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KEIYO BLDG. TOKYO

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CALCULATIONS FOR

(1)

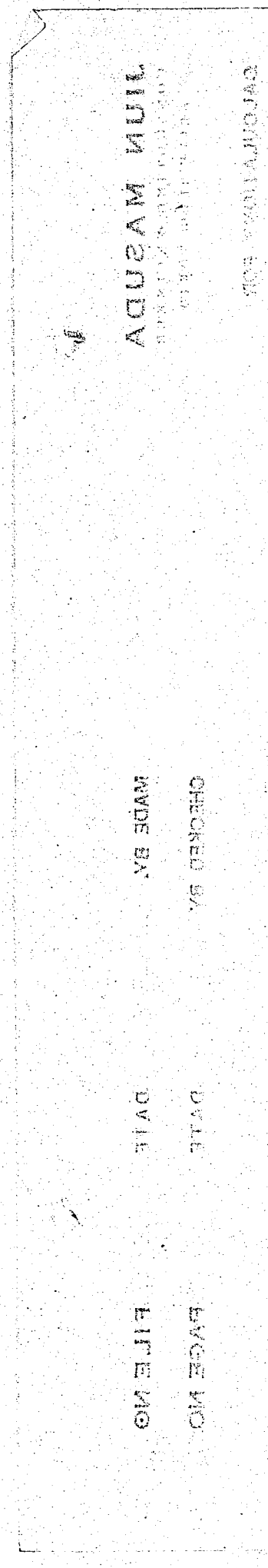
✓

土木技術者倫理

上下二段式、五型随意 A1 土木技術者倫理

自第一頁
至第三十八頁 二十八葉

増田寛也関係資料
（独立行政法人 土木研究所）



(3) √

曲Ｃ二五・地震未考ノ分

赤坂見付
停車場
上下二段式函型隧道設計書

新西向 学士設 二五末

自五十六頁
至八十一頁

二十六年中

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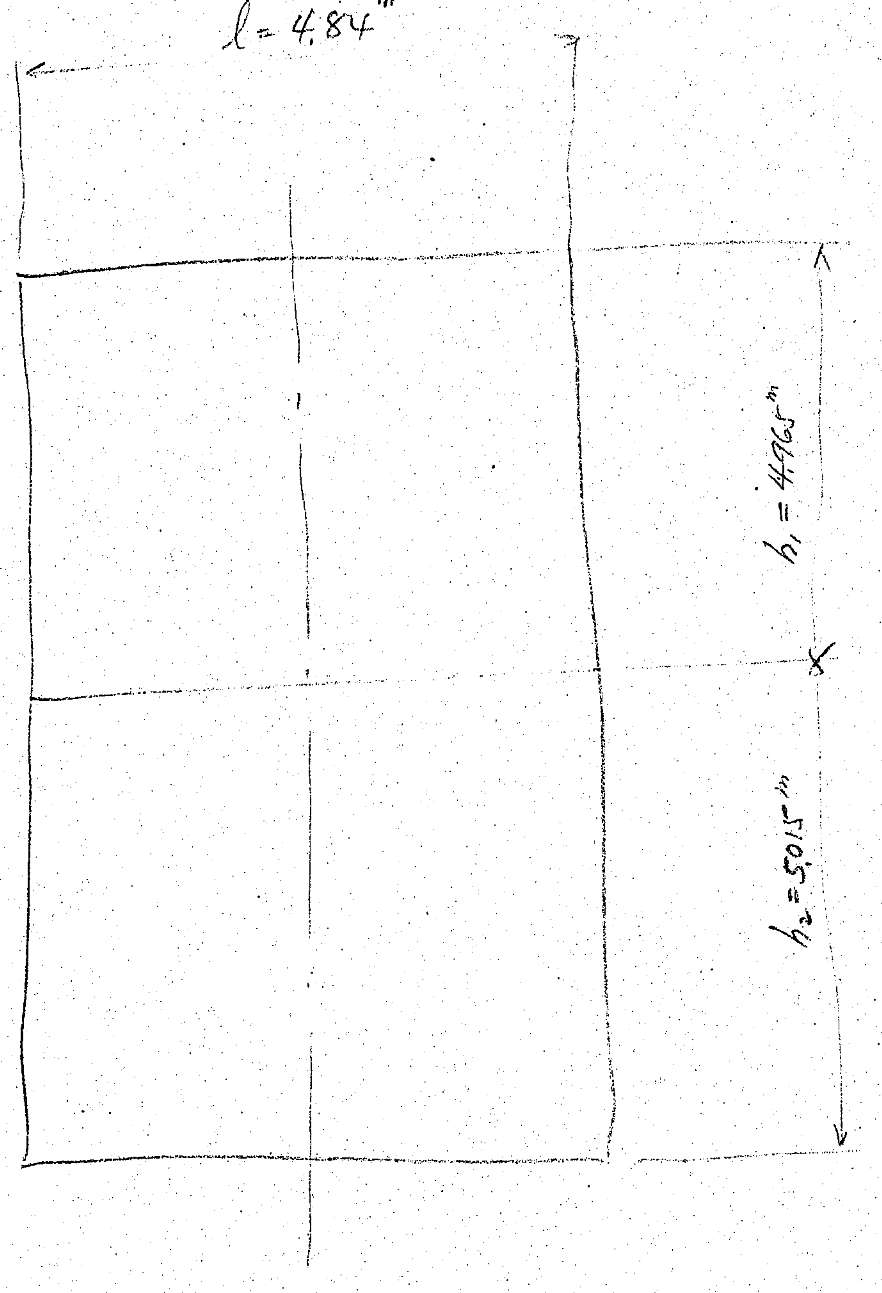

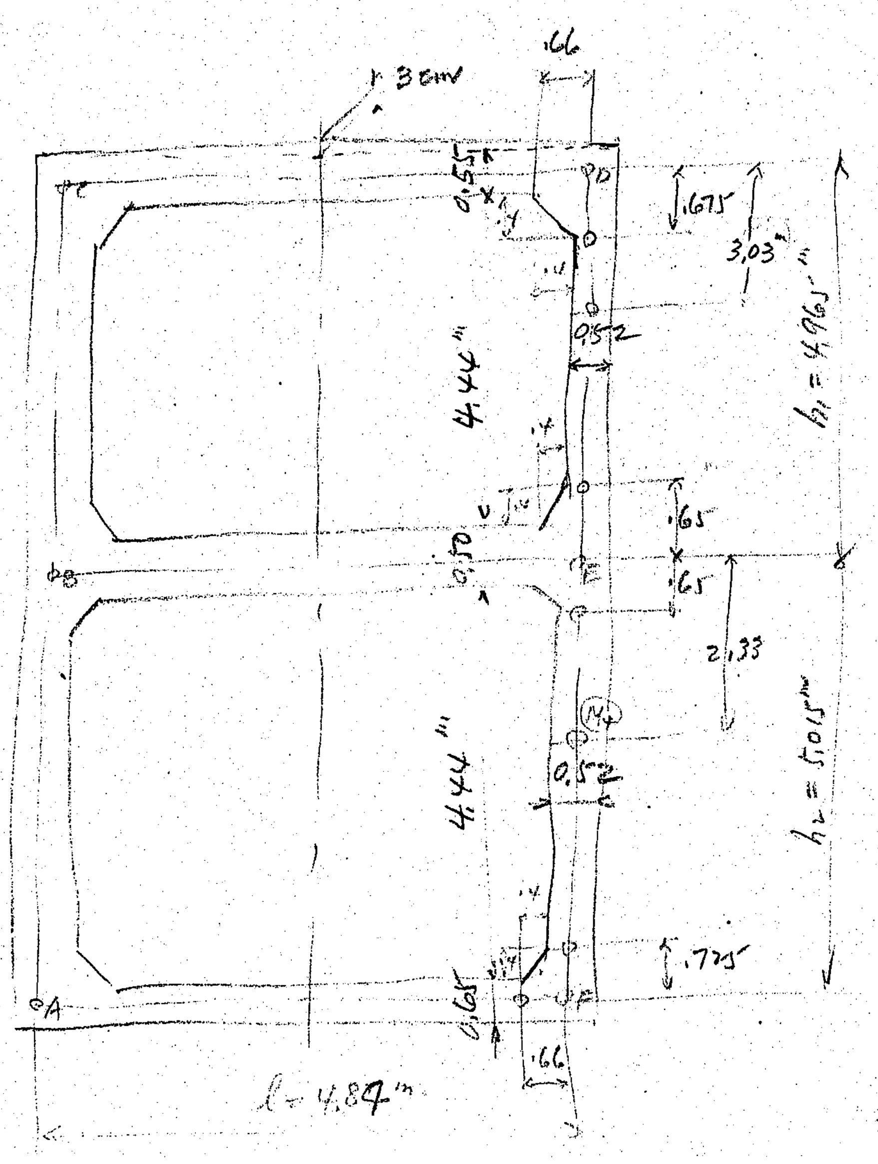

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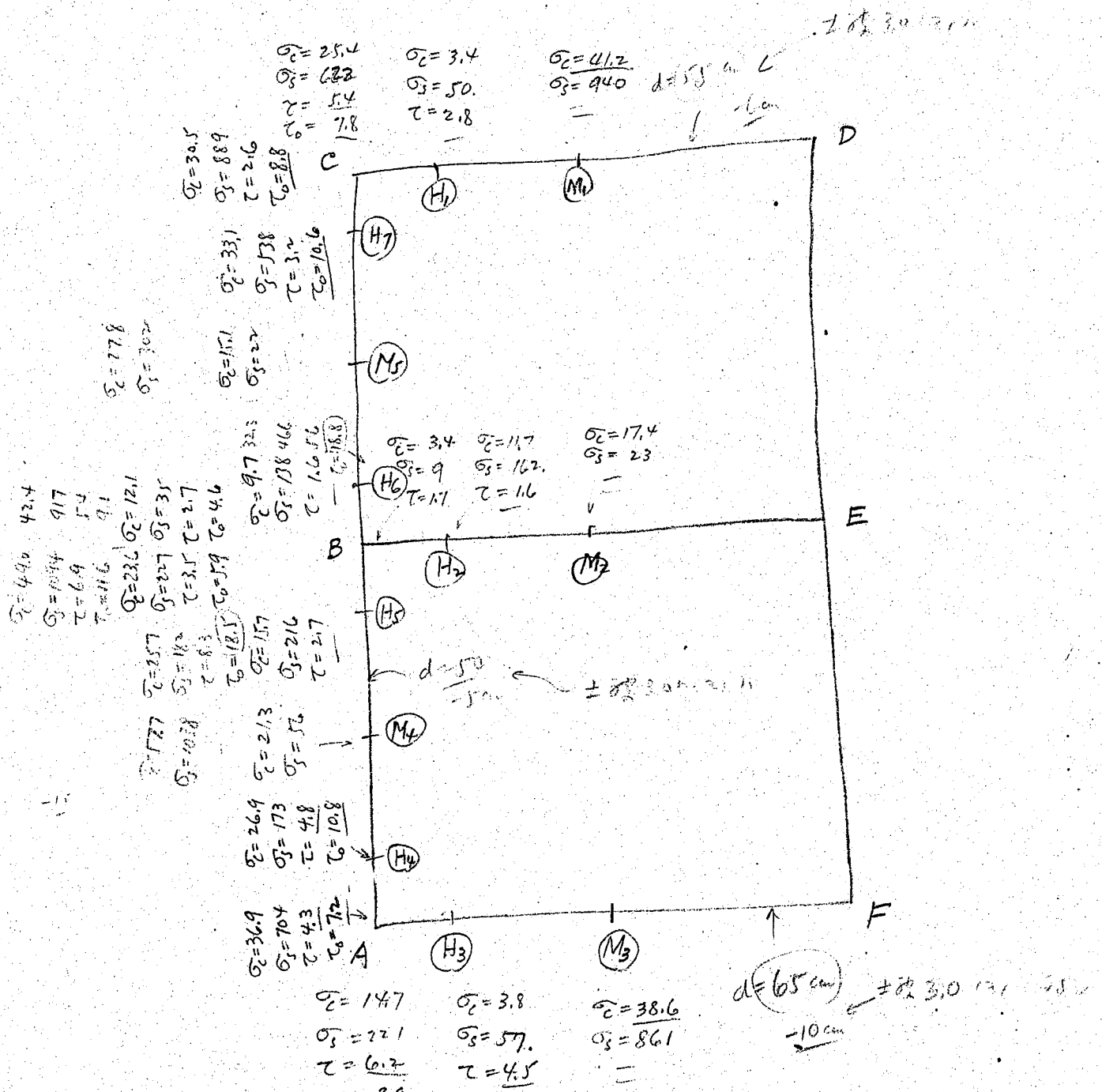

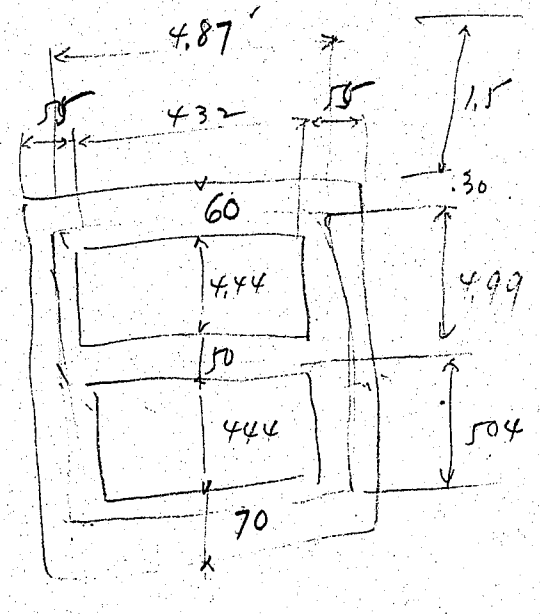

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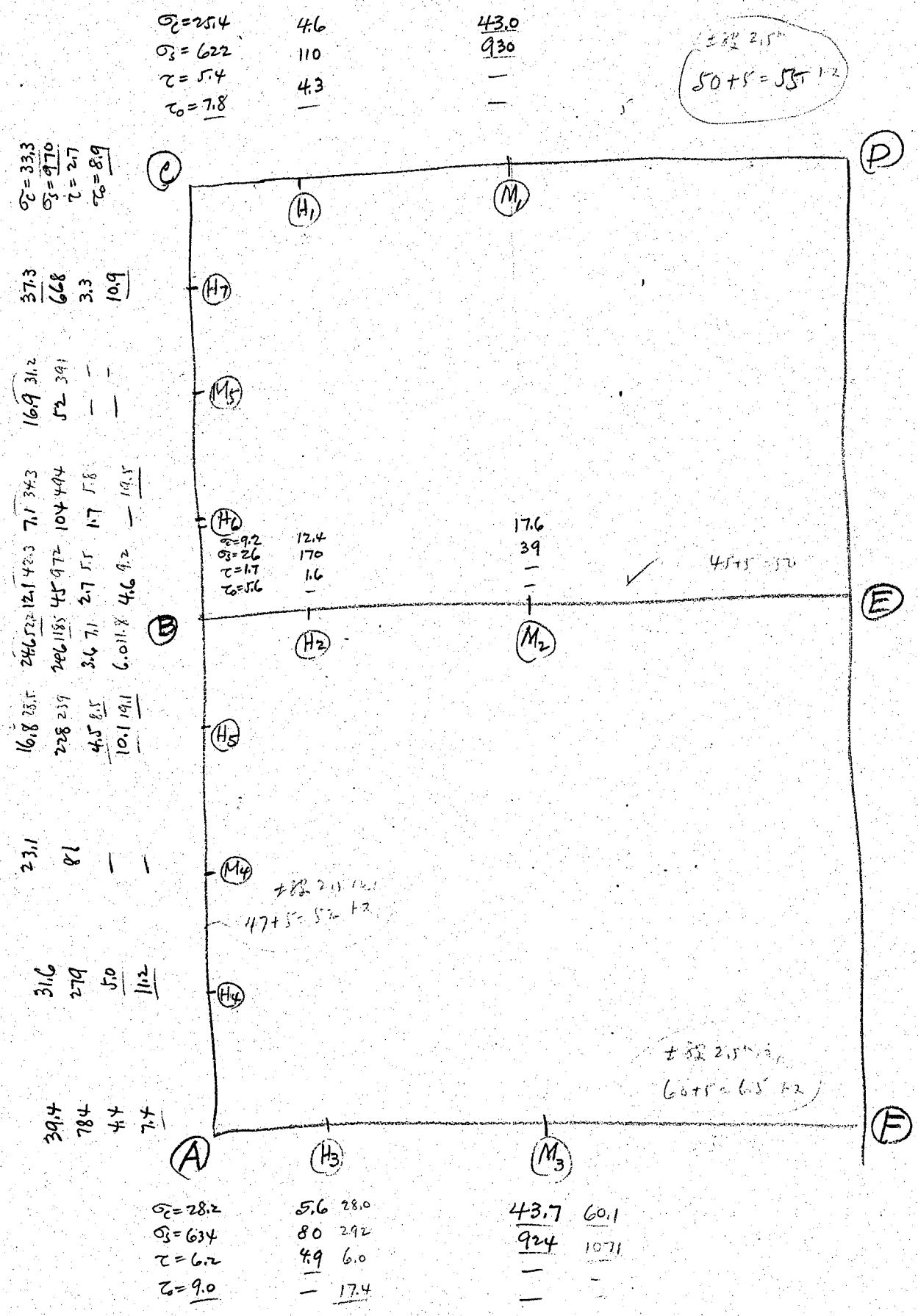
CALCULATIONS FOR



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CALCULATIONS FOR

(M1) $M = 20,000$ $N = 16,500$ $S = 6$

$\frac{M}{N} = \frac{2000000/100}{16500} = 12.12$ cm

$d-n = \frac{21.3}{142.5}$ cm

$e =$

$e' = 142.5 - 45 = 97.5$

$\frac{e'}{e} = 97.5/142.5 = 0.684$

$\frac{Ne}{bd^2} = \frac{16500 \times 142.5}{100 \times 50^2} = 9.40$

$k = .380$ $\frac{Ne}{bd^2} = .181$

$\sigma_c = \frac{9.4}{.181} = 52.0$

$\sigma_s = 15 \times 52 \times \frac{1-.38}{.38} = 127$

$b = 100$ $h = 55$

$d = 50$ $d' = 5$

$A_s = 10-19^\phi = 28.4$ $10-22^\phi = 38.0$

$A_s' = 2.5-19 = 7.1$ $2.5 = 4$ 9.5

$p = 0.00568$ $p = .00760$

$p' = 0.00142$ $p' = .00190$

$d'/d = 5/50 = 0.100$

~~176~~
~~180~~
181

$d'/h = .109$ $d/h = .527$

$d'/h = 0.091$ $n = 29.0$

$p_0 = .00691$ $d-n = 21.0$

$p' = .00173$

203

$\frac{M}{N} = 12.12$

$d-n = \frac{21.0}{142.2}$

$e =$

$e' = 97.2$

$\frac{e'}{e} = .684$

$\frac{Ne}{bd^2} = \frac{16500 \times 142.2}{100 \times 42^2} = 9.38$

$k = .42$ $\frac{Ne}{bd^2\sigma_c} = .203$

$\sigma_c = \frac{9.38}{.203} = 46.2$

$\sigma_s = 15 \times 46.2 \times \frac{1-.42}{.42} = 958$

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MADE BY K. I. DATE 10-10-8 FILE NO (3)
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CALCULATIONS FOR

上下二段式函型隧道 断面A, 端 土被 2,5米

中途ノ(未訂正)

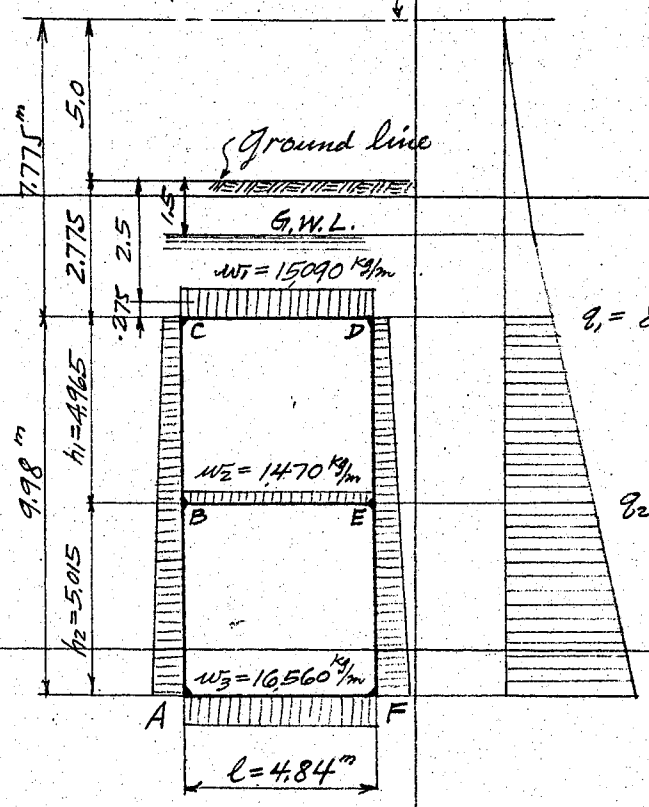
Seismic Stresses

Earth pressure during earthquake

$q = k_1 w h = 0.654\, w h$ see on page 18.

Cincharge for assumed building load

where $k_1 = (1+k_H)\frac{1-\sin\varphi'}{1+\sin\varphi'} = 0.654$



Earth pressure intensity

at D

6.5m @ 1600 × 0.654 =	6,800
1.275 @ 2000 × 0.654 =	1,670
	8,470 kg/m²

at E.

6.5 @ 1600 × 0.654 =	6800
6.24 @ 2000 × 0.654 =	8160
	14,960 kg/m²

at F

6.5 @ 1600 × 0.654 =	6800
11.255 @ 2000 × 0.654 =	14720
	21,520 kg/m²

Load on Top slab. See on page 56

$w_1 = (1+k_H)13720 = 13720 \times 1.1 = 15,090$ kg/m

Load on Middle slab.

$w_2 = 1340 \times 1.10 = 1,470$ kg/m.

Load on Bottom slab.

$w_3 = w_1 + w_2 = 15090 + 1470 = 16560$ kg/m

Values of moment C.

$C_{CD} = C_{DC} = w_1 l^2/12 = 15090 \times 4.84^2 \div 12 = 29450$ kgm or 29,45 ton.m.

$C_{BE} = C_{EB} = w_2 l^2/12 = 1470 \times 4.84^2 \div 12 = 2,870$ " " 2,87 "

$C_{AF} = C_{FA} = w_3 l^2/12 = 16560 \times 4.84^2 \div 12 = 32,320$ " " 32,32 "

$q' = q_2 - q_1 = 14960 - 8470 = 6,490$ kg/m.

$C_{BC} = \frac{h_1^2}{60}(5q_1 + 3q') = \frac{4.965^2}{60}(5\times8470 + 3\times6490) = 25,400$ kgm or 25,40 ton.m.

$C_{CB} = \frac{h_1^2}{60}(5q_1 + 2q') = \frac{4.965^2}{60}(5\times8470 + 2\times6490) = 22,750$ " " 22,75 "

$q'' = q_3 - q_2 = 21520 - 14960 = 6560$ kg/m.

$C_{AB} = \frac{h_2^2}{60}(5q_2 + 3q'') = \frac{5.015^2}{60}(5\times14960 + 3\times6560) = 39,600$ kgm or 39,60 ton.m.

$C_{BA} = \frac{h_2^2}{60}(5q_2 + 2q'') = \frac{5.015^2}{60}(5\times14960 + 2\times6560) = 36,800$ " " 36,80 "

Values of ρ and γ same as for normal state, see on page 58.

Values of $P = \Sigma C$ for each panel point. −C ↗ ↘ +C

$P_A = -32.32 + 39.60 = 7.28$ t,m
$P_F = -7.28$ "

$\varphi_A^{(0)} = \frac{P_A}{P_A} = \frac{7.28}{0.01732} = 421$, $\varphi_F^{(0)} = -421$,

$P_B = -36,80 + 2,87 + 25,40 = -8,53$ "
$P_E = 8,53$ "

$\varphi_B^{(0)} = \frac{P_B}{P_B} = \frac{-8.53}{0,01586} = -538$, $\varphi_E^{(0)} = 538$,

$P_C = -22,75 + 29,45 = 6,70$ "
$P_D = -6.70$ "

$\varphi_C^{(0)} = \frac{P_C}{P_C} = \frac{6,70}{0,01254} = 534$, $\varphi_D^{(0)} = -534$,

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CALCULATIONS FOR

上下二段式函型隧道 断面A, 路土被 2.5米.

Determination of $\mathcal{S}$ for each panel point.

534 / 174 / 154 / $\mathcal{S}_C^{(1)}$= 862	534 / 217 / 300 / 1,051	©	0.289 $\mathcal{S}_C^{(0)}$= 534	0.289 $\mathcal{S}_D^{(0)}$= -534	Ⓓ	-534 / -249 / -175 / $\mathcal{S}_D^{(1)}$ -958	-534 / -304 / -217 / -1,055
534 / 210 / 277 / 1,021	534 / 218 / 305 / $\mathcal{S}_C^{(4)}$= 1,057	0.211	862 / 1,021 / 1051 / 1,057	-958 / -1039 / -1,055 / -1,057	0.211	-534 / -295 / -210 / -1039	-534 / -305 / -218 / $\mathcal{S}_D^{(4)}$= -1,057
-538 / -115 / -89 / -84 / $\mathcal{S}_B^{(1)}$= -826	-538 / -156 / -174 / -159 / -1,027	0.167			0.167	538 / 160 / 115 / 129 / $\mathcal{S}_E^{(1)}$= 942	538 / 176 / 156 / 160 / 1,030
-538 / -149 / -160 / -147 / -994	-538 / -157 / -176 / -161 / $\mathcal{S}_B^{(4)}$= -1032	Ⓑ 0.177	0.156 $\mathcal{S}_B^{(0)}$= -538 / -826 / -994 / -1027 / -1032	0.156 $\mathcal{S}_E^{(0)}$= 538 / 942 / 1,016 / 1,030 / 1,032	0.177 Ⓔ	538 / 174 / 149 / 155 / 1,016	538 / 176 / 157 / 161 / $\mathcal{S}_E^{(4)}$= 1,032
421 / 142 / 87 / $\mathcal{S}_A^{(1)}$= 650	421 / 294 / 165 / 880	0.162 Ⓐ	0.338 $\mathcal{S}_A^{(0)}$= 421 / 650 / 843 / 880	0.338 $\mathcal{S}_F^{(0)}$= -421 / -794 / -871 / -886	0.162 Ⓕ	-421 / -153 / -220 / $\mathcal{S}_F^{(1)}$ -794	-421 / -167 / -298 / -886
421 / 269 / 153 / 843	421 / 299 / 167 / $\mathcal{S}_A^{(4)}$= 887		887	-887		-421 / -165 / -285 / -871	-421 / -167 / -299 / $\mathcal{S}_F^{(4)}$= -887

Summary for values of $\mathcal{S}$.

$\mathcal{S}_A$ = 887, $\mathcal{S}_F$ = -887,

$\mathcal{S}_B$ = -1,032, $\mathcal{S}_E$ = 1,032,

$\mathcal{S}_C$ = 1,057, $\mathcal{S}_D$ = -1,057,

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CALCULATIONS FOR

上下二段式函型隧道 断面A1 端土被2.5米

Moment at each panel point.

$M_{AF} = K_{AF}(2\mathcal{I}_A + \mathcal{I}_F) + C_{AF} = 0.00585(1774 - 887) + 32.32 = 5.19 + 32.32 = 37.51$ t.m.
$M_{AB} = K_{AB}(2\mathcal{I}_A + \mathcal{I}_B) - C_{AB} = 0.00281(1774 - 1032) - 39.60 = 2.09 - 39.60 = -37.51$,

$M_{BA} = K_{AB}(2\mathcal{I}_B + \mathcal{I}_A) + C_{BA} = 0.00281(-2064 + 887) + 36.80 = -3.31 + 36.80 = 33.49$,
$M_{BC} = K_{BC}(2\mathcal{I}_B + \mathcal{I}_C) - C_{BC} = 0.00265(-2064 + 1057) - 25.40 = -2.67 - 25.40 = -28.07$,
$M_{BE} = K_{BE}(2\mathcal{I}_B + \mathcal{I}_E) - C_{BE} = 0.00247(-2064 + 1032) - 2.87 = -2.55 - 2.87 = -5.42$,

$M_{CB} = K_{CB}(2\mathcal{I}_C + \mathcal{I}_B) + C_{CB} = 0.00265(2114 - 1032) + 22.75 = 2.87 + 22.75 = 25.62$,
$M_{CD} = K_{CD}(2\mathcal{I}_C + \mathcal{I}_D) - C_{CD} = 0.00362(2114 - 1057) - 29.45 = 3.83 - 29.45 = -25.62$,

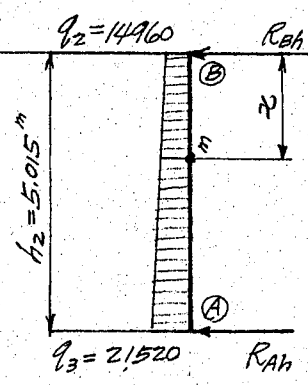
We have moment at each panel point as follows.

$M_{AB} = M_{AF} = -37.51$ t.m.,
$M_{BA} = -33.49$,
$M_{BC} = -28.07$,
$M_{BE} = -5.42$ t.m.,
$M_{CB} = M_{CD} = -25.62$ t.m.

Shears.

		Shear at Support.	Shear at end of haunch.
$S_{AF} = \frac{1}{2} \cdot w_3 l =$	$-\frac{1}{2} \times 16560 \times 4.84 =$	-40060 kg,	$-40060 + 16560 \times 0.66 = -29130$ kg,
$S_{BE} = \frac{1}{2} \cdot w_2 l =$	$\frac{1}{2} \times 1470 \times 4.84 =$	3560 ,	$3560 - 1470 \times 0.66 = 2590$,
$S_{CD} = \frac{1}{2} \cdot w_1 l =$	$\frac{1}{2} \times 15090 \times 4.84 =$	36500 ,	$36500 - 15090 \times 0.66 = 26540$.

$R_{Ah} = \frac{h_2}{6}(2q_3 + q_2) = \frac{5.015}{6}(43040 + 14960) = 48500$ kg



$R_{Bh} = \frac{h_2}{6}(q_3 + 2q_2) = \frac{5.015}{6}(21520 + 29920) = 43000$,

$S_{AB} = R_{Ah} + \frac{M_{BA} - M_{AB}}{h_2} = 48500 + \frac{4020}{5.015} = 49300$,

$S_{BA} = -R_{Bh} - \frac{M_{AB} - M_{BA}}{h_2} = -43000 + \frac{4020}{5.015} = -42200$,

Taking origine at B, general equation to shear will be as follows.

$S_m = S_{BA} + q_2 x + \frac{q_3 - q_2}{2h_2} x^2 = -42200 + 14960x + 655x^2$

Value of x for point of zero shear.

$655x^2 + 14960x - 42200 = 0$

$x = \frac{-14960}{1310} \pm \frac{\sqrt{14960^2 + 4 \times 655 \times 42200}}{1310} = 2.54$ m.

Values of S_m.

x	x^2	S_{BA}	$+14960x$	$+655x^2$	$=$	S_m.	
0.65 m	0.4225	−42200	+ 9730	+ 280	=	−32190 kg	---- haunch H5
2.54	6.452	"	+ 37970	+ 4230	=	0 "	
4.29	18.404	"	+ 64200	+ 12060	=	34060 "	---- haunch H4

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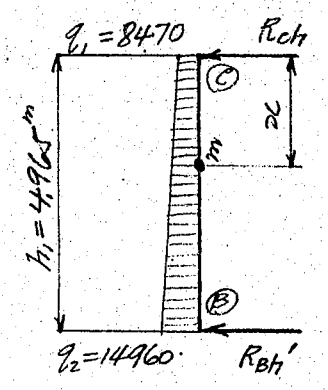
CALCULATIONS FOR

上下二段式函型隧道 断面A1 肺土被2.5米



$R_{Bh}' = \frac{h_1}{6}(2q_2+q_1) = \frac{4.965}{6}(29920+8470) = 31750$ kg

$R_{ch} = \frac{h_1}{6}(2q_1+q_2) = \frac{4.965}{6}(16940+14960) = 26400$ "

$S_{BC} = R_{Bh}' + \frac{M_{CB}-M_{BC}}{h_1} = 31750 + \frac{2450}{4.965} = 32240$ "

$S_{CB} = -R_{ch} - \frac{M_{BC}-M_{CB}}{h_1} = -26400 + \frac{2450}{4.965} = -25910$ "

Taking c as origine, general equation to shear will be as follows.

$S_m = S_{CB} + q_1 x + \frac{q_2-q_1}{2h_1}x^2 = -25910 + 8470x + 654x^2$

Value of x for point of zero shear.

$654x^2 + 8470x - 25910 = 0$

$x = \frac{-8470}{1308} \pm \frac{\sqrt{8470^2+4\times654\times25910}}{1308} = 2.56$ m.

Values of S_m.

x	x^2	S_{CB}	+ 8470x	+ 654x^2	=	S_m	
0.675m	0.4556	− 25910	+ 5710	+ 300	=	−19900 kg	--- haunch H_1
2.56	6.540	"	+ 21640	+ 4270	=	0 "	
4.315	18.625	"	+ 36550	+ 12190	=	22830 "	--- haunch H_2

Axial Thrust in each member.

$N_{AF} = S_{AB} = = 49300$ kg c

$N_{BE} = S_{BA} + S_{BC} = 42200 + 32240 = 74440$ "

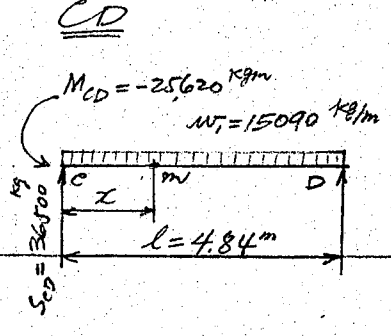
$N_{CD} = S_{CB} = = 25910$ "

$N_{AB} = S_{AF} = = 40060$ "

$N_{BC} = S_{CD} = = 36500$ "

Moment at any point in each member.

CD



$M_m = M_{CD} + S_{CD}x - \frac{1}{2}w_1x^2 = -25620 + 36500x - 7545x^2$.

x	x^2	M_{CD}	+ 36500x	− 7545x^2	=	M_m	
0.66m	0.4355	−25620	+ 24100	− 3290	=	− 4810 kgm	--- haunch H_1
2.42	5.855	"	+ 88300	− 44150	=	18530 "	--- center M_1

BE

$M_m = M_{BE} + S_{BE}x - \frac{1}{2}w_2x^2 = -5420 + 3560x - 735x^2$

x	x^2	M_{BE}	+ 3560x	− 735x^2	=	M_m	
0.66	0.4355	−5420	+ 2350	− 320	=	− 3390 kgm	-- haunch H_2
2.42	5.855	"	+ 8610	− 4300	=	− 1110 "	--- center M_2

AF

$M_m = M_{AF} - S_{AF}x - \frac{1}{2}w_3x^2 = -37510 + 40060x - 8280x^2$

x	x^2	M_{AF}	+ 40060x	− 8280x^2	=	M_m	
0.66	0.4355	−37510	+ 26440	− 3610	=	− 14680 kgm	--- haunch H_3
2.42	5.855	"	+ 96950	− 48450	=	+ 10990 "	--- center M_3.

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CALCULATIONS FOR

上下二段式函型隧道 断面A, 跡土被 2.5米

AB

$$M_m = M_{BA} - S_{BA}x - \frac{q_2}{2}x^2 - \frac{q_3-q_2}{6h_2}x^3$$

$$= -33490 + 42200x - 7480x^2 - 218x^3$$

x	x^2	x^3	M_{BA}	$+42200x$	$-7480x^2$	$-218x^3$	$=M_m$	
0.65m	0.4225	0.2746	−33490	+ 27420	− 3,160	− 60	= − 9,290	kgm --- haunch H5
2.54	6.45	16.39	"	+ 107240	− 48,230	− 3570	= + 21,950	" --- max. pos. m. M4
4.29	18.404	78.954	"	+ 181,050	− 137,700	− 17,210	= − 7350	" --- haunch H4

BC

$$M_m = M_{CB} - S_{CB}x - \frac{q_1}{2}x^2 - \frac{q_2-q_1}{6h_1}x^3$$

$$= -25620 + 25910x - 4235x^2 - 218x^3$$

x	x^2	x^3	M_{CB}	$+25910x$	$-4235x^2$	$-218x^3$	$=M_m$	
0.675	0.4555	0.3075	−25620	+ 17500	− 1930	− 70	= − 10,120	kgm ---- haunch H7
2.56	6.55	16.78	"	+ 66350	− 27750	− 3660	= + 9320	" --- max. pos. m. M5
4.315	18.625	80.30	"	+ 111,800	− 78900	− 17520	= − 10,240	" --- haunch H6

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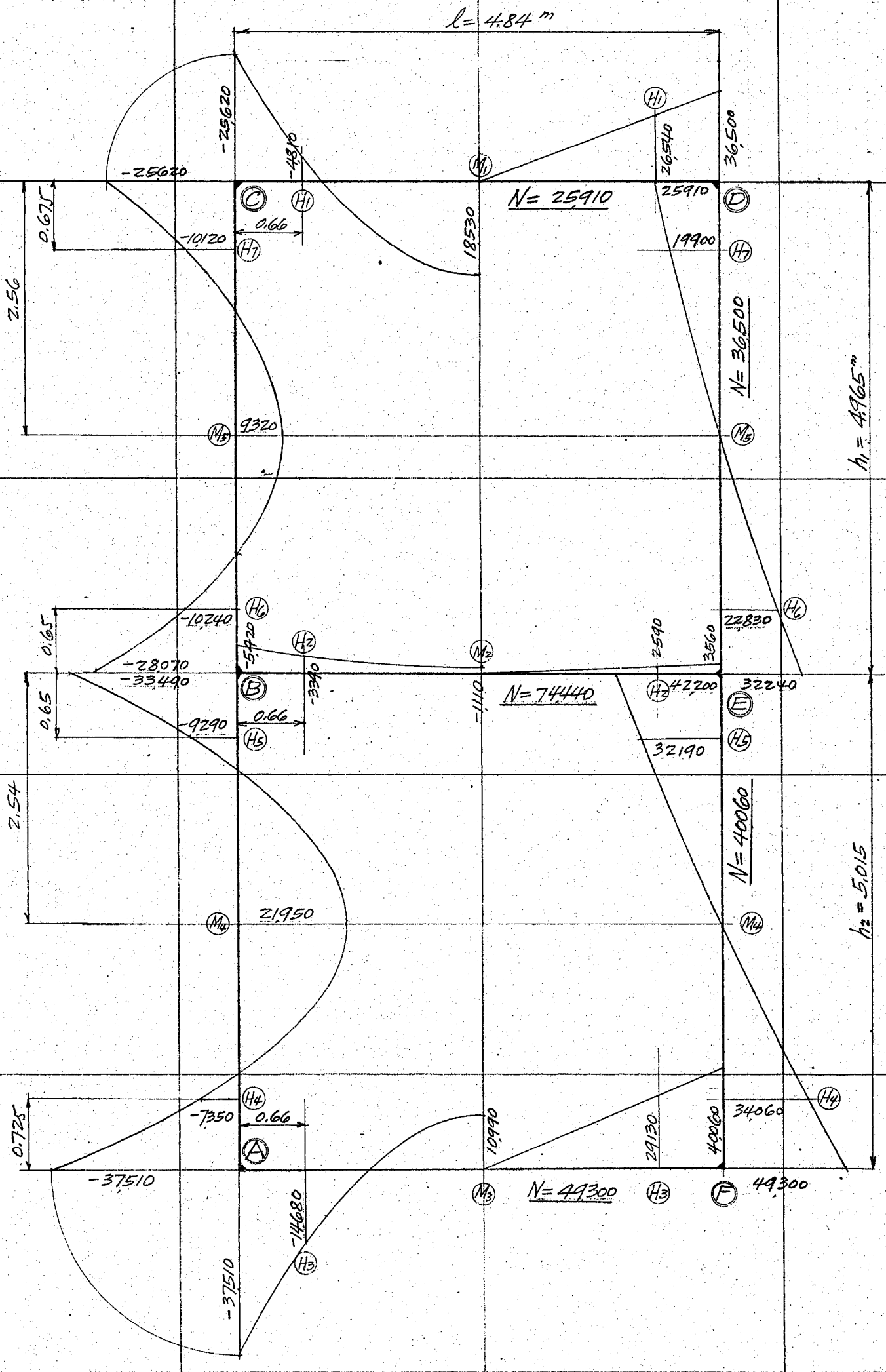
CALCULATIONS FOR

上下二段式函型隧道 断面A, 路土被2.5米

Bending moment and shear diagrams.



MOMENT DIAGRAM
scale 1/100 m = 10,000 kgm.

SHEAR DIAGRAM
scale 1/200 m = 10,000 kg

Scale of space 1:50

地震時

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CALCULATIONS FOR

上下二段式函型隧道 断面 A, 端 土被 2.5米.

Seismic Unit stresses.

at (H3) $M = -14{,}680$ kgm, $N = 49{,}300$ kg, $S = 29{,}130$ kg.

$\frac{M}{N} = \frac{14680 \times 100}{49300} = 29.8$ cm

$d - u = 27.1$ cm

$e = 56.9$ cm

$e' = 56.9 - 55 = 1.9$ "

$e'/e = 1.9/56.9 = 0.033$

$\frac{Ne}{bd^2} = \frac{49300 \times 56.9}{100 \times 60^2} = 7.800$

$b = 100$ cm, $h = 65$ cm
$d = 60$ cm, $d' = 5$ cm.
$p = \frac{19.00}{6000} = 0.00317$
$p' = \frac{9.5}{6000} = 0.00158$
$d'/d = 5/60 = 0.0833$

$k = 0.550$, $\frac{Ne}{bd^2\sigma_c} = 0.2445$

$\sigma_c = 7{,}800 / 0.2445 = 31.9$ kg/cm²

$\sigma_s = 15 \times 31.9 \times \frac{1-.55}{.55} = 392$ "

$\tau = \frac{29130}{100 \times .817 \times 60} = 6.2 <$ 4.5×1.8

$\tau_0 = \frac{29130}{6.912 \times 5 \times .817 \times 60} = 17.8 <$ 11.0×1.8 = 19.8 kg/cm²

at (M4) $M_4 = 21950$ kgm, $N = 40060$ kg, $S = 0$

$\frac{M}{N} = \frac{21950 \times 100}{40060} = 54.8$ cm

$d - u = 19.8$

$e = 74.6$ cm

$e' = 74.6 - 42 = 32.6$ "

$e'/e = 32.6/74.6 = 0.437$

$\frac{Ne}{bd^2} = \frac{40060 \times 74.6}{100 \times 47^2} = 13.52$

$k = 0.450$, $\frac{Ne}{bd^2\sigma_c} = 0.207$

$b = 100$ cm, $h = 52$ cm
$d = 47$ cm, $d' = 5$ cm.
$p = 0.00604$
$p' = 0.00151$
$d'/d = 0.106$

$\sigma_c = 13.52 / 0.207 = 65.3$ kg/cm² < 47×1.8 = 85 kg/cm²

$\sigma_s = 15 \times 65.3 \times \frac{1-.45}{.45} = 1198$ "

at (H5) $M = -9290$ kgm, $N = 40{,}060$ kg, $S = 32{,}190$ kg

$\frac{M}{N} = \frac{9290 \times 100}{40060} = 23.2$ cm

$d - u = 20.0$

$e = 43.2$ cm

$e' = 43.2 - 42 = 1.2$ cm

$e'/e = 1.2/43.2 = 0.028$

$\frac{Ne}{bd^2} = \frac{40060 \times 43.2}{100 \times 47^2} = 7.84$

$k = 0.620$, $\frac{Ne}{bd^2\sigma_c} = 0.264$

$b = 100$ cm, $h = 52$ cm
$d = 47$ ", $d' = 5$ "
$p = 0.00453$
$p' = 0.00151$
$d'/d = 0.106$

$\sigma_c = 7.84 / 0.264 = 29.7$ kg/cm²

$\sigma_s = 15 \times 29.7 \times \frac{1-.62}{.62} = 273$ "

$\tau = \frac{32190}{100 \times .793 \times 47} = 8.6$ "

< 14.0×1.8
> 4.5×1.8 = 8.1

$\tau_0 = \frac{32190}{5.97 \times 7.5 \times .793 \times 47} = 19.3$ "

< 11×1.8 = 19.8

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CALCULATIONS FOR

上下二段式函型隧道 断面A1物 土被2.5米.

at Ⓑ (lower side) M_{BA} = −33,490 kgm, N = 40060 kg, S = 42200 kg

$\frac{M}{N} = \frac{33490\times100}{40060} = 83.6$ cm

$d-u = 114.3$ cm

$e = \frac{30.7}{114.3}$

$e' = 114.3-64 = 50.3$ "

$e'/e = 50.3/114.3 = 0.440$

$\frac{Ne}{bd^2} = \frac{40060\times114.3}{100\times69^2} = 9.63$

$k = 0.395$, $\frac{Ne}{bd^2\sigma_c} = 0.180$

b = 100 cm, h = 74 cm
d = 69 cm, d' = 5 cm
p = 0.00412
p' = 0.00073
d'/d = 0.073

$\sigma_c = 9.63/0.18 = 53.5$ kg/cm² < 47×1.8

$\sigma_s = 15\times53.5\times\frac{1-.395}{.395} = 1230$ " < 1200×1.8

$\tau = \frac{42200}{100\times.868\times69} = 7.1$ "

$\tau_0 = \frac{42200}{59.7\times.868\times69} = 11.8$ " < 11.0×1.8

at Ⓑ (Upper side) M_{BC} = −28070 kgm, N = 36500 kg, S = 32240 kg

$\frac{M}{N} = \frac{28070\times100}{36500} = 76.9$ cm

$d-u = 108.2$ cm

$e = \frac{31.3}{108.2}$

$e' = 108.2-64 = 44.2$ "

$e'/e = 44.2/108.2 = 0.409$

$\frac{Ne}{bd^2} = \frac{36500\times108.2}{100\times69^2} = 8.30$

$k = 0.395$, $\frac{Ne}{bd^2\sigma_c} = 0.195$

b = 100 cm, h = 74 cm
d = 69 ", d' = 5 "
p = 0.00412
p' = 0.00206
d'/d = 0.073

$\sigma_c = 8.30/0.195 = 42.6$ kg/cm²

$\sigma_s = 15\times42.6\times\frac{1-.395}{.395} = 978$ "

$\tau = \frac{32240}{100\times.868\times69} = 5.4$ "

$\tau_0 = \frac{32240}{59.7\times.868\times69} = 9.0$ "

at Ⓗ6 M = −10240 kgm, N = 36500 kg, S = 22830 kg.

$\frac{M}{N} = \frac{10240\times100}{36500} = 28.0$ cm

$d-u = 48.6$ cm

$e = \frac{20.6}{48.6}$

$e' = 48.6-42 = 6.6$ cm

$e'/e = 6.6/48.6 = 0.136$

$\frac{Ne}{bd^2} = \frac{36500\times48.6}{100\times47^2} = 8.04$

$k = 0.49$, $\frac{Ne}{bd^2\sigma_c} = 0.223$

b = 100 cm, h = 52 cm,
d = 47 cm, d' = 5 cm,
A_s = 14.2 cm²
A_s' = 7.1 "
$p = \frac{14.2}{4700} = 0.00302$
$p' = \frac{7.1}{4700} = 0.00151$
$d'/d = 5/47 = 0.106$

$\sigma_c = 8.04/0.223 = 36.1$ kg/cm²

$\sigma_s = 15\times36.1\frac{1-.49}{.49} = 564$ "

$\tau = \frac{22830}{100\times.837\times47} = 5.8$ "

$\tau_0 = \frac{22830.}{5.97\times5\times.837\times47} = 19.4$ " < 11.0×1.8 = 19.8

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CALCULATIONS FOR

上下二段式函型隧道 断面A1 被土被2.5米

at (M5) $M_5 = 9320$ kgm, $N = 36500$ kg, $S = 0$

$\frac{M}{N} = \frac{9320 \times 100}{36500} = 25.5$ cm

$d - u = 20.6$ cm

$e = 46.1$ cm

$e' = 46.1 - 42 = 4.1$

$e'/e = 4.1/46.1 = 0.089$

$\frac{Ne}{bd^2} = \frac{36500 \times 46.1}{100 \times 47^2} = 7.62$

$b = 100$ cm, $h = 52$ cm
$d = 47$ ", $d' = 5$ "
$p = 0.00302$
$p' = 0.00151$
$d'/d = 0.106$

$k = 0.52$, $\frac{Ne}{bd^2\sigma_c} = 0.232$

$\sigma_c = 7.62/0.232 = 32.9$ kg/cm²

$\sigma_s = 32.9 \times 15 \frac{1-.52}{.52} = 455$ "

$\tau = 0$.

All assumed sections are ample for seismic stresses.

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CALCULATIONS FOR

赤坂停車場見付上下二段式連型隧道鐵筋含有量概算書

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CALCULATIONS FOR
赤坂見付停車場
上下二段式函型隧道

鐵筋量概算書

特A, 第 土被 2.5米 (延長一米=付キ)

主鐵筋			本数	長	總長	
22φ	B 5500	4 × 2.5 =	10 @	5.50 m	= 55.00 m	上下床上下
〃	Ba 6000		5 @	6.00	= 30.00	下床
〃	Bb 6000		2.5 @	6.00	= 15.00	〃
〃	Bc 5750		5.0 @	5.75	= 28.75	上床
〃	Bd 5750		2.5 @	5.75	= 14.38	〃
〃	B 2250	4 × 2.5 =	10 @	2.25	= 22.50	上下床
					165.63 m	
19φ	C 2000	2 × 5.0 =	10 @	2.00	= 20.00	中床上部両端
〃	C 3250		5 @	3.25	= 16.25	側壁
〃	C 5750	4 × 2.5 =	10 @	5.75	= 57.50	〃
〃	C 3750		5 @	3.75	= 18.75	〃
〃	Ca 4000		5 @	4.00	= 20.00	〃
〃	Cb 4750		5 @	4.75	= 23.75	〃
〃	Cc 4250		5 @	4.25	= 21.25	〃
〃	Cd 5000		5 @	5.00	= 25.00	〃
〃	Ce 4000		5 @	4.00	= 20.00	〃
〃	Cf 6500		2.5 @	6.50	= 16.25	〃
〃	Cg 5500		2.5 @	5.50	= 13.75	〃
〃	Ch 6000		2.5 @	6.00	= 15.00	〃
〃	Ci 6000		2.5 @	6.00	= 15.00	〃
〃	Cj 3750		5 @	3.750	= 18.75	〃
〃	Ck 5500		5 @	5.50	= 27.50	〃
					328.75 m	
16φ	D 5250		5 @	5.25	= 26.25	中床
〃	Da 5500		5 @	5.50	= 27.50	〃
〃	Db 5500		2.5 @	5.50	= 13.75	〃
〃	D 2000		5 @	2.00	= 10.00	〃
					77.50 m	
横筋		隧道延長一米=付 横鉄筋長平均 5.75÷5 = 1.15 m				
12φ			255 @	1.15	= 293.25 m	全部
肋筋						
9φ	Ma		35 @	1.507	52.70	
〃	Mb		5 @	1.933	9.67	
〃	Mc		20 @	1.661	33.22	
〃	Md		120 @	1.239	148.60	
〃	Me		5 @	1.733	8.67	
〃	Mf		35 @	1.307	45.75	
〃	Mj		35 @	1.189	41.60	
〃	MK		5 @	1.97	9.85	
〃	ML		5 @	1.79	8.95	
					359.00 m	

重量		總長				
22φ	鉄筋	165.63 m	@	2.98 kg	=	494 kg
19φ	〃	328.75	@	2.22	=	729
16φ	〃	77.50	@	1.57	=	122
12φ	〃	293.25	@	0.88	=	258
9φ	〃	359.00	@	0.49	=	176
						1,779 kg (隧道延長1米=付キ)

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CALCULATIONS FOR

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混凝土容積（隧道延長 1m 当り）

	厚	長	巾	数	容積
下床	0.680	4.32	1.0	1	2.94 m³
中床	0.500	4.32	1.0	1	2.16
上床	0.565	4.32	1.0	1	2.44
側壁	0.520	10.61	1.0	2	11.05
持送	平均 0.200	1.00	0.40	8	0.64
					19.23 m³

特A1型隧道

混凝土1立米当鉄筋量 = 1779 / 19.23 = 92.5 kg　鉄筋比 (1.18%)　11.9%

特A2型

主鉄筋

25φ	A 4.5	2@2.5 =	5.0	@	4.5 =	22.50 m	下床
〃	A 5.5	〃	5.0	@	5.5 =	27.50	〃
〃	Aa 7.0		5.0	@	7.0 =	35.00	〃
〃	Ab 4.25		5.0	@	4.25 =	21.25	〃
〃	Ac 3.750		2.5	@	3.75 =	9.38	〃
〃	Ad 7.50		2.5	@	7.50 =	18.75	〃
						134.38 m	
22φ	B 4.25	2@2.5 =	5.0	@	4.25 =	21.25	上床
〃	B 5.50	2@〃 =	5.0	@	5.50 =	27.50	〃
〃	Ba 7.0		5.0	@	7.0 =	35.00	〃
〃	Bb 3.75		5.0	@	3.75 =	18.75	〃
〃	Bc 3.75		2.5	@	3.75 =	9.38	〃
〃	Bd 7.0		2.5	@	7.0 =	17.50	〃
〃	B 2.5		5.0	@	2.5 =	12.50	下床
〃	B 2.25		5.0	@	2.25 =	11.25	上床
						153.13 m	
19φ	C 6.5	2@2.5 =	5.0	@	6.5 =	32.50	外側壁 両側ヨリ
	C 6.75	〃	5.0	@	6.75 =	33.75	〃
	C 3.25	〃	5.0	@	3.25 =	16.25	〃
	Ca 4.5	〃	5.0	@	4.5 =	22.50	〃
	Cb 5.0	〃	5.0	@	5.0 =	25.00	〃
	Cc 3.25	〃	5.0	@	3.25 =	16.25	〃
	Cd 5.5	〃	5.0	@	5.5 =	27.50	〃
	Ce 4.0	〃	5.0	@	4.0 =	20.00	〃
	Cf 4.5	〃	5.0	@	4.5 =	22.50	〃
	Cg 4.5	〃	5.0	@	4.5 =	22.50	〃
	Ch 6.5	〃	5.0	@	6.5 =	32.50	〃
	Ci 5.5	〃	5.0	@	5.5 =	27.50	〃
	Cj 4.5	〃	5.0	@	4.5 =	22.50	〃
	Ck 6.5	〃	5.0	@	6.5 =	32.50	〃
	Cl 6.5	〃	5.0	@	6.5 =	32.50	〃
	C 3.0	〃	5.0	@	3.0 =	15.0	〃
						401.25 m	

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CALCULATIONS FOR

16φ	$D_{4.0}$	2@2.5' = 5.0@4.0' =	20.00 m	中床
〃	$D_{6.0}$	〃 5.0@6.0' =	30.00 〃	〃
〃	D_a 3.25'	5'@3.25' =	16.25 〃	〃
〃	D_b 7.0'	5@7.0' =	35.00 〃	〃
〃	D_c 6.5'	2.5'@6.5' =	16.25 〃	〃
〃	D_d 3.25'	2.5'@3.25' =	8.13 〃	〃
〃	D 2.0 〃	2@12.5' = 25.0'@2.0' =	50.00 〃	〃
			175.63 m 〃	

横鉄筋 隧道延長1米ニ対スル横鉄筋長 平均 8@60÷4235 = 1.13

12φ		340@1.13 =	384.00 m	全部

肋筋

9φ	M_a	21@2.5' = 52.5@	2.214 〃 =	116.20 〃
	M_b	2@ 〃 = 5@	2.864 〃	14.32 〃
	M_c	8@ 〃 = 20@	2.178 〃	43.56 〃
	M_d	46@ 〃 = 115@	1.716 〃	197.40 〃
	M_e	2@ 〃 = 5@	2.261 〃	11.31 〃
	M_f	21@ 〃 = 52.5@	1.805 〃	94.80 〃
	M_g	21@ 〃 = 52.5@	1.587 〃	83.30 〃
	M_h	2@ 〃 = 5@	2.495 〃	12.48 〃
	M_i	2@ 〃 = 5@	2.31 〃	11.55 〃
	M_j	2@ 〃 = 5@	2.62 〃	13.10 〃
			598.03 〃	

重量

25φ 鉄筋	134.38 m	@ 3.85	kg/m	=	517. 〃
22φ 〃	153.13		2.98 〃		456 〃
19φ 〃	401.25		2.22 〃		891 〃
16φ 〃	175.63 〃		1.577 〃		276 〃
12φ 〃	384.00		0.88 〃		338 〃
9φ 〃	598.03 〃		0.49 〃		293 〃
					2,771 〃 kg

(隧道延長1米当り)

混凝土容積	厚	長	巾	数	容積
下床	1.030 m 〃	7.88 m 〃	1.0 〃	1 〃	8.12 〃
中床	0.700 〃	7.88 〃	1.0 〃	1 〃	5.52 〃
上床	平均 0.825 〃	7.88 〃	1.0 〃	1 〃	6.50 〃
側壁	0.760 〃	11.13 〃	1.0 〃	2 〃	16.92 〃
持送り	平均 0.20 〃	1.0 〃	0.4 〃	8 〃	0.64 〃
					37.70 m³

(　　)

特 A_2 型 隧道

混凝土一立米当り鉄筋量 = 2771 / 37.70 = 73.5 kg 鉄筋比 (0.94 %)

125 — 8 本
250 — 4
375 — 2.67 ×2 = 5.33

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CALCULATIONS FOR

特A3型

主鉄筋

			本		
25φ	A7.5	2 @ 2.667	= 5.33 @ 7.50 =	91.94 m	下条
〃	Aa 3.25	2 @ 〃	= 5.33 @ 3.25 =		〃
〃	Ab 6.5	2 @ 〃	= 5.33 @ 6.50 =		〃
22φ	B7.5	2 @ 2.667	= 5.33 @ 7.50 =		上条
〃	Ba 3.25	〃 〃	= 5.33 @ 3.25 =		〃
〃	B6 6.00	〃 〃	= 5.33 @ 6.00 =	114.60 m	〃
〃	B2.25	〃 〃	= 5.33 @ 2.25 =		〃
〃	B 2.50	〃 〃	= 5.33 @ 2.50 =		下条
19φ	C4.0	4 @ 2.667	= 10.67 @ 4.00 =	42.68	12.5 ﾌﾈｽﾐ
〃	C3.0	2 @ 〃	= 5.33 @ 3.00 =		〃
〃	C6.0	2 @ 〃	= 5.33 @ 6.00 =	67.96	〃
〃	C3.75	2 @ 〃	= 5.33 @ 3.75 =		〃
〃	Ca 4.25	4 @ 〃	= 10.67 @ 4.25 =	45.35	〃
〃	Cb 4.50	2 @ 〃	= 5.33 @ 4.50 =		〃
〃	Cc 6.50	2 @ 〃	= 5.33 @ 6.50 =		〃
〃	Cd 5.00	2 @ 〃	= 5.33 @ 5.00 =	173.23	〃
〃	Ce 4.50	2 @ 〃	= 5.33 @ 4.50 =		〃
〃	Cf 6.00	2 @ 〃	= 5.33 @ 6.00 =		〃
〃	Cg 6.00	2 @ 〃	= 5.33 @ 6.00 =		〃
				329.22 m	
16φ	D7.50	2 @ 2.667	= 5.33 @ 7.50 =		中条
〃	Da 2.75	2 @ 〃	= 5.33 @ 2.75 =	86.61	〃
〃	Db 6.00	2 @ 〃	= 5.33 @ 6.00 =		〃
〃	D 2.00	8 @ 〃	= 21.33 @ 2.00 =	42.66	〃
				129.27 m	

横鉄筋

15φ	12φ	隔距延長 1.0 m = 1本 横鉄筋長平均 6.00 + 5.36 =	1.12	全条
		308 @ 1.12 =	344.96 m	

肋筋

9φ	Ma	19 @ 2.0	= 38.0 @ 2.064 =	78.45	
〃	Mb	2 @ 2.0	= 4.0 @ 2.514 =	10.50	全
〃	Mc	8 @ 2.0	= 16.0 @ 1.908 =	30.52	
〃	Md	46 @ 2.0	= 92.0 @ 1.446 =	133.10	条
〃	Me	2 @ 〃	= 4.0 @ 2.031 =	8.13	
〃	Mf	19 @ 〃	= 38.0 @ 1.575 =	59.80	
〃	Mg	19 @ 〃	= 38.0 @ 1.637 =	62.20	
〃	Mh	2 @ 〃	= 4.0 @ 2.545 =	10.18	
	Mi	2 @ 2.667	= 5.33 @ 2.040 =	10.87	
	Mj	2 @ 〃	= 5.33 @ 2.260 =	12.05	
				415.80 m	

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CALCULATIONS FOR

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鉄筋重量

		総長			
25φ	鉄筋	91.94 m @	3.85	=	354
22φ	〃	114.60	2.98		342
19φ	〃	329.22	2.22		731
16φ	〃	129.27	1.57		203
12φ	〃	344.96	0.88		304
9φ	〃	415.80	0.49		204
					2138 kg. (隧道長1米当り)

混凝土容積

		厚	長	巾	員数	容積
下床		0.93 m	6.70 m	1.0	1	6.23
中床		0.70	6.70	1.0	1	4.69
上床	平均	0.685	6.70	1.0	1	4.59
側壁		0.60	10.89	1.0	2	13.07
持送	平均	0.20	1.00	0.40	8	0.64
						29.22 m³ (?)

特A3型隧道
混凝土一立米当り鉄筋量 = $\frac{2138}{29.22}$ = 73.1 kg 鉄筋比 (0.93 %)

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CALCULATIONS FOR

特A4ノ一型　土被 2.5m

主鉄筋

25φ	A 5.00	2.5 @ 5.00	= 12.50	中床
〃	Aa 4.50	2.5 @ 4.50	= 11.25	側壁 左下
〃	Ab 7.00	2.5 @ 7.00	= 17.50	〃 右下
			41.25 m	
22φ	Ba 5.50	5 @ 5.50	= 27.50	中床
〃	B6 4.25	5 @ 4.25	= 21.25	〃
〃	Bc 2.50	5 @ 2.50	= 12.50	〃
〃	Bd 7.00	2.5 @ 7.00	= 17.50	側壁 左下
〃	Be 5.0	2.5 @ 5.00	= 12.50	〃 右下
〃	Bf 4.50	2.5 @ 4.50	= 11.25	〃 左下
〃	Bg 6.50	2.5 @ 6.50	= 16.25	〃 右下
〃	Bh 4.75	2@2.5 = 5.0 @ 4.75	= 23.75	〃 左右下
〃	Bi 5.00	2@〃 = 5.0 @ 5.00	= 25.00	〃 〃 〃
〃	B. 5.00	5 @ 5.00	= 25.00	中床
			192.5 m	
19φ	C 4.00	2.5 @ 4.0	= 10.00	下床
〃	C 5.75	2@2.5 = 5 @ 5.75	= 28.75	側壁 左右下
〃	C 2.0	5 @ 2.0	= 10.0	中床
〃	C 2.25	5@2.5 = 12.5 @ 2.25	= 28.13	下中床隔
〃	C 5.00	2.5 @ 5.0	= 12.50	左下床
〃	Ca 6.5	2.5 @ 6.5	= 16.25	〃
〃	Cb 7.0	2.5 @ 7.0	= 17.50	〃
〃	Cc 5.75	2@2.5 = 5 @ 5.75	= 28.75	〃
〃	Cd 6.50	〃 〃 = 5 @ 6.50	= 32.50	〃
〃	Ce 4.0	2 〃 = 5 @ 4.0	= 20.00	側壁 左右下
〃	Cf 5.50	2 〃 = 5 @ 5.50	= 27.50	下床
〃	Cg 6.50	2 〃 = 5 @ 6.50	= 32.50	〃
			264.38 m	
16φ	D 1.75	4@2.5 = 10 @ 1.75	= 17.50	上中床隔
〃	D 4.75	2.5 @ 4.75	= 11.88	上床
〃	D 5.50	2.5 @ 5.50	= 13.75	側壁 左右上
〃	D 5.0	2.5 @ 5.0	= 12.50	〃 左上
〃	D 4.50	2.5 @ 4.5	= 11.25	〃 〃
〃	Da 5.50	2.5 @ 5.5	= 13.75	〃 〃
〃	Db 6.0	2.5 @ 6.00	= 15.00	〃 左上
〃	Dc 4.0	2.5 @ 4.0	= 10.00	〃 〃
〃	Dd 3.25	2.5 @ 3.25	= 8.13	〃 左上
〃	De 3.75	〃 @ 3.75	= 9.38	〃 右上
〃	Df 4.50	〃 @ 4.50	= 11.25	〃 左上
〃	Dg 6.00	〃 @ 6.00	= 15.00	上床 右
〃	Dh 4.00	〃 @ 4.00	= 10.00	側壁 右上
〃	Di 6.00	〃 @ 6.00	= 15.00	〃 〃
〃	Dj 4.50	5 @ 4.5	= 22.50	〃 左右上
〃	Dk 3.75	5 @ 3.75	= 18.75	〃 〃
〃	Dl 3.25	5 @ 3.25	= 16.25	上床 右
〃	Dm 4.5	5 @ 4.5	= 22.50	側壁 左右上
〃	Dn 3.75	5 @ 3.75	= 18.75	〃 〃
〃	Do 6.00	2.5 @ 6.00	= 15.00	〃 右上
			288.14 m	

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CALCULATIONS FOR

横 鉄 筋
16φ
12φ

隧道延長1米=付す鉄筋平均長 D--- $\frac{6,00}{4.9}$ = 1,225 , L --- $\frac{5.75}{4.9}$ = 11.73米

48本 @ 1,225 = 58.8m
237 @ 1,173 = 278.0m

肋 筋

9φ	Ma	13@	2,5 = 32,5	@	1,601	=	52,1
〃	Mb	2@	〃 = 5	@	2,063		10,3
〃	Mc	5@	〃 = 12,5	@	1,748		21,9
〃	Md	30@	〃 = 75	@	1,292		96,9
〃	Me	3@	〃 = 7,5	@	1,868		14,0
〃	Mf	19@	〃 = 47,5	@	1,416		6,7
〃	Mg	3@	〃 = 7,5	@	1,865		14,0
〃	Mh	3@	〃 = 7,5	@	1,523		11,4
〃	Mi	35@	〃 = 87,5	@	1,075		94,0
〃	Mj	4@	〃 = 10	@	1,517		15,2
〃	Mk	2@	〃 = 5	@	1,697		8,5
〃	Ml	2@	〃 = 5	@	1,960		9,8
〃	Mm	2@	〃 = 5	@	1,880		9,4
〃	Mn		2,5	@	1,810		4,5
							368,7 m

鉄筋重量

	総長					
25φ 鉄筋	41,25 m	@	3,85	=	159	
22φ 〃	192,50		2,98		574	主鉄筋
19φ 〃	264,38		2,22		587	
16φ 〃	288,14		1,57		453	
16φ 〃	58,80		1,57		92	横鉄筋
12φ 〃	278,00		0,88		245	
9φ 〃	368,70		0,49		181	肋筋
					2291 kg	

混凝土容積	厚	長	巾	負面	容積
下床	0,73	4,10	1,0	1	3,09
中床	0,60	4,10	1,0	1	2,46
〃	0,63	2,18	1,0	1	1,37
側壁 下	0,54	5,73	1,0	2	6,19
〃 上	0,44	4,84	1,0	2	4,26
上床	0,44	4,10	1,0	1	1,81
接逢り	0,20	0,40	1,0	10	0,80
					19,98 m³

特A7型隧道
混凝土1立米当鉄筋量 = $\frac{2291}{19.98}$ = 114,8 kg

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CALCULATIONS FOR

特A5型1(二) 土被 4.0m.

主鉄筋

19φ	C4.5	4@ 2.5 = 10	@	4.5	= 45.00 m	下床	
〃	Ca 5.0	2.5	@	5.0	= 12.50	〃	
〃	Cb 5.5	2@ 2.5 = 5	@	5.5	= 27.50	〃	
〃	Cc 4.0	2.5	@	4.0	= 10.00	且床	
〃	Cd 4.25	2.5	@	4.25	= 10.63	〃	
〃	Ce 5.0	2.5	@	5.00	= 12.50	〃	
〃	C2.0	4@ 2.5 = 10	@	2.00	= 20.00	上下床版	
〃	C3.0	5	@	3.00	= 15.00	上床	
〃	Cg 3.75	5	@	3.75	= 18.75	上床	
〃	Ch 2.50	15	@	2.50	= 37.50	上下床	
〃	C 4.5	10	@	4.5	= 45.00	中央壁	
〃	C 4.25	2.5	@	4.25	= 10.63	〃	
〃	C 4.75	7.5	@	4.75	= 35.60	〃	
					300.61 m		

16φ	D3.0	2.5	@	3.0	=	側壁	左 (AB)
〃	D3.75	2.5	@	3.75	=	〃	〃
〃	Da 4.0	2.5	@	4.0	=	〃	
〃	Db 4.75	2.5	@	4.75	=	〃	〃
〃	Dc 4.25	2.5	@	4.25	= 105.63 m	〃	〃
〃	Dd 4.5	2.5	@	4.5	=	〃	〃
〃	De 4.25	2.5	@	4.25	=	〃	〃
〃	Df 5.00	2.5	@	5.00	=	〃	〃
〃	Dg 3.75	2.5	@	3.75	=	〃	〃
〃	Dh 5.00	2.5	@	5.00	=	〃	〃
〃	D 5.00	4@ 2.5 = 10	@	5.00	= 50.00	上下床	右 DE, FG
〃	Di 5.00	2.5	@	5.00	=	〃	〃
〃	Dj 5.50	2.5	@	5.50	=	〃	〃
〃	Dk 2.25	2.5	@	2.25	=	〃	〃
〃	Dℓ 5.500	2.5	@	5.500	= 77.5	〃	〃
〃	Dm 5.000	2.5	@	5.000	=	〃	〃
〃	Dn 5.50	2.5	@	5.50	=	〃	〃
〃	Do 2.25	2.5	@	2.25	=	〃	〃
〃	D 1.75	2@ 2.5 = 5.0	@	1.75	= 8.75	〃	〃
〃	D 2.00	2.5	@	2.00	= 5.00	〃	〃
					141.25 m		
〃	D 3.00	2.5	@	3.00	=	側壁	右 EF
〃	D 3.25	2.5	@	3.75	=	〃	〃
〃	Dp 4.00	2.5	@	4.00	=	〃	〃
〃	Dq 4.75	2.5	@	4.25	=	〃	〃
〃	Dr 4.00	2.5	@	4.00	= 97.5 m	〃	〃
〃	Ds 4.00	2.5	@	4.00	=	〃	〃
〃	Dt 4.00	2.5	@	4.00	=	〃	〃
〃	Du 4.50	2.5	@	4.50	=	〃	〃
〃	Dv 3.50	2.5	@	3.50	=	〃	〃
〃	Dw 4.50	2.5	@	4.50	=	〃	〃
					344.38 m		

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横筋 隧道延長1.0米=付横鉄筋平均長
中央壁用 5.75+6.50 = 12.25" ÷10 = 1.225 m
上下床及側壁用 5.75 ÷5 = 1.15 m

上下床及側壁用	12φ	本 185	@	1.15	=	213.0
中央壁用	〃	80	@	1.225	=	98.0
						311.0 m

助筋

9φ	Ma	11	@ 2.5 = 27.5	@	1.675	= 46.00
	Mb	2	@ 〃 = 5	@	2.157	10.78
	Mc	2	@ 〃 = 5	@	2.170	10.85
	Md	4	@ 〃 = 10	@	1.870	18.70
12 8 11	Me	31	@ 2.5 = 77.5	@	1.836	142.40
	Mf			2.5 @	2.090	5.22
	Mg			2.5 @	2.117	5.29
	Mh	7	@ 2.5 = 17.5	@	1.635	28.60
	Mi			2.5 @	2.197	5.49
	Mj			2.5 @	2.397	5.99
	Mk			2.5 @	2.597	6.49
	Ml			2.5 @	2.797	6.99
	Mm			2.5 @	3.517	8.80
	~~Mm~~					
11	Mn	11	@ 2.5 = 27.5	@	1.195	32.90
	Mo	2	@ 〃 = 5	@	1.906	9.54
	Mp			2.5 @	2.614	6.54
	Mq	2	@ 〃 = 5	@	1.584	7.92
	Mr	11	@ 〃 = 27.5	@	1.106	30.42
	Ms			2.5 @	1.794	4.48
	Mt	2	@ 2.5 = 5	@	1.544	7.72
	Mu	12	@ 2.5 = 30	@	1.066	32.00
	Mv			2.5 @	1.954	4.88
	Mw			2.5 @	1.868	4.67
	Mx			2.5 @	1.994	4.98
	My			2.5 @	3.034	7.54
						301.60 m

鉄筋重量

	総長				
19φ 鉄筋	300.61 m	@	2.22 kg	=	680.
16φ 〃	344.38		1.57		541
12φ 〃	311.00		0.88		274
9φ 〃	301.60		0.49		148
					1643 kg (隧道長1米=付キ)

混凝土容積

	厚	長	巾	条数	容積
下床 AH	0.77	3.62	1.0	1	2.79
〃 FG	0.63	4.12	1.0	1	2.59
〃 〃	0.50	0.15	1.0	1	0.28
上床 BC	平均 0.73	3.62	1.0	1	2.64
〃 〃	平均 0.40	1.50	1.0	1	0.60
〃 DE	〃 0.475	4.12	1.0	1	1.96
〃 〃	0.40	0.50	1.0	1	0.20
上下床隔	平均 0.20	0.40	1.0	8	0.64
側壁 AB	0.60	5.77	1.0	1	3.46

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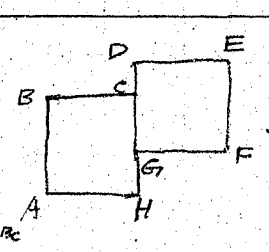
CALCULATIONS FOR

	厚	長	巾	条数	容積	
側壁 EF	0.44	5.37	1.0	1	2.36	
中央壁 AG	0.60	3.50	1.0	1	2.10	
〃 GCD	0.50	5.40	1.0	1	2.70	
G妻	平均 0.25	0.50	1.0	1	0.13	
					22.45 m³	

特A5、二型 隧道
混凝土 一立米当り鉄筋量 = 1643 / 22.45 = 73.2 kg　鉄筋比 (0.93%)

特A6号 土被 4.5m



主鉄筋

19ヶ	$C_{4.75}$	4 @ 2.5 =	10	@ 4.75	= 47.50m	上下条 AH, BC
〃	$C_{a\,3.75}$		5	@ 3.75	= 18.75	下条 AH
〃	$C_{b\,2.50}$		5	@ 2.50	= 12.50	〃 〃
〃	$C_{c\,2.50}$		2.5	@ 2.50	= 6.25	〃 〃
〃	$C_{d\,4.00}$		2.5	@ 4.00	= 10.00	〃 〃
〃	$C_{e\,3.75}$		5	@ 3.75	= 18.75	上条 BC
〃	$C_{f\,2.50}$		5	@ 2.50	= 12.50	〃 〃
〃	$C_{g\,2.50}$		2.5	@ 2.50	= 6.25	〃 〃
〃	$C_{h\,3.75}$		2.5	@ 3.75	= 9.38	
〃	$C_{2.00}$	4@2.5 =	10	@ 2.00	= 20.00	上下条 AH, BC
〃	$C_{2.25}$		5	@ 2.25	= 11.25	上条 BC
〃	$C_{2.75}$		5	@ 2.75	= 13.75	側壁 AB
〃	$C_{4.0}$		5	@ 4.0	= 20.00	〃 〃
〃	$C_{4.25}$		5	@ 4.25	= 21.25	〃 〃
〃	$C_{4.75}$		5	@ 4.75	= 23.75	〃 〃
〃	$C_{4.00}$		2.5	@ 4.00	= 10.00	〃 〃
〃	$C_{5.00}$		2.5	@ 5.00	= 12.50	〃 〃
〃	$C_{m\,3.75}$		2.5	@ 3.75	= 9.38	〃 〃
〃	$C_{n\,6.00}$		2.5	@ 6.00	= 15.00	〃 〃
〃	$C_{o\,4.75}$	3@5.0 =	15	@ 4.75	= 71.25	中央壁 DCGH
〃	$C_{p\,4.00}$		5	@ 4.00	= 20.00	〃 〃
〃	$C_{q\,4.50}$		5	@ 4.50	= 22.50	〃 〃
〃	$C_{j\,4.75}$	2@5.0 =	10	@ 4.75	= 47.50	〃 〃
〃	$C_{i\,4.25}$		5	@ 4.25	= 21.25	〃 〃
〃	$C_{2.75}$		2.5	@ 2.75	= 6.78	〃 〃
〃	$C_{2.50}$		5	@ 2.50	= 12.50	〃 〃
〃	$C_{2.75}$		5	@ 2.75	= 13.75	〃 〃
					514.29 m	
16ヶ	$D_{4.75}$	4 @ 2.5 =	10	@ 4.75	= 47.50	上下条 DE, FG
〃	$D_{a\,3.50}$	2@5 =	10	@ 3.50	= 35.00	〃 〃 〃
〃	$D_{b\,2.25}$	2@5 =	10	@ 2.25	= 22.50	〃 〃 〃
〃	$D_{c\,2.00}$	2@2.5 =	5	@ 2.00	= 10.00	〃 〃 〃
〃	$D_{d\,3.75}$	2@〃 =	5	@ 3.75	= 18.75	〃 〃 〃
〃	$D_{1.75}$	4@〃 =	10	@ 1.75	= 17.50	〃 〃 〃
〃	$D_{2.50}$		5	@ 2.50	= 12.50	側壁 EF
〃	$D_{3.75}$		5	@ 3.75	= 18.75	〃 〃
〃	$D_{e\,3.50}$		2.5	@ 3.50	= 8.75	

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16φ	D_f 5.50	2.5 @ 5.50 =	13.75	TRI壁	EF
〃	D_g 3.50	2.5 @ 3.50 =	8.75	〃	〃
〃	D_h 4.50	2.5 @ 4.50 =	11.25	〃	〃
〃	D_i 4.00	5 @ 4.00 =	20.00	〃	〃
〃	D_j 4.50	5 @ 4.50 =	22.50	〃	〃
〃	D 1.75	4@2.5 = 10 @ 1.75 =	17.50	〃	〃 中央壁 隔
			285.00 m		

横 鉄筋
12φ

隔壁延長1米に付 横鉄筋平均長 5.75÷5 = 1.15 m
255 本 @ 1.15 = 293.5 m

肋 筋

9φ	M_a	11 @ 2.5 =	27.5	@ 1.515	=	41.60
〃	M_b	2 @ 〃 =	5	@ 2.037		10.20
〃	M_c		2.5	@ 2.117		5.29
〃	M_d	2 @ 〃 =	5.0	@ 1.577		7.78
〃	M_e	13 @ 〃 =	32.5	@ 1.115		36.25
〃	M_f		2.5	@ 2.077		5.19
〃	M_g	2 @ 〃 =	5	@ 1.897		9.49
〃	M_h	11 @ 〃 =	27.5	@ 1.435		39.45
〃	M_i	2 @ 〃	5	@ 2.017		10.08
〃	M_j	4 @ 〃 =	10	@ 1.562		15.62
〃	M_k	2×11 @ 〃 =	55	@ 1.111		61.10
〃	M_l		2.5	@ 1.779		4.45
〃	M_m	2 @ 〃 =	5	@ 1.439		7.20
〃	M_n	13 @ 〃 =	32.5	@ .991		32.20
〃	M_o		2.5	@ 1.679		4.19
〃	M_p		2.5	@ 2.318		5.79
〃	M_q	3 @ 〃 =	7.5	@ 2.058		15.43
〃	M_r	2 @ 〃 =	5	@ 2.178		10.88
〃	M_s		2.5	@ 2.738		6.85
〃	M_t	10 @ 1.25 =	12.5	@ 2.025		25.30
						354.34 m ✓

鉄筋重量

	総長			
19φ 鉄筋	5 1429 m	@ 2.22	=	1143
16φ 〃	285.00	1.57		447
12φ 〃	293.50	0.88		257
9φ 〃	354.34	0.49		174
				2021 kg

コンクリート容積

		厚	長	巾	個数	容積
下床	AH	0.69	3.96	1.0	1	
上床	BC 平均	0.63	3.96	1.0	1	9.04
〃	DE 〃	0.475	3.96	1.0	1	
下床	FG	0.449	3.96	1.0	1	
側壁	AB	0.46	5.73	1.0	1	2.64
〃	EF	0.40	5.37	1.0	1	2.15
中央壁	DCGH	0.60	6.90	1.0	1	4.14
特通り		0.20	0.40	1.0	8	0.64
〃		0.25	0.50	1.0	2	0.25
						18.86 m³

特A6 隧道

コンクリート一立米当り鉄筋量 = 2021 / 18.86 = 107.2 kg (鉄筋比 1.37)

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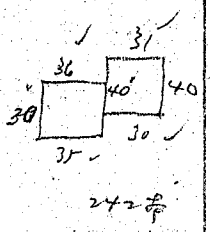
CALCULATIONS FOR

2.5×2 = 5 ✓
17.5+ 7.5 = 25
5 + 5 = 10
5
45

特A7型 土被 4.5米

主鉄筋

19φ	C4.75	8 @ 2.5 = 20.	@ 4.75 =	95.00	上下共
〃	Ca5.0	2 c 〃 = 5	c 5.00 =	25.00	〃
〃	Cb5.10	4c 〃 = 10	c 5.10 =	50.00	〃
〃	Cc5.00	4c 〃 = 10	c 5.0 =	50.00	〃
〃	Cd5.25	2c 〃 = 5	c 5.25 =	26.25	〃
〃	Ce 3.25	2c 10 = 20	c 3.25 =	65.00	〃
〃	C 1.75		45 c 1.75 =	78.75	〃
〃	C 1.75		2.5 c 1.75 =	4.38	外側壁 (左)
〃	C3.25	4 c 2.5 =	10 c 3.25 =	32.50	〃 たれ
〃	Cf 4.25	2 c 〃 =	5 c 4.25 =		〃 〃
〃	Cg 4.5		5 c 4.50 =		〃 〃
〃	Ch 4.0		5 c 4.00 =		〃 〃
〃	Ci 4.5		5 c 4.50 =		〃 〃
〃	Cj 4.0		5 c 4.0 =	177.5	〃 〃
〃	Ck 4.75		5 c 4.75 =		〃 〃
〃	Cl 4.0		5 c 4.0 =		〃 〃
〃	Cm 5.5		5 c 5.5 =		〃 〃
〃	C3.25		5 c 3.25 = 16.25		中央壁
〃	Cg 4.5		2.5 c 4.50 = 11.25		〃
〃	Cf 4.25		2.5 c 4.25 = 10.63		〃
			642.5 m		
22φ	Ba 4.25		2.5 c 4.25 = 10.63		中央壁
〃	Bb 5.00	2c 2.5 =	5 c 5.00 = 25.00		〃
〃	Bc 4.5		2.5 c 4.5 = 11.25		〃
〃	Bd 2.75	2c 5 =	10 c 2.75 = 27.5		〃
			74.4 m		



242本

横鉄筋 12φ 242 c 1.15 = 278.3 m

肋筋

9φ	Ma	44 c 2.5 =	110 c 1.120 =	123.2	
	Mb	8 c 2.5 =	20 c 1.582 =	31.6	
	Mc	4 c 〃 =	10 c 1.802 =	18.0	
	Md	4 c 〃 =	10 c 1.462 =	14.6	
	Me	26 c 〃 =	65 c 1.000 =	65.0	
	Mf	2 c 〃 =	5 c 1.682 =	8.4	
	Mg	2 c 〃 =	5 c 2.161 =	10.8	
	Mh	2 c 〃 =	5 c 2.061 =	10.3	
	Mi	12 c 1.25 =	15 c 2.035 =	30.5	
				312.4 m	

鉄筋重量	糸長			
22φ 鉄筋	74.4 m	@	2.98 =	222 kg
19φ 〃	642.5	@	2.22 =	1425 〃
12φ 〃	278.3	@	0.88 =	245 〃
9φ 〃	312.4	@	0.49 =	153 〃
				2045 〃

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CALCULATIONS FOR

	巾	長	中	数取	容積
混凝土容積					
下床	0.490	4.03	1.0	2.0	3.95
上床	0.475	4.03	1.0	2.0	3.82
側壁	0.400	5.37	1.0	2.0	4.30
中央壁	0.600	5.99	1.0	1	3.59
持送	0.20	0.40	1.0	8 =	0.64
〃	0.25	0.50	1.0	2 =	0.25
					16.55 m³.

特A7型隧道

混凝土1立米当鉄筋量 = 2045 / 16.55 = 123.6 kg (1.57%)

鉄筋比

鉄筋含有量一覧表

	混凝土1立米当鉄筋量
特A1型 —— 土被 2.5m ——	92.5 kg.
特A2型 —— 〃 2.5 ——	73.5 〃
特A3型 —— 〃 2.5 ——	73.1 〃
特A4,二型 —— 〃 2.5 ——	114.8 〃
特A5,二型 —— 〃 4.0 ——	73.2 〃
特A6型 —— 〃 4.5 ——	107.2 〃
特A7型 —— 〃 4.5 ——	123.6 〃