

Table BILL OF QUANTITY (ITEM NO 4.3, 08, 09, 10, 12, 14)  
SALURAN CENGKARENG

No of	1	2	3			4										5	6					
			Bridge	FC	Width	Gap		Road		B/Q Item										Rem-arks		
						G	10.5°G	Main	Branch	No08	No09		No10		No12			No14				
					L-1	L-2	SUM L	A4	A4*L	H2	H2*L	H3	H3*L	K	K*L	2*L						
BCM 1	B	7/III/III 9.60-2	1.04	0.52	127.80		127.80	0.14	17.89	2.40	306.72	0.41	52.40	0.36	46.01	255.60						
BCM 2	B	(7.00) III/III 9.60-3	1.941	0.971	179.08	101.05	280.13	0.32	89.64	4.13	1156.94	0.62	173.68	0.45	126.06	560.26						
BCM 3	B	IV 4.60-1	1.544	0.772	77.20		77.20	0.25	19.30	3.33	257.08	0.53	40.92	0.43	33.20	154.40						
BCM 4	P	2.50	1.376	0.688		5.60	5.60	0.21	11.18	24.57	49.14	0.49	2.74	0.39	0.78	11.20						
BCM 5	B	III/IV 6.60-3	1.412	0.706	101.60	77.20	178.80	0.22	39.34	3.00	536.40	0.50	89.40	0.39	69.73	357.60						
BCM 6	B	III/IV 6.60-3	1.801	0.901	97.05	47.73	144.78	0.31	44.88	4.00	579.12	0.60	86.87	0.44	63.70	289.56						
BCM 7	P	2.50	2.564	1.282		10.40	10.40	0.45	4.68	48.00	96.00	0.77	8.01	0.69	1.38	20.80						
BCM 8	P	2.50	2.103	1.052		8.40	8.40	0.57	3.11	33.14	66.28	0.53	4.55	0.45	0.90	16.80						
BCM 9	P	2.50	2.596	1.298		10.40	10.40	0.48	4.99	48.00	96.00	0.77	8.01	0.69	1.38	20.80						
BCM 10	B	III/IV 6.60-3	2.307	1.154	118.67	56.53	175.20	0.40	70.08	4.96	868.99	0.71	124.39	0.61	106.87	350.40						
BCM 11	B	I 12.20-3	0.973	0.487	85.84	53.83	139.67	0.13	18.16	2.07	289.12	0.40	55.87	0.55	48.88	279.34						
BCM 12	B	I 12.20-3	2.351	1.176	176.08		176.08	0.40	70.43	5.17	910.33	0.71	125.02	0.63	110.93	352.16						
BCM 13	B	III/III 8.20-1	0.846	0.423	64.40		64.40	0.13	8.37	1.97	126.87	0.37	23.83	0.51	19.96	128.80						
BCM 14	B	(7.00) III/III 9.60-3	0.838	0.414	60.20	62.20	122.40	0.13	15.91	1.97	241.13	0.37	45.29	0.51	37.94	244.80						

Table BILLOF QUANTITY (ITEM NO 4.3,08,09,10,12,14)

GEDE/BOR

No of	1	2	3			4				5										6
			Gap G	0.5*G	Road		No08		No09		No10		No12		No14 2*L	Rem- arks				
Width	L-1	Main			Branch	A4	A4*L	H2	H2*L	H3	H3*L	K	K*L							
Bridge	FC																			
BGM 1	B	(7.00) III/II	0.500	0.250	114.60					0.08	9.17	0.70	80.22	0.29	33.23			229.20		
BGM 2	B	(7.00) III/II	1.014	0.507	120.60	65.30				0.13	24.17	2.20	408.98	0.40	74.36			371.80		
BGM 3	P	2.50	1.912	0.956	0.00	7.60						31.14	62.28			0.50	1.00	15.20		
BGM 4	B	6.60-3	2.885	1.443	58.13	59.13				0.53	62.15	6.20	727.01	0.85	99.67			234.52		
BGM 5	B	4.60-1	2.875	1.438	86.00	117.89				0.53	108.06	6.20	1264.12	0.85	173.31			407.78		
BGM 6	B	4.60-1	2.232	1.116	3.00	72.80				0.39	29.56	4.91	372.18	0.69	52.30			151.60		
BGM 7	B	4.60-1	2.322	1.161	38.50	45.80				0.40	33.72	4.96	418.13	0.72	60.70			168.60		
BGM 8	B	6.60-3	1.754	0.877	86.00	43.85				0.29	37.66	3.76	488.24	0.57	74.01			259.70		
BGM 9	B	6.60-3	2.149	1.075	115.93	86.26				0.37	74.81	4.67	944.23	0.67	135.47			404.38		
BGM 10	B	3.50-S	2.197	1.099	97.77	75.41				0.38	65.81	4.80	831.26	0.69	119.49			346.36		
BGM 11	B	4.60-1																		
BGM 12	B	8.20-1																		

Table BILL OF QUANTITY (ITEM NO 4.3 ,08,09,10,12,14)  
GEDE/BOR(BRANCH)

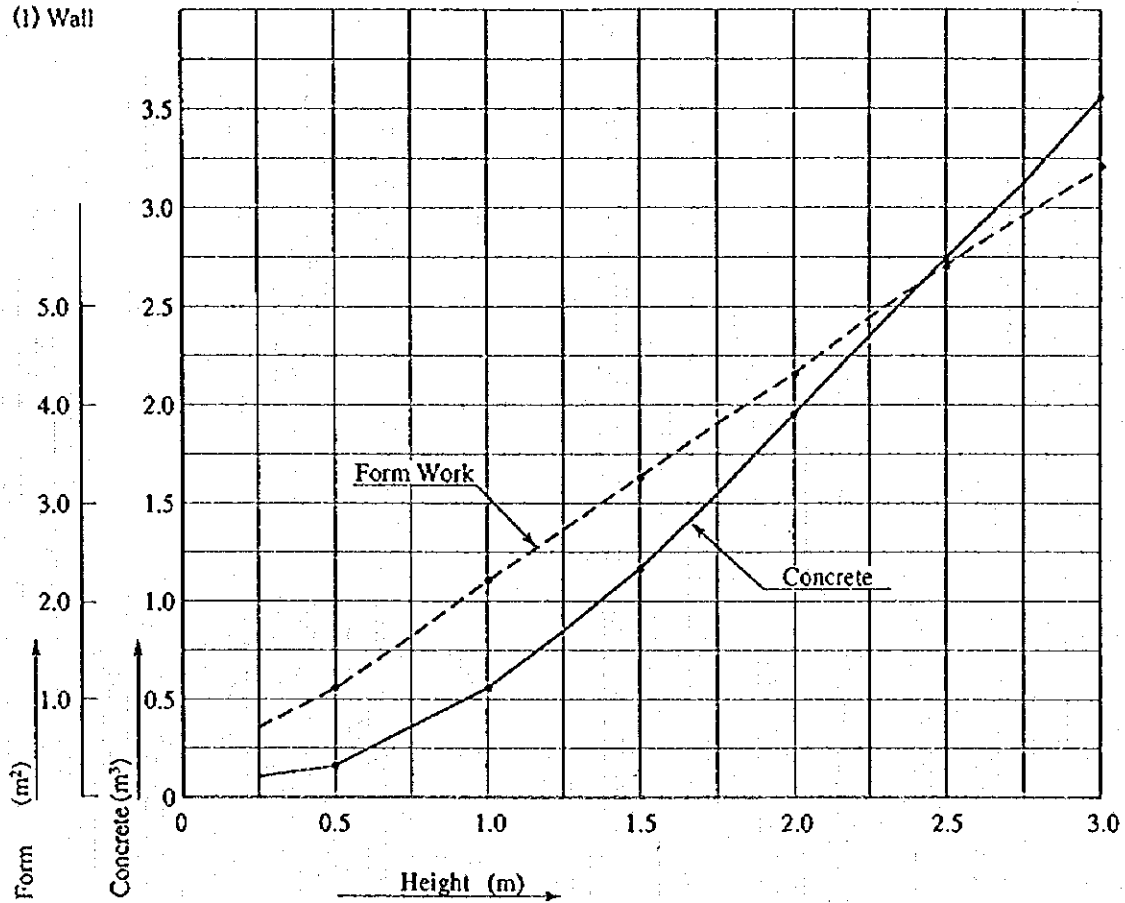
No of:	1	2	3					4							5					6				
			Bridge	FC	Width	Gap	G	Road		SUM L	No08			No09		No10		No12			No14	Rem-arks		
								0.5*G	L-1		Main	Branch	L-2	A4	A4*L	H2	H2*L	H3	H3*L				K	K*L

Table BILL OF QUANTITY (ITEM NO 4.3 ,08,09,10,12,14)  
MERUYA

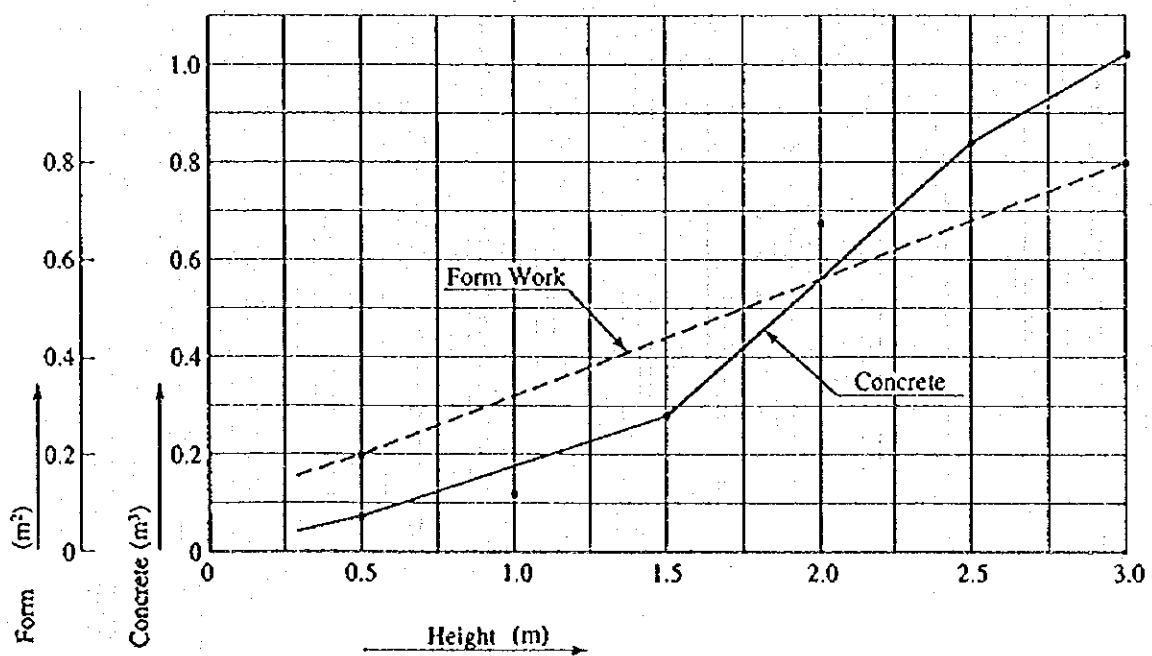
No of:	1	2	3					4							5					6					
			Bridge	FC	Width	Gap	G	Road		SUM L	No08			No09		No10		No12			No14	Rem-arks			
								0.5*G	L-1		Main	Branch	L-2	A4	A4*L	H2	H2*L	H3	H3*L				K	K*L	2*L

## 2.2 Bridge

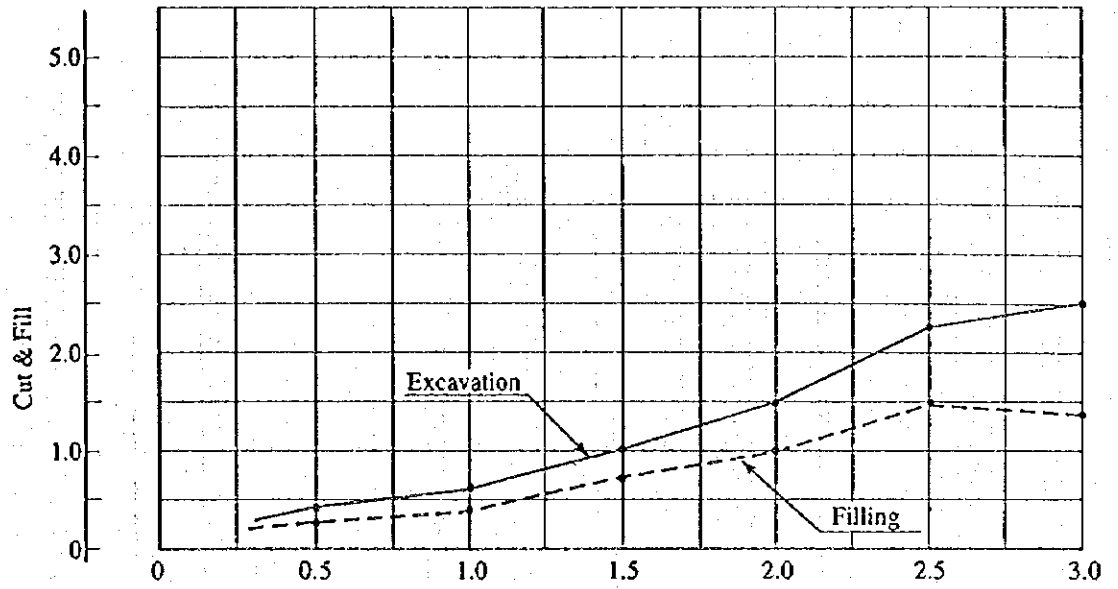
(1) Wall



(2) Foundation

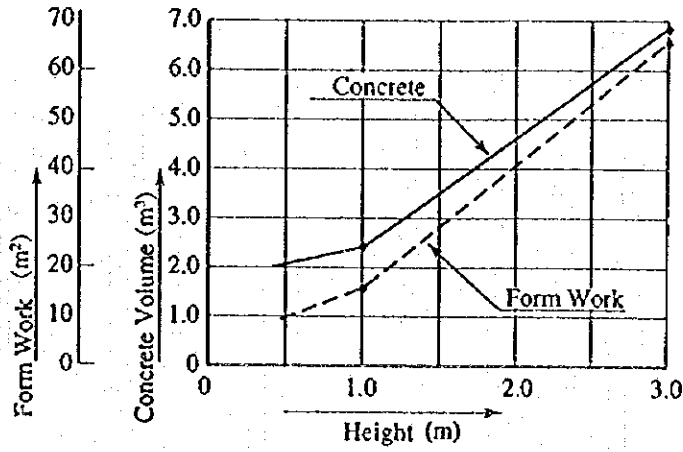


(3) Excavation and Filling

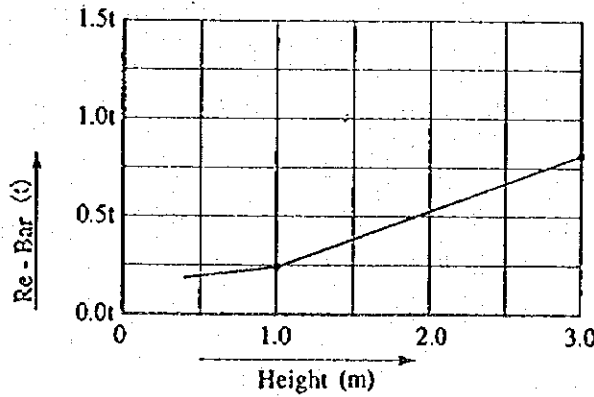


Pedestrian  
(per one side)

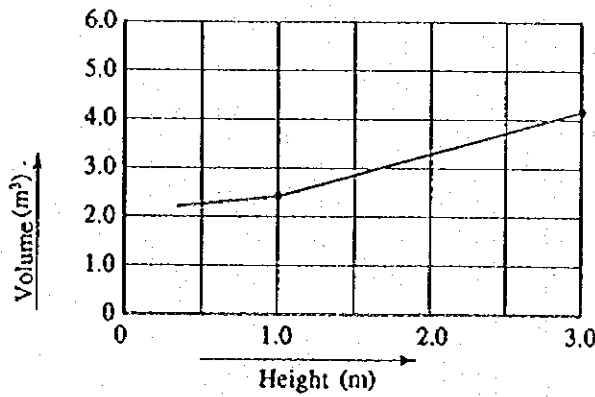
(1) Concrete Volume and Form Work



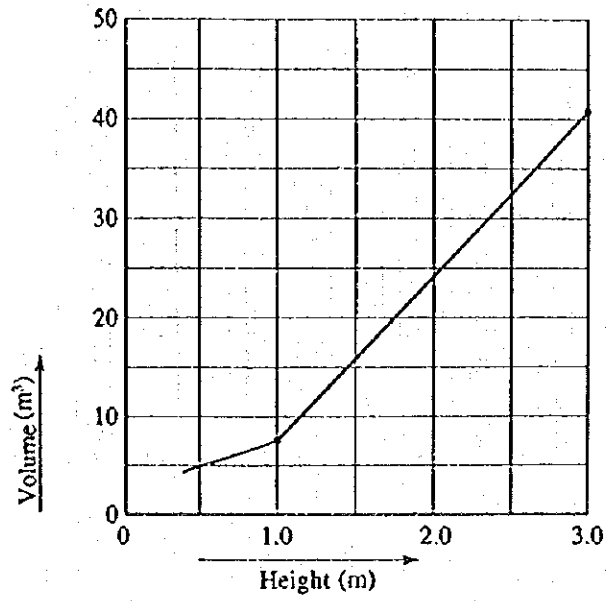
(2) Re - Bar



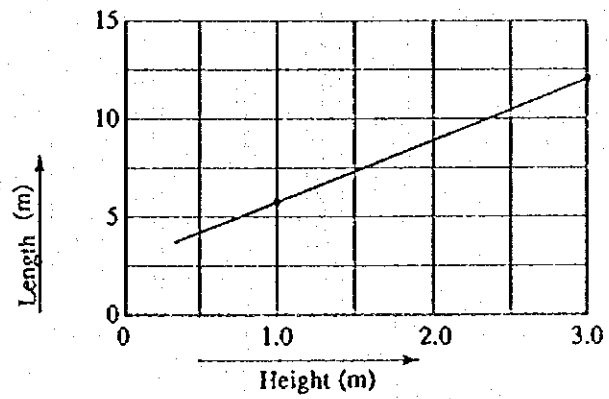
(3) Excavation



## Backfilling Plus Embankment



## Handrail

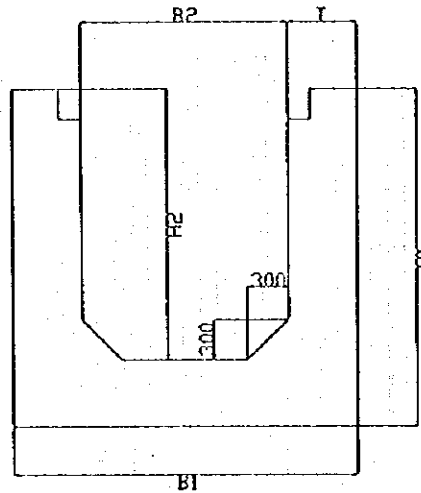


## 2.3 Bridge(In-situ Slab Bridge)

### Calculation of Quantity

BMM1-16, BNM1-4, BKE19,20

Substructure (RC Side Ditch)



Dimension	H1	B1	H2	B2	T	W
BMM1	2.48	2.50	1.98	1.50	0.50	7.60
BMM2	2.50	2.50	2.00	1.50	0.50	9.00
BMM3	2.53	2.50	2.03	1.50	0.50	9.00
BMM4	2.53	2.50	2.03	1.50	0.50	9.00
BMM5	2.56	2.50	2.06	1.50	0.50	9.00
BMM6	2.56	2.50	2.06	1.50	0.50	9.00
BMM7	2.62	2.50	2.12	1.50	0.50	7.60
BMM8	2.66	2.50	2.16	1.50	0.50	7.60
BMM9	2.71	2.35	2.16	1.25	0.55	7.60
BMM10	2.73	2.35	2.18	1.25	0.55	7.60
BMM11	2.45	2.35	1.90	1.25	0.55	7.60
BMM12	2.45	2.35	1.90	1.25	0.55	10.60
BMM13	2.49	3.30	1.94	2.20	0.55	7.60
BMM14	2.19	3.30	1.64	2.20	0.55	7.60
BMM15	2.23	2.00	1.83	1.20	0.40	7.60
BMM16	2.10	2.00	1.70	1.20	0.40	7.60
BNM1	2.69	3.10	2.24	2.20	0.45	8.20
BNM2	2.69	3.10	2.24	2.20	0.45	4.60
BNM3	2.69	3.10	2.24	2.20	0.45	4.60
BNM4	2.69	3.10	2.24	2.20	0.45	4.60
BKE19	2.12	2.80	1.72	2.00	0.40	4.60
BKE20	1.97	2.80	1.57	2.00	0.40	4.60

W : Bridge Width



•Concrete

Concrete  $V1 = (H1 * T * 2 + B2 * T - 2 * .28 * .165 + .3 * .3) * W$  (m3)  
 Lean Concrete  $V2 = B1 * W * 0.1$  (m3)

•Formwork

for Concrete  $A1 = (2 * H2 + 2 * H1 - 4 * .3 + 2 * 1.41 * .3) * W$   
 $+ 2 * (H1 * T * 2 + B2 * T - 2 * .28 * .165 + 0.3 * 0.3)$  (m2)  
 for Lean Concrete  $A2 = 2 * B1 * 0.1 + 2 * W * 0.1$  (m2)

•Excavation

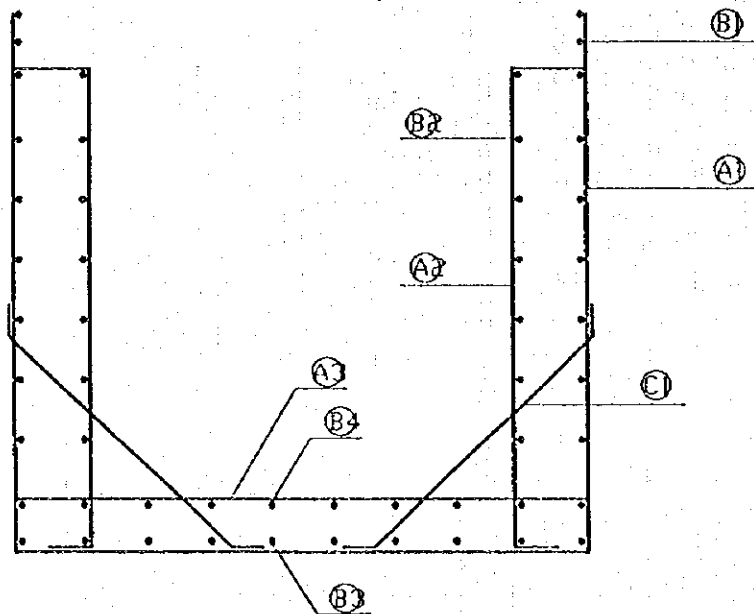
$V3 = H1 * B1$

	Concrete(m3)		Formwork(m2)		Excavation(m3)
	V1	V2	A1	A2	V3
BMM1	24.5	1.9	90.6	2.0	6.2
BMM2	29.2	2.3	106.8	2.3	6.25
BMM3	29.5	2.3	107.9	2.3	6.325
BMM4	29.5	2.3	107.9	2.3	6.325
BMM5	29.8	2.3	109.1	2.3	6.4
BMM6	29.8	2.3	109.1	2.3	6.4
BMM7	25.6	1.9	95.1	2.0	6.55
BMM8	25.9	1.9	96.4	2.0	6.65
BMM9	27.9	1.8	96.5	2.0	6.3685
BMM10	28.0	1.8	97.2	2.0	6.4155
BMM11	25.7	1.8	88.0	2.0	5.7575
BMM12	35.8	2.5	120.1	2.6	5.7575
BMM13	30.0	2.5	97.6	2.2	8.217
BMM14	27.5	2.5	87.8	2.2	7.227
BMM15	17.2	1.5	78.7	1.9	4.46
BMM16	16.4	1.5	74.6	1.9	4.2
total	432.3	32.9	1563.6	34.3	99.5
BNM1	28.0	2.5	110.2	2.3	8.339
BNM2	15.7	1.4	64.8	1.5	8.339
BNM3	15.7	1.4	64.8	1.5	8.339
BNM4	15.7	1.4	64.8	1.5	8.339
total	75.0	6.8	304.6	6.9	33.4
BKE19	11.5	1.3	51.6	1.5	5.936
BKE20	10.9	1.3	48.6	1.5	5.516
total	22.4	2.6	100.1	3.0	11.5

• Re-bar

Diameter and Pitch

	A1	A2,B1,C1	A3	B2	B3,4
BMM1	D19@125	D19@250	D13@125	D16@250	D13@250
BMM2					
BMM3					
BMM4					
BMM5					
BMM6					
BMM7					
BMM8					
BMM9	D19@125	D19@250	D13@125	D16@250	D13@250
BMM10					
BMM11					
BMM12					
BMM13	D19@125	D19@250	D13@125	D16@250	D13@250
BMM14					
BMM15					
BMM16	D16@125	D16@250	D13@125	D13@250	D13@250
BNM1	D19@125	D19@250	D13@125	D16@250	D13@250
BNM2					
BNM3					
BNM4					
BKE19	D16@125	D16@250	D13@125	D13@250	D13@250
BKE20					



Length	(m)							
	A1	A2	A3	B1	B2	B3	B4	C1
BMM1	6.86	2.80	2.30	7.40	7.40	7.40	7.40	2.01
BMM2	6.90	2.82	2.30	8.80	8.80	8.80	8.80	2.01
BMM3	6.96	2.85	2.30	8.80	8.80	8.80	8.80	2.01
BMM4	6.96	2.85	2.30	8.80	8.80	8.80	8.80	2.01
BMM5	7.02	2.88	2.30	8.80	8.80	8.80	8.80	2.01
BMM6	7.02	2.88	2.30	8.80	8.80	8.80	8.80	2.01
BMM7	7.14	2.94	2.30	7.40	7.40	7.40	7.40	2.01
BMM8	7.22	2.98	2.30	7.40	7.40	7.40	7.40	2.01
BMM9	7.17	3.03	2.15	7.40	7.40	7.40	7.40	2.15
BMM10	7.21	3.10	2.15	7.40	7.40	7.40	7.40	2.15
BMM11	6.65	2.82	2.15	7.40	7.40	7.40	7.40	2.15
BMM12	6.65	2.82	2.15	10.40	10.40	10.40	10.40	2.15
BMM13	7.68	2.86	3.10	7.40	7.40	7.40	7.40	2.15
BMM14	7.08	2.56	3.10	7.40	7.40	7.40	7.40	2.15
BMM15	5.86	2.45	1.80	7.40	7.40	7.40	7.40	1.73
BMM16	5.60	2.32	1.80	7.40	7.40	7.40	7.40	1.73
BNM1	7.88	2.96	2.90	8.00	8.00	8.00	8.00	1.87
BNM2	7.88	2.96	2.90	4.40	4.40	4.40	4.40	1.87
BNM3	7.88	2.96	2.90	4.40	4.40	4.40	4.40	1.87
BNM4	7.88	2.96	2.90	4.40	4.40	4.40	4.40	1.87
BKE19	6.44	2.34	2.60	4.40	4.40	4.40	4.40	1.73
BKE20	6.14	2.19	2.60	4.40	4.40	4.40	4.40	1.73

Numbers	(Nos)							
	A1	A2	A3	B1	B2	B3	B4	C1
BMM1	61	31	31	24	20	6	6	31
BMM2	72	36	36	22	18	6	6	36
BMM3	72	36	36	22	18	6	6	36
BMM4	72	36	36	22	18	6	6	36
BMM5	72	36	36	24	20	6	6	36
BMM6	72	36	36	24	20	6	6	36
BMM7	61	31	31	24	20	6	6	31
BMM8	61	31	31	24	20	6	6	31
BMM9	61	31	31	24	20	5	5	31
BMM10	61	31	31	24	20	5	5	31
BMM11	61	31	31	22	18	5	5	31
BMM12	85	43	43	22	18	5	5	43
BMM13	61	31	31	22	18	9	9	31
BMM14	61	31	31	20	16	9	9	31
BMM15	61	31	31	22	18	5	5	31
BMM16	61	31	31	20	16	5	5	31
BNM1	66	33	33	24	20	9	9	33
BNM2	37	19	19	24	20	9	9	19
BNM3	37	19	19	24	20	9	9	19
BNM4	37	19	19	24	20	9	9	19
BKE19	37	19	19	20	16	8	8	19
BKE20	37	19	19	18	14	8	8	19

Total Weight

Unit Weight

D13 0.995 kg/m  
 D16 1.56 kg/m  
 D19 2.25 kg/m

(kg)

(kg)

	D19	D16	D13	total
BMM1	1676.6	342.1	88.4	2107.1
BMM2	1944.6	376.3	105.1	2426.0
BMM3	1956.8	376.3	105.1	2438.1
BMM4	1956.8	376.3	105.1	2438.1
BMM5	2008.5	403.7	105.1	2517.3
BMM6	2008.5	403.7	105.1	2517.3
BMM7	1724.8	342.1	88.4	2155.3
BMM8	1738.6	342.1	88.4	2169.1
BMM9	1748.5	334.9	73.6	2157.0
BMM10	1755.4	334.9	73.6	2163.9
BMM11	1625.7	311.8	73.6	2011.1
BMM12	2267.6	436.3	103.5	2807.3
BMM13	1769.9	357.7	132.5	2260.1
BMM14	1633.3	334.6	132.5	2100.5
BMM15	-	1013.7	261.7	1275.3
BMM16	-	959.5	247.0	1206.5
total	25815.8	7045.8	1888.5	34750.2
BNM1	1960.7	398.9	143.3	2502.9
BNM2	1100.0	223.2	78.8	1402.1
BNM3	1100.0	223.2	78.8	1402.1
BNM4	1100.0	223.2	78.8	1402.1
total	5260.9	1068.6	379.7	6709.2
BKE19	-	629.6	189.2	818.8
BKE20	-	594.1	180.5	774.6
total	0.0	1223.7	369.7	1593.4

• Super Structure(In-situ Bridge)

Dimension (m)							
	Girder Length (L)	Width (W)	Girder Height (H)	Guard Rail	Main Re-bar	Distribution Re-bar	H2
BMM1	1.80	7.6	0.16	without	D19@125	D13@125	1.98
BMM2	1.80	9	0.16	without	D19@125	D13@125	2.00
BMM3	1.80	9	0.16	without	D19@125	D13@125	2.03
BMM4	1.80	9	0.16	without	D19@125	D13@125	2.03
BMM5	1.80	9	0.16	without	D19@125	D13@125	2.06
BMM6	1.80	9	0.16	without	D19@125	D13@125	2.06
BMM7	1.80	7.6	0.16	without	D19@125	D13@125	2.12
BMM8	1.80	7.6	0.16	without	D19@125	D13@125	2.16
BMM9	1.55	7.6	0.16	without	D19@125	D13@125	2.16
BMM10	1.55	7.6	0.16	without	D19@125	D13@125	2.18
BMM11	1.55	7.6	0.16	without	D19@125	D13@125	1.90
BMM12	1.55	10.6	0.16	without	D19@125	D13@125	1.90
BMM13	2.50	7.6	0.2	with	D22@125	D16@125	1.94
BMM14	2.50	7.6	0.2	with	D22@125	D16@125	1.64
BMM15	1.50	7.6	0.16	without	D19@125	D13@125	1.83
BMM16	1.50	7.6	0.16	without	D19@125	D13@125	1.70
BNM1	2.80	8.2	0.2	with	D22@125	D16@125	2.24
BNM2	2.80	4.6	0.2	with	D22@125	D16@125	2.24
BNM3	2.80	4.6	0.2	with	D22@125	D16@125	2.24
BNM4	2.80	4.6	0.2	with	D22@125	D16@125	2.24
BKE19	2.30	4.6	0.2	with	D22@125	D16@125	1.72
BKE20	2.30	4.6	0.2	with	D22@125	D16@125	1.57

H2 : Height from channel bed to girder bottom

- Formwork
  - BMM1-12,15,16  $A1 = (W+2*H)*L+2*H*W$  (m2)
  - BMM13,14,BNM1-4,BKE19,20  $A2 = (W+2*H)*L+2*H*W + 12*0.1*0.9+12*0.15*0.9$  (m2)
- Concrete
  - BMM1-12,15,16  $V1 = L*W*H$  (m3)
  - BMM13,14,BNM1-4,BKE19,20  $V2 = L*W*H+12*0.1*0.15*0.9$  (m3)
- Support  $A3 = L*W*H2$  (m3)

	Concrete(m3)		Formwork(m2)		Support(m2)
	V1	V2	A1	A2	A3
BMM1	2.2		16.7		27.1
BMM2	2.6		19.7		32.4
BMM3	2.6		19.7		32.9
BMM4	2.6		19.7		32.9
BMM5	2.6		19.7		33.4
BMM6	2.6		19.7		33.4
BMM7	2.2		16.7		29.0
BMM8	2.2		16.7		29.5
BMM9	1.9		14.7		25.4
BMM10	1.9		14.7		25.7
BMM11	1.9		14.7		22.4
BMM12	2.6		20.3		31.2
BMM13		3.8		25.7	36.9
BMM14		3.8		25.7	31.2
BMM15	1.8		14.3		20.9
BMM16	1.8		14.3		19.4
total	31.5	7.6	241.4	51.5	463.5
BNM1		4.6		30.1	51.4
BNM2		2.6		18.5	28.9
BNM3		2.6		18.5	28.9
BNM4		2.6		18.5	28.9
total		12.4		85.7	138.0
BKE19		2.1		16.0	18.2
BKE20		2.1		16.0	16.6
total		4.3		32.1	34.8

•Re-bar

Unit Weight    D22    3.04 (kg/m)  
                   D19    2.25 (kg/m)  
                   D16    1.56 (kg/m)  
                   D13    0.995 (kg/m)

	Length (m)		Nos		Weight (kg)				
	Main	Distribution	Main	Distribution	D22	D19	D16	D13	total
BMM1	1.80	7.40	60	7	328.3	-	80.8	-	409.1
BMM2	1.80	8.80	72	7	394.0	-	96.1	-	490.1
BMM3	1.80	8.80	72	7	394.0	-	96.1	-	490.1
BMM4	1.80	8.80	72	7	394.0	-	96.1	-	490.1
BMM5	1.80	8.80	72	7	394.0	-	96.1	-	490.1
BMM6	1.80	8.80	72	7	394.0	-	96.1	-	490.1
BMM7	1.80	7.40	60	7	328.3	-	80.8	-	409.1
BMM8	1.80	7.40	60	7	328.3	-	80.8	-	409.1
BMM9	1.55	7.40	60	6	282.7	-	69.3	-	352.0
BMM10	1.55	7.40	60	6	282.7	-	69.3	-	352.0
BMM11	1.55	7.40	60	6	282.7	-	69.3	-	352.0
BMM12	1.55	10.40	84	6	395.8	-	97.3	-	493.2
BMM13	2.50	7.40	60	10	-	337.5	-	73.6	411.1
BMM14	2.50	7.40	60	10	-	337.5	-	73.6	411.1
BMM15	1.50	7.40	60	6	273.6	-	69.3	-	342.9
BMM16	1.50	7.40	60	6	273.6	-	69.3	-	342.9
total					4746.0	675.0	1166.6	147.3	6734.9
BNM1	2.80	8.00	65	11	-	409.5	-	87.6	497.1
BNM2	2.80	4.40	36	11	-	226.8	-	48.2	275.0
BNM3	2.80	4.40	36	11	-	226.8	-	48.2	275.0
BNM4	2.80	4.40	36	11	-	226.8	-	48.2	275.0
total					0.0	1089.9	0.0	232.0	1321.9
BKE19	2.30	4.40	36	9	-	186.3	-	39.4	225.7
BKE20	2.30	4.40	36	9	-	186.3	-	39.4	225.7
total					0.0	372.6	0.0	78.8	451.4

•Expansion joint,Guard pipe and Pavement

	Expansion joint (m)	Guard pipe (m)	Pavement (m3)
BMM1	7.6	-	0.68
BMM2	9	-	0.81
BMM3	9	-	0.81
BMM4	9	-	0.81
BMM5	9	-	0.81
BMM6	9	-	0.81
BMM7	7.6	-	0.68
BMM8	7.6	-	0.68
BMM9	7.6	-	0.59
BMM10	7.6	-	0.59
BMM11	7.6	-	0.59
BMM12	10.6	-	0.82
BMM13	7.6	-	0.95
BMM14	7.6	-	0.95
BMM15	7.6	-	0.57
BMM16	7.6	-	0.57
total	131.6		11.73
BNM1	8.2	3.1	1.15
BNM2	4.6	3.1	0.64
BNM3	4.6	3.1	0.64
BNM4	4.6	3.1	0.64
total	22.0	12.4	3.08
BKE19	4.6	2.6	0.53
BKE20	4.6	2.6	0.53
total	9.2	5.2	1.06



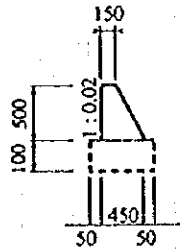
2.4 Access Road

Basic Data for Approach Road

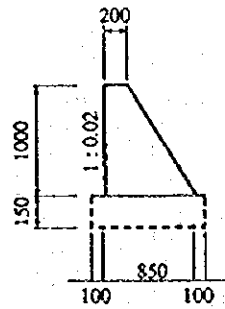
Retaining Wall

Section

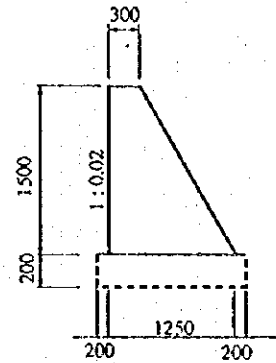
a) 0.5M



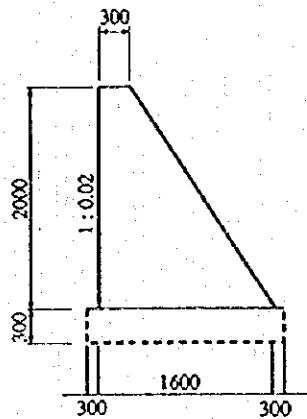
b) 1.0M



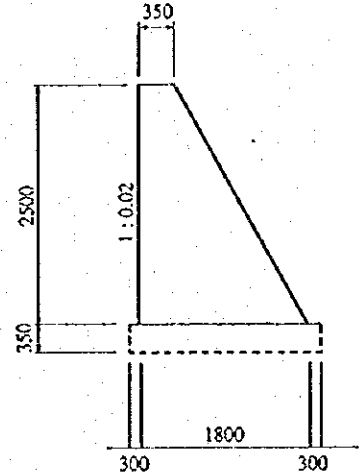
c) 1.5M



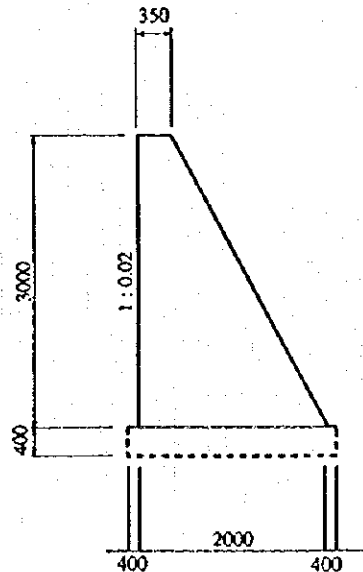
d) 2.0M



e) 2.5M



f) 3.0M



2.5 Box Culvert

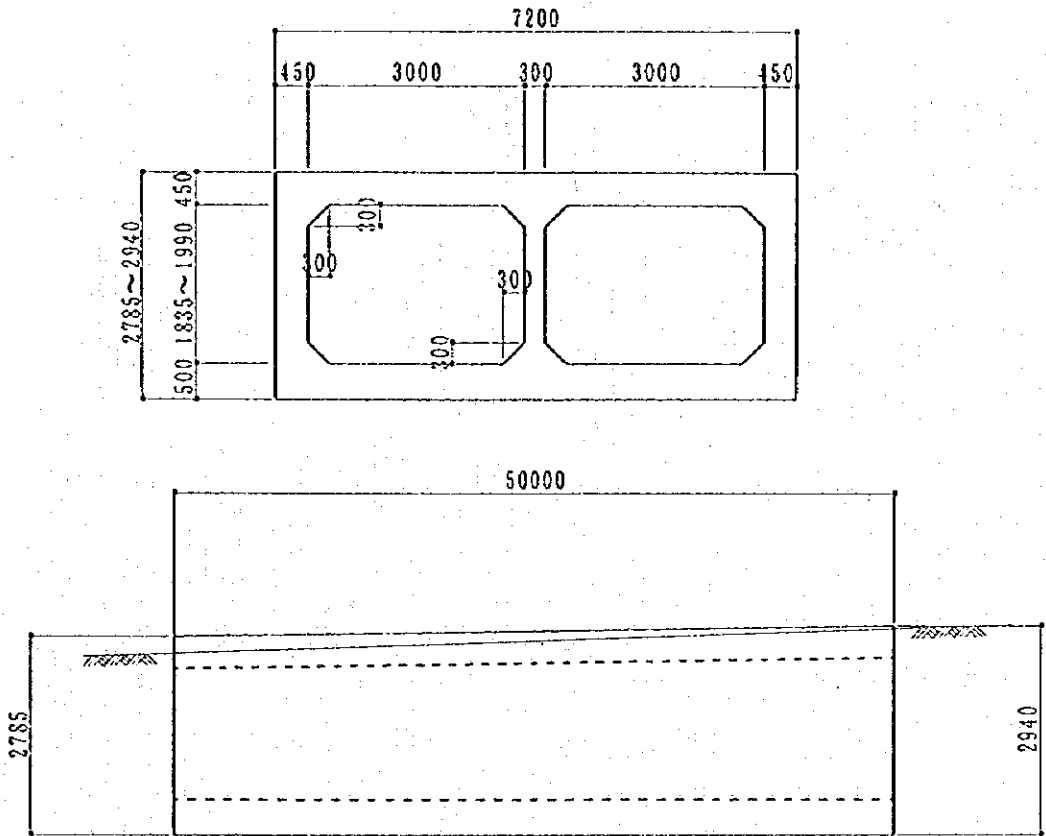
Bill of Quantities

Type	Unit	TYPE 1 M101115 ~M101115	TYPE 2 M101115 ~M101115	TYPE 3 M101115 ~M101115	TYPE 4 M101115 ~M101115	TYPE 5 M101115 ~M101115	TYPE 6 M101115 ~M101115	TYPE 7 M101115 ~M101115	TYPE 8 M101115 ~M101115	TYPE 9 M101115 ~M101115	Total	Remark
Diameter	m	B=1.000m x 2 H=1.950m	B=1.000m x 2 H=1.950m	B=1.000m x 2 H=1.950m	B=1.000m x 2 H=2.214m	B=1.000m H=2.214m	B=1.000m H=2.214m	B=1.000m H=1.811m	B=1.000m H=1.811m	B=1.000m H=1.811m		
		50.00	56.70	36.40	15.50	306.20	7.40 x 2 x 14.80	31.00	42.20	214.80	799.600	
Concrete Volume	m³	(9.497)	(9.583)	(9.723)	(9.837)	(9.371)	(2.872)	(3.087)	(3.000)	(2.972)		
		474.750	542.640	372.316	152.724	1806.730	42.520	95.677	127.866	638.600	4254.931	sch=180m³/ton
Form Work	m²	(18.167)	(19.623)	(20.202)	(20.976)	(13.552)	(11.522)	(10.640)	(10.282)	(9.864)		
		958.350	1113.124	779.674	325.128	4556.182	170.970	379.840	433.056	2123.083	10789.417	
D19	kgf	(46.800)	(46.800)	(46.800)	(46.800)	(46.800)	(46.800)	(46.800)	(46.800)	(46.800)		
		2340.000	2652.560	1797.120	725.400	2340.000	725.400	1797.120	2340.000	2340.000	7516.000	
D16	kgf	(250.480)	(251.480)	(252.780)	(254.080)	(176.090)	(12.232)	(62.184)	(61.592)	(61.000)		
		12524.000	14258.916	9707.039	3938.408	59203.475	181.054	2547.204	3442.182	17396.800	125302.658	
D13	kgf	(209.301)	(212.593)	(215.350)	(217.102)	(208.570)	(103.576)	(143.180)	(137.902)	(132.624)		
		14465.050	16847.007	11341.440	4605.081	7021.234	2470.925	4438.580	5819.464	28487.825	158346.416	
Total	kgf	(648.581)	(651.873)	(654.933)	(657.993)	(654.660)	(175.809)	(275.364)	(273.493)	(271.624)		
		29279.050	33558.483	22845.615	9268.909	12924.709	2601.959	6886.284	9262.646	45886.435	209965.154	
Support	m³	(11.113)	(11.540)	(12.252)	(12.974)	(6.482)	(3.141)	(3.864)	(3.593)	(3.380)		
		555.750	656.586	470.477	200.322	2172.574	46.487	117.924	151.751	727.742	5099.563	
Scaffolding	m²	(5.720)	(5.880)	(6.164)	(6.320)	(6.220)	(4.922)	(4.733)	(4.544)	(4.355)		
		286.150	331.396	234.394	98.084	2093.824	84.774	152.582	199.733	976.051	4459.118	
Earth Work	m³	(20.180)	(21.320)	(22.200)	(23.660)	(18.240)	(7.000)	(7.000)	(6.520)	(6.000)		
		1008.000	1265.544	967.680	412.920	6132.288	87.024	217.000	401.747	1503.600	11995.900	
Back Filling	m³	(1.044)	(1.044)	(1.220)	(1.859)	(6.407)	(0.217)	(0.217)	(0.192)	(0.172)		
		59.220	59.220	122.863	59.816	2152.966	6.720	128.059	251.776	2777.422		

Figures in ( ) are unit quantities. ( / m )

§ 2. TYPE-1

MM104+65~MM104+115  
L=50.00m



### 1. Concrete

$$a 1 = 7.20 \times 2.785 - (3.00 \times 1.835 - 2 \times 0.300^2) \times 2 = 9.402 \text{m}^2$$

$$a 2 = 7.20 \times 2.940 - (3.00 \times 1.990 - 2 \times 0.300^2) \times 2 = 9.588 \text{m}^2$$

$$V 1 = \frac{1/2 \times (9.402 + 9.588) \times 50.00}{9.495} = 474.750 \text{m}^3$$

### 2. Formwork

$$a 1 = 2.785 \times 2 + (4 \times 0.424 + 2 \times 1.235 + 2.400) \times 2 = 18.702 \text{m}^2$$

$$a 2 = 2.940 \times 2 + (4 \times 0.424 + 2 \times 1.390 + 2.400) \times 2 = 19.632 \text{m}^2$$

$$A 1 = \frac{1/2 \times (18.702 + 19.632) \times 50.00}{19.167} = 958.350 \text{m}^2$$

### 3. Re-bar

$$D 19 \quad 46.800 \times 50.00 = 2340.000 \text{kgf}$$

$$D 16 \quad \frac{1/2 \times (249.480 + 251.480) \times 50.00}{250.480} = 12524.000 \text{kgf}$$

$$D 13 \quad \frac{1/2 \times (285.004 + 293.598) \times 50.00}{289.301} = 14465.050 \text{kgf}$$

---

$$586.581 \text{kgf} \qquad W = 29329.050 \text{kgf}$$

### 4. Supporting

$$v 1 = (3.000 \times 1.835 - 2 \times 0.300^2) \times 2 = 10.650 \text{m}^3$$

$$v 2 = (3.000 \times 1.990 - 2 \times 0.300^2) \times 2 = 11.580 \text{m}^3$$

$$V 1 = \frac{1/2 \times (10.650 + 11.580) \times 50.00}{11.115} = 555.750 \text{m}^3$$

### 5. Scaffolding

$$a 1 = 2 \times 2.785 = 5.570 \text{m}^2$$

$$a 2 = 2 \times 2.940 = 5.880 \text{m}^2$$

$$A 1 = \frac{1/2 \times (5.570 + 5.880) \times 50.00}{5.725} = 286.250 \text{m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 2.80 \text{m} \qquad B = 7.20 \text{m}$$

$$V 1 = \frac{2.80 \times 7.20 \times 50.00}{20.160} = 1008.000 \text{m}^3$$

#### (2) Back Filling

$$H = 1/2 \times (2.785 + 2.940) = 2.863 \text{m}$$

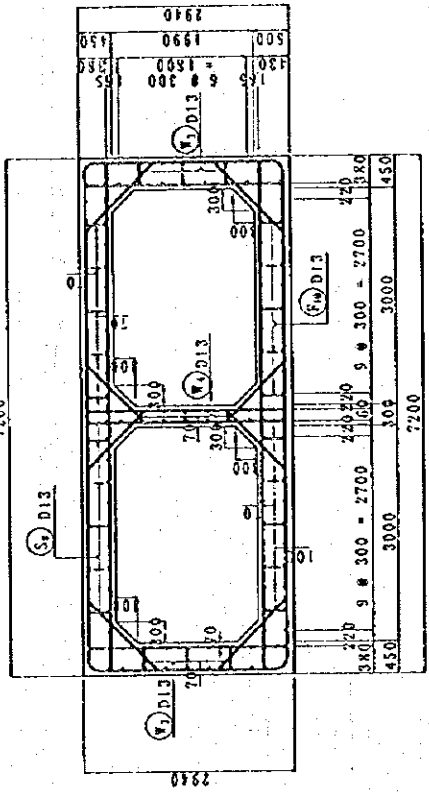
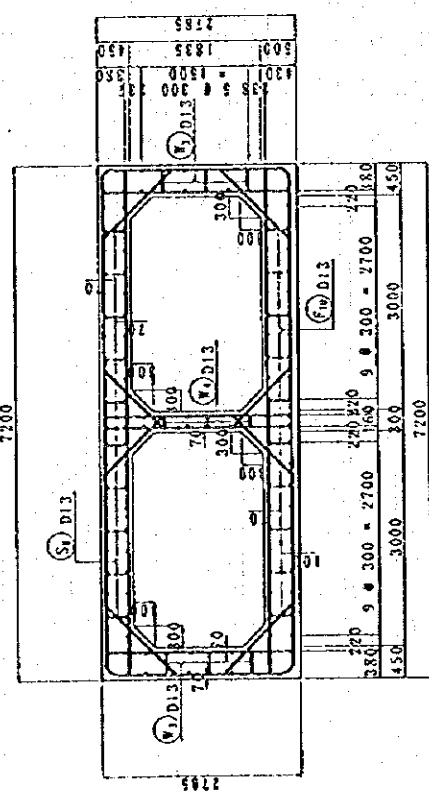
$$H = 2.80 \text{m}$$

$$H = 2.863 \text{m}$$

XMI04165~XMI04115  
L=50000

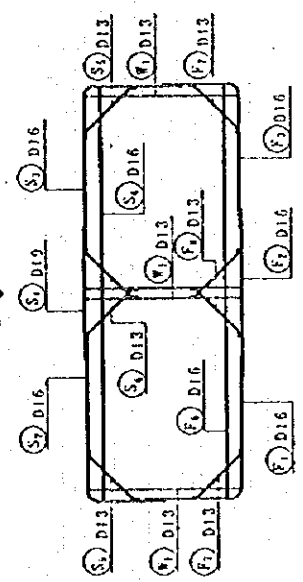
Beginning

End



Ø 125

1 3



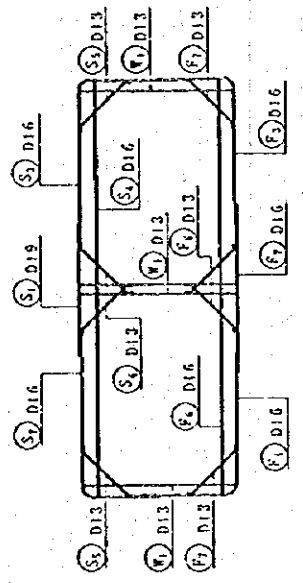
2 4

S1/D19



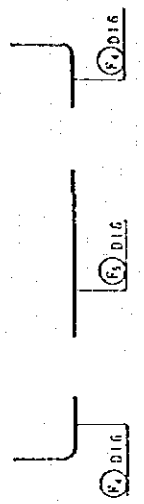
Ø 125

1 3



2 4

S1/D19



Beginning

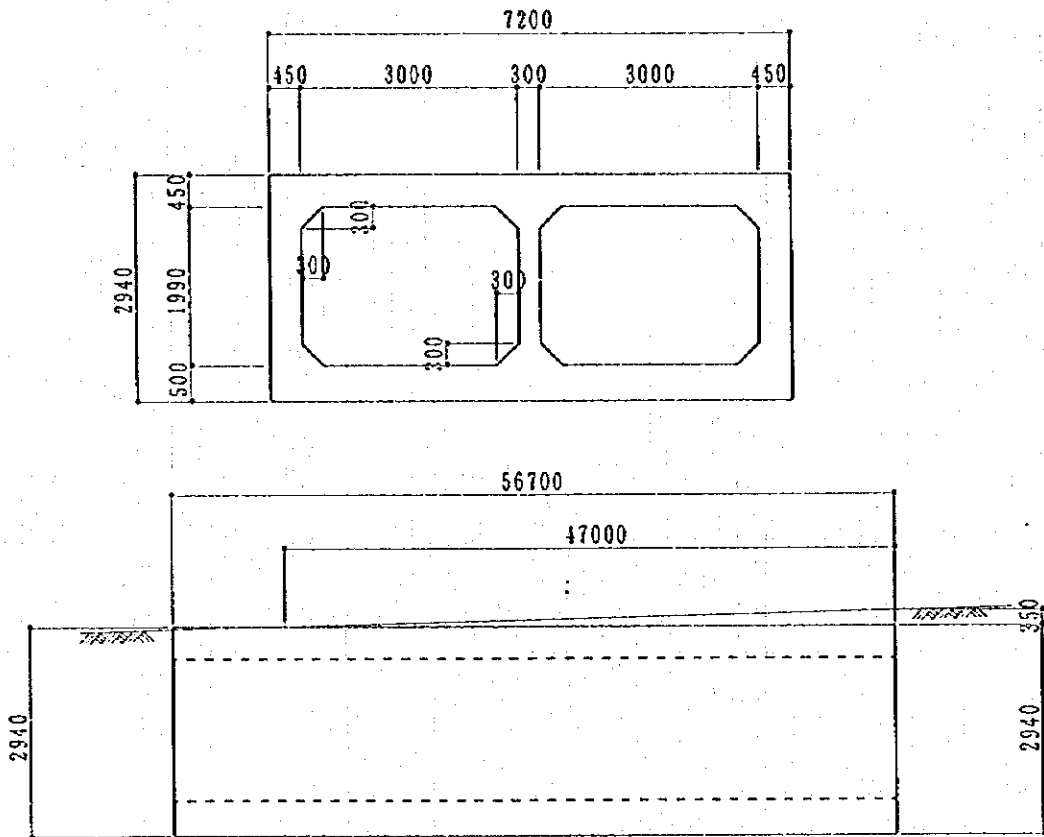
			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		3930	1.560	4	24.525
S 3	D16		4330	1.560	4	27.019
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2620	0.995	16	41.710
W 2	D13		1040	0.995	36	37.253
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		3930	1.560	4	24.525
F 2	D16		3300	1.560	4	20.592
F 3	D16		3530	1.560	4	22.027
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.728
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.985
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.880
			D19	46.800kgf		
			D16	249.480kgf		
			D13	285.004kgf		
			Total	581.284kgf		

End

			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		4010	1.560	4	25.026
S 3	D16		4410	1.560	4	27.518
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2770	0.995	16	44.096
W 2	D13		1040	0.995	42	43.461
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		4010	1.560	4	25.026
F 2	D16		3300	1.560	4	20.592
F 3	D16		3610	1.560	4	22.526
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.723
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.985
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.880
			D19	46.800kgf		
			D16	251.480kgf		
			D13	293.598kgf		
			Total	591.878kgf		

§ 3. TYPE-2

MM104+115~MM00-20  
L=56.70m





### 1. Concrete

$$a_1 = 7.20 \times 2.940 - (3.00 \times 1.990 - 2 \times 0.300^2) \times 2 = 9.588 \text{m}^2$$

$$V_1 = 9.588 \times 56.70 = 543.640 \text{m}^3$$

### 2. Formwork

$$a_1 = 2.940 \times 2 + (4 \times 0.424 + 2 \times 1.390 + 2.400) \times 2 = 19.632 \text{m}^2$$

$$A_1 = 19.632 \times 56.70 = 1113.134 \text{m}^2$$

### 3. Re-bar

$$D 19 \quad 46.800 \times 56.70 = 2653.560 \text{kgf}$$

$$D 16 \quad 251.480 \times 56.70 = 14258.916 \text{kgf}$$

$$D 13 \quad 293.598 \times 56.70 = 16647.007 \text{kgf}$$

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$$591.878 \text{kgf} \qquad \qquad \qquad W = 33559.483 \text{kgf}$$

### 4. Supporting

$$v_1 = (3.000 \times 1.990 - 2 \times 0.300^2) \times 2 = 11.580 \text{m}^3$$

$$V_1 = 11.580 \times 56.70 = 656.536 \text{m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 2.940 = 5.880 \text{m}^2$$

$$A_1 = 5.880 \times 56.70 = 333.396 \text{m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 3.10 \text{m} \qquad B = 7.20 \text{m}$$

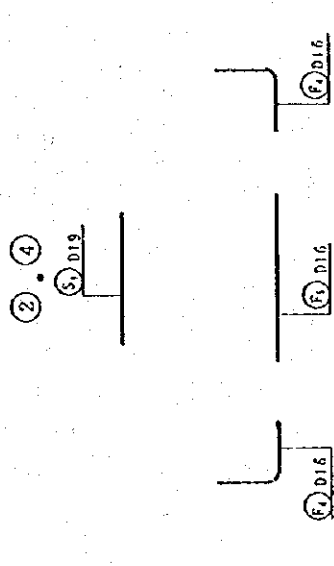
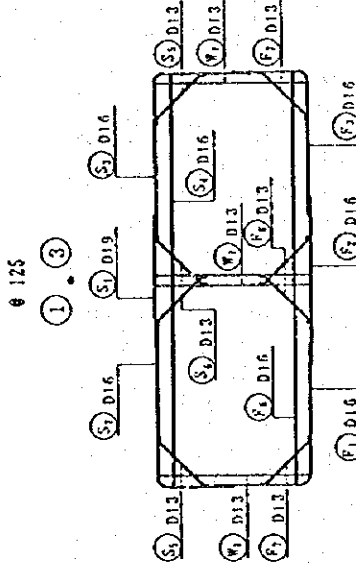
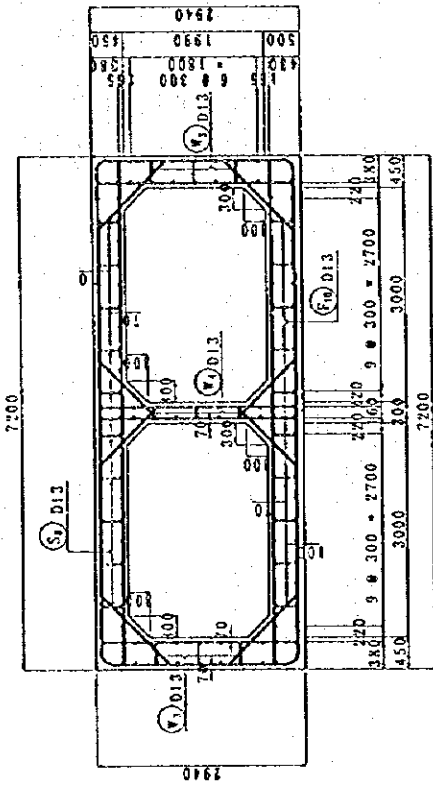
$$V_1 = \frac{3.10 \times 7.20 \times 56.70}{22.320} = 1265.544 \text{m}^3$$























#### (2) Back Filling

$$V_1 = 7.20 \times 1/2 \times 47.00 \times 0.350 = 59.220 \text{m}^3$$

XX104115 ~ XX00-20

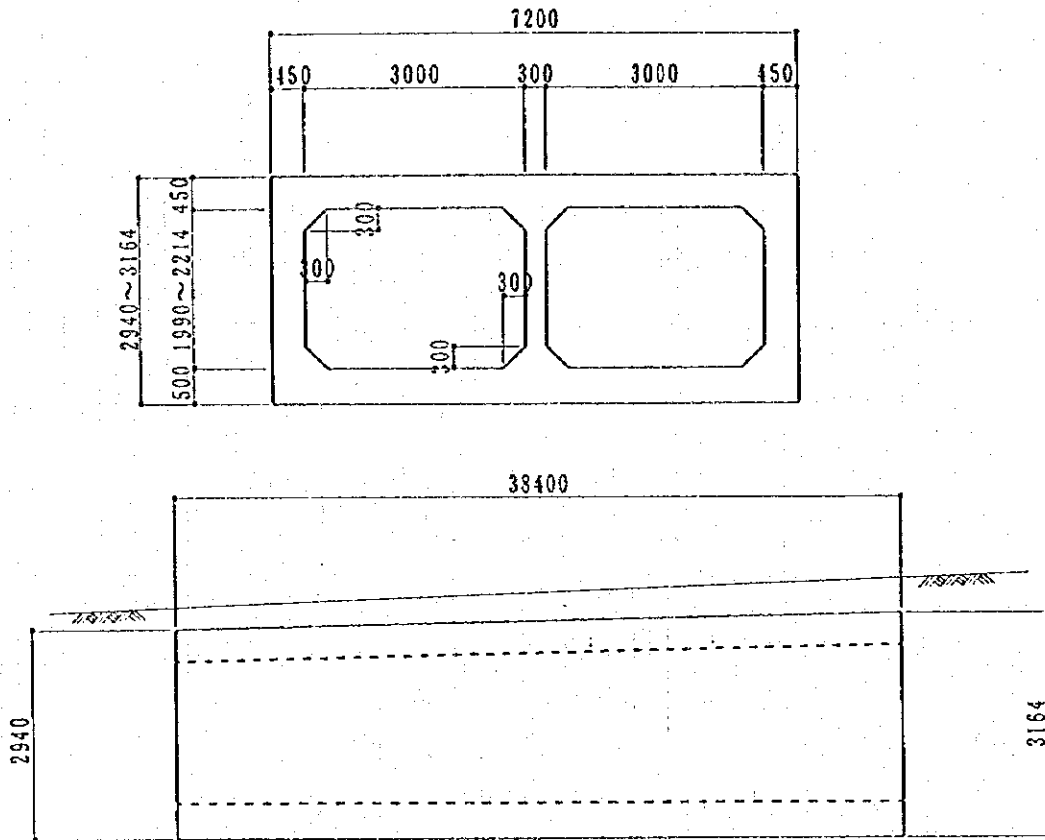
L=56700



			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		4010	1.560	4	25.026
S 3	D16		4410	1.560	4	27.518
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2770	0.995	16	44.096
W 2	D13		1040	0.995	42	43.461
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		4010	1.560	4	25.026
F 2	D16		3300	1.560	4	20.592
F 3	D16		3610	1.560	4	22.526
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.728
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.985
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.830
				D19	46.800kgf	
				D16	251.480kgf	
				D13	293.598kgf	
				Total	591.878kgf	

§ 4. TYPE-3

MM00-20~MM302-10  
L=38.40m



### 1. Concrete

$$a 1 = 7.20 \times 2.940 - (3.00 \times 1.990 - 2 \times 0.300^2) \times 2 = 9.588 \text{ m}^2$$

$$a 2 = 7.20 \times 3.164 - (3.00 \times 2.214 - 2 \times 0.300^2) \times 2 = 9.857 \text{ m}^2$$

$$V 1 = \frac{1/2 \times (9.588 + 9.857) \times 38.40}{9.723} = 373.344 \text{ m}^3$$

### 2. Formwork

$$a 1 = 2.940 \times 2 + (4 \times 0.424 + 2 \times 1.390 + 2.400) \times 2 = 19.632 \text{ m}^2$$

$$a 2 = 3.164 \times 2 + (4 \times 0.424 + 2 \times 1.614 + 2.400) \times 2 = 20.976 \text{ m}^2$$

$$A 1 = \frac{1/2 \times (19.632 + 20.976) \times 38.40}{20.304} = 779.674 \text{ m}^2$$

### 3. Re-bar

$$D 19 \quad 46.800 \times 38.40 = 1797.120 \text{ kgf}$$

$$D 16 \quad \frac{1/2 \times (251.480 + 254.096) \times 38.40}{252.738} = 9707.059 \text{ kgf}$$

$$D 13 \quad \frac{1/2 \times (293.598 + 297.102) \times 38.40}{295.350} = 11341.440 \text{ kgf}$$

---

$$594.938 \text{ kgf} \qquad W = 22845.619 \text{ kgf}$$

### 4. Supporting

$$v 1 = (3.000 \times 1.990 - 2 \times 0.300^2) \times 2 = 11.580 \text{ m}^3$$

$$v 2 = (3.000 \times 2.214 - 2 \times 0.300^2) \times 2 = 12.924 \text{ m}^3$$

$$V 1 = \frac{1/2 \times (11.580 + 12.924) \times 38.40}{12.252} = 470.477 \text{ m}^3$$

### 5. Scaffolding

$$a 1 = 2 \times 2.940 = 5.880 \text{ m}^2$$

$$a 2 = 2 \times 3.164 = 6.328 \text{ m}^2$$

$$A 1 = \frac{1/2 \times (5.880 + 6.328) \times 38.40}{6.104} = 234.394 \text{ m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 3.50 \text{ m} \qquad B = 7.20 \text{ m}$$

$$V 1 = \frac{3.50 \times 7.20 \times 38.40}{25.200} = 957.680 \text{ m}^3$$

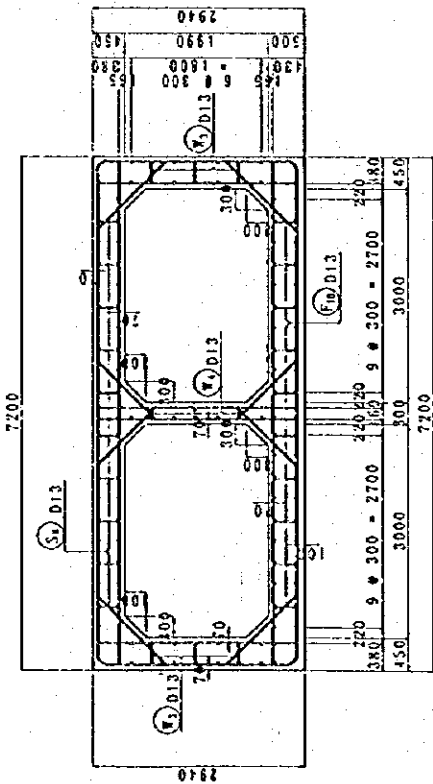
#### (2) Back Filling

$$H = 1/2 \times (2.940 + 3.164) = 3.052 \text{ m}$$

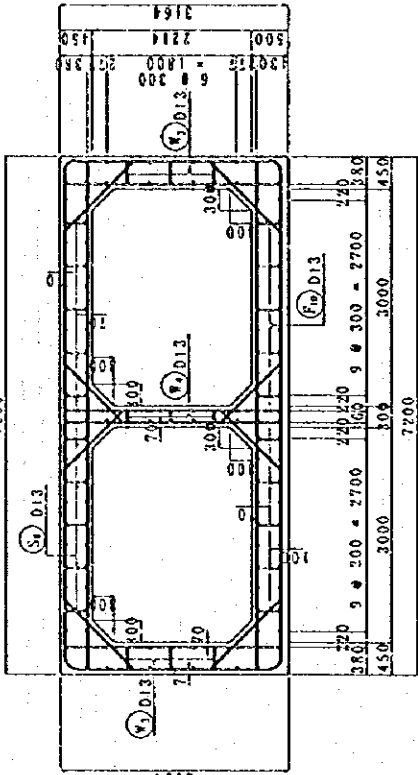
$$V 1 = \frac{7.20 \times (3.50 - 3.052) \times 38.40}{3.226} = 123.863 \text{ m}^3$$

XM00-20-MK302-10  
L=33400

Beginning

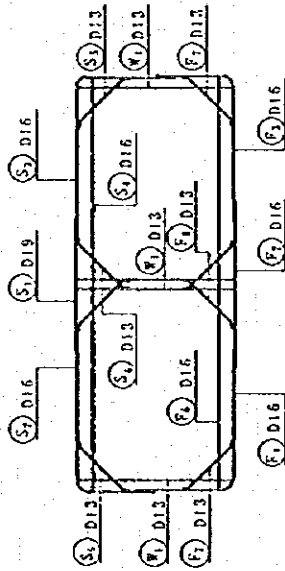


End

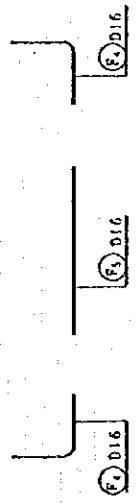


Ø 125

① ③

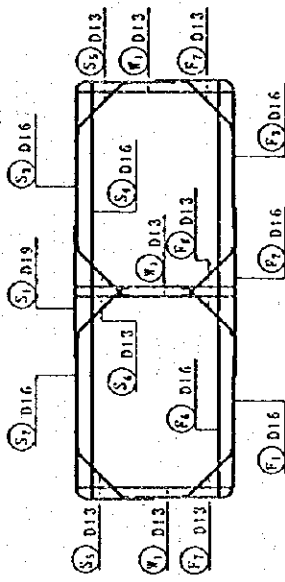


② ④

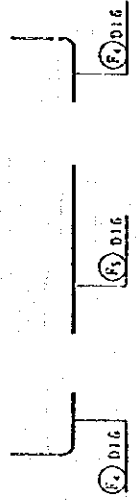
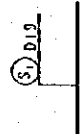


Ø 125

① ③



② ④



Beginning

			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		4010	1.560	4	25.026
S 3	D16		4410	1.560	4	27.518
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2770	0.995	16	44.096
W 2	D13		1040	0.995	42	43.461
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		4010	1.560	4	25.026
F 2	D16		3300	1.560	4	20.592
F 3	D16		3610	1.560	4	22.526
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.728
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.985
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.880
				D19	46.800kgf	
				D16	251.480kgf	
				D13	293.598kgf	
				Total	591.878kgf	

End

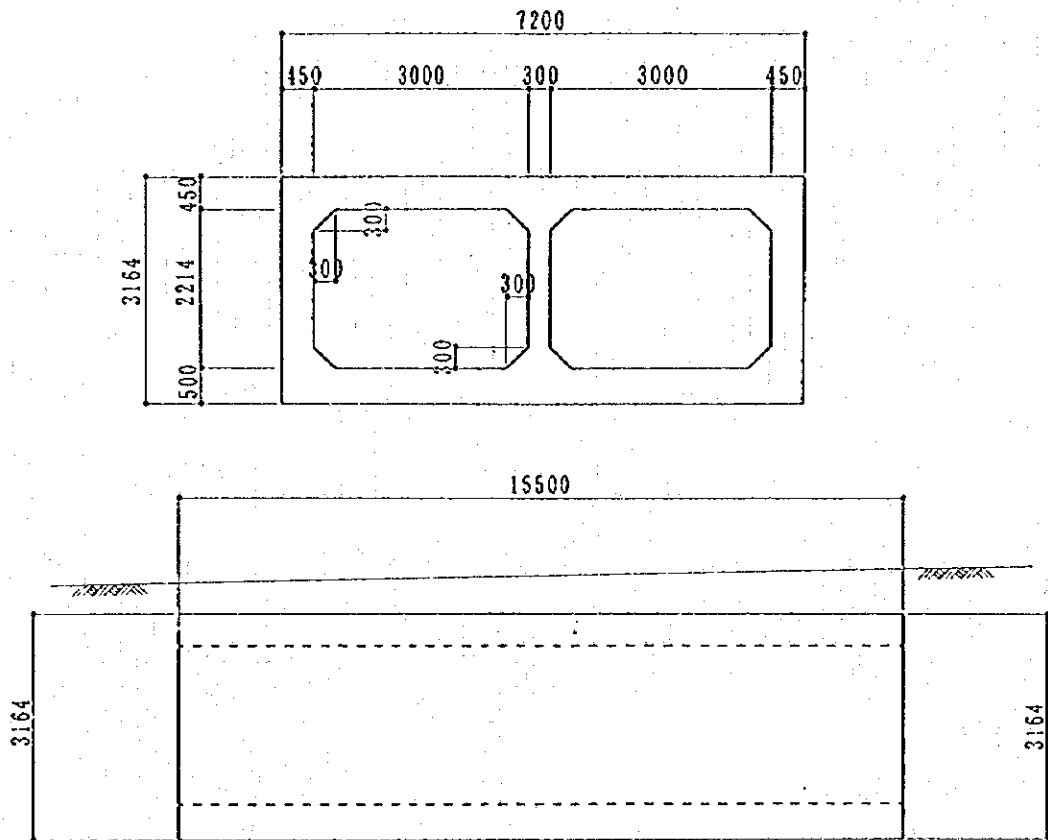
			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		4120	1.560	4	25.707
S 3	D16		4520	1.560	4	28.205
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2990	0.995	16	47.600
W 2	D13		1040	0.995	42	43.461
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		4120	1.560	4	25.587
F 2	D16		3300	1.560	4	20.592
F 3	D16		3720	1.560	4	23.213
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.728
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.935
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.830
				D19	46.800kgf	
				D16	254.096kgf	
				D13	297.102kgf	
				Total	597.998kgf	



§ 5. TYPE-4

MM302-10~MM302+5.50

L=15.50m



### 1. Concrete

$$a_1 = 7.20 \times 3.164 - (3.00 \times 2.214 - 2 \times 0.300^2) \times 2 = 9.857 \text{m}^2$$

$$V_1 = 9.857 \times 15.50 = 152.784 \text{m}^3$$

### 2. Formwork

$$a_1 = 3.164 \times 2 + (4 \times 0.424 + 2 \times 1.614 + 2.400) \times 2 = 20.976 \text{m}^2$$

$$A_1 = 20.976 \times 15.50 = 325.128 \text{m}^2$$

### 3. Re-bar

$$D 1.9 \quad 46.800 \times 15.50 = 725.400 \text{kgf}$$

$$D 1.6 \quad 254.096 \times 15.50 = 3938.488 \text{kgf}$$

$$D 1.3 \quad 297.102 \times 56.70 = 4605.081 \text{kgf}$$

---

$$597.998 \text{kgf} \qquad W = 9263.969 \text{kgf}$$

### 4. Supporting

$$v_1 = (3.000 \times 2.214 - 2 \times 0.300^2) \times 2 = 12.924 \text{m}^3$$

$$V_1 = 12.924 \times 15.50 = 200.322 \text{m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 3.164 = 6.328 \text{m}^2$$

$$A_1 = 6.328 \times 15.50 = 98.084 \text{m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 3.70 \text{m} \qquad B = 7.20 \text{m}$$

$$V_1 = \frac{3.70 \times 7.20 \times 15.50}{26.640} = 412.920 \text{m}^3$$

#### (2) Back Filling

$$H = 3.164 \text{m}$$

$$V_1 = \frac{7.20 \times (3.70 - 3.164) \times 15.50}{3.859} = 59.818 \text{m}^3$$

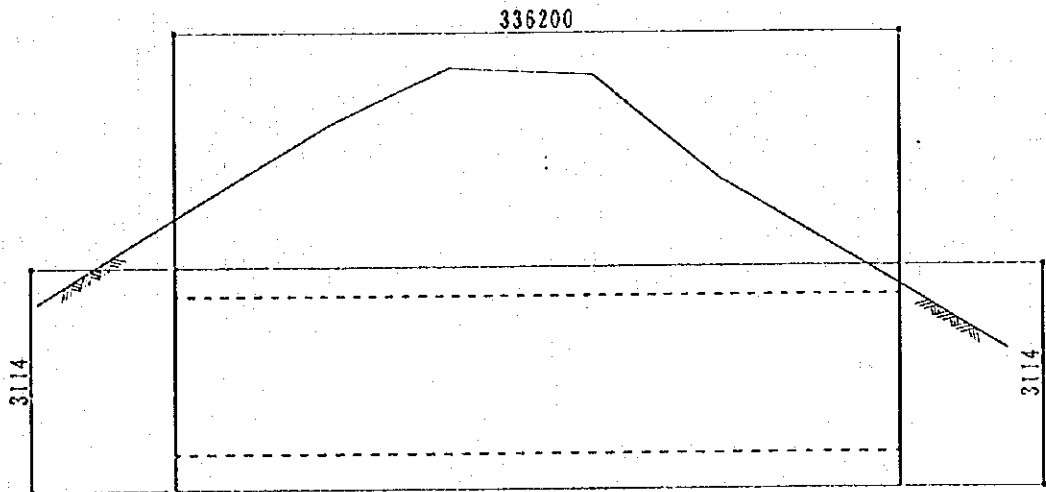
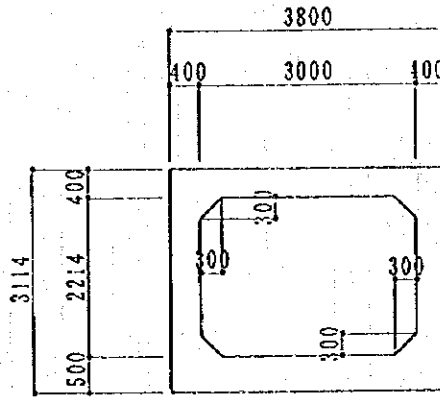


			Length	Unit Weight	Nos	Weight
S 1	D19		2600	2.250	8	46.800
S 2	D16		4120	1.560	4	25.707
S 3	D16		4520	1.560	4	28.205
S 4	D16		7060	1.560	4	44.056
S 5	D13		1560	0.995	8	12.418
S 6	D13		1350	0.995	8	10.746
S 7	D13		1040	0.995	50	51.740
S 8	D13		1160	0.995	20	23.084
W 1	D13		2990	0.995	16	47.600
W 2	D13		1040	0.995	42	43.461
W 3	D13		540	0.995	12	6.448
W 4	D13		390	0.995	6	2.328
F 1	D16		4120	1.560	4	25.587
F 2	D16		3300	1.560	4	20.592
F 3	D16		3720	1.560	4	23.213
F 4	D16		2320	1.560	8	28.952
F 5	D16		2200	1.560	4	13.728
F 6	D16		7060	1.560	4	44.056
F 7	D13		1590	0.995	8	12.672
F 8	D13		1380	0.995	8	10.985
F 9	D13		1040	0.995	50	51.740
F 10	D13		1200	0.995	20	23.880
D19 46.800kgf						
D16 254.096kgf						
D13 297.102kgf						
Total 597.998kgf						

§ 6. TYPE-5

MM302+5.50~MM309+34.30

L=333.60m



### 1. Concrete

$$a_1 = 3.80 \times 3.114 - 3.00 \times 2.214 + 2 \times 0.300^2 = 5.371 \text{m}^2$$

$$V_1 = 5.371 \times 336.20 = 1805.730 \text{m}^3$$

### 2. Formwork

$$a_1 = 3.114 \times 2 + 4 \times 0.424 + 2 \times 1.614 + 2.400 = 13.552 \text{m}^2$$

$$A_1 = 13.552 \times 336.20 = 4556.182 \text{m}^2$$

### 3. Re-bar

$$D 16 \quad 176.096 \times 336.20 = 59203.475 \text{kgf}$$

$$D 13 \quad 208.570 \times 336.20 = 70121.234 \text{kgf}$$

---

$$384.666 \text{kgf} \qquad \qquad \qquad W = 129324.709 \text{kgf}$$

### 4. Supporting

$$v_1 = 3.000 \times 2.214 - 2 \times 0.300^2 = 6.462 \text{m}^2$$

$$V_1 = 6.462 \times 336.20 = 2172.524 \text{m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 3.114 = 6.228 \text{m}^2$$

$$A_1 = 6.228 \times 336.20 = 2093.854 \text{m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 4.80 \text{m} \qquad B = 3.80 \text{m}$$

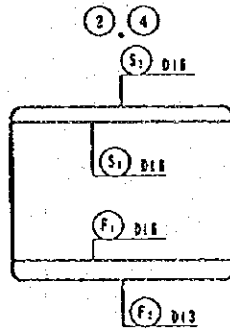
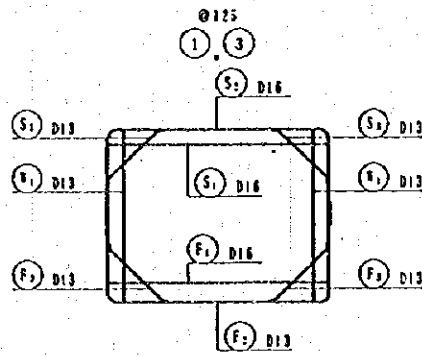
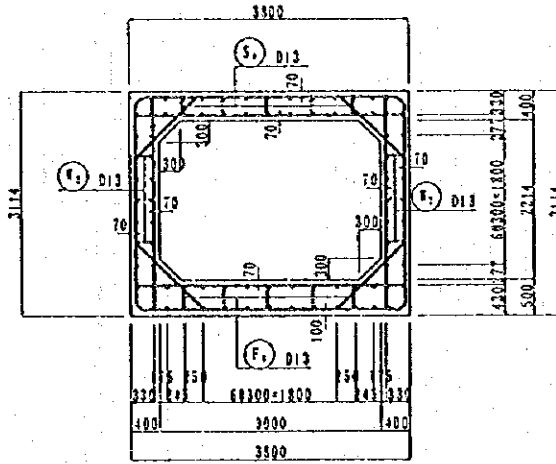
$$V_1 = \frac{4.80 \times 3.80 \times 336.20}{18.240} = 6132.288 \text{m}^3$$












#### (2) Back Filling

$$H = 3.114 \text{m}$$

$$V_1 = \frac{3.80 \times (4.80 - 3.114) \times 336.20}{6.407} = 2153.966 \text{m}^3$$

XV30215.50~XV309+36.90  
L=336200



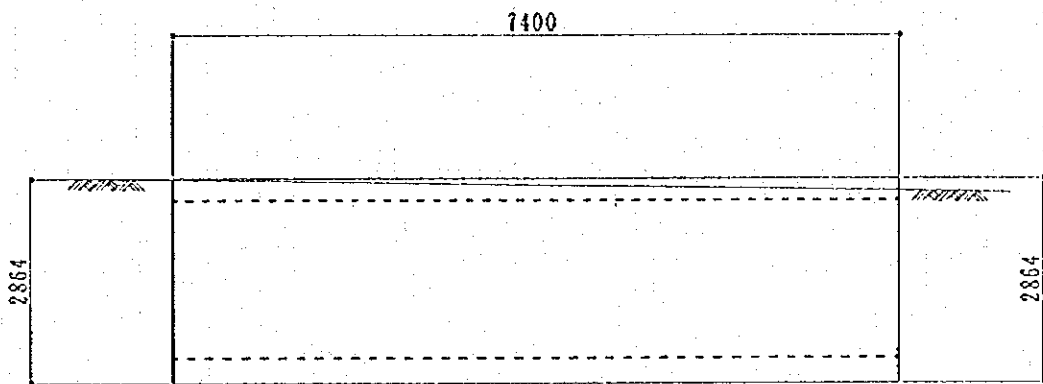
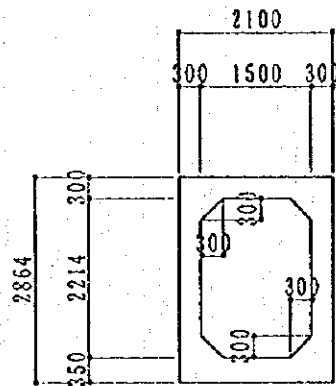
			Length	Unit Weight	Nos	Weight
S 1	D16		3660	1.560	8	45.680
S 2	D16		6790	1.560	8	84.736
S 3	D13		1420	0.995	8	11.304
S 4	D13		1060	0.995	6	6.330
W 1	D13		2940	0.995	8	23.480
W 2	D13		490	0.995	12	5.856
F 1	D16		3660	1.560	8	45.680
F 2	D13		6950	0.995	8	55.400
F 3	D13		1520	0.995	8	12.096
F 4	D13		1200	0.995	6	7.164
H 1	D13		1040	0.995	84	86.940
D16 176.096kgf						
D13 208.570kgf						
Total 384.666kgf						



§ 7. TYPE-6

MM309+34.30~MM310

L=10.00×2=20.00m



### 1. Concrete

$$a_1 = 2.10 \times 2.864 - 1.50 \times 2.214 + 2 \times 0.300^2 = 2.873 \text{m}^2$$

$$V_1 = 2.873 \times 14.80 = 42.520 \text{m}^3$$

### 2. Formwork

$$a_1 = 2.864 \times 2 + 4 \times 0.424 + 2 \times 1.614 + 0.900 = 11.552 \text{m}^2$$

$$A_1 = 11.552 \times 14.80 = 170.970 \text{m}^2$$

### 3. Re-bar

$$D 16 \quad 12.232 \times 14.80 = 181.034 \text{kgf}$$

$$D 13 \quad 163.576 \times 14.80 = 2420.925 \text{kgf}$$

---

$$175.808 \text{kgf} \qquad \qquad \qquad W = 2601.959 \text{kgf}$$

### 4. Supporting

$$v_1 = 1.500 \times 2.214 - 2 \times 0.300^2 = 3.141 \text{m}^3$$

$$V_1 = 3.141 \times 14.80 = 46.487 \text{m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 2.864 = 5.728 \text{m}^2$$

$$A_1 = 5.728 \times 14.80 = 84.774 \text{m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 2.80 \text{m}$$

$$B = 2.10 \text{m}$$

$$V_1 = \frac{2.80 \times 2.10 \times 14.80}{5.880} = 87.024 \text{m}^3$$

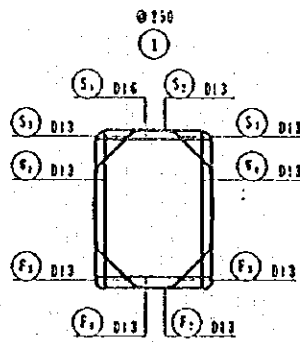
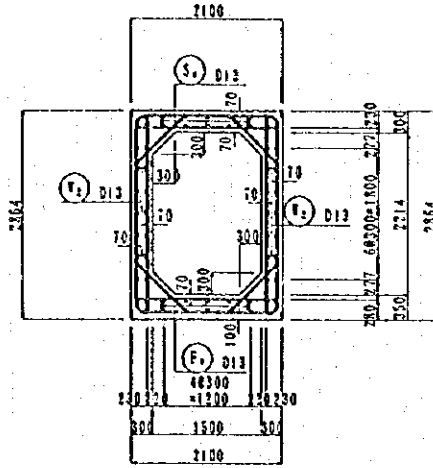
#### (2) Back Filling












$$H = 2.864 \text{m}$$

$$H = 2.80 \text{m}$$

$$H = 2.864 \text{m}$$

XN309+36.90~XN310  
L=14800

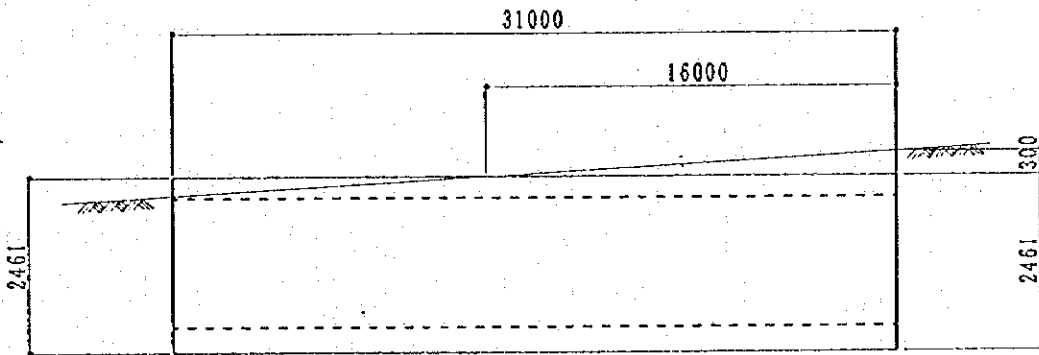
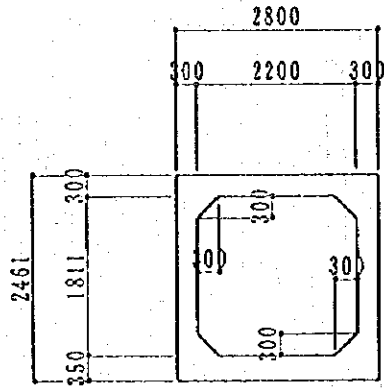


			Length	Unit Weight	Nos	Weight
S 1	D16		1960	1.560	4	12.232
S 2	D13		4840	0.995	4	19.264
S 3	D13		1140	0.995	8	9.072
S 4	D13		860	0.995	6	5.136
W 1	D13		2690	0.995	8	21.496
W 2	D13		390	0.995	12	4.656
F 1	D13		1960	0.995	4	7.800
F 2	D13		4880	0.995	4	19.424
F 3	D13		1160	0.995	8	9.312
F 4	D13		890	0.995	6	5.316
H 1	D13		1040	0.995	60	62.100
D16 12.232kgf						
D13 163.576kgf						
Total 175.808kgf						

§ 8. TYPE-7

MM21+46.00~MM22

L=31.00m



### 1. Concrete

$$a_1 = 2.80 \times 2.461 - 2.20 \times 1.811 + 2 \times 0.300^2 = 3.087 \text{ m}^2$$

$$V_1 = 3.087 \times 31.00 = 95.697 \text{ m}^3$$

### 2. Formwork

$$a_1 = 2.461 \times 2 + 4 \times 0.424 + 2 \times 1.211 + 1.600 = 10.640 \text{ m}^2$$

$$A_1 = 10.640 \times 31.00 = 329.840 \text{ m}^2$$

### 3. Re-bar

$$D 16 \quad 82.184 \times 31.00 = 2547.704 \text{ kgf}$$

$$D 13 \quad 143.180 \times 31.00 = 4438.580 \text{ kgf}$$

---

$$225.364 \text{ kgf} \qquad W = 6986.284 \text{ kgf}$$

### 4. Supporting

$$v_1 = 2.200 \times 1.811 - 2 \times 0.300^2 = 3.804 \text{ m}^3$$

$$V_1 = 3.804 \times 31.00 = 117.924 \text{ m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 2.461 = 4.922 \text{ m}^2$$

$$A_1 = 4.922 \times 31.00 = 152.582 \text{ m}^2$$

### 6. Earth Work

#### (1) Excavation

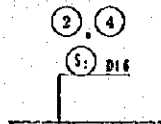
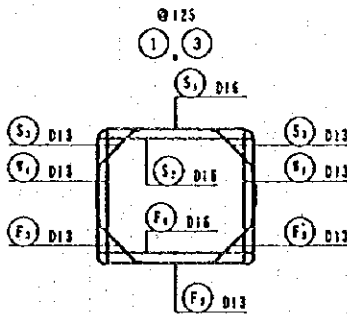
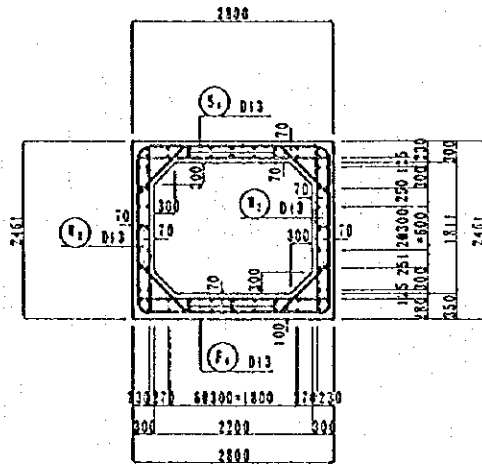
$$H = 2.50 \text{ m} \qquad B = 2.80 \text{ m}$$

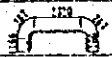


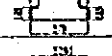



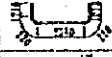

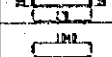

$$V_1 = \frac{2.50 \times 2.80 \times 31.00}{7.000} = 217.000 \text{ m}^3$$

#### (2) Back Filling

$$V_1 = 2.80 \times 1/2 \times 16.00 \times 0.30 = 6.720 \text{ m}^3$$

MX21146. 0~M422  
E=31000



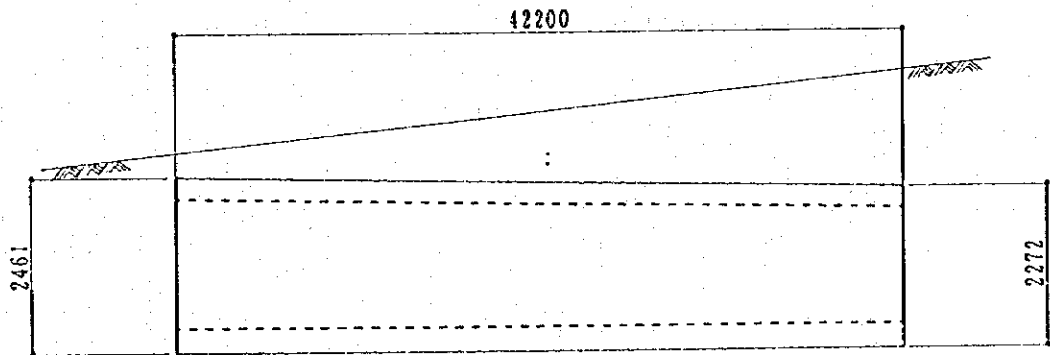
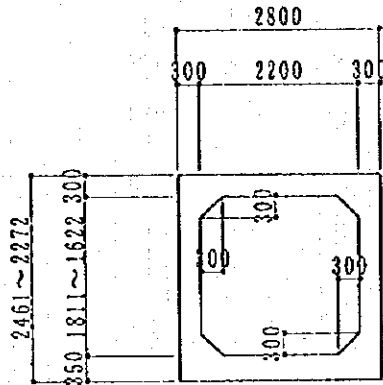
			Length	Unit Weight	Nos	Weight
S 1	D16		5190	1.560	4	32.384
S 2	D16		2660	1.560	8	33.200
S 3	D13		1140	0.995	8	9.072
S 4	D13		860	0.995	6	5.136
W 1	D13		2290	0.995	8	18.312
W 2	D13		390	0.995	12	4.656
F 1	D16		2660	1.560	4	16.600
F 2	D13		5250	0.995	4	20.996
F 3	D13		1160	0.995	8	9.312
F 4	D13		900	0.995	6	5.316
H 1	D13		1040	0.995	68	70.380
D16 82.184kgf						
D13 143.180kgf						
Total 225.364kgf						



§ 9. TYPE-8

MM22~MM22+42.20

L=42.20m



### 1. Concrete

$$\begin{aligned} a 1 &= 2.80 \times 2.461 - 2.20 \times 1.811 + 2 \times 0.300^2 &= 3.087 \text{m}^2 \\ a 2 &= 2.80 \times 2.272 - 2.20 \times 1.622 + 2 \times 0.300^2 &= 2.973 \text{m}^2 \\ V 1 &= \frac{1/2 \times (3.087 + 2.973) \times 42.20}{3.030} &= 127.866 \text{m}^3 \end{aligned}$$

### 2. Formwork

$$\begin{aligned} a 1 &= 2.461 \times 2 + 4 \times 0.424 + 2 \times 1.211 + 1.600 &= 10.640 \text{m}^2 \\ a 2 &= 2.272 \times 2 + 4 \times 0.424 + 2 \times 1.022 + 1.600 &= 9.884 \text{m}^2 \\ A 1 &= \frac{1/2 \times (10.640 + 9.884) \times 42.20}{10.262} &= 433.056 \text{m}^2 \end{aligned}$$

### 3. Re-bar

$$\begin{aligned} D 1 6 & \frac{1/2 \times (82.184 + 81.000) \times 42.20}{81.592} &= 3443.182 \text{kgf} \\ D 1 3 & \frac{1/2 \times (143.180 + 132.624) \times 42.20}{137.902} &= 5319.464 \text{kgf} \\ \hline & & 219.494 \text{kgf} & W = 9262.646 \text{kgf} \end{aligned}$$

### 4. Supporting

$$\begin{aligned} v 1 &= 2.200 \times 1.811 - 2 \times 0.300^2 &= 3.804 \text{m}^3 \\ v 2 &= 2.200 \times 1.622 - 2 \times 0.300^2 &= 3.388 \text{m}^3 \\ V 1 &= \frac{1/2 \times (3.804 + 3.388) \times 42.20}{3.596} &= 151.751 \text{m}^3 \end{aligned}$$

### 5. Scaffolding

$$\begin{aligned} a 1 &= 2 \times 2.461 &= 4.922 \text{m}^2 \\ a 2 &= 2 \times 2.272 &= 4.544 \text{m}^2 \\ A 1 &= \frac{1/2 \times (4.922 + 4.544) \times 42.20}{4.733} &= 199.733 \text{m}^2 \end{aligned}$$

### 6. Earth Work

#### (1) Excavation

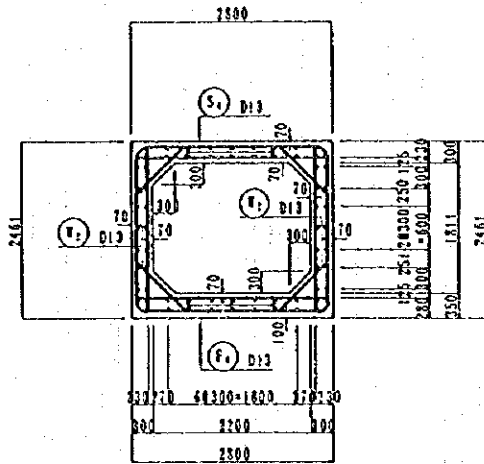
$$\begin{aligned} H &= 3.40 \text{m} & B &= 2.80 \text{m} \\ V 1 &= \frac{3.40 \times 2.80 \times 42.20}{9.520} &= 401.744 \text{m}^3 \end{aligned}$$

#### (2) Back Filling

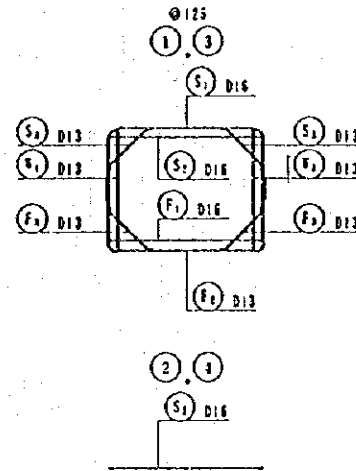
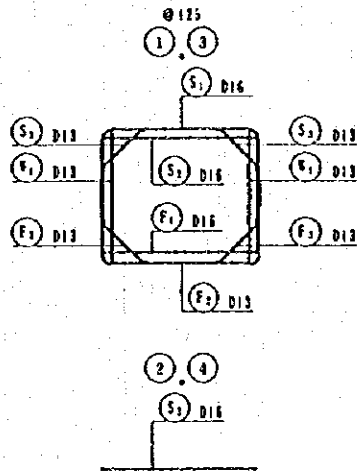
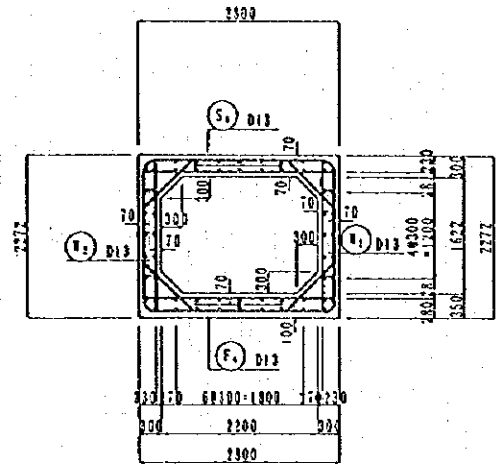
$$\begin{aligned} H &= 1/2 \times (2.461 + 2.272) = 2.367 \text{m} \\ V 1 &= \frac{2.80 \times (3.40 - 2.367) \times 42.20}{2.892} &= 122.059 \text{m}^3 \end{aligned}$$

XY22~XY22F12.20  
L=42200




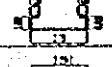




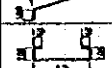
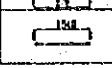

Beginning



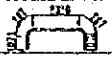

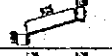
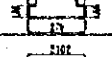



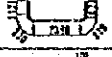

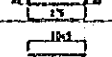

End



Beginning

			Length	Unit Weight	Nos	Weight
S 1	D16		5190	1.560	4	32.384
S 2	D16		2660	1.560	8	33.200
S 3	D13		1140	0.995	8	9.072
S 4	D13		860	0.995	6	5.136
W 1	D13		2290	0.995	8	18.312
W 2	D13		390	0.995	12	4.656
F 1	D16		2660	1.560	4	16.600
F 2	D13		5250	0.995	4	20.996
F 3	D13		1160	0.995	8	9.312
F 4	D13		900	0.995	6	5.316
H 1	D13		1040	0.995	68	70.380
				D16	82.134kgf	
				D13	143.130kgf	
				Total	225.364gf	

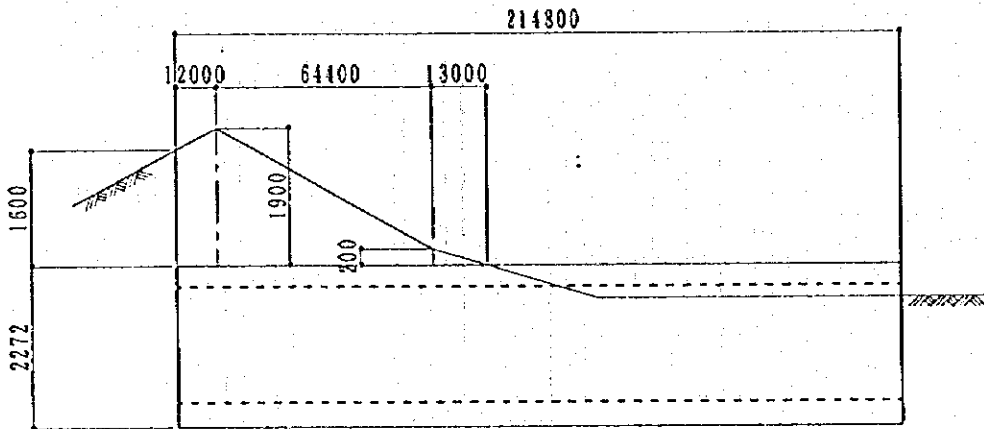
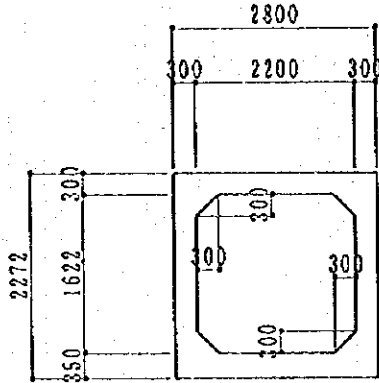
End

			Length	Unit Weight	Nos	Weight
S 1	D16		5000	1.560	4	31.200
S 2	D16		2660	1.560	8	33.200
S 3	D13		1140	0.995	8	9.072
S 4	D13		860	0.995	6	5.136
W 1	D13		2100	0.995	8	16.192
W 2	D13		390	0.995	12	4.656
F 1	D16		2660	1.560	4	16.600
F 2	D13		5060	0.995	4	20.240
F 3	D13		1160	0.995	8	9.312
F 4	D13		890	0.995	6	5.316
H 1	D13		1040	0.995	60	62.100
D16 81.000kgf						
D13 132.624kgf						
Total 213.624kgf						

§ 10. TYPE-9

MM22+42.20~MM25+89.60

L=214.80m



### 1. Concrete

$$a_1 = 2.80 \times 2.272 - 2.20 \times 1.622 + 2 \times 0.300^2 = 2.973 \text{ m}^2$$

$$V_1 = 2.973 \times 214.80 = 638.600 \text{ m}^3$$

### 2. Formwork

$$a_1 = 2.272 \times 2 + 4 \times 0.424 + 2 \times 1.022 + 1.600 = 9.884 \text{ m}^2$$

$$A_1 = 9.884 \times 214.80 = 2123.083 \text{ m}^2$$

### 3. Re-bar

$$D 16 \quad 81.000 \times 214.80 = 17398.800 \text{ kgf}$$

$$D 13 \quad 132.624 \times 214.80 = 28487.635 \text{ kgf}$$

---

$$213.624 \text{ kgf} \qquad W = 45886.435 \text{ kgf}$$

### 4. Supporting

$$v_1 = 2.200 \times 1.622 - 2 \times 0.300^2 = 3.388 \text{ m}^2$$

$$V_1 = 3.388 \times 214.80 = 727.742 \text{ m}^3$$

### 5. Scaffolding

$$a_1 = 2 \times 2.272 = 4.544 \text{ m}^2$$

$$A_1 = 4.544 \times 214.80 = 976.051 \text{ m}^2$$

### 6. Earth Work

#### (1) Excavation

$$H = 2.50 \text{ m} \qquad B = 2.80 \text{ m}$$

$$V_1 = \frac{2.50 \times 2.80 \times 214.80}{7.000} = 1503.600 \text{ m}^3$$

#### (2) Back Filling

$$V_1 = 1/2 \times (1.60 + 1.90) \times 12.00 \times 2.80 = 58.800 \text{ m}^3$$

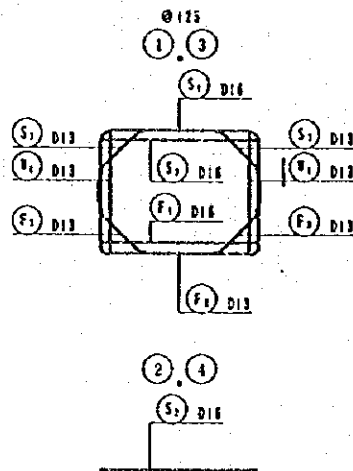
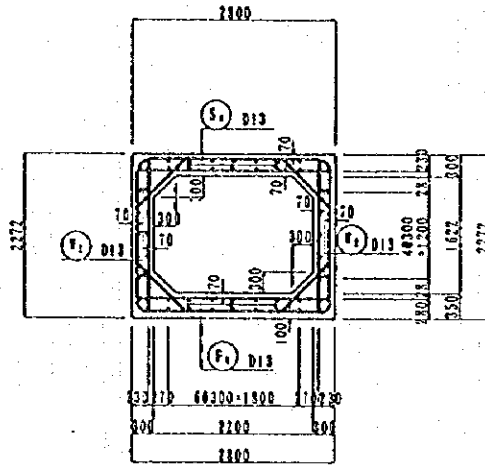
$$V_2 = 1/2 \times (1.90 + 0.20) \times 64.40 \times 2.80 = 189.336 \text{ m}^3$$

$$V_3 = 1/2 \times 0.20 \times 13.00 \times 2.80 = 3.640 \text{ m}^3$$



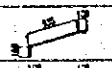
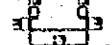




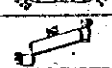
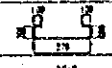

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$$V = 251.776 \text{ m}^3$$

MM22+42.20~MM25+89.60  
L=214800

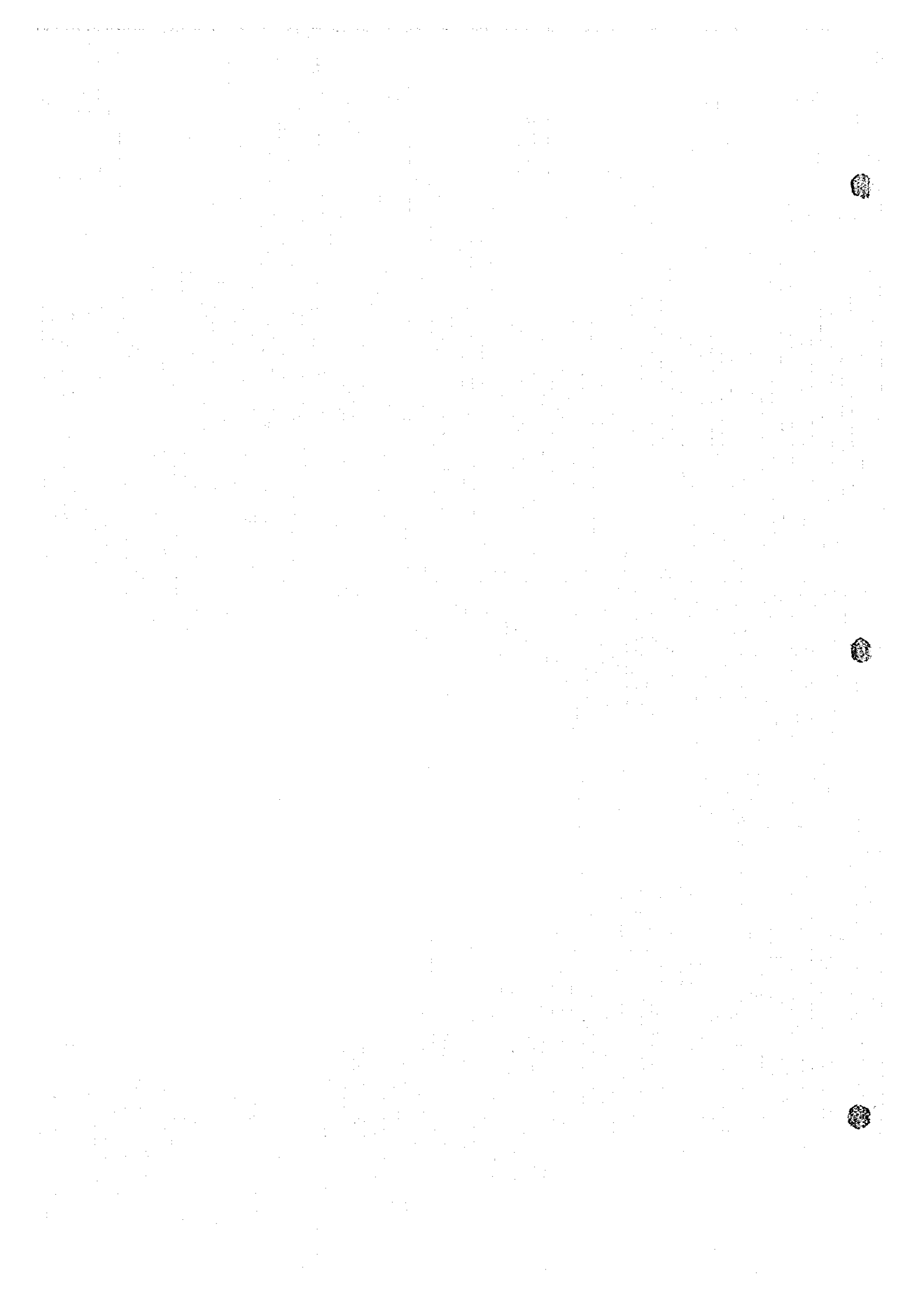




			Length	Unit Weight	Nos	Weight
S 1	D16		5000	1.560	4	31.200
S 2	D16		2660	1.560	8	33.200
S 3	D13		1140	0.995	8	9.072
S 4	D13		860	0.995	6	5.136
W 1	D13		2100	0.995	8	16.792
W 2	D13		390	0.995	12	4.656
F 1	D16		2660	1.560	4	16.600
F 2	D13		5060	0.995	4	20.240
F 3	D13		1160	0.995	8	9.312
F 4	D13		890	0.995	6	5.316
H 1	D13		1040	0.995	60	62.100
				D16	81.000kgf	
				D13	132.624kgf	
				Total	213.624kgf	









110A