 1.087 t/m			3 <u>13 3 3 3</u>	· · · · ·	
L1 = 4.0 m	H= .	1.4 m			
Mmax = qmax * L1*L1/2 =		ton m / m	ļ 4.00		1
Mmax Iolal =		ton m / m		1	
Mdes = 1.20 * Mmax =		ton m / m	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
MICS - 1.20 Millox -					
the stress concrete fc' =	22.05	Moa		4 142	
	156.86	•			
the yield stress of steel fy = Dimension of concrete ht =	and the second s	mm			
	1000				
	A second	mm.			
d = 100 (con to be con to be contained by the co		0.080514			
$pb = [\{\beta1^*(c'^0.85) / (y)\}^*(600 / 600 + (y))]$	y) =	0.008925			
ρmin = 1.4/fy =				te a ver i e La companya	
Koefisien k =		0.06			
ρ = k*ρb =		0.00483	·		
As1 = p * b * d =		1690.79			
T1 = As1*fy =		265217.05 N			
a1 = T1 / (0.85 fc' b) =		14.15 r	A CONTRACTOR OF STREET	er in the	
Z = d - 0.5 a1 =		342 92 1			
$Mr1 = T1 \cdot Z = \dots$		90949481 1	and the second of the second of	s mor	
		90.95 1	the second secon		
Mmax =		104.35 k	(Nm		
Because Mmax > Mr1 required double	le reinforced c	concrete :			
ΔM = Mmax -Mr1 =		13.40	and the state of the		Ni in
$As2 = \Delta M / (y(d-d')) =$		284.85 r			
As= As1 + As2 =		1975.64 r			
	D 19 - 140	As terpsg =	2024 mr		
	D 19 - 140	As' terosg =	2024 mr		
Longitudinal steel bars : 20 % As =		ha kinga da	395 mr	m^2	
	D 13 - 300	Asbagi =	442 mr	m^2	

```
Category of
Name of
                                                                                  Page
                                           calculation
Structure
  REINFORCED CONCRETE OF WING WALL ABUTMENT
                                                                               File:RC-WINGgempa
  The earth pressure on wingwall of abulment: (look at cross section 1-1)
             qmax = pa1 + pa2
                           · 4.956 Vm
             gmax =
                                1.8 m
                                               H = [5 m]
                                               8.029 ton m/ m
   Mmax = qmax * L1*L1/2 =
                                               8.029 ton m / m
   Mmax total =
                                               8,430 ton m / m
   Mdes = 1.05 * Mmax =
                                                                    (earthquake condition fc'=1.5xfc')
                                              33.075 Mpa
   the stress concrete fc' =
                                                                    (earthquake condition fy=1.5xfy)
                                              235.29 Mpa
   the yield stress of steel fy =
                                                 400 mm
   Dimension of concrete ht =
                                                1000 mm
                                                 350 mm
                                d =
                                                          0.072954
   \rho b = \{ \{ [ 11^{\circ} fc'^{\circ} 0.85 \} / fy ]^{\circ} [ 600 / 600 + fy ] = 
                                                          0.005950
   emin = 1.4/fy =
                                                               0.04
   Koefisien k =
                                                           0.00292
   ր = k*ቦb =
                                                           1021.35 mm<sup>2</sup>
   As1 = \rho^*b^*d =
                                                         240314.35 N
   T1 = As1*fy = 
                                                               8.55 mm
   a1 = T1 / (0.85*fc'*b) =
                                                             345.73 mm
   Z = d - 0.5 a1 =
                                                          83082928 Nmm
   Mr1 = T1 * Z =
                                                              83.08 KNm
                                                              84.30 KNm
   Mmax =
   Because Mmax > Mr1 required double reinforced concrete:
                                                               1.22 KNm
   ΔM = Mmax -Mr1 =
                                                              20.72 mm<sup>2</sup>
   As2 = \Delta M / fy(d \cdot d') =
                                                            1042.07 mm<sup>4</sup>2
   As= As1 + As2 =
                                                                          1134 mm^2
                                                      As terpsg =
                                        D 19 - 250
   the tensile of steel bars:
                                                                          1134 mm^2
                                        D 19 - 250
                                                      As' terpsg =
   the compressive of steel bars
                                                                           208 mm^2 💎
   Tulangan bagi : 20 % As =
                                                                           442 mm^2
                                        D 13 - 300
                                                      Asbagi =
   The earth pressure on wingwall of abutment: ( look at cross section 2-2)
               qmax = pa1 + pa2
                               4.059 t/m
               amax =
                                                H = 4.0 \,\mathrm{m}
                                 2.6 m
               L1 =
                                               13.720 ton m / m
                                                                          2.60 -----
   Mmax = qmax * L1*L1/2 =
                                               13.720 lon m/m
    Mmax total =
                                               14.406 ton m / m
    Mdes = 1.05 * Mmax =
                                                                     (carthquake condition fc'=1.5xfc')
                                               33.075 Mpa
    the stress concrete fc' =
                                                                     (varthquake condition fy=1.5xfy)
                                               235.29 Mpa
    the yield stress of steel fy = "
                                                  400 mm
    Dimension of concrete ht =
                                                1000 mm
                               d =
                                                  350 mm
                                                           0.072954
    pb = [\{\beta 1^* (c^* 0.85) / (y)\}^* [600 / 600 + (y)] =
                                                           0.005950
    \rhomin = 1.4/fy =
```

				•
Name of Structure		Category o		Page
Koefisien	k =		0.06	
ρ = k*ρb =	·		0.00438	
ρ = κ•ρυ * As1 = ρ *			1532.03	mm^2
71 = As1*			360471.53	
	- -		12.82	
	(0.85*fc'*b) =		343.59	
Z = d - 0.9		100	123854071	and the second s
Mr1 = T1	*	August 18 Comment		
			123.85	
Mmax =			144.06	NINII
	Mmax > Mr1 required doub	se temiorcea co		1251
4 4	ax -Mr1 =		20.21	
	1 / fy(d-d') =	ing All Alexander	286.27	The state of the s
As= As1 +		er Aller Hiller	1818.30	
the tensile	e of steel bars :		As terpsg =	1889 mm^2
the comp	ressive of steel bars	D 19 - 150 /	As' terpsg =	1889 mm^2
Longitudia	nal steel bars : 20 % As =		en e	364 mm^2
		D 13 - 300 /	Asbagi =	442 mm^2
	ing the state of the second			
The earth	pressure on wingwall of at	outment : (look	at cross sect	ion 3-3)
	qmax = pa1 + pa2			
	qmax = 1.728 Vn	The second secon		
	L1 = 4.0 m	H= 1	1.4 m	
Mmax = c	max * L1*L1/2 =	13.820 t	lon m / m	4.00
Mmax tot	•	13.820 t	lon m / m	
· ·	.05 * Mmax =	14.511 t	lon m / m	
the stress	concrete fc' =	33.075 1	Мра	(earthquake condition fc'=1.5xfc')
	stress of steel fy =	235.29 1		(earthquake condition fy=1.5xfy)
	n of concrete ht =	400 ı		
	b =	1000 r	nm	
	d =	350 r	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
ob = 1 (81	"(c"0.85) / (y]"(600 / 600+		0.072954	
omin = 1.			0.005950	· 不可以不要的 () () () () () () () () () (
Koefisien			0.05	化三维多定数 海巴西亚克拉斯 电割
$\rho = \mathbf{k} * \rho \mathbf{b}$	•		0.00365	
As1 = p *		* .	1276.69	mm^2
T1 = As1			300392.94	
	(0.85*fc'*b) =		10.68	
Z = d - 0.5			344.66	→ 1
Mr1 = T1			103532693	
			103.53	
Maran -			145.11	
Mmax =	Mmax > Mr1 required doub	de reinforced co	and the second of the second of the second	
1	wmax > wii i required doub ax -Mr1 =	ne rennuncea co	41.58	KNm
1		\$ 144 A 17 A 18	589.05	
	M / fy(d-d') =		1865.74	
As≃ As1 +		D 10 150 1		1889 mm^2
1 .	e of steel bars :	and the second s	As terpsg =	
	ressive of steel bars	D 19 - 150 /	As' terpsg =	1889 mm^2
Longitudii	nal steel bars : 20 % As =	D 40 000 4	Nahasi -	373 mm^2
		D 13 - 300	Asbagi =	442 mm^2
1	and the second second second second	the state of the same of	and the second	



REINFORCED CONCRETE OF PIER-1, PIER-2, PIER-3 KREO BRIDGE

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Computer program for the Strength Design of Reinforced Concrete Sections

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3:41 Licensed to: Licensee name not yet specified.

General Information:

File Name: A:\KREO-P1.COL

Project: KREO BRIDGE
Column: PIER-1

Engineer: Ir.Purwanto MS.

Code: ACI 318-89 Units: SI Metric

Date: 10/10/99 Time: 18:07:11

Run Option: Investigation Short (nonslender) column Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 33.075 MPa Ec = 29076 MPa fc = 15.0549 MPa eu = 0.003 mm/mm Stress Profile: Block

fy = 235.29 MPa Es = 210000 MPa erup = 0 mm/mm

Beta1 = 0.810152

Geometry:

=======

Rectangular: Width = 2000 mm

Depth = 900 mm

Gross section area, $Ag = 1.8e+006 \text{ mm}^2$

 $Ix = 1.215e+011 \text{ mm}^4$ $Iy = 6e+011 \text{ mm}^4$

Xo = 0 mmYo = 0 mm

Reinforcement:

Rebar Database: Us						1.
Size Diam 1	Area Size	Diam	Area	Size	Diam	Area
10 11	100 16					
20 20	300 25	16 25	200 500	19	19	284
35 36 1	1000 45	44	1500	55 55	50 56	. /UU - 2500 -
		10 2 1 1 N 1 1 1			30	2300

Confinement: Tied; phi(c) = 0.7, phi(b) = 0.9, a = 0.8 N-15 ties with N-55 bars, N-15 with larger bars.

Layout: Rectangular

Pattern: Sides Different [Cover to transverse reinforcement (ties)]

. Had an Albadad

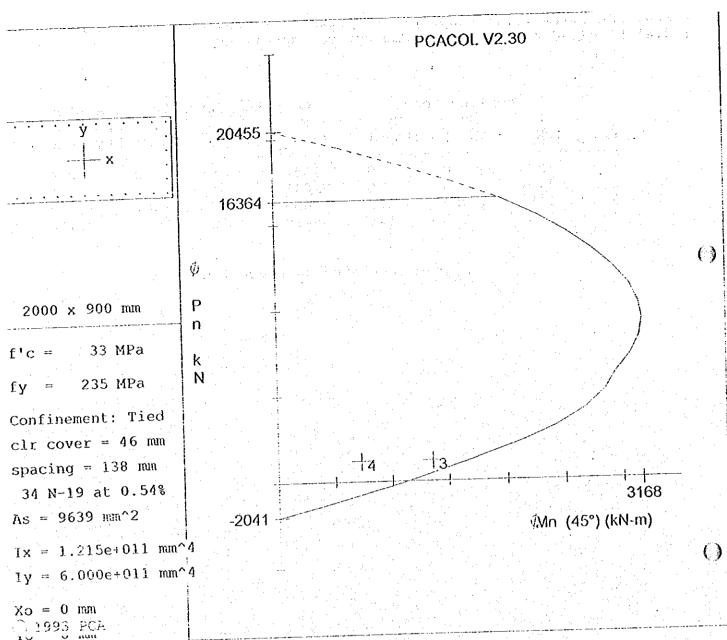
Total steel area, As = 9639 mm^2 at 0.54%

	Тор	Bottom	Left	Right
Bars	13 N-19	13 N-19	4 N-19	4 N-19
Cover (mm)	30	30	30	30

:33:41 Licensed to: Licensee name not yet specified.

	Applied Loads			Computed Strength			Computed/
Pt.	P (kN)	Mx (kN-m)	My (kN-m)	P (kN)	Mx (kN-m)	My (kN-m)	Applied Ray length
							
1	1204	0	0	-2041	-0.	-0	1.695
2	1186	0	0	-2041	~0	-0	1.721
3	1186	959	959	1659	1357	1361	1.409
4	1186	515	515	4410	1952	1947	3.736

Program completed as requested!



bicensed To: Licensee name not yet specified.

File name: A:\KREG-P1.COL

Project: KREO BRIDGE

Column Id: PIER-1

Engineer: Ir. Purwanto MS.

Date: 10/10/99

Code: ACI 318-89

Units: Metric

Time: 18:07:11

Beta1 = 0.81

Stress Profile: Block

Material Properties:

fc = 15.05 MPa

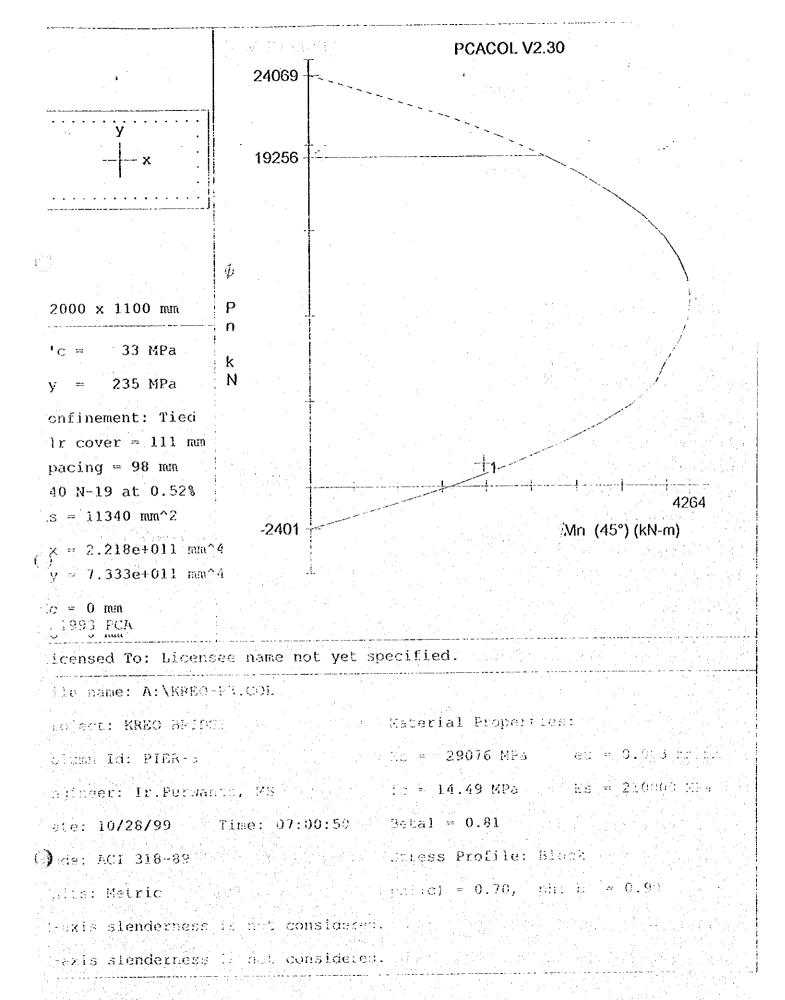
phi (c) = 0.70, phi (b) = 0.90

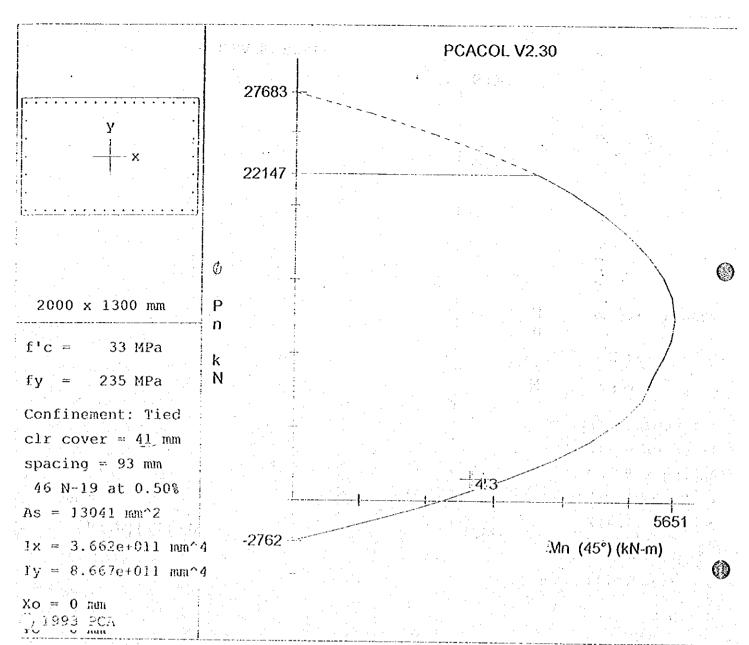
Ec = 29076 MPa eu = 0.003 mun/mun

 $_{\odot}$ Es = 210000 MPa

X-axis slenderness is not considered.

Y-axis slenderness is not considered.





name not yet specified.

File name: A:\KREO-P2.COL

Project: KRED BRIDGE

Column Id: PIER-2

Engineer: 1: Purwanto, MS

Date: 10/28/99

Code: AC1 318-89

Units: Metric :

Time: 04:44:58 Beta1 = 0.81

Stress Profile: Block

Material Properties:

Ec = 29076 MPa

fc = 14.10 MPa

phi(c) = 0.70, phi(b) / 0.99

eu = 0.003 mm/mm

()

Es = 210000 MPa

X-axis slenderness is not considered.

Y-axis slenderness is not considered.

REINFORCED CONCRETE OF PIER-1 (P-1):

File:RC-P1-1-3

The earth pressure under the normal condition :

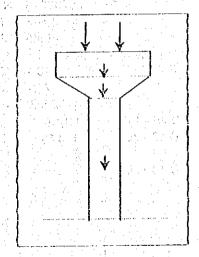
Height of Abutment
Width of footing Abutment
Length of footing Abutment

H≃	6.0	*;	m
B =	3.5	-1-	m
լ = 🦠	3.5		m

part	. Weight of part	
3.3 7.3	(lon)	
1	1.6'0.4'2.5'2.7 =	4.3200
2	(1.6+0.9)/2*0.4*2.5*(2.7+2)/2=	2.9375
3	0.7*4.3*2.5*2.0 =	19,3500
4	P1	46
5	P2	46
 	Total: ΣFv=	118.6075

Bending moment = 1.2*M =
Normal force N =
the concrete stress fc' =
the yeild stree of steel fy =

0.000 ton m /m = 0.00 KNm/m 118.61 ton / m = 1186.08 N/m 22.05 Mpa 156.86 Mpa

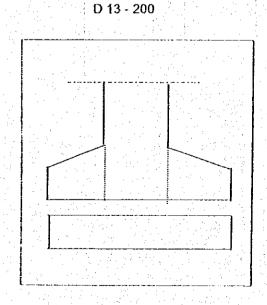


REINFORCED CONCRETE OF PIER-1 ON TOE AND HEEL

File:RC-P1-1-3

663 mm²

		r	EE.RG-P1-1-3
Compute soil pressure :		ing the state of t	
qmax = 39.991 Vi	n		
L1 = 1.3 m			
Mmax = qmax * L1*L1/2 = 🐰 :	33.79	2 ton m / m	
Mmax total =	33.79	2 ton m/m	
Mdes = 1.2 * Mmax =	40.55	1 ton m / m	
	11.		
the concrete stress fc' =	22.0	5 Mpa	
the yield stress of steel fy =	156.8	6 Mpa	
Dimension of concrete ht =	90	0 mm	
b =	100	0 mm	
d =	80	0 mm	
$\rho b = [\{\beta 1'fc''0.85\} / fy]'[600 / 600]$	+fy] =	0.0805	
ρmin = 1.4/fy =		0.0089	
Koefisien k =	radionale Patrick State of State	0.05	
ρ = k *ρ b =	in north on the second of the	0.00403	
$As1 = \rho * b * d =$		3220.55 m	ım^2
T1 = As1*fy = 1		505175.33 N	
a1 = 11 / (0.85*fc'*b) =		26.95 m	ım
Z = d - 0.5 a1 =		786.52 m	ım
Mr1 = T1 * Z =		397332151 N	mm
		397.33 K	Nm
Mmax =		405.51 K	Nm
Because Mmax > Mr1 required dou	ble reinforced	concrete	
ΔM = Mmax -Mr1 =		8.18 K	Nm
$As2 = \Delta M / fy(d-d') =$		74.47 m	m^2
As= As1 + As2 =		3295.02 m	m^2
dipakai tulangan tarik :	D 25 - 145	As terpsg =	3384 mm^2
dipakai tulangan tekan :	D 16 - 300	As' terpsg =	670 mm^2
Tulangan bagi : 20 % As =			659 mm^2
			111 INSTIT



REINFORCED CONCRETE OF PIER -1 (P-1): FIe:RC-P1-2-3 The earth pressure under the normal condition (Case-II): 6.0 W H≖ Height of Abulment 3.5 m B = Width of footing Abutment

3.5

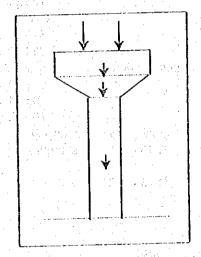
լ≖

m

part	Weight of part	
	((on)	4.320
2	1.6*0.4*2.5*2.7 = (1.6+0.9)/2*0.4*2.5*(2.7+2)/2=	2.938
3	0.9.4.3.25.50 =	19.350
4	P1	46.000
5	P2	46.000
	Total: ΣFv=	118.608

Length of footing Abutment

- 1	0.000 ton m /m =	0.00 KNm/m
Bending moment = 1.2*M =	118.61 ton/m=	1186.08 N/m
Normal force N = the concrete stress fc' =	110.01	22.05 Mpa
the yield stress of steel by	=	156.86 Mpa



REINFORCED CONCRETE OF PIER-1 ON TOE AND HEEL

File:RC-P1-2-

Com	pule	soil	pressure	:
-----	------	------	----------	---

qmax = 32.9420 t/m L1 = 1.3 m

Mmax = qmax * L1*L1/2 = 27.836 ton m / m Mmax total = 27.836 ton m / m Mdes = 1.2 * Mmax = 33.403 ton m / m

the concrete stress fc' = 22.05 Mpa
the yield stress of steel fy = 156.86 Mpa
Dimension of concrete ht = 900 mm
b = 1000 mm
d = 800 mm

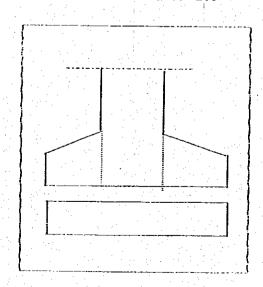
 $\rho b = [\{\beta 1 \text{ fc'*0.85}\} / \text{ fy }] \text{ } [600 / 600 + \text{fy}] =$ 0.080514 ρ min = 1.4/fy = 0.008925 Koefisien k = 0.041 $\rho = k*\rho b =$ 0.00330 As1 $= \rho * b * d =$ 2640.85 mm² T1 = As1*fy =414243.77 N a1 = T1 / (0.85 fc''b) =22.10 mm Z = d - 0.5 a1 =788.95 mm Mr1 = T1 * Z =326817241 Nmm 326.82 KNm Mmax = 334.03 KNm

Because Mmax > Mr1 required double reinforced

AM = Mmax ·Mr1 = 7.21 KNm As2 = Δ M / (y(d-d') = 65.71 mm^2 As= As1 + As2 = 2706.56 mm^2

tensile reinforced: D 25 - 175 As terpsg = 2804 mm^2 compresive reinforced D 16 - 300 As' terpsg = 670 mm^2

Longitudinal steel: 20 % As = 541 mm² D 13 - 200 663 mm²



REINFORCED CONCRETE OF PIER - 1 (P-1):

File:RC-P1-3-3

The earth pressure under the earthquake condition (Case III):

Carrie process	•		
Height of Abutment	· H =	6.0	m
Width of fooling Abutment	B =	3.5	m
Length of footing Abulment	、 · L≔	3.5	m

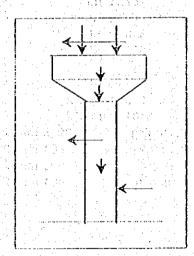
Long Section:

part	Weight of part		Arm	Moment 2
	(ton/m)	프랑크 원칙		tón m/m
1	1.6*0.4*2.5*2.7 =	4.32	0.000	0.000
2	(1.6+0.9)/2*0.4*2.5*(2.7+2)/2=	2.94	0.000	0.000
3	0.90*4.3*2.5*2 =	19.35	0.000	0.000
4	PI 37 ATM SHARE SHIP TO BE	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	P = 0.9315	0.9315	0.201	0.188
- 7	KP = 13.800	13.80	5.170	71.346
8	KW = 3.992	3.99	2.100	8.383
	Total : ΣFv =	118.61	ΣMr =	79.917

Bending moment = 1.2*M =
Normal force N =
the concrete stress fc' =
the yield stress of steel fy =

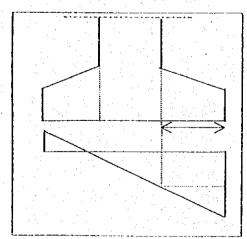
95.900 ton m /m = 118.61 ton / m = 33.075 Mpa 235.29 Mpa

959.00 KNm/m 1186.08 N/m (earthquake condition fc'=1.5xfc') (earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER-1 ON TOE AND HEEL: File:RC-P1-3-3

Compute soil pressure			and the ground	at was a first of		
-1	88.3362 t/m		weight of con	crete q =	1.68	t/m
qmin =	-15.8713 t/ m	•	qmin -q =		14.1913	.t/m
	in in the		L1 =	1.3	m	
q1 = qmax-qmin =	72.4649 <i>U</i> m					
Mmax1 = (qmin-q) * L		•	ton m / m			- :
Mmax2 = 1/2*q1*L1*(2/3)*L1 =		ton m / m			- 1
Mmax total =			ton m / m			
Mdes = 1.2 * Mmax =	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	63.376	ton m / m	્રાંત કર્યો. કોંગ્સું એમ કેમ્પ્ર	ing a second of the second of	
the concrete stress for	့ = ကို ကိုလည်း	33.075	Мра	(earthquak	e condition ,	fc'=1.5xfc')
the yield stress of stee	elfy=	235.29	Мра	(earthquak	e condition ,	[v=1.5xfy]
Dimension of concrete	e ht = 500 100 0	900	mm			
	b = ,	1000	mm			
	d =	800	mm	Brancia.		
$\rho b = \{ \{ \beta 1 \text{ fc'* } 0.85 \} / f \}$	y]*[600 / 600+fy]	=	0.07295			
ρmin = 1.4/fy =			0.00595			
Koefisien k =			0.05			
ր = k ∗ րb = % 13 կցն	1 4.4	des tur	0.00365	A Hims	i au <i>ri</i> st 171	
As1 = $\rho^* b * d = \{ \}$		ring 131	2918.15	mm^2		
		September 1	686612.43	N		
a1 = T1 / (0.85*fc'*b) :			24.42	mm		
Z = d - 0.5 a1 =	•		787.79	mm		
Mr1 = T1 * Z =			540905498	Nmm		
			540.91	KNm		
Mmax =			633.76	KNm		
Because Mmax > Mr1	required double	reinforced		4 7 (3) 4 (4)		
$\Delta M = Mmax - Mr1 =$	and the second		92.86	KNm		
As2 = Δ M / fy(d·d·) =			563.78	mm^2		
As= As1 + As2 =			3481.94	mm^2		
use tensile reinforced		25 - 125	As terpsg =	3925	mm ^x 2	
use compressive reinf	orced con. D	16 - 250	As' terpsg =	804	mm^2	
Longitudinal steel bars	s : 20 % As = 🦪			696	mm^2	
	D	13 - 150	Asbagi =	884	mm^2	
	A CONTRACTOR OF THE CONTRACTOR	:	and the second of the second o	A CONTRACTOR OF THE PARTY OF TH		and the second second second second



REINFORCED CONCRETE OF PIER-1 (P-1):

File:RC-P1-4-3

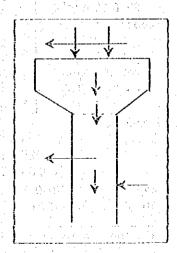
The earth pressure under theearthquake condition (Case IV):

Height of Abutment	H=	6.0	m
Width of footing Abutment	B =	3.5	m
Length of footing Abutment	L=	3.5	m

part	Weight of part		Arm	Moment ton m/m
1	1.6'0.4'25'2.7 =	4.32	0.000	0.000
2	(1.6+0.9)/2*0.4*2.5*(2.7+2)/2=	2.94	0.000	0.000
3	0.9*4.3*2.5*2.0 =	19.35	0.000	0.000
4	P1	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	P = 2.2365	2.24	0.201	0.450
7	KP = 6.900	6.90	5.170	35.673
8	KW = 3.237	3.24	2.100	6.798
	Total : ΣFv =	118.61	ΣM1 =	42.921

Bending moment = 1.2*M =
Normal force N =
the concrete stress fc' =
the yield stress of steel fy =

51.505 ton m /m = 118.61 ton / m = 33.075 Mpa 235.29 Mpa 515.05 KNm/m 1186.08 N/m (earthquake condition fc'=1.5xfc') (earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER-1 (P-1):

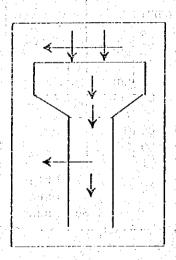
File:RC-P1-4-3 Compute soil pressure: qmax = 62.571 Vm qmin = 5.8338 t/m qmax-qmin = 56.7372 t/m q1 = 34.04232 t/m q2=q1+(qmax-qmin)= 39.87612 t/m $q3 = qmax \cdot q2 =$ 22.69488 t/m L1 = _____ 1.3 m 📑 $Mmax = 0.5*q2*L1^2 =$ 33.695 Mmax = 1/2*q3 * L1*2/3*L1 =12.785 ton m / m Mmax total = 46.480 ton m / m Mdes = 1.2 * Mmax = 55.776 ton m / m thr concrete stress fc' = 33.075 Mpa (earthquake condition fc'=1.5xfc') the yield stress of steel fy = 235.29 Mpa (earthquake condition fy≈1.5xfv) Dimension of concrete ht = 900 mm b = 1000 mm **d** = 800 mm $\rho b = [\{\beta 1 \text{ fc'*0.85} \} / \{y\} \text{ } \{600 / 600 \text{ fy}\} = 0.072953848$ $\rho min = 1.4/fy = 10.00111$ 0.005950104 coeficient k = 0.05 p = k*բb = 0.00365 $As1 = \rho * b * d =$ 2918.15 mm^2 $T1 = As1^*fy =$ 686612.43 N a1 = T1 / (0.85*fc"b) = 24.42 mm Z = d - 0.5 a1 =787.79 mm Mr1 = T1 * Z =540905498 Nmm 540.91 KNm Mmax ≈ 557.76 KNm Because Mmax > Mr1 required double reinforced $\Delta M = Mmax - Mr1 =$ 16.86 KNm $As2 = \Lambda M / fy(d-d') =$ 102.34 mm² As= As1 + As2 = 3020.49 mm² tensile reinforced D 25 - 150 As terpsg = 3271 mm² compressive reinforced D 16 - 300 As' terpsg = 670 mm² Longitudinal steel bars : 20 % As = 604 mm^2 D 13 - 200 Asbagi = 663 mm^2

REINFORCED CONCRETE OF PIER -1:

	File. NO-P1-3
The earth pressure under the earthquake condition	ı (Case V):
Height of Abutment	H = 6.0 m
Width of footing Abutment	B = 13.5 m = 0
Length of footing Abutment	L = 3.5 m
	电影对解的图像 (1967)

part	Weight of part (ton/m)		Arm	Moment ton m/m	
1	1.6'0.4'2.5'2,7 =	4.32	0.000	0.000	
2	(1.6+0.9)/2*0.4*2.5*(2.7+2)/2=	2.94	0.000	0.000	
3	0.7.4.3.2.5.2 =	19.35	0.000	0.000	
4	P1	46.00	-0.350	-16.100	5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
5	P2 .	46.00	0.350	16,100	the state of
6	KP = 13.8	13.80	5.170	71.346	
7	KW = 3.992	3.99	2.100	8.383	
	Total: ΣFv =	118.61	ΣMr =	79.729	

of All Congression and the All Congression of the C	A Section		र प्राप्त प्रसार कर हता. के रास्त्र सुर्धाः
Bending moment = 1.2*M =	95.675	ton m/m =	956.75 KNm/m
Normal force N =	118.61	tòn/m=	1186.08 N/m
the concrete stress fc' =	33.075	Мра	(earthquake condition fc'=1.5xfc')
the yield stress of steel fy =	235.29	Мра	(earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER - 1 ON TOE AND HEEL:

File:RC:P1-5-3

```
Compute soil pressure:
                       91.5927 Vm
          emax =
          e nimp
                      -11.6098 Vm
                                            1.75 ton m / m
          weight of concrete q =
                      50.05406 t/m
          Q1 =
                      41.53864 t/m
          q2 =
          q3 =q1-q= 48.30406 t/m
          L1 =
                            1.3 m
Mmax = 1/2*q2 * L1*L1*(2/3) =
                                         23.400 ton m / m
Mq = 1/2*q3*L1*2 =
                                         40.817 ton m / m
                                         64.217 ton m / m
Mmax total =
Mdes = 1.2 * Mmax =
                                         77.060 ton rn / m
the concrete stress fc' =
                                         33.075 Mpa
                                                               (earthquake condition fc'=1.5xfc')
the yield stress of steel fy =
                                         235.29 Mpa
                                                               (earthquake condition fy=1.5xfy)
Dimension of concrete ht =
                                         🚊 900 mm
                            b =
                                           1000 mm
                                            800 mm
                            ď≂
\rho b = [\{\beta 1^* (c'^* 0.85) / \{y\}\}^* [600 / 600 + \{y\}] =
                                                      0.07295
                                        0.00595
\rhomin = 1.4/fy =
                                          0.071
coeficient k =
                                        0.00518
ը = k*ըb =
As1 = \rho^*b^*d =
                                        4143.78 mm^2
T1 = As1'fy =
                                      974989.66 N
a1 = T1 / (0.85*fc'*b) =
                                          34.68 mm
                                         782.66 mm
Z = d - 0.5 a1 =
Mr1 = T1 * Z =
                                     763085321 Nmm
                                         763.09 KNm
Mmax =
                                         770.60 KNm
Because Mmax > Mr1 required double reinforced:
\Delta M = Mmax - Mr1 =
                                                          7.52 KNm
As2 = \Delta M / fy(d-d') =
                                                         45.65 mm^2
As= As1 + As2 =
                                                      4189.43 mm^2
tensile reinforced:
                                   D 25 - 115
                                                As terpsg =
                                                                    4266 mm^2
compressive reinforced
                                   D 16 - 220
                                                As' terpsg =
                                                                     913 mm<sup>2</sup>
Longitudinal steel : 20 % As =
                                                                     838 mm^2
```

D 13 - 150

Asbagi =

884 mm^2

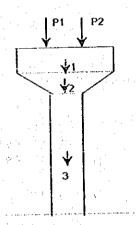
REINFORCED CONCRETE OF PIER-2 (P-2):

File:RC-P2-1-3

The earth pressure under the normal condition	Case I):	1.5	100
Height of Pier	Н≕	10.00	: m
Width of footing Pier	B =	4.55	m
Length of footing Pier	L≖	4.55	. m
Length of footing (io.			

part	Weight of part (ton)	
1	1.6*0.4*2.5*2.7 =	4.32
2	(1.6+1.3)/2*0.4*2.5*(2.7+2)/2=	3.41
3	1,3*8*2.5 =	52.00
4	P1	46.00
5	P2	46.00
	Total . SEV-	151 728

Bending moment = 1.2*M = 0.000 ton m /m =	0.00 KNm/m	
Normal force N = 59.73 ton / m =	597.28 KN/m	
the concrete stress (c' =	22.05 Mpa	
the vield stress of steel fy =	156.86 Mpa	



REINFORCED CONCRETE OF PIER -1 ON TOE AND HEEL:

File:RC-P2-1-3

Compute soil pressure :	i i di	er de en englische eine eine eine	
qmax =	9.792 t/m		
L1 = 10 %	1.625 m	en de la companya de La companya de la co	
Mmax = qmax * L1*L1/	2 =	12.929 ton m / m	, .
Mmax total =		12.929 ton m / m	
Mdes = 1.2 * Mmax =		15.514 ton m / m	
at a strong fol m	1. 1	22.05 Mpa	
the concrete stress fc' =		156.86 Mpa	-
the yield stress of steed		1300 mm	4
Dimension of concrete		1000 mm	
	d =	1100 mm	
$\rho b = [\{\beta 1^* f c'^* 0.85\} / f y]$			
pmin = 1.4/fy =		0.00893	
coeficient k =		Li yaliye (25.51) 0.01	
keah =		0.00081	

 ρ = k*ρb =
 0.00081

 As1 = ρ*b*d =
 885.65 mm²2

 T1 = As1*fy =
 138923.22 N

 a1 = T1 / (0.85*fc*b) =
 7.41 mm

 Z = d - 0.5 a1 =
 1096.29 mm

 Mr1 = T1 * Z =
 152300674 Nmm

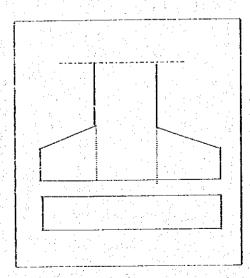
 Mmax =
 155.14 KNm

Because Mmax > Mr1 required double reinforced: $\Delta M = Mmax - Mr1 = 2.84 \text{ KNm}$ $\Delta S = \Delta M / (v(d-d)) = 18.11 \text{ mm}^2$

As2 = Δ M / fy(d-d') = 18.11 mm²2 As= As1 + As2 = 903.76 mm²2

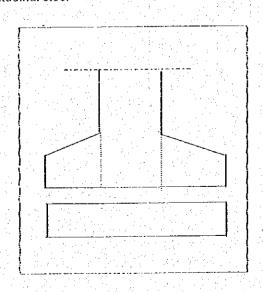
tensile reinforced: D 19 - 250 As terpsg = 1134 mm^2 compressive reinforced D 13 - 250 As terpsg = 531 mm^2 Longitudinal steel: 20 % As = 181 mm^2

use longitudinal steel D 13 - 250 531 mm²



REINFORCED CONCRETE OF PIER-2 (P-2) ON TOE AND HEEL:

	•		
Compute soil pressure :	Leading of the	31 - A	File:RC-P2-2-3
qmax = 6.0	83 t/m		100
1.65 ± 1.65	25 m		
Mmax = qmax * L1*L1/2 =	8.031	ton m / m 🐇 -	e la finale de la companya de la co
Mmax total =	8.031	ton m / m	
Mdes = 1.2 * Mmax =	9.638	ton m / m 👙	
		,	
the concrete stress fc' =	22.05	Мра	1960年 1967年 中
the yield stress of steel fy =	156.86	Мра	
Dimension of concrete ht =	1300	mm	
	= 1000	mm	
d de la companya de	i = 1100	mm	
$\rho b = [{\beta 1^* fc'^* 0.85} / fy]^* [600]$	/ 600+fy] =	0.08051	
emin = 1.4/fy =		0.00893	
Koefisien k =		0.006	
$\rho = k*\rho b =$		0.00048	
As1 = ρ*b*d =		531.39	mm^2
T1 = As1*fy =	Proceedings of the second of t	83353.93	$N = \{\{1,2,\dots,4\}, \{1,2,\dots,4\}\}$
a1 = T1 / (0.85*fc'*b) =	Constitution of the field	4.45	mm
2 = d - 0.5 a1 = 1.5 (A15.0)	A March Seas	1097.78	mm
· Mr1 = T1 * Z = √ eq (* .×.) (91503971	Nmm
		91.50	KNm
Mmax =		96.38	KNm
Because Mmax > Mr1 require	o double reinforced	concrete:	
AM = Mmax -Mr1 =		4.87	KNm
$As2 = \Delta M / (y(d-d') =$		31.07	mm^2
As= As1 + As2 =		562.46	mm^2
tensile reinforced concrete	D 19 - 250	As terpsg =	1133.54 mm ²
compressive reinforced concr		As' terpsg =	530.66 mm^2
Longitudinal steel : 20 % As =			112.49 mm^2
use Longitudinal steel	D 13 - 250		530.66 mm^2
add Editigitadinia area.		the state of the s	



REINFORCED CONCRETE OF PIER-3 (P-3):

File:RC-P2-3-3

The earth pressure	under the earthquake	condition (Case III):
--------------------	----------------------	-----------------------

Height of Pier :	<i>ारव</i> े H = .	10.00 m
Width of footing Pier	: B =	4.55 m
Length of footing Pier	լ =	4.55 m

part	Weight of part		Arm	Moment ton m/m
1	1.6'0.4'2.5'2.7 =	4.32	0.000	0.000
2	(1.6+1.3)/2*0.4*2.5*(2.7+2)/2=	3.41	0.000	0.000
3	1.3'8'2.5 =	52.00	0.000	0.000
4	P1	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	P = 2.7315/20	2.73	1.616	4.413
7	KP = 13.800 /2.0	13.80	8.870	122.406
8	KW = 8.342	8.34	3.800	31.700
	Total : ΣFv =	151.73	ΣMr =	158.519

Bending moment = 1.2*M = Normal force N =

1902.23 KNm/m

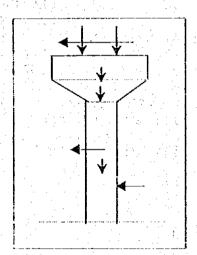
a. 1517.28 N/m 151.73 ton / m =

the concrete stress fc' = the yield stress of steel fy =

33.075 Mpa 235.29 Mpa

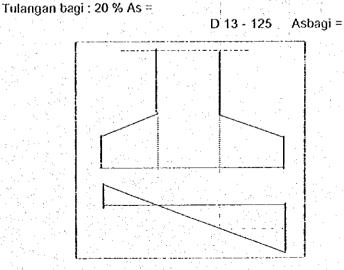
190.223 ton m/m =

(earthquake condition fc'=1.5xfc') (earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER-2 ON TOE AND HEEL:

File:RC-P2-3-3 Compute soil pressure: 2.5 Vm weight of concrete q= amax = 🕒 98.9245 Vm gmin = □ 47.9888 Vm -32.2884 t/m q1-q = q1 = 50.4888 Vm L1 = 1.625 m 63.360 ton m/m M1 = (q1-q) * L1*L1/2 =M2 = 1/2*(qmax-q1)*L1*L1*2/3 =42.634 ton m / m 105.994 ton m/m Mmax total = Mdes = 1.2 * Mmax = 127.192 ton m / m (earthquake condition fc'=1.5xfc') Mutu beton fc' = 15 33.075 Mpa (earthquake condition fy=1.5xfy) 235.29 Mpa Mutu baja fy = 1200 mm Dimensi beton ht = 1000 mm **b** = . d = 1100 mm $\rho b = [\{\beta 1*fc'*0.85\} / fy]*[600 / 600+fy] =$ 0.072953848 0.005950104 ρ min = 1.4/fy = 0.06 Koefisien k = 0.00438 $\rho = k*\rho b =$ 4814.95 mm^2 $As1 = \rho * b * d =$ 1132910.52 N . T1 = As1*fy =40.30 mm a1 = T1 / (0.85 fc'*b) =1079.85 mm Z = d - 0.5 a1 =1223374904 Nmm Mr1 = T1 * Z =1223.37 KNm 1271.92 KNm Mmax =Karena Mmax > Mr1 maka perlu tulangan rangkap 48.55 KNm $\Delta M = Mmax - Mr1 =$ 206.34 mm² $As2 = \Delta M / fy(d-d') =$ As= As1 + As2 = 5021.29 mm² 5281.48 mm^2 As terpsg = dipakai tulangan tarik: D 29 - 125 803,84 mm² dipakai tulangan tekan : D 16 - 200 As' terpsg =



1004.259 mm^2

1061.32 mm^2

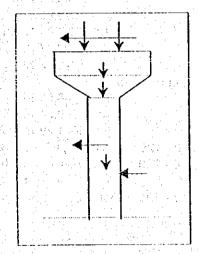
REINFORCED CONCRETE OF PIER -2 (P-2)

File:RC-P2-4-3

The earth pressure under the earthquake	condition (Case IV):
Height of Pier :	H = 10.00 m
Width of footing Pier	B = 4.55 m
Length of footing Pier	L= 4.55 m

part	Weight of part (ton/m)		Arm	Moment ton m/m	
1	1.6'0.4'2.5'2.7 =	4.320	0.000	0.000	
2	(1.6+1.3)/2*0.4*2.5*(2.7+2)/2=	3.408	0.000	0.000	
3	1,3'8.0'2.5'2.0 =	52.000	0.000	0.000	
4	P1	46.00	-0.350	-16.100	10.3 (4)
5	P2	46.00	0.350	16.100	
6	P = 40365	4.04	2.859	11.539	14,5
7	KP = 13.800	13.80	8.870	122.406	
8	KW = 8.969	8.96	3.800	34.044	
	Total : ΣFv =	151.73	ΣMr =	167.989	10012
					la e e e e

Ber	nding moment = 1.2*M =	201.587 ton m /m =	2015.87 KNm/m
	Normal force N =	151.73 ton/m =	1517.28 N/m
	Mutu Beton fc' =	33.075 Mpa	(earthquake condition fc'=1.5xfc')
	Tulangan Baja fy =	235.29 Mpa	(earthquake condition fy=1.5xfy)
		and the second of the second o	

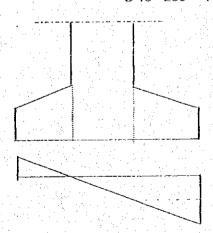


REINFORCED CONCRETE OF PIER-2 ON TOE AND HEEL:

File:RC-P2-4-3

Compute soil pressure :

				•
qmax = 68.9547 t/m		weight of con-	crete q=	2.5 Vm
qmin = -3.9186 t/m	1.	q1-q =		32.6633 Vm
q1 = 35.1633 t/m				
L1 = 1.625 m				
M1 = (q1-q) * L1*L1/2 =	43.126	ton m/m		
M2 = 1/2*(qmax-q1)*L1*L1*2/3 =	29.744	ton m / m		
Mmax total =	72.869	ton m / m 👙		
Mdes = 1.2 * Mmax =	87.443	ton m / m		
		riga itali italia. Nationalia		The Date No.
Mutu beton fc' = 33.075 Mpa	a	(earthquake co	ndition fc'=1.5	xfc')
Mutu baja fy = 235.29 Mpa	a	(earthquake co	ndition fy=1.5.	v(iv)
Dimensi beton ht = 1200 mm				
b = 1000 mm			1	
d = 1100 mm				
pb = [{\beta1*fc'*0.85} / fy]*[600 / 600+f	[y] =	0.07295		
omin = 1.4/fy =		0.00595		
Koefisien k =		0.04		
$\rho = k*\rho b =$		0.00292		343
$As1 = \rho *b *d =$		3209.97	mm^2	
$T1 = As1^{*}fy =$		755273.68	N	
a1 = T1 / (0.85*fc'*b) =		26.86	mm	
Z = d - 0.5 a1 =		1086.57	mm	
Mr1 = T1 * Z =		820655861	Nmm	
		820.66	KNm	
Mmax =		874.43	KNm	
Karena Mmax > Mr1 maka pedu tula	ngan rangka	р		
AM = Mmax -Mr1 =			KNm	
$As2 = \Delta M / fy(d-d') =$		22.85	mm^2	
As= As1 + As2 =		3232.82		
dipakai tulangan tarik :	O 29 - 200	As terpsg =	3300.93 n	and the second second
	D 16- 300	As' terpsg =	669.87 m	
Tulangan bagi : 20 % As =			646.5648 m	
	D 13 - 200	Asbaoi =	663,325 m	ıın^2



REINFORCED CONCRETE OF PIER -2 (P-2):

File:RC-P2-5-3

The earth pressure under the earthquake condition (Case V):

Height of Pier:		. :	`H=	10.00	m
Width of footing Pier	:		B =	4.55	m
Length of footing Pier			L =	4.55	m

part	Weight of part		Arm	Moment ton m
1	1.6'0.4'2.5'2.7 =	4.320	0.000	0.000
2	(1.6+1.3)/2*0.4*2.5*(2.7+2)/2=	3.408	0.000	0.000
3	1.3'8'2.5'2.0 =	52.000	0.000	0.000
4	P1	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	KP =13.8	13.80	8.870	122.406
7	KW = 8.959	8.96	3.800	34.044
1 1	Total : ΣFv =	151.73	ΣMr =	156.450

Bending moment = 1.2*M = Normal force N =

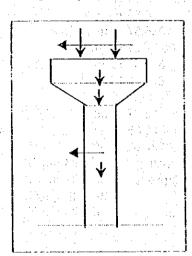
Normal force N = Mutu Beton fc' = Tulangan Baja fy =

187.740 ton m /m = 151.73 ton / m = 33.075 Mpa

235.29 Mpa

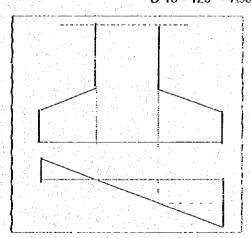
1877.40 KNm/m 1517.28 N/m

(earthquake condition fc'=1.5xfc') (earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER-2 ON TOE AND HEEL:

First Consultation of the			Fle:RC-P2-5-3
Compute soil pressure :			
qmax = 107.929	t/m	weight of cor	icrete q= 2.5 t/n
qmin = -18.825	t/m	q1-q =	57,99235 Vm
q1 = 60.49235	t/m		
L1 = 1.625	m		
M1 = (q1-q) * L1*L1/2 =	76.56	8 ton m / m 🕟	
M2 = 1/2*(qmax-q1)*L1*L1*2/3 =	41.75	4 ton m / m 🕟	
Mmax total ≕	118.32	2 ton m/m	
Mdes = 1.2 * Mmax =	141.98	7 ton m / m 🦠	
Mutu beton fc' = 33.075	Мра	(earthquake co	ondition fc'=1.5xfc')
Mutu baja fy = 235.29	Мра	(earthquake co	ondition fy=1.5xfy)
Dimensi beton ht = 1200	mm 💮 💮		
b = 1000	mm		
d = 1100	mm		
$\rho b = [{\beta 1*fc'*0.85} / {y}]*[600 / 60]$	00+fy] =	0.072953848	Barry Commence
ρmin = 1.4/fy =	n Silandi arbah ang menggungan	0.005950104	
Koefisien k =		0.06	
p = k*pb =		0.00438	
$As1 = \rho * b * d =$		4814.95	mm^2
T1 = As1*fy =		1132910.52	? N
a1 = T1 / (0.85*fc'*b) =		40.30) mm
Z = d - 0.5 a1 =		1079.85	mm
Mr1 = T1 * Z =		1223374904	Nmm
		1223.37	' KNm
Mniax =		1419.87	KNm
Karena Mmax > Mr1 maka perlu	lulangan rangka	ip –	Park the company of the first
ΔM = Mmax -Mr1 =		196.49	KNm
$As2 = \Delta M / fy(d-d') =$		83.51	mm^2
As= As1 + As2 =		4898.46	mm^2
dipakai tulangan tarik :	D 29 - 130	As terpsg =	5078.35 mm^2
dipakai tulangan tekan :	D 16 - 260	As' terpsg =	772.92 mm^2
Tulangan bagi : 20 % As =			979.6928 mm^2
	D 13 - 125	Asbagi =	1061.32 mm^2



REINFORCED CONCRETE OF PIER-3 (P-3):

File:RC-P3-1-3

The earth pressure under the normal condition:

Height of Pier

Width of footing Pier

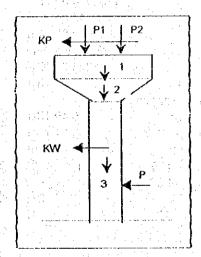
Length of footing Pier

H = 8.0 m

B = 4.0 m

L = 4.0 m

part	Weight of part (ton)	
1	1.6'0.4'2.5'2.7 =	4.320
2	(1.6+1.1)/2*0.4*2.5*(2.7+2)/2=	3,173
3	1.1'6.1'2.5'2.0=	33.550
4	P1= 46	46.000
5	P2 = 46	46.000
	Total: ΣFv =	133.0425



REINFORCED CONCRETE OF PIER -3 ON TOE AND HEEL:

File:RC-P3-1-3

Comp	oute soil pressure qmax =	e : 10,536 Vm			
	L1 ≈	1.3 m		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Mmax	c = qmax * L1*L	1/2 = 1	8.903	ton m / m	
	c total =	ing A Street	8.903	ton m / m	
	= 1.2 * Mmax =	Section 2	10.684	ton m / m	
the co	oncrete stress fo	; ;' =	22.05	Mpa	
	eld stress of stee		156.86	Мра	
	nsion of concrete		1100		

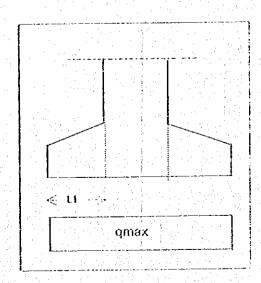
Difficulties of Garage			
· ·	b= 40.04033	1000 mm	
	d = 13 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	900 mm	
$\rho b = [\{\beta 1*fc'*0.85\}]/fy$	/]*(600 / 600+fy) =	0.080514	
•		0.008925	5
-		0.01	
ρ = k *ρb =	3. 性多数 1 · 10 · 10 · 10	0.00081	l
As1 = $\rho * b * d = \frac{1}{2}$	A. 244 (1986)	724.62	2 mm^2
T1 = As1*fy =		113664.45	5 N
a1 = T1 / (0.85*fc'*b) =		6.06	🦠 mm 8
Z = d - 0.5 a1 = 0.5		896.97	7 mm 🗀
Mr1 = T1 * Z = 10 161		101953344	4 Nmm

Mr1 = T1 * Z = 101953344 Nmm 101.95 KNm Mmax = 106.84 KNm

Because Mmax > Mr1 required double reinforced concrete : $\Delta M = Mmax - Mr1 = 4.88 \text{ KNm}$ $\Delta S = \Delta M / fy(d-d') = 38.90 \text{ mm}^2$ $\Delta S = \Delta S + \Delta S = 763.53 \text{ mm}^2$

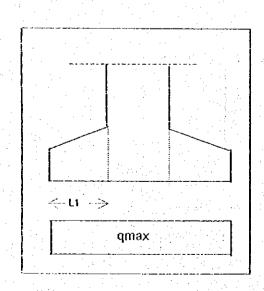
use tensile steel bars : D 19 - 250 As terpsg = 1134 mm² use compressive steel bars : D 16 - 250 As terpsg = 804 mm² Longitudinal steel bars : 20 % As = 153 mm²

use longitudinal steel bars : D 13 - 250 531 mm^2



REINFORCED CONCRETE OF PIER-3 ON TOE AND HEEL:

Compute soil pressure :	File:RC-P3-2-3
qmax = 8.068 Vm	
L1 = 1.3 m	
Mmax = qmax * L1*L1/2 =	6.817 ton m / m
Mmax total =	6.817 ton m / m
Mdes = 1.2 * Mmax =	** 8.181 ton m / m
the conclere stress fc' =	22.05 Mpa
the yield stress of steel fy =	156.86 Mpa
Dimension of concrete ht =	
b = 141.4	1000 mm
1 + 1 + 1 = 1 + 1 = 1 + 1 = 1 + 1 = 1 + 1 = 1 =	
$\rho b = [\{\beta1^*fc^*0.85\} / fy]^*[600 / 600 + fy]$	
pmin = 1.4/fy =	0.00893
Koefisien k =	0.008
$\rho = k*\rho b =$	0.00064
As1 = $p * b * d = [35/3]^{1/3}$	579.70 mm^2
T1 = As1*fy =	90931.56 N
a1 = T1 / (0.85*fc'*b) =	4.85 mm
: Z = d - 0.5 a1 =	897.57 mm
· Mr1 = T1 * Z = 2 / 2 / 2 / 3 / 3 / 3 / 3 / 3 / 3 / 3 /	81617821 Nmm
	81.62 KNm
. Mmax =	81.81 KNm
Because Mmax > Mr1 required double	reinforced concrete:
$\Delta M = Mmax - Mr1 = 0$	0.19 KNm
$As2 = \Delta M / fy(d-d') =$	1.53 mm^2
As= As1 + As2 =	581.23 mm^2
	19 - 250 As terpsg = 1133.54 mm ²
·	13 - 250 As' terpsg = 530.66 mm^2
Longitudinal steel bars : 20 % As =	116.2453 mm^2
use longitudinal steel bars : D	13 - 250 530.66 mm^2



REINFORCED CONCRETE OF PIER-3 (P-3):

File:RC-P3-3-3

The earth pressure under the earthquake condition (Case III):

Height of Pier :	: H =	8.0	m
Width of footing Pier	8 =	4.0	m
Length of footing Pier	u a _g t t. ≠	4.0	- m

part	Weight of part		Arm	Moment
	(ton/m)	18 No. 18 18		ton m/m
1	1.6'0.4'2.5'2.7 =	4.320	0.000	0.000
2	(1.6+1.1)/2*0.4*2.5*(2.7+2)/2=	3.055	0.000	0.000
3	1.1'6.1'2.5'2.0 =	33.550	0.000	0.000
4	P1 - 3 - 1.1 - 2.3 - 1 - 3	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	P = 1.8315	1.83	0.859	1.573
7	KP = 13.800	13.80	6.970	96.186
8	KW = 6,139	6.14	2.900	17.803
	Total : ΣFv =	132.93	ΣMr =	115.562

Bending moment = 1.2*M = 138,674 ton m/m = Normal force N =

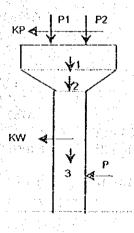
the concrete stress fc' = the yield stress fy =

132.93 ton / m =33,075 Mpa

235.29 Mpa

1386.74 KNm/m 1329.25 N/m

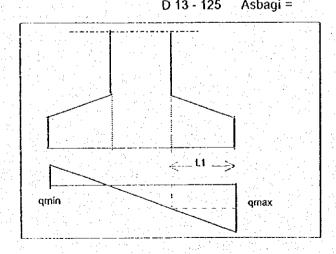
(earthquake condition fc'=1.5xfc') (earthquake condition fy=1.5xfy)



REINFORCED CONCRETE OF PIER-3 ON TOE AND HEEL:

File:RC-P3-3-3

Compute soil pressure :	g tight termina grown in the annual addition of the
qmax = 95.211 t/m	weight of concrete q= 2.5 Vm
qmin = -25.463 Vm	q1-q = 9000 48.300 Vm
q1 = 50.800 t/m	
L1 = 1.45 m	
M1 = (q1-q) * L1*L1/2 =	50.776 ton m / m
M2 = 1/2*(qmax-q1)*L1*L1*2/3 =	31.124 ton m / m
Mmax total =	81.900 ton m / m
Mdes = 1.2 * Mmax =	98.280 ton m / m
the concrete stress fc': 33.075 Mpa	(earthquake condition fc'=1.5xfc')
the yield stress fy = 235.29 Mpa	(earthquake condition fy=1.5xfy)
Dimension of concrete ht =	
2、 多字的 表演的复数 医肾 b 量的 [2]。	1000 mm
d =	900 mm
$\rho b = [\{\beta 1 \text{ fc'*} 0.85\} / \text{ fy }] [600 / 600 \text{ fy}] =$	[[] [[] [] [] 0.07295 [[] [[] [] [] [[] [] [] [] [] [] [] []
pmin = 1.4/fy =	0.00595
coeficient k =	0.07
$\rho = k * \rho b =$	(A) (1) (a) (b) (b) (b) (c) (c) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d
$As1 = \rho^*b^*d =$	4596.09 mm^2
T1 = As1*fy =	1081414.58 N
a1 = T1 / (0.85*fc'*b) =	38.47 mm (1869) 13 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Z = d - 0.5 a1 =	880.77 mm
Mr1 = T1 * Z =	952474450 Nmm
	952.47 KNm
Mmax =	982.80 KNm
Because Mmax > Mr1 required double rei	nforced concrete:
$\Delta M = Mmax - Mr1 =$	30.32 KNm
$As2 = \Delta M / fy(d-d') =$	161.09 mm^2
As= As1 + As2 =	4757.19 mm^2
use tensile steel bars : D 29	1 - 125 As terpsg = 5281 mm ²
use compressive steel bars : D 16	6 - 250 As' terpsg = 804 mrn^2
Longitudinal steel bars : 20 % As =	951 mm^2
D 13	3 - 125 Asbaqi = 1061 mm^2



REINFORCED CONCRETE OF PIER -3

The earth pressure under the earthquake condition (Case IV):

Cattle brooders and a man and and		• • •	
Height of Pier:	H =	8.0	m
Width of footing Pier	B =	4.0	m
Length of footing Pier	L=	4.0	m

part	Weight of part (ton/m)		Arm	Moment ton m/m	
1	1.6'0.4'2.5'2.7 =	4.32	0.000	0.000	
2	(1.6+1.1)/2'0.4'2.5'(2.7+2)/2=	3.173	0.000	0.000	
3	1.1'6.1'2.5'20 =	33.55	0.000	0.000	
4	P1	46.00	-0.350	-16.100	
5	P2	46.00	0.350	16.100	
6	P = 3.1365	3.14	0.859	2.693	
 1	KP = 6.900	6.90	6.970	48.093	
8	KW = 5.19375	5.19	2.900	15.062	
-	Total: $\Sigma Fv =$	133.04	ΣMr =	65.848	

Mdes = 1.2 * Mr =

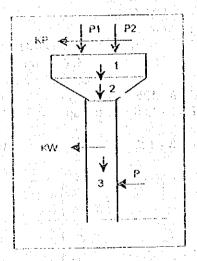
the yield stress fy =

79.02 ton m /m = 133.0425 ton / m =

790174486.80 Nmm/m 1330425 N/m

Normal Force N = the concrete stress fc' =

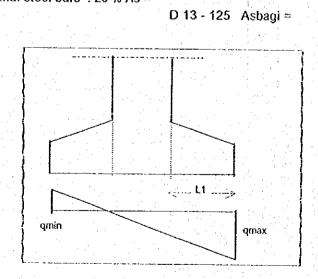
33.075 Mpa 235.29 Mpa (earthquake condition fc'=1.5xfc') (earthquake condition fv=1.5xfy)



REINFORCED CONCRETE OF PIER -3 (P-3):

File:RC-P3-4-3

				File.RC-P3-4-3
Compute soil pressure :				
qmax =	65.235 t/m		weight of co	ncrete q=
qmin =	-1.2875 t/m			2.5 t/m
q1 =	32.18339 t/m		q1-q =	29.68339 t/m
L1 =	1.3 m			
M1 = (q1-q) * L1*L1/2 =		25.082	ton m / m	
M2 = 1/2*(qmax-q1)*L1*L	.1*2/3 =		ton m / m	
Mmax total =		43.702	ton m / m 🕝	
Mdes = 1.2 * Mmax =		52.442	ton m / m	
the concrete stress fc' =	33.075 Mpa		(earthquake c	ondition fc'=1.5xfc')
the yield stress fy =	235.29 Mpa		(earthquake c	ondition fv=1.5xfv)
Dimension of concrete	hi =	1100	mm	
	b =	1000	mm	
	ď≒	900	mm	
$\rho b = [\{\beta 1^* f c'^* 0.85\} / f y]^* [$			0.07295384	8
pmin = 1.4/fy =	(0.00595		
Koefisien k =		0.03		
ρ = k *ρ b =		0.00219		
$As1 = \rho * b * d =$		1969.75		
T1 = As1*fy =		463463		
a1 = T1 / (0.85*fc'*b) =		16.49		
Z = d - 0.5 a1 =		891.76		
Mr1 = T1 * Z =	413	296889	and the second second	
		413.30	and the second second	
Mmax =		524.42		
Because Mmax > Mr1 red	juired double rein	forced c		
$\Delta M = Mmax - Mr1 =$			the second of th	? KNm
As2 = Δ M / fy(d-d') =				1 mm^2
As= As1 + As2 =			4.5) mm^2
use tensile steel bars	and the second s		As terpsg =	5281 mm^2
use compressive steel ba		2 - 250	As' terpsg =	1520 mm^2
Longitudinal steel bars : 2	20 % As =	100	14. 0 - 1	512 mm^2

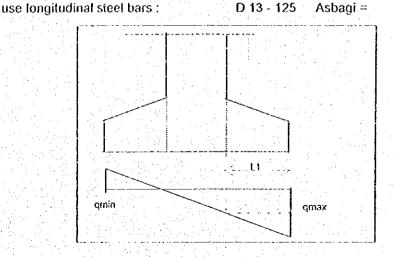


REINFORCED CONCRETE OF PIER-3 ON TOE AND HEEL

File:RC-P3-5-3

1061.32 mm²

Compute soil pressure: 101.1354 Um qmax = weight of concrete q= -16.8479 Vm 2.5 Vm qmin ≈ 57.40752 Vm qí= q1-q = 54.90752 t/m L1 = 1.3 m M1 = (q1-q) * L1*L1/2 =46.397 ton m / m 24.633 ton m / m M2 = 1/2*(qmax-q1)*L1*L1*2/3 =71.030 ton m / m Mmax total =. Mdes = 1.2 * Mmax = 85.236 ton m / m the concrete stress fc' = 33.075 Mpa (earthquake condition fc'=1.5xfc') the yield stress fy = 235.29 Mpa (earthquake condition fv=1.5xfv) Dimension of concrete 1100 mm 1000 mm **b** = 900 mm **d** = $\rho b = [\{\beta 1*fc'*0.85\} / fy]^*[600 / 600+fy] =$ 0.07295 ρ min = 1.4/fy = 0.00595 0.06 Koefisien k = բ = k*բb = 0.00438 $As1 = \rho^* \dot{b}^* \dot{d} =$ 3939.51 mm^2 T1 = As1*fy =926926.79 N a1 = T1 / (0.85*fc'*b) = 32.97 mm Z = d - 0.5 a1 =883.51 mm 818953448 Nmm Mr1 = T1 * Z =818.95 KNm Mmax = 852,36 KNm Because Mmax > Mr1 required double reinforced concrete: 33.41 KNm $\Delta M = Mmax - Mr1 =$ As2 = Δ M / fy(d-d') = 177.49 mm² As= As1 + As2 = 4117.00 mm² D 29 - 125 5281.48 mm^2 use tensile reinforced concrete: As terpsg = D 16 - 250 803.84 mm² use compressive reinforced con: As' terpsg = Longitudinal steel bars : : 20 % As = 823.40 mm²



REINFORCED CONCRETE OF PIER-3:

File:RC-P3-5-3

The earth pressure under the earthquake condition (Case V):

Height of Pier :	H =	8.0	or and
Width of footing Pier	B ==	4.0	m
Length of footing Pier	L =	4.0	m

part	Weight of part		Arm	Moment
	(ton)			ton m
1	1.6*0.4*2.5*2.7 =	4.32	0.000	0.000
2	(1.6+1.1)/2'0.4'2.5'(2.7+2)/2=	3.17	0.000	0.000
3	1.1.6.1.2.5.2.0 =	33.55	0.000	0.000
4	P1	46.00	-0.350	-16.100
5	P2	46.00	0.350	16.100
6	KP =13.8	13.80	6.970	96.186
7	KW =10.388	10.39	2.900	30.124
	Total : ΣFv =	133.04	ΣΜr =	126.310

Mdes = 1.2 * Mr =

151.5717 ton m /m =

1515717000 Nmm/m

Normal Force N = the concrete stress fc' =

133.0425 ton / m =

1330425 N/m (earthquake condition fc'=1.5xfc')

th eyield stress fy =

33.075 Mpa 235.29 Mpa

(earthquake condition fy=1.5xfy)

